Interpreting Pond Water Quality

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Alkalinity: recommended = greater than 20 mg/L

Alkalinity, the total concentration of bases, is a measure of the capacity of water to neutralize (buffer) acids with carbonate and bicarbonate ions. Alkaline (basic) pond waters are those with pH values greater than 7. In general, alkaline pond waters (>20 mg/L CaC03), exhibit greater fish productivity than acidic waters, and are more resistant to rapid changes in pH. Liming (applying agricultural limestone powder) a pond is used to neutralize acid waters, increased nutrient availability, and promote fish and plankton production.

Aluminum: less than 0.01 mg/L

Aluminum is the 3rd most abundant element the earth's soils. Some forms (inorganic monomeric) can be very toxic to fish, particularly in soft, acidic pond waters. The solubility of aluminum increases as the pH decreases. Aluminum toxicity to fish (damage to fish gills) generally occurs below a pH of 5 in ponds that receive acid rain or mine acid drainage.

Ammonia NH3 (unionized): less than 0.05 mg/L

Ammonia is a by-product excreted by fish and the decomposition of natural substances. Unionized ammonia (NH3) is very toxic to fish, whereas other forms of nitrogen (ammonia, NH4; nitrite, N02; nitrate, N03) are usually harmful. The toxicity of ammonia (NH3) to fish is directly related increasing pH and water temperatures. Although ammonia levels rarely reach toxic levels in fish ponds, spills of nitrogen fertilizers, livestock feed lot run-off, and algae die-offs can result in fish kills.

Copper: less than 0.01 mg/L

Copper is a toxic metal commonly used in certain herbicides, especially copper sulfate (bluestone) which is frequently used to control algae. High concentrations of copper ions (Cu++) are also toxic to fish, especially trout, and shellfish (mussels) and crayfish. Copper applied to ponds with soft or acidic water is more toxic to aquatic life than in ponds with hard or alkaline water.

Dissolved Oxygen: greater than 5 mg/L; over 75% saturation

Dissolved oxygen is essential for all aquatic life. It is the most critical of all water quality parameters. Most of the oxygen in a pond is produced by water plant (algae and rooted plants) photosynthesis during the daylight hours (reaching a maximum value near 6 PM). Fish kills generally occur at night as the oxygen produced during the daylight is used (minimum values occur near 6 AM). Summer fish kills often result because warmer waters hold less oxygen than cooler waters. Trout generally require more oxygen (6 mg/L) than warmwater fish (5 mg/L). Fish may live at low levels, but growth, reproduction and long-term survival will be compromised. Oxygen measurements must be made on-site. Mixing, aerating, pumping, and spraying the water into the atmosphere with motors, pumps, windmills, and paddlewheels will can dissolved oxygen concentrations.

Hardness: greater than 20 mg/L

The hardness of water is a measure of the total mineral content (polyvalent metal ions) expressed as mg/L equivalents of calcium carbonate. Calcium and magnesium are the primary causes of hardness in natural waters, but other metals (Mn, Fe, Zn, Al) also contribute. Natural pond waters range from soft (0-75 mg/L) to very hard (> 300 mg/L). In general, hard waters are more biologically productive than soft waters (poor in mineral content and acid buffering capacity).

Iron: less than 0.1 mg/L

Although some iron is essential to aquatic animals, more than 0.1 mg/L precipitates on exposure to air and can decrease pond clarity (increase turbidity), clog drainpipes, and favor the growth of iron bacteria which can disflavor water and fish flesh. High levels (> 1 mg/L) can indicate mine acid drainage.

Nitrite (N02): less than 7 mg/L

Nitrite concentrations lethal to fish can occur in cool pond waters in the spring and fall as nitrifying bacteria (nitrosomonas) activity is reduced. High levels of nitrite interior with the oxygen-carrying capacity of the blood, resulting in fish suffocation. This is characterized as "brown blood disease" in catfish. The treatment is to add 3 mg/L chloride for every 1 mg/L of nitrite, usually in the form of salt (NaCL =61% Cl).

Nitrate (N03): less than 5.0 mg/L

Nitrate is generally non-toxic to fish, but it is a plant nutrient and high concentrations (> 10 mg/L) can result in overfertilization of ponds and corresponding nuisance algae blooms, fish kills, and taste and odor problems. Decomposing mats of algae can deplete the oxygen supplies in the pond causing fish kills. Limit fertilizer and animal waste runoff into ponds. Nitrate levels exceeding 100 mg/L can cause methemoglobinemia in human infants.

Nitrogen Gas Supersaturation: less than 103%

Nitrogen gas comprises 78% of the atmosphere. It can become dissolved in high concentrations in falling water below high dams, and in groundwater supplies, or in recirculating aquaculture systems, especially under high pressure and temperature conditions. Total gas pressure should be maintained at less than 110% and nitrogen gas content should be less than 103%.

pH (acidity or alkalinity): between 6.5-9.0

pH is a numerical measure of the acidity or alkalinity of pond water on a scale of 0 to 14, with a mid-point reading of 7 indicating neutral water (neither acid or basic). Fish kills or stress occurs in acidic waters with a pH below 5 or alkaline waters with a pH greater than 11. The pH of pond water increases daily as phytoplankon consume carbon dioxide during photosynthesis (reaching a maximum value near 6 PM), and decreases at night as they release carbon dioxide during respiration (reaching a minimum value near 6 AM). A pH between 6.5 and 9.0 at dawn is recommended for fish ponds. Pond with low pH values (< 5) receiving acid rain, mine acid drainage, or acidic swamp water can be improved by liming.

Phosphorus: Less than 1 mg/L

Phosphorus is the nutrient most needed (limiting) for plankton growth in ponds. In general, fish production increases with nutrient levels, but high levels of phosphorous may lead to excessive fertilization and nuisance algae and rooted weed problems. Excessive weed growth can cause flavor and odor problems and fish kills.