Tank and Cage Systems for Fish Culturing

Solution Holder is **Bernadette Fregene** and can be contacted through **b.fregene@cgiar.org**

Summary

Tanks are enclosures placed on land to culture fish that are suitable for intensive production near urban centers with high market demand. Tank culture is a preferred alternative to ponds if limited amounts of water or land is available and the economics are favorable. Cage culture production involves growing of fish inside floating netted containers that are suspended within larger waterbodies. These cages require a comparatively low capital investment if locally produced. Cages also serve to clean waters through feeding activities.

Technical Description

Tanks should be constructed where there is year-round availability of quality water. Fish farming in tanks requires a complete feed diet with proteins, vitamins, and minerals as there is little to no natural foods available within the system. For cage culture, choosing the right location has a major influence on the economic viability of the operation. Inappropriate positioning of cages may cause poor fish growth, high mortality, and conflict with other water users. Feeding regimes for extensive cage culture rely upon natural foods and detritus, benthos, whereas more intensive culture also supplies fish feed.

Uses

Concrete tanks are best for rearing species such as catfish that can be farmed at high stocking density. Tilapia species can also grow well at high densities in tanks when excellent water quality is maintained. Extensive cage culture without additional feeding is better suited for microphagous tilapia species, such as Oreochromis niloticus, O. mossambicus and O. aureus; more than the macrophagous tilapia species, Coptodon zilli and C. rendalli. Flexible open cage systems are affected by the water flow that at higher velocities causes horizontal drag on the net and may reduce its volume. Suitable current speeds inside cages range from 0.1 m/s to 1 m/s for different aquaculture species.

Composition

Fish farming tanks are made of concrete, wood, plastic, fiberglass, or steel in a variety of shapes, but the most common forms are circular and rectangular tanks. Different types of water and air supply systems can be used in tanks, including flow-through and recirculation. There are four basic types of cages: fixed cages, floating cages, submerged

cages, and submersible cages. Cage frames are built with floatable pipes or barrels made from high density polyethylene, galvanized iron, or PVC plastic. Usually, a 1 to 2 inch (2.5-5 cm) nylon net is mounted on the cage frame to hold fish. Finer mesh sizes contain smaller fish but decrease flow inside the cage and increase horizontal drag because of water flow, which poses risk of damage under high current.

Means of application

For catfish in tanks, 25-gram fingerling can be stocked at 1,500 fish per cubic meter to produce 50- to 60-gram harvests within 5 weeks, or at 1,000 fish per cubic meter to produce 100-gram fish in 9 to 10 weeks. To minimize mortality by cannibalism in tanks or cages, the stock must be sorted every two weeks, and faster maturing individuals removed. In tanks and cage systems it is important to remove uneaten feed or feces that accumulates underneath, avoiding proliferation of parasites and diseases. Adequate space below the cage (at least 3 m) ensures adequate water circulation through the cage and minimizes unwanted accumulation beneath.

Agroecologies	All Agroecologies.
Regions	Africa South of Sahara.
Developed in Countries	Ethiopia, Angola, Zambia, Uganda, Togo, Tanzania, Sudan, South Sudan, Somalia, Sierra Leone, Senegal, Rwanda, Mozambique, Mali, Malawi, Madagascar, Liberia, Kenya, Guinea, Eritrea, Equatorial Guinea, Djibouti, Democratic Republic of the Congo, Central African Republic, Cameroon, Burkina Faso, Botswana, Benin.
Available in	Ethiopia, Angola, Zambia, Uganda, Togo, Tanzania, Sudan, South Sudan, Somalia, Sierra Leone, Senegal, Rwanda, Mozambique, Mali, Malawi, Madagascar, Liberia, Kenya, Guinea, Eritrea, Equatorial Guinea, Djibouti, Democratic Republic of the Congo, Central African Republic, Cameroon, Burkina Faso, Botswana, Benin.
Solution Forms	Equipment.
Solution Applications	Fish Farming.
Agricultural Commodities	Fish.

Target Beneficiaries	Small-scale farmers, Commercial farmers.

Commercialization

Commercialization Category

Commercially available

Startup Requirements

Key factors to be considered for tanks: 1) Secure access to a reliable source of water, and 2) Choose the appropriate type and size of tank with respect to that water supply system (see Technology 6). Key factors for starting up cage culture are: 1) The water surface area should be at least 0.2 ha, 2) Nearby lands should be free of water erosion and waters should not contain weedy aquatic vegetation for preventing oxygen depletion, 3) At least 5m from lowest water level for floating cages. Less than 5m can be used for fixed cages 4) The depth of water column should allow a free space of about 4-5 meters between the bottom of the cage and bottom of the water body during minimum recorded water level for floating cages. However, this space should not be less than 2 meters, and 5) The location should have adequate prevailing winds to prevent water stagnation.

Production Costs

The price involved with constructing tanks and cages depends on the size and materials used. Premade suspended tanks made of metal frames and polyethylene with a volume of 2000 liter may be purchased in China for as low as US $120. Concrete tanks are more expensive but are last longer. Epoxy-coated galvanized iron frames are a lower cost option but suitable for small-scale production. A fish cage of 8 cubic meter with galvanized steel and floating barrels that are locally manufactured costs as little as US $150 depending on the mesh size of the netting.

Customer Segmentation

Cages are more feasible for fishermen that can access waterbodies and have rights to their waters. Tanks are available to all fish farmers.

Potential Profitability

A concrete pond measuring 3 by 4 meters and 0.85 meter deep with a stocking rate of 50 fish per square meter and best management practices can harvest up to half of a ton (500 kg) of fish every 9 months. A floating cage of 8 cubic meter with 1,000 fish raises about US $1,500 per harvest and has a gross margin of US $330 after deducting costs for cage construction, feed, and labor.

Licensing Requirements

Specific national laws governing the use of public waters guide cage site location.

Innovation as Public Good

Information on tank and cage construction is a Regional Public Good advanced by WorldFish.

Solution Images

A concrete tank for raising catfish

Floating cage for tilapia farming inside Lake Victoria (Credit: Erick Ochieng Ogello)

A low-cost polyethylene fish tank with metal frame

Institutions

WorldFish

Accompanying Solutions

All Male Tilapia Fingerlings with Greater Yield and Uniformity

Fast Growing and Hybrid African Catfish