



Tilapia cage culture design

Cage culture is a system in which fish are grown in a cage made of bamboo, metal or wood that is covered with nets. The netting encloses the cage on all sides or on every side except the top, which is left open. The size of the net depends on the size of the fish. In the cage system, the mesh enclosure retains the fish, making it easier to feed, manage and harvest the fish.

There are three types of cages: submersible, floating and fixed.

1. A submersible cage consists of a frame with slats for openings and is submerged under the flowing water and anchored to the bottom. This type of cage is built with a rigid frame that allows it to move up and down the water column to take advantage of water conditions.
2. A floating cage is made from netting supported by a buoyant collar or a stable frame that allows the cage to move up or down with the fluctuating water level without submerging.
3. A fixed cage is a net bag used in shallow water that is supported by posts anchored to the bottom of the water.

Materials

When selecting material for cage construction, there are several criteria to consider, including availability, durability, strength, weight, weather resistance (rot, corrosion), toxicity and, of course, cost. The materials should be smooth and non-abrasive, especially the cage bags. In cage bags, rigid materials are more resistant to deformation in strong water currents compared to flexible materials, but flexible materials absorb energy from water currents better and make harvesting simpler for farmers. No single material possesses all these qualities, but some are better suited to certain species and site conditions.

A cage consists of the following parts: frame, net, anchor, ropes, floats/floater, walkway/platform and a freeboard. Anchors are placed at various points along the bottom of nets to make sure they do not get twisted up and dragged by the water current. Anchors may be made of iron, concrete, or even bags and bottles filled with wet sand. The freeboard is the section of the net that is above the water level.

Components of a small-scale fish cages

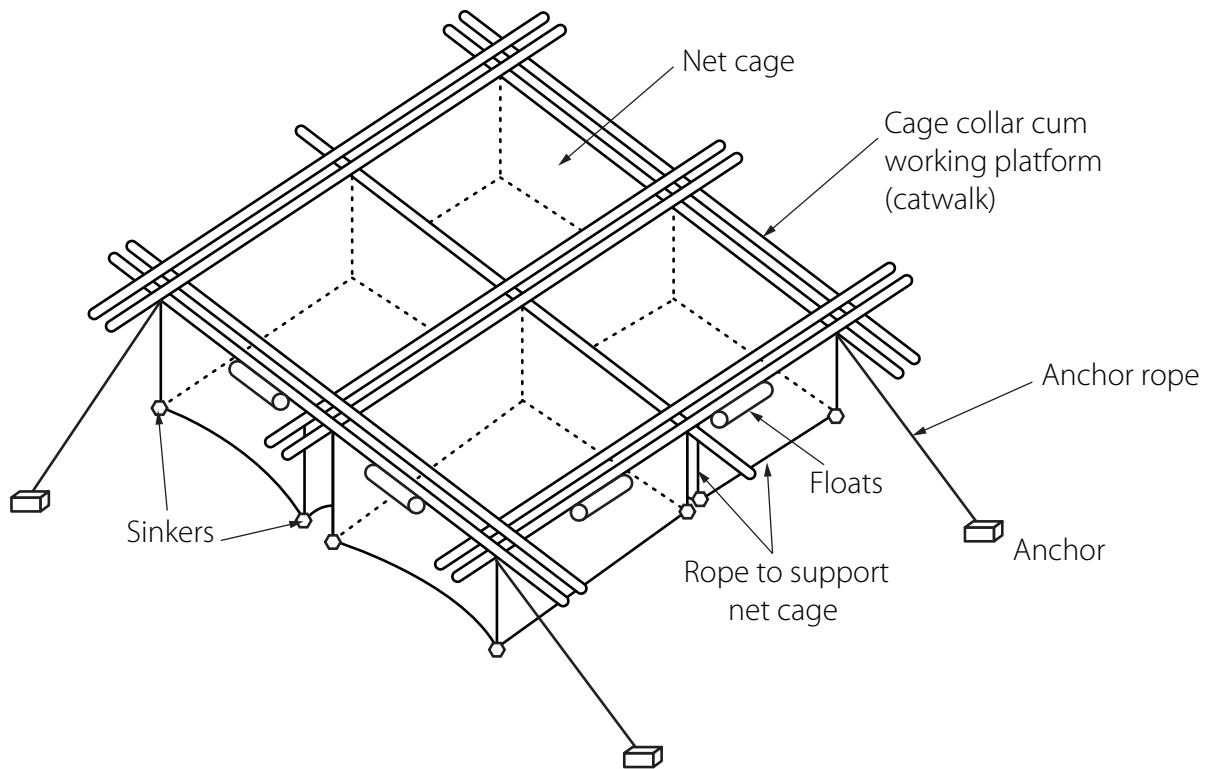


Figure 1. Components of small fish cages.

Cage frame

The cage frame is the skeletal structure that holds the net in which the fish are cultured. Frames can be made of galvanized pipes, wood, bamboo, PVC pipes or other materials that will not easily deteriorate in the water. In modern large circular cages, high density poly ethylene (HDPE) is used. The frame must be strong enough, corrosion resistant and easily repairable or replaceable.

The cage can be of any shape, whether round, square or rectangular, and the size depends on the scale of production intended by the farmer. Special joints must be used to fix the various frame elements together to form the desired shape.

Netting

The netting is what keeps the fish together. It protects the fish against predators and external influences, and allows the water to flow freely through the cage.

The size of the mesh depends on the size of the fish stocked in the cage. It can be as small as 5 mm for rearing fry and 2–2.5 cm or bigger for outgrowing. The mesh size for the protective netting could be 5 cm, and the cover net that covers the mouth of the cage can be made with 6 mm or 10 mm nylon thread or braided twine, and a quarter-inch net can be sewn and placed inside.

A larger mesh size improves the oxygen supply to the fish and reduces problems with the nets. To prevent the nets from clogging and deteriorating, they must be cleaned regularly or replaced as needed. In floating cages, wetting the freeboard regularly will help slow down the deterioration of the net from exposure to sunlight.

Cage frame



Plate 1. Cage culture infrastructure.

Mesh sizes

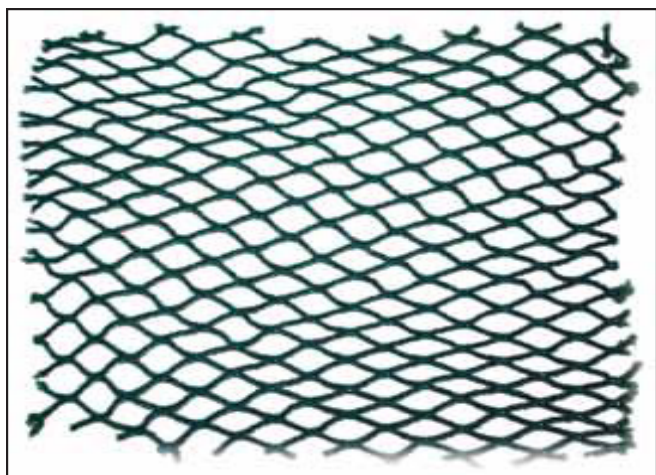
Choosing a mesh size for a cage depends on the size of the fish.

Mesh size (cm)	Length of fish (cm)
0.5	1–2
1	5–10
2	20–30
4–8	larger than 25

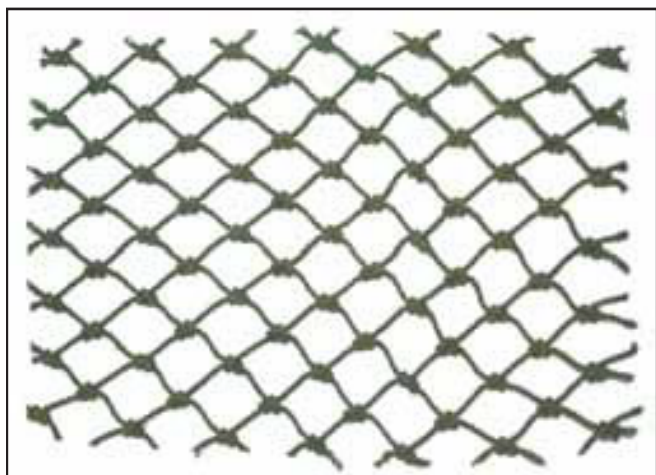
Table 1. Appropriate mesh sizes for fish length.

Types of nets used in tilapia culture

There are two types of nets that are currently used for tilapia cages: knotted and knotless. Knotless nets are more expensive but are more durable than knotted nets and less prone to clogging, deteriorating, damaging and tearing. Be sure to order your nets from a reputable agent. If you would like the nets sewn for you, contract an artisan with a proven track record of fixing nets that do not unravel at the seams, as this can cause fish to escape.



Knotless net material



Knotted net material

Plate 2. Knotless (top) and knotted (bottom) nets.

Floats

Floats are fixed at the upper sections of cages, using braided twine, to make them buoyant. The floats should suspend the entire cage structure (netting, frame, feeder, walkway, etc.) safely on the surface of the water. Examples of floats include HDPE floats and also sealed plastic barrels or Styrofoam boxes. HDPE floats are less prone to leaks and deterioration than drums (rubber barrels), gallons or PVC pipes.

Anchors

The cage requires an anchor to hold it in place. The anchor can be made with concrete blocks and placed in the water column with a 16 mm rope to hold the cage firmly in place. Navel anchors can also be used, though these are more expensive. A wooden platform should be laid on top of the cage to allow movement and farm operations to continue.

Mooring

Moorings are required to hold the cages in place against the forces generated by wind, water currents and waves and to keep the cages in a particular spot. Moorings also influence the forces from the water current and wind acting on the cages and related structures.

There are two types of mooring systems: single-point and multi-point.

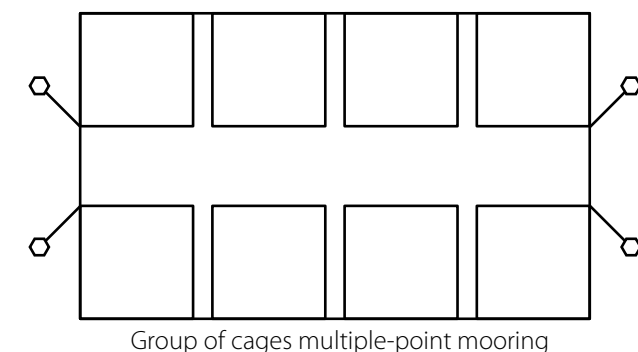
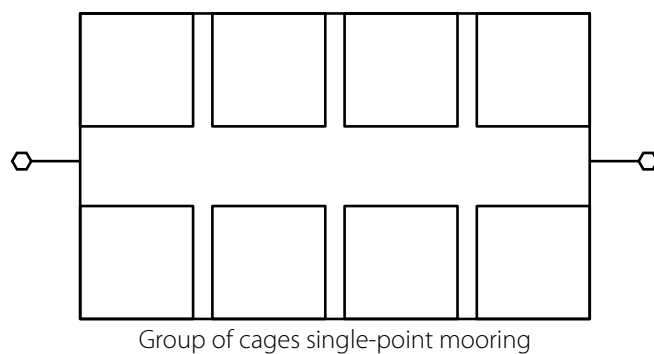
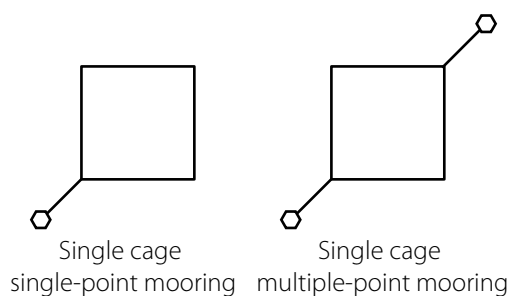


Figure 2. Examples of single-point and multi-point mooring.

Construction

To build a cage properly, first fix the components (frames and floaters) together on land, and then tow the cage to the specific location on the water to be fixed. Use an anchor to secure the cage firmly. A walkway can also be built to allow easy passage.

Cages can be small, medium or large in size.

Acknowledgement

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Size of the cage	Dimensions (m)		
	Width	Length	Depth
Small	1–2	1–3	1–2
Medium	3–5	3–10	2–3
Large	10–25	30–50	3–5

Table 2. Small, medium and large cages.

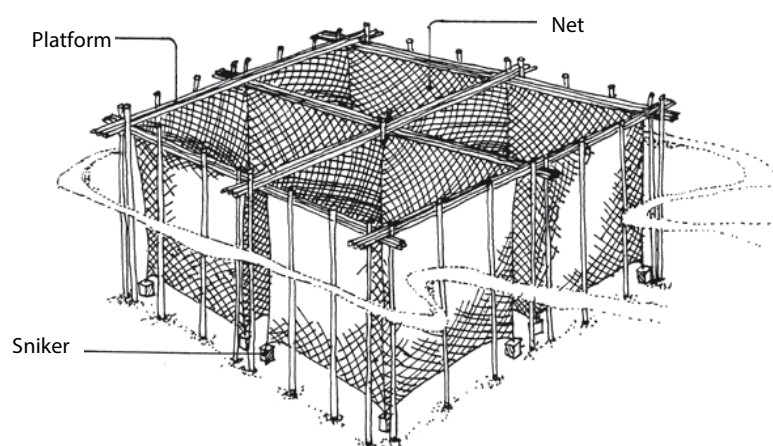


Figure 3. Illustration of a fish cage.

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