CHAPTER 8

FISH HEALTH AND PREDATOR CONTROL

Maintenance of good fish health is critical to profitable fish culture. Slow growth, poor feed conversion, low yields, increased disease incidence and mortality, consequently, low profitability are the results of poor fish health. Physiological stress is the fundamental cause of most fish health problems. The best way to manage fish health is through prevention. Practical health management is based on stress management. This involves preventing and minimizing stress to the fish in the culture environment through:

1. **Good water quality management.** This begins by picking a farm site with good water quality and quantity. Maintain water quality at non-stressing levels,
2. **Good nutrition.** Feed high quality feed (nutritional and physical aspects) in the proper size and amounts.
3. **Good stocks of fish.** Only stock healthy, unstressed and disease-free fish and handle them as recommended.

Remember,

1. Fish are cold-blooded animals and respond directly to environmental conditions.
2. Aquaculture systems are innately unstable. This is because, their environmental components (chemical, physical and biological) are constantly changing, as fish biomass and nutrient inputs (feed) increase over time. The challenge to the farmer, is to maintain environmental parameters within the fishes normal to tolerance limits during the course of production.
3. Catfish do not have scales to protect them so rely on mucous to protect their skin. When the mucous is rubbed off, the catfish are very prone to infection and parasites.
4. Fish do not have eyelids and cannot protect their eyes when they are being rubbed against each other or being poured from a basket or net.

8.1. Fish Stress

*Stress* is an abnormal physiological condition of fish that results when the fish's collective adaptive responses to environmental factors are extended to, or approach its limit of tolerance. When fish are stressed,
or continuously exposed to stress, their immune system becomes weakened (just as people do when they are poorly nourished, overworked or exposed to harsh environmental conditions). Consequently, their ability to fight disease is reduced and they then succumb to infections and fall sick. In severe or prolonged cases, this may lead to death. Stress can be acute or chronic. Chronic cases are less obvious to the eye but result in reduced feeding response, higher FCRs and lower returns.

Other practical on-farm indicators of stressed fish are changes in behavior (such as when a fish prefers to remain alone rather than stay with the rest of the group), changes in their physical appearance (for example, they may become darker, lose fins), reduced feeding response and poorer growth rates.

Table 8.1: Generalized illustration of how Warm-Freshwater Fish might respond to Specific Environmental Factors under Certain Conditions

Adapted from Schmittou et al., 1998. Note clarias have slightly different temperatures for each of these categories.

<table>
<thead>
<tr>
<th>Fish Response</th>
<th>Environmental Factor</th>
<th>pH</th>
<th>NH₃-N</th>
<th>°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exhaustion and Death</td>
<td>Death</td>
<td>11.0</td>
<td>0.5</td>
<td>&gt;34</td>
</tr>
<tr>
<td>Fatigue</td>
<td>Short-term tolerance limit</td>
<td>9.8</td>
<td>0.4</td>
<td>33</td>
</tr>
<tr>
<td>Adapt</td>
<td>Long-term tolerance limit</td>
<td>9.5</td>
<td>0.2</td>
<td>31</td>
</tr>
<tr>
<td>Escape</td>
<td>Upper optimum limit</td>
<td>9.0</td>
<td>0.0</td>
<td>30</td>
</tr>
<tr>
<td>Normal</td>
<td>Ideal</td>
<td>6.5 to 8.0</td>
<td>0.0</td>
<td>26 to 28</td>
</tr>
<tr>
<td>Escape</td>
<td>Lower optimum limit</td>
<td>6.0</td>
<td>0.0</td>
<td>15 to 24</td>
</tr>
<tr>
<td>Adapt</td>
<td>Long-term tolerance limit</td>
<td>5.5</td>
<td>0.0</td>
<td>5-15</td>
</tr>
<tr>
<td>Fatigue</td>
<td>Short-term tolerance limit</td>
<td>5.0</td>
<td>0.0</td>
<td>&lt;5</td>
</tr>
<tr>
<td>Exhaustion and Death</td>
<td>Death</td>
<td>4.0</td>
<td>0.0</td>
<td>0</td>
</tr>
</tbody>
</table>
### 8.1.1. Common Sources of Stress

Most stress in fish farming arises from physical, chemical, biological and procedural sources (see table 8.2: below).

#### Table 8.2: Common Stressors in Production

<table>
<thead>
<tr>
<th>Chemical Stressors</th>
<th>Biological Stressors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acidity</strong></td>
<td>1. <strong>Diet Composition</strong></td>
</tr>
<tr>
<td>pH 6.5 to 8.0 ideal</td>
<td>Nutritionally-incomplete feed, especially when essential amino acids and vitamins are lacking.</td>
</tr>
<tr>
<td>pH ≤ 5.5 and ≥ 9.5 stressful</td>
<td><strong>Population Density</strong></td>
</tr>
<tr>
<td>pH ≤ 4.0 and ≥ 11.0 are lethal</td>
<td>At extremely low density - territorial behaviour - fights.</td>
</tr>
<tr>
<td><strong>Alkalinity</strong></td>
<td><strong>Micro- and Macro-Organisms</strong></td>
</tr>
<tr>
<td>Unlikely to cause stress</td>
<td>Existence of ecto- and endo-parasites.</td>
</tr>
<tr>
<td>Require more than 20 mg/l to buffer against stressing pH fluctuations</td>
<td><strong>Diseases</strong></td>
</tr>
<tr>
<td><strong>Hardness</strong></td>
<td><strong>Predators</strong>.</td>
</tr>
<tr>
<td>Stressful when concentrations are below 10 to 20 mg/l.</td>
<td>Predators such as man, birds, otters, etc. scare the fish and physically injure them.</td>
</tr>
<tr>
<td><strong>Heavy Metals</strong></td>
<td><strong>Physical Stressors</strong></td>
</tr>
<tr>
<td>In alkaline water, Cu and Zn are stressful at 0.05 mg/l and toxic at 0.1 mg/l</td>
<td>1. <strong>Temperature</strong></td>
</tr>
<tr>
<td><strong>Metabolic Wastes</strong></td>
<td>Stressful if fluctuates by 3° to 5°C in less than an hour.</td>
</tr>
<tr>
<td><em>Ammonia</em>:</td>
<td><strong>Light</strong></td>
</tr>
<tr>
<td>0.02 mg/l - chronic stress</td>
<td><strong>Sound</strong></td>
</tr>
<tr>
<td>0.05 mg/l - acute stress</td>
<td>Sudden sharp loud noises can cause fish to panic.</td>
</tr>
<tr>
<td>Growth may be reduced by 50% at 0.4 mg/l</td>
<td><strong>Low Dissolved Oxygen</strong></td>
</tr>
<tr>
<td>Mortality may begin at 0.5 mg/l</td>
<td>No matter what the reason, as long as fish cannot access the oxygen they require, they will be stressed.</td>
</tr>
<tr>
<td><strong>Nitrite</strong></td>
<td><strong>Physical Stressors</strong></td>
</tr>
<tr>
<td>0.01 mg/l stress</td>
<td>1. Associated with handling, holding, transporting and treating fish.</td>
</tr>
<tr>
<td>0.02-1.0 mg/l can get 'brown blood disease' and mortality</td>
<td>2. Crushing effect of gravity when holding fish out of water in nets/baskets.</td>
</tr>
<tr>
<td><strong>Physical Stressors</strong></td>
<td><strong>Procedural Stressors</strong></td>
</tr>
<tr>
<td><strong>Sound</strong></td>
<td>1. Associated with handling, holding, transporting and treating fish.</td>
</tr>
<tr>
<td><strong>Light</strong></td>
<td>2. Crushing effect of gravity when holding fish out of water in nets/baskets.</td>
</tr>
</tbody>
</table>

Often clinical signs of outbreaks of disease do not occur among un-stressed populations. The most common stressors to fish in ponds that
lead to disease are, (in order of observed occurrence and disease severity):

1. fish handling (pre-stock seining, holding, transporting and stocking, post-stock sampling, predators).
2. low dissolved oxygen levels
3. poor nutrition, especially vitamin C deficiency (See Plate 8.1).

8.1.2. Stages of Stress
In order to control stress, one must be able to understand what the stressors are and recognize fish under stress. There are four distinct stages of stress that are physically identifiable in fish:

1. **Alarm Reaction.** This is when the fish try to escape the stressor. An example of this is when stocking the pond and instead of swimming out freely into the pond, they skip across the water surface.

2. **Resistance.** When the fish react to the stressor through physiological adaptation. For example, when dissolved oxygen levels are low, the catfish will come out of the water to gasp atmospheric air.

3. **Fatigue.** The fish are noticeably weak but respond to stimuli.

4. **Exhaustion.** This is when the fish's physiology is unable to sufficiently adapt to a persisting stressful condition, and it can no longer respond to stimuli.

The impact of stress on fish depends on the duration and magnitude of the stress condition. Death is the ultimate result. Sub-lethal stress conditions cause reduced fish growth, low yield, poor feed conversion and poor health, including pathological diseases.
Table 8.3: Typical Appearances of Fish at Different Stages of Stress

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NORMAL</td>
<td>Healthy, alert, normal activity, normal body colour, social (schooling) activity</td>
</tr>
<tr>
<td>ESCAPE</td>
<td>Healthy, alert, increased activity and body movement, slight increase in opercular (respiration) movement, possible slight body color change (usually darker), schooling fish remain together</td>
</tr>
<tr>
<td>ADAPT</td>
<td>Healthy, alert, usually swimming higher than normal in water, increased opercular movement (look like breathing fast), schooling fish remain together</td>
</tr>
<tr>
<td>FATIGUE</td>
<td>Lethargic but sufficiently alert to avoid dip-net capture, reduced activity and movement, usually gasping at or near surface, color change distinct (usually much darker), schooling fish separate to individuals</td>
</tr>
<tr>
<td>EXHAUSTION</td>
<td>Hanging listlessly, usually disoriented (commonly upside down) at surface, little or no response to avoid dip-net capture</td>
</tr>
</tbody>
</table>

8.2. Predators and their Control

Predators are a major source of stress to fish and can also cause significant losses. **NOTE:** Large African catfish can predate on smaller ones; so, maintaining uniform sizes within ponds is critical.

Predators:
1. consume the fish in the pond,
2. consume the fish’s feed,
3. may transmit parasites and other infections to fish,
4. scare the fish when they are chasing them up, and
5. cause physical injury to several fish in the process of hunting.
6. May trans-locate fish to a different pond

The wounded fish left in the pond consequently cannot get to the feed as well as the other normal fish. This is because, for example, their eyes...
might be injured or their open wounds might get infected, etc. Consequently, their growth rate slows and chance of survival drops. Controlling predators is therefore important in commercial production.

The most common predators are:

1. **Humans Beings**
   Provide security to your premises by fencing off and keeping the place active. Some places have gotten local authorities to recognize how harmful theft is to the development of commercial fish farming in their area and have enlisted their help in prosecuting fish farm thieves. As well, be a good neighbor and make sure others appreciate the fact your farm is there. This can create “social pressure” to reduce thievery.

2. **Frogs and Snakes.**
   The populations of frogs and snakes can be controlled by keeping premises around clean and clear. Do not allow bushes to grow around the ponds. Water channels should also be kept clean and clear. Screen the ponds as recommended. Screens within the water channels also help reduce frogs’ access to the ponds. Frogs tend to come into pond areas via the water channels. Short grass around the ponds reduces hiding places for the snakes and frogs, which makes them more vulnerable to predation by hawks.

3. **Birds.**
   a. Wading birds (such as the heron, marabou stork, hammerkop) walk into the pond to catch fish. To control wading birds, ensure pond average water depths of 1 meter so that the birds are unable to stand in the pond (See Plate 8.3b).
   b. Diving birds (such as the king fishers, ducks) fly over or swim on the water surface then dive down to pick the fish. Tying string at close intervals over the pond prevents them from being able to fly away once they have come down or dive through the strings (see Plate 8.6b).
   c. Avoid setting your ponds near places where birds can perch, such as having pond under telephone or electricity wires/poles, trees, etc. These provide a spot for birds of prey to sit, watch the fish and time when best to hunt them (see Plate 8.6a). Tall sticks placed in ponds are excellent perches for kingfishers. If sticks are required in a pond, they should be kept as short as possible.
d. Scarecrows or sudden loud noises may be used to scare away birds. However, if this option is used, change the tactics at least every two weeks. This is because the birds learn fairly fast that the object is not life threatening and will eventually ignore the scarecrow or noise (see Plate 8.6g).

e. Learn at what time birds come to hunt fish. Most times, birds come down to get fish soon after feeding, early in the mornings or late in the evening. Be around at such times to scare away the birds. Human activity helps to keep birds away.

f. Do not leave any dead animals or feed, etc. lying around ponds because birds may come to feed upon them. Dispose of all rubbish and carcasses by burying them away from the pond area.

g. String may be tied across the pond or specifically around the feeding area to prevent diving and wading birds predating upon the fish.

h. One may also train dogs on the farm to scare away birds (See Plate 8.6e).

Cormorants and pelicans are usually the most nuisance of predators because they fish in groups can crowd the fish just as if they were a seining crew.

Birds do provide some service by removing unhealthy fish from the ponds. However, some birds develop the habit of “following the feeder” and end up removing health fish. So, it is best stay at the pond until fish have consumed the feed.

Birds can be a “bio-indicator”. They will begin to gather around a pond where the fish are having trouble. So, if you see a gathering of birds on your farms, check it out.


Clear the bush around so that they have no nesting close by. Set traps to catch monitor lizards and otters. Dogs are also very good at chasing away these predators. Otters are most likely to show up at night.
Summary Guidelines for Preventing Stress and Disease to Fish
The following is a check list of management guidelines to avoid fish health problems.

1. **Select Good Fish Stock.** Fish in poor health and physical condition will grow slowly, convert feed poorly and general production performance will always be lower than for fish of select quality. Guidelines for choosing stock have been discussed in Chapter 3.

2. **Handle Fish With Care** when collecting, holding, transporting, stocking and sampling. Improper handling of fish is one of the most serious and common stressors that result in poor fish production, disease and death.
   The guidelines for proper handling include:
   a. identify and minimize all chemical, physical and biological stressors for each handling situation.
   b. be especially careful to avoid the most common stressors:
      - never remove fish from water unless absolutely necessary,
      - do not hold fish out of water longer than absolutely necessary, and do not handle with dry hands,
      - do not overload fish in nets and containers out of water,
      - do not hold fish at high densities in closed water containers and tanks without proper aeration and water quality control,
      - do not change water temperature around fish by more than 3 °C at one time and by 2 °C/hour over long periods of time,
      - do not measure and weigh individual fish unless there is some specific need for that information and the fish are expendable,
      - avoid using chemicals, including anesthetics, when handling fish.

3. **Feed Fish with only Good Quality Feeds.** Proper nutrition is not only essential for good growth and feed efficiency but for good health as well. Good quality feeds prevent nutritional diseases and are critical to the prevention of other pathogenic and stress-related diseases.
   Guidelines for feed quality:
   - Use nutritionally-complete pellets, 30-32% protein fortified with stabilized vitamin C and mineral supplements for fish.
   - Use freshly manufactured feeds. Avoid feeds older than 2 months.
Always check date of manufacture. Note that some feeds will remain good longer than others if they are sufficiently dried and are made with stabilized vitamins, or extra vitamins, mold inhibitors and anti-oxidants.
- Do not use molded, spoiled or otherwise degraded feed.

4. **Never Apply Drugs or Chemicals to the Fish or their Water Unless it is Absolutely Necessary.** A salt dip of 0.5% is recommended for prophylaxis when handling fish. (This is 5 grams of salt in every liter of water)

5. **Maintain Good Water Quality Control in Ponds.**
   - Construct ponds as recommended
   - Ponds must be at least 1 meter average water depth
   - Practice *static water* management and avoid leaking ponds
   - *Stock* and manage based upon *carrying capacity* for feed specifications.

6. **Control Predators**
   - Minimize the amount of vegetative growth around ponds as these act as a refuge for many potential predators e.g. Birds, snakes, otters, monitor lizards, thieves.
   - Keep the place around farm active and be observant.
   - Keep area around ponds clean.
   - In the event that some predators become uncontrollable with non-lethal means, contact the Uganda Wildlife Authority.

Use non-lethal means to control predators. The common 'predators' other than man are wildlife and are protected by law (see appendix 10). In the event that birds, otters, monitor lizards, snakes become uncontrollable, report to the Uganda Wildlife Authority who will then have these animals captured and trans-located.

If you attempt to use poisons, a non-target animal may be killed, including people, and you can be held responsible.
Plate 8.1: Crack Head

A cracked head is a sign of vitamin C deficiency in Catfish.

Plate 8.2: Aeromonas sp.

Bacterial infections become common when fish are kept for prolonged periods in water of poor quality and are fed a non-balanced diet. This case was obtained from a pond that had reached its carrying capacity and oxygen levels were below 0.2 ppm and total ammonia levels above 20 ppm over a period of a month. For grow-out fish, the most economical treatment is to withhold feed, flush pond and reduce stocking densities. After improving environmental conditions re-start feeding.
Plate 8.3: Common Predatory Wading Birds (Pictures courtesy of UWA)
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Plate 8.3: Common Predatory Wading Birds, cont. (Pictures courtesy of UWA)

g. Egret
h. Shoe-billed stork

Plate 8.4: Predatory Diving Birds

a. Pied kingfisher with fish
b. Kingfisher getting ready to dive
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a. **Fish Eagle:** usually picks from the water's surface with its talons.

Cormorants (diving birds), Marabou Stork and Yellow Bill, wading birds (Picture courtesy of UWA)

**Plate 8.4:** Predatory Diving Birds, continued
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Plate 8.5: Other Predators

a. Monitor Lizard
b. Otters
c. Crocodiles
d. Human Beings
a. **Birds Perched on Electricity Wires.** As much as possible, locate ponds where there is little room for birds to perch or other animals to hide around the pond. Picture courtesy of Uganda Wildlife Authority.

b. **Strings Tied Close Over the Pond.** Strings tied close over the pond, especially over the feeding area prevent diving birds entering. When tied around ponds, entry of wading birds is also interfered with.

c. **Kingfisher with Fish.** Keep area around ponds clean. Do not leave rubbish such as dead fish or feed lying around. Picture courtesy of Uganda Wildlife Authority.

d. **Marabou Stork by Pond Side.** Wading birds cannot walk into ponds whose water is deep to fish. The recommended average pond water depth is 1m.

**Plate 8.6: Controlling Predators**
e. Dogs
Dogs may be trained to scare birds and otters away. They can be very effective.

f. Pond with Little Freeboard
Birds cannot build nests in the pond banks after this pond is full as there is too little room.

g. Scare-devices
Remember to Change the Scare-device and tactics at most every two weeks because birds can learn that the device is not a threat.

Plate 8.6: Controlling Predators, continued