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# Aquaculture Business Handbook



For Micro, Small and Medium-sized Enterprises in Cambodia

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This publication produced by **Cambodia MSME Project**, Funded by **USAID** to Cambodian People for improving their Aquaculture Business

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# Foreword

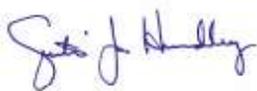
## Aquaculture in Cambodia

Cambodia's abundant lakes and rivers have made it a land rich in natural fisheries resources. Fish is an integral part of the Cambodian diet and an important source of protein. Today this natural endowment is being rapidly depleted due to a variety of reasons, including over-fishing and fisheries habitat destruction. Aquaculture has an important role to play in providing food, sustainable livelihoods and protecting the environment. Aquaculture is evolving as a dynamic business opportunity for many Cambodian families who are now changing their productive resources from supplying fish for their own family consumption to supplying local, provincial, and national markets.

## Cambodia MSME Project

Development Alternatives, Inc. (DAI) is implementing the USAID-funded Cambodia MSME Project to assist thousands of rural businesses to overcome technical constraints and improve business relationships, products, services, credit and the business environment. Aquaculture is one of the key rural businesses the project is assisting in Kandal, Prey Veng, Svay Rieng, Kampong Cham, Kampong Speu, and Kratie provinces. The Project assists producers to improve their business relationship and reduce risk by introducing improved techniques and processes that improve productivity, and access to markets.

This Aquaculture Business Handbook will help bridge the gap as families and firms graduate from subsistence aquaculture to becoming aquaculture businesses. The handbook integrates the required technical skills with needed business skills, such as record keeping and marketing. It demonstrates how to start small and grow the business by re-investing profits. Examples are provided of successful business models of varying sizes to encourage entrepreneurs and demonstrate that anyone can profitably operate an aquaculture business if they learn new techniques and business skills.



Curtis Hundley, Chief of Party  
Cambodia MSME Project

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# Aquaculture as a Business

Aquaculture provides the businessperson or farmer an opportunity to start small and grow a business with incremental capital investments. In many cases the small backyard fish pond, which has provided subsistence fish for family consumption can be used as a first step in an aquaculture business.

No matter how small you start, it is important to begin your business using the correct basic fish culturing techniques. This helps to avoid a waste of time and effort and ensures a good return for your investment of time and resources. Improving fish culturing techniques is the most important step in increasing production, reducing costs, raising the productivity of the fish pond, and improving the businesses profits.

## Why Aquaculture is Important to You and Cambodia?

- Fish is a good source of protein and nutrition for your family.
- Fish raising can provide an additional source of regular income.
- Aquaculture increases fish production without depleting local fisheries resources.
- Makes use of idle land and maximizes the use of existing local resources.
- Fish can be used as emergency food for family consumption and visitors.

## What Do You Need to Start To Start an Aquaculture Business?

- An understanding of basic fish culturing concepts and practices.
- A willingness to learn and adapt correct fish culturing techniques.
- Enough labor or time to take care of the fish ponds.
- Access to suitable fingerlings.
- Access to animal manure, fertilizer and available nutrients or feed materials or prepared feed.

# Aquaculture Techniques

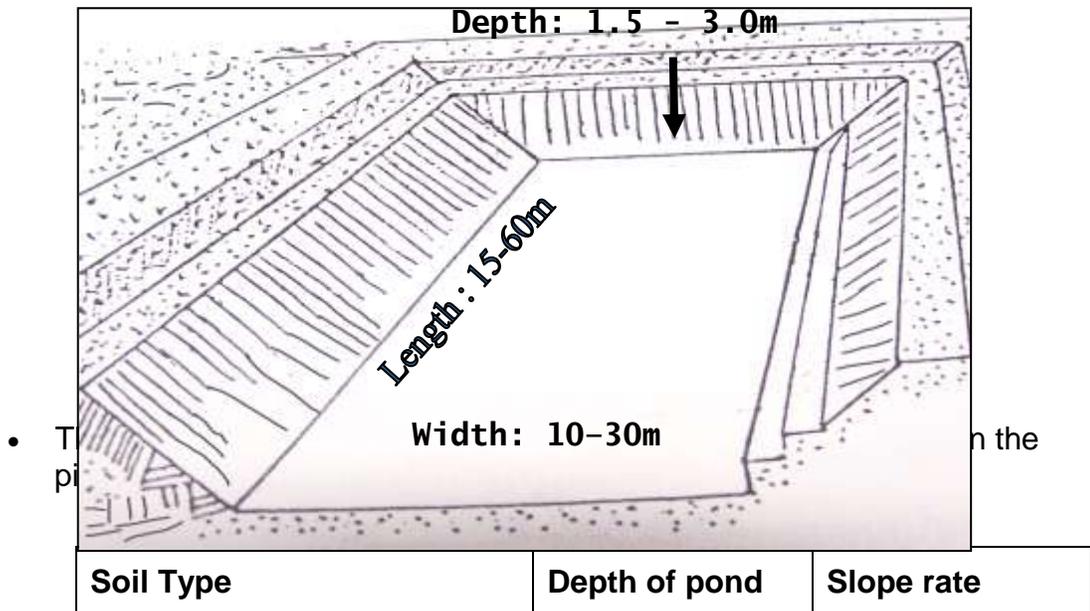
## Selecting the Site and Constructing the Pond

### Criteria for Site Selection

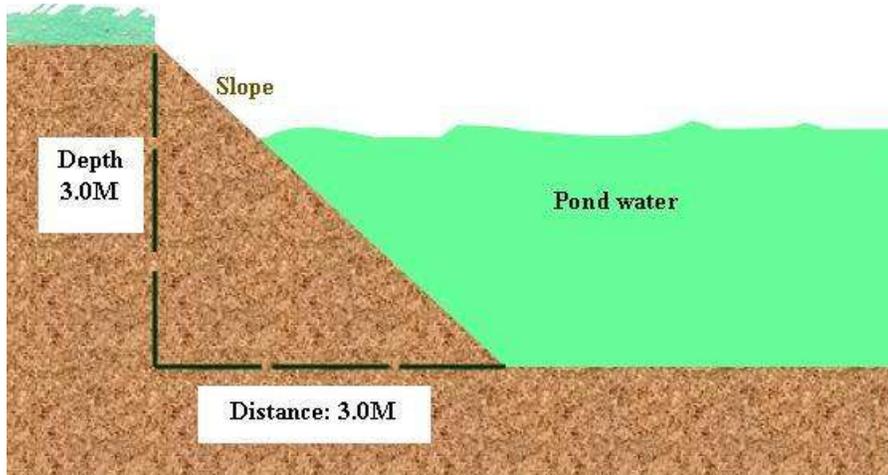
- Location should be close to resident household.
- Low-land site that does not flood during rainy season.
- Close to a water source as possible.
- Soil with long term water retention capability over six-month period.
- Treeless plains.
- A pond associated with a rice paddy is much better for Common Carp, Silver Barb, Indian Carp and Tilapia fish varieties.
- Pond should be located away from areas using agricultural chemicals and pesticides

### Pond Construction Technique

- Dig the pond in a rectangular shape.
- The pond should be between 150-1800m<sup>2</sup>.
- A depth of 1.5 to 3.0 meters is sufficient.
- A 500m<sup>2</sup> size is an average, manageable pond.
- The bottom must be flat and inclined to the sides of the pond.



Clay	1.0m	1.0m
Clay loam	1.0m	1.5m
Sandy loam	1.0m	1.5-2.0m



- A dike must be constructed to prevent surface water and waste matter from draining into the pond and causing the fish to die.
- Grass should be grown on the pond dike to reduce erosion that causes water turbidity.
- When constructing the dike, a pipe must be buried in the ground to be used for water inlet and outlet as shown in the following example.



Water inflow



Water outflow

## Preparing the Pond Before Stocking Fish

### Preparing an Old Pond

1. All the water must be pumped out to eradicate wild predators, such as snake head fish, water snakes, frogs, eels, and crabs.

2. Remove mud from the bottom of the pond.
3. Restructure the pond as necessary. Repair the pond dike and fill any crab holes with soil.

### **Preparing a New Pond**

1. Prepare the pond as detailed in Pond Construction Technique on page 3 of this handbook.
2. Fill 10-20cm of water in the pond.

### **After the Above, for Preparing Both Old and New Ponds**

1. Apply lime. Add about 5 to 10 kilograms for every 100m<sup>2</sup> and leave pond for 2 to 3 days to reduce pollutant gas and to kill bacteria.
2. Fill more water into pond until pond is full and then keep for a period of 2 to 3 days more to increase natural fish feed in pond.

**Note: Fish fingerlings can be stocked into the pond once the color of the water in the pond becomes green.**

### **The Importance of Liming**

- Improves water and soil quality with acidic composition.
- Kills some wild predators such as wild fish.
- Increases water visibility.
- Helps in the growth of cultured fish.

**Note: The rate of lime usage is based on the type of pond. Old ponds need less lime.**

## **Special Techniques for Carps and Tilapia Fish Culture**

Animal dung may be sprayed directly into the water. After liming and drying pond:

1. Fill water into pond up to one third of pond depth
2. Apply fertilizers
  - 2.1. Applying animal dung
    - If using wet cow or buffalo dung, apply 30-50kg.
    - If using wet pig dung, apply 20-35kg per 100 m<sup>2</sup>.
    - If using wet chicken or duck dung, apply 10-15kg per 100 m<sup>2</sup>.
    - If using green manure, apply 20-30kg by soaking in water at the corner

of the pond.

2.2. Apply chemical fertilizers, such as

- DAP : 300g per 100 m<sup>2</sup> - soak in water overnight
- Urea : 700g per 100 m<sup>2</sup> - dissolve in water

3. Keep for one week (7 days) to increase natural fish feed such as Phytoplankton and Zooplankton.

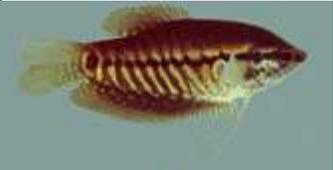
**Note: Natural fish feed is important for fingerlings at the first stage because they will not recognize a feed place yet.**

## Selecting Fish Species to Culture

Ask the following questions to select the best fish species.

- What species of fish is preferred by local people in the local market?
- What species of fish has a good demand in the province or large city market to which you can sell?
- What species is easiest to raise in your type of pond?
- Can fingerlings of the species be easily obtained?
- Is this species allowed by the Fisheries Administration?
- Is the species resistant to disease?

The recommended species for Cambodia are Silver Barb, Snake Skin Gourami, Hoeven's Slender Carp (Trey Proul), Catfish (Trey Pra), Tilapia, Common Carp, Silver Carp, and Mrigal/Indian Carp.

Fish Species	Living Characteristic	Feed Characteristic	Growth In One year
Silver Barb 	Prefers living at pelagic and middle part of water body.	Prefers eating <ul style="list-style-type: none"> <li>• Vegetable matter, leaves, duck weed morning glory and termites</li> <li>• Added fish feed</li> </ul>	200-500g
Snake Skin Gourami 	Prefers living at pelagic and middle part of water body.	Prefers eating <ul style="list-style-type: none"> <li>• Vegetable matter, leaves, duck weed morning glory and termites</li> <li>• Added fish feed</li> </ul>	50-100g
Catfish (Trey Pra) 	Prefers living at middle and or near the bottom layer of the pond.	Able to eat multiple types of feed with meat composition <ul style="list-style-type: none"> <li>• Rice field snails, crab, worm and insects</li> <li>• Added fish feed</li> </ul>	1-1.5kg
Hoeven's Slender Carp (Trey Proloung) 	Prefers living at the upper, sunlit areas where most of the organisms live and in the middle part of water body.	Able to eat multiple types of feed with meat composition <ul style="list-style-type: none"> <li>• Plankton and cereals</li> <li>• Rice field snails, crabs, worms and insects</li> <li>• Added fish feed</li> </ul>	300-500g

Fish Species	Living Characteristic	Feed Characteristic	Growth In One year
<p>Tilapia</p> 	<p>Prefers living and moving in all water layers.</p>	<p>Able to eat multiple types of feed</p> <ul style="list-style-type: none"> <li>• Aquatic plants, algae, worms and termites</li> <li>• Added fish feed</li> </ul>	<p>300-500g</p>
<p>Silver Carps</p> 	<p>Prefers living in the middle layer of water.</p>	<p>It eats plankton, especially phytoplankton.</p>	<p>500-700g</p>
<p>Common Carp</p>  <p>Note: This species tends to dig holes in the pond walls and pond bottom and should be limited to only 5% of total stock.</p>	<p>Prefers living at the bottom layer of the pond.</p>	<p>Able to eat multiple types of feed</p> <ul style="list-style-type: none"> <li>• Aquatic plan, snails, crabs, worms, termites and insects</li> <li>• Added fish feed</li> </ul>	<p>500g-1.0kg</p>

Fish Species	Living Characteristic	Feed Characteristic	Growth In One year
India Carps/ Mrigal 	Prefers living at the bottom layer of the pond.	Able to eat multiple types of feed <ul style="list-style-type: none"> <li>• Aquatic animal, plants and duck weed</li> <li>• Added fish feed</li> </ul>	500-700g

**Note: For small-scale aquaculture, mixed species is highly recommended. For medium-scale aquaculture, usually a single species is selected. Catfish and Tilapia are popular choices for medium-scale ponds.**

## Transporting Fingerlings

There are many ways to transport fingerlings. The selection of an appropriate means of transportation is based on the distance and road quality.

Transportation is best done in the morning or evening and especially in cool weather conditions. The two most popular ways to transport are closed and open transport. The choice of transportation method is also based on other features such as the size of the fingerlings, distance between destinations, time and capacity of the plastic bag.

- Closed transportation is used for long distance transportation. For closed transportation it is best to take a plastic bag for carrying fingerlings, a basket for holding the plastic bag, plastic tie, and oxygen. A plastic bag in the size of 60 cm x 100 cm can hold 300-500 fingerlings.
- Open transportation is used for short distance of transportation. A large container or canteen can be used and oxygen is not needed.





## Stocking Fingerlings

### Best Time for Stocking Fingerlings

Fish culturing, generally, can be done at anytime depending on the availability of water sources.

### Size for Stocking

Stocking size has to be similar at about 5 to 6 cm as shown in the example below. This size improves survival by enabling the fingerlings to easily escape from wild predators. Fingerlings must be healthy and active.



## Stocking Density

The stocking density depends on the species. The table below shows the correct stocking for each species.

<b>Species</b>	<b>Stocking density (m<sup>2</sup>)</b>	<b>Why</b>
<b>Pangasius / Catfish</b>	Up to 10-15 head (stagnant water)	Tolerant with stagnant pond water
<b>Carps: Silver Carp, Indian Carp,</b>	3-6 head	Need more oxygen and space for living
<b>Common Carp Silver barb</b>	Common carp: only 5% of total stock	If over 5%, it will spoil the water as this species tends to dig holes in pond wall and pond bottom
<b>Tilapia</b>	1-2 head	Breeding in pond water

## Releasing Fingerlings

- The best time to release fingerlings is in cool weather, especially between 9 am and 11 am.
- Fingerlings stocked in a plastic bag must be soaked in the pond water for 10 to 15 minutes before releasing so that the fingerlings will adjust to the water temperature gradually.
- Check the temperature of the water in the plastic bag by opening the bag and putting your hand inside the bag in which the fingerlings are stored. After that, place your hand in the pond water. If the water temperature inside the plastic bag is different from the pond water, add some water from the pond into the plastic bag until the water temperature of the pond water and plastic bag are similar.
- If the pond water temperature is very high stirring the pond water from bottom up will cause a decrease in the pond water temperature.



## Adding Manure after Releasing Fingerlings into the Pond

After 10 days of releasing the fingerling into the pond check the pond water. If the pond water is not green anymore it is time to add more manure. There are many ways to apply manure.

### Indirect Application

This is the best method as the quantity can be controlled.

1. Dig a hole near the pond as shown in the picture below.
2. The shape of the hole should be quadrilateral and its size around 0.5-1.0m diameter and 0.3-0.5m depth. The hole should have a pipe for water drainage into the pond. The bottom of the hole should be constructed higher than the water level of the pond to easily drain the manure into the pond.
3. Inside the hole, place manure such as fertilizer or cow dung, pig dung, water buffalo dung, chicken dung, duck dung, green plants included Tun Trea Khet and vegetable scraps. Water should be put into the hole daily and allowed to drain into the pond.
4. Leftover manure inside the hole should be removed after 20-30 days.
5. In case the pond water becomes dark green color or brown (or water has a bad smell) temporarily stop draining water from the hole into the pond. You could start draining manure water again when the pond water is not green and the bad smell has gone.



### Direct application

- Applying animal dung. See Page 5
- Applying chemical fertilizer. See page 5

### Feed and Feeding

Although in the wild fish grow without any need for supplementary feeding, in aquaculture, supplementary feed in the correct type and amount is very important. Good feed and correct feeding help the fish to reach market size within a shorter production cycle and increase profitability of the business.

## Feed

There are two kinds of feed for fish, natural feed and artificial feed.

**Natural feed:** natural feed includes zooplankton, phytoplankton and aquatic animals that live in the bottom of the pond. This can be produced using fertilizer. Besides these, natural feed can be found in the villages such as water coconuts, moina, water convolvulus, termites and earthworms. Natural fish feed alone is not sufficient for aquaculture.

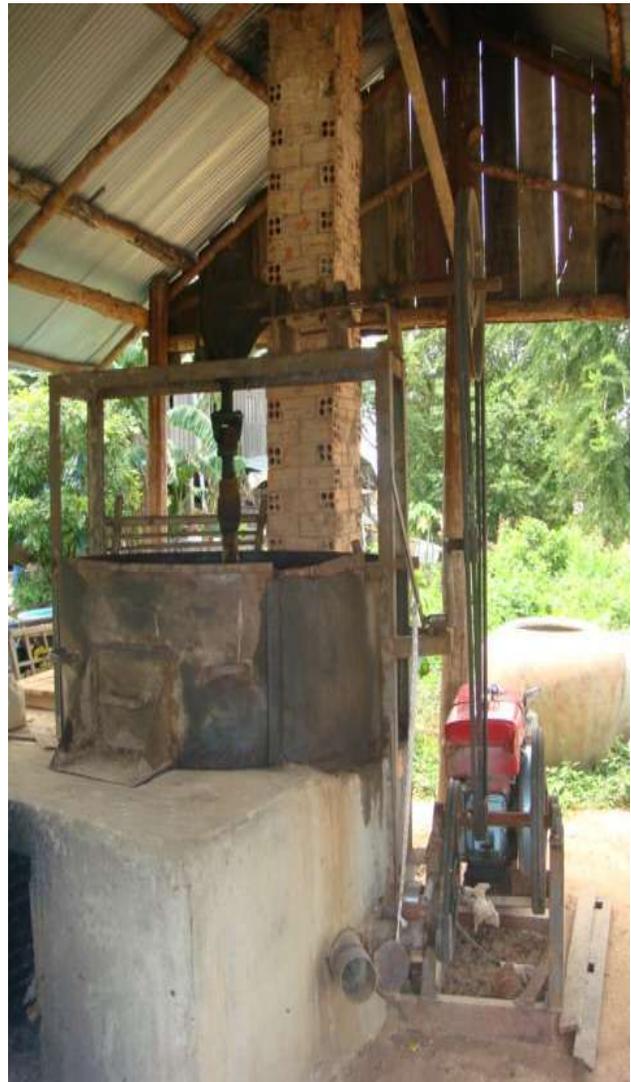
**Artificial feed:** artificial feed is produced with foodstuff such as rice bran, fish meal, rice fragments, corn, bean, leftover vegetable matter and slaughterhouse waste.

Good home-made artificial feed can be produced by cooking 50% rice bran, 10% broken rice or corn, 10% soybean and 30% fish meal/small (trash) fish.

Leftover vegetable matter and waste from slaughterhouses may be added.

The food should be cooled before feeding. It should be mixed well when cooking. A motorized mixer can be used for big quantities, as shown in the example here.

A number of varieties of artificial pellet feed can also be purchased and these must be used based on the manufacturer's instructions.



## Feeding

- Fish must be fed in a defined place in the pond and at specific times every day. The fish quickly learn the time and place and come there to eat.
- The best time for feeding fish is around 9am to 10am and 4pm to 5 pm.
- The quantity of fish feed is based on the fish size. The correct quantity of feed is 4-5% of the total weight of fish in the pond.
- Home-made fish feed should be well cooked and cooled before feeding. The feed may be made into small pellets by hand and placed in a basket.

Sink the basket into water to a depth of 0.3-0.5m.

- A motorized granulator can also be used. See picture on the next page.
- Fish may also be fed by hand by forming the feed into fist sized balls and throwing them into the water.
- For floating feed such as water coconut, (very small, edible eggs of a light blue color found in the water), and leftover vegetable matter a feed cage should be constructed at the corner of the pond as shown in the example below. When collecting duckweed for fish feed you should be careful not to collect duckweed from polluted water as eating this will cause the fish to die.





A motorized granulator costs about US\$200-\$250 and can be manufactured locally.

The advantage of using the granulator is that fish food is ground into small portions that take much longer to disintegrate in the water. This allows the fish more time to eat and reduces pollution of pond water through feed sedimentation.

When fish are fed by hand the best way is to form the cooked feed into balls before putting them into the water. The size of the ball depends on how big the fish are. Feeding by hand provides a good opportunity to observe the behavior of the fish and diagnose any problems early.



Feeding fish using a food basket is the most preferred method for small scale producers. Fish food is placed in the basket and then lowered into the water from a pole. In this way the quantity of feed can be adjusted based on the amount remaining in the basket and there is less waste. Water pollution by excess feed is also minimized.

## Controlling and Maintaining the Fish Pond

To culture fish successfully, pay attention to the following factors:

- The pond should get enough sunlight.
- Pond preparation should follow the appropriate technical specifications before releasing fingerlings into the pond.
- Grass must be grown on the dike to reduce soil erosion.
- The pond should have a strong fence/net to prevent any wild fish entering the pond and to prevent fish escaping from the pond as shown in the example below.
- Putting a net on the pond will also help prevent wild fish from entering the pond.



- Cut the grass and aquatic plants (water lily, lotus, water convolvulus, water coconut) in the pond and leave not more than 20%.
- Check the pond dike to avoid any damage or breach.
- Check the water quality inside the pond and keep it green by putting green manure/chemical fertilizers in regularly. This is really important for fast fish growth.

- Observe and kill any insects that can destroy the fish in the pond.
- Do not allow animals to wallow in the pond or make it muddy by other activities.
- Do not soak palm leaf, bamboo leaf or any kind of leaf inside the fish pond as the water becomes toxic.
- If the fish have a disease or some fish are found dead take these fish out of the pond immediately.
- Check to avoid any toxic waste like pesticides entering the fish pond.
- When inletting water into the pond use a small net to prevent wild fish and any insects from entering the pond.
- If you are dependent on rain water sources fish culture should start early in the rainy season.

## Common Misconceptions in Aquaculture Management

1. **“I have no time to clean the pond before stocking”** - If you do not clean the pond and prepare it well, wild predators who are already in the pond will eat the fingerlings. Some fish may also escape through holes in the pond wall. This is a waste of money and time. At the time of harvest you will have only a few fish left.
2. **“If I put more fingerlings in I will get a better harvest”** - Investing in more fingerlings than necessary is a waste of money. When there are too many fish in the pond the food and water is not sufficient for the fish to grow well. The water will get contaminated easily and the fish will grow slowly.
3. **“Wild fish are not fed so I do not need to feed my fish”** - In the wild, fish take a long time to grow. But in aquaculture business it is not profitable to wait for a long time. If you feed the fish the correct type and quantity of food they will grow within a short period and you will get a good harvest and income.
4. **“When the fish come to the top they are hungry and must be fed”** - Fish come to the surface to breathe, this does not mean they are hungry. Feeding should be at regular times and places, not throughout the day and at different places in the pond. Quantity of feed must be adjusted based on how much is eaten. Over feeding will pollute the water and kill the fish.
5. **“It is good to grow a lot of morning glory, lotus and other weeds in the fish pond as the fish can eat them”** - There should be less than 20% weed cover in the fish pond or the oxygen in the pond will be depleted and fish will die or grow slowly.
6. **“Wild fingerlings will survive better than fingerlings from a grower”** - In reality, fingerlings from a hatchery are much better adapted to pond water conditions and feed. They are a similar size and will grow fast. Using wild fingerlings will also deplete the natural fishery resources very fast and so it is illegal.

# Harvesting Fish

## Partial Fish Harvesting

- After three months of fish culture some fish can be harvested for food. If a small quantity is harvested daily the remaining fish in the pond will grow faster.
- Fishing gear such as hooks, gillnets, or cast nets can be used for daily fishing.

## Total Fish Harvesting

- The fish harvest can be done when the fish price is high or when the pond water is nearly dry (in seasonal ponds).
- Fish must be harvested only at the time of sale.
- Before throwing or drying water from the pond, tools like hapa and net should be prepared to keep fish alive after harvest. Live fish are much more valuable to traders than dead ones.
- The best way to harvest without damage to fish is to pump or drain only half the water out before catching the fish. A cast or gill net can used to minimize the trauma to the fish.



**Partial harvest using a net**

**Daily fishing using a gillnet**



# Marketing and Markets

## Local and Commune Markets

For small scale fish producers, local and commune markets are good places to sell fish. Before starting an aquaculture business, the wild fish seasonality in your area must be determined. Aquaculture commands good prices during the off season and you should plan your production accordingly. Waiting for a passing trader to come along is disadvantageous. Try to enter into a forward arrangement with your trader to buy the fish. Always have one or two traders and check current the prices before you sell.

## Provincial Markets

To supply regular provincial and big markets, you need to plan to supply a regular quantity of fish during the required season. This means having access to water when it is needed and not depending only on rain water sources. Provincial markets may also require different species of fish than local markets and you should check with one or more traders before you begin fish production.

## Markets in Kandal Province, Siem Reap and Phnom Penh

To access more sophisticated markets you need to address some important criteria:

- The color of the fish meat has to be white.
- Taste and smell of fish must meet customer requirements.
- Markets want a regular supply of quality fish.

You should check with one or more traders or middlemen to know what the requirements are in your target market before you begin fish production.

**Note: The experiences of some aquaculture businesses show that the color of fish meat is affected by the kind of feed used. Feed with more corn and rice bran tend to give a yellow coloration to fish meat which is not acceptable in quality conscious markets. Good clean water sources will improve the taste and smell of fish.**

## Taking Care of the Aquaculture Business

## Expense and Income Record

Keeping a record of income and expenditure is very important because it helps you to know the cost of production, profitability and to make good decisions about the development of your business. A good income and expense record is also useful for borrowing money from banks and money lenders. It shows that you are serious about managing the business.

Recording expenditures in categories is more useful than simply writing down everything together. For example, when you want to grow the business, invest in another pond or expand the present pond, it is useful to know the cost of pond preparation and management. These are some expenditure categories to record:

Cost of pond preparation:

- Labor
- Water pump machine
- Fuel for pumping machine
- Lime
- Fertilizers

Cost of stocking:

- Fingerlings
- Transport
- Labor

Cost of feed and feeding:

- Feed stock materials
- Cooker and cooking pot
- Fuel for cooking
- Feeding machine
- Labor

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Cost of Managing Water Quality and controlling:

- Fertilizer
- Pumping water in and out of pond
- Cost of any medicines used
- Net for protecting wild fish into pond

- Labor

The following should be taken into account in calculating the income and quantity of fish produced (weight):

- Sales of small fish (partial sales) of tilapia
- Fish taken for consumption
- Fish given to other people
- Fish kept for reproduction
- Final sale of fish

The following format can be used for recording expenditures in a book. Costs should be written down as they occur or on a daily basis.

Size of Pond: \_\_\_\_\_ Location: \_\_\_\_\_  
 Date of Stocking: \_\_\_\_\_ Species: \_\_\_\_\_ Qty: \_\_\_\_\_  
 Species: \_\_\_\_\_ Qty: \_\_\_\_\_

**Record of Expenditure**

Date	Pond Preparation		Stocking		Feed and Feeding		Water Quality Management		Estimated Weight of Fish
	Item	Value	Item	Value	Item	Value	Item	Value	

**Note: Appendix 1 shows a format that medium scale businesses can use to analyze costs.**

# Investing in the Aquaculture Business

An aquaculture business can be started by MSME's with a small capital and using any pond size over 500m<sup>2</sup>. There are four fundamental factors to consider:

1. Correct pond preparation
2. Pond management techniques—controlling and maintaining pond water quality
3. Feed and Feeding
4. Produce for the market—required species and quality at the right time

On average a 500m<sup>2</sup> pond can produce a harvest of between 1 MT to 5MT under management by Micro, Small and Medium Enterprises depending on the investment, time spent and management techniques. In large scale business the productivity is much higher and a similar pond can produce 10MT. The production cycle is also much shorter in large scale business. To grow the aquaculture business and increase the productivity of the pond it is important to have a plan to re-invest in the business. When the aquaculture business is growing it makes good business sense to contact bigger traders and look for bigger markets while continuing to supply to the village market. Some characteristics of successful MSME aquaculture businesses at different levels in Cambodia are:

## **Business Level 1: Harvest 1.5 to 2 kg/m<sup>2</sup>**

The main investment to get this level of harvest is:

1. Good pond preparation and correct stocking mix.
2. Using home made fish feed and natural fish feed by growing plankton which is produced by fertilizer usage.

At Business Level 1, the most important investment is in pond preparation and feed. It is possible for any small fish grower to pay attention to the recommended pond preparation technique and feed information and reach these harvest levels. Own labor or family labor can be used for preparing the pond and feeding. At this stage an average 500m<sup>2</sup> pond will give a harvest of almost 1 MT.

## **Business Level 2: Harvest 5 to 6 kg/m<sup>2</sup>**

To increase the harvest up to Business Level 2 the aquaculture businessperson needs to pay more attention to feed quality, feeding frequency and method and pond water quality. Investment is needed in producing home made fish feed and in labor for taking care of the pond. Investment is also required to access good water sources.

In a fish pond with a higher density of fish, the fish can easily get diseased if more feed than necessary is used. Waste of feed will pollute pond water. So at this level good care should be taken in managing the quantity of feed and the water quality. The main areas to concentrate are on:

1. Good pond preparation and stocking with good quality fingerlings.
2. Feed and feeding: Use of supplementary fish feed by using small (trash) fish mixed with rice bran. It's necessary to feed fish twice a day.
3. Control pond water quality: Water needs to be changed 2-3 times per culture period to protect from diseases and ensure fast growth of fish.
4. Management of fish diseases: Using medicines to protect and cure fish diseases.

## **Business Level 3: Harvest 8 to 10 kg/m<sup>2</sup>**

At Business Level 3 the businessperson needs to pay a lot of attention to pond water quality. The higher density of fish in the pond can only be successfully maintained if the water quality can be managed well. Frequent water change is necessary and can be managed by partially draining and refilling the pond each week. Feed quantity must be carefully monitored as waste food in pond will pollute the water very quickly. At Business Level 3, the entrepreneur will need to invest in more labor for managing the fish pond, higher protein fish feed, the purchase of a fish feed granulator if using home made fish feed, and access to good water sources

The main areas to concentrate on are:

1. Pond preparation and stocking—be careful not to over stock.
2. Use of feed granulator or pellet feed. It is necessary to feed fish twice a day.
3. More protein in fish feed.
4. Pond water quality: Change 20-30% of pond water every week.
5. Fish diseases: Use medicines to protect and cure fish diseases.

## **Success Cases in the Aquaculture Business**

## Successful Small-Scale Aquaculture Businesses

Small scale aquaculture can benefit much by improving the fish culture technique and correctly applying the basic techniques of pond management and feeding. Lack of pond preparation, reduction of fish stock due to presence of predator fish, improper or insufficient feeding, too much surface water plants are some common problems faced by small scale producers. As a result small scale producers get very little produce from the fish pond for the effort they put in. Many of Cambodia MSME's small scale aquaculture clients have doubled their aquaculture production once they understood and applied the right techniques. This has given sufficient production for their own consumption and to actively sell to local markets. The increased profits have been used by astute entrepreneurs to expand their production.

### Case 1 - Mr. Ang Chamroeun — Cheaklang Commune, Prey Veng Province



Mr. Ang Chamroeun has a fish pond of 375 m<sup>2</sup>. Before he joined with the Cambodia MSME Project, he harvested 0.2MT of fish every year. After applying correct aquaculture techniques, Mr. Chamroeun was able to increase the productivity of his fish pond from 1 kg per m<sup>2</sup> to 2 kg per m<sup>2</sup>. Now he harvests 0.6MT of fish every year, which represents a 300% increase in harvest.

Some fish he uses for his family consumption. The main harvest he sells to traders from the commune and from Prey Veng Province. For his last sale Mr. Chamroeun obtained a selling price of \$2 per kg.

Mr. Chamroeun says the following fish raising techniques helped him to double his productivity:

- Improving the source of water: Using water well and rain water pumped by machine
- Good fish feed and regular feeding. He feeds his fish at regular times one or two times per day by using:
- Home made fish feed: feed mixed together with rice bran and vegetable waste. It is cooked well before feeding.
- Natural fish feed in pond: Made by applying

- Chicken dung/animal manure
- Chemical fertilizers: UREA/DAP
- Correct stocking density: 6 fish/m<sup>2</sup>
- More management: Controlling and maintaining the fish pond by changing the water, reducing the chance of predator fish entering the pond, protecting the fish pond from toxic waste.

### Case 2 - Mr. Keo La — Domreipoon Village, Prey Veng Province



Before receiving assistance from the Cambodia MSME Project, Mr. Keo La could harvest fish from his pond only once a year. The fish took a long time to grow.

After applying correct fish raising techniques, he can now obtain fish from his pond all year long for subsistence and for sale in the village/commune market. Last year Mr. La harvested 1.8MT of fish in his 300m<sup>2</sup> pond. He sold about 1.2MT in the village market. Mr. La and his

family consumed about 0.6MT of fish year round.

Using his successful application of the fish raising techniques and the profits from last year Mr. La has expanded one old pond to 900m<sup>2</sup> and two more ponds averaging about 600m<sup>2</sup> this year. From January to June 2008 Mr. La partially harvested about 1 MT of fish. He sold around 0.9 MT of this in the village market. Due to the improved quality the price for his fish increased from 7,000 riels to 10,000 riels as more traders wanted to buy his fish. Mr. La expects to double his harvest and his family's fish consumption this year. He will also earn money from the fingerlings he is raising.

Mr. La practiced the following fish raising techniques after receiving training from the Cambodia MSME Project:

- Improved source of water: Using water well and rain water pumped by machine.
- Good fish feed and feeding technique.
- Use of kitchen waste.
- Cooked mixed rice bran and morning glory fed 1 - 2 times per day. Application of fertilizers for increased natural fish feed production in pond—phytoplankton and zooplankton.
- Use of pellet fish feed to supplement home made fish feed.
- Stocking density: 7-8 fish/m<sup>2</sup>.
- More management: controlling and maintaining fish pond.

### **Successful Medium-Scale Aquaculture Business**

Medium scale producers tend to have bigger ponds – 1,000 m<sup>2</sup> and over, but use up a lot of resources unproductively if they don't apply the right fish raising techniques. Over stocking and under or over feeding are the common problems associated with medium scale aquaculture. With good aquaculture management techniques a 1,000 m<sup>2</sup> pond has the potential to produce 8-10MT in a production cycle of around 8 months.

Based on what they learned from the Cambodia MSME Project, some of the medium scale clients invested in a feed cooking and stirring machine and a fish feed granulator. This helped them to improve the cooking of large quantities of homemade feed. Feeding using a granulator saves time and makes it easy for the fish to eat the food without spoiling the water.

#### **Case 3 - Mr. Sok Sim — Kompong Preh Commune, Batheay District, Kampong Cham Province**



Mr. Sok Sim has one fish pond of about 1,000m<sup>2</sup> in which he grows *Pangasius catfish*. For many years Mr. Sok Sim's pond used to produce about 4kg/m<sup>2</sup> in a long production cycle of 16-18 months. He sold about 1-2 MT to the local trader.

After applying correct fish raising techniques, he has increased his fish production to 6-7kg/m<sup>2</sup> and shortened his production cycle to 06-08 months. Now Mr. Sok Sim can do two production cycles in

the time it took him to complete one. Last year Mr. Sok Sim obtained a harvest of about 7 MT from one production cycle in his pond.

Cambodia MSME helped Mr. Sok Sim to think about his market as well. If he stayed with the same local trader it would be difficult to sell this larger quantity of fish and the price would drop. Mr. Sok Sim contacted a big trader who was able to buy a large quantity. The big trader was also looking for better quality fish. Mr. Sok Sim's improved production techniques helped convince the big trader that the fish quality would be suitable for his market. Since the trader was confident that Mr. Sok Sim can produce good quality Pangasius fish he was willing to contract to buy and also settle on a better price.

Some of the fish raising techniques adopted by Mr. Sok Sim are:

- Improved pond preparation before stocking.
- Improved source of water: Using water well and rain water pumped by machine.
- Improving pond water quality management by changing pond water once a month.
- Feed preparation and feeding: he feeds fish two times per day using a high protein diet:
  - pellet fish feed,
  - fresh fish,
  - and home made fish feed—using small (trash) fish with rice bran.
- The fish food is cooked using a mechanical stirrer and pelletized at the time of feeding using a granulator.
- Stocking density: 10 fish/m<sup>2</sup>.
- More management: control water quality—pH, Color of pond water, and characteristic of fish.

#### **Case 4 - Mr. Veng Long — Kompong Preh Commune, Batheay District, Kampong Cham Province**

Mr. Veng Long has a pond of about 2,100m<sup>2</sup>. Before joining the Cambodia MSME project he could collect only about 3-4 MT from his pond i.e. 1.5-2 kg/m<sup>2</sup>. It took about two years to grow the fish.

After applying correct fish culture techniques, he now harvests about 8 MT from the same pond. His pond productivity is about 3-4 kg/m<sup>2</sup>. The time taken has been reduced to just eight months.



Some of the fish raising techniques improved successfully by Mr. Veng Long are:

- Correct pond preparation before stocking.
- Improved source of water: Using water well and rain water pumped by machine
- Improving pond water quality management by changing pond water once a month
- Feed preparation and feeding: he feeds fish two times per day using a high protein diet:
  - Dried small (trash) fish,
  - Homemade fish feed—small fish cooked with rice bran. It is cooked and stirred by machine. After that it is ground by machine into pellet fish feed.
- Stocking density: 10 fish/m<sup>2</sup>
- More management: control water quality—pH, color of water, and characteristic of fish.

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## **Notes**

## **Useful Contacts and References**

# Appendix 1 - Expense and Income Analysis Template

Monthly and Yearly Costs for \_\_\_\_\_ fish farm from.....to.....

Categories	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
<b>Pond preparation</b>													
Labour													
Water pump Machine													
Fuel for Pumping machine													
Lime													
Fertilizers													
<b>Costs of stocking</b>													
Fingerlings													
Transport													
Labour													
<b>Cost of feed and feeding</b>													
Feed stock material													
Cooker and cooking pot													
Fuel for Cooking													
Feeding machine													
Labour													
<b>Cost of Managing Water quality</b>													
Fertilizer													
Pumping water in and out of the pond													
<b>Medicine</b>													
Labor													
<b>Harvesting costs</b>													
<b>Other costs</b>													
<b>Total</b>													

