RESEARCH STUDY TO INFORM AQUACULTURE AND FISH WELFARE ON THE SHORES OF LAKE VICTORIA IN KAMPALA UGANDA.

STUDY CONDUCTED BY:
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1.ABSTRACT

The study aimed to investigate aquaculture and its impact on fish welfare in Uganda's Lake Victoria region. Specific objectives included analyzing demographics, evaluating aquaculture practices, assessing fish welfare in the Uganda Context as well as exploring and understanding further water quality, environmental impact and the overall wellbeing of Fish.

Very important to note that Aquaculture in Uganda has been growing steadily over the past decade, with the government recognizing its potential to contribute to food security, poverty reduction, and economic development, however very little or no attention is paid to the Fish welfare in this context.

To put together this Research Study, a mixed-methods design was used involving interviews, questionnaires and focus group discussions with 50 active respondents selected from a diverse population involved in aquaculture. Findings highlighted the importance of water quality management, aquaculture's influence on fish supply and livelihoods, and environmental and community consequences while actively engaging in this practice. The findings also discussed further the impact of aquaculture on the welfare of fish ranging from how fish is fed, the amount and quality of water available for fish to live in, as well as the fish quality in ponds vs fish in fresh water bodies.

This study generally analyzes the constraints related with aquaculture development in Uganda. It highlights the importance of improving the welfare of fish to majorly all who are involved in Aquaculture.

1.1 INTRODUCTION

Aquaculture a growing practice is Uganda literally means the breeding, raising, and harvesting of fish, shellfish, and aquatic plants. Basically, it can be termed as farming in water.

As the demand for fish as a protein food increase in Uganda it will be noted that very many business oriented and minded people have involved themselves in Aquaculture for commercial purposes too. This practice encroaches on the welfare of fish ranging from water quality, natural feeds for fish to being fed on fish pellets very small ounces of food given once in two days.

As we discuss the impact of Aquaculture on Fish welfare, it's important to note that as aquaculture grows, fish welfare must grow too that ranges from the overcrowding in fish ponds, restrictive conditions, better water quality, starvation, and suffocation.

According to the National Agricultural Advisory Services (NAADS) Uganda produces up to 15,000 tons of fish from aquaculture, including production from small-scale fish farmers, emerging commercial fish farmers and stocked community water reservoirs and minor lakes. There are an estimated 20,000 ponds throughout the country with an average surface area of 500 m^2 per fish pond.

In Uganda, the aquaculture enterprise has gained shape with many farmers taking on aquaculture for majorly commercial purposes. This has been mainly due to the fish from natural water bodies like lakes, streams and rivers being insufficient for the fish-eating populations.

However, due to the recent increase in population and high upshot of fish processing plants for export, the natural stocks have dwindled to alarming levels in that, meeting the domestic demand alone is a problem without providing alternative sources of fish.

Aquaculture therefore presents the major alternative to natural water bodies in as far as fish production is concerned. Uganda is widely covered by free-flowing water that can be utilized for aquaculture production and even the large water bodies like lakes and rivers can be utilized for fish cage establishments.

A lot is desired about the welfare of these fish thus the cause for this study. To understand fish welfare, the 5 Freedom Model was constituted to define welfare and these include;

- Freedom from hunger and thirst.
- Freedom from environmental challenges (e.g. water quality or temperature).
- Freedom from pain, injury, and disease.
- Freedom to express normal behavior.
- Freedom from fear and distress.

1.2 MAIN GOALS OF THE STUDY.

- A broad understanding and discussion on the moral implications of fish welfare in aquaculture and argues for the recognition of fish as sentient beings deserving of ethical consideration.

- In depth understanding of the physiological stressors in aquaculture can impact fish welfare and increase their susceptibility to diseases.
- Assessing the Impact of Stress on Fish Health and Performance.
- Assessing fish welfare in aquaculture based on physiological, behavioral, and health indicators.

2.PROBLEM STATEMENT

In Aquaculture particularly with fish farming large numbers of fish are confined in a small area which can cause serious welfare problems. Tilapia and catfish which are the main types of fish kept in fish ponds, that are around 35 cm long, can be given the space equivalent of just a bathtub of water each. Additionally with aquaculture, Fish are more susceptible to disease and suffer more stress, aggression, and physical injuries such as fin damage, along with lack of space, overcrowding which also lead to poor water quality, so the fish have less oxygen to breathe in the long run.

The behavioural requirements of most of the fish species used in aquaculture are poorly understood. It is unlikely that the conditions in intensive fish farming meet even the basic needs of fish. For example, rearing fish in these locally made ponds/ cages prevents their natural swimming behaviour. Fish are naturally migratory, and would naturally swim great distances in natural water bodies. Instead, they swim in circles around the ponds, rubbing against the mesh and on each other thus compromising the fish welfare.

Pellets the major fish feed in aquaculture is often given to fish in a stressful procedure. Some fish may be starved for two weeks or more before emptying the gut. It's important to note that because of the nature of the ponds, natural feeds called phytoplanktons are rare in artificial ponds.

2.1 Technical Requirements Vs Fish Welfare.

In order for fish farming projects to succeed in Uganda as per the Ministry of Agriculture, Animal Industry and Fisheries, it is important to undertake a proper needs assessment before embarking on Aquaculture. There are 3 major requirements that are suitable for fish farming but little or no attention is paid to fish welfare.

2.1.1 Water availability:

Good sites should have good sources of water visible like streams, lakes, springs available at least throughout the year because fish lives and does everything in water. It is the most critical factor to consider. Little or no attention is paid to the amounts of water thus a cause to discuss fish welfare from the onset.

2.1.2 Nature of soil:

Soils are important in that; they hold the water that fish live in. the soils to consider are those that are a mixture of clay-loam. Pure clay cracks during hot weather and is very minimal in nutrients hence it should not be considered. Sandy soil is not desirable because water easily percolates through and hence a lot of water is lost. Areas with sandy soils and

extremely clay soils should be therefore avoided. Few areas in Kampala Uganda where this study was conducted are not clay-loam in texture thus an effect on aquaculture practice.

2.1.3 Size and shape of the pond:

For commercialization of ponds there is need to be at least more than $300m^{2.}$ The ponds must be rectangular for easy management, with a gentle slope for easy drainage, dykes must be well compacted and with a slope at least of 2:1. The minimum water depth should be 1M at the outlet and 0.8M at the inlet. Inlet and outlet pipes must be fitted well. The inlet and outlet pipes should be well screened. Due to the nature of land scarcity in the central region most times farmers cheat these dimensions which in the long run affect proper fish growth.

Aware of these technical requirements, little or no attention is paid to the welfare and living standards of these fish as earlier elaborated on the 5F's that define fish welfare.

3.GENERAL METHODOLOGY

The research study conducted on aquaculture focusing on fish welfare around Lake Victoria the main natural water body in Kampala Uganda where aquaculture is mainly practiced.

This Research employed a mixed methods approach, drawing from both quantitative and qualitative research methods. This dual approach was instrumental in providing a comprehensive understanding of the subject matter. The Research was done with 50 direct respondents involved in fish farming with the use of various methodological approaches. i.e. Interviews through Q&A, Questionaries and focus group discussions.

A set of questions was designed by the research expert in liaison with the Uganda Vegan Society Program Staff to inform the interests of this Research. This answers the questions, what did the researcher want to know, where was the interest regarding aquaculture. A set of questions defining both qualitative and quantitative data were developed and used for this research.

Small Focus group discussion with 10 out of the 50 respondents were also conducted and this informed an integral part of this research Study.

3.1 THE RESEARCH METHODOLOGIES:

3.1.1 Data collection through Questionnaires: To acquire quantitative data, structured surveys were administered to individuals actively engaged in aquaculture. The surveys included questions related to demographics, aquaculture practices, fish welfare, water quality, and the impact of aquaculture on the local environment and communities. The survey method also enabled the collection of standardized, quantitative data from a representative sample of fish farmers.

3.1.2 Interviews:

In-depth interviews were conducted with key stakeholders, including experienced fish farmers, local community members, and experts in aquaculture and environmental conservation. These interviews provided qualitative data and allowed for a deeper exploration of the challenges, opportunities, and perspectives related to aquaculture in the central region.

3.1.3 Focus Group Discussions:

FGDs were conducted with 10 of the 50 respondents with an aim of further understanding the strategies used by fish farmers, duty bearers and key personnel in ensuring fish welfare while practicing aquaculture.

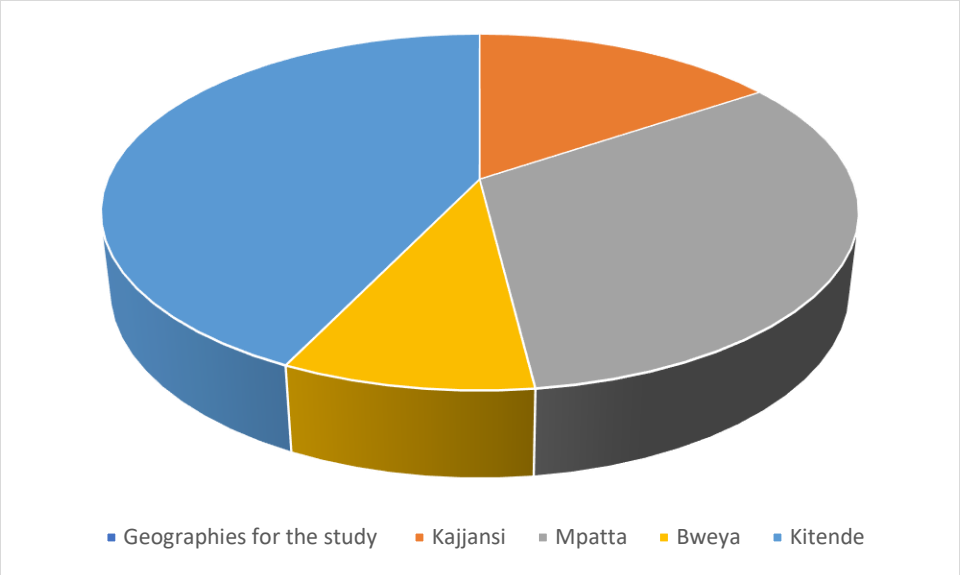
3.1.4 Data Analysis:

Quantitative data from the surveys were analyzed using statistical tools to derive descriptive statistics, such as frequencies, percentages, and correlations. The quantitative analysis aimed to provide a comprehensive overview of the demographics, practices, and perceived impacts of aquaculture on fish welfare. The tools used for this research include the Participatory Rural Approach (PRA) focusing on the farmers themselves at grass root level.

4.RESEARCH FINDINGS

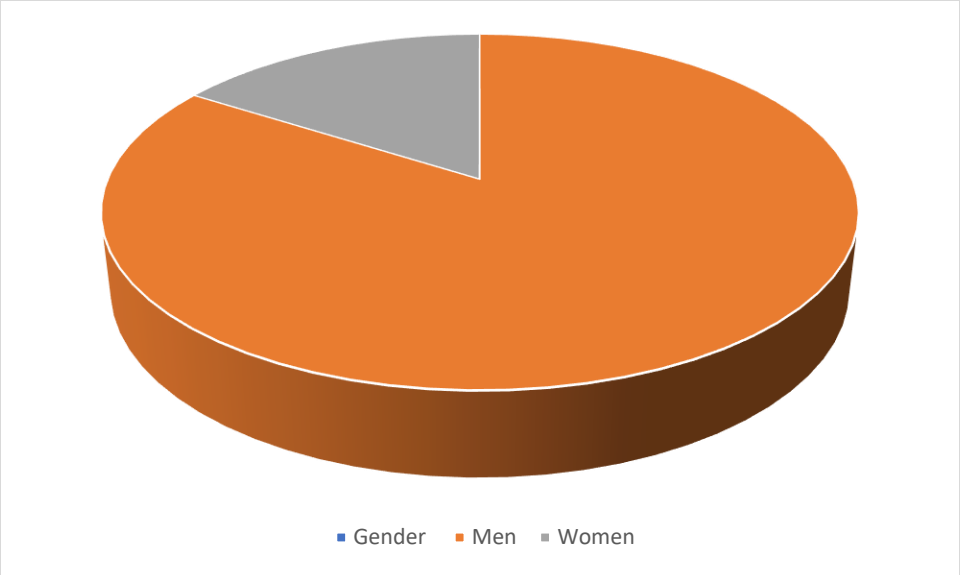
4.1 Demographics and Aquaculture Practices

The heart of the aquaculture industry around Lake Victoria is a dynamic group of persons aged between 20 - 40 years. Their involvement underscores a promising future for fish farming, driven by youthful energy and innovative ideas. The study was done in the geographies of Kajjansi, Mpatta village, Bweya and Kitende.



Fish farming in the Lake Victoria region predominantly relies on the utilization of ponds. Ponds provide controlled environments where factors like water quality and fish welfare can be closely monitored and managed, reflecting a commitment to maintaining optimal conditions for fish growth and overall health. This is a key factor in fish welfare. The majority of respondents have lived in close proximity to Lake Victoria for more than five years, signifying a deep-rooted connection to the lake and its resources. This long-term residency contributes to a profound understanding of the local ecosystems, which is crucial in fish farming.

Majority of the respondents were males and these very ones are the biggest representative of men practicing Aquaculture.



To better understand the welfare of fish in aquaculture we used the 5 Freedoms approach and these are some of the findings gathered.

The 5 Freedoms are;

4.1.1 Freedom One. Freedom from environmental challenges (e.g. water quality or temperature).

The quality of water in these catchment areas is a critical determinant of fish welfare. Water pollution and salinity issues have been identified as impediments to fish growth, Respondents suggest solutions ranging from water treatment to stringent water quality standards, reflecting their dedication to ensuring optimal fish welfare.

Fish farming presents a dual-sided impact on the environment and local communities, The long-term effect of this practice includes the draining of swamps, pollution, and habitat disruption which affects environment largely in the long run. Quotation for respondent Kigundu seith from Mpala *"…the fish is stressed due to inability to move freely and as a result the fish is poor in quality."*

4.1.2 Freedom two. Freedom from hunger and thirst.

Research findings has shown hunger and thirst in aquaculture. There is a high starvation rate, fish being fed once a week, sometimes once in two weeks, and even when the feeds are given it is on small pellets / flakes. It has been observed that there are being fed and with inappropriate feeding methods and being allowed to perform a correct osmoregulatory response. Respondents said that a poor diet can lead to disease and malnutrition (lack of essential nutrients or elements), poor appetite and changes in behaviour leading to stress responses. These are some of the major constraints suffered in aquaculture.

Feeding methods and regimes can affect the social structure of the fish tanks/cages. One point feeding can lead to aggression and hierarchies, dominance and chronic stress and this is a common practice in aqua culture. Fish are fed in one common point on the entire pond. Other methods of feeding: Continuous vs discrete feeding, predicted vs unpredicted etc. have been observed in this research according to the species-specific needs. The same happens with the day and night feeders and that should be considered to allow natural behaviours. Respecting the natural behaviours of the animals like feeding behaviour is one of the key domains related to the welfare of the fish. To quote a respondent Ms. Margret from Kigunga on what hinders freedom from hunger and thirst. *"…These fish are only given food in this case the fish pellets after a week or some times even after two weeks, put your self in the shoes of these fish getting food after a week, this is real starvation."*

A picture showing fish pellets

4.1.3 Freedom Three. **Freedom from pain, injury, and disease.**

This explains an in-depth understanding of how fish live in water. To prevent fish from injury and disease and pain. Fish ought not to be over crowded. Overcrowded fish hurt each other from fin damage to tail damage to mention but a few. This is the long run causes suffocation and death since fins are an important part of the fish. Research finding noted that this freedom is deprived of following the various living conditions the fish are subjected to. A respondent was quoted saying, *"… sometimes we find these fish with broken fins or even some die in the water due to congestion."*

4.1.4 Freedom to express normal behavior.

Fish are naturally swimmers this is what defines their living. Fish swim long distances and this determines the welfare of fish. Fish can not only adapt to their environment, but they need face biological challenges to reach optimal well-being and to get a sense of stability through a

dynamic nature. This process according to Senior Researcher and Biologist at Fisheries point in Kajjansi town council, that houses some of the largest fish ponds in Uganda is called “allostasis”. This fulfills fishes’ freedom to express natural behavior by creating a proper degree of stimulation. As a result, fishes can achieve a balance between positive and negative experiences, which improves their quality of life. In our findings due to the lower table levels of water and small ponds fish are not allostating as would be for fish living in the natural habitats like the lakes.

4.1.5 Freedom from fear and distress.

Lastly the other freedom that was paid attention to is the fear and distress. This can be due to exposure to predators as a welfare issue for the fish. Exposure to predators may cause a stress response just by the sight or smell of the fish around the ponds or cages. Also, some of the ways of reducing the predator risk might affect the fish, for example, the noise produced by some deterrents. Acoustic deterrents can affect the wildlife around the cages. Some issues related to wild animal welfare are the fish or crustaceans or other farmed aquatic animals, escapees, via adults, seeds or larvae. There are risks of introgression with natural native populations, the danger of introduction of diseases and the potential to become invasive species like Tilapia. This being the commonest specie kept by farmers in Uganda can be potentially harmful to the welfare of fish. Issues for welfare include stocking densities and exposure to predation.

5. CONCLUSION

How do we get to achieve fish welfare in aquaculture?

The respondents had some after action reviews and some lessons they have learnt over the years. They mention that some practices are adaptable and that its important to plan for healthier eco systems putting the 5Fs at the fore front.

Also to note that as aquaculture continues to grow in Uganda, fish welfare must grow too. Lastly to note that fish welfare is the future. There

is no healthy aquaculture practice without noting that welfare is the right thing for the environment, and the fish.

Most of the food values being hunted in fish can also be achieved in plant based foods rich in proteins.

After Action Review

1. Fish with high welfare have fewer diseases and parasites.
2. Fish with higher welfare have better survival rates and increase farm efficiency.
3. Higher welfare sustains a healthy ecosystem and environment.
4. Higher welfare ensures the conservation of local species.
5. High welfare is the right thing for fish.

APPENDICE 1:

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