Managing Water and Soil Quality in Your Pond

Introduction

Good water quality must be maintained if fish are to remain healthy, grow well, and give you a good crop in a reasonable amount of time. To maintain water quality, farmers must monitor pond conditions every day, taking note when things do not appear normal or if fish are behaving in unusual ways. Following are some water and soil quality characteristics to be concerned with and some methods to ensure that pond conditions remain good.

Dissolved Oxygen (DO)

Your goal should be to keep DO at 3 mg/L or higher for tilapia and catfish by:

- Promoting and maintaining a good phytoplankton bloom through fertilization; however, do not overfertilize your pond.
- Stocking your fish at the recommended rates.
- Feeding your fish at the recommended daily rates and avoiding overfeeding, which wastes feed and may compromise DO levels.
- Reducing feeding rates during cloudy weather, periods of slow growth, or when water temperatures are unusually high.
- Running bubbling fresh water into your pond in emergency situations; if possible, simultaneously release oxygen-poor water from near the bottom of the pond.

Figure 4.4-1. Low levels of oxygen can lead to sudden, massive fish kills.

Plankton Turbidity

Maintain a plankton density ("bloom") that allows you to see about 30-45 cm into the water (The depth where you can just see the palm of your hand if you extend your arm into the water up to your elbow). This can be achieved by:

- Fertilizing the pond at recommended rates prior to stocking, and as needed during the fish production cycle, to maintain the plankton bloom .
- Checking visibility frequently during the culture period and taking necessary actions before problems arise:
- In case of low visibility, physically remove excess plankton.
- If visibility is high, apply additional fertilizer.

Alkalinity and Hardness

It is desirable to maintain both alkalinity and hardness at 40-70 mg $CaCO_3$/L. This can be done by:

- Where water is "soft" or acidic and soils are acid, apply lime (agricultural limestone) to the pond soil at recommended rates prior to filling the pond (see Section 4.1).
- Lime is usually applied to the soil prior to filling the pond; however, it may be added after filling by spreading it uniformly over the water surface.
- In areas where soils are alkaline and hardness and alkalinity are high, application of lime is not required.
- Note that these methods are the same as those used for managing water pH; indeed proper management of hardness and alkalinity will usually eliminate the need to worry about pH.

pH

The pH of pond waters should be maintained between the optimum limits for fish, i.e., between 6.5 and 9.0. This can be achieved by:

- Maintaining alkalinity at or above 40 mg $CaCO_3$/L so that pH does not fluctuate widely.
- Applying lime (agricultural limestone) to the pond soil at recommended rates in regions where water and soils are acidic. Note that in areas where soils are alkaline and hardness and alkalinity are high, application of lime is not needed.

Ammonia

Un-ionized ammonia (NH_3) concentrations in pond water should be kept below 0.5 mg/L. Concentrations of this form of ammonia, which is toxic to fish, are influenced by DO, pH, and alkalinity, so it essential to manage these parameters as explained above, including:

- Keeping pH near neutral, and at least below 9.0.
- Keeping DO concentrations high.
- Maintain water alkalinity at 40 mg $CaCO_3$/L or above.

Pond Fertility

Ponds should be provided with adequate supplies of the nutrients needed by pond organisms to ensure good health, reproduction, and fast growth of the fish. This can be done by:

- Liming and fertilizing the pond at the correct rates, as described above and in Section 4.1.
- Monitoring phytoplankton density using a Secchi disk or your hand and adjusting fertilization accordingly.

Clay Turbidity

Clay turbidity in pond water (muddy water) can be harmful to fish and limit pond productivity. Minimize clay turbidity in pond waters by:

- Using a diversion canal to divert muddy water around the pond.
- Treating turbid ponds with animal manures at rates of 2.4 T/ha every three weeks.
- Treating turbid ponds with lime (agricultural limestone), using rates recommended for improving soil pH and water alkalinity.
- Avoiding stocking species that stir up pond bottom mud.

Toxic Materials

Pond managers must ensure that substances toxic to fish and other organisms (herbicides, insecticides, and other chemicals) are kept out of the pond. Some methods for protecting the pond from toxic substances include:

- Not using insecticides, herbicides, or other chemicals (except for recommended inorganic fertilizers) in or near your pond.
- Not allowing runoff from nearby agricultural fields to enter the pond.
- Not spraying agricultural crops near fish ponds on windy days.

Water Temperature

As much as possible, water temperatures should be maintained within the optimum ranges of the species being farmed. Although it is generally difficult to control water temperatures in ponds, some ways to ensure that temperatures are suitable for the species being farmed include:

- Stocking species whose optimum temperature ranges match the temperature of the water available at your location.
- If sources of water with different temperatures are available, adjusting pond water temperatures by adding cooler water to lower the temperature.

Soil pH and Acidity

Ensuring that soil pH and acidity are within acceptable limits is a necessary part of managing the alkalinity, hardness, and pH of the water, which were discussed above. The key is to keep soil pH at 6.5 or above, which will usually maintain water pH, hardness, and alkalinity at desirable levels. Soil pH can be kept at the right level by:

- Drying the pond for at least two weeks after each harvest before refilling and restocking.
- Applying lime (preferably agricultural limestone) to the pond after each harvest. Normally lime should be applied to the pond bottom before it is refilled, but if necessary, it can be applied to the water surface after filling the pond. Only recommended liming materials and application rates should be used

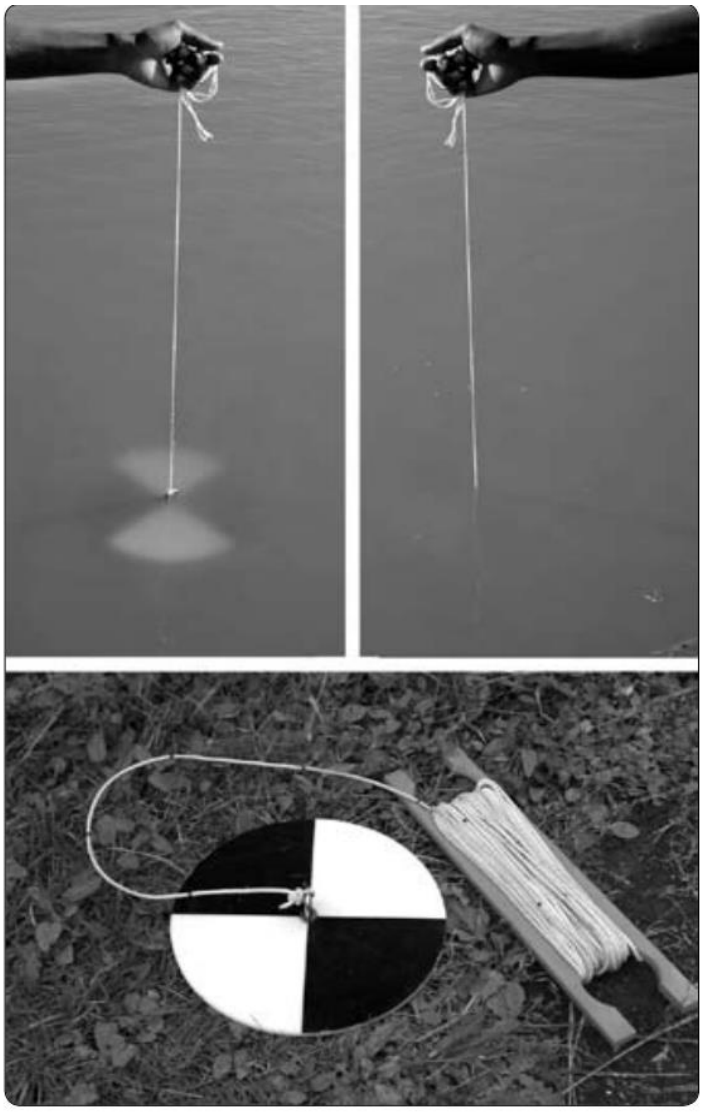

Figure 4.4-2. A Secchi disk is used to estimate phytoplankton density and the fertility of a pond. If you can still see the disk when it is lowered beyond 45 cm, then the pond should be fertilized. If the disk disappears at a depth much less than 30 cm, then the pond is too fertile.

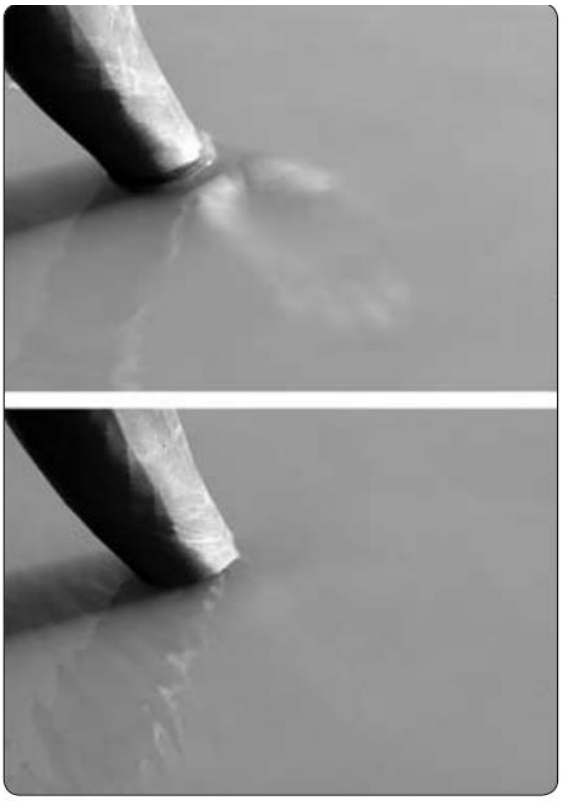

Figure 4.4-3. If you do not have a Secchi disk, you can use your hand to check visibility (phytoplankton density, fertility) in a pond.

Moving on

In addition to monitoring and maintaining good water quality in your pond, take measures to ensure that diseases and predators do not become a problem. The next section outlines some potential problems and some methods for prevention.

4.5: Preventing Fish Diseases and Controlling Predators

Introduction

In East Africa fish diseases are not common on fish farms due to the low rates at which fish ponds are stocked and the relative hardiness of the fish that are usually farmed here, e.g., tilapia and African catfish. The term "disease" may refer to any "illness" of fish, as evidenced by changes in their appearance and/or behaviour and perhaps by death. As with humans, diseases of fish usually result from exposure to excessive stress in the environment, which lowers their resistance to disease organisms. Common sources of stress for fish include:

- Poor nutrition
- Poor sanitation and environmental conditions
- Overcrowding in ponds
- Rough handling of fish by farm workers
- Presence of disease vectors and intermediate hosts

Signs of stress, parasites, and disease

Monitor your fishpond and observe the behaviour of your fish at least daily, looking for any of the following signs of stress and/or disease:

Figure 4.5-1. When fish are seen "piping" at the water surface or crowding around a water inlet, oxygen levels in the pond are probably low.

- Many fish "gulping air" ("piping") at the water surface
- Large numbers of fish crowding around an inlet of freshwater
- Loss of appetite by fish
- Individual fish swimming erratically and apart from the rest
- Individual fish of unusual colouration—often very dark in appearance
- Individual fish swimming in circles ("whirling")
- Retarded growth
- Distended stomach

- External parasites visible on the fins, body (perhaps protruding from under scales), or gills of fish; parasites (worms) visible on/in internal organs
- Excess mucus on skin
- Cotton- or wool-like growths (fungus) on the skin surfaces
- Peeling skin, ulcers, lesions, and erosion of fins.

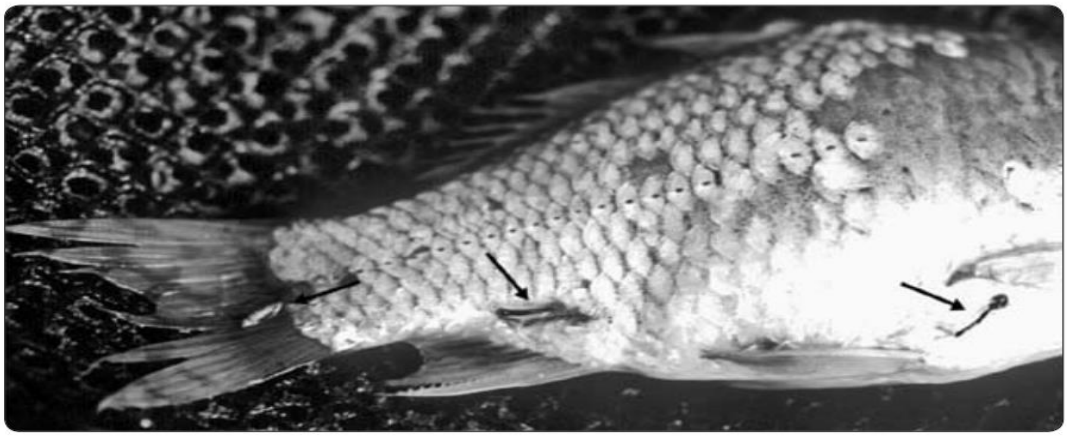

Figure 4.5-2. External parasites protruding from between the scales of a fish.

Examples of extreme or advanced cases of disease or parasite infestations include:

- White lesions on the head, back, and gills
- Hemorrhagic ulcers on body or on internal organs
- Deep ulcers extending into muscles
- Internal bleeding and kidney damage or anemia
- Sloughing away of gills and excessive slime
- Fish deaths increasing over time

Symptoms such as anemia, anorexia, bone deformations, and cataracts or cloudy lenses (in the eyes) may sometimes appear, but these generally suggest nutritional deficiencies rather than actual diseases or parasite infestations.

Preventive measures

Practice the following measures to reduce stress and avoid the development of parasites and diseases in your fishpond:

- Dry your pond after each culture cycle.
- Apply lime to your pond soil as a preventive measure, even if you do not need it to manage soil pH or water alkalinity.
- Keep weeds cut back in and around your pond.
- Control populations of birds, reptiles, snails, frogs, and wild fish around your fishpond.
- Stock only with healthy fish obtained from a known source — inspect fish purchased for stocking before taking delivery of them.
- Quarantine any fish exhibiting strange behaviour or an unusual appearance.

- Always handle fish carefully and only when necessary.
- Don't stock more than the recommended number of fish in your pond.
- Maintain a regular feeding schedule and avoid wastage of feed (overfeeding).
- Maintain good pond sanitation.
- Avoid feeding your fish with moldy or spoiled feed.
- Remove and examine dead fish as soon as possible.

If you suspect that a disease or parasite problem is developing in your pond, it would be prudent to consult your fisheries extension office for advice.

Controlling predators around your pond

Predators, especially birds such as kingfishers, pelicans, and herons, can cause massive crop losses for you, perhaps without you even knowing there is a problem until you harvest your fish. Other predators that can cause damage include monitor lizards, frogs and tadpoles, snakes, turtles, and carnivorous fishes. For very young fish (larvae or fry), even aquatic insects and insect larvae can be serious predators. Some basic steps to minimize these problems include:

- Keep grasses on dykes and around ponds cut low.
- Install covered hapas in your pond for rearing very young fish, e.g., catfish fry.
- Construct a low barrier around ponds to keep small land animals out.
- Stretch netting over ponds to keep birds out.

Figure 4.5-3. Low barriers can be put up around ponds to keep predators out.

Figure 4.5-4. Netting can be stretched over ponds to keep predators out.

Figure 4.5-5. Birds such as herons and egrets can remove significant numbers of fish from a farmer's pond.

Moving on

Regular monitoring of your pond and fish will help you identify potential problems early and prevent the development of full-scale disease or parasite problems. By preventing such problems you are more likely to have a large crop of healthy fish at harvest time.