CHAPTER 4:

STOCKING PONDS

Putting fish into the pond, stocking, marks the beginning of a production cycle. It is among the most stressful processes the fish go through in the course of production. The process of stocking referred to here, starts with the collection of fingerlings from the hatchery, transporting them to the farm and, finally, putting them into the pond. Poor stocking procedures, are among the major causes of low survival in grow-out ponds. They result in disease, reduced growth and mortality. However, because the ensuing mortalities do not occur normally until after about three days, and many of the fish that die do not actually come up to the surface, many farmers do not recognize it as a serious factor.

Upon draining the pond the farmer often experiences many fewer fish than the number stocked. This makes most farmers think the fish were either stolen, predated upon or the said number was not received. Farmers who do not realize that most of their fish died within the week following stocking, tend to overfeed and can lose a lot of money. For this reason, a month of nursery phase is recommended (see appendix 2 for summary recommendations for nursery pond management). After 1 month, the small nursery pond is harvested and the fingerlings, which by this time are larger and more resistant to handling, are weighed and counted into the larger production pond.

Successful stocking depends upon the quality of fingerling, how they are stocked and when they are stocked.

4.1. Quality of Fingerlings

The third most important factor, that affects production and returns in pond culture after nutrition and environmental (water) quality, is the quality of fish stocked. Stock quality does not just refer to the genetic make up of the fish. It also refers to the general health, relative size and other physical and physiological characteristics of the fish. Practically, every farmer should be in position to assess the physical characteristics and physiological status of good fingerlings. Poor quality stock will give poor production performance regardless of other factors.
The most important practical criteria for assessing the quality of catfish fingerlings are source, physical appearance and how they swim.

4.1.1. The Source of Fingerlings
Preferably, purchase fingerlings from a hatchery that follow Best Management Practices (BMPs) for catfish seed production.

A well-run fish hatchery:
1. Can guarantee the good quality of fingerlings or stockers it supplies.
2. Has a good reputation among other farmers (check with other farmers)
3. Follows the stipulated BMPs for hatcheries (see appendix 3). The manner in which fish are reared and handled within the hatchery directly affects their health status, survival and potential to perform.
4. The hatchery should have adequate facilities to hold and condition fish before live transportation.
5. Keeps good hatchery records. The hatchery should have a proper record system that enables them as well as the buyer to trace the lot of fish purchased down to the batch in case of any questions.
6. Provide fingerlings above 10cm.

4.1.2. Physical Characteristics
The fingerlings should be of a uniform color and size. Catfish fingerlings usually are darker (blackish) on the top and lighter (creamy) around the belly (see Plate 4.1a). Do not purchase the fish if:
(i) several of them have patches over their body,
(ii) they have less than two barbels, no tail or missing fins,
(iii) they show signs of physical injury or bleeding,
(iv) they are deformed (see Plate 4.1b),
(v) they are less than 10cm in total length.

These are signs of poor condition. Such fish are likely to be already diseased and are less likely to survive transportation or stocking.

It is important to stock fish of uniform size otherwise the larger fish will cannibalize the smaller ones. They will also dominate the feeding area which will result in them growing bigger and the smaller fish remaining small. In such a situation, at harvest, there will be only a few extremely
large fish (shooters) and several tiny fish of unmarketable size. Survival rates from stocking to harvest in this case will be extremely low.

4.1.3. Physiological Characteristics
The fingerlings in the holding unit in the hatchery should be swimming normally and should be active. Fish remaining up-right, that are sluggish and do not respond to stimuli or prefer to be isolated from the rest of the group, are unlikely to be well (see Chapter 7 for more details). Do not purchase and stock such fish.

4.2. Stock Stress-Free Animals
The fish should be stress free, lively and active. Stressed fish start dying about three days after stocking and mortalities can continue for up to a week. It should be noted that, not all the dead fish float to the surface. As has been mentioned above, stress associated with stocking is among the major causes of low survival. However, because the deaths do not occur immediately and dead fish are often picked up by birds at dawn or dusk, many farmers fail to link the ensuing mortalities and low survival with poor handling at stocking. Minimising stress associated with stocking starts at the hatchery. Therefore, take note of the following when you intend to stock your ponds.

4.2.1. Place the Order for Fingerlings from the Hatchery in Advance
Order the fingerlings at least four days in advance. Re-confirm your collection time for picking up the fingerlings a day or two before the receiving day. This is to give ample time to the hatchery operators to sort, grade and condition the fish a few days before they are transported to the grow-out farm.

To enable the hatchery operators sort and grade the right fish and pack it for transportation appropriately the following information must be given when placing your order.

1. The number and sizes of ponds you intend to stock.
2. How many fish are to be stocked into each of the ponds?
3. Size of fish you require. The minimum recommended size for stocking catfish grow-out ponds is 10 cm or 5g. Stocking larger fingerlings (from 10 g up) though is preferable.
4. The destination (location of farm) i.e. how far to travel.
5. On which day and at what time you intend to collect the fish.
6. How you propose to transport it. For example, if you are to use public transport, either you or the hatchery operator might need to arrange for packing boxes so that the transport bags remain secure in the bus.

4.2.2. Handling at the Hatchery.

A hatchery that follows BMPs, should be in a position to undertake the following, to ensure that the fish collected are not stressed, and that they are in the best condition for stocking.

1. Fish should be Conditioned for 48 Hours before Collection. To prepare the order, the fingerlings have to be seined, sorted, graded, counted and then held in holding facilities (either tanks or hapas) with good water quality and aeration as needed, for at least two days prior to collection. The fingerlings are to be left in these holding units without feed until the collection day, but for not more than 3 days. This process is termed ‘conditioning’ the fish. Conditioning provides time for the fish to empty their guts before transportation and for the weak/deformed fish to be identified and removed. Do not transport fish with full guts because they will defecate and vomit in the transportation container, which reduces the water quality by increasing the levels of ammonia and organic load. When their guts are full, the fish require extra levels of oxygen to enable them breakdown the food in their guts. This results in a more rapid depletion of dissolved oxygen levels within the transport container. Holding fish prior to transportation in conditions of poor water quality is extremely stressful, and is a major predisposing factor for disease and mortality. Do not transport fish for stocking that have not been conditioned for at least 48 hours in good holding conditions.

2. Estimate Counts by Weight or Volumetrically. Counting fish one-by-one is extremely stressful especially for the young stages. At this sensitive stage, fingerlings should always be kept in water. It is least stressful, therefore, to have the numbers estimated volumetrically or by weight. For example, if the average weight of the fish is 10 g, then 1 kg of fish should be equivalent to approximately 100 fish (i.e., 1,000g/10g = 100). Fish counted in this way are least stressed and there are fewer reported losses during transportation and at stocking. It also requires less labour, so the hatchery should be in position to give 5% of the total number of fingerlings purchased for free to cover for any possible shortage.
3. **Package for Live Transportation.** When you arrive at the hatchery, fish should be packed for live transportation in either bags with oxygen or in tanks with aeration. Each bag should receive its fish after your arrival and immediately have the air evacuated and oxygen added. A bag should be done completely from adding fish to oxygen at a time. The hatchery should not allow bags with water and fish to remain in line awaiting oxygen otherwise by the time this is done, the fish with have been held for a while in water devoid of oxygen (*stressed*).

In addition, the bags or tank should not be overloaded with fish. The general *stocking* rate for oxygenated transport bags is 1 to 2kg of *fingerlings* for every 10 litres of water (100-200 g/L) depending on the size of fish, transport condition and distance to travel. Smaller fish require about four times more oxygen than adults.

Furthermore, each bag should be labelled individually with a tag providing the information shown in figure 4.1 below.

- Hatchery Name and Contact Details
- Fish Species
- Number/Weight of fish in bag
- Average Weight of Fish (g)
- Lot or Batch No. (this should be traceable back to unit from which the fish were obtained and the date of harvest)
- Estimated DOB (Date of birth) (fish sold as a lot or batch should be within a month old from each other)
- Any other Specifications or Required Details (e.g. if selected stock; intended destination - *e.g. Johns farm, pond C*, etc.)

**Figure 4.1**: Recommended Labelling for Containers used in Live Haulage of Fingerlings to Farms.

The objective of having each bag labelled independently is to:

1. **Assure Quality.** The hatchery commits itself to the contents in the bag at packing.

2. **Minimise the Amount of Physical Handling.** When each bag is packed and labelled for its final destination (*e.g. grow-out pond B*), the grow-out farmer can *stock* his ponds without having to touch or count his fish again, except for removing those that might die or are too weak to *stock*. This reduces the levels of handling *stress* associated with *stocking* grow-out ponds. More than one bag might
be required per pond depending on its size because the bags should not be overloaded with fish.

3. Ensure the Fish are in Good Quality Water up to Stocking. Once a bag packed with oxygen is opened, the oxygen escapes immediately out of the bag. The fingerlings will quickly consume and deplete the remaining oxygen in the water. Therefore, if the fish from one bag need to be divided among different places, the lengthy stocking time results in the last fish being stressed from low oxygen. The last fish will have literally been suffocated though they might still be moving. Losses in such a case will subsequently be very high soon after stocking and survival rates at harvest low. If fish from the bag must be counted and divided for stocking, the water in the bag must either be aerated or the fish moved to a larger volume of good quality water or a tank with flowing fresh water. (For more details on the recommendations for packing fish for live fish transportation, see appendix 4).

4.2.3. Live Transportation of Fingerlings from Hatchery to the Farm

The survival of the fish enroute from the hatchery to the farm is the transporter's responsibility. Transportation should be as stress-free as possible. Consequently, it is extremely important that the transit time to the farm is minimised to the utmost. Do not stop to run errands after collecting fish from the hatchery. Rather complete all your errands before collecting the fingerlings from the hatchery. This is because:

1. By simply being crowded and confined in containers, the fish are subjected to stress. In addition, they will still be releasing metabolic wastes into the water in which they are being transported. While the levels of waste (notably the solid wastes) they release will have been minimised as a result of the 'conditioning' process, dissolved wastes (e.g., ammonia and carbon dioxide) will still be released. The longer the transportation time, the more these wastes will accumulate and the more stressed the fish will be.

2. The polythene bags in which fingerlings are transported act as a greenhouse. If left out in direct sunlight, the water in the bags can become extremely hot (to above 32°C) within a few hours. Rapid changes in temperature or extreme temperatures are extremely
stressful to the fish and result in fatigue and eventually mortality (see table 4.1 below). Therefore, keep the transport containers or bags shaded and cool during transportation. If the fingerlings are being transported at the back of a pick-up for example, cover bags/tank with wet sisal gunny bags, mats or banana leaves. This will help keep them shaded and cool. The darkness also helps keep the fish calm. Bags should also be placed in boxes, basins or baskets to help support them during transportation and prevent punctures (see Plate 4.2).

Caution!!

1. If at any time during transport, the bag deflates, it means the oxygen has left the bag and the fish will die soon. The only way to keep your fish alive after the oxygen has gone from the bag is to keep changing the water. CAUTION: Replacement water should be of equal quality and similar temperature; otherwise, the fish will be stressed even more. If the bag begins to deflate soon after you have left the fingerling vendor, you should return to the vendor and ask them to change the bag and to add more oxygen and re-close the bag.

2. Do not transport fish for more than twenty minutes without some form of aeration because the oxygen levels drop to zero within less than five minutes in containers (see table 4.1). Remember all living things need oxygen. Once the dissolved oxygen levels approaches zero, fish will begin to die. Larger catfish are, however, air breathers and can survive by gulping air at the surface. They need to be able to get to the water surface in order to survive.

3. If you are transporting fingerlings in a transport tank with aeration, do not change the water simply because the temperature has risen unless it is over 30 °C. It is more important to have adequate levels of oxygen within the tank.

NOTE: It is worth spending an extra bit of money to ensure that the fingerlings are packaged as recommended. Fingerlings are one of the major operating costs. Any losses will result in loss of profits.
<table>
<thead>
<tr>
<th>Type of fish</th>
<th>Reason for transport</th>
<th>Type container</th>
<th>volume of water in container (litres)</th>
<th>average size fish (g)</th>
<th>amount fish (kg)</th>
<th>Aeration (yes/no)</th>
<th>Type aeration (oxygen/air)</th>
<th>Readings at Departure</th>
<th>Readings at Destination</th>
<th>Transit Time to Destination</th>
</tr>
</thead>
<tbody>
<tr>
<td>tilapia</td>
<td>transfer from one pond to another on the same farm</td>
<td>basin</td>
<td>15</td>
<td>5</td>
<td>3.0</td>
<td>no</td>
<td>none</td>
<td>4.92</td>
<td>25.5</td>
<td>2.62</td>
</tr>
<tr>
<td>tilapia</td>
<td>transfer from one pond to another on the same farm</td>
<td>basin</td>
<td>20</td>
<td>5</td>
<td>3.0</td>
<td>no</td>
<td>none</td>
<td>5.2</td>
<td>26.1</td>
<td>3.43</td>
</tr>
<tr>
<td>tilapia</td>
<td>transfer from one pond to another on the same farm</td>
<td>basin</td>
<td>20</td>
<td>5</td>
<td>4.0</td>
<td>no</td>
<td>none</td>
<td>5.6</td>
<td>25.8</td>
<td>2.61</td>
</tr>
<tr>
<td>tilapia</td>
<td>stocking on another farm</td>
<td>tank</td>
<td>200</td>
<td>10</td>
<td>75.5</td>
<td>yes</td>
<td>air</td>
<td>7.52</td>
<td>27.8</td>
<td>4.9</td>
</tr>
<tr>
<td>tilapia</td>
<td>stocking on another farm</td>
<td>tank</td>
<td>200</td>
<td>3</td>
<td>23.0</td>
<td>yes</td>
<td>air</td>
<td>8.36</td>
<td>25.6</td>
<td>6.01</td>
</tr>
<tr>
<td>catfish</td>
<td>loading tank for transportation (reading before tank leaves hatchery)</td>
<td>tank</td>
<td>500</td>
<td>3</td>
<td>150.0</td>
<td>no</td>
<td>none</td>
<td>6.4</td>
<td>26.7</td>
<td>0.8</td>
</tr>
<tr>
<td>catfish</td>
<td>stocking on another farm</td>
<td>bags</td>
<td>20</td>
<td>3</td>
<td>1.5</td>
<td>yes</td>
<td>oxygen</td>
<td>6.3</td>
<td>22.4</td>
<td>2.9</td>
</tr>
<tr>
<td>catfish</td>
<td>bait (loading jerry can)</td>
<td>jerry can</td>
<td>10</td>
<td>10</td>
<td>2.0</td>
<td>no</td>
<td>none</td>
<td>5.4</td>
<td>24.5</td>
<td>1.3</td>
</tr>
</tbody>
</table>
4.3. Size to Stock

Fingerlings, stockers or sub-market sized fish can be stocked into ponds for grow-out production (see table 4.2).

Table 4.2: Description of Catfish Sizes Recommended for Stocking Grow-out Ponds.

<table>
<thead>
<tr>
<th>Size Description</th>
<th>Length (cm)</th>
<th>Average weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fingerlings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small fingerlings</td>
<td>7-10</td>
<td>3-6</td>
</tr>
<tr>
<td>Medium fingerlings</td>
<td>10-12</td>
<td>6-9</td>
</tr>
<tr>
<td>Large fingerlings</td>
<td>12-15</td>
<td>9-20</td>
</tr>
<tr>
<td>Extra large fingerlings</td>
<td>&gt;15</td>
<td>20</td>
</tr>
<tr>
<td>Stockers</td>
<td>21-100</td>
<td></td>
</tr>
<tr>
<td>Sub-market</td>
<td>100-399</td>
<td></td>
</tr>
<tr>
<td>Table size</td>
<td>+400</td>
<td></td>
</tr>
</tbody>
</table>

The minimum recommended stocking size for grow-out ponds, however, is 10cm (6g). This is because fish of this size are able to avoid predation from other water life, overcome minor stressful situations and can ably swim across the ponds to feed. If good quality fish are stocked, fed and managed properly, survival rates at harvest can be very good (see table 4.3 below).

Table 4.3: Size at stocking versus survival rates at harvest in ponds managed as grow-out catfish ponds.

<table>
<thead>
<tr>
<th>Size at stocking (g)</th>
<th>Survival rate at harvest (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.3-1.5</td>
<td>6-20</td>
</tr>
<tr>
<td>1.5-3.0</td>
<td>19 - 30</td>
</tr>
<tr>
<td>3-5</td>
<td>30 - 50</td>
</tr>
<tr>
<td>5-10</td>
<td>40-60</td>
</tr>
<tr>
<td>10-50</td>
<td>60-90</td>
</tr>
<tr>
<td>50-100</td>
<td>80-100</td>
</tr>
<tr>
<td>+100</td>
<td>90-100</td>
</tr>
</tbody>
</table>

Data from USAID FISH Project Farm Trials (2005-2008).

Never stock fish that are too small in a grow-out pond because the low survival reduces profit margins as well as raising the costs of production.
Box 2: The Actual Cost of Stocking Grow-Out Ponds with Fish below the Recommended Size

EXAMPLE: A farmer has a grow-out pond of 1,000m² and intends to stock it with 2,000 catfish. However, the farmer has been presented with two options, fry of an average weight of 3g at USh. 100/= each or large fingerlings of an average weight of 10 g each at 200/= each. Which of the two sizes will give the best production results and returns?

<table>
<thead>
<tr>
<th></th>
<th>Option A</th>
<th>Option B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average weight of Catfish to Stock (g)</strong></td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td><strong>Unit Cost (USh.) at hatchery</strong></td>
<td>100</td>
<td>200</td>
</tr>
<tr>
<td><strong>Total Amount Spent for Fish Stocked (USh.)</strong></td>
<td>200,000</td>
<td>400,000</td>
</tr>
<tr>
<td><strong>Expected Survival Rate (%)</strong></td>
<td>30</td>
<td>70</td>
</tr>
<tr>
<td><strong>Estimated Number of fish at harvest</strong></td>
<td>= 2000 fish x 30 = 600 fish</td>
<td>= 2000 fish x 70 = 1,400 fish</td>
</tr>
<tr>
<td><strong>Actual Cost of Each Catfish Stocked (USh.)</strong></td>
<td>= 200,000/= 600 fish = 333/=</td>
<td>= 400,000/= 1,400 fish</td>
</tr>
<tr>
<td><strong>Months required to attain market size</strong></td>
<td>About 8 months</td>
<td>6 months</td>
</tr>
<tr>
<td><strong>Number of fish that will be available for sale at harvest</strong></td>
<td>600 fish only</td>
<td>1,400 fish</td>
</tr>
</tbody>
</table>

**NOTE:** You may not always be saving money by stocking fry rather than fingerlings of the recommended size just because they are cheaper. Make the decision after knowing what survival rates you are likely expect and check the cost. If you only have access to fry, raise them in a nursery pond to fingerling size first.

Therefore, because survival rates are low when grow-out ponds are stocked with fish of 5 g or less, it is recommended that such fish are first stocked into a nursery pond for about a month until they get to a size of about 50g. Stocking fingerlings from the hatchery into a nursery pond prior to stocking in a production pond presents the following advantages:

1. it is easier to protect a small pond from predators,
2. the higher stocking densities in nursery ponds allow for easier feeding of the fry or fingerlings,
3. it enables the farmer avoid the situation of wasting feed for a whole cycle because when he empties the nursery pond, the farmer will be in position to count exactly how many fish will have survived and are stocked into the grow-out pond (see appendix 2 for more details on catfish nursery pond management).
4.4. Stocking Rates

It is recommended that fish be stocked based on the pond’s carrying capacity vis-à-vis the targeted market size. This is because a pond is an ecosystem which has a maximum load that it can safely support. Consequently, when overloaded beyond its limits, instead of having a favourable environment for production, the result is a polluted system that cannot support production. The pond’s water quality starts to deteriorate because the pond’s systems can no longer effectively break down and assimilate wastes. If the situation worsens, fish experience disease and mortality (See figure 4.2). Once the pond’s carrying capacity has been attained, the fish will cease to grow no matter how long they stay in the pond. Production and returns actually start to diminish (point of diminishing returns) at “critical standing crop” prior to reaching the carrying capacity. The carrying capacity for static water catfish monoculture ponds in southern Uganda when fed nutritionally-complete diets can be estimated at about 20 tons/ha (or 2.0 kg/m²).

**Figure 4.2:** How the total biomass in the pond changes as carrying capacity is reached

Figure 4.2 illustrates how change in biomass declines and almost becomes static with time when carrying capacity has been attained. If there were 20,000 fish in this pond, they would not grow to a very large size.
A pond’s *carrying capacity* is influenced by:
1. the size of fish in the pond (because this influences the feeding rate)
2. the species of fish being raised because fish like clarias become air breathers and do not need to rely on dissolved oxygen in the pond, therefore the *carrying capacity* is higher for clarias compared to tilapia
3. the amount and type of feed or fertilizer added to the pond
4. the water volume and quality (see Chapter 5 for more discussion.)

Therefore, the number of fish to be *stocked* depends not just on the targeted market size, but additionally, on the way the pond was constructed, the type of feed used and the pond management program. The *carrying capacity* of a nursery pond is also different from that of a grow-out pond because the fish are fed a higher percent body weight. The *carrying capacity* of a catfish nursery pond is about 5,000 kg/ha (or 0.5 kg/m²).

**Equation 1** below illustrates how the number of fish to be *stocked* in a pond can be estimated based on the pond’s *carrying capacity*.

\[
\text{Number to stock} = \frac{\text{Estimated maximum carrying capacity of a pond (kg)}}{\text{Desired weight at harvest (kg)}} + 10\%
\]

The 10% is to cater for mortality. Note that it is best to use *critical standing crop* but most farmers base *stocking* on *carrying capacity* with the understanding they will do a partial harvest as growth begins to slow.
The “split-stocking” management option

In order to get the most from their ponds, farmers will often elect to stock at high density with the intention of splitting the total fish number into multiple ponds before the fish reach market size. This can be done in many ways. Typically the farmer will stock about 3 times as many fish as the pond could hold and then harvest out 2/3 of them after a few months and put them into 2 more ponds. For example, if a farmer knows that pond A should be able to hold about 1 ton of catfish and the final size desired is 600 g, then the pond should have about 1,000 kg/0.6 kg = 1,667 fish at harvest time. Let’s say the farmer would stock 2,000 to cover for any losses. However, the farmer can stock 6,000 and then when the total calculated population gets close to 1,000 kg, seine the pond and remove 4,000 fish. Those 4,000 fish can be put into 2 more ponds of the same size, thus resulting in 3 ponds of 2,000 fish each.

Many farmers have found this option to be desirable because they can renovate one pond first and while they are renovating the other 2 ponds, their fingerlings can be growing out in a nearby pond. When they make the split, they can even grade the fish so one pond receives the larger fish and another receives slightly smaller fish.
Box 3: Example of How to Calculate the Number of Fish to Stock

EXAMPLE: The size of pond to be stocked is 1,000 m². The size of fingerlings is 15 g and the targeted size for harvest is 800 g. The intended management regime is catfish monoculture fed entirely on commercial nutritionally-complete pellets in static water ponds. How many fish should be stocked?

The critical standing crop for catfish monoculture fed commercial pellets is estimated at 1.8 kg/m² (18 tons/ha). Add 10% to account for mortalities.

\[
\text{Number of Fish} = (1,000 \text{ m}^2 \times 1.8 \text{ kg/m}^2) + 10\% \text{ of } (1,000 \text{ m}^2 \times 1.8 \text{ kg/m}^2)
\]

\[
= 2,250 + 225
\]

\[
= 2,475 \text{ fingerlings should be stocked}
\]

NB: Cross check that the daily amount of food required to feed the fish as they approach harvest does not exceed 20 g of feed/m² pond area. Use the feeding chart (see appendix 5) to help you make this estimate. If it will exceed the limits, reduce the stocking rate or plan on using a flow-through system.

Therefore, in this case, assuming a survival rate was 90% (i.e. 225 fish died), we can estimate that there shall be 2,250 fish of an 800 g average weight at harvest.

Therefore, the amount of feed that will be required per day when fish are at about harvest size.

\[
= \text{Daily Feed/Fish (g)} \times \text{No. of fish in the Pond}
\]

From the feeding chart at 800 g the daily feed requirement for each fish is between 8.7 to 9.1 g (estimate 8.9 g).

\[
= 8.9 \text{ g} \times 2,250
\]

\[
= 20,025 \text{ g of feed/day}
\]

\[
= 20.1 \text{ kg of feed would be required to feed the 1,000 m}^2 \text{ pond when the fish are ready to harvest.}
\]

However, not more than 20 g of feed per m² per day should be fed to non-aerated static water ponds otherwise water quality problems might arise. Therefore, in this case, the maximum feed amount that can be added a non-aerated pond of 1,000 m² is:

\[
= 20 \text{ g feed m}^2 \times 1,000 \text{ m}^2
\]

\[
= 20 \text{ kg feed/day}
\]

For this case, therefore, we are relatively safe and can stock the actual number that was calculated. If our projected feed requirement at harvest would have exceeded the safe limit, then (i) we would have had to reduce the number of fish to stock in order that by harvest our projected feeding rate would be within safe limits, or (ii) as we approach the daily feed limit, we could do a partial harvest, thereby reducing the amount of feed required per day., or (iii) we could begin flushing water through the pond to wash out the wastes.

The same procedure should be used to estimate the number of fingerlings to stock in a nursery pond.
4.5. When to Stock
Ponds should be stocked as soon as possible after they have been filled with water. Remember to check that the water quality in the pond is suitable for stocking especially if pre-stocking pond treatments have been done a day or two before the planned stocking date. Set your stocking date to suit your market’s needs.

4.5.1. What Is The Best Time Of Day To Stock The Pond?
The best time of day to stock the pond depends on the water quality (notably oxygen levels, temperature and pH) and not particularly on the hour of the day. It is recommended that the pond be stocked when the pond’s water quality is at its best. The dissolved oxygen levels should preferably be not less than 5 mg/L (5 ppm), water temperature not less than 25 °C, and pH levels between 7 and 7.5 at stocking.

The other consideration one must take into account is one’s work schedule. When stocking the pond, one must have the time to be present to monitor the fish during and a couple of hours after the stocking process. Therefore, it is preferable to stock during the day, and not at night.

4.5.2. Intervals between Stockings
At times it may not be possible to get all the fish required to stock the pond at once. In the event that this happens, do not stock fish more than two weeks apart because by then there will literally be two entirely different populations. Fighting and subsequently stress and lower survival rates may ensue. Also, remember that the lot stocked first will be growing in the mean-time and it is important to have uniform sizes stocked into the pond, to avoid cannibalism.

4.6. How to Stock
Stocking should be done in a manner that minimizes stress to the fish. Stress results in mortalities and disease outbreaks. Therefore, do not pour the fish straight into the ponds. Acclimatize the fish first over 15 to 30 minutes and gently release the fish into pond. This helps them adapt to the differences in water quality between the transport container and the pond without shocking the fish. When fish are shocked by the sudden changes in water quality, they become stressed or die. Temperature, oxygen, mineral content and pH are the key parameters for which acclimation needs be done for catfish fingerlings. Allow 15 minutes for every degree change in temperature and for every unit change in pH.
4.6.1. **Guidelines for stocking fish from bags.**

The following are the recommended steps to follow when *stocking* fish into ponds from bags.

1. **DO NOT** open any of the bags before they get to the pond. This is because once a bag is opened, all the oxygen in the bag will leave into the atmosphere. The fish only have about 5 to 10 minutes before they run out of oxygen after a bag has been opened.

2. Set the bags right next to the pond (keep bags in basket or box to support the bag) or just in the pond. You are going to add water to the bag, so it may be too heavy to move after that.

   If you have the equipment, check the water quality parameters of the pond before opening the bags and the water quality within the bags as well as during the course of acclimation, especially for temperature and oxygen.

3. Open one bag at a time. Begin with the bag that is least inflated.

   If you have no tools for checking water quality, use your fingers to detect for any obvious temperature differences between the pond water and water in the bag.

4. Add water from the pond into the bag. While doing this, you can allow the other un-opened bags to float on the pond. This will allow the other bags to adjust to the pond temperature. Cover these bags to shade and prevent excessive sunlight.

   **NOTE:** Floating the un-opened bags on ponds alone is insufficient to *acclimate* the fish properly. This is because bags used for packing fish for grow-out ponds are large and the bag often contains much more fish unlike those used to pack ornamental fish for *stocking* aquaria.

5. Add small amounts of water from the pond into the bag over 10 to 20 minutes to allow the temperature and water quality (e.g., pH) of the transported water to slowly become similar to that of the pond water.

6. The total amount of water added should be double or triple the amount already in the bag.

7. Then lower the bag in the pond and tip it so that the fish can swim out on their own. Observe how they swim out.

   **NOTE:** Pouring fish from a bag or throwing them into the pond can be stressful. It is best to let them swim out of a bag or out of a net by themselves. In some countries, lakes are indeed *stocked* by dropping the fish from airplanes, but survival is not reported.
4.6.2. Guidelines for stocking from transport tanks/containers

1. Drive down as close as possible to the pond.
2. Check the water quality in the pond and in the tank.
3. With a bucket, remove about a third of the water in the tank. Then add pond water. Repeat this process 2 times giving time for the parameters to gradually re-adjust as mentioned in 4.6 above.
4. Scoop out a few fish at a time into a bucket with adequate water using a scoop net.
5. Gently lower bucket in water and let fish swim out on their own.

NOTE:
1. Keep the aeration going in the tank right through the process until all the fish have been stocked.
2. It is important to stay around and observe how the fish swim out of the bag or container. Any fish that lie immediately on the pond bottom will likely die within a day or two. Fish that swim erratically or have any discoloration on their bodies or fins may die within 2 to 4 days. If the fish swim back into the container, it is probably due to the fact that the water current has reversed (fish swim against the current). Be around to ensure no birds take the fish during stocking or soon after.

4.7. Records

Record all the stocking information including the source of the fingerlings, average size stocked, total number and kilograms stocked as well as any notable observations during the stocking process in the pond’s management record sheet (see Chapter 9 for more details on how to fill in the record sheet and figure 9.2 (pages 155-156) for an example of a FULLY filled record sheet). Watch closely for any mortalities after stocking and record them as numbers, or, if the number is too high, estimate number based upon the total weight and a sample.
Summary Guidelines for the Stocking of Catfish Grow-Out Ponds

1. At the hatchery, take note of the following:

   a. Fingerlings/stockers should have been conditioned prior to packaging for transportation. This means held in separate units and not fed for at least 24 - 48 hours prior to transportation. Conditioning also makes it possible for the hatchery to select fish in good condition. Therefore, inform the hatchery at least 3 days in advance if you are to get well conditioned fingerlings or stockers to stock your pond.

   b. Check the size of fish being packed. It should be what you ordered for.

   c. Each individual bag should be labeled as follows: size of fish, number of fish, age of fish, species of fish, hatchery batch no. This is important information because it enables you:
      • reduce the need to count fish at stocking which minimizes stress to the fish from to physical handling.
      • determine the initial feed type and feeding rates to use
      • traceability and quality control.

2. When Stocking Catfish Grow-out Ponds:

   a. Fill pond to the recommended average pond water depth of 1 meter.

   b. Stock fingerlings of not less than 10 cm (above 5 g) average length. It is highly recommended that the fingerlings (especially if they are less than 10 cm) be stocked first into a nursery pond for about a month when they are stockers 30-50 g average weight.

   c. After a month, drain the nursery pond and stock the stockers into the grow-out pond.

   d. Stock both the nursery and grow-out ponds based on the intended size at harvest and its carrying capacity. The carrying capacity for catfish nursery ponds fed complete diet commercial sinking pellets is 5 tons/ha and of grow-out ponds (32% Crude Protein) is 15 - 18 tons/ha.

   e. Prior to stocking assure that the inlet has at least a 20 cm drop to maximum water level AND has a filter sock on the pond side. This will prevent fingerlings from swimming out of the inlet.

   f. The area immediately surrounding the inlet should be protected from wading and diving birds on days when water flows into the pond. The catfish tend to congregate near the water inflow and make picking them easy for birds.

   g. Acclimate the fish adequately before releasing them from the bag or tank into the pond.

3. Records:

   Record the source, type, number and weight of fish you have stocked as well as any other observations associated with stocking in the pond record sheet.
a. **Good Quality Catfish Fingerlings.** Note the uniform size, uniform colour patterns, all body parts intact.

**Plate 4.1: Physical Characteristics of Good Catfish Fingerlings**

b. **Poor Quality Catfish Fingerlings.** Note the white patches on the body, missing body parts.

**Plate 4.2: Packaging and Transporting Fingerlings in Bags with Oxygen**

a. **Packing Fingerlings for Live Transportation in Bags with Oxygen.** Note the double bagging. It is important to do so to reduce the risk of loss of oxygen in the event of a puncture in either layer during transportation.

b. **Transporting Fingerlings Packed in Bags to Farm.** Bags should be placed in boxes, basins or baskets to help support them during transportation and prevent punctures.