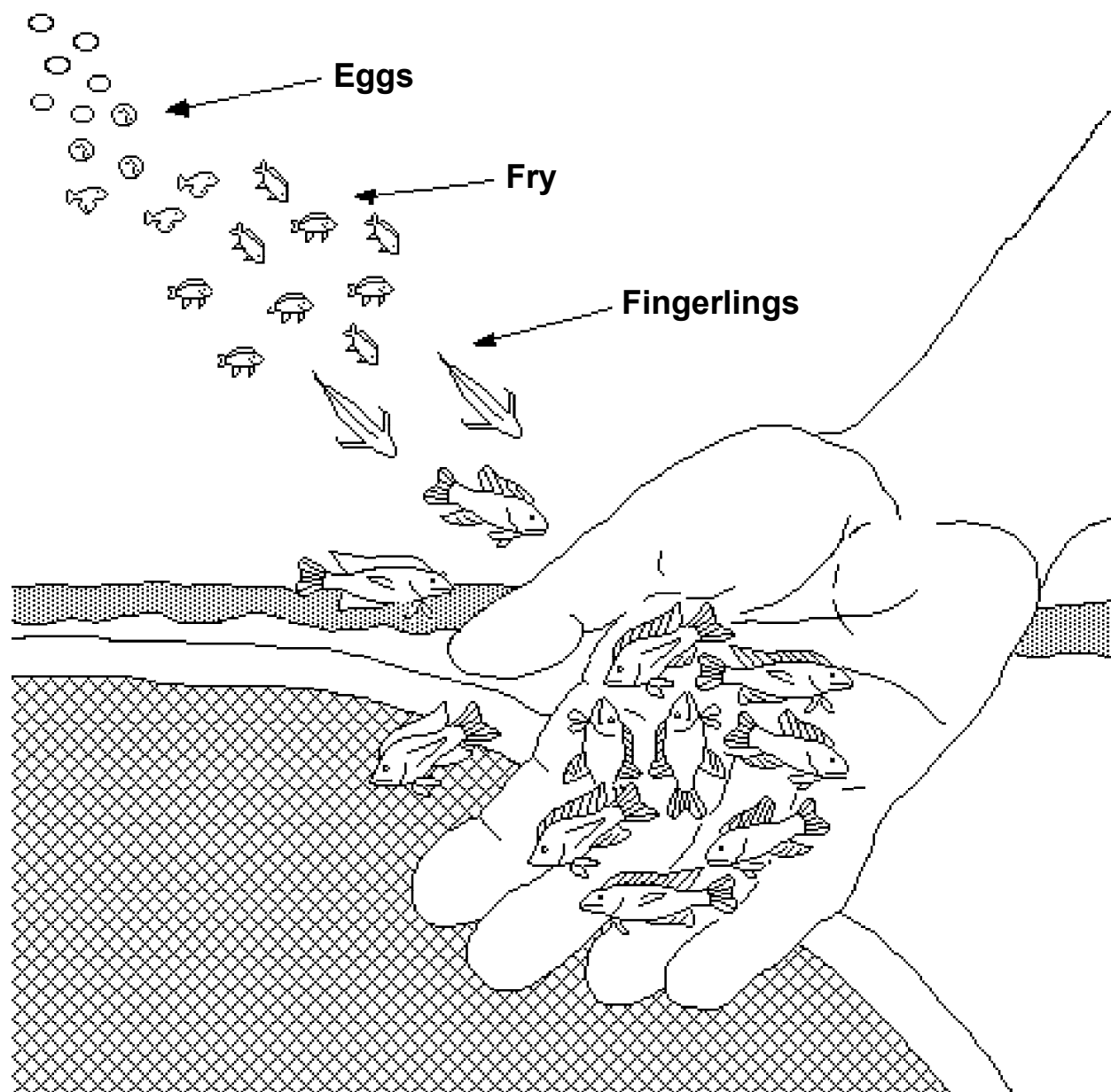

WATER HARVESTING AND AQUACULTURE
FOR RURAL DEVELOPMENT

INTRODUCTION TO *OREOCHROMIS NILOTICUS*
FINGERLING PRODUCTION SYSTEMS



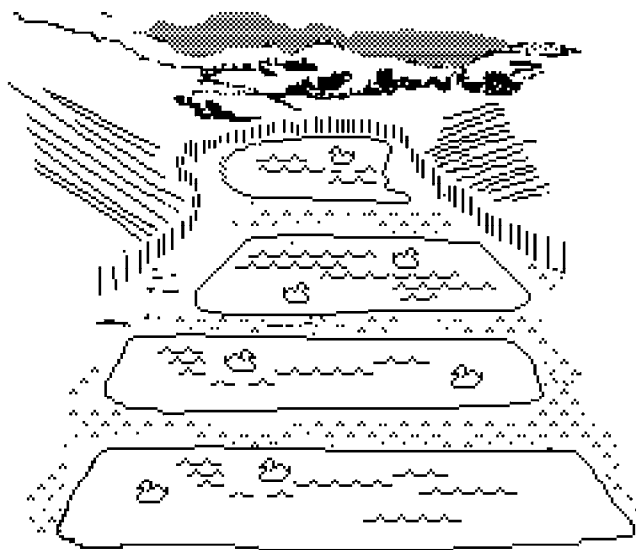
INTERNATIONAL CENTER FOR AQUACULTURE
AND AQUATIC ENVIRONMENTS
AUBURN UNIVERSITY

INTRODUCTION

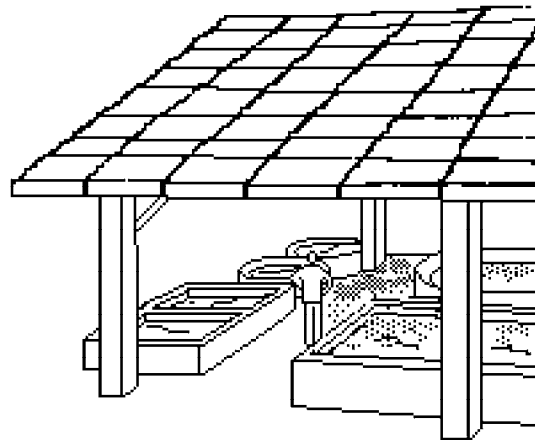
Fish culture is an important component of many rural development projects in areas suffering from protein shortages. *Oreochromis niloticus* is often chosen for its good cultural characteristics. However, an adequate supply of fingerlings is not always available through established hatcheries. Farmers can produce their own tilapia fingerlings for sale or culture using one or more of the methods introduced in this publication.

FACILITIES FOR FINGERLING PRODUCTION

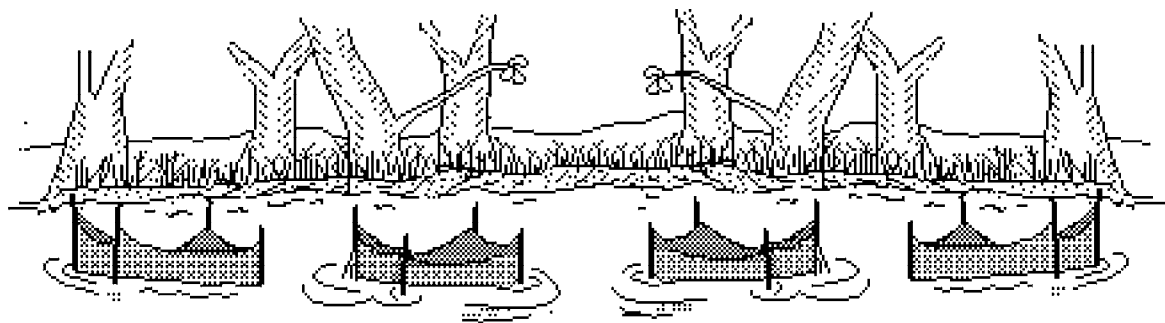
Tilapia fingerlings are most widely produced in ponds. However, net enclosures called hapas, aquaria and tanks made of wood, fiberglass, metal, plastic or concrete are also used. Choice of facility will depend on available resources and the demand for fingerlings.



Ponds



Tanks



Hapas

Figure 1: Various facilities used for producing tilapia fry and fingerlings.

SYSTEMS FOR PRODUCING TILAPIA FINGERLINGS

The following systems are used for producing tilapia fry and fingerlings. Table 2 provides estimates of the numbers of fry and fingerlings which may be produced with each system. These numbers are not exact. They are affected by many variables including environmental factors such as temperature and water quality, the management practices and skills of the producer, fish health and others. Numbers presented here are only estimates which provide a crude basis for comparison among systems.

System 1: 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.

System 2: Reproduction pond

Commercial fingerling producers using this system employ a separate pond for reproduction. 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 produced using System 1. Partial harvesting results in increased fingerling production and growth due to reduced cannibalism and overcrowding.

System 3: Multiple ponds

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. Males are used in monosex tilapia culture where food fish of at least 200 g are preferred by the market. 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 which are not discussed in this manual, but which require multiple ponds, are sex reversal and hybridization. These techniques need intensive management and require highly developed skills and facilities which are not practical for small-scale farmers.

System 4: Net enclosures or "hapas"

Brood fish are stocked into net enclosures called "hapas" for reproduction. Fry are collected and transferred to other hapas, ponds or tanks for further culture into fingerlings or food fish. Complete removal of fry from the breeding hapa eliminates cannibalism by parent fish and siblings. Fry are concentrated in a small area so maximum recovery rates are achieved. Total fry production per unit area is much higher than previous systems. Hapas may be moved and set up in a variety of locations, but are especially well suited to lakes and ponds. Continuous production is possible.

System 5: 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.

WHICH METHOD IS BEST?

A farmer must choose which production method is best suited to his situation. Table 1 provides a rough guide to determine which system to use.

TABLE 1: Characteristics of different fry and fingerling production systems.

SYSTEM

<u>DECISION FACTOR</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
- FINGERLING SALES IMPORTANT	no	yes	yes	yes	yes
- SUBSISTENCE LEVEL FARMING	yes	yes	no	no	no
- ONLY A SINGLE POND AVAILABLE	yes	yes	no	no	no
- SIMPLE METHODS AND EQUIPMENT	yes	yes/no	no	no	no
- FINGERLINGS OF UNIFORM AGE AND SIZE	no	yes	yes	yes	yes
- COMMERCIAL FINGERLING SALES	no	yes	yes	yes	yes
- ALL-MALE FINGERLING PRODUCTION	no	no	yes	yes	yes
- PRACTICAL IN UNDRAINABLE AREAS	no	no	no	no	no
- FRY COLLECTION VERY EASY	no	no	no	yes	yes
- EASY WATER MANAGEMENT AND ROUTINE MAINTENANCE	no	no	no	no	yes

BASIC REQUIREMENTS FOR PRODUCING FINGERLINGS

1. Culture facilities require sufficient, good quality water free of harmful chemical substances.
2. All facilities should be cleaned and maintained on a routine basis. Hapas require periodic scrubbing to remove organisms and debris which clog the netting and prevent water circulation.
3. Ponds and tanks should be built where they will not flood. Pond inlets and outlets should be screened to keep out predators.
4. Ponds should be exposed to sunlight so that adequate plankton can be produced as natural food.
5. Reproduction and nursery ponds should be dried after each production cycle to eliminate small tilapia, wild fish or other undesirable organisms.
6. Ponds and tanks for commercial fingerling production should be completely drainable and have catch basins.

Table 2: Guide to the approximate numbers of fry and fingerlings produced in each system.

System 1

- a) 3000 to 5000 fry and fingerlings produced per 100 m² of pond for each 4 to 6 month production cycle.

System 2

- a) 1300, 1 g fingerlings per 100 m² per week
- b) 300, 5 to 15 g fingerlings per 100 m² of pond per week with 2 production cycles per year.

System 3

- a) reproduction phase - 1300, 1 g fingerlings per 100 m² per week
- b) nursery phase - 350, 25 g all-male fingerlings per 100 m² per 9 weeks
- c) 2 to 3 production cycles per year

System 4

- a) 1000 fry per 4 m² hapa per week with continuous production possible.

System 5

- a) 6000 to 8000 fry per 8 m² tank per month with continuous production possible.
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GLOSSARY OF TERMS

brood fish - sexually mature fish selected for reproduction.

fingerling - a fish ranging in weight from 1 g to 25 g or greater than 2.5 cm in total length.

food fish - fish cultured and marketed for human consumption.

fry - recently hatched fish which weigh less than 1 g or measure less than 2.5 cm in total length.

grow-out pond/facility - a pond or other facility used to grow aquatic animals to marketable size.

hapa - an enclosure of fine mesh net used for breeding fish and nursing fry.

monosex culture - culture of all-male fish for market.

nursery pond/facility - a pond or other facility used to culture aquatic animals to a size suitable for stocking into a grow-out facility.

partial harvesting - periodic harvesting of a portion of the fish from a culture facility during a culture cycle.

plankton - very small or microscopic, aquatic organisms (plants and animals) that serve as food for larger aquatic animals and fish.

reproduction pond/facility - a pond or other facility used for fish breeding.

spawning - the act of depositing eggs and producing young.

Funding for this series was provided by the United States Agency for International Development. Communications regarding this and other technical brochures on water harvesting and aquaculture should be sent to:

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