6: Harvesting Your Fish

Introduction

Good farming practices include regular harvesting of the crop to earn the farmer an income. The frequency of harvests and the quantities and returns realized are key indicators of the economic viability of the enterprise.With good management, as described in the preceding sections, your fish should be ready to harvest within six to nine months after stocking. By this time, tilapia should have reached a size of approximately 250-300 g and catfish a size of 250-500 g, depending on their size at stocking, the density at which they were stocked, and water temperatures during the growing period.

Preparing for the harvest

- Make marketing arrangements well in advance of the harvest date.
- Plan to harvest your fish early in the morning or early in the evening.
- Stop applying fertilizers one to two weeks prior to harvesting.
- Stop feeding the fish two days before harvesting.
- Set up all harvesting and transportation equipment well in advance. Contact fisheries personnel if you need guidance to acquire the right equipment for harvesting.
- Prepare the manpower.
- Partially drain the pond very early in the morning on the day of harvest.

Figure 4.6-1. Harvesting equipment assembled on the pond bank prior to beginning the harvest.

Figure 4.6-2. Harvesting fish with a seine net.

Figure 4.6-3. Using poles to hold up a seine in a pond.

The harvest:

Most earthen pond harvesting is done with a seine.

- Seine early in the morning, while the weather is still cool.
- Begin seining in the shallow end of the pond and work towards the deep end.
- Work carefully, disturbing the pond bottom as little as possible.
- If possible, finish the seine haul near a water source in the deep end.
- Loosen the seine somewhat to avoid crowding the fish too much during handling.
- Long, forked sticks can be used to hold up the top of the seine.
- If possible, spray a stream of fresh water over the fish while they are being held and handled.
- Gradually lower the water as you near completion of the harvest.
- Use a dipnet to move fish from the seine to buckets on the pond bank.
- Use cast nets, lift nets, hoop nets, or gill nets for harvesting if ponds are too deep or are not drainable, or if you do not have a seine.

- Fish can be marketed dead or alive. Always handle live fish wit extreme care, stressing them as little as possible.
  - Keep the fish in fresh water at all times.
  - Move fish into less-confined holding tanks as soon as possible
  - Transport them to the market as soon after harvest as possible.
  - If possible, provide aeration for live fish during transportation.

Figure 4.6-4. If flowing water is not available at the deep end of the pond then a bucket can be used to provide fresh water for fish being harvested.

Figure 4.6-5. With good management you can produce high-quality products for the market.

Moving on

When your harvest is complete, you are ready to prepare the pond for another crop of fish. Refer back to the first section in this chapter to review the necessary steps.

INTENSIFYING PRODUCTION IN YOUR FISHPONDS

Introduction

You can intensify your production system by providing additional inputs to your pond and by increasing your management effort. By doing this you can increase the ponds carrying capacity, productivity, and output. There are several methods available to do this.

Options to intensify your production system:

1. Feed your fish (in addition to regularly fertilizing your pond)

- You can prepare and mix your own feeds using locally available materials. Refer to Section 3-3, "Feeding your fish."
- You can use feeds prepared for other animals, such as chick mash or pig starter pellets, if fish feeds are not available. Although these are not specifically formulated for fish, they can increase fish growth and will also supplement your use of organic fertilizers to enrich the pond.
- You can use commercial fish feed formulations when they become available.

2. Stock two or more species together in the same pond (polyculture)

- Stock catfish and tilapia together in the same pond. If you stock the right number of catfish, your tilapia production will remain the same or even increase, plus you will have the benefit of an additional species to take to the market.

Figure 4.7-1. Fish feeds such as brans (rice, wheat, corn) can be broadcast along the sides of ponds.

Figure 4.7-2. A home-made feed from a pellet machine.

Figure 4.7-3. Polyculture of Nile tilapia and African catfish can result in large, marketable fish of both species rather than just one or the other.

3. Stock your pond at a higher density than recommended for fertilized-only ponds. For example, you might increase your tilapia fingerling stocking rate from 1–2 fish/m² to 3–4 fish/m².

- Only do this if you have begun a feeding program and will be faithful in monitoring and managing your fishpond.
- Stocking at higher densities and adding feeding to your management scheme increases oxygen demand in the pond; you will therefore need to monitor it more closely for potential problems.
- Because of the increased oxygen demand of intensively managed ponds, mechanical aeration sometimes becomes necessary.
- Consult your local fisheries officer for advice on increasing your stocking densities.

4. Split your fish stock halfway through your production cycle

- You can stock your pond more heavily if partway through the production cycle you split the fish population into two groups. You can either move the fish to another pond on your farm or sell them to another farmer who will rear them to market size.
- Alternatively, you can simply move your entire population of stocked fish to a larger pond. The smaller pond then becomes available for restocking with another batch of fish.
- You must split your stock or move your fish to a larger pond if the carrying capacity of your pond has been reached but the intended harvest size has not yet been reached. Fish kept in the pond after its carrying capacity has been reached will not grow any larger, and keeping them in the pond will only cost you money.

5. Aerate your pond.

- With increased numbers of fish and the addition of feeds, your pond's oxygen demand will increase. In this case you may need to use mechanical aerators to compensate for the increased demand.

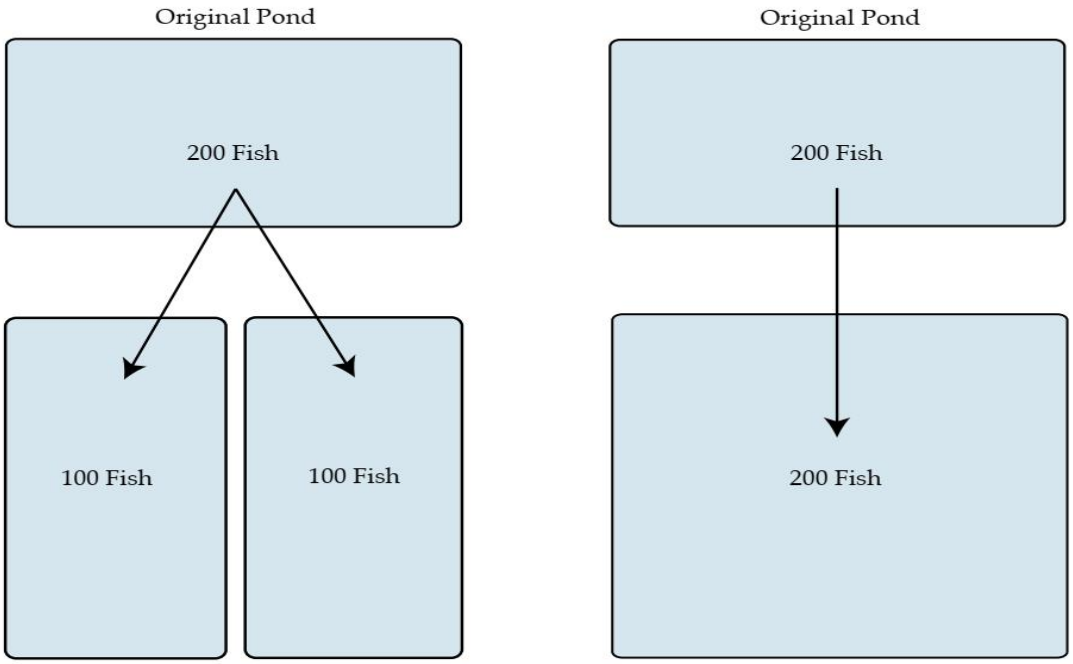

Figure 4.7-4. Splitting a stock of fish from one pond into two (left) or transferring a stock of fish to a larger pond (right) after carrying capacity has been reached.

- If power supplies are reliable in your area, you can use electric aerators to increase or maintain levels of dissolved oxygen sufficiently to support a greater mass of fish.

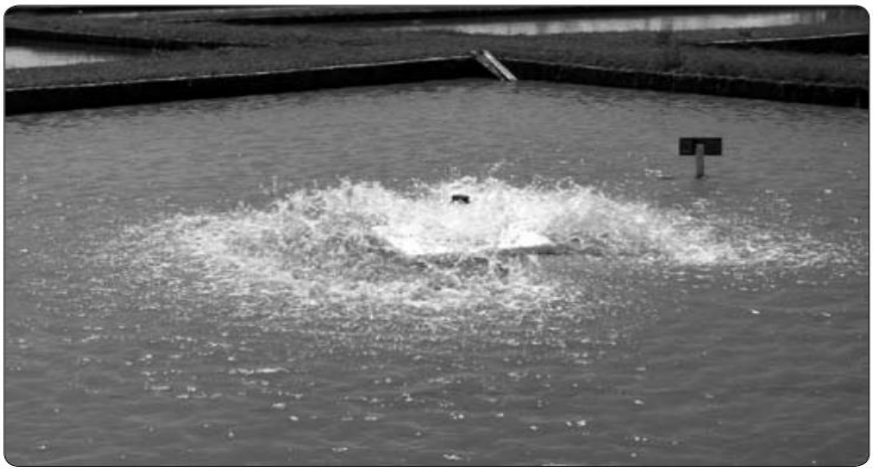

Figure 4.7-5. An electrical aerator.

Moving on

Take steps to intensify your production system only if you are willing and able to put in and sustain the extra effort required. Your pond will only produce more fish for you if you increase and maintain your management effort.

KEEPING FISH FARM RECORDS

Introduction

As a commercial fish farmer, your main objective is to earn money by selling fish at a profit. To understand why you are getting good or poor results, and—more importantly—whether or not you are making a profit, you will need to keep complete and accurate records of everything that goes on at your farm.

What are records?

Records are sets of information that have been systematically and carefully collected and appropriately stored for a specific purpose. To be able to run any economic enterprise successfully, carefully thought out and properly collected records are a must. Comprehensive record keeping will assist both in tracking farm activities and expenses and in assessing the level of investment, the motivation of the investor, and the management skills of the farmer. As the management level rises, culture systems become more complex and so does the record keeping. This is the reason the farmer must think very carefully about which records need to be kept.

Importance of record keeping

Maintaining good records helps you with the following:

- Tracking the activities of your enterprise
- Tracking the expenses of the enterprise
- Monitoring the performance of the enterprise
- Evaluating the performance and operations of the enterprise
- Making decisions about improving operations
- Keeping institutional memory of the enterprise

Good records will, for example:

- Be useful in projection of expected production
- Help in determining the amount of inputs required for specific ponds at various stages of fish production
- Help determine the expected harvesting time
- Determine the economic health of the enterprise

Important aquaculture parameters for record keeping

- Pond identity
- Total area under culture
- Fish species stocked
- Sources of seed
- Stocking densities and time
- Kinds, quantities, and costs of inputs
- Daily events
- Fish production in amounts and values
- Production of other farm crops and their values

Figure 4.8-1. Monitor all ponds and other farm facilities on at least a daily basis to ensure that everything continues to function as it should.

Figure 4.8-2. Develop a system for keeping detailed records to ensure ponds are performing well and you are making money.

Classification of fish farming records

Fish farming records can be classified into:

- Fish farming biological management records, e.g.:
  - Specific pond production (quantity and value), by species
  - Stocking details for each pond (species and numbers)
  - Harvest details for each pond (species, numbers, and weights)
- Financial management records such as:
  - Purchase of inputs, including quantities and costs
  - Records of input usage, e.g., feeds and labour
  - Costs of labour, including the type and duration
  - Costs of new construction or repairs
  - Salaries, both in cash and in kind
  - Sales records, including what was sold, quantities, and prices
  - Inventory of equipment
  - Costs of renting or hiring equipment, machinery, services, etc.
- Records of significant events at the farm, including:
  - Visits by extension officers and recommendations given
  - Unusual weather that may affect pond productivity or farm operations

As the culture system becomes more and more complex and the management level intensifies, monitoring also becomes more difficult. This involves checks on:

- Water supply: Main water intake, main feeder canal, other canals, and pond inlets.
- Pond: Water level, water quality, dyke condition, bottom mud, aquatic vegetation, other structures.

- Fish: Behaviour, colour, feed utilization, growth/production, health.
- Farm: Protection (fencing, theft, erosion), stores/stocks, land vegetation, animal husbandry.

Reasons to monitor fish regularly:

- Check the general condition and health of the fish.
- Determine rates of growth.
- Determine efficiency of feeding (feed conversion).
- Adjust the daily feeding ration and save on feed costs.
- Check if stocking rate is appropriate; if too high, crop (out) the bigger fish.
- Check if stock is reaching target weights and help plan or revise the production or harvesting schedule.

As small-scale fish farming becomes a more commercial venture, maintaining detailed and accurate records becomes an important task to be carried out regularly by the farm manager for several reasons:

- Pond management records will be used for analyzing the production in each pond as well as for determining the reasons for good or poor results.
- Financial records of all transactions, both in kind and in cash, will keep the manager well informed on expenditures and incomes, hence help check how well the farm is doing as a commercial enterprise.
- Good records will provide a sound basis for future management practices and accurate planning and financing well an advance.

The types of records you should keep include:

- Quantities of inputs (lime, fertilizers, feed, etc.) used in each pond.
- Stores inventory and records of supplies added or removed.
- Costs of inputs (fingerlings, fertilizers, feeds, labor) for each pond.
- Stocking details for each pond (species numbers, and weights)
- Daily observations: notes about the weather, colour of water, visibility, dead fish, etc.
- Harvest details for each pond (species numbers, and weights)
- Fish production in each pond, total and by species.
- Income received for fish from each pond, by species and size group.
- Integrated production, for example chickens, ducks, pigs, sheep etc.
- Overall finances of the fish farm, i.e., expenditures and income.

Examples of record keeping forms:

Each farmer should develop a set of forms he or she can use for keeping farm and pond records. The following tables are examples of forms that might be used for record keeping:

Table 4.8-1, which is used for recording data on commercial fish stocks, has three major sections:

1. Stocking data (columns 1 through 6) includes date, species, number of fish, their total weight (kg), average weight (g). The origin of fish, their price, their condition, etc., may be noted under remarks. Total stocking weight (initial biomass) appears at the bottom of column 4.
2. Harvesting data (columns 7 through 11) includes date, species, number of fish, their total weight (kg) and average individual weight (g). From these the following parameters are calculated for the production section:
3. Production data:
   - Fish production (in kg, column 12) for each species and weight class. It is equal to output minus stocking weight, e.g. 368.9 kg of large sized fish of tilapia harvested from Pond B-1 on 30 Oct. Their production = 993.5 kg - 122.5 kg = 871 kg.
   - Duration of production cycle (in days, column 13).
   - Average production rate (in kg/100 m^2/year, column 14) are estimated for each species and weight class as ((total production kg x 365)/(pond area in 100 m^2 x n days))
   - Average growth rate of fish (in g/day, column 15) are estimated as ((average weight at harvest – average weight at stocking)/n days) e.g., for tilapia it was ((122.7 g – 20 g)/166 days) = 0.62 g/day.
   - Survival rates (in percent, column 16) are obtained by comparing for each species, number of fish stocked (NS) to total number of fish harvested (NH), as ((NH/100) x NS)
   - Under Remarks (column 17) note further information such as sale price of fish, destination after harvest, fish condition, etc.

Table 4.8-2 is used for recording data on periodic sampling of a fish crop: This form provides space for recording date, species, number in sample, total and average weights, days, total and average fish growth, estimated standing crop, survival (number and percent), and total biomass at the time of sampling (columns 18 through 30).

Table 4.8-3 contains sections for recording feed distribution, liming, and fertilization:

1. Feed distribution (columns 31 to 40) includes:
   - Period during which feeding rate was constant. Corresponds to period between two successive samplings of fish stocks for growth monitoring purposes
   - Duration of this period (in days)
   - Estimated biomass of fish present in the pond (kg)
   - Feed type – single feed items, e.g., maize bran (MB), wheat bran (WB), rice bran (RB), cotton seed cake (CSC), sunflower seed cake (SSC), or brewery waste (BW). It may also be a more elaborate mix of various ingredients.
   - Daily Feeding Rate (DFR, in percent of fish biomass per day).

- Feed ration to be used during the period (in kg/day). Multiply fish biomass (column 33) by DFR percent (column 35) (e.g., for the period from 20/6 - 3/7, feed 158 kg x 0.33 = 52 kg of brewery waste per day.
- Number of feeding days (column 37). As fish are usually not fed every day of the week, at the end of the period indicate how many days feed was distributed in the pond.
- Total weight of feed distributed during the period (in kg, column 38) = daily ration (column 36) by number of feeding days (37).
- Feed Conversion Ratio (FCR) or weight of feed distributed per kg of fish produced = total weight of feed given/fish production during the period (e.g., for the period 5/7 - 20/7, FCR = 372 kg/64 kg = 5.8. At the bottom of the form, obtain the overall FCR for the production cycle in a similar way, after adding up columns 37 and 38.)
- Under the remarks (column 40) add any information useful to the interpretation of the results such as feed quality, type of mix, feed cost, fish behaviour, water quality, etc.

2. Liming and fertilization (columns 41 through 44) includes:
   - Date on which fertilizer is applied to the pond (41).
   - Fertilization, type and total amount applied (in kg) (42).
   - Under remarks note further information such as method of application, quality of fertilizer, price, etc. (42 - 43).
   - If you are liming a pond, either before filling or later, record the information either in one additional column or in column 43.
   - Any remarks are put in column 44.

And finally, a form for keeping track of activities in each individual pond is very useful. This example of a **Pond Record Form** includes space for the following kinds of information:

- Stocking records
- Harvesting records
- Pond Management Records: Inputs (Feeds and/ or Fertilizers)
- Visits by extension agents
- General remarks

Moving on

Keeping good records of farm operations contributes directly to understanding the economics — particularly the balance between costs and returns — of your operation, which determines how profitable it is. The next section describes two major economic tools you can use to help monitor and evaluate your enterprise.

Table 4.8-1. Fish stocking, harvesting, and production. Pond B-1 . Size: 1,321 m^2. Type of production: Food fish.

STOCKING						HARVESTING					PRODUCTION					
Date	Species	No.	Weight		Remarks	Date	Species	Yield			Production			Average growth (g/d)	Survival	Remarks
			Total (kg)	Avg. (g)				No.	Weight (kg)	Avg. (g)	Total (kg)	Days	Kg/100 m^2/yr			
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
1/3	*TN*	*6125*	*122.5*	*20*	*Pond 9*	*30/10*	*TN*	*3154*	*993.5*	*315*	*871*	*243*	*1.7*	-	*51.5*	*Partial crop-sale @ Kshs 70/kg*
20/7	*CG*	*234*	*27.3*	*117*	*Pond 8*	*14/11*	*TN*	*3007*	*246.4*	*122.7*	*246.4*	*166*	*17.4*	*0.62*		*Final crop-sale @ KShs 70/kg*
						-	*CG*	*224*	*158.7*	*830.0*	*158.7*	*117*	*15.9*	*6.09*	*96.9*	*Sale @ KShs 50/kg*
						-	*TN*	*834*	*25.2*	*30.1*	*25.2*	-	-	-		*Fingerling to pond 4*
Total			*149.8*			Total			*601.5*		*451.7*	*(166)*	*31.8*	-		

TN = Nile tilapia (*Oreochromis niloticus*); CG = African catfish (*Clarias gariepinus*)

Table 4.8-2. Periodic fish sampling.

Date	Sp.	No. sample	Weight		Days	Fish growth		Est. standing crop			Production (kg)	Remarks
			Total-kg	Avg-g		Total-g	Avg-g/d	Surv (%)	Total No.	Biomass-kg		
18	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
1/6	*TN*	-	-	*20.0*	*0*	-	-	-	*6125*	*122.5*	-	*1st stocking (tilapia)*
20/6	*TN*	*164*	*4705*	*28.7*	*19*	*8.7*	*0.46*	*90*	*5512*	*158*	*35.5*	*1st sampling by seining*
5/7	*TN*	*145*	*7150*	*39.7*	*15*	*11*	*0.73*	*95*	*5236*	*208*	*50*	*Reproduction has started*
20/7	*TN*	*172*	*11000*	*54.7*	*15*	*15*	*1.00*	*95*	*4974*	*272*	*64*	*Cast net* ***plus seining***
-	*TN*	*29*	*0.133*	*4.6*	-	-	-	-	-	-	-	*1st fry in sample*
20/7	*CG*	-	-	-	*0*	-	-	-	*234*	*27.3*	-	*Second stocking (catfish)*
3/8	*TN*	*126*	*9575*	*66.7*	*14*	*12*	*0.866*	*90*	*4476*	*298*	*26*	*2 cormorants seen feeding*
-	*TN*	*43*	*0.267*	*6.2*	-	-	-	-	-	-	-	
18/8	*CG*	*11*	*1925*	*175.0*	*15*	*58*	*3.87*	*98*	*229*	*40*	*12.7*	

Table 4.8-3. Feed distribution and liming/fertilization in a 3,121 m^2 pond.

FEED DISTRIBUTION										LIMING AND FERTILIZATION			
Feeding Period		Biomass (kg)	Feed type	DFR %/day	Ration Kg/day	Feed days	Total feed kg	FCR	Remarks	Date	Organic (kg)	Inorganic (kg)	Remarks
From-to	Days												
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**
1/6-20/6	*19*	*122.5*	*BW*	*33*	*40*	*14*	*560*	*15.8*	*Fresh BW; transport cost only*				*Horse manure*
20/6-5/7	*15*	*158*	*BW*	*33*	*52*	*10*	*520*	*10.4*					*Avg dose 30g/m^2*
5/7-20/7	*15*	*208*	*RC+ CC*	*15*	*31*	*12*	*372*	*5.8*	*Mix 2:1 (rice bran : cotton seed cake)*				*Chicken manure*
20/7-3/8	*14*	*338*	*BW*	*20*	*67*	*9*	*603*	*15.6*	*BW slightly fermenting, low DO*				*Manure diluted & distributed*
Total	166	-	-	-	-	143	6008	13.3		Total	3937	SP 97	

POND RECORD FORM

District
Division
Location
Sublocation
Village

Owner's Name
If Group, Number members
No. Men
No. women
Pond number ____ of _____ total owned
Date constructed
Cost of construction
Pond surface area

Stocking Records

DATE	SPECIES	NUMBER	SIZE	TOTAL WEIGHT	SOURCE (SUPPLIER)

Harvesting Records

Date	Total or partial	Species	Number	Average Weight	Total weight	Total sales	Production Kg/ha

Pond Management Records: Inputs (Feeds and /or Fertilizers)

Date	Type of input	Amount	Frequency	Cost	Sampling or Fish Mortality Date	Number	Size or Wt	No. dead

Visits by Extension Agents

Date	Comments/ Recommendations	Signature

General Remarks

