Prospects for Increasing Fish Production in Uganda Through Cage Fish Farming

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Outline

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2. What is cage fish farming;
3. Challenges;
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Why Cage Fish Farming

- Capture fisheries had stagnated with limited chance to increase leading to decrease in per capita fish consumption in Uganda to 8 kg compared to 17 kg recommended by FAO;
- Human rate of human population increase 3% per annum;
- Uganda’s population of 35 m people needs 0.6Mt of fish annually to meet the FAO per capita consumption and export markets require ~0.4Mt [Tot. 1Mt];
- Currently production ~0.5Mt [~0.4Mt from capture fisheries and ~0.1Mt aquaculture [deficit 0.5Mt];
- Aquaculture is the fastest growing food industry in the world and provides the option for meeting the deficit in fish production.
What is Cage Fish Farming

- Cage aquaculture is growing of fish in cages suspended in water at Low Volume High Density (LVHD) of 150-500 fish m\(^{-3}\) or High Volume Low Density (HVLD) of 80-100 fish m\(^{-3}\).

- LVHD started in Uganda in 2006 and has demonstrated better production of 150-300 kg m\(^{-3}\) compared to 2-10 kg m\(^{-3}\) from pond culture introduced 60 year ago.

- Cage fish farming is expanding fast from <100 to >3000 cages on lake Victoria alone, with cages on virtually all water bodies and growing fast including other African lakes.
Challenges of cage fish farming

Cage fish farming can interfere with other social and economic activities in water. High stocking densities require water of good quality. Inputs and wastes can degrade water quality. Therefore, guidance is required to ensure proper location, optimization of production, and securing the environment.

Provide effort by NaFIRRI to provide guidance to cage fish farmers on:

- Site capability and suitability;
- Zoning;
- Production practices;
- Monitoring the farms environment; and
- Policy, regulations and institutions
Cages should be located in areas where its does not interfere with other lake uses (suggested distances given based in literature):

- Security areas (2 km);
- Harbors (500 m);
- Navigation channels (100 m);
- Protected areas (100 m);
- Recreational facilities (500 m);
- Landing sites (200 m);
- Fish breeding and nursery grounds (200 m);
- Hydropower plants (1 km);
- Water intake and extraction points (100 m);
- Effluent discharging and waste disposal points (500 m);
- Weed hotspots (100) among other.
Suitability of the sites for cage fish farms must be assessed prior to setting up a cage fish farm, recommended water quality characteristics are as follows:

- Depth: 5-20 m;
- Dissolved Oxygen (DO): ≥5 mgL$^{-1}$;
- Water transparency: >70 cm;
- Wind velocity: ≤10 knots;
- Wave height: <1 m;
- Temperature: 27-30°C;
- Biochemical oxygen demand (BOD): ≥6 mgL$^{-1}$;
- Current speed: 10 to 100 cm/sec$^{-1}$;
- Carbon-dioxide (CO$_2$): <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;
- Salinity: 2-3 ppt; Hardness: 30-180 mgL$^{-1}$;
- Chloride: 60-100 mg L$^{-1}$;
- Faecal coliform: ≤100 count per 100 ml.

The reasons for the different levels are summarized in the booklet.
The site and adjacent areas should be described;
The area should be zoned;
The carrying capacity of the area should be determined;
An Environmental and Social Impact Assessment (ESIA) of the site may be required for certain sizes of farms.
Site plan of the farm

The plan of the farm should be made including the following components:

- Boundary of the farm;
- Zone of max. accumulation;
- Cages and any other containment structures;
- Anchor blocks & mooring lines;
- Cage dimensions and number;
- Navigation markers and pathways around the farm;
- Buildings, offices, stores, living quarters etc.
- Walkways, utilities, cables, catwalks;
- Access road to the site;
- Water lines;
- Mortality storage and net cleaning points;
- Depth contours;
- Predominant current direction;
- Anchor blocks, mooring lines, marker buoys and shore attachments.
Cage structure

- Cages can be rectangular, circular or cylindrical;
- A typical cage comprises of a cage frame, cage bag, floaters, feed enclosures or feed barrier, cage covers and sinkers.
- Mesh size of the cage bag should be 8 mm for nursery and 13 mm for grow out cages
- Cages must be strong enough to retain the fish.
Cage layout

- Cages should be laid in rows spaced at least 2 m apart;
- They should be placed in water deep enough for the cage bottom to be at least 2-3 m above the bottom sediments;
- The area should be accessible to facilitate routine maintenance and feeding and in a place where they can be easily monitored and security provided;
- The cage perimeter can be enclosed by a chain link with an access gate to provide security.
Culture species and seed

- Nile tilapia is the recommended species for cage culture. It grows fast and tolerates high stocking densities;
- All male juveniles sexually reversed are best for cage culture;
- Juveniles of not <1 g are stocked in a nursery cage a density of 1000-2500 fish m⁻³, reared to at least 15 g for 8 weeks, graded; and stocked in production cages at a density of 150-300 fish m⁻³ and reared for 6-7 months to 350-600 g before harvesting depending on market demands.
Feeds and feeding

- Juveniles should be fed on powdered feeds or crumbles of at least 45% Crude Protein (CP) for 2 months to attain at least 15g.
- They are then transferred to production cages fed first on 2mm pellets of 35% CP for 2 months, 3 mm pellets of 30% CP for 3 months, and finally 4-5 mm pellets of 20-25% CP for the rest of the growth period.
- Fish should be sampled once every four weeks to determine weight gain, Feed Conversion Ratio (FCR) and growth rate to guide adjustment of feed ration size.
Production Statistics

- Number of days per growth cycle: 180-210 days;
- FCR at harvest: 1.5;
- Survival rate: 80-95%;
- Average growth per day at harvest: 1.5 g/day
- Average weight at harvest: 350-600 g;
Production economics

- If the fish is harvested at an average weight of 350 g, survival rate 80%, and FCR 1.5, the amount of feed required is 1875 kg and a very min. yield of 80 kg. m\(^{-3}\), the estimated tonnage from a cage of 15.6 m\(^3\) would be 1200 kg.

- The estimated operational cost per cage is:
  - Cost of cage (Shs 1,200,000 - US$ 340);
  - Cost of seed (Shs 950,000/= - $270);
  - Cost of feed Shs 3,000/= per kg, Shs 5,625,000/= ($1,610);
  - Operational costs ~US$ 300 per cage;

- Total cost of production per cage is ~US$ 2,500.

- Current selling price of tilapia ~US$ 2.5 per kg;

- Gross income per cage would be ~US$ 3,000;

- Net profit of ~US$ 500.
Monitoring and Securing the Environment

- Fish health should be checked regularly and any infected fish isolated and reported;
- There should be security measures to avoid escape of fish into the wild, minimize predation and theft;
- Wastes on the farm should be managed to reduce contamination and there should be a plan to dispose-off materials at close of the farm;
- Environmental variables in the farm area should be monitored using the data generated during site selection as baseline and compared with NEMA standards.
Policies and Institutions

- Policies and regulation to specifically guide cage culture are still inadequate;
- However, existing policies and regulations of water, fisheries, environment and local governments can be applied to address the issues and concerns of cage culture but need strengthening;
- There are fisheries, water and environmental and academic institutions to support cage culture
Challenges

- The major challenges include:
- Improving availability of affordable high quality feed and seed;
- Building human resource capacity;
- Controlling predators, theft and vandalism;
- Fish losses due to damage of cage bags;
- Competition between cultured and wild fish for markets; and
- Inadequate policies specifically addressing cage culture
Conclusions and Recommendations

Cage culture has the potential to improve fish production and create wealth in Uganda with guidance; There is, therefore need to utilize the opportunities and address the challenges of cage culture by continually refining and improving these guidelines with new knowledge and building capacity.
Thank You For Your Attention