



## WATER ANALYSIS PARAMETERS

The proper control of water quality is an essential part of any successful aquaculture operation. Immediate test results provided by on-site water analysis equipment can confirm a healthy environment or give early warning signals for required treatment.

- ◆ **Alkalinity:** Composed primarily of carbonate ( $\text{CO}_3^{2-}$ ) and bicarbonate ( $\text{HCO}_3^-$ ), alkalinity acts as a stabilizer for pH. Alkalinity, pH and hardness affect the toxicity of many substances in the water.
- ◆ **Ammonia:** Ammonia, present in both ionized ( $\text{NH}_4^+$ ) and unionized ( $\text{NH}_3$ ) forms, is extremely toxic to fish in the unionized form. Even low levels of un-ionized ammonia may affect the fish's central nervous system, reduce its ability to obtain oxygen and lowers resistance to disease. A product of organic waste, ammonia enters the water directly from the fish and from other organic material and uneaten food. Ammonia levels are pH dependent, and can fluctuate throughout the day.
- ◆ **Carbon Dioxide:** Different species of fish have different susceptibilities to carbon dioxide toxicity. In some species, excess carbon dioxide hinders the ability of the blood to hold oxygen. Produced during respiration and consumed during photosynthesis, carbon dioxide levels fluctuate throughout the day opposite to dissolved oxygen levels. High carbon dioxide levels lower the pH, which in turn affects the ration of un-ionized to ionized ammonia.
- ◆ **Chloride:** Chloride levels can affect fish health in two ways; as the major constituent of salinity or as a treatment to prevent nitrite toxicity. In systems with existing or chronic high nitrite levels, chloride will often be added to prevent the fish from succumbing to nitrite toxicity.
- ◆ **Conductivity** measures the ability of a solution to conduct an electric current between two electrodes. In solution, the current flows by ion transport. Therefore, with an increasing amount of ions present in the liquid, the liquid will have a higher conductivity. If the number of ions in the liquid is very small, the solution will be "resistive" to current flow. AC current is used to prevent complete ion migration to the two electrodes.
- ◆ **Copper:** Copper, in the form of copper sulfate, is often used in aquaculture systems as an algicide and bactericide, however high levels can be toxic to fish. High pH and alkalinity levels will complex copper, helping to reduce its toxicity.
- ◆ **Dissolved Oxygen:** The dissolved oxygen test is one of the most important in aquaculture. Dissolved oxygen levels can affect fish respiration, as well as ammonia and nitrite toxicity. Salinity and temperature are both factors that affect dissolved oxygen levels.
- ◆ **Hardness:** Total hardness is defined as the concentration of calcium ( $\text{Ca}_2^+$ ) and magnesium ( $\text{Mg}_2^+$ ) in the water. Closely related to alkalinity and pH, sufficient hardness levels can decrease ammonia and pH toxicity. Calcium is also necessary for proper egg and fry development.
- ◆ **Nitrite:** Formed as an intermediate product between ammonia and nitrate in the nitrification process, nitrite ( $\text{NO}_2^-$ ) is extremely toxic to fish. High nitrite levels, combined with low chloride and dissolved oxygen concentrations, may result in methemoglobinemia, better known as brown blood disease.



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- ◆ **pH:** One of the most common water tests, pH is a measure of the acidity or basicity of the water. The pH scale is logarithmic, and runs from 0 to 14; 7.0 is considered neutral with those values less than 7 being acidic and those above 7 basic. The greatest concern with pH is how it affects the toxicity of many other substances, including nitrite and ammonia.
- ◆ **Phosphate (Phosphorous):** Phosphates enter the water supply from many sources, including agricultural runoff and sewage. Although phosphorous is an essential nutrient for bone formation and is a primary ingredient in fertilizers, excessive levels can promote an overabundance of algae.
- ◆ **Temperature:** In an established system the water temperature controls the rate of all chemical reactions, and affects fish growth, reproduction and immunity. Drastic temperature changes can be fatal to fish.