SOCIO-ECONOMIC SITUATIONAL ANALYSIS OF CAGE AQUACULTURE IN THE UGANDA LAKE VICTORIA BASIN



Cage photo: Pearl Aquatics farm
[Courtesy of Dr. Mujibu Nkambo]

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Table of Contents

ACKNOWLEDGEMENT ..... **I**
TABLE OF CONTENTS ..... **II**
LIST OF TABLES ..... **III**
LIST OF FIGURES ..... **III**
ABBREVIATIONS AND ACRONYMS ..... **III**
EXECUTIVE SUMMARY ..... **IV**
1. INTRODUCTION **7**
1.1 SPECIFIC TASKS OF THE CONSULTANCY 8
2. APPROACH AND METHODOLOGY **8**
2.1 STUDY AREA 9
2.2 SAMPLING 9
2.3 DATA COLLECTION 10
2.4 DATA ANALYSIS 11
2.5 STUDY LIMITATIONS 11
3. RESULTS AND DISCUSSION **13**
3.1 AQUACULTURE POLICY PRIORITIES AND DEVELOPMENT PLANS 13
3.2 ZONING/SITE SELECTION FOR CAGE AQUACULTURE 14
3.3 SOCIAL ECONOMIC IMPACT OF CAGE AQUACULTURE 15
3.4 SOCIAL SUITABILITY OF CAGE AQUACULTURE SITES 20
3.5 CHALLENGES FACING CAGE AQUACULTURE 29
4. RECOMMENDATIONS **32**
REFERENCES **35**
APPENDIX I: NUMBER OF EMPLOYEES IN THE SAMPLED CAGE FISH FARMS **36**
APPENDIX II: DATA COLLECTION INSTRUMENT **37**
APPENDIX III: NAMES AND POSITIONS OF INTERVIEWED PERSONS **41**
APPENDIX IV: SOME PHOTOS TAKEN DURING FIELD WORK **43**

List of tables

Table 1: Cage aquaculture plans and priorities by district 14
Table 2: Social suitability assessment of surveyed aquaculture farm sites 21
Table 3: Conflict analysis of interaction between land and lake uses in the study area 26

List of figures

Figure 1: Map showing sampled sites/farms by districts in and around L. Victoria 9
Figure 2: Map showing social suitability of sampled cage sites 28

Abbreviations and acronyms

ACC	Aquaculture Carrying Capacity
ARDC	Aquaculture Research and Development Centre
BMU	Beach Management Units
GIS	Geographic Information System
DFO	District Fisheries Officer
DRC	Democratic Republic of Congo
DiFR	Directorate of Fisheries Resources
EAA	Ecosystem Approach to Aquaculture
EAC	East African Community
FAO	United Nations Food and Agriculture Organization
LC	Local Council
LVFO	Lake Victoria Fisheries Organization
NFP	National Focal Point
SCC	Social Carrying Capacity
MAAIF	Ministry of Agriculture Animal Industry and Fisheries
NaFIRRI	National Fisheries Resources Research Institute
NEMA	National Environment Management Authority
UCFFA	Uganda Commercial Fish Farmers Association

Executive Summary

This report is a result of a study commissioned by LVFO and FAO under the TRUEFISH project Result Area 3.2 that focuses on ensuring an orderly and sustainable cage aquaculture development through zoning and Ecosystem Approach to Aquaculture (EAA) implementation. The EAA is a strategy for the integration of the aquaculture within the wider ecosystem where the activity occurs, such that it promotes sustainable development, equity, and resilience of interlinked social-ecological systems.

The purpose of the study was to produce a "Situational Analysis" towards an inclusive and participatory development of cage aquaculture in the Lake Victoria basin. The analysis is intended to help set the upper limits of aquaculture production given its social acceptability, thus avoiding "unacceptable change" to the social functions and structures of the Lake Victoria basin. The analysis therefore highlights areas within Lake Victoria that have been assessed to be socially compatible with the development of the cage aquaculture.

Data collection included discussions with the Assistant Commisioner-Aquaculture Management and Development, who is the National Focal Point Person (NFP) of the assignment and respective District Fisheries Officers (DFOs), to inform them about the work and to obtain official documents regarding policy provisions, lake zoning and lists of cage aquaculture operators in the districts. The study was based on a sample of four districts (Buikwe, Jinja, Mukono and Wakiso), the criteria used being that these districts host the highest number of cage aquaculture operators. The consultant reviewed relevant documents, and held consultations with fisheries officials at national and local government level, and selected stakeholders in the study area including cage aquaculture operators, other lake users and community leaders. Observations of the various lake uses were also made. The data gathered being largely qualitative, thematic content analysis was used.

The study found that awareness about the aquaculture provisions at national level among key stakeholders was adequate. However, the respondents, especially cage aquaculture operators and district fisheries staff, felt that the government and DiFR in particular has not provided adequate support for the regulatory and monitoring roles of district fisheries staff, and to cage aquaculture operators to address challenges that affect their businesses.

The study established that districts plans and priorities regarding the development of cage aquaculture, including carrying out comprehensive zoning, strengthening enforcement of regulations, promoting farmer registration with producer organisations such as UCFFA, capacity building and provision of extension services. The study however noted a lack of harmonisation of the various district priorities given that the lake is a shared resource.

No comprehensive zoning for cage aquaculture has been carried out on the Uganda section of the lake. The National Fisheries Resources Research Institute however carried out cage aquaculture site suitability studies (NaFIRRI-NARO 2013, Ogutu-Ohwayo et al., 2016) on which some of the cage aquaculture establishments were based. In other instances, the operators privately sought services of researchers to carry out suitability assessments of sites they had identified themselves. The guidelines for establishing cage aquaculture enterprises are not strictly followed.

The study assessed positive and negative socio-economic impacts of cage aquaculture. The positive impacts include increased incomes from fish trade (for both cage operators and the small scale village traders, most of whom are women), increased availability of fish (for trade and household nutrition), increased awareness about fish farming among the communities (leading to investment in the sector where community members have necessary starter capital), increased regional fish trade and access to fish markets. Other impacts include increased employment opportunities (especially for youths and

women), markets for other goods and services, and support to community social and infrastructure services by cage aquaculture operators. Some cage farmers have also supported community projects / activities aimed at improving cage fish farm-community relations and obtain their social licence to operate, given the initial negative attitude to cage farms among local communities and other lake users. The recycling of fish feed bags into various uses by the communities is also an added benefit, despite the urgent need to manage the volume of the bags to prevent potential negative environmental impact.

Among the negative impacts is restricted access to fishing grounds by local fishers, increased insecurity and thefts on the lake and the potential environmental degradation associated with cage fish farming.

The study assessed the social suitability of the sampled cage aquaculture sites. Of the thirteen sampled sites in the four districts, cage aquaculture was assessed to be incompatible with some of the other existing lake uses. Nine sites were found socially suitable as no conflicts existed between the cage aquaculture establishment and other lake uses. Three sites were found socially suitable but with moderate conflicts, while one site was assessed as unsuitable due to conflicts. In this regard, it was noted that compatibility can be ensured with appropriate in interventions to eliminate the conflicts through enforcement of guidelines by the relevant authorities, particularly DiFR, NEMA, in collaboration with the District Local Governments.

Regarding the challenges facing cage aquaculture, the study identified limited joint planning for cage aquaculture development between the DiFR and the District Local Government, competing lake uses, limited enforcement of environmental regulations and biosecurity, high cost of aquaculture inputs (which limits local people's participation in the sectors), fish price fluctuations, and limited technical skills among cage fish farmers and their employees. Other challenges include inadequate and poor quality feeds and natural hazards.

The study makes the following recommendations:

1. **Enforcement of existing policy and regulatory framework: This should be done** through joint planning for cage aquaculture development between DiFR and the District Local Governments. The DiFR also needs to ensure enforcement to the LVFO 2018 guidelines for establishment and operation of cage fish farming. There is need to update the database of cage aquaculture establishments
2. **Enforcement of environmental regulations and biosafety:** Closer monitoring of the fish farm operations by MAAIF in collaboration with NaFFIRI and other stakeholder organizations such as NEMA needs to be strengthened. There is also need for enforcement of regulations on the management of non-biodegradable feed bags. For monitoring to be effective, the capacity of District Fisheries Offices needs to be enhanced through staffing and equipment.
3. **Harmonization of competing lake uses:** Undertaking social suitability alongside biophysical suitability, and involving key stakeholders during the process is important so as to create consensus. Regular engagement between the key stakeholders to resolve latent conflicts before escalation should be the norm. The boundaries of cage fish farm should be clearly specified on paper (in MoUs) and visible on the lake/ground.
4. **Cost of aquaculture inputs**: There is need to control the cost of aquaculture inputs including support local feed manufacturers to produce quality feed at low cost, controlling the types and amounts of imported fish feed, to boost local production. Taxes on fishing nets and other cage fish inputs should be reduced Key services needed in the industry including electricity and road infrastructure should be prioritized by central and local government to ease operations of the sector.
5. **Support to fish marketing**: Government should identify new markets (including export beyond the region) and support farmers to take advantage of these opportunities because cage fish production potential is very high.

6. **Technical capacity development:** This is important as a means to encourage local people's participation in the sector. This includes organizing fish farmers into producer organizations/co-operatives for training and extension service provision. This will enhance benefits and impact of cage aquaculture among the host communities.

The major limitation to the study was the lack of data on systematic zoning as had been anticipated and indicated in the ToRs. Only sample-based and old information was found about site suitability studies carried out in 6 districts namely Buikwe, Mukono, Wakiso, Busia, Mayuge, and Kalangala Districts. No zoning activity has been undertaken to provide a lake-wide picture. This limitation calls for a comprehensive lake zoning exercise that involves a multidisciplinary team. Nonetheless, this study results should be considered as a true representation of the situational analysis of cage aquaculture around Lake Victoria.

1. Introduction

Globally, aquaculture industry is considered as the fastest growing food producing industry (Naylor et al., 2000). Improved production from aquaculture is anticipated to fill the gap of demand as most of global capture fisheries is declining while the population is increasing and the concern for protein from aquatic products is rising as well (Naylor et al. 2000; FAO 2020). The situation is not different from Lake Victoria, Africa´s largest tropical lake whose fisheries production levels has flattened off and can hardly achieve the growing demand of fish protein in the region. As a result, production from aquaculture remains the most feasible option to fill the gap (FAO 2018; Boyd 2007). However, given the size of the lake and availability of other infrastructure vital for the growth of aquaculture industry, it is quite imperative that promotion of aquaculture in this lake, preferably investments in cage fish farming, do not lead to negative environmental and social impacts.

Upon this background, United Nations Food and Agriculture Organization (FAO) in collaboration with Lake Victoria Fisheries Organization (LVFO) through the TrueFish project are pursuing an orderly and sustainable cage culture development, with the aim of eradicating the risk of uncontrolled spatial distribution of fish farms and the unsustainable use of natural resources, through zoning and Ecosystem Approach to Aquaculture (EAA) implementation. Zoning is a process that the East Africa Community (EAC) members and the LVFO are adopting to sustainably and responsibly identify and allocate areas that are biophysically and socio-economically suitable for aquaculture.

The TrueFish project is implementing a zoning system in the Lake Victoria basin using three primary tools, namely, Spatial Planning (SP), Ecosystem Approach to Aquaculture (EAA), and Aquaculture Carrying Capacity (ACC). Ecosystem Approach to Aquaculture (EAA) is a strategy for the integration of the aquaculture within the wider ecosystem where the activity occurs, such that it promotes sustainable development, equity, and resilience of interlinked social-ecological systems (Aguilar-Manjarrez et.al 2017, Brugère et al., 2019). This approach underlies the implementation of the cage aquaculture aspect of the project, and the need to understand the current situation.

The purpose of this consultancy is to produce a “Situational Analysis” towards an inclusive and participatory development of the cage culture in the Lake Victoria basin. The Situational Analysis aimed at determining the areas within Lake Victoria that are socially compatible with the development of cage aquaculture attending to governance, economic and social parameters. The study has been done by three different national consultants in the Kenya, Uganda and Tanzania sections of the Lake Victoria. This analysis is considering both areas with current development of aquaculture and those “new” suitable for the potential growth of the activity. It should be noted that situational analysis is an adapted version of the Social Carrying Capacity (SCC) which is understood as the amount of aquaculture that can be developed without adverse social impacts (McKindsey et al., 2006). The ultimate goal of determining social carrying capacity is to quantify the value of stakeholder involvement in a science-based effort to determine the proper limits to aquaculture in their local waters (Byron et al., 2011). Ecological degradation or adverse changes to ecosystems, due to aquaculture, may inhibit social uses. The point at which alternative social uses become prohibitive or severely affected due to level, density, or placement of aquaculture farms is the threshold of social carrying

capacity of aquaculture (adapted from Byron et al., 2011c). The findings of this study will aid in setting the upper limits of aquaculture production given its social acceptability, thus avoiding "unacceptable change" to the social functions and structures of the Lake Victoria basin.

1.1 Specific tasks of the consultancy

a) Assess, via interviews with the relevant national authorities, through designated project National Focal Points, the aquaculture development plans approved and/or proposed for these national authorities, with specific incidence on the areas selected by the countries for developing aquaculture in the Lake basin.
b) Identification of human activities in Lake Victoria and coastal areas, including aquaculture, fishing, agriculture, recreational, other resource users, visual impacts, etc.
c) Based on above identification of uses, develop a matrix of interactions between coastal and lake uses for understanding and analysing the weight of the existing interactions[1].
d) Based on the above matrix, identification of relevant stakeholders for consultation.
e) Based on the information gathered in the above listed items, to assess, via field and online interviews, the current social and environmental context, aquaculture status, local communities and stakeholders' interests and plans regarding aquaculture development in Lake Victoria and its catchment area.
f) Identify, in the pre-selected areas, relevant non-aquaculture spatial development plans, including those of local governments, housing, agricultural intensification, wastewater treatment, fishing, and other industries, clearing of trees and other land uses to set the context of future zoning.
g) To map, via google maps, or any other geographic information systems (GIS)[2] the areas in the Lake Victoria Basin, in relation with the different levels of feasibility for aquaculture development, regarding the social and economic acceptability. Produce a final report including the assessments conducted, their results and the national map with the categorised identified areas by levels.

2. Approach and Methodology

Before carrying out this assignment a regional virtual meeting between the three national consultants for Tanzania, Kenya and Uganda was held with the Food and Agricultural (FAO) Fisheries Technical Adviser. The purpose of this meeting was to brief the national consultants on the objective of the assignment and to reach consensus on the methodological approach. The meeting was followed by a two-day training session on Geographic Information System (GIS) to acquaint the team with necessary skills in mapping the various activities or features around the zoned cage areas.

In preparation for commencing data collection, the consultant held discussions with the National Focal Point (NFP) and respective District Fisheries Officers (DFOs). The purpose of the discussion was to inform them about the work and to obtain official documents regarding policy provisions, zoning and establishment of cage aquaculture operations in the districts.

[1] The matrix of interactions was based on the methodology applied on *"Developing criteria and methodology for determining aquaculture zones under Marine Spatial Planning in the EU",* 2019, Pgs., 16-17, Figure 1: Conflict analysis (BaltSeaPlan Report 16 (2011). Note: FAO will provide this documentation.

[2] Software and equipment was discussed during the initial planning phase and provided by FAO.

The consultation also involved obtaining lists of cage aquaculture operators, identifying the various lake users, and stakeholders to be interviewed. The discussions also brought out initial pointers about compatibility and conflict between lake and land uses.

2.1 Study area

The geographical focus of the study was the riparian districts within Ugandan part of L. Victoria. The study targeted selected districts in and around L. Victoria where cage aquaculture operations exist. The documents reviewed showed that a total of 15 districts namely, Bugiri, Jinja, Masaka, Mayuge, Mukono, Namayingo, Wakiso, Buikwe, Kampala, Busia, Kalungu, Mpigi and Kyotera have a portion of L. Victoria shoreline, including two districts (Kalangala and Buvuma) that are islands within the lake. Eleven districts in and around L. Victoria, namely had cage aquaculture operations (Ogutu-Ohwayo et al., 2016, Lattice Aqua Trust – FAO. 2022).

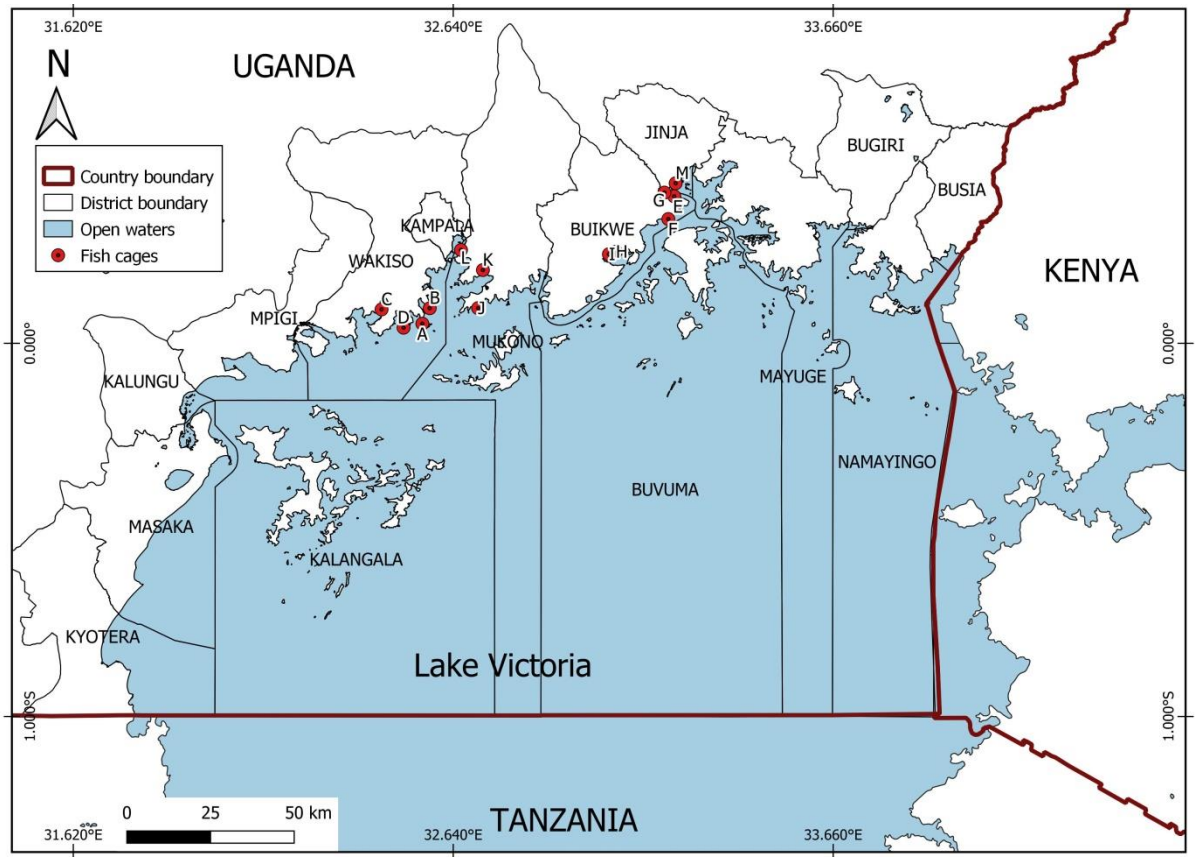

Figure 1: Map showing the sampled cage sites by districts

2.2 Sampling

Sampling was guided by preliminary consultations with the country focal person and a review of relevant documents. The consultations provided information about the distribution of cage culture sites in the lake basin. This enabled arriving at a representative sample of districts and respondents. The decision to determine sample size and geographical coverage was purposive. The key consideration was the need to select areas and respondents deemed to have the data needed to answer the objectives of the study, such as and the districts with the

highest number of cage operators and level of concentration of cages at a particular site. Buikwe, Jinja, Mukono and Wakiso districts had the highest number of cage aquaculture operations and were thus selected for the study. Drawing from Aguilar-Manjarrez, Soto and Brummett (2017) on Ecosystem Approach to Aquaculture, it was envisaged that large scale cage operations were likely to impact and be impacted by other human activities taking place in the lake and the surrounding off-shore areas. Similarly, the respondents were purposively selected as they were deemed to possess the information needed to answer the objectives of the study. Besides big operators, the selection included farmers running their enterprises in form of a cooperative and women operators. The reason for women selection was based on the lists at DAMD and Lattice that indicated fewer women cage operators. Purposive selection also considered the need to generate results that can be generalised for the lake basin districts not included in the study.

2.3 Data collection

The data collection process was guided by an implementation plan that outlined the specific tasks identified from the ToRs, the information needed, the appropriate methods and data sources. A data collection instrument (Appendix I) was developed to obtain information from various categories of stakeholders. The information sought aimed at understanding the planning and development of cage aquaculture, identifying the various human and non-human activities within the zoned areas in and around L. Victoria; the interactions between cage fish farms with other lake and land users, positive and negative impacts of cage fish investments; number of cages in each district; and criteria used for identifying the sites for cage establishments and the challenges facing cage aquaculture in general. Focus was on understanding the social and environmental context of aquaculture status and development in Lake Victoria and its catchment area. Data and information were collected using relevant methods and from different sources. Social suitability was determined through obtaining and analysing opinions of the various stakeholders using a semi-structured questionnaire.

1. Review of documents
   The National Aquaculture policy of 2018 was reviewed for purposes of understanding government policies on aquaculture development. In addition, a number of research reports and published papers regarding cage aquaculture in Uganda and East Africa were reviewed. Guidelines for establishment and operation of cage fish farming in the East African Community were also reviewed.

2. National and local government level consultations
   Meetings were held with relevant government officials involved in policy, planning regulation, research, and extension of fisheries and aquaculture technologies. In addition, the selected fisheries and aquaculture researchers, District Fisheries Officers and fisheries officers designated to handle aquaculture aspects in the study districts were consulted. In some instances, respondents preferred providing their responses via e-mail. All the questionnaires were received, and where necessary, follow-up telephone calls were made for clarifications.

   The consultations provided preliminary data needed to inform the most effective strategy to carry out fieldwork, and to identify other relevant stakeholders for interviews. Lists of

cage aquaculture operators were also obtained from the Department of Aquaculture Management and Development (DAMD), and from DFOs to guide the selection of respondents.

3. Interviews with respondents in the study area
   Different categories of stakeholders were interviewed during data collection in the sampled districts. The DFOs or their assistants introduced the consultant to the Local Council offices and to members of the local committee working alongside the Fisheries Protection Force. Data collection largely involved conducting face-to-face interviews with the selected respondents. To obtain data on cage culture operations, owners or managers of the enterprises were interviewed (depending on availability). In addition, the consultant made observations of the various lake based/lake dependent operations/businesses. Appendix 2 indicates the list of persons interviewed.

2.4 Data analysis

Most of the data gathered was qualitative to enable in-depth analysis aimed at determining the social feasibility of cage aquaculture. Content analysis was therefore used to analyse the data. The data analysis procedure commenced with typing the hand written responses and merging them with data collected electronically via emailed questionnaires. The next step was organising the data according to the identified themes in line with expected outputs of the consultancy. This was followed by analysis, interpretation and drawing implications, conclusions and recommendations.

Due to unavailability of information on zoned areas for cage aquaculture, analysis of suitability was applied for cage aquaculture sites visited. Based on the views of the stakeholders at each site, the various lake uses were identified and assessed against the existing cage aquaculture farm. Emphasis was placed on obtaining a balanced assessment by analysing the positive and negative attributes.

Furthermore, the analysis of the overall picture of social suitability of cage aquaculture focused on assessment of interactions between lake uses and the weight of existing interactions. The analysis used a matrix to determine three different levels of conflict where level A represented with green colour indicated Compatible lake or land uses, while yellow colour represented level B (lake or land uses that are compatible with moderate conflicts), and red colour represented level C (lake uses that are incompatible/conflicting) with cage aquaculture or other lake/land uses.

2.5 Study limitations

Preliminary consultations revealed that no systematic zoning was carried on the Ugandan side of L. Victoria as had been indicated in the ToRs. Only sample based and old information was found about site suitability studies carried out in 6 districts namely Buikwe, Mukono, Wakiso, Busia, Mayuge, and Kalangala districts (NaFIRRI-NARO 2013, Ogutu-Ohwayo et al., 2016). This limitation clearly indicates that only a small portion of the lake has been surveyed for site suitability and not a zoning activity that could provide a lake-wide picture. Nonetheless, this

study results should be considered as a true representation of the situational analysis of cage aquaculture around the Ugandan side of Lake Victoria.

The survey took longer than expected due to time spent while carrying out consultations and search of necessary official documents. More so, obtaining appointments with cage operators was lengthy as most of them are not based at the farms. Often the Farm Managers were not in position to respond to all the questions, and sometimes not allowed to speak to researchers without permission of the farm owner. Also some farm operators were initially reluctant to interact with the consultant. None the less, upon obtaining consent to the consultation, all the respondents freely provided the information sought.

3. Results and discussion

3.1 Aquaculture policy priorities and development plans

The National Aquaculture Policy of 2018 (MAAIF 2018) is the main framework for the development and management of aquaculture in the country. The goal of the policy is to increase fisheries and aquaculture production to 1.7 million tonnes annually so as to contribute to food security, nutrition and economic growth. With regard to cage aquaculture, the policy recognizes the growing interest and commercial investment initiatives. All the government officials and cage aquaculture operators interviewed were aware of the existence of the Aquaculture policy. The respondents however, mentioned that the policy does not explicitly mention cage aquaculture, but aqua parks that are yet to be established by the government. The respondents, particularly cage aquaculture operators, mentioned that it was not clear whether their current private commercial ventures were regarded as aqua parks. Thematic area 2.9, namely Commercialisation of Aquaculture through aqua parks, Policy statement 2.9.1 states that;

> *Government shall invest in the development of aqua parks under a Public Private Partnership arrangement to increase a competitive, market-oriented and profitable, environmentally responsible aquaculture industry.*

Regardless of the issues that respondents raised about the terminologies, the main concern was the need for the Department of Fisheries Resources and the Local governments to support the development of cage aquaculture, and enable realisation of the food security and income objectives.

Box 1: Thematic areas of the Fisheries and Aquaculture Policy

Fisheries Aquaculture Management and Governance
Research and Appropriate Technology
Human Resource Capacity and Development
Fish Production and Productivity
Post-harvest Management, Value Addition and Quality Assurance
Trade and Marketing
Environmental Sustainability and Climate Change
Fish Bio-safety and Disease Control
Commercialization of Aquaculture through Aqua parks
Fisheries and Aquaculture Management Information System (FAMIS)
Source: MAAIF 2018

Respondents enumerated specific areas that DiFR should address for purposes of streamlining development of cage aquaculture. They include:

- Harmonising research and site suitability studies for establishment cage aquaculture
- Regulating and guiding the development of cage aquaculture through identifying, zoning and gazetting suitable areas
- Organising periodic workshops and training for cage aquaculture operators
- Organising smallholder farmers into producer organisations that can effectively engage in cage aquaculture

- Supporting feasible mechanisms for local production of good quality fish feeds
- Promoting coordination among the respective public and private agencies in the development and management of cage aquaculture
- Determining the best measures to curb environmental degradation and associated with in-shore and off-shore fisheries and aquaculture activities.
- Ensuring effective and efficient collection, compilation, analysis, storage and dissemination of cage aquaculture information
- Lobbying for support to the development of infrastructure and utility services for potential sites on land and water.

Apart from the national level, local governments make plans for the various sub-sectors, including fisheries. Results from a review of district development plans, and from consultations with the DFOs, indicated that cage aquaculture is among the priorities. The study however noted a lack of harmonisation of the various district priorities given that the use of the lake as a shared resource. Table 1 depicts cage aquaculture plans and priorities of the study districts.

Table 1: Cage aquaculture plans and priorities by district

Plan	District
Provision of extension services through training farmers and giving inputs (feeds and fingerings) to farmers	Buikwe, Mukono
To maximise use of the lake for cage aquaculture	Jinja
Support to fisher folk to diversify into cage farming, by district local government through trials	Jinja
To build capacity of the private sector and local government levels in cage aquaculture	Jinja
Zoning of lake area for cage aquaculture (in collaboration with NaFIRRI scientists)	Jinja
Collaboration with research institutions for appropriate technology transfer to farmers	Mukono, Wakiso
Strengthening regulation and control of aquaculture development	Mukono
Monitoring and supervision of aquaculture establishments	Mukono
Development of aquaculture cages as a business activity	Wakiso
Emphasis on undertaking social suitability assessments simultaneously with biophysical assessment prior to establishing cage aquaculture farms	Mukono
Establishment of favourable policy and provision of enabling environment for cage operations	Wakiso
Organising the farmers into producer organisations	Wakiso

3.2 Zoning/Site selection for cage aquaculture

The results of the study established that no comprehensive zoning for cage aquaculture has been carried out on the lake. The National Fisheries Resources Research Institute however carried out cage aquaculture site suitability studies (NaFIRRI-NARO 2013, Ogutu-Ohwayo et al., 2016) on which some of the cage aquaculture establishments were based. In other instances, the operators sought services of researchers to carry out the suitability assessments of the identified sites. This implies that the guidelines for establishing cage aquaculture enterprises are not strictly followed.

The guidelines (LVFO 2018) indicate that before establishing a cage fish farm, an operator is supposed to have a site suitability study done, by the mandated technically competent authorised organisation or NaFIRRI. The study found that the common practice was that the studies are mainly done by scientists from NaFFIRI, usually on a client-scientist arrangement. In some cases, the client engages scientists on a private arrangement, with limited participation of the DiFR. This scenario was confirmed by non-existence of some of the site suitability reports at the DiFR. Cage fish farmers are also required to undertake an Environmental Impact Assessment (EIA). The EIA should cover environmental, ecological and socio-economic aspects clearly document potential impacts. Once the EIA is approved, cage fish farmers are supposed to pay for an aquaculture facility establishment permit and later an operational permit that is renewed annually.

However, some interviews with cage farmers and fisheries staff indicated that some proprietors identify suitable areas, purchase land onshore and set up farms, without undertaking any environmental or social suitability assessment, and without a permit. In some cases the investors has experience in pond fish farming, and use their experience to assess the suitability of the sites they have chosen for both nurseries and cages. While some operators such as Asante Fish Farm were reported by some fisheries staff to have undertaken both biophysical and social suitability assessment before setting up farms, most cage farmers only do biophysical assessments and do not undertake discussions with other lake users to reconcile interests and agree on coexistence before setting up their farms, as one Fisheries Officer narrated;

> *Mukono District has no zoned areas for cage aquaculture. So some wealthy persons who acquire land on shore assume they are free to set up a cage farm. There are cages in almost all the bays on the lake. Some cage farmers just install cages without even involving fisheries officers or other lake users. They only come to the fisheries officers when they get problems, such as when conflict arises between cage fish farmers and fishers over access to fishing grounds. Many of the cage fish farmers do not undertake bio-physical and social suitability assessment or talk to other lake users to agree on location before setting up farms. Upon completing the process of setting up the cage fish farm, the farmers start restricting fishers from accessing the bays.* (Fisheries Officer, Mukono district).

3.3 Social economic impact of cage aquaculture

3.3.1 Positive socio-economic impact

Increased incomes from fish trade

The ultimate beneficiaries of cage farming are the proprietors. The sector is very lucrative. While there are both nationals and foreign investors, most of the big farmers are mainly foreign, because of the huge capital investment involved, plus the deliberate government policy to encourage foreign investors. Most of the cage farmers reiterated the high yields from cage aquaculture and the advantage of bulk sales. The fishers interviewed also stated

that fish catches around the cages are higher as wild fish tends to congregate around cage sites, to feed on cage feeds. Some of the fish produced is sold to local traders, including women from the villages around the cage farms. This is a form of employment benefit to local traders.

Increased availability of fish

The increased volumes of fish produced have controlled fish price hikes, and fish is more affordable to the general community. This has increased consumption of fish, a nutritional impact. It is easier for local community members to afford to engage in small scale fish trading.

Increased awareness about fish farming

Learning from existing farms, local people have started installing small scale fish cage farms. Some former employees of older farms eventually started their own relatively big farms (e.g. one of the prominent Cage Farmers surveyed started off as an employee on another cage farms, the other was initially a member of the Masese Cage Farmers Association, later separated and started his own farm). This of course is subject to access to capital. A young woman who entered aquaculture at Masese-Walukuba as a part of an NGO-supported youth group, with each member owning a cage had this to say about how aquaculture has impacted her life:

> *I have acquired knowledge and skills. We were trained by the Fisheries Officer at Masese. In the training I acquired life skills. This job taught me how to think outside the box. I learnt how to be self-reliant, to save, to plan for my life, to budget in order to meet my expenses including rent and daily fish feed. This job has kept me focussed as a young person……learning to row the boat was challenging, but I was encouraged by other women* (Female Cage Operator, Masese).

The cage farms have provided training ground in aquaculture. Three farms surveyed (Source of The Nile (SON), Ssebaggala cages and Norvia Investments) mentioned offering internship training to students from higher institutions of learning. SON actually admits two lots of students per year from Makerere University, Busitema University and Fisheries Training Institute. Each of the lots comprises on average 30 students. The SON farm also participates in National Agricultural shows to demonstrate aquaculture.

Increased regional fish trade and access to fish markets

The large volumes of fish from cage culture have attracted large markets in the region for example the Democratic Republic of Congo, Rwanda, Kenya and South Sudan. There seems to be no actual competition for market between fishers and cage farmers because they target different markets. The fishers mainly sell their fish to local consumers (tilapia and other smaller species), while Nile perch, which is the other major catch is sold both to local consumers and fish processing factories. The cage fish farmers on the other hand produce tilapia and target the regional market.

Increased employment opportunities

The number of people involved in the fish value chain has increased, including managers of cage farms, production specialists, marketing specialists, fish feeders, transporters, fish loaders, fish sorters, fishnet knitters, cage makers, fish traders, labourers that maintain fish farm sites, security personnel and cooks. Many people from host communities and beyond (mostly male youths, with few females) are employed as fish feeders. All the fish farms sampled mentioned that fish sorters are mainly women from the host communities. The sector is thus empowering youths and women through access to employment.

There has been considerable skill transfer to the youths in cage setting, netting and fish feeding. For example, Yalelo has a students' internship programme which benefits 10 students per year. They also run a programme for 10 fresh graduates per year, some of whom the company offers employment. Some of the experienced employees find it easy to get employment in better paying farms, or to set up their own cages if they have capital. Many women have easy access to fish for trade and home consumption. In Masese, the Chairman of the Cage Fish Farmers Association mentioned that some feeders have eventually saved enough capital to raise their own fish, sometimes in old cages lent to them by their employers.

However some of the cage farmers bring workers from outside the host communities, and this creates negative attitude towards the cage fish farmers. These cage farmers mentioned that they desist from employing local people mainly because of thefts that are performed in connivance with local residents. Also, in places where local youths have been involved in fishing (where cage farms are close to fish landing sites), they find the wages offered by some cage farmers very low, and unattractive.

Increased markets for other goods and services

Many of the employees of cage farms reside among the neighbouring communities. This has created a market for housing and food among the neighbouring villages. Where farms are located, improved social services (roads, access to electricity) have increased the market and value of land. Security firms have also got a market for their services.

Support to social and infrastructure services

To ease their business operations, some of the companies have had to invest in social infrastructure, since they are located in remote settings. The infrastructure serves both the cage farms and the host communities. Two farms surveyed invested in maintenance of the feeder road to the farms. One farm extended electricity to its farm, from about 20kms away, and households who can afford have accessed electricity. The company also extended the piped water system (built by an NGO) to this village. Two farms allow the adjacent communities to access safe water provided from their premises. These gestures have built considerable good will among the communities.

Recycling fish feed bags

Throughout the villages around the lake, recycled feed bags are visible, being used for shelter construction, food handling, protection of bricks at brick making sites, as floor carpets and many other uses. However the amount of feed bags in the area is huge, and there are environmental implications. The feed bags are not bio degradable and the impact on land and

the environment is inevitable. The community members near one of the fish farms raised a concern that fish farmers need to manage the bags. For example, Yalelo stopped giving empty feedbags to community members, and put in place a reuse and recycling programme.

Community projects / activities supported by cage farmers

Some of the cage fish farms have deliberately undertaken activities aimed at having a positive impact on local communities and improving cage fish farm-community relations. Some of the community members get opportunity to sell foodstuffs, and other items to the cage aquaculture companies. These range from free fish given to workers, selling fish to village-level traders at reasonable costs (some farms sell the smaller fish which is not sold to the bulk buyers to village traders), recruiting workers from host communities, supporting community hygiene projects and mobilising the community for health programs, including COVID-19 vaccination. On two occasions, one of the companies transported health workers from the local Health Centre to the community to undertake COVID vaccination.

Source of the Nile, the oldest cage farm on the Ugandan section of the lake has deliberately undertaken activities aimed at having a positive impact on local communities and improving company-community relations. These include renovating a local school, organising corporate sports leagues, donation of fish to orphanages, community sensitisation on lake security, selling fish fingers to other farmers and once offered free starter fingerings to local groups of fish farmers at Rippon and Masese, and training local cage farmers in cage farming. L. Victoria Precious Cage Farm in Mukono was hailed by the LC 1 Chairperson for improving security in their village, continuously engaging the local leadership where conflict arises between the farm employees and the members of the community, participating in local sports activities and offering a cow for beef to the community on Christmas days.

3.3.3 Negative socio-economic impact

Restricted access to fishing grounds

Fishermen sometimes fish within or very close to cage farm boundaries- at the risk of damage to cage nets, and possibly theft. Cage farms usually require fishers not to fish in the 50m buffer around cages. Fishermen on the other had complain that cage farms have attracted a lot of wild fish to round cage sites, and they want to cast their nets close to the cages to increase their catch. Sometimes this comes with noise as they cast nets, or use beach seines and “tycoon” fishing method[3]. This brings a risk of cage net damage and causing stress among fish in the cages, leading to injury or death. Cage owners insist the fishers should respect farm boundaries. This is a constant source of contention.

Some fishers claimed that even when strong winds move nets towards the fish cages they are often wrongly accused of encroaching on the fish farms. Fishers were of the view that the buffer areas around cages sites should be clearly marked, but limited in size. Fishers allege uncontrolled expansion of cage farms beyond boundaries set in suitability assessments. This affects fishers that normally do fishing in shallow inshore bays. In Kamwanyi Bay (Mukono), the two Cage Farm operators were said to have started restricting fisher access to the bay area. Yet, the fishers believe the area is a good fishing ground. One of the farmers interviewed

[3] Beating or splashing of water commonly known as “kikubo” or “tycoon” with the intention of scaring or driving fish into a net or any other fishing appliance

said the intention to restrict fishers was to protect the fish breeding grounds, but also claimed that his permit allowed him control over the whole bay area. In Kigaya-Golomolo, the fishers mentioned that the area originally earmarked for cage farming is not where the cages were placed, and they ended up in a key fishing ground. One fisherman mentioned that "…t*he problem is that cage farmers assume priority over fishermen"* (Fisherman at Kamwanyi landing site)

Insecurity

The heavy investment in cage infrastructure attracts thieves, causing a security threat to the cage farms and other lake users. In some sites like Masese and Bulega, cage owners have employed security guards who stay at the lake overnight to secure their cages. Despite the fact that the Masese Fish Farmers Association jointly hire security staff to guard the cage sites, there are still complaints of fish theft, suspected to be by security personnel, fish feeders and fishers. In Kigaya-Golomolo, fishers claimed that security guards of fish farms harass fishers on the lake, and that collision of boats with cages that are not well lit at night risks fishers being shot at by cage security guards.

Potential Environmental degradation

Fisheries officers mentioned that pollution of the environment is an anticipated challenge. Feeds left overs, as well as treatment subjected to fish in case of disease breakouts could cause nutrient loading and undesired effects to water bodies. Although cage fish farmers undertake water quality tests before they set up the farms, most of them do not repeat these tests annually, as specified in the regulations (LVFO 2018). In Masese, NWSC has raised concerns about cages polluting the water at their inlet by increasing the nutrient loads from sinking feed, and that this increases the cost of water purification.

Increased land activity resulting from Cage fish farming brings the threat of soil erosion and sedimentation of the lake as already evident at Masese landing site. Members of one community near a cage fish farm in Buikwe indicated that the proprietor cut a shoreline forest to set up farm infrastructure. Increased numbers of people attracted by cage farming (regular employees, casual workers, traders, transporters) have created demand for products and services at the landing sites. This necessitates construction of business infrastructure (restaurants, shops, bars, etc.). In Masese cage farmers indicated that there is influx of people, especially fish feeders and traders who stay in the nearby area so as to effectively carry out fish feeding 2-3 times a day.

The common practice is for adjacent land owners to clear forest and wetland vegetation on the shoreline to pave way for construction and landing sites for fish, sand, charcoal and other products transported across the lake. More so, land owners adjacent to the lake do not observe the 200 buffer area of the lake[4].

Fisheries staff also mentioned that cage fish farms can have negative impact on fish breeding grounds if they are not properly identified and protected. They explained that most of the

[4] As provided in the National Environment (Wetlands, River Banks and Lake Shores Management) Regulations, No 3/2000)

breeding grounds are in the bays which are also good sites that protect cages from strong winds. These observations point to the need for cautious planning of cage aquaculture.

As said above, the amount of feed bags circulating in the areas around the lake is a cause for worry. The environmental impact of these bags is foreseeable, calling for a serious recycling plan and action.

3.4 Social suitability of cage aquaculture sites

As part of the assignment the team assessed the social suitability of aquaculture development as one of the lake uses at each of the surveyed sites. Initially the team got expert opinion from the Fisheries Officers about the occurrence of conflict and/or compatibility between lake and land uses. During field work, the common lake and land uses were identified at each sites. The team then asked the lake and land users at each particular site about any existing conflicts of compatibility between the lake and land uses. The team also used its expert knowledge to assess situations of conflict or compatibility between the uses. However the opinions and perceptions of local communities are central in determining suitability of these sites for cage fish farming.

From the discussion, research activities on the lake, fish hatcheries on site, navigation of big vessels and ferries, feed mills on site, tree planting on the shoreline and recreation facilities were deemed to have no conflict with cage aquaculture. Fishing, fish landing sites (the very busy and highly populated ones), sand mining and transportation through the lake, tree cutting and swamp clearing on the shoreline, navigation by small vessel transporters, livestock rearing and watering in the lake, fishing in fish breeding grounds and tourist boat cruises were identified to be compatible with cage fish farming, but with moderate conflict. On the other hand, crop farming close to fish ponds and swamps (especially where there is heavy use of agrochemicals, waste disposal in the lake, including animal waste and effluent discharge by industries/factories were said to conflict with cage fish farming. The tables below provide further details on the nature of conflict between the lake and land uses.

Table 2: Social suitability assessment of surveyed aquaculture farm sites

Cage Farm site	Identified lake/land uses	Description of comparability or conflict		Overall Categorization of the site
		Positive attributes	Negative attributes	
Masese / Walukuba	• Big vessel transporters • Water intake (Industrial) • Fishing • Fish landing site • Sand mining and transportation through the lake • Small vessel water transport • Livestock rearing and watering in the lake • Fishing in fish breeding grounds • Waste disposal in the lake, including animal waste • Effluent discharge by industries/factories	• Local people's participation in cage aquaculture • Former fishers engaged in cage aquaculture • Large numbers of female and male youths employed in cage aquaculture • Women engaged in cage aquaculture • Cage operators organized in a cooperative (Masese Cage Fish Farmers Cooperative society) • Collective and bulk marketing of fish • Shared costs of operations (paying labor for feeders, security, and boat transport to the cages…)	• Bio waste leads to growth of too much algae in the water, leading to reduction in dissolved oxygen • Effluents affect fish, sometimes leading to death • Fishing in fish breeding grounds affects fish population, and leads to conflict between Cage farmers and fishers. • Limited room for expansion	Suitable with moderate conflict
Norvia Fish Farm	• Crop farming close to swamps • Recreation facilities • Fishing • Livestock rearing and watering in the lake • Fish landing site • Small vessel water transport • Fishing in fish breeding grounds	• Cages enhances the neighboring tourism facility • Employs laborers from the community • Local traders are given opportunity to buy fish from the cages • Availability of suitable area for expansion	• Fishing close to the cage site • Livestock rearing and watering in the lake	Suitable
Source of the Nile Fish Farm	• Crop farming • Big vessel transporters • Recreation facilities • Fishing • Small vessel water transport	• Employs the largest number of local workers, majority of whom are from the community • Has boosted fish trade in the community • Has supported community development projects	• Bio waste leads to growth of too much algae in the water, leading to reduction in dissolved oxygen • Use of agro-chemicals in crop Farming affects fish growth and	Suitable with moderate conflict

Cage Farm site	Identified lake/land uses	Description of comparability or conflict		Overall Categorization of the site
		Positive attributes	**Negative attributes**	
	• Livestock rearing and watering in the lake • Tourist boat cruises • Waste disposal in the lake, including animal waste • Effluent discharge by industries/factories	• Has contributed to capacity building/skilling in aquaculture (internship, apprenticeship…) •	fish in breeding areas through contamination of water • Agro-chemicals affect fish breeding grounds • Diversion of stream water for irrigation interferes with fish ponds volumes • Cruise boats are noisy, stress fish in cages, leading to poor feeding • Limited suitable area for expansion	
NAM Fish Farm	• Crop farming • Fishing • Fish Landing site • Small vessel water transport	• Local fish traders, particularly women, can purchase cage fish at harvest • Improvement of infrastructure in the community (feeder road, electricity…) • Local employment	• Conflict over fishing close to cages • Crop cultivation using agrochemicals close to the shoreline	Suitable
Asante Fish Farm	• Crop farming • Fishing • Fish Landing site • Tree cutting and swamp clearing on shoreline • Small vessel water transport Fishing	• Local fish traders, particularly women, can purchase cage fish at harvest • Improvement of infrastructure in the community feeder road • Employment of local people • Undertook discussions with other lake users at suitability assessment stage • Participates in health campaigns by LCs and community	• Conflict over fishing ground and fish breeding bay • Crop farming close to shoreline and using herbicides • Fishing in fish breeding grounds • Use of illegal fishing methods by fishers	Suitable with moderate conflict
Lake Victoria Precious Fish Cages	• Tree plantation onshore • Fishing	• Local fish traders, particularly women, can purchase cage fish at harvest • Extended community feeder road • Allows community to access clean water source installed at the site	• Fishing close to cages	Suitable

Cage Farm site	Identified lake/land uses	Description of comparability or conflict		Overall Categorization of the site
		Positive attributes	**Negative attributes**	
		• Mobilizing community and workers for health campaigns such as COVID-19 vaccination • Supports community sports league • Collaboration with LCs for conflict resolution between workers and community members • Tree planting on shore		
Ssebaggala Cage Fish Farm-Nakiwogo	• Big vessel transporters, Ferry • Recreation facilities • Fishing • Fish Landing site • Small vessel water transport • Tourist boat cruises • Waste disposal in the lake from landing site and market	• No reported conflicts despite the highly populated and busy adjacent landing • Cages placed far away from the main access point at landing site • Employs laborers from the community	• Cruise boats are noisy, stress fish in cages, leading to poor feeding • Limited suitable area for expansion given the many other lake uses	Suitable
Victoria Treasures	• Occasional fishing • Fish hatchery • Fish processing factory • Fish transporters	• Employs laborers from the community	• Local fish traders not given opportunity to buy cage fish • Fishing close to cages	Suitable
UFRESH	• Recreation facilities • Sand mining and transportation through the lake • Fishing • Fish landing site • Small vessel water transport	• Employs laborers from the community	• Sand mining and transportation makes shore water turbid • Fishing in fish breeding grounds	Not suitable[5]
JAKOC	• Fishing • Fish Landing site • Small vessel water transport	• Collaboration with other cage operators on same site • Provides clean water to community members	• Employs workers from outside the community	Suitable

[5] Proprietor and DFO of Buikwe district confirmed the decision and plan to relocate the cages to an appropriate site

Cage Farm site	Identified lake/land uses	Description of comparability or conflict		Overall Categorization of the site
		Positive attributes	Negative attributes	
	• Fishing in fish breeding grounds • Different cage operators at the same site			
Rock Springs Fish Farm	• Fishing • Fish Landing site • Small vessel water transport	• Extended electricity to the area • Provides clean water to community members • Employs laborers from the community • Local fish traders, particularly women, purchase cage fish at harvest	• Crop farming by community members is close to the shore	Suitable
Pearl Aquatics	• Fishing • Tourist boat cruises • Livestock farming • Real Estate development • Small vessel water transport	• Local fish traders, particularly women, purchase cage fish at harvest • Employs workers from the community • Attracted fishers to leave fishing and get employed at the cage fish farm	• Cruise boats are noisy, stress fish in cages, leading to poor feeding • Fishing close to cages	Suitable
Yalelo	• Fishing • Crop farming	• Employs over 60 workers, from within the community. • Attracted fishers to leave fishing and get employed at the cage fish farm. • Entire company employs over 400 workers including those in the various marketing outlets across the country. • Purchasing locally available building materials from the community Rock Excavator group of youths. • Community members, particularly women sell food stuffs to the company's canteen via a women's group. • Supported community projects eg Latrine in the trading centre, hygiene promotion activities.	• Thefts of fish from cages by fishers • Fishing close to cages is restricted. Besides fish thefts, it has a risk of spreading fish diseases	Suitable

Cage Farm site	Identified lake/land uses	Description of comparability or conflict		Overall Categorization of the site
		Positive attributes	**Negative attributes**	
		• Bi-monthly meetings with community leaders (LCs, Schools, Church) of the three neighbouring villages (Karega, Butembe, Bwagaju) to promote good relations • Offers opportunity to local traders to purchase cage fish		

Table 3: Conflict analysis of interaction between land and lake uses in the study area

	Cage Fish Farming	Fishing grounds	Fish breeding/ nursery grounds	Land-based aquaculture and hatcheries	Fish landing sites	Fish processing establishments	Navigation routes (canoes/ship/fe	Ports	Water intake/extracti on points	Household water use	Waste water discharge/indu strial effluent	Tourism installations /activity	Recreation facilities	Crop farming practices	Livestock raring	Sand mining	Nature conservation/ biodiversity	Natural and plantation forests	Residential areas/ settlements	Cultural heritage sites	Military/securit y installations	Factories	Road infrastructure	Hydropower plants, dams
Cage Fish Farming								-				[6]		[7]					[8]	-	-			-
Fishing grounds								-												-	-			-
Fish breeding and nursery grounds								-												-	-			-
Land-based aquaculture and hatcheries								-												-	-			-
Fish landing sites								-																
Fish processing establishments								-												-	-			-
Navigation routes (canoes/ship/ferry)								-												-	-			-
Ports	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water intake/extraction points								-												-	-			-
Household water use								-												-	-			-
Waste water discharge/industrial effluent discharge								-												-	-			-
Tourism installations/activity								-												-	-			-
Recreation facilities								-												-				
Crop farming practices								-												-	-			-
Livestock raring								-												-	-			-
Sand mining								-												-	-			
Nature conservation/biodiversity								-												-	-			-
Natural and plantation forests								-												-	-			-
Residential areas/settlements								-												-	-			-
Cultural heritage sites	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			-		-
Military/security installations	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-		
Factories																				-	-			-
Road infrastructure																								-

[6] Tourism boat cruises are noisy- may affect fish in cages

[7] Crop farming conflicts where it's close to the shoreline and applies toxic agro-chemicals

[8] Conflict arises where residential area activities lead to soil erosion and lake sedimentation

Hydropower plants, dams	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

	Compatible/non-conflicting lake uses
	Compatible with moderate conflicts
	Conflicting lake uses
-	Uses not existing in the sampled study area, hence not applicable for conflict analysis

This survey reveals that most of the cage fish farm operations visited were socially suitable, while a few were socially suitable but with moderate conflict. The most cited conflict is competition for space between cage farming and other lake uses, mainly fishing and sand mining. Among all the cage sites surveyed, Masese site had the highest number of cited lake and land use conflicts. The conflicts arise from the multiple lake and land uses in and around the bay area, including fishing, cage fish farming, National Water and Sewerage Cooperation water intake, water intake by another factory, navigation, effluent discharge from factories, livestock watering, feed milling and multiple activities at the shore.

Most of the sources of conflicts can be easily managed if the lake and land users engage each other before setting up cage farms and regularly thereafter, to discuss the causes of conflict and agree on mitigation measures. For that to happen, all land users have to respect each other as legitimate and entitled lake users. But also the regulation role of the Fisheries Department must be strengthened, and enforced. Even though the conflicts as reflected in tables 4 and 5 have no adverse effects on cage aquaculture operations, the negative effect on communities' lives must be prevented. Conversely, the positive impact of host communities should be enhanced to boost the 'social licence' to operate cage fish farming. Among the positive impacts that seem to create appreciation among the host communities are employment opportunities given to members of host communities, improved access to social services for host communities (roads, electricity, water, heath outreach services, support to education), and opportunities for fish trade by community members.

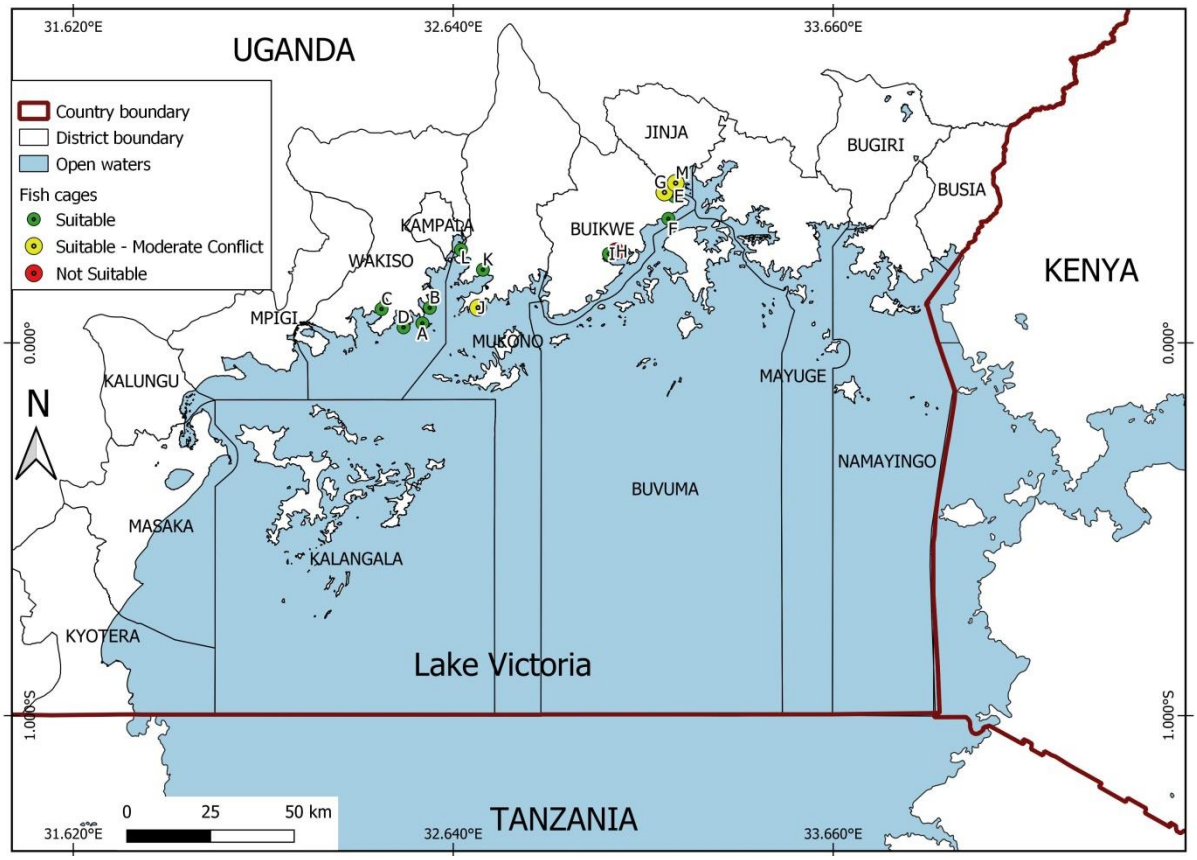

Figure 2: Map showing social suitability of sampled cage sites

Besides looking at the social suitability of specific cage sites, there are other important features that must be considered in cage site selection. In particular, public installations take priority for their protection and ensuring safety people within the vicinity. Similarly, sound from such installations can stress the fish and lead to poor growth, thereby compromising the economic viability of the enterprise. The maps below indicate examples of social suitability criteria in terms of infrastructure that should be considered during cage site selection. The infrastructure includes Bukakata port, Jinja Pier, Jinja Airfield and Entebbe International Airport.

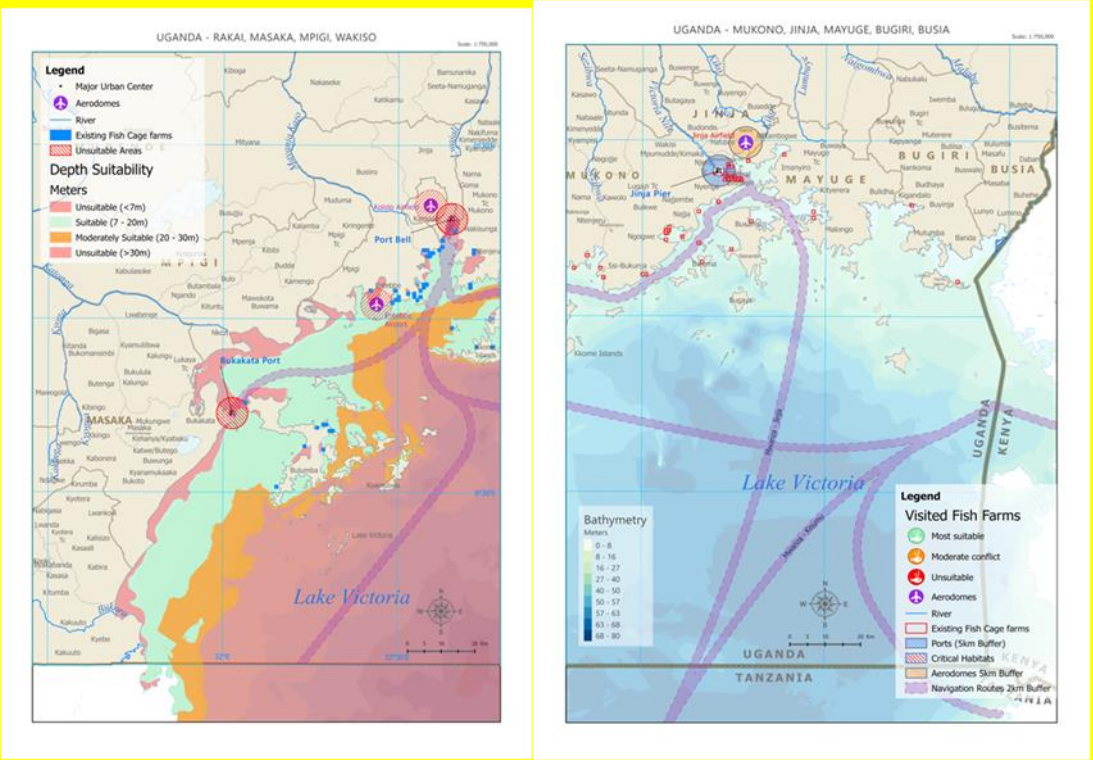

Figure 3: Maps showing selected examples of social suitability

3.5 Challenges facing cage aquaculture

Amidst the growing interest in cage culture in the region, the practitioners encounter some challenges. While the focus of the study was social suitability, the challenges enumerated cut across other spheres such as the physical conditions of the lake including existing infrastructure, the ecological aspects, and production variables such as investment, yields and markets.

Table 4: Cage aquaculture challenges encounters in the countries

Challenge	Kenya	Tanzania	Uganda
Feeds (inadequate, poor quality and high cost)	*	*	*
Insecurity	*	*	*
Inadequate enforcement of guidelines			*
High investment and operational cost	*	*	*

Natural hazards	*	*	*
Limited knowledge and skills	*	*	*
Unstable markets and fluctuating prices			*
Unfavourable taxes			*
Poor infrastructure		*	*

Inadequate and poor quality feeds

Inadequate access to good quality feeds, and mismatch between demand and supply, coupled with high cost are the major challenges mentioned by cage aquaculture. The demand of fish feed is very high and increasing due to the growing cage aquaculture operations. The most common types of feeds used are imported from large scale manufacturers and distributors. The feeds include Laguna from Brazil, Koudijs from the Netherlands, Aqua from Egypt and Aller from Zambia.

Some of the cage aquaculture operators have opted to produce their own feeds locally. The farmers who produce their own feeds mentioned that the quality cannot match the imported feed as evidenced by slow fish growth. The farmers who depend on fish feeds produced locally face a challenge of erratic production and supply. One farmer mentioned that the difference in price between locally-made feeds and imported ones is small and does not offset the risk of inconsistent quality of locally made feeds. Two cage farmers in Masese who also mill their own feed lamented that their fellow farmers do not buy their products and still prefer imported feed (even though their feed is half the price of imported feed), because of uncertainty about quality. One of the farmers mentioned that he periodically takes his slow sinking feed for nutrition balance testing (protein content /proximate analysis at Makerere University, but lamented that the costs of testing are high (at Ughs. 400,000 per sample). The other miller said she actually manufactures floating feed, but the cage fish farmers say they prefer sinking feeds, limiting her market basically to pond fish farmers. The bottom line is that the feed component of the cage aquaculture value chain needs a lot of intervention to improve quality and consistency. One farmer mentioned that unlike foreign feed companies who actively look for clients in the field (like Koudijs), local feed millers are not investing in marketing and outreach, so some of the farmers do not know about their feeds.

High cost of feeds

This hikes the cost of production, especially or small farmers. Most of the feed is imported by middlemen, and the prices are high, probably because of high taxes. Although floating feeds are recommended as best for fish, many farmers do not use them because of the high prices. Instead they use sinking feeds. The fish production cycle is 9-12 months. For cage farmers with single or few cages, this is a period of continuous expenditure with no income from the enterprise.

Inadequate biosecurity enforcement

The cage aquaculture guidelines (LVFO 2018) state that introduction of new species or genetically modified species should not be allowed in any East African Community (EAC) water bodies, except with scientific clearance. This study however indicated that some cage owners illegally import foreign fish because it matures quickly. This scenario is an indicator of loopholes in the enforcement system. The long term effects of this may not be clearly known.

Insecurity on the lake

Insecurity takes place in form of conflict between the fishers and the Fisheries Protection unit (the Army) trying to control poor fishing methods, thefts of fish, cages, boat engines, plastic drums (floaters), feeds, malicious damage of cages, lack of committed and trust-worthy labourers. In Masese where multiple cage operators utilise the same feeders it was mentioned that feeders steal feed and resell it. Yet the Cage Farmers association does not allow incoming farmers to bring their own feeders, and they are required to use feeders already being used by existing farmers.

Natural hazards

These include strong winds, water plants, moving vegetation and Islands that invade cages and the lake level rise that happened in the recent years. The rise in water levels led to fish escape from some cages, and some small-scale farmers halted production. Some of the small-scale cage operators (one or two cages) rely on manual boats to go to their cage sites. This is hard work and the users face the risk of heavy winds. Most of them cannot afford boat engines. A few cage fish farmers mentioned that Nile Perch sometimes rips the cage nets leading to loss of fish.

High initial investment costs

This is the main factor limiting participation of local people. The fish sector has not been supported by government like other sectors. Also lending institutions do not understand the sector well, and are reluctant to lend money to cage fish farmers. The cost of cage nets is high, so farmers keep mending old nets at the risk of fish escaping from the cages. High costs of inputs (cage material, nets, feeds), were mentioned by some cage operators to be limiting their expansion, despite the high market potential. For example, Norvia Investment which had 72 cages by the time of this survey said they intend to expand to 200 cages to be able to harvest fish weekly or monthly, if resources are available. Cage fish farmers mentioned that service providers who distribute support from government (e.g. the Operation Wealth Creation program) usually provide very low quality inputs (very poor grade fingerings and feeds).

Market unavailability and fluctuating prices

Some Cage Farmers have temporality not stocked fish because fish prices are low, yet input process are high. Small-scale cage farmers indicated that they are disadvantaged by big farmers who undercut prices. Cage fish farmers have a challenge of middlemen who offer low prices. So those who can afford buy their own trucks and transport fish directly to more lucrative markets in Busia, Malaba and DRC, as narrated by the respondents below:

> *"Fish prices have greatly reduced. Before COVID-19 we sold fish at 8,000/kg. Now we sell fish at 5,000/kg. The reason for the decrease is that the number of farms has increased and so has production, amidst reduced incomes by consumers. Bigger farmers have the advantage of owning trucks and can transport their fish to farther away markets. But the dealers who buy from here offer low prices"* (Female Cage farmer, Masese).

The market in Rwanda had been interrupted by the border closure, but also the high taxes at the border. It was mentioned each fish truck crossing the border to DRC was charged $2,000 irrespective of size. This means that transporters need to have large tonnage. The market in Rwanda also prefers larger fish (700g-1kg), which some farms do not produce in large tonnage. The farmers feel the current markets may soon get saturated. New markets need to be explored, as farmed fish is not allowed in the EU market.

Limited availability of skilled labour

Regarding knowledge and skills for cage aquaculture, many fish farmers and their workers do not have technical knowledge, and do things on trial and error basis. Cage aquaculture operators have noted that there are few people skilled in the sub-sector. At the same time, there is high labour turnover. When students from tertiary institutions get recruited, they soon leave for better-paying companies, to work in less remote areas or for further studies. While some youths have secured employment at the cage farms, employers observe that some tend to leave because they do not like working in remote settings, and to do very manual jobs. The industry thus faces a problem of non-professional workers, leading to slow growth. Often employees need very close supervision, which is not easy. GIZ is implementing a youth skilling program that includes aquaculture.

4. Conclusion

The purpose of this consultancy is to produce a "Situational Analysis" towards an inclusive and participatory development of the cage culture in the Lake Victoria basin. The situation analysis aimed at determining social carrying capacity of the lake for aquaculture development. In other words, the analysis aimed at determining cage aquaculture development that does not lead to unacceptable social impacts. This analysis considered both areas with current development of aquaculture and those "new" suitable for the potential growth of the activity.

The study found that cage aquaculture is socially suitable in most of the areas where it is practiced. Only in a few instances that cases of incompatibility with existing lake uses were noticed in the three countries. Despite some environment-related challenges associated with the management of the lake and the catchment, and the technical aspects, the study established that cage aquaculture offers benefits such as food, employment, trading opportunities and incomes to local communities. It is thus concluded that through proper planning including appropriate siting and zoning, cage aquaculture offers short and long term social and economic benefits at the local and national level. The TRUEFISH project intervention to adopt the EAA approach to promoting cage aquaculture is anticipated to address the few existing and potential negative effects.

5. Recommendations

1) **Enforcement of existing policy and regulatory framework**
   - There is need for joint planning and monitoring for cage aquaculture development between the Central Government Departments of Fisheries and the Local Governments.

- There is need to ensure enforcement to the LVFO 2018 guidelines for establishment and operation of cage fish farming.
- There is need to update the database of cage aquaculture establishments

2) **Enforcement of environmental regulations and biosafety**

- Monitoring of the cage fish farm operations by the Ministries in charge of fisheries in collaboration with the Fisheries research institutes (KEMFRI, TAFIRI, NaFIRRI) and other stakeholder organizations needs to be strengthened, to prohibit introduction of foreign fish species, and to ensure enforcement to environmental regulations, including the management of non-biodegradable fish feed bags.
- For monitoring to be effective, the capacity of the Fisheries Offices at the local government levels must be enhanced in terms of staffing and equipment.

3) **Harmonization of competing lake uses**

- The process of assessing suitability of sites for cage fish farms should entail both social and biophysical suitability, and involve key stakeholders to create consensus. This will reduce social conflict likely to arise between cage operators and other lake users.
- There should be regular engagement between the key stakeholders including: cage farmers, Fisheries Staff, other key lake users at that specific site (fishers, cage operators, transporters, sand miners, shoreline land owners, cultivators and livestock farmers) to resolve latent conflicts before escalation. This should be initiated and facilitated by government fisheries staff in collaboration with lake users.
- This study only focused on socio-economic aspects and covered few but highly representative areas of the lake. There is need for successive comprehensive studies involving other aspects such as, physical and environment and covering the entire lake. TrueFish project should incorporate this suggestion into the planned project activities.

4) Support improved access to aquaculture inputs

- Local feed manufacturers should be supported to produce quality feed at low cost. The nature of support needed should be discussed on the forum for cage aquaculture operators for further engagement with government. His would encourage local investment in fish feed manufacturing in order to lower production costs.
- There is need for government to control the types and amounts of imported fish feed, to boost local production.
- Restrictions on importation of inputs and nets as a means of controlling use of illegal fishing gear is affecting aquaculture through input scarcity and high cost of nets. Fish farmers proposed that controls on legal sizes of nets should be made at point of use, and not at importation. Cage farmers also proposed that taxes on fishing nets and other cage fish inputs, particularly cage construction materials should be reduced or subsidised. This responsibility should be addressed by other actors as it is not within TrueFish mandate.
- Energy is a key input in aquaculture operations. Cage aquaculture is a growing and lucrative industry that needs government support. Energy subsidies are important to promote local production of key inputs such as feeds.

- Fish transportation needs a good road network because the product is perishable. Local governments should provide reasonable roads, because cage aquaculture is increasingly becoming a key contributor to the economy.

5) **Technical capacity development**

- Capacity development is key to encourage local people's participation in cage aquaculture. This includes organizing fish farmers into producer organizations/co-operatives for training and extension service provision.
- Effective bulk marketing and lobbying for resources will enhance benefits and impact of cage aquaculture among the host communities. Deliberate support of male and female youths and women to own cages as group investments can lead to increased incomes as opposed to low wages offered by employers. Once such groups are in place, support activities such as training on cage aquaculture operations, formalization of the enterprise, savings and financing management can be offered.
- The training and institutionalization of such groups should include streamlining issues of governance to ensure that all the members benefit from their investments. The governance interventions should include participatory decision making systems and accountability by leadership.
- In general there is need to develop technical skills in aquaculture. This can be done by deliberately skilling male and female youths to appreciate aquaculture as a profession. This intervention can contribute to the growth of the industry.

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Appendix I: Number of employees in the sampled cage fish farms

District	Cage Farm	Number of Employees	Number of Local Employees	Number of Female employees	Comment
Buikwe	Norvia Investment	20	15	1	The only female employee is the cook. The farm also hires some casual labourers during harvesting to sort and load fish
	SON	131	118	27	3 women in top management, the rest are in fish sales, netting, production, packing and one woman in security. The farm also hires some casual labourers during harvesting to sort and load fish
	Rock Springs Fish Farm	50	10	8	Local employees do feeding, netting, fish sorting and road maintenance, cooking. Farm occasionally hires casual labour during harvesting.
	Yalelo Uganda Ltd.	407	169	97	The entity is a huge establishment employing over 450 workers in the various departments and fish marketing outlets. Majority of the workers at the farm are from within the surrounding area. There is affirmative action for employing women.
Jinja	Majidu Magumba	6	7	1	Majority of workers are male youths who mainly weave nets and feed fish. A few female youths also feed fish. They learned to row the boats.
	Cooperative member Judith	3	3	2	The association has over 300 cages with 52 operators. They have a pool of over 30 workers, majority of whom are males employed to feed fish.
	Cooperative member Jackie	4	4	2	
	Vamont Fisheries	5	2	1	The technical employees on thee feed mill and on the cages are from outside the district. The casual workers hail from within the community.
Mukono	NAM Fish Farm	8	7	1	One female worker and her husband are the only ones from outside the district.
	Asante Fish Farm	5	4	2	Prefers local employees for purposes of maintaining good relations with community members.
	L. Victoria Precious Cages Farm	40	6	2	Most of the workers are from Arua and Mayuge Districts.
Wakiso	Jakoc Fish Farm	8	0	1	All employees are from outside the district. Stopped employing local people because of theft problem.
	Ssebaggala Fish Farm	3	0	0	Stopped employing local people because of theft problem.
	Pearl Aquatics	10	1	0	The farm is situated in a peri-urban area where most of the residents hail from outside the districts.
	Victoria Treasurers	46	13	1	The farm is situated in a peri-urban area. The surrounding area is characterised by affluent residents.

Appendix II: Data collection instrument

SITUATIONAL ANALYSIS FOR CAGE DEVELOPMENT IN THE LAKE VICTORIA

QUESTIONNAIRE/KEY INFORMANT GUIDE

A. Background information1. Country
(1) Kenya (2) Tanzania (3) Uganda

2. District name_____ 3. Sub-county name _____4. Village _____

5. Respondent name_____ 6. Gender of respondent_____

7. Respondent occupation
(1) Fisheries official (Policy)
(2) Fisheries official (Research)
(3) Fisheries official (Extension)
(4) Fish farmer (Cage aquaculture operator/Practitioner)
(5) Fisher
(6) Transporter
(7) Community/Political leader
(8) Other (specify)_____

B. Information on cage aquaculture development

8. Is there a national aquaculture development policy/plan/strategy?
(1) Yes (2) No (3) Don´t know

9. Which priorities are outlined in the national aquaculture development policy/plan/strategy?
_____

10. What are the local government (County/District) development plans and priorities for cage aquaculture in the respective area of operation?
_____

11. How many sites/areas have been identified/zoned for aquaculture development in the district/sub-county within Lake Victoria? (1) _____(2) Don't know

11a. What are the names of the sites/areas where you operate?
_____

12. What were the rationale/criteria used for zoning these areas for aquaculture?
_____

13. Which areas in your district or sub-county have been identified for future/further aquaculture development?
_____

14. How many fish cages have been installed/are operational within the district?
(1) _____ (2) Don't know

15. What is your opinion about the suitability of identified/selected zones for cage aquaculture development?

Name of zone/area (*As shall be identified in available zoning reports*)	**Opinion about Socio-economic suitability**

16. What is the name of your cage aquaculture farm/establishment?
_____

16a. Which year was it established? _____

16c. Which institutional procedures did you go through to finally decide on this particular site?
_____

17. Which socio-economic aspects did you consider in selecting and establishing the site?
_____

17c.Which are the other **main** lake and land uses in the land and lake area around your cage farm?
_____

17d.Which of those activities complement or are compatible with cage farming? Describe to me the complementarity or relationship between those activities /uses and cage farming.
_____

17e.Which of those lake/land uses conflict or are incompatible with cage farming? Describe to me the incompatibility/conflict.
_____

18. In the vicinity of your cage site, are there other suitable sites for cage aquaculture establishment/expansion? (1) Yes (2) No (3) I don't know

18a. What is the name/description/coordinates of the area?
_____

19. Do you belong to any fish farmers association?
(1) Yes (Please indicate name of the association_____
(2) No (Please indicate reason_____

19a. If yes, what have been the benefits of belonging to the association?
_____

20. Have you supported any projects for the benefit of the community?
20a. (1) Yes (Please indicate name of the project_____)
(2) No (Please indicate reason_____)

21. What was the purpose of the support/project you extended to the community?
_____

C. Suitability of cage sites

22. How do the following land/lake uses activities interact with each other and cage aquaculture, and what is the level of compatibility?

	Cage Fish Farming	Fishing grounds	Fish breeding/ nursery grounds	Land-based aquaculture and hatcheries	Fish landing sites	Fish processing establishments	Navigation routes	Ports	Water intake/extraction points	Household water use	Waste water discharge/industrial effluent discharge	Tourism installations /activity	Recreation facilities	Crop farming practices	Livestock raring	Sand mining	Nature conservation/biodiversity hot	Natural and plantation	Residential areas/ settlements	Cultural heritage sites	Military/ security installations	Factories	Road infrastructure	Hydropower plants, dams
Cage Fish Farming																								
Fishing grounds																								
Fish breeding and nursery grounds																								
Land-based aquaculture and hatcheries																								
Fish landing sites																								
Fish processing establishments																								
Navigation routes (canoes/ship/ferry)																								
Ports																								
Water intake extraction points																								
Household water use																								
Waste water/industrial effluent discharge																								
Tourism installations/activity																								
Recreation facilities																								
Crop farming practices																								
Livestock raring																								
Sand mining																								
Nature conservation/ biodiversity																								
Natural and plantation forests																								
Residential areas/settlements																								
Cultural heritage sites																								
Military/security installations																								
Factories																								
Road infrastructure																								
Hydropower plants, dams																								

	Compatible/non-conflicting lake uses
	Compatible with moderate conflicts
	Conflicting lake uses

23. What are the **non-aquaculture spatial development plans** (housing, agricultural intensification, waste water treatment, fishing, other industries, clearing of trees, other land uses, …) **by central or local governments** to set the context of future zoning?

_____

24. How has the/your cage aquaculture development/establishment in the area **positively affected** human and non-human activities? [*Indicate multiple responses where applicable*]

(1) Improved accessibility to fish markets
(2) Provide market for fish feeds and other inputs
(3) Improved access to market for other goods and services (agricultural produce, general merchandise, transport services, tourism services)
(4) Provided off-farm employment
(5) Increased coverage of infrastructure /social services (roads/electricity, transport, etc)
(6) Increased value of land
(7) Provided market for housing/rentals
(8) Improved security
(9) Others reason _____

24a. Please elaborate on your responses; and indicate the categories of community members most affected **positively, and how they are affected**

_____

25. What can be done, to enhance the positive impacts?

_____

26. How has the/your aquaculture development in the area **negatively affected** human and non-human activities? [*Indicate multiple responses where applicable*]

(1) Displaced population from their activities
(2) Restricted access to fishing grounds
(3) Polluted the environment
(4) Interfered with navigation
(5) Hiked land rentals/value
(6) Increased population influx/competition for employment
(7) Created insecurity
(8) Interfered with tourism/recreation businesses
(9) Other reasons _____

26a. Please elaborate on your responses; and indicate the categories of community members most affected **negatively and how they are affected**

_____

27. What can be done, to mitigate the negative impacts?

_____

28. What challenges face cage aquaculture operations in the area?

_____

28a. What can be done, to mitigate/address the challenges?

_____

Appendix III: Names and positions of interviewed persons

	Name	Gender	Position	District
1.	William Joshua Kadume	Male	Cage aquaculture Manager/Supervisor, Norvia Investment	Buikwe
2.	Allen Kusasira	Female	Operations Manager, Source of the Nile Farm	Buikwe
3.	Robert Osinde	Male	Manager Source of the Nile Farm/Chairperson UCFFA	Buikwe
4.	Sam Orukan	Male	Director, Rock Springs Fish Farm, Nabbaale	Buikwe
5.	Patrick Obwakou	Male	Data Manager, Rock Springs Fish Farm, Nabbaale	Buikwe
6.	James Katali	Male	District Fisheries Officer, Buikwe	Buikwe
7.	Lydia Nakazibwe	Female	Restaurant owner, Nabbaale Landing Site	Buikwe
8.	Farook Ssenabulya	Male	Fisher and Boda boda rider, Kigaya village	Buikwe
9.	Waswa Mayobwe	Male	Fish Trader, Kigaya-Golomolo	Buikwe
10.	Godfrey Kyazze	Male	Local Contact, Fisheries Protection Unit- Kigaya-Golomolo	Buikwe
11.	Joseph Okor	Male	Fisher, Kigaya-Golomolo	Buikwe
12.	Karim Isaabirye	Male	Chairman, AFALU-Nabbaale	Buikwe
13.	Ronald Wafula	Male	Fisher, Nabbaale	Buikwe
14.	Tom Nsubuga	Male	Operations Manager, UFRESH	Buikwe
15.	Majidu Magumba	Male	Cage Aquaculture operator, Masese Cage Fish Farmers Cooperative Society	Jinja
16.	Judith Maduudu	Female	Cage Aquaculture operator, Masese Cage Fish Farmers Cooperative Society	Jinja
17.	Jackie Tibaberwa	Female	Cage Aquaculture operator, Masese Cage Fish Farmers Cooperative Society	Jinja
18.	Hussein Mukuye	Male	Vamont Fisheries - Cage Aquaculture operator, Masese Cage Fish Farmers Cooperative Society	Jinja
19.	Mbilingi Bwambale	Male	Fisheries official (Research)	Jinja
20.	Joyce Akumu	Female	Fisheries official (Research)	Jinja
21.	Sarah Namulondo	Female	District Fisheries Officer	Jinja
22.	Harunah Opio	Male	Fisher, Masese	Jinja
23.	Martin Ochom	Male	Masese, Fish trader, Masese	Jinja
24.	Richard Mulondo	Male	Transporter, Masese	Jinja
25.	Kaliza Iddi	Male	Community /Political Leader, Masese	Jinja
26.	Bumali Kidooma	Male	Fisher/Fish Trader, Masese	Jinja
27.	Deborah Athieno	Female	Fish Feeder/Cage Operator, Masese Cage Fish Farmers Cooperative Society	Jinja
28.	Emmanuel Bwire	Male	Fish Feeder, Masese Cage Fish Farmers Cooperative Society	Jinja
29.	Mujibu Nkambo	Male	Fisheries official (Research), NaFIRRI-ARDC Kajjansi	Wakiso
30.	Derrick Wangwe Powella	Male	Director, Asante Fish Farm	Mukono
31.	Benjamin Kagoda	Male	Manager, L. Vic Precious Cages Farm	Mukono
32.	James Isebaiddu	Male	District Fisheries Officer, Mukono	Mukono
33.	Christine Namaganda	Female	Fisheries Officer (Extension)	Mukono
34.	Muzahamu Mukalazi Kiyaga	Male	Fisheries Officer (Extension)	Mukono
35.	Ronald Musoke	Male	Store Manager, NAM Fish Farm	Mukono
36.	Godfrey Ssegawa	Male	Security Guard, NAM Fish Farm	Mukono
37.	Anyaka	Male	Fish feeder, L. Victoria Precious Cage Farm	Mukono
38.	Benjamin Kagoda	Male	Manager, L. Victoria Precious Cage Farm	Mukono
39.	Ruth Ndagire	Male	Local Council I Chairperson, Bukulwe Village	Mukono
40.	Richard Ssebaggala	Male	Director, Ssebaggala Fish Farm	Wakiso
41.	Andrew Izaara	Male	Director, Pearl Aquatics Farm	Wakiso
42.	Nasur Bakaaki	Male	Cage Aquaculture Technician, Victoria Treasures	Wakiso
43.	Daisy Olyel Aciro,	Female	Fisheries official (Policy)	Wakiso
44.	Stella Nabayunga	Female	District Fisheries Officer	Wakiso
45.	Joseph Ssekaayi	Male	Fisheries Officer (Extension)	Wakiso
46.	Charles Mbuga	Male	Fisher, Nakiwogo Landing Site	Wakiso
47.	Abdu Ssimbwa	Male	Fisher, Nakiwogo Landing Site	Wakiso
48.	Kasujja David Ssalongo	Male	Chairman LC1nn and Fisher	Wakiso

49.	Margaret Awori	Female	Director, Jokoc Cage Fish Farm	Wakiso
50.	Barongo	Male	Feeder, Jokoc Cage Fish Farm	Wakiso
51.	Solomon Ngoboka	Male	Environment and Social Manager, Yalelo Uganda Ltd.	Buikwe
52.	Alaphat Kiwanuka	Male	Grow-out Senior Team Leader, Yalelo Uganda Ltd.	Buikwe
53.	Joseph Omoro	Male	LC 1 Chairperson, Butembe Village	Buikwe

Appendix IV: Some photos taken during field work



Cattle at the lake shore



Interviewing Cage farmer (Masese)



Textile factory at Masese



Sand mining and transportation at Kigaya



Washing motorcycles at the lake shore



Charcoal trade at Nakiwogo