



Feed pellets

Health and environmental management: Fish health should be checked regularly by monitoring fish behavior, deformities, mortality and presence of parasites. Infected fish should be removed from the cage, isolated, recorded and reported to relevant authorities. Water quality in the cage area should be monitored regularly by checking key parameters especially DO, Temperature, pH, Total Ammonia Nitrogen and Turbidity.

Harvesting and marketing: The market should be identified before harvesting. Harvesting can be done by lifting the cage bag out of water and removing the fish or by using a scoop or cast net. Fish should be handled and preserved properly. Small scale producers are advised to produce and sell fish through groups to optimize profits.



Nile tilapia harvested from a cage

Production records: The farmer should keep accurate production records to facilitate good business and financial management.

Environmental monitoring

The water environment, bottom sediments, and biological communities in and around the cage fish farm should be monitored at least twice a year by an independent competent authority and compared with the baseline data collected at siting and with National, Regional and International standards to guide development of mitigation measures and compliance with good production practices.

Conclusions

These guidelines have been prepared based on the experience of established cage fish farms in Uganda, experiments conducted by NaFIRRI, and acceptable international standards for cage fish farming. They will be regularly updated based on information generated through adaptive research.

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Guidelines for Cage Fish Farming in Uganda



Background

Cage fish farming involves growing fish at High Density in Low Volume (LVHD) cages of less or equal to 30 m³ or Low Density in High Volume (HVLD) cages of more than 30 m³ suspended and secured in water, while maintaining free exchange between the enclosure and the water body. Cage fish farming offers great potential to increase fish production to meet the deficit in fish supply. It can, however, pose environmental threats and conflicts with other water uses and requires adequate guidance. This requires effective policies, institutions and manpower; proper siting, farm layout, fabrication and installation; good production practices; and environmental monitoring.

Policy and institutional requirements

Cage fish farmers should adhere to key regulations, especially those of environment, fisheries, water, navigation and veterinary drugs. In Uganda, the key regulations include: The Fish Act 2000; Fish and Aquaculture Rules 2003; Water Act, 1997; and The National Environment Management Act 1995.

Prospective cage fish farmers should prepare a proposal and share it with the District Fisheries Office (DFO); Get a suitability and capability report of the proposed site from the National Fisheries Resources Research Institute (NaFIRRI); Apply for an establishment permit from the Directorate of Fisheries Resources (DiFR); Obtain a water use permit from the Directorate of Water Resources Management (DWRM); and depending on the scale of production, conduct an Environmental and Social Impact Assessment (ESIA) and submit an Environmental Impact Statement (EIS) to the National Environmental Management Authority (NEMA) for approval.

Siting

Cages should be located in a site where they have minimum interference with other lake uses and suitable conditions for fish growth.

The recommended minimum distances of the site from other lake uses are: Security installations (2km); Harbors (200m); Navigation routes (100m); Protected areas (100m); Recreational facilities (500m); Landing sites (200m); Fish breeding and nursery areas (200 m); Hydropower plants (1km); Water extraction points (500m); Effluent discharge and waste disposal points (500m); and Weed hotspots (100m).

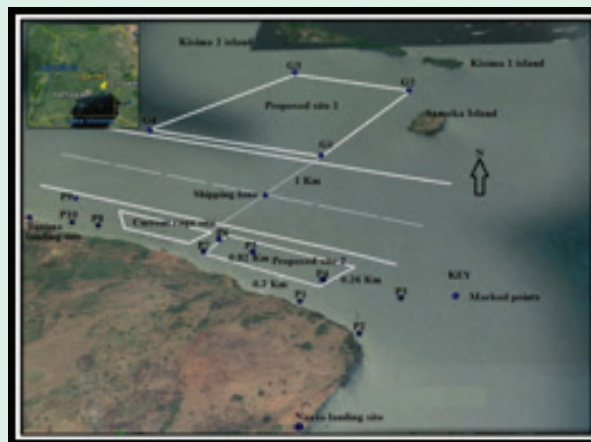
The recommended optimum environmental conditions of the site are: Depth: 5-20 m; Dissolved Oxygen (DO): ≥ 5 mgL⁻¹; Water transparency: >70 cm; Wind velocity ≤ 10 knots; Wave height: <1 m; Temperature: 24-30°C; Biochemical oxygen demand (BOD): ≥ 6 mgL⁻¹; Water current speed: 10 to 100 cm.sec⁻¹; Carbon-dioxide (CO₂): <5 mgL⁻¹; Total phosphorous: <100 µg/L; Chlorophyll-a <75 µg/L; Total Ammonia Nitrogen: <0.01 mgL⁻¹; Nitrate : 0.1-4.0 mg L⁻¹; Nitrite: <0.2 mgL⁻¹; Total dissolved solids (TDS): <40 mg L⁻¹; Total suspended

solids: <10 mgL⁻¹; Alkalinity 120-400 ppm; pH: 6.5-9; Conductivity: 30-5,000 mSiemens/cm; Hardness: 30-180 mgL⁻¹; Chloride: 60-100 mg L⁻¹; Faecal coliform ≤ 100 count per 100 ml.

Other physical and biological factors including bottom sediments, algae, invertebrates and fish at the proposed site should be determined to provide baseline information for environmental monitoring. The site should be zoned with GPS coordinates and adjacent lake uses indicated. The views of communities in the area should be sought.

Farm plan and layout

The farm should have a plan showing: The boundary with GPS coordinates; Cage design, number and placement; Buildings; Utilities; Access roads; Waste management and net cleaning points. There should be measures to control fish escapes, predators, theft and vandalism. The farms should have a decommissioning plan to clear and restore the site to its original state at the end of the operation.



Zoning of a cage culture site

Components and fabrication

A basic cage consists of a cage frame, cage bag, floaters, feed barrier, cage cover, and sinkers (see cover page). The farmer should use environmentally friendly materials in cage fabrication. Anti-corrosive paint should be used to prevent metallic frames from rusting. The minimum recommended mesh size for a cage bag is 5mm. Sinkers should be heavy enough to ensure that the bag is well stretched. Air tight plastic drums or jerrycans are recommended for floatation of cages with metallic or wooden frames.

Installation

Accessories such as feed barriers, covers and sinkers should be attached to the cage bags prior to rigging onto the frames and before installation. The cages should be placed in water at least twice the depth of the cage. Cage grids should be firmly secured with anchors of at least 40 kg and strong nylon ropes of at least 18 mm.

Production practices

Culture species: The species to be cultured should be native or naturalized in the water body such as Nile tilapia (Ngege).



Nile tilapia (*Oreochromis niloticus*)

Seed: Fingerlings should be obtained from certified producers and free of diseases and of relatively the same size and color. They should be nursed preferably using land based systems to at least 15g, and graded before stocking in production cages at a density depending on water quality characteristics and targeted market size. The pioneer cage fish farm on Lake Victoria, with over ten years experience, recommends that for a target yield of 60-80kg m⁻³ for LVHD cages and 20-40 kg.m⁻³ for HVLD cages with a survival rate of 85%, and a target market size of 500g, the stocking rate should be 140-180 fish m⁻³ for LVHD and 40-80 fish m⁻³ for HVLD cages.

Feed and feeding: Fish should be fed on nutritionally complete floating pellets from certified suppliers. The size of pellets, crude protein (CP) content and the frequency of feeding varies as the fish grows from 2 mm pellets of 35 % CP, 3 times a day for the first two months followed by 3 or 4 mm pellets of 30% CP, twice a day up to the fourth month, and 5 mm pellets of 25% CP once or twice a day for the rest of the growth period. The amount of feed should be estimated on the basis of average body weight of fish using a feeding chart and feeding by response. Performance of the feeds should be evaluated monthly to determine Food Conversion Ratio (FCR), weight gain, growth rate and the feed ration adjusted through sampling. Sampling should be done during cool weather and minimum stress should be exerted on the fish.