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Techno Guide Series

Volume 4, No. 3, December 1, 1997

Bureau of Fisheries and Aquatic Resources
**EASTERN VISAYAS INTEGRATED FISHERIES RESEARCH & DEVELOPMENT CENTER
(EVIFRDC)
BFAR Regional Office No. 8**

Tilapia Hatchery and Nursery Management



Introduction

Tilapia (Family Cichlidae) is widely grown in warm countries both in domestic and commercial scale.

In the Philippines, tilapia is an important food fish and has gained acceptance in the local markets. It ranks with milkfish as the most extensively cultured finfish in the country's inland waters.

It is a fast growing fish reaching an average weight of 120 to 200 grams in four months with at least 80% survival. Though essentially herbivorous, it eats diverse food and grows favorably even under a low protein diet. It feeds on detritus, crustaceans, benthos, and various forms of supplemental feeds present in the water. It tolerates crowding and is resistant to pests and diseases.

Like, the marine fishes, tilapia is a very good source of protein, vitamins, and minerals needed by the body. It can be a good substitute for the marine fishes whose prices are getting higher.

Species/Strain

The kind of species/strain to be cultured should be well defined according to the purpose it is intended for. For a semi-intensive production, the ***Tilapia nilotica***, is recommended considering its advantages in terms of growth, survival, and adaptability to various environment.

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Disease	Parasite	Infected Fish	Treatment
Anchor worm disease	<i>Lernea</i>	The external parasites can be seen attached to or projecting from the skin often surrounded by a patch of fungus. The parasite resembles a shaft of a small barb inserted into the flesh of the fish.	Therapeutic bath in 0.1% KMNO ₄ solution
Skin flukes	<i>Dactylogyrus</i>	Found on the gills. Infected fish gape for breath, gills are expanded and very pale.	Therapeutic bath in 2.5% salt solution for 10-15 minutes (early stage of infection). Or bath in 15 ppm formalin solution.
	<i>Cichidogyrus</i> <i>Gyrodactylus</i>	(same as above) Found on the skin. Infected fish is pale in color, fins droop and fold and gradually become torn. Skin shows small blood spots.	
Hemorrhagic septicemia	<i>Bacteria</i> <i>Aeromonas</i> <i>Pseudomonas</i>	Large bloody eroded areas on the sides and base of fins are common signs.	Terramycin given for 10-12 days at 2.5 g per 45.4 kg of fish per day mixed with feed given at 3% of total body weight of fish.

Source: Pillay, T.V.R.1993. *Aquaculture principles and Practices*. Fishing News Books. Osney Mead Oxford, England.

Classification of Tilapias in Aquaculture

The tilapia, which is under Family Cichlidae, belongs to 3 genera: *Tilapia*, *Sarotherodon*, and *Oreochromis*. The genera are distinguished by their reproductive behavior.

Most common cultured species:



Male (top) and female *O. aureus*



Male (top) and female Tilapia *O. mossambicus*



Male (top) and female Tilapia *Oreochromis niloticus*



Male (top) and female Red Tilapia

HATCHERY AND NURSERY MANAGEMENT

Tilapia can be bred as early as three months from the fry stage. Their ability to naturally spawn in captivity makes tilapia suitable for mass production. Hatchery operations can be a lucrative business since there is presently a high demand for tilapia fingerlings.

Breeding Habits of tilapia

Most tilapia species breed in saucer-shaped nests built by the male at the pond bottom. The female tilapia cares for the fry by mouthbrooding, in the case of most tilapias in the Philippines.

After spawning 100-500 eggs (depending on the size of the female) on the nest, the male discharges sperm to fertilize the eggs. The female picks the eggs up in her mouth. The eggs hatch within 3-5 days depending on the temperature. Eight to ten days after hatching, the fully developed fry are released but they return to the female's mouth when threatened by predators. During mouthbrooding, the female seldom eats if at all, thus retarding its growth.

The breeding habit is common to *T. nilotica*, *T. mossambica* and *T. aurea*. Mouthbrooders have recently been reclassified under genus *Oreochromis* which generally have relatively lower fecundity than substrate spawners.

The female *T. zillii* is, on the other hand, a substratum spawner. Eggs are laid on the substratum (a clean stone or a smooth object). The eggs are fertilized by the male and the emerging young are guarded by both parents. The female can spawn as much as 5,000 eggs.

Male tilapia can mate with more than one female. Tilapia can breed as frequently as every 6-8 weeks as long as the water is warm enough (24-30°C). High salinities, (above 15 ppt) however, inhibit spawning of *T. nilotica*.

Their presence are characterized by lesions, cottony growth or discolored spots at various parts of the fish. Infected fish suffer from body distortions, slow growth and sometimes, death.

Common parasites of tilapia and their control treatment

Disease	Parasite	Infected Fish	Treatment
Trichodinosis	<i>Trichodina</i>	Fish appears to have a bluish-white coating on the skin and localized discolored area or lesions. Parasite adheres to the gills, skin, and fins of fish.	Therapeutic bath in 0.1 mg KMNO ₄ per 50 liters of water for 30 seconds or in 1 g salt per 50 liters water for 10-15 minutes.
"Ich" or white spot	<i>Ichthyophthirius</i>	Fish develops a thickened epithelium and produce excessive mucus. Parasites appear as small white modules over the body surface. Parasites infect the gills, skin, and fins of fish.	Therapeutic bath in 0.7% salt solution from 3 to 20 days
Red sore disease	<i>Epistylis</i>	Scales and spines may be eroded away. A cottony growth which is actually colonies of <i>Epistylis</i> may be associated with sores. The sores could be the entry of bacteria and fungus.	(Treatment for bacterial and fungal infection)

Important requirements and Characteristics of Sexually Mature, Pond-raised *Oreochromis niloticus*.

AGE : 4 to 6 months
WEIGHT : 5 to 100 grams
LENGTH : 10 to 12 cm

SPAWNING TEMPERATURE –
OPTIMUM 25 to 30 °C
MINIMUM 21°C

EGG PRODUCTION PER FEMALE

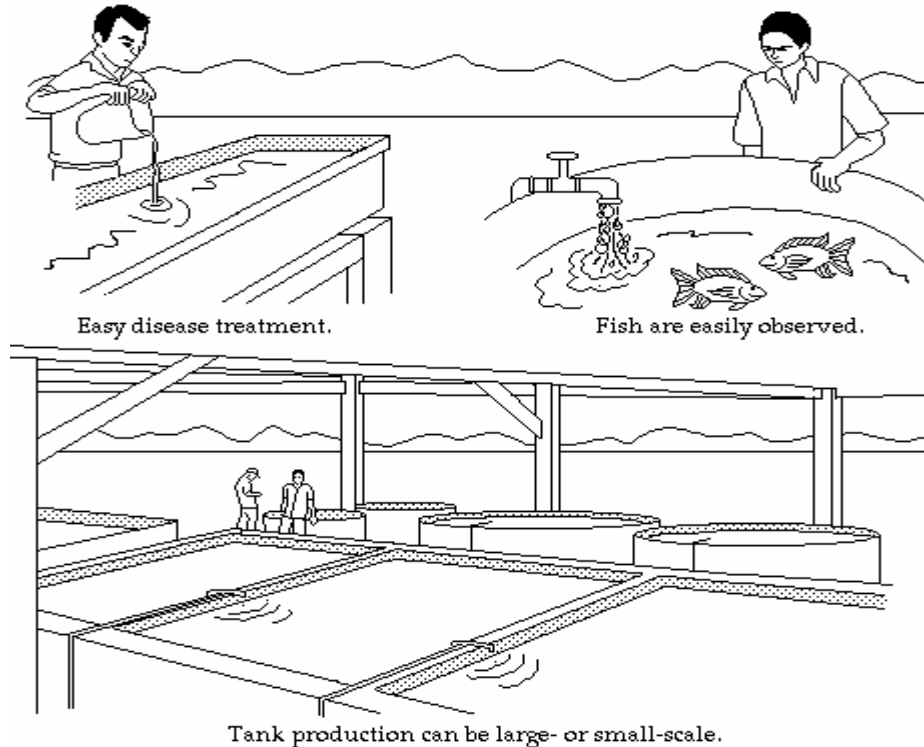
RANGE	100 to 200 eggs/ spawning
AVERAGE	200 TO 400 eggs / spawning
A 200 g FEMALE	250 to 500 fry/ 4 to 5 weeks

BEST SIZE FOR BROODSTOCK 100 to 200 g

SPAWNING SEQUENCE FOR *Oreochromis niloticus* :

The following sequence characterizes the mating behavior of *Oreochromis niloticus* in captivity

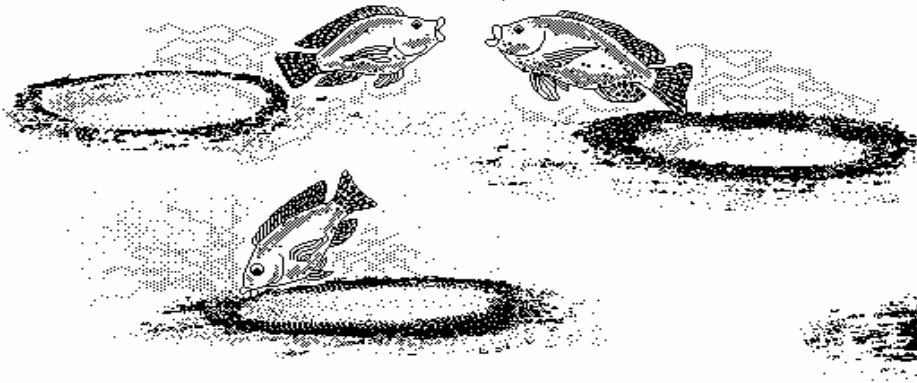
1. Broodstock become acclimated to their surroundings 3 to 4 days after stocking.
2. Males define and defend territories on the bottom, and form a nest by cleaning a circular area 20 to 30 cm. Wide. In ponds with soft bottoms, the nest excavated 5 to 8 cm deep by digging with the mouth.



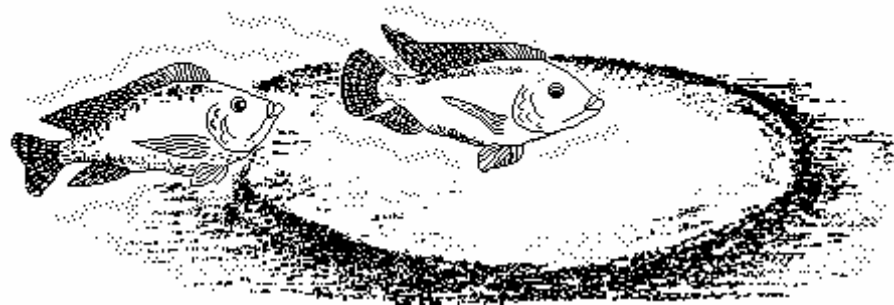
Control of Parasites and Diseases

Parasite infection had not been observed in tilapia but a number of parasites have been isolated from the fish.

Fouling of water, crowding, and fish stress can render fish vulnerable to parasites and fungal infection. Parasites may inhabit the external (skin, fins, gills) and internal (body cavity, eyes, organs, flesh) parts of the fish.



3. The female is attracted to the nest where the male courts her.



Multiple Pond system

The objective of this system is to produce 20-g male fingerlings in nursery ponds. The multiple pond system requires at least 2 ponds. A reproduction pond produces 1 to 2 g mixed sex fingerlings which are harvested and stocked into a nursery pond for culture to approximately 20 g. They are then harvested and sorted by sex. This system is designed for commercial operations with high fingerling requirements where control of reproduction in grow-out ponds is desirable, and for specialized markets where the additional expense of producing fast growing, all-male fish is justified. Two to three production cycles per year are possible.

Two specialized methods for producing all-male fingerlings for monosex culture are used : sex reversal and hybridization.

Estimated production :

- a) reproduction phase – 1,300, 1-grammer fingerlings per 100sq.m. per week
- b) nursery phase - 350 25-grammer all-male fingerlings per 100sq.m. per 9 weeks
- c) 2 to 3 production cycles per year

Tanks

Tank production of tilapia fry and fingerlings is practical where space for ponds is limited or expensive to develop. Cement tanks are common, but other materials, such as fiberglass or plastic lined pools, may be used. Greater control over water management and routine maintenance is possible than with other systems. Fish may be easily collected with dip-nets or a small seine, and well-built tanks can last a lifetime. Continuous production is possible. Fry yields per unit area are higher than all the reproduction systems described except for net enclosures.

Estimated Production : 6,000 to 8,000 fry per 8 sq.m. tank per month with continuous production possible.

this time and phytoplankton density in the rearing unit kept high. Visibility from the water surface should extend to a depth of only 25 to 30 cm and the water

should be a rich green color. The number of fry should be reduced by half if no supplemental food is given. Survival may range to 50 to 75% during this first month. Fry are then thinned and stocked at rates of 10 to 20/m² in secondary nursery units.

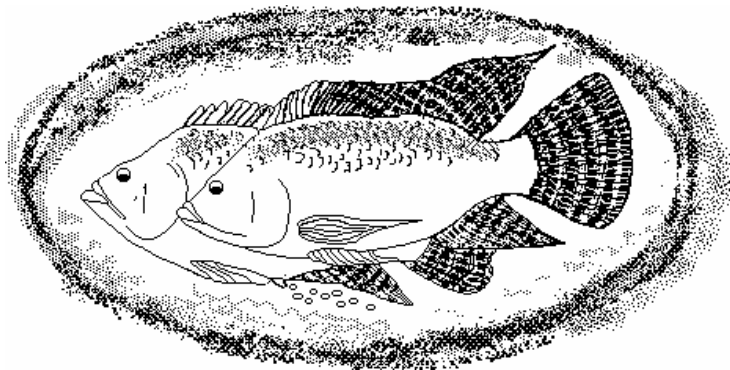
Estimated production : 1000 fry per 4 sq.m. hapa per week with continuous production possible

Reproduction Pond

Commercial fingerling producers using this system employ separate pond for fry production. Brood fish averaging 100 g are stocked in this pond for spawning. Their fry grow into fingerlings weighing from 1 to 15 g. Continuous partial harvesting of fingerlings with nets of mesh sizes ranging from 6 to 12 mm, depending on fingerling size desired, begin 5 to 7 weeks after stocking the brood fish. Harvesting is done at 1 to 2 week intervals. Fingerlings are transferred to other facilities for culture to larger sizes. The reproduction pond is drained, prepared and restocked with brood fish every 6 to 8 months. A one-pond operation is possible. Fingerlings obtained from this system are more uniform in age and size than fingerlings in Single-pond systems. Partial harvesting results in increased fingerling production and growth due to reduced cannibalism and overcrowding.

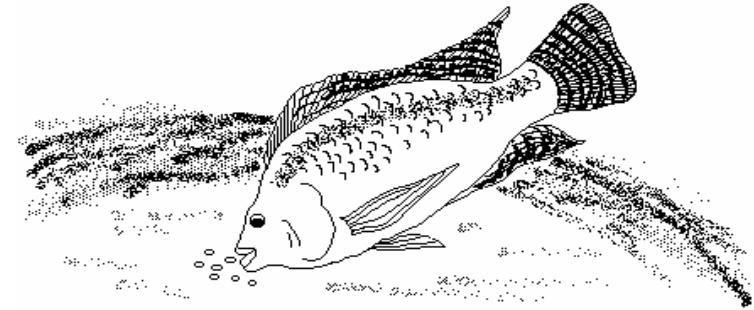
Estimated production :

- a) 1300, 1-grammer fingerlings per 100 sq.m. per week
- b) 300 5-grammer fingerlings per 100 sq.m. of pond per week with 2 production cycles per year



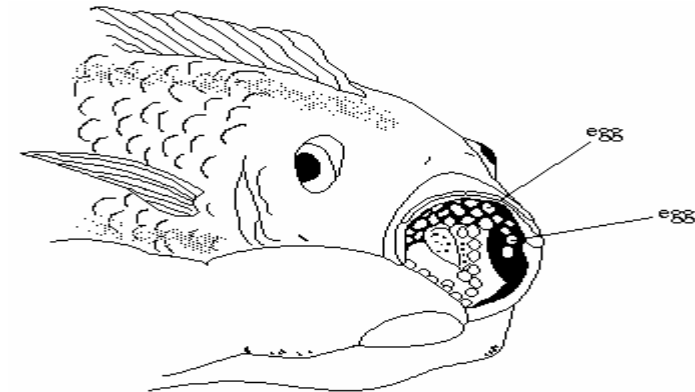
4. A mating pair of *Oreochromis niloticus*

5. The female lays her eggs in the nest after which they are fertilized by the male.



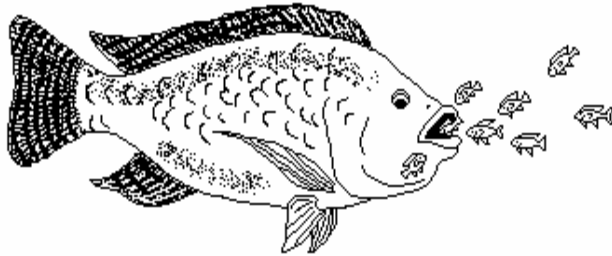
6. The female picks up the fertilized eggs in her mouth and leaves the nest. The male continues to guard the nest and attract other females for mating. Courtship and mating require less than a day.

7. Eggs are incubated for 2 to 5 days in the female's mouth before they hatch.



Young fry stay with their mother for an additional 5 to 7 days. They hide in her mouth when danger threatens. The female does not eat while incubating her eggs or caring for the new fry.

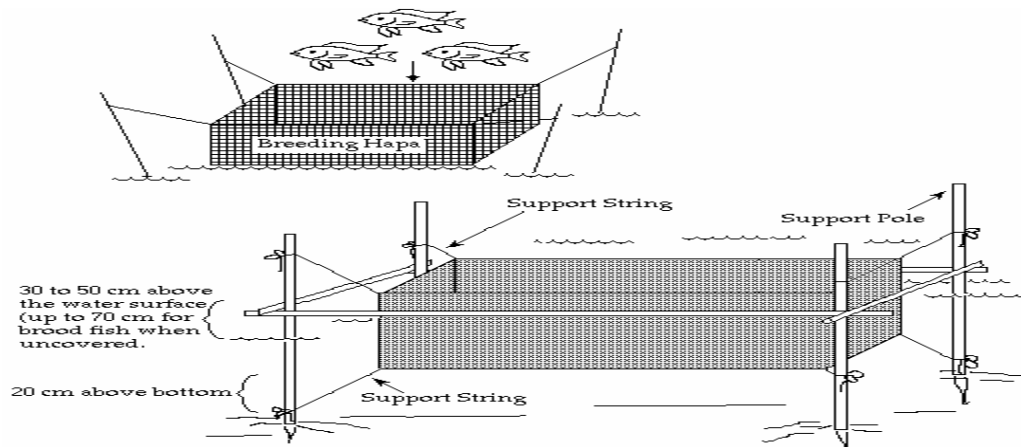
8. A female guards her young for 5 to 7 days. They hide in her mouth when danger threatens.



Place the hapa where it will be protected from strong currents. If hapas are placed in ponds, the pond should be prepared 2 weeks prior to stocking broodfish using standard fertilization practices. This allows phytoplankton to grow as food for the broodfish. Brood fish may be fed at 1% of their body weight daily with a good quality feed.

Examine the hapa for fry every 10 to 14 days after stocking brood fish. If the time period is shorter, females will still be incubating eggs. After more than 14 days, fry numbers will be reduced from cannibalism. Fry may be seen swimming in schools near the water surface. They can be scooped out with a fine mesh dip net, placed in pails and transferred to nursery ponds, tanks or hapas.

Collected fry are graded to uniform size to reduce cannibalism and stocked into nursing facilities at rates of 1000 to 2000/m² and grown for 1 month. Adequate natural and/or supplemental food must be provided during

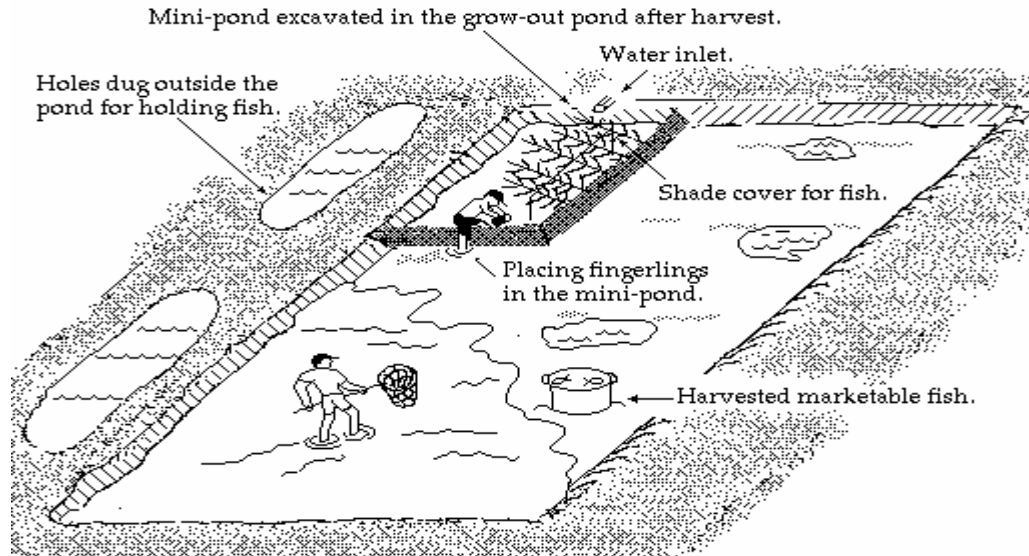


Net Enclosure or Hapa Method

This is the easiest and simplest way to breed tilapia. An inverted mosquito net or hapa made of mesh polyethylene netting is used for the purpose. The enclosure protects the fish against predators and ensures high survival of fingerlings.

Hapa are suspended in series in shallow portions of ponds, lakes or riverbanks with slow moving water. Water should be at least 60 cm deep and the enclosure 30-50 cm above the waterline to prevent the escape of the fish.

Net enclosures vary in size depending on the scale of operations. For plankton ponds, net measuring 1.5 x 1 m have been found practical. Three



females and one male are held in each enclosure. Expected fry production is 500/enclosure in 2 weeks.

9. The female will be ready to mate again about one week after she stops caring for the fry.
10. Fry from schools after leaving their mother and can be easily harvested with small mesh nest at this time. Large schools of fry may be seen 13 to 18 days after broodstock have been introduced to their new surroundings.

Selection and Care of Breeders

Picture of (a) male and (b) female tilapia



As a rule, breeders should be purchased from reliable sources, preferably those with broodstock management programs. To obtain good quality fingerlings, high quality strains free from body deformities and diseases should be used. Fish with body weights ranging from 50-80 g or about 3-4 months old are used for breeding.

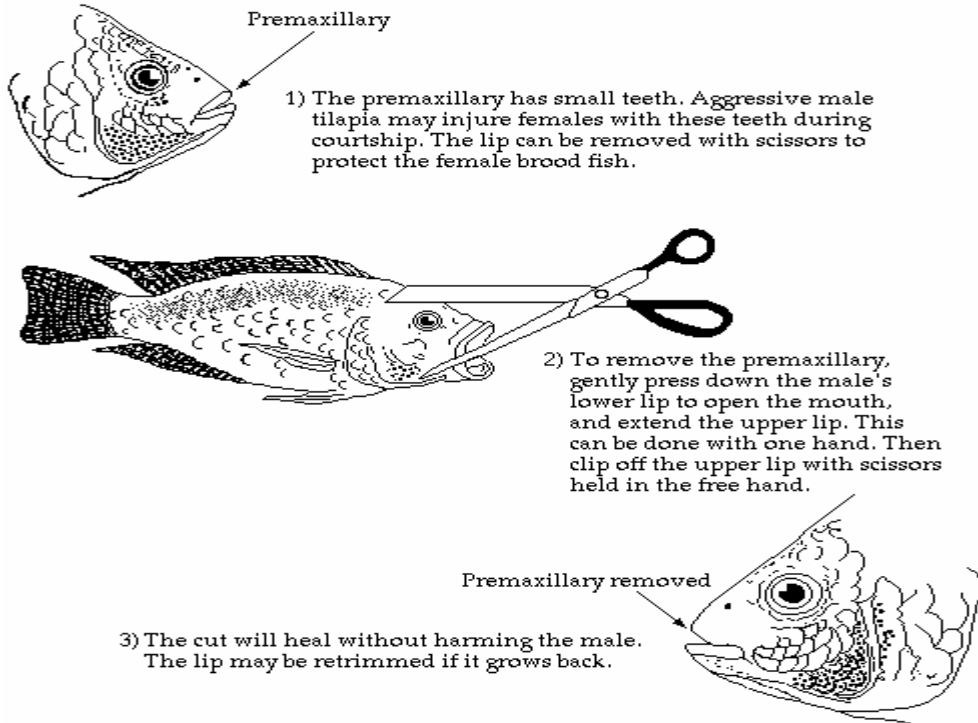
For optimum growth breeders require 20-30% crude protein in their diet. Chicken starter mash, broiler pellets, trigo and rice bran are suitable feeds. Breeders are fed twice daily at 1.5 % of fish body weight per feeding.

To keep them in optimum reproductive capacity, spent breeders should be netted out and segregated by sex after several spawning. The number of schools of fry formed more or less indicates the number of spawning that has occurred.

Male tilapia are aggressive and can injure unresponsive females while attempting to mate. Dense phytoplankton reduces visibility in water and reduces aggressive behavior. If fish are to be kept in clear water, the premaxillary or "upper lip" of the male can be removed with scissors or a sharp razor to provide protection for the female.

Breeders are maintained separately in net enclosures. They are fed and conditioned for about 2 weeks before being bred again.

The potency of females decline as they age. On the average, hatchery operators change breeders every 21 months. Partial change of breeders is necessary after one year. Females are changed more often than males, which become oversized faster.



HATCHERY SYSTEMS

Tilapia may be bred in water-based or land-based hatcheries.

Single Grow-out Pond

This system is the simplest and requires only one pond. Fingerlings are stocked in the pond and cultured for a full production cycle. Some reproduction occurs during this time and the resulting fingerlings are restocked into the same pond for grow-out after the food fish are harvested. Fingerling holding facilities are required while the grow-out pond is being prepared for restocking. One production cycle ranges from 4 to 6 months. Numbers of fry and fingerlings produced in this system are low because of crowding and cannibalism. Commercial fingerling sales are not an objective.

Estimated production for single-pond system is 3,000 to 5,000 fry /fingerlings produced per 100 sq.m. pond for each 4 to 6 month production cycle.