# Fish Farming as a Business: Culturing Fish in Ponds, What I should know as a New Farmer?

Is there a sustainable solution for optimising production?

# Pond Culture as a Production System

- Ponds can be earthen ponds or concrete ponds, but most production takes place in earthen ponds.
- Ponds vary in sizes and range from about a quarter acre to several acres.
- Fish production may take place in a farm pond or in ponds specifically designed and constructed for aquaculture. Though most farm ponds have fish growing in them, they may not be suitable for commercial aquaculture because, quite often, they have uncertain water quality and uneven water depths and do not have a drainage system. However, many farm ponds have been used to produce fish in cages and in recreational or fee-fishing operations.
- Ponds specifically designed and constructed for fish culture require some amount of clay soils to retain water. Ponds that are less than 2 acres are recommended because they are less difficult to manage than larger ones.

# Production Methods Associated with Pond Culture

**Extensive Culturing**

- This uses large stagnant ponds that allow only a low stocking density and rely on natural production to feed the fish (i.e. there is no supplemental feeding).
- Management and skills input is low.

**Semi-Intensive Culturing**

- This is much like extensive production culture method, however there is a greater degree of intervention either through feeding and/or improvement of water quality through aeration and partial water exchange. This allows for an increase in the production of fish when compared to extensive production culture method.
- Management and skills input occur at a medium level.

# Species Associated with Pond Culture

The table below provides a list of species suitable for Pond culturing:

| Species | |
|---|---|
| Bluegill | Largemouth Bass |
| Catfish | Rainbow Trout |
| Fathead minnows | Smallmouth Bass |
| Freshwater Prawn | Tilapia |
| Goldfish | Walleye |
| Golden Shiner | Yellow Perch |
| Hybrid Striped Bass | |

# Pond Management

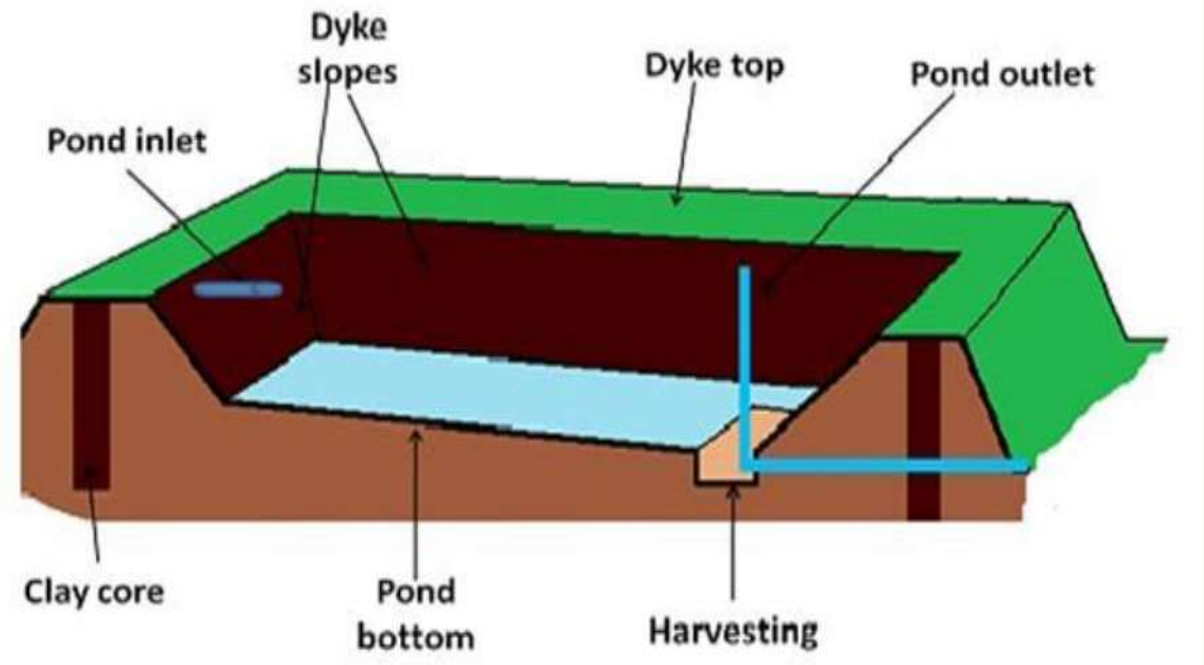


Figure 1: A cross section of a typical earthen fishpond showing the pond profile and important features (Source: FAO)

- Due to inadequate technical knowledge and training in methods of fish farming in ponds, our farmers are not getting the expected yield.
- Fish farming in ponds are practiced all over Africa and it's getting highly popular. However, due to lack of technical knowledge and ambiguous ideas, most of the farmers are not getting expected yield. Even many are losing money in fish farming.
- This presentation will give us an overview on Pond utilization for fish culturing and management techniques to improve our yields.

# Pond Management

## 1. Methods of Pond Preparation

- **Small pond repairs:** When drying the pond, it is important to carry out pond repairs. The pond (especially the dykes) should be cleaned and weak spots reinforced, cracks filled in, holes dug by crabs or rats should be filled in to avoid water seepage and prevent the dykes from collapsing. For small repairs, the dry soil from the pond bottom can be used and should be compacted well. Do not use the mud for repairs since it will fall apart easily when it gets wet again! Repairs include correcting the slope of the dykes. Grass that grows in the pond should be removed and excess mud/silt from the pond bottom has to be removed as well. The mud from the bottom of the pond is very fertile and can be applied to your vegetable garden. Some people have doubled their vegetable production with this! It is recommended to have 1 to 1½ meters (3 to 5 feet) of water in the pond. For ponds where fish are fed with algae (no additional feeding) a depth of 1 meter is recommended. Don't use the mud from the pond bottom, but the soil to reinforce the dykes.

# Pond Management

## 1. Methods of Pond Preparation

- **Drying of the pond:** The preparation for the next crop begins the day after the last fish are harvested from the pond. First of all, the pond has to be completely drained – which might be a challenge especially in the rainy season. If necessary, use a (Fuel) water pump. Dig small trenches towards the outlet (or the pumping pit) so that only little water puddles remain at the pond bottom. The pond is completely dry when all water puddles have been dried out by the sun and the first cracks appear at the pond bottom. Proper drying of a pond will take 2 to 3 weeks, but it has huge benefits. It will improve availability of nutrients in the pond bottom, the mud will decompose and most pests, water insects, amphibian larvae (e.g. tadpoles) and unwanted wild fish will disappear. So it is worth the time spent waiting! Drying is the cheapest and easiest way to get a clean pond for the next crop.

# Pond Management

## 1. Methods of Pond Preparation

- **Disinfection with lime:** If it is not possible to completely dry the fish pond (until the bottom cracks) you will have to use lime to disinfect your pond. Proper disinfection of the pond bottom and the dykes is very important especially if the pond cannot be dried completely (e.g. during the rainy season). Lime kills most small creatures (parasites, insects, tadpoles, etc.) which are harmful to your fish, or which might transfer diseases. All small fish have to be killed, because if it is tilapia (either wild or your own fish) it can lead to overcrowding of your pond and/or they could carry diseases that will affect your new fish. Your own fingerlings could be growing slower because they are mixed sex and could suffer from inbreeding. Wild tilapia grows slower than the selected fingerlings from good hatcheries.

# Pond Management

## 1. Methods of Pond Preparation

**Liming:** Disinfecting the pond is possible by increasing the pH to 10 or 11. This can be achieved by using two types of lime which can be purchased at most agricultural stores:

- **Agricultural lime:** Rule of thumb: use 500 gram of agriculture lime (CaCO3) per m2. Sprinkle it over the whole pond if it is still wet or sprinkle it only over the area which has water puddles.
- **Quick lime:** Rule of the thumb: use 250 gram of Quick lime (CaO) per m2.

**How to apply lime:**

- Lime for disinfection is preferably applied when there is hardly any water left, but the soil is still moist. If there are areas where there are still puddles of water apply more lime on these spots. The right amount of lime is applied to your pond by sprinkling it evenly on to the pond bottom and the slopes of the dykes of your pond. After applying, verify if the lime is working by observing if the insects are dying, signs are that they reduce their movement.

# Pond Management

Table 1: Amount of Agricultural lime ($CaCO_3$) to be used for liming (DISINFECTING) a pond

| Soil pH | Amount of Agric. lime ($CaCO_3$) per $m^2$ | Calculation: | Amount of Agric. lime ($CaCO_3$) per 300 $m^2$ |
|---|---|---|---|
| Below 5 | 0.3 kg | 0.3 kg x 300= | 90 kg |
| 5 – 5.5 | 0,25 kg | 0.25 kg x 300= | 75 kg |
| 5.5 – 6.0 | 0,2 kg | 0.2 kg x 300= | 60 kg |
| 6.0 – 6.5 | 0,15 kg | 0.15 kg x 300= | 45 kg |
| 6.5 - 7 | 0,1 kg | 0.1 kg x 300= | 30 kg |

1kg= 1000 Grams, 0,1Kg = 100 grams

**Measurements:** For a serious farmer it is important to know exactly how much is needed. For that every farm should have a: * measuring tape of minimum 10 meters
* weighing scale for fish (10-50kg) (precision 100 grams)
* Weighing scale for feeds/lime 0-10kg (precision 10 grams)

- Liming to improve the pond (soil) fertility is different from liming for disinfection. To measure the acidity of your pond soil, mix some of the soil from just below the surface with rain water (or tap water), stir it well, wait for some minutes and measure the acidity of the water. You can test the acidity by using small test strips for pH (Lackmus or Litmus paper) or pH water test kit. If the strips are not stored well or are too old, they don't work anymore. To find out if they are working you can put a strip on your tongue and then it should read a pH of 7. By knowing the pH of your pond you are sure you give the right amount and do not waste your money.

# Pond Management

**2. Filling the Pond with Water**

- When filling the pond with water or whenever you release water to the pond (e.g. for topping up or flushing) the farmer should make sure the inlet pipe of your pond is always covered by a mosquito net bag and make sure that this mosquito net bag is well fixed to the pipe so that it is not removed by the water force during filling. You have to use a bag of at least 1 m (3 feet) in length otherwise the net will be clogged by dirt or silt. It is very important to protect the inlet (and the outlet as well) with a mosquito net to keep harmful insects and wild fish out of your pond and keep your own fish in the pond.
- By placing a splash board under the inlet pipe unwanted turbidity is avoided. Water is essential for a successful fish farmer; as a rule of thumb, a fish farm should have enough water to fill one pond in 7 days.

# Pond Management

**3. Fertilization**

- Fertilizing the pond is to stimulate the growth of algae. Tilapia feeds on green algae and hence will reduce your feeding costs. In addition algae produce oxygen during daytime which helps keeping the fish healthy. Algae grow best if the pH (acidity) of the soil is above 7 and if there are enough nutrients (fertilizers). Liming increases the pH of the soil.
- When the pond has approx. 20 cm (9 inches) of water you can apply fertilizer. If you use inorganic fertilizer, make sure it is dissolved completely in a bucket before you sprinkle it evenly on the water surface. Make sure you splash it into the water and not onto the dykes. If you use dry manure, you can broadcast it directly onto the water surface.
- When the water becomes green (in 5 to 7 days) you can fill the pond completely up to the desired level. You have to measure the turbidity of the water weekly with a secchi disk or by using your hand. If the disk (or your hand) is not visible at a depth of 30 - 40 cm (1-1½ foot) stop fertilizing. Too much fertilizer deteriorates the water quality and oxygen levels. On the other hand, with too little fertilizer your algae will grow slowly.

# Pond Management

### 3. Fertilization

- If the secchi disk (or your hand) is visible below a depth of 30-40 cm continue applying fertilizer every week as specified in the table below:

Table2: **Weekly amount of fertilizer**

| | | Weekly amount per $m^2$ | Calculation (example for 300$m^2$ pond) | Weekly amount for a 300 $m^2$ pond |
|---|---|---|---|---|
| Option A | Di-Ammonium Phosphate (DAP)[1] | 2 g | 2g x 300$m^2$ | 600 g |
| | Urea[1] | 3 g | 3g x 300$m^2$ | 900 g |
| Option B | Dry manure[2] | 50 g | 50g x 300$m^2$ = 15,000g<br>15,000/1,000 = 15kg | 15 kg |

[1] It is highly recommended to use DAP and Urea together.

[2]Dry manure, from chicken, pigs, cattle, goat, sheep etc.

# Pond Management

**Example calculation:**
5 fish of **200** grams each = 1 Kg. Each piece is sold at 140 shillings which is in total **700** Ksh
2 fish of **500** grams each = 1 Kg. Each piece is sold at 250 shillings which is in total **500** Ksh
actually you make more profit with the smaller fish, but if people in your area only like the big fish you will not be able to sell them!

Table 3: **Stocking numbers of fish for different feed qualities. The average weight for a fish at harvest is estimated at 200 grams per piece.**

| Quality of the available feed | **Recommended** density at **harvest** in **Kg/ m²** | Number of fish **per m² (fish of 200g each)** | Number of 200g fish in a 300 m² pond **at harvest** | Number of **fingerlings to be purchased** at 10% mortality |
|---|---|---|---|---|
| Only Algae, no other feeds available | 0.3 - 0.5 | 1.5 - 3 fish | 450 - 900 fish | 500 – 1000 |
| Community fish feeds available | 0.6 - 0.8 | 3 - 4 fish | 900 – 1,200 fish | 1000 – 1350 |
| Commercial fish feeds available | 0.8 – 1.0 | 4 - 5 fish | 1,200 – 1,500 fish | 1,350 – 1,700 |
| Aeration possible | 1.0 – 1.5 | 5 - 8 fish | 1,500 – 2,400 fish | 1,700 – 2,700 |
| Intensive fish farming | Up to 50Kg/m3 | Only for closed circulation systems (expensive!) | | |

### 3. Stocking

- Before stocking, you have to think of selling. Find out from the market what size of fish people prefer and then calculate your profits. Grow fish up to a size that is both profitable and easy to sell.
- Once you know what size of fish to grow you can, based on table 3 below, calculate how many fingerlings you will have to buy. Make optimal use of your space; stocking too many fish will lead to slow growth and in the long run the fish will be gasping for oxygen. Low stocking density means that you are losing out on profit. If you are a beginning fish farmer start with lower stocking density because the management is easier and there is less risk of the fish getting diseases or lack of oxygen.
- After the pond is filled with water and the water is green (algae bloom) the pond can be stocked with fingerlings.

# Pond Management

**3. Stocking**

Stock the pond with all male fingerlings. The use of mixed sex tilapia is not recommended because:

- Males grow faster than females and
- Mixed sex tilapia will start to reproduce after a few months.

This reproduction cannot be controlled, even by stocking some catfish with tilapia.

Uncontrolled breeding leads to poor growth of the fish and other problems like diseases. Spending a bit more money on buying all male tilapia fingerlings of good quality and of good size from your trusted fingerling producer will pay off at harvest!

The recommended minimal size for stocking tilapia fingerlings into an open pond is 5-10g. If you can only get smaller tilapia it is recommended to stock them in hapas first until they have grown to 5-10g or even bigger. In the hapas they are safe from predators like frogs and a cover net will keep them safe from birds.

You can stock 500 fish in a 5 $m^2$ hapa net. Start feeding the fish 1 or 2 days after stocking to allow them to recover from stress of transport. The advantage of the hapa is that you can easily count the number of fish and you know exactly how many you have.

# Pond Management

**4. Mortality**

- In fish farming you have to take into account that some fish will die either through diseases, damages or predators.
- Therefore you will have to buy more fingerlings than the desired number of fish at harvest; a rule of thumb is that mortality is 10% over a period of 6 months.
- Meaning if you buy 1000 fish, you will end up with 10% less which is 900 (as seen in table 3 above). Fry are smaller than fingerlings and therefore more sensitive which means that the mortality is higher, but the price is also lower. When starting with fry or small fingerlings overall mortality can be over 20%.

# Pond Management

**5. Sampling**

- For calculating the right amount of feed you have to get the total weight of fish in the pond and the calculate average bodyweight of the individual fish.
- To calculate this you will need a weighing scale 0-10kg precision 100grams, alternatively you could use a measure cup or a bucket where you have marked the litres (1 kg of fish is the same as one litre).
- Sample your fish every two weeks to calculate the total weight of fish in your pond and the individual weight of your fish. This allows you to calculate the growth, daily feeding rations and Food Conversion Ratio (FCR).
- To sample the fish you have to catch some fish (about 100) with a cast net or with a drag net. To catch them easily you can attract them with some feed. Place the fish gently into a weighing basket (the water has to pour off) weigh them and quickly release them back into the pond while counting. Make sure all your equipment including your hands are wet before you handle the fish.

# Pond Management

## 5. Sampling

**Table 4**: How to calculate the estimated total weight of your fish (biomass) in your pond

| Explanation | Calculation |
|---|---|
| Data from your sampling | Number of fish caught : 78 pieces<br>Total weight : 680 grams |
| Average bodyweight of one fish:<br>Total weight **/** number of fish | 680g **/** 78 pieces = 8.7g rounded to **9 gram** |
| Actual number of fish:<br>Initial number of fish stocked : 1,000<br>Dead fish (get this from your records) : 89 | =1,000 – 89 = **911 pieces** |
| Actual weight of all fish in your pond:<br>Number of fish **x** average bodyweight<br>Convert grams to kg (divide by 1,000) | =911 pieces **x** 9 gram = 8,199 gram<br>8,199 gram**/** 1000 = **8.2 Kg** |

You can compare your result with growing tables you can find in the internet or you can get from your feed producer to see if your fish are growing up to expectation or not.

# Pond Management

**6. Feeding**

- Feeding your fish is the most important daily routine task at your farm and with wrong feeding techniques you can make losses. In fact correct feeding is more an art than a business. **Feed = Money!** Feeding fish is throwing money in the pond; make sure it is money well spent.
- **Feed types:** Small fish need small pellets, big fish require bigger pellets. Good pellets have ingredients that are ground very fine, which the fish can digest better. Only farmers who have been trained on how to make feeds should make this to make sure the feed is of good quality.
- Below is a table of the different types of feed on the market:

# Pond Management

## 6. Feeding

Figure 5: Types of feed and their characteristics

| Type of feed | Price range | Remarks |
|---|---|---|
| Algae | Cheapest | Algae can be used as additional feed for your fish.<br>Fertilizers make algae grow.<br>Algae are a complete diet, but fish grow slow with only algae and you can only have less fish per $m^2$ but with same growth (see table 3).<br>☹ The quantity of algae cannot directly be controlled by the farmer (only through fertilization). |
| Floating pellets (extruded) | Expensive | ☺ Less waste<br>☺ Feed is easier to digest since it is cooked (best FCR)<br>!! It is not a "must" to have |
| sinking pellets | Less expensive | ☺ Cheaper<br>☺better FCR than mash<br>☹ once feed has sunk to the bottom fish will not eat it anymore (it is a loss)<br>!! Needs careful feeding |
| mashed (powdered) feed | Cheap | ☺Easy available<br>!! calculate your FCR and expenses |
| Homemade pellets | ? | **!! Not recommended, it is very difficult to do it good**<br>☹ not a complete diet<br>☹ not for professional farmers<br>☹ a lot of work for little feed, accumulates at the pond bottom and lowers oxygen levels on the long run |

# Pond Management

Figure 6: Tilapia feeding chart

| Weeks in production | Size of Fish (in g) | Feed amount (% of bodyweight) | Total daily amount of feed per fish in gram | Sizeof feed Diameter* | Protein content in % |
|---|---|---|---|---|---|
| Fry | 0.2 - 1 | | | 1 mm | |
| Fingerling | 1 - 3 | | | 1 mm | |
| 1 | 10 | 5.0 | 0.5 | 2 mm | 35 |
| 2 | 13 | 4.8 | 0.6 | 2 mm | 35 |
| 3 | 17 | 4.8 | 0.8 | 2 mm | 35 |
| 4 | 22 | 4.6 | 1.0 | 2 mm | 35 |
| 5 | 29 | 4.5 | 1.3 | 2 mm | 35 |
| 6 | 37 | 4.5 | 1.7 | 2 mm | 35 |
| 7 | 46 | 3.8 | 1.7 | 2 mm | 35 |
| 8 | 56 | 3.7 | 2.1 | 2 mm | 35 |
| 9 | 69 | 3.5 | 2.4 | 3 mm | 35 |
| 10 | 83 | 3.4 | 2.8 | 3 mm | 30 |
| 11 | 98 | 3.4 | 3.3 | 3 mm | 30 |
| 12 | 115 | 3.2 | 3.7 | 3 mm | 30 |
| 13 | 132 | 3.2 | 4.2 | 3 mm | 25 |
| 14 | 149 | 3.0 | 4.5 | 3 mm | 25 |
| 15 | 167 | 3.0 | 5.0 | 3 mm | 25 |
| 16 | 185 | 2.9 | 5.4 | 3 mm | 25 |
| 17 | 204 | 2.8 | 5.7 | 3 mm | 25 |
| 18 | 223 | 2.6 | 5.8 | 3 mm | 25 |
| 19 | 243 | 2.5 | 6.1 | 3 mm | 25 |
| 20 | 263 | 2.4 | 6.3 | 3 mm | 25 |
| 21 | 284 | 2.3 | 6.5 | 3 mm | 25 |
| 22 | 305 | 2.3 | 7.0 | 3 mm | 25 |
| 23 | 326 | 2.0 | 6.5 | 5 mm | 25 |
| 24 | 347 | 2.0 | 6.9 | 5 mm | 25 |
| 25 | 368 | 2.0 | 7.4 | 5 mm | 25 |
| 26 | 389 | 2.0 | 7.8 | 5 mm | 25 |
| 27 | 410 | 2.0 | 8.2 | 5 mm | 25 |
| 28 | 431 | 1.8 | 7.8 | 5 mm | 25 |
| 29 | 452 | 1.8 | 8.1 | 5 mm | 25 |
| 30 | 473 | 1.8 | 8.5 | 5 mm | 25 |
| 31 | 494 | 1.7 | 8.4 | 5 mm | 25 |
| 32 | 515 | 1.7 | 8.8 | 5 mm | 25 |
| 33 | 536 | 1.4 | 7.5 | 5 mm | 25 |

Note!: The 25% protein feeds is ONLY applicable where the ponds are adequately fertilized (green). If the pond water is not well fertilized (not always green) continue with 30% protein feed.
* 2mm and smaller is crumble, 3mm and above are pellets

## 6. Feeding

- The daily amount of feed is determined by the size of your fish and the total amount of fish biomass in your pond. Normally the fish feeds manufacturers give recommendations as they know the exact formulation of their feed. As a basic guideline you can use the figures from table 6.

Figure 7: How to use the feeding table:

| Explanation | Calculation |
|---|---|
| Data from your records | Average body weight sampling of fish: 123 g<br>Number of fish: 750 Pieces |
| Total weight of fish in the pond:<br>Weight x number of fish | 123g x 750 pieces = 92,250 g /1,000 = 92,25 Kg<br>rounded is 92 Kg. |
| Lookup in the table the size of the pellets: | A fish weighing 123g, best pellet size is 3 mm ,<br>daily feeding rate is 3.2% of the body weight |
| Total amount to feed daily to your fish:<br>Weight of fish in the pond x daily feeding rate | 3.2% = 0.032 (if you use your phone to calculate)<br>92 Kg x 0.032 = 2.944 Kg =2.9 Kg |
| Feeding portions (for this example 2 portions): | Morning feed : 2.9 / 2 = 1.45 Kg<br>Afternoon feed : 2.9 / 2 = 1.45 Kg |

Make sure you feed the right pellet size to your fish. As fish cannot chew they have to swallow the feed particles whole. And if the feed is too big they cannot swallow it, thus they will not eat.

# Pond Management

Figure 8: How to calculate your FCR

| Explanation | Calculation |
|---|---|
| Data from your sampling | Previous weight of all fish in your pond: 95 Kg<br>Current weight of all fish in your pond: 130 Kg<br>Feed given to fish (from your records) 3 bags of 20Kg = 60Kg in total |
| Weight gain: Current weight - Previous weight | 130Kg – 95Kg = 35 Kg |
| FCR: Kg of feed / Weight gain in Kg | 60Kg / 35 Kg = 1.7 |
| An FCR of 1.7 means: by feeding 1.7Kg of feed you have produced 1 Kg of fish.<br>In the analysis also take into consideration the price of the feed (and the algae you are growing (through fertilization of the water). | |

- **6. Feeding**
- **Calculation of FCR:** The FCR, Food Conversion Ratio, is a good indicator to see how the fish are growing. It shows how efficient the feed makes the fish grow. Below is a box that shows you how to calculate it.
- **How to calculate the FCR= Feed Conversion Ratio = Kg of feed / Kg of gain in body weight** in other words how much feed did the fish eat to gain 1 Kg of body weight. Example: an FCR of 2 means that you fed our Fish 2Kg of feed to gain 1 Kg of bodyweight an FCR of 1.3 means that you fed your fish 1.3 Kg of feed to gain 1 Kg of bodyweight Conclusion: **a lower FCR is better if the feed has the same cost.**
- After you have sampled your fish and you have determined the growth rate and the body mass of your fish you can calculate the FCR.
- In other words you have fed the fish 1.7 kg of feed to have a weight increase of 1 kg.

# Pond Management

**6. Feeding**

- Feed the fish twice a day, in the morning and early afternoon. Recommended feeding times are between 11am and 4pm.
- Feed the fish always at the **same time** at the **same place** of your pond. You can "call" your fish by knocking on the feed bucket or making a sound. Fish will learn fast when and where to get the feeds.
- Try to attract the fish to the feeding place by only throwing a small amount of feed over a larger area of the pond in the beginning of your feeding session.
- Don't feed your fish when the oxygen levels are low or the water temperature is low. See the table for possible signs of problems.
- Signs for low oxygen levels and discomfort of the fish are: fish gasping on the surface, brown or grey water colour, etc.
- Fish cannot digest the feed effectively when the oxygen levels or temperature levels are too low.

# Pond Management

Figure 9: Trouble shooting

| Observation | Possible problem | Possible solution |
|---|---|---|
| The fish are not feeding well | Low water temperature (e.g. just after the rain) | Stop feeding and wait till the water has warmed up |
| | The oxygen levels are low | Don't feed the fish and |
| | Wrong feeding time | See chapter 5 for timing |
| Fish are floating belly up | Low oxygen levels/poisoning | Contact an expert! |
| Fish gasping on the surface | Low oxygen levels | Contact an expert!<br>Too many fish in the pond? |
| Fish start dying in the pond | Ammonia levels have become toxic in the pond water, Nitrite poisoning or very low or lack of oxygen | Contact an expert<br>Flush out part of the pond water; allow fresh water into the pond. |

## 6. Feeding

- Never feed the fish when they are not healthy, or when the oxygen levels or the water temperatures are low (e.g. after some heavy rain falls).
- If you use sinking pellets the fish have to take the feed before it has reached the pond bottom. Usually tilapia will not eat the feed anymore when it reaches the bottom. At the bottom it could even decrease the water quality and lower the dissolved oxygen levels in the water.
- As feed is very expensive (in fact it is by far the most expensive single expenditure in your fish farming business) it is important to feed the correct amount.
- Stop feeding the fish 24 hours before you transport them.

# Pond Management

**7. Fish Health**

- Healthy fish eat well and grow well and are more resistant to diseases. Fish health is influenced by three factors: Environment, stress and pathogens (diseases).
- To have healthy fish you will need e.g. to have enough good food available, enough oxygen in the pond, protect them from predators, avoid too high stocking densities and handle fish well.
- Anything that comes from outside is a potential source of diseases, therefore you should make sure you get feeds and fingerlings from a reliable source, keep wild fish out of your ponds and always disinfect your pond to kill anything that could carry diseases.
- This slide should be very long and you will need to know much more about it than these few lines, but this will give you an idea of what diseases are and how to deal with it. If you need more information contact your fisheries office for more information.

# Pond Management

**8. Harvesting**

The following steps are essential for a successful harvest and making good money. Plan early to avoid surprises and do not let your customer down; give honest and good information. This way you will make good money and have customers for the next harvests.

- **Step 1:** Announce that you are harvesting fish at least a week before. You could also talk to hotels before to notify that you want to harvest your fish, but then you will have to tell them how many fish you have, what size and try to fix the price to avoid disappointment.
- Be honest because if you disappoint a client he will not buy fish from you again.
- When you say you will harvest on Wednesday then do not change the date, unless the client wants to.
- **Step 2:** Stop feeding the fish 2 days before the harvest
- **Step 3:** Prepare the tools and labour for harvesting; this includes repairing big holes in the sein net. You will need: Plastic buckets, sein net, weighing scale.
- **Step 4:** Reduce the water level in the pond; this makes it easier to harvest the fish.
- **Step 5:** Harvesting is preferably done very early in the morning. While harvesting handle the fish with care to avoid damages and post-harvest losses.
- **Step 6:** If you bring fish to the market put the fish on ice, if you have the sellers already at your farm, then it is up to them to organize this.

# Pond Management

**9. Record Keeping**

- For serious business people it is essential to keep records. The records should show you how much profit you are making and the records should show you which type of pond management is the most profitable.
- Have a separate notebook for each pond and a separate notebook for the harvest of and planning for the whole farm.
- The harvest sheet record will help you to monitor prices and quantities of fish sold (and to whom) this can be done for all your fishponds.
- On the Input records form write all inputs per pond. For items that you use from your own farm, calculate the price that you would have gotten for it if you would have sold it at your farm. This way you will be able to monitor how much money you will have spent and how much profit you are making.
- By trying out different feeds or feeding techniques, different stocking densities and different fingerlings you can compare and see what the most profitable type of management is. You can also see which ponds are more productive and find out which are less productive.

# Pond Management

- **Your 6 steps to success (Summary)**
- **1. Disinfection:** Always disinfect the pond after the final harvest. This will keep your fish healthy, reduces infections, pests, predators and stops unwanted natural fish reproduction
- **2. Fertilization:** Always apply the right amount of good quality and effective fertilizers to create a good algae bloom and maintain green waters. This will help you to maintain good water parameters, to keep your fish healthy and reduces your feeding costs.
- **3. Fingerlings:** Always stock your pond with the right numbers of good quality fingerlings. Do not overstock (maximum 3 fish per $m^2$). Use all male fingerlings as the males grow faster and unwanted reproduction will be prevented. Stock big fingerlings (> 5 g) to your ponds.

# Pond Management

- **Your 6 steps to success (Summary)**
- **4. Feeding:** Preferably use quality fish feeds and fertilize your pond well to keep the water green. Monitor the quality of your feed by calculating the FCR.
- **5. Record keeping:** Always keep records (see annex). Write down all the expenses of you business. Do regular fish sampling and calculate growth and bodyweight. Also document all losses of fish and mortalities. Calculate the FCR and the feeding costs. Record your amount of harvested fish and the sales prices for different fish sizes and the total revenue to calculate your profits.
- **6. Post-harvest:** In order to receive the highest price for your fish inform potential buyers before harvesting. Make sure that the buyer gets fresh fish or if you take it to the market yourself make sure that the fish is kept fresh and chilled until you reach the selling point (market).
- Act as a professional, responsible and business oriented fish farmer!

# Pond Management

- More and more people want to eat fish because it is healthy and is tasty. There is a good market for fish from ponds, because fish prices have doubled and the catches from the lakes and other water bodies have gone down. If you manage your ponds well, you can earn a good amount of money; in addition fish eating is also very healthy!
- We hope this presentation will gives you an insight in the technical aspects of pond management. Though not exhaustive; it is for people who will love to do fish farming as a business and not as a hobby.
- In case you need more information, please feel free to post your questions on the blog so that we can help you with the required recommendations and solutions. Noting that the more information you have the more successful you are as a fish farmer.