Environmental Diseases

The majority of fish health problems are related to environmental stress, such as the effect of handling or poor water quality, where an infectious disease is involved, this is the end result of interaction between the pathogenic organism, a susceptible fish host and environmental stress. Most prevalent diseases of environmental condition of fish are:

1. Environmental hypoxia.

2. Gas bubbles disease.

3. Ammonia poisoning.

4. Nitrite poisoning.

5. Temperature stress.

6. Stress due to variations in pH values.

1-Environmental hypoxia

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One of the major causes of fish mortality in intensive aquaculture is decrease of dissolved oxygen in water. Environmental hypoxia means that a low concentration of dissolved oxygen exists in the water. Oxygen is the most important water quality factor for proper fish health. Sensitivity to low dissolved oxygen concentrations differs between species, between the various life stage and between life processes (feeding, growth and reproduction) which may depend on swimming ability and specialized behavior which may also be influenced by dissolved oxygen requirements for fisheries must take this in to account, bearing in mind the type of fishery, the times places the fish occur and the likely impact on the fishery of impairment of each part of the life cycle. Dissolved oxygen concentration in intensive fish farms is affected by three factors:

1. The rate of oxygen consumption by respiration.

2. The rate of oxygen production through photosynethesis.

3. The rate of oxygen transfer through the air water interface.

Causes of Environmental hypoxia:

Environmental hypoxia occurs in the fish culture under the following circumstances:

1. Concentration of phytoplankton in fish farm. They reduce light penetration in day that lead to reduce production of oxygen in the lower layers of water and consume dissolved oxygen at night.

2. Overcrowding of the heterotrophic organisms (bacteria, protozoa, fish, etc.) all consume oxygen both day and night.

3. Light is essential for photosynthesis, decrease the length of the day or reduction of light due to cloudiness may be lead to hypoxia.

4. High temperature. Low oxygen is common in ponds especially in summer. Warm temperatures lead to decrease oxygen solubility and increase the pond organisms' metabolism and subsequent oxygen demand.

5. Many chemicals that are commonly used to treat fish disease (cupper sulfate, pot. permanganate or formalin) may be lead to environmental hypoxia.

6. Wind is one of the most important climatic factors affecting the transfer of dissolved oxygen through the interface.

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7. During transport of fish, when their number in containers introduced is too large as compared to the supply of oxygen from the surface or from an artificial source of oxygen supply.

8. Due to an intensive system of fish production in ponds, enclosures and closed plants with recycled water at very high stocking densities and excess feeding with dry mixed feeds rich in protein. In intensively cultivated ponds, oxygen deficiency occurs due to various deteriorating phenomena caused by the biological activity of the phytoplankton.

9. Anoxia can be result from combination of these causes.

Clinical signs:

1. Acute environmental hypoxia:

a. Highly mortality especially large fish.

b. Common behavioral signs include lethargy and the congregating of fish near-water interface.

c. Fish have pale and edematous gills.

d. The fish swim to the water inlet and collect air. Fish are piping for air.

2. Chronic environmental hypoxia: Chronic hypoxia does not kill fish outright but causes considerable stress. At least 5 mg/L of dissolved oxygen is needed for optimal growth and reproduction of most fish. Below this food consumption decreases and becomes less efficient and growth slows.

Diagnosis of environmental hypoxia:

Diagnosis of hypoxia is based upon:

1. Case history.
2. Clinical signs.
3. Measuring of dissolved oxygen in water by electronic meter or by commercial test kit.

Treatment and control:

Acute environmental hypoxia is an emergency situation, and immediate step must be taken:

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1. Providing fish with oxygenated water.
2. Supplemental aeration should begin with both pneumatic (Air pumps) or mechanically by Paddle wheels.

Chronic environmental hypoxia can be treated with reducing feeding, reducing the fish number and control the phytoplankton.

2-Gas Bubble Disease

Gas bubble disease (GBD) is a non-infectious, induced process caused by high total dissolved gas pressure, which produces primary lesions in the blood (emboli) and tissues (emphysema), and subsequent physiological dysfunction. It presents the opposite problem to hypoxia!!

Causes and pathogenesis: Dissolved gases are typically measured in milligrams per liter. However, the level of saturation is typically presented as a percent of saturation. This is the percentage of the total gas concentration relative to "saturated" conditions.

% Saturation = C/C* x 100 (%)

where:

C = dissolved gas concentration (mg/l)

and

C* = saturation dissolved gas concentration at a given temperature, pressure, and salinity (mg/l)

Water of different temperature, salinity, and pressure holds differing amounts of gases. When the concentration of a gas, such as nitrogen, is the exact amount the water can hold for its pressure, temperature, and salinity, the water is considered "saturated". When there is more gas than the water can hold, it is "supersaturated". If there is less gas, it is "undersaturated". So, if we say that the percent of saturation is 115%, this means that the actual dissolved gas concentration is 15% greater than the saturated dissolved gas concentration at the given temperature, pressure, and salinity.

The principal gases found in the water are nitrogen, oxygen, and carbon dioxide. The super (over) -saturated liquid will constantly attempt to release the excess gas in the form of small bubbles, as the access gases will come out of solution. Similarly, when a fish is exposed to a supersaturated environment, the gas dissolved in the tissues and fluids is forced to come out of solution and if this happen too rapidly, bubbles form in different parts of the fish, causing a variety of signs and symptoms.

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Nitrogen is the most common of the inert gases in fresh and salt water, and enters a fish through its gills, just like oxygen. It is then carried to the tissue by the blood. Once distributed, nitrogen remains in the tissue while oxygen is consumed. Because fish do not metabolize nitrogen, it is the gas most commonly associated with gas bubble disease. Oxygen moderately above saturation in water is not typically a problem because fish use oxygen to breathe. Nonetheless, oxygen supersaturation due to phytoplankton blooms, coupled with late afternoon pond warming, is quite common.

1. Pressure can increase the amount of gas per unit volume that water contains. One of the best practical demonstrations of this law is offered by opening a bottle of carbonated beverage. When the cap is removed from the bottle, gas is heard escaping, and bubbles can be seen forming in the drink. This is the carbon dioxide gas coming out of solution as a result of sudden exposure to lower barometric pressure.

a. A rapidly changing barometric pressure over the path of hurricane Andrew in 1992 has induced GBD which was considered a major culprit in the death of almost 10 million marine fishes valued at $7.8 million.

b. The deeper the water, the more gas the water can hold.

c. Water that is pumped through pressurized systems will hold more gas than unpressurized systems.

2. Water at higher temperature holds less gas per unit volume because it is less dense. Thus, if the temperature of cold water with a normal dissolved gas content is raised due to increased environmental temperature, supersaturation conditions can be created.

a. Problems with GBD are commonly encountered when fish are cultured in the heated effluents of power plants or where heat is recovered from steam generating facilities.

3. The higher the salinity, the less gas water can hold. This is because the dissolved salts take up room that the gas could be using.

4. Supersaturated conditions can also result if a gas such as nitrogen is forced into solution

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a. a crack in a pipeline

b. water falls

c. excessive splashing

Symptoms:

Affected fish may display acute morbidity (illness) and mortality (death). Fish eggs can tolerate a relatively high total gas pressure of 110%-115%. After the eggs hatch, however, they are very sensitive to supersaturation damage with mortalities expected at gas (nitrogen) pressures ranging from 102% to 105%. Adult fish are more tolerant of excessive total gas pressure conditions, on the order of 115%-120%. Problems can arise at 105% saturation, and at 140% saturation and higher GBD can kill fishes.

1. Gas bubbles can form in the body cavities of fish, such as behind the eyes causing exophthalmia, or between layers of skin tissue.

2. Bubbles can form in the thin tissue between the fins on and along the back and tail.

3. Small bubbles can form within the vascular system, blocking the flow of blood and causing tissue death.

4. Worse, bubbles can form in the gill lamellae and block blood flow, occasionally resulting in death by asphyxiation.

5. Blisters are clearly visible beneath the skin, particularly in the head area, in and around the eyes.

6. Sick fish will make a croaking sound when removed from the water, and the skin will crackle if you run your finger across it.

Diagnosis:

Supersaturation disease can be difficult to confirm since problems visible to the naked eye (gross lesions) are commonly not present when the fish are found. Gill biopsies and wet mount examination of other organs under the microscope may show gas emboli within the bloodstream. Supersaturation is difficult to diagnose with a water test kit since most kits do not measure dissolved nitrogen. You should consider a diagnosis of supersaturation disease for any acute deaths that cannot be attributed to other water quality disorders or specific pathogens or toxins.

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Treatment:

Gas bubble disease is rarely reversible because of the damage to the internal organs. Attempts to "pop" these superficial bubbles do not get to the cause of the problem and probably do more harm than good, as it causes infection and most likely increases the suffering of the animal.

Prevention:

It is obviously better to avoid a situation than to have to cure one.

1. Avoid, if possible, causes of supersaturation.

2. Perform an immediate water change to restore the proper gas balance.

3. Clean away Algae and reduce the amount of live plants.

4. Reduce lighting to reduce oxygen production by the plants.

5. Good aeration is one of the simplest ways to prevent GBD. Bouncing, splashing, spraying, and/or cascade culture water through air before it reaches fish will promote the release of supersaturated gases.

6. Increase salinity, if possible.

3-Ammonia poisoning (New tank syndrome)

All animals produce nitrogen compounds as a by-product of normal daily metabolism. Most species of fish produce ammonia which is very toxic in the aquarium.

Under normal circumstances, fish in the wild don't have ammonia toxicity problems since they live in millions or even billions of gallons of water and their ammonia becomes quickly diluted and incorporated into the nitrogen cycle where it is detoxified by naturally occurring bacteria.

Ammonia poisoning is one of the most common water quality problems in newly established recirculating systems, shipping containers, or following medication of fish by bath treatments with certain chemicals (e.g., formalin). Ammonia is the primary nitrogenous (protein breakdown) waste product excreted by fish and is also produced when organic matter, including uneaten food decomposes in water. Ammonia can cause acute mortality but most often it present as a sublethal stress. High levels of ammonia in the aquarium are probably the number one killer of pet fish. Any measurable amount of ammonia indicates either an overloaded aquarium (too many fish or too much food) or an inadequate filter. The ammonia level in a fish farm is usually lowest at the water inflow and highest at the outflow. When fish are introduced into a new tank in which the biological filter is not well established. The ammonia rapidly rises killing the fish (new tank syndrome).The biological filter contains nitrifying bacteria as nitrosamines species that convert ammonia to nitrite. Professionals commonly ask at what point ammonia levels should be considered dangerous. The best answer is that any detectable ammonia in an established aquarium indicates a filtering deficiency. Ammonia should not be detectable in a pond with a healthy biological filter at all times. The ideal and normal measurement of ammonia is zero.

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Causes of high ammonia level in the water:

1. Inadequate number of nitrosamines bacteria lead to accumulation of ammonia in the aquarium water. If the biological filtration capacity is too low to remove all the ammonia produced by fish the ammonia level will raise. The total amount of ammonia that can be converted to nitrite depends on the amount of biological filtration in the tank where the aquarium water passes over a surface that has nitrosamines bacteria thus the biological filtration is greatest when there is a high water flow over a large surface area.

2. Antibiotics that are dumped into the water can damage a biological filter resulting in elevated ammonia levels.

3. If the biological filter cleaned vigorously removing most of its bacteria sudden rise of ammonia will occur.

4. Uneaten food, decaying substances and ammonia generated by excretion of fishes are the largest sources of ammonia in a fish farm.

5. Algae and nitrosamines bacteria are the major consumers of ammonia so ammonia tends to increase during fall and winter because of decrease in algal and bacterial metabolism at low temperatures.

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6. Massive death of algae (occurs either spontaneously or caused by algicidal chemicals) not only reduces ammonia assimilation but also increases the level of ammonia by the decaying dead algae.

7. Too many fish (Overcrowding) in an aquarium with an un-established or inadequate biological filter.

Clinical signs of ammonia poisoning:

1. Acute toxicity is associated with anorexia (stop feeding), lethargy, swim erratically, behavioral abnormalities and neurological signs.

2. The pond water is frequently cloudy and in some cases dead fish and uneaten food may be present (contributing to the problem).

3. Some fish produce excessive mucus in response to the elevated ammonia and may appear cloudy or pale. The eyes may be opaque and the gills pale or swollen (diffuse gill epithelium proliferation).

4. Increase blood and tissue ammonia levels causing elevation of blood pH and osmoregulatory disturbance.

5. Decrease disease resistance resulting from stress.

Diagnosis of ammonia poisoning:

1. History: overcrowding, new fishes may have been added without increasing filtration, change in the management of the system (a new person is feeding the fish, the type and amount of food has changed, the frequency of water changes has decreased, dead plants and fish are not removed immediately), recent addition of chemical, newly established aquaria and recently washed biological filter or failure of the biological filter.

2. Clinical signs.

3. Measurement of the level of unionized ammonia: test your water and confirm whether or not you have an ammonia problem in your aquarium or pond by commercially available kits. Ammonia is present in two forms:

a. Unionized ammonia (NH_3) which is toxic to fish.

b. Ionized ammonia (NH_4^+) (ammonium) which is less toxic.

The amount of unionized ammonia NH_3 in water depends on the pH, temperature and salinity of the water. High pH and temperature and low salinity favor the presence of unionized (harmful) ammonia. If the unionized ammonia is greater than 0.05 mg/L it should be reduced as quickly as possible.

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Treatment:

1. Frequent change of water or increase the water flow will reduce the ammonia level.

2. Adding fresh water will dilute the ammonia concentration.

3. Transfer the fish if the ammonia level reaches 2.5 ppm.

4. Avoid accumulation of excess feed or even stop feeding the fish if detected in an established pond.

5. Decrease the pH of the water (every 1 unit decrease in pH there is a ten fold decrease in unionized ammonia). But this must be done with great care because rapid drop in pH cause other problems.

6. Increase the biological filtration capacity.

7. Reduce the stocking density in the tank.

8. Many medications are toxic to nitrifying bacteria so after use of such medications the biological filter must be re-established.

9. In ponds prevention of ammonia toxicity is better than therapy since ammonia cannot be rapidly removed from the pond (by not overstocking, overfeeding, or overmedicating, the chances of an ammonia problem are greatly reduced. Coupling these strategies with an adequately functioning biological filter will insure that ammonia toxicity will be something you only read about).

4- Nitrite Poisoning (Brown Blood Disease)

Nitrite Toxicity, Methemoglobinemia or Brown Blood Disease is a disease caused by high nitrite concentrations in the water. The source of the nitrite is the metabolic wastes produced by fish when they metabolize the protein in their diet. The primary nitrogenous waste product of fish is ammonia. When this is excreted into the water it is oxidized by the *Nitrosomonas* bacteria to form nitrite. The nitrite is subsequently oxidized by the *Nitrobacter* bacteria to form nitrate. Most circumstances causing ammonia poisoning can also lead to nitrite Poisoning. Nitrite build up usually occurs after ammonia has peaked .This is because the nitrobacter bacteria that convert nitrite (NO2) to nitrate (NO3) require time to become active. Nitrite nitrifyers (*nitrobacter*) are also inhibited by ammonia and other chemicals causing sudden rise in nitrite level. If fish are heavily fed and/or if the Nitrobacter do not efficiently oxidize the nitrite to nitrate, the nitrite concentration can increase to problematic levels. Nitrite poisoning is common in fall because the temperature is not the optimum for nitrobacter bacteria or during the spring as the water temperature increases, fish activity can often increase faster following a temperature increase than the bacterial action does. This also can happen following the addition of a large number of new fish to a pond or when the biological filter becomes partially obstructed with waste materials reducing its effectiveness that can cause the nitrite levels to increase. Nitrite is not a problem in flow-through systems because there is no significant conversion of ammonia to nitrite during the short time that the water is present in the system. Nitrite toxicity is affected by many factors including chloride level in the water, pH, fish size, previous exposure, nutritional status and dissolved oxygen level. Nitrite can become toxic to fish at concentrations as low as 0.5 mg/L (= ppm). Nitrite, NO2, measured in parts per million (ppm), is the second chemical measurement (after ammonia) made to determine the "health" of the biological filter. Nitrite should not be detectable in a pond with a properly functioning biological filter. Thus

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the ideal and normal measurement of nitrite is zero. At all times Levels of nitrite should be kept below 0.1 mg/L.

Pathogenesis and Clinical signs of nitrite poisoning:

1. Nitrite has been termed the invisible killer as the pond water may look great, but nitrite cannot be seen.

2. Nitrite damages the nervous system, liver, spleen, and kidneys of the fish. Even lower concentrations over extended periods.

3. Nitrite is actively transported across the gills where it enters the blood stream and oxidizes hemoglobin to methemoglobin.

4. Methemoglobin cannot transport oxygen efficiently so tissues are deprived of oxygen.

5. Oxygenated hemoglobin is red, while methemoglobin is brown.

a. Fish with nitrite poisoning have pale brown colored gills.

b. Methemoglobin concentration of about 40% causes the blood to become chocolate brown and pale brown gills.

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6. Anemic fish have pale gills but with red tinge

7. Fish with methemoglobin are dyspneic even with adequate oxygen.

8. Behavioral changes associated with nitrite poisoning are similar to those of hypoxia including lethargy, gasp at the water surface or crowded near the water inlets.

9. A common indication of a fish that has a severe nitrite spike in the past is that the gill covers may be slightly rolled outward at the edges. They do not close flat against fish's body.

Diagnosis of nitrite poisoning :

1. Case history: over-crowding, recent medication or other chemicals added, failure of the biological filter and fall season.

2. Clinical signs:- mentioned before.

3. Measurment of nitrite concentration in water (colorimetric kits can be used).

4. Measurment of methemoglobin concentration in the blood of fish.

5. Exposure of fish to very high nitrite concentration is associated with presence of foci of accumulated iron-containing macrophages caused by increased erythrocyte destruction.

Treatment of nitrite poisoning:

1. Increase aeration to maximum.

2. It is best to keep nitrite level as low as possible.

3. Nitrite is much less toxic when chloride is present [chloride inhibits nitrite uptake across the gills competitively] so addition of chloride is recommended (usually as sodium chloride) to the affected water system as soon as possible. In most cases, the addition of 1.0 part per thousand (ppt) salt will yield approximately 500 ppm chloride (more than enough to do the job). One part per thousand is the same as 1 gram per liter (about 4 grams per gallon).

4. 25-50% water change depending on nitrite concentration.

5. Addition of nitrifying bacteria (nitrobacter).

6. Increase the biological filtration.

7. Decrease stocking density of fish.

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8. Reduce the feeding rate.

9. Reduce the water temperature.

5-Temperature Stress

Fish are poikilothermic aquatic vertebrates therefore water temperature greatly affects their metabolism and immunity. Decrease in water temperature suppresses the fish immune response. Most of pond fish diseases occur in the spring and fall when the temperature Fluctuation is greatest.

Temperature tolerance depends on many factors:

1. The temperature to which the fish has been acclimated.

2. Salinity.

3. Life stage.

4. Reproductive status.

5. The speed of temperature change.

Temperate fish species often tolerate a wide temperature range than tropical fishes or cold water species. Most fish tolerate a rapid drop in temperature better than an equivalent rise in temperature [this is due to the physiological changes that occur with increasing temperature as the metabolic rate and thus oxygen consumption increase]. The biologic activity doubles for each 10 c rise in temperature. The toxicity of ammonia increases as the temperature rises and the amount of dissolved oxygen that the water can hold decreases, lead to hypoxia. Fish that are normally exposed to wide temperature fluctuation are more tolerant to rapid temperature change than fish that are kept under more stable conditions [thermostatically controlled temperature in aquarium].There is no exact recommendations for allowable temperature change because it varies with species , environment and prior acclimation conditions for example fish acclimated to a higher temperature often can withstand hyperthermia better than the same species maintained at lower temperature . Also fish sensitivity to changes in water temperature varies throughout its life cycle. Fish are most sensitive to water temperature changes during spawning and larval development. Water temperature should not be changed more than about 1c / hour. Sudden stop of the heater in winter is followed by rapid drop in temperature (10c in one day) might cause many fish to die immediately. The most common cause of hypothermia is the absence of a submersible aquarium heater and if a heater is present, its power must be evaluated, and it should be checked to make sure it is working properly. Aquaria placed close to drafty areas, even when properly heated, may still expressing hypothermia.

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Temperature ideal Range is (20 c-25 c).

Acceptable range (2 c-30 c).

Direct sunlight during the day can cause the temperature to rise higher, and heat loss on clear nights can cause the temperature to drop lower than shaded ponds. A clear night sky can absorb a large amount of heat from a small pond and actually drive the pond temperature below air temperature.

Diagnosis:

1. case history:

a. hypothermia temperature at or near the lower lethal limit, shutdown of the heater, thermometer not working. Properly, too small heater, aquarium exposed to air draft, lethargy and water mold infection.

b. hyperthermia temperature near the upper lethal limit, aquarium exposed to heat source, too large heater, improperly working thermostat and dyspnea.

2. clinical signs:

a. The First evidence of hypothermia in fish is a loss in color followed by rapid breathing/gill movement. Additionally erratic swimming may occur. The effects of hypothermia can lead to hypoxia, which basically means that the fish is starving for oxygen. While it is true that cold water holds more oxygen by its nature, because the fishs metabolism is so slow it cannot adequately take up oxygen and suffers from low oxygen.

b. At low temperature Fish appear sluggish, depressed, and may be anorexic (not eating). Hypothermia can lead to an abnormal metabolism and dysfunction of the immune system.

c. Mortality varies and depends on species, temperature of the water, and duration of exposure.

d. Low pond temperature has been associated with an idiopathic syndrome known as winter kill.

e. High temperature associated with dyspnea.

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3. Measurment of the temperature of the water by using thermometer.

Treatment and prevention:

Temperature control can be done in small closed systems but in ponds or other culture systems with large volumes of water temperature control is usually difficult and not economic.

Temperature control is performed when either recycling most of the water or when egg incubation systems that use very little water.

Hypothermia

1. Use plastic sheeting to insulate ponds during cold snaps.

2. the water temperature should be raised to at least near their normal temperature range gradually& slowly [filling plastic bags with worm water and floating them in the pond].

Hyperthermia

1. reduce or stop feeding because the amount of oxygen needed for both homeostasis and digestion of food may exceed the amount of oxygen that can be extracted from the water.

2. lower the temperature to the physiological range of the species. A thermometer should always be present in the aquarium in order to maintain optimal temperatures.

Most heaters are equipped with a thermostat in order to control and maintain environmental temperature tightly.

6-Acidic pH (Low pH)

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Fish species differ in their optimal PH range, a pH range of 6.5-8.5 is generally recommended for freshwater fish, a pH of more than 11 or less than 4 is lethal to most fish species. Many freshwater fishes come from poorly buffered waters that are high in organic acids and thus do best in neutral to slightly acidic conditions ,while marine fishes require a stable alkaline pH. pH values do change somewhat during each 24 hours, depending upon the temperature, quantity of plants (algae and others), and the size of the pond, so try to take the measurements at about the same time of day. Fish acclimated to a relative low pH can survive a drop in pH better than the same species maintained at a higher pH ,Fish routinely exposed to wide PH fluctuation are more tolerant to rapid pH change than fish kept under more stable conditions(Rapid changes in pH can cause extreme stress to the fish similar to shock in humans). Many toxins are highly affected by pH especially metals which become more toxic at low pH (Aluminum is more soluble and more toxic in acidic pH, thus aluminum toxicity can occur and may be the principle cause of death). Established ponds will normally maintain their equilibrium pH value if decaying organic material is routinely removed from the pond, mechanical filter, and biological converter.

Causes of low pH water:

1. Ground water (well or spring) has dissolved carbonates, carbon dioxide and silicate so has low pH.

2. soil type highly influence pH of the water, acid sulphate soils may have a pH less than 4 because oxidation of sulphide to sulphoric acid.

3. Acid rain or water that drains acidic soils have low pH (large amount of acids are washed into a stream water supply).

4. In closed systems the metabolic activities of fish and other aquatic organisms produce acids that tend to gradually reduce pH (if water change not regularly performed or the pH not adjusted).

The bicarbonate / carbonate buffer system is the major moderate of pH in aquatic system; alkalinity is the buffering capacity in water and is measured by the amount of bicarbonate / carbonate present.

Water with high alkalinity resist pH change from acids produce by the aquatic organisms respiration (CO_2), low pH is the most common in water with low alkalinity because the lower the alkalinity the less the buffering capacity of the water to neutralize acid production .

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Pond pH is influenced not only by the amount of bicarbonate present but also by the photosynthesis , plant photosynthesis uses CO_2 raising the pH reaching peak near sunset, at night cessation of photosynthesis result in a net accumulation of CO_2 causing drop in pH .

Clinical signs:

1. Acute acidosis characterized by tremors and hyperactivity, gill tissue is the primary target organ in which low PH stimulates increased mucous production which interferes with gas and ion exchange leading to respiratory and osmotic stress.

2. Chronic acidosis is associated with poor growth, reproductive failure and increased accumulation of heavy metals.

Diagnosis:

1- Case history:

a. In acute cases there are acute mortalities with tremors, hyperactivity and dyspnea.

b. In chronic cases there is increased mucous production.

2- Clinical signs:

3- Measurement of the pH of the water by colorimetric test or pH meter.

Treatment:

1- Frequent change of water.

2- Reduce the stocking density.

3- Add buffer Raise alkalinity by adding Calcium Carbonate, Sodium bicarbonate, concrete blocks, limestone, or even egg shells. To raise the alkalinity by 40 ppm, add 1/2 oz of Calcium Carbonate (precipitate powder) per 100 gallons of water. A concrete block or two submerged in the pond or filter area may be all that is needed.

4- Be sure to check and treat for any ammonia presence BEFORE attempting to raise pH through either chemical or water change out means. Ammonia increases in toxicity with rising pH (Adjust the PH only if ammonia level is safe).

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5- Periodic pH measurements are important.

A change in pH from 7 to 6 means 10 times more acidic water. A further drop to a pH of 5 equals 100 times more acidic water. Keep in mind to change pH slowly as it causes a lot of stress to your fish. Maintaining a stable pH is generally more the way to go.

7-ALKALINE pH (High pH)

Too high (alkaline) pH is much less common than too low (acidic) pH because most closed culture systems tend to decrease in pH with the time and acids are much more common environmental contaminants than alkalis. Alkalinity is related to the amount of dissolved calcium, magnesium, and other compounds in the water and as such, alkalinity tends to be higher in "harder" water.

Lime leaching out of concrete ponds is a primary source of alkalinity but it is also slowly increased by evaporation which concentrates the source compounds. Alkalinity is naturally decreased over time through bacterial action which produces acidic compounds that combine with and reduce the alkalinity components.

Causes of acute high pH:-

1- High level of alkalis leaching out of inadequately cured concrete containers.

2- Improper use of slaked or hydrate lime will rapidly rise the pH.

3- Chronic high pH in ponds is caused by the presence of excessive phytoplankton and thus excessive photosynthesis which consume CO2 during the day time.

Clinical signs and problems:-

1-High PH in ponds is dangerous because it increases the amount of toxic unionized ammonia.

2- Corneal damage.

3- Long term conditions above 9.0 can cause kidney damage.

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4- Hypertrophy of the gill mucous cells and epithelial cells.

5- Alkaline pH increases the mortality of incubating eggs (acid water is somewhat bacteriostatic).

Diagnosis:-

1- Case history: - improper lime treatment of the pond, cloudiness of the skin and gills.

2- Clinical signs :- (mentioned before).

3- Measurement of the pH of the water by colorimetric test or digital electronic pH meter.

Treatment:-

*Adding water will dilute the pond water and reduce pH.

* High alkalinity is normally prevented by routine water change outs (assuming the tap water has a lower alkalinity than the pond water).

*Adjust the pH by adding buffers (phosphate buffer).

*Calcium and alum are used successfully in ponds (precipitation of calcium carbonate inhibit the rise in pH).

*Filtering the water through peat will reduce the pH.

*Killing some of the plants and algae with an appropriate herbicide (but not usually recommended because of adverse side effects which are low dissolved oxygen resulting from decreased photosynthesis and possible herbicide toxicity to fish).

*Concrete containers should be cured with hydrochloric acid and allowed to leach out all alkali before using for fish culture. After cure is complete and the pond is ready to be filled for use (now you can put in a few test fish). Recheck after each water change out and again in 24 hours. Don't forget to check the pH of the water being added, it may be part of the problem. At a pH of 9, do daily 10% to 25% water change outs. For a pH of 10, do 25% to 50% water change outs. At pH extremes over 10, remove any remaining fish. Only under EMERGENCY conditions should chemical means be used to lower the pH in a pond. (Any attempt to lower the pH chemically can be particularly hazardous to you, the biologic converter, and the fish).

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