Technical Report

STRATEGIES TO IMPROVE PROFITABILITY AND MARKET ACCESS FOR FISHERIES ENTERPRISES ON LAKES ALBERT, KYOGA AND VICTORIA, UGANDA



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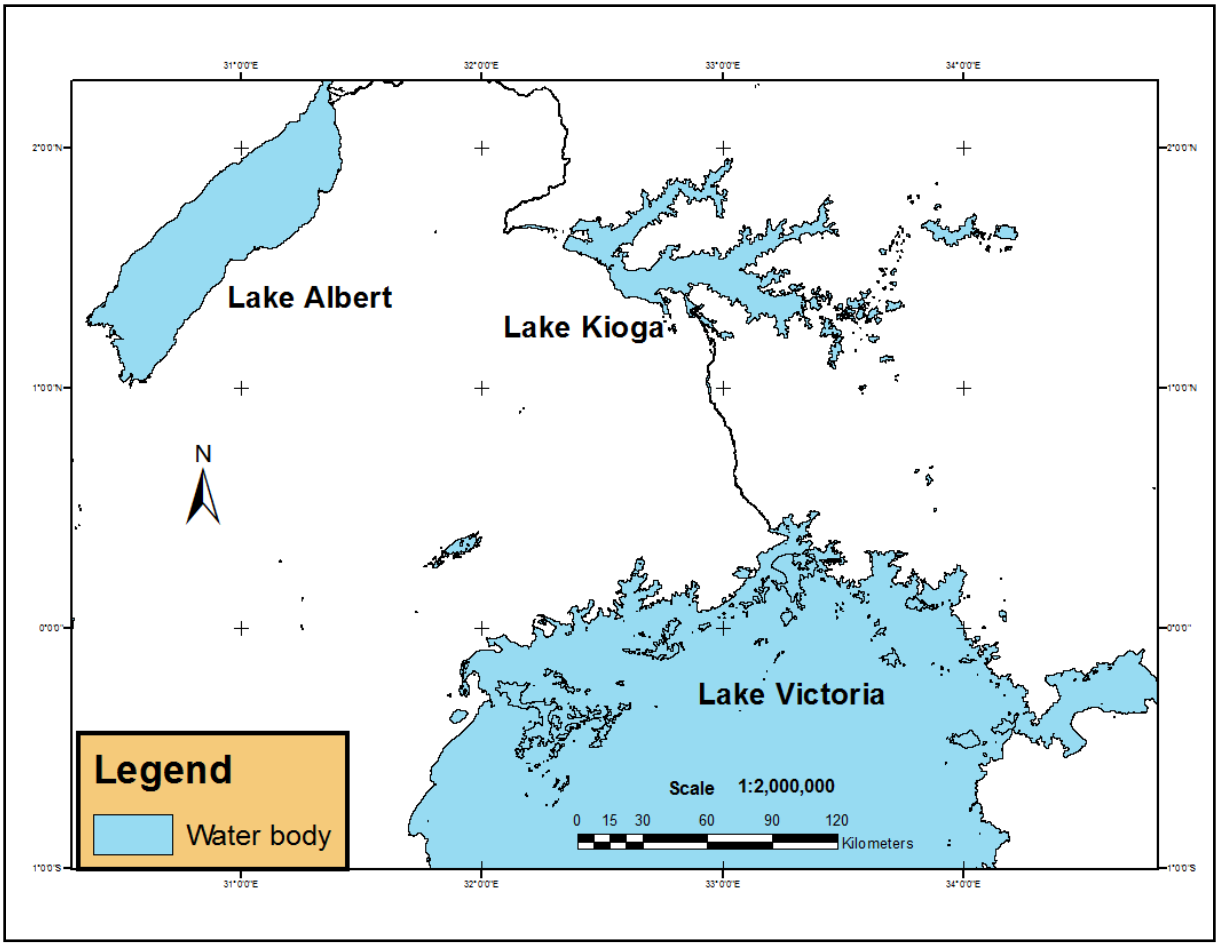

Fig. 1: Map of Lakes Albert, Kyoga and Victoria showing landing sites sampled under the study

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Acronyms

BEP	Break-Even Point
DFR	Department of Fisheries Resources
DRC	Democratic Republic of Congo
DSIP	Development Strategy and Investment Plan
LVFO	Lake Victoria Fisheries Organisation
NaFIRRI	National Fisheries Resources Research Institute
NARO	National Agricultural Research Organisation
NDP	National Development Plan
PBP	Pay-Back Period
SPSS	Statistical Package for Social Scientists
TC	Total Cost
TFC	Total Fixed Costs
TR	Total Revenue
TVC	Total Variable Costs

Executive summary

1. Introduction

The purpose of the research was to determine economic returns for the different commercial fish species enterprises on Lakes Albert, Kyoga and Victoria and develop strategies for enhancing profitability and market access, aimed at improving incomes of fishers. The methodology involved secondary data review, focusing on past fisheries frame, catch assessment and socio-economic surveys and a sample survey of fishers conducted at 20 landing sites covering 587 respondents. the key profitability indices, namely gross annual profits, break-even points and pay-back periods were computed for the commercial species of the water bodies. The main market destinations and characteristics were also identified and transaction costs determined.

Net profit is a measure of the profitability of an enterprise after accounting for all costs. It is the money left over after paying all the expenses of the fishing business. Break-even point is the level of catch a fisher needs to achieve for costs and revenues to be equal, resulting in neither loss or gain for the fishing unit. Pay-back period refers to the period of time required for the return on an investment to "repay" the sum of the original investment. All else being equal, shorter payback periods are preferable to longer payback periods.

2. Results and discussion

2.1 Characteristics of fishers

The results revealed that there was gender disparity in the fisheries, with 85.6% and 14.4% of the boat owners being males and females respectively, implying inequitable distribution of earnings from fisheries. Most respondents had attained incomplete primary level education (46.8%), followed by incomplete secondary education (22.2%), a condition which would limiit their capacity to adopt improved resource management practices and productivity technologies.

2.2 Fish production costs

The average number of days fished per week was 5, giving an average of 260 fishing days in a year. The number of days fished for mukene on Kyoga and Victoria and *B. nurse/ N. bredoi* on Albert was about half of this, as fishing the species during full moon was not considered paying. Most respondents targeted *B. nurse/ N. bredoi* (48.2%), tilapia (56.8%) and Nile perch (43.1%) on Albert, Kyoga and Victoria respectively.

The main type of boat used on Albert was the Congo barque, on Kyoga the ssese and “parachute” and on Victoria, mostly the ssese with a few parachute. Average costs of boats were Shs 636,336; 823,000 and 277,280 for Congo barque, ssese and parachute respectively. The life spans for the above boat types were 3.1, 4.2 and 3.3 years respectively.

The respondents who fished with outboard engines were 21.1%, mostly found on Albert and Victoria, using outboard engines of less than 10 HP, of average cost of Shs 3,636,208, with average life time of 10 years.

Labour was the highest cost item in fish production, incurred in fishing, gear preparation and splitting fish. Annual labour costs per boat were highest for Nile perch (Shs 16,623,418), followed by tilapia (Shs 11,920,497).

Of the different gear types in use, the most common legal types were the multifilament gill nets of legal mesh sizes and mukene seine nets. On average, respondents used 72 gill nets per boat, with a unit value of Shs 50,817. For mukene seine nets, the average number of units used was 1.4, valued at Shs 459,173 per unit. Annual expenditures on gear were highest for *B. nurse/ N. bredoi* (Shs 1,617,553) and mukene (Shs 1,018,814) per boat while for Nile perch it was Shs 467,987.

Other costs included the small implements, namely oars, floats, sinkers and anchors. For light fishing, lanterns, paraffin, basins and drying racks are used. Operational expenses included food, polythene sheets, charcoal, blankets and cigarettes. The proportions of the cost items indicated that the highest were labour (50%) and crew expenses (32%). Overall, annual total costs per boat were highest for Nile perch (Shs 25,016,983), followed by mukene (Shs 21,129,148).

2.3 Sales revenues

Revenues were determined by the catches and fish prices. On average, Nile perch average daily catches per boat were 24.7 and 89.2 kgs for low and high catch seasons respectively. Its average prices were Shs 6,094 and 4,764 per kg during low and high catch seasons respectively. Low catch seasons lasted on average for 8 months in a year. Overall, annual total revenues per boat were highest for *B. nurse/ N. bredoi* (Shs 92,342,467), followed by *Hydrocynus* (Shs 72,063,160).

2.4 Profitability indices

Based on annual total cost and revenue data, the highest annual gross profits before taxation were for *B. nurse/ N. bredoi* (Shs 77,487,687), followed by *Hydrocynus* (Shs 61,337,783). The annual profits for Nile perch, tilapia and mukene were Shs 38,434,631, 11,327,840 and 36,846,693 respectively.

Break even points for Nile perch and tilapia was 4.6 tonnes per year, mukene 1,091 basins and *B. nurse/ N. bredoi* 1,427 basins.

Pay back periods were for Nile perch 1.3 months, tilapia 7.0 months, mukene 0.8 months and *B. nurse/ N. bredoi* 0.2 months. The pay back periods were low because as shown above, investments were not the main cost items in fish production but labour, which is not included in pay back period computations.

The factors respondents considered most import for profitability of their business were high fish demand (89.1%), effective enforcement of fisheries regulations (67.3%) and access to input supply (65.9%). Access to refrigerated trucks/ boats and access to credit were not considered so important (30.1%).

2.5 Market access

With respect to access to market, the main buyers of fish were local traders (55.6%), direct consumers (21.1%) and factory agent/industrial processors (12.8%). The fishers sold mostly at their beach markets (83.5%) and in other districts (10.0%). Respondents' most commonly used means of transport for fish were boats (31.6%) and hired trucks (27.5%). The main market destinations for Albert were Panyimur and Kampala, for Kyoga were Soroti and Gulu and for Victoria were Kampala and Jinja.

On average, respondents made 2.1 trips to the market per week, covering a distance of 3.6 km to the main markets and incurring annual transaction costs of Shs million 8.4 and 3.6 on transport and Fish Movement Permit charges respectively.

3. Conclusions and recommendat*ions*

Fishers have a chance to achieve high income levels compared to other rural producers in the economy. However, to compensate for declining stocks and catches especially of Nile perch and tilapia, they have to apply a combination of high price markets and high value products. Stable stocks of the small pelagics are also opportunities for high incomes but fishers should guard against high cost production and economic as well as physical post-harvest losses, triggered mainly by weather variations. They should operate in groups to minimize their costs by purchasing gear in bulk and hiring transport to markets jointly. Through the groups, they would also be given training in business management to improve their decision making.

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1. INTRODUCTION

1.1 Background

The fisheries sector of Uganda has enormous potential to contribute towards national development goals, yielding benefits in the form of incomes and food security to communities, profits for the private sector and revenues for the state. Uganda is striving for a competitive, profitable and sustainable fisheries sector envisaged in the vision of the National Fisheries Policy, in line with NDP and the Agriculture Sector DSIP. A major constraint to this development is limited understanding of profitability of fisheries of the lakes, weak marketing systems and poorly defined value chains.

Lake Albert, one of Uganda's major water bodies, is shared between Uganda and the Democratic Republic of Congo (DRC). In Uganda, it is situated within five districts, namely Nebbi, Buliisa, Hoima, Kibaale and Ntoroko. Fishing is a major livelihood activity for each of the districts, supplementing crop and livestock farming and commodity trade. It provides direct employment to estimated 15,420 fishers as boat owners and crew members, operating about 6,000 boats (Mbabazi *et al*, 2012). The main species targeted are Nile perch, tilapia, *Bracynus nurse* (muziri) and *Neobola bredoi* (ragoge), *Hydrocynus forskali* (ngasia), *Alestes baremose* (angara) and *Bagrus bayad* (lanya). The annual catch for 2012 was estimated at 151.6 tonnes, valued at USD million 49.7, with 79% of it made up by *B. nurse* (35%) and *N. bredoi* (44%) (Mbabazi *et al*, 2012).

Lake Kyoga, the third largest water body in Uganda, lies entirely within the boundaries of Uganda. It is shared between nine districts, namely Kayunga, Nakasongola, Apac, Dokolo, Amolatar, Kaberamaido, Serere, Kumi and Buyende, spanning the Central, Eastern and Northern Regions of Uganda. The region is home to close to 3 million people, or 10% of Uganda's total population. It is a semi-arid region, with livestock keeping and crop farming being the major income activities. Fish catch from the Kyoga lakes has continued to decline gradually in the recent years, having fallen drastically from the all time high of 165,000 tonnes per year in the 1970s, when they were the most productive water bodies in the country. The Kyoga lakes now contribute about 60,000 tonnes of fish, or about 16% of Uganda's total annual fish catch (DFR 2012). The estimated number of boats in 2008 was 8,405 (NaFIRRI 2009).

Lake Victoria is Uganda's largest water body, shared between Uganda (45%), Kenya (6%) and Tanzania (49%), with the Ugandan portion covering 31,000 km^2, within 14 Districts, namely Busia, Namayingo, Bugiri, Mayuge, Jinja, Buikwe, Mukono, Kampala, Wakiso, Mpigi, Kalungu, Masaka, Rakai and Kalangala. For the Ugandan portion of the lake, its contribution to the national fish catch was 45.7% in 2012 (UBOS, 2013). The number of fishers in 2010 was 56,957 and the number of crafts was 23,455 (LVFO, 2010). Fish catches from the lake have been decreasing over time, attributed to the widespread use of inappropriate fishing gear and methods, inadequate capacity within the Department of Fisheries Resources and Beach Management Units (BMUs) to enforce regulations and lack of co-operation from some fishers, among others (LVFO, 2010). The commercial species of the lake are Nile perch, tilapia and *Rastrineobola argentea*, locally known as mukene. Uganda's major urban and commercial centres, namely Kampala, Jinja, Entebbe and Masaka, are located close to the lake, hosting most of the fish factories. The lake is source to fish for the domestic, regional and international markets.

Under Uganda's development goals, a minimum income of Shillings 20 million per year has been set as the target for household and there is need to develop strategies to achieve this in fisheries. This technical report provides insights into the business aspects of fishing on Lakes Albert, Kyoga and Victoria and how incomes can be improved to achieve the above target.

1.2 Objective

The objectives of the study were as follows:

i) To determine economic returns for fisheries enterprises for optimum exploitation of the commercial fish species on Lakes Albert, Kyoga and Victoria.

ii) To develop strategies to improve market access for the commercial fish species, their products and by-products locally, nationally and regionally.

1.3 Expected outputs

i) Profitability indices, namely Annual profits, Break-even points and Payback periods, estimated and drivers of profitability identified for optimum exploitation of commercial fish species on Lakes Albert, Kyoga and Victoria.

ii) Market characteristics, main market destinations and transactions costs for commercial fish species established for improved market access.

1.4 Expected outcomes

The expected outcomes of the project would include:

i) Increased economic returns from fisheries enterprises, resulting from knowledge of profitability and the underlying factors.

ii) Improved market access for fishers as a result of better information on market opportunities along the value chains.

1.5 Expected impacts

i) Improved incomes for fishers as a result of engaging in profitable fisheries enterprises.

ii) Improved livelihood indices for fishing households resulting from improved market access and earnings.

2. THEORETICAL CONCEPTS

In the study, the profitability indicators examined were annual profits, break-even points and pay-back period for the different commercial species and water systems.

2.1 Annual profits

Net profit, also referred to as the bottom line, net income, or net earning, is a measure of the profitability of a venture after accounting for all costs. Net profit is the money left over after paying all the expenses of a business. To calculate net profit, subtract all costs, including a fair share of total corporate overheads, from the gross revenues or turnover.

$$\text{Net profit (NP)} = \text{Sales revenue (TR)} - \text{Total costs (TC)}$$

Net profit is a measure of the fundamental profitability of the venture. "It is the revenues of the activity less the costs of the activity. Total revenues are given as the total of all the products of sales quantities and prices. Total costs are given as a sum of fixed, variable and overhead costs. For fixed costs, annual depreciaton and maintenance costs are used. for variable costs, the full amounts incurred in a year are considered while for overhead costs, they are included for the year.

2.2 Break-even points

Break-even point (BEP) is the level of catch at which costs and revenue are equal and as a result, there is no net loss or gain and the enterprise has "broken even." It is shown graphically as the level of catch (BEP) where the total revenue (TR) and total cost (TC) curves meet (Fig. 2).

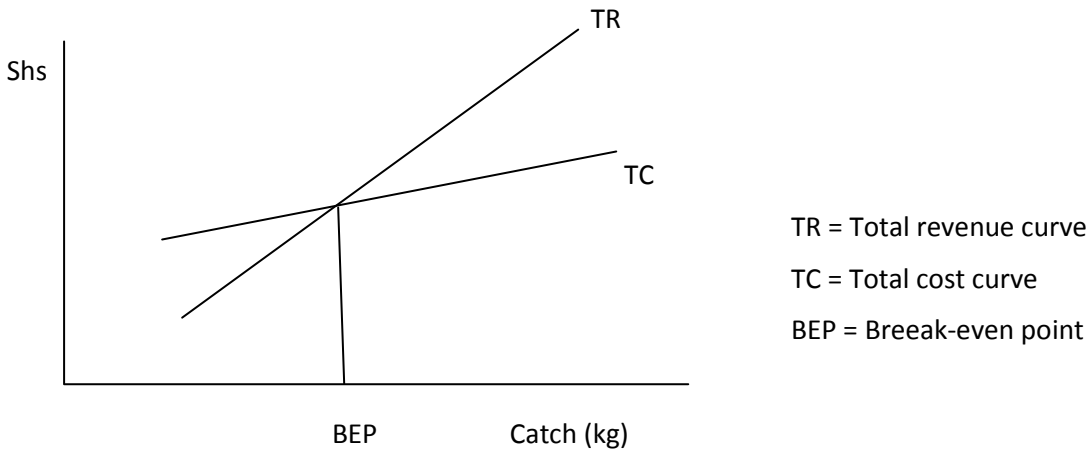


Fig. 2: Derivation of BEP from revenue and cost curves

BEP is derived from the equaton below:

Total Revenue (TR) = Total Cost (TC)

= Total Fixed Costs (TFC) + Total Variable costs (TVC)

2.3 Pay-back period

Payback period refers to the period of time required for the return on an investment to "repay" the sum of the original investment. All else being equal, shorter payback periods are preferable to longer payback periods. Payback period as a tool of analysis is often used because it is easy to apply and easy to understand for most individuals. When used carefully to compare similar investments, it can be quite useful. The payback period is a method of analysis with some limitations and qualifications for its use, because it does not account for the time value of money, risk, financing or other important considerations, such as the opportunity cost.

3. METHODOLOGY

3.1 Data sources

The study was conducted using the following methods:

i) Literature review of theoretical concepts and methodological approaches appropriate for the study were conducted at NaFIRRI, making use of web resources..

ii) Secondary data search was carried out at NaFIRRI, LVFO, DFR and MAK to establish and review existing data and information relevant for the analysis and identify gaps that would be filled through field data collection.

iii) Field sample surveys were conducted at twenty purposively selected landing sites, covering 587 respondents on Lakes Albert, Kyoga and Victoria.

iv) Key Informant Interviews were held with Beach Management Unit (BMU) leaders at the twenty selected landing sites to obtain overall landing site data.

v) Field observations were made at data collection sites.

3.2 Data Analysis

Data analysis involved the use of SPSS Ver. 17 and Excel 2007 as follows:

i) Data entry into SPSS, for numeric and string variables.

ii) Capital costs were computed as depreciation on the capital items, namely boats, engines, gear, oars, floats and sinkers, anchors, lanterns and basins.

iii) Labour costs for fishing, net preparation and fish splitting were computed on number of workers deployed, days worked in a year and amounts paid.

iv) Other operating costs, namely fuel, food and cigarettes were computed on annual basis, based on number of days worked.

v) Catches were computed based on number of days worked for high and low catch seasons.

vi) Sales were computed from catches and prices for high and low catch seasons.

vii) Annual profits were computed as the difference between annual sales and costs per species.

viii) Break even points were computed as the quantity of catch at which the sales revenues were equal to total costs.

ix) Pay-back period was computed as the number of years in which the annual profits add up and equal to the investment costs.

4. RESULTS

4.1 Characteristics of fishers

The characteristics of the fishers on Lakes Albert, Kyoga and Victoria were examined and the information is summarized in this section.

The gender composition of respondents consisted of 93.5%, 81.9% and 82.2% males and 6.5%, 18.1% and 17.8% females on Lakes Albert, Kyoga and Victoria respectively.

The educational achievements data on the fishers revealed that majority of the respondents were of incomplete primary education (46.8%), followed by persons with incomplete secondary education (22.2%) (Chart 1,Table 1). Proportions of respondents who completed secondary was around 5% fior all the water bodies but for tertiary level, Victoria (0.8%) lagged behind Kyoga (1.9%) and Albert (1.8%).

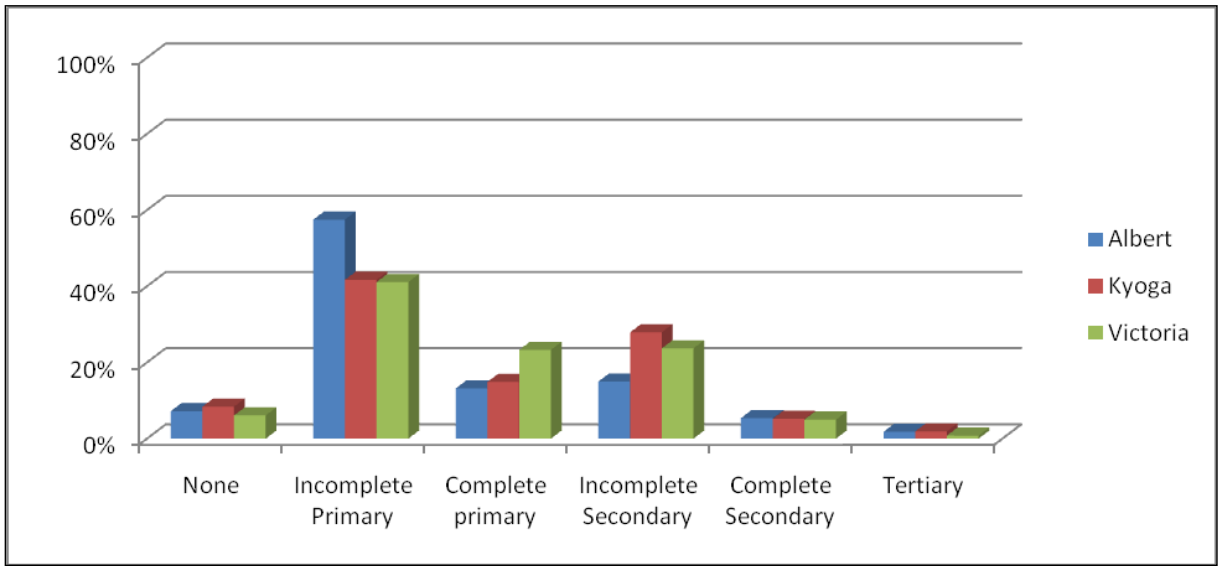


Chart 1: Educational achievements of respondents by water body

Overall, respondents fished on average 5.0 days in a week (Chart 2, Table 2). The lowest average of 4.6 days was on Kyoga. With respect to species, mukene fishers on Kyoga had the lowest number of days fished per week (4.2). It was also fished about half of each month, during the dark phase of the lunar cycle.

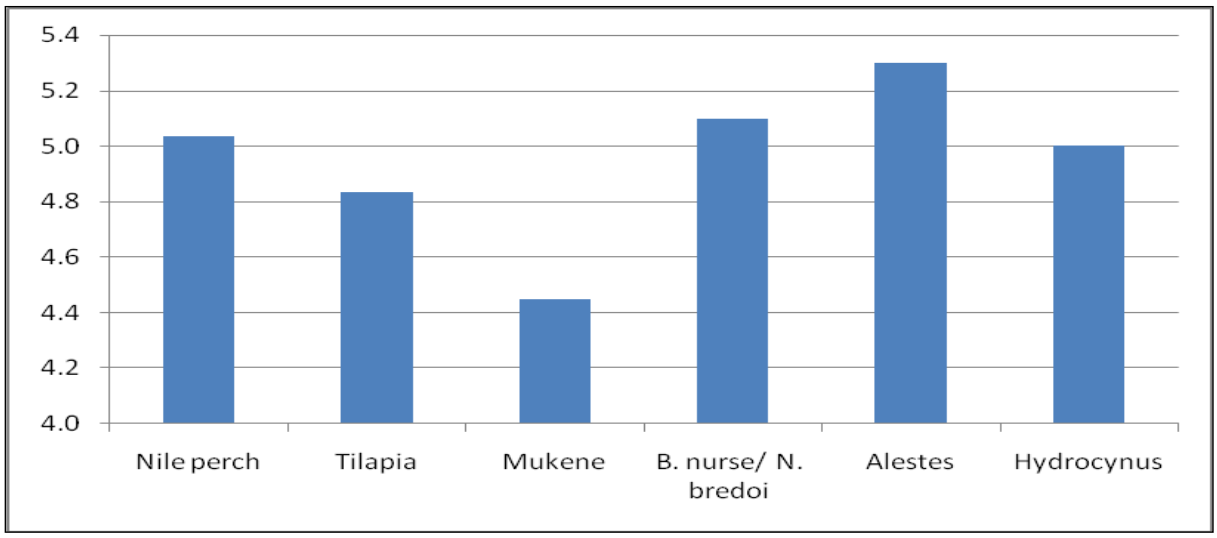


Chart 2: Average number of days fished in a week by species and water bodies

Fish species targeted varied from one water body to another. On Albert, most respondents targeted *B. nurse/ N. bredoi* (48.2%) due to its stock abundance, feasibility of its production and ready market as raw material for feed producton. It was followed by tilapia (17.3%) and *Hydrocynus* (13.7%) (Chart 3 and Table 3).

On Kyoga, the majority of respondents fished tilapia (56.8%), due to stock availability and demand for the species. It was followed by Nile perch (29.0%).

On Victoria, the majority fished Nile perch (43.1%), followed by tilapia (32.2%), due to the high demand and prices for the species.

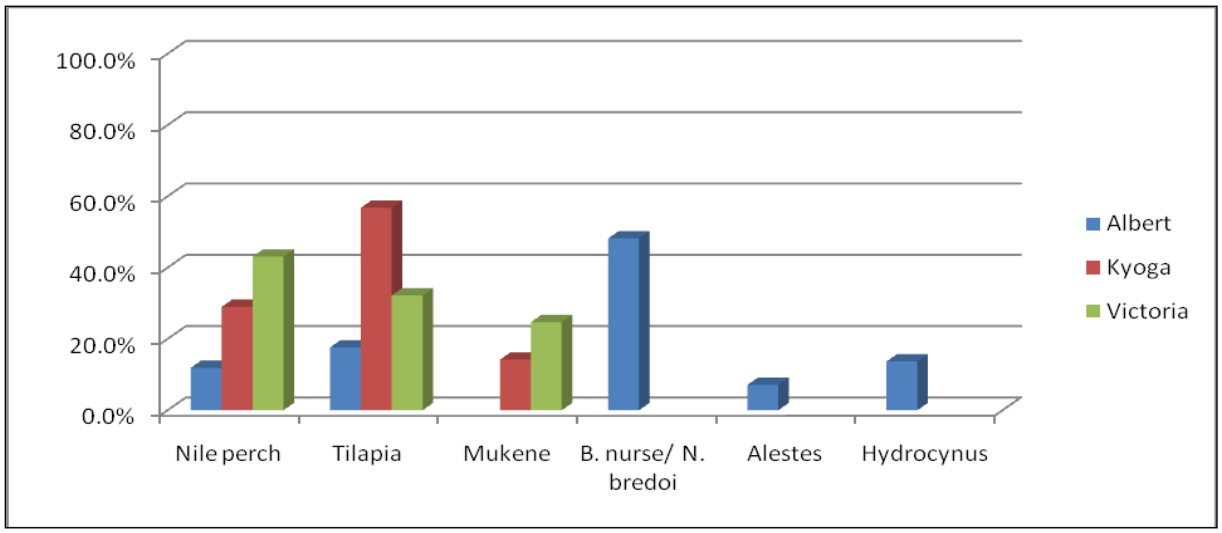


Chart 3: Proportions of respondents who targeted the different species by water body

4.2 Fish production costs

4.2.1 Fishing boats

Fishing boats owned and used were examined and the results revealed that 83.9% of the respondents owned the boats they used while 16.1% rented them. There was more renting of boats on Kyoga (26.7%) compared to Albert (10.7%) and Victoria (11.0%).

Among those who rented the boats, the average rent paid per day was Shs 7,719. Boat rent was highest on Albert (Shs 15,429 per day), because it was charged in proportion to catch, compared to Kyoga (Shs 2,348) and Victoria (Shs 5,379) where flat weekly or daily rates applied.

Among respondents who owned boats, the main characteristics of the boats were as follows:

i) The majority used Congo barque, parachute and ssese on Albert, Kyoga and Victoria respectively (Table 4).

ii) The average number of boats per person were 1.5, 1.9 and 2.0 on Albert, Kyoga and Victoria respectivley.

iii) The average cost per boat for Congo barque, parachute and ssese on Albert, Kyoga and Victoria respectively were Shs 636,336; 347,514 and 989,571 (Chart 4).

iv) Repair costs per half year ranged from Shs 59,250 for parachute on Kyoga to 198,449 for ssese on Victoria.

v) Life spans for Congo barque, parachute and ssese were reproted to be 3.1, 3.6 and 4.2 years respectivley.

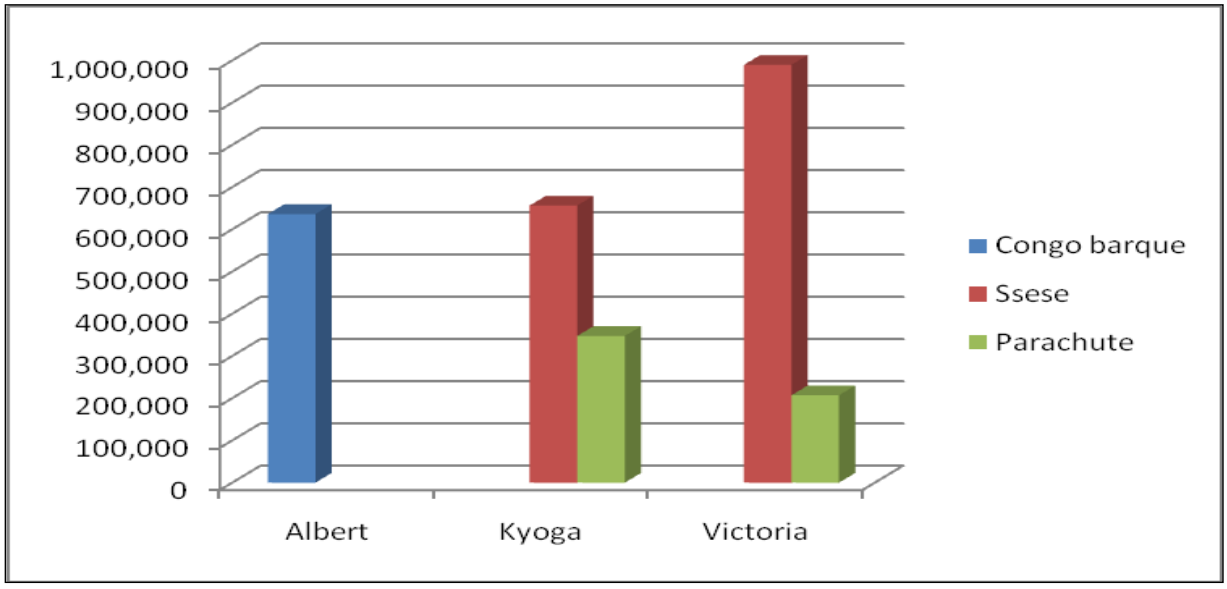


Chart 4: Average costs of boat types by water body (Shs)

Annual boat operation costs for the different species and water bodies were examined, based on straight line annual depreciation of the boat costs, using their life spans. The data revealed that on average, the annual cost of boat operation was highest for Nile perch (Shs 481,703), and least for tilapia (Shs 259,677) (Chart 5, Table 5).

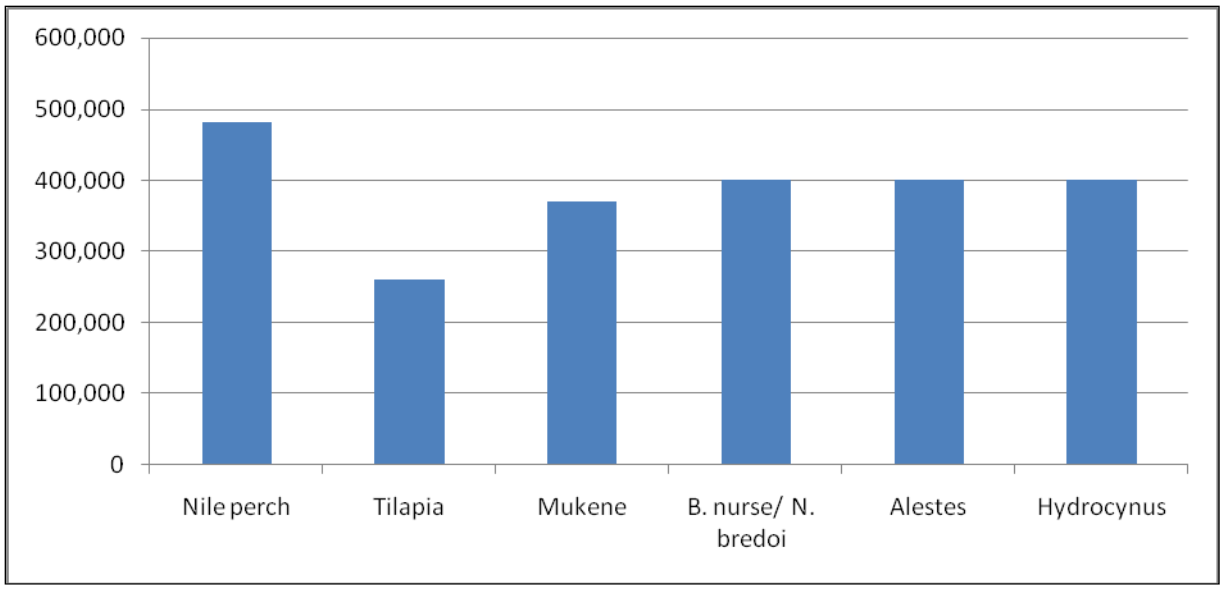


Chart 5: Average annual boat costs of operation by species (Shs)

4.2.2 Motorised fishing

Motorisation of fishing by the enterprises was established at 21.1% of the respondents, with the highest levels being on Victoria at 31.40%, followed by Albert at 29.8% and lowest on Kyoga at 2.1% (Chart 6, Table 6). Motorisation by species was highest for Nile perch on Victoria (50.4%), followed by Nile perch on Albert (35.0%) and mukene on Victoria (30.5%).

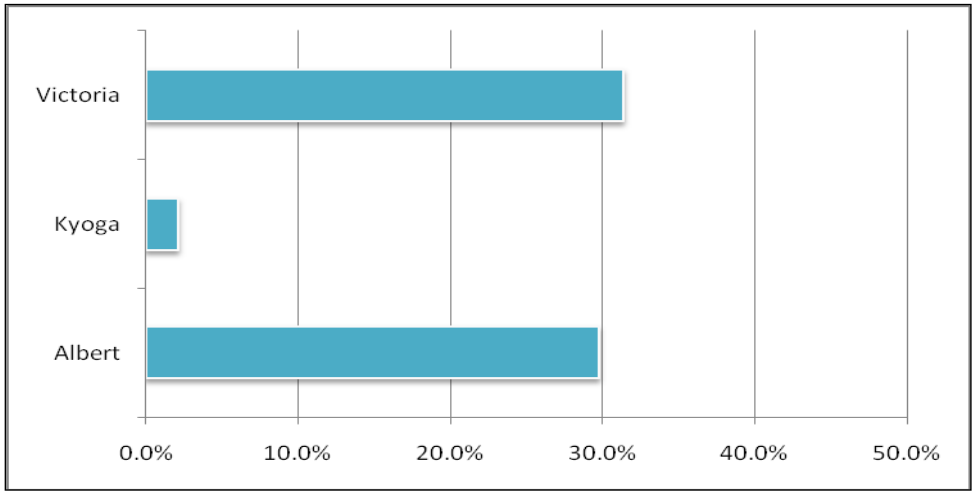


Chart 6: Proportions of respondents who fished with outboard engines

The engines most commonly used were of less than 10 HP and those between 10 to 20 HP, forming 55.8%and 44.2% respectively on Albert. On Victoria, there were more of the bigger engines and the proportions were 45.35% and 54.7% for the less than 10 HP and between 10 to 20 HP engines respectively. As mentioned earlier, motorised fishing on Kyoga was insignificant.

Cost of the engines varied from engne size to size and between the water bodies. The engines of less than 10 HP cost on average Shs 4,087,800 and 3,184,615 on Albert and Victoria respectively (Table 7). Engines of between 10 to 20 HP cost Shs 8,963,200 and 5,521,300 on Albert and Victoria respectively.

Fuel cost data was obtained from Albert and Victoria because of the significant levels of motorization there compared to Kyoga. On average, more fuel was used per day on Victoria (33.4L) compared to

Albert (19.0L), due to the distances to the fishing grounds and sizes of engines used (Table 8). Consequently, more oil was used on Victoria.

4.2.3 Fishing oars

The fishing oars commonly used were categorized as small and large (Table 9). On Albert, more fishers used large oars (82.22%) than small oars (17.78%). This was attributed to the method or rowing, involving simultaneous backward rowing by a pair of crew. On Kyoga the preference was for small oars (61.40%) compared to large oars (38.6%). Similarly, on Victoria, more respondents used small oars (84.45%) than large oars (15.55%).

The oars were not high cost item in fish production, ranging from Shs 5,997 on Victoria to 11,485 on Kyoga for the small oars while the cost of large oars ranged from Shs 9,932 on Victoria to 13,899 on Albert.

On average, a boat owner used between 2-4 oars and these had average life span of 9.6 and 9.3 months for small and large oars respectively. Repairs were carried out once on the oars, costing on average Shs 2,800 and 4,900 for small and large oars respectively.

4.2.4 Labour costs

Fishers used labour to carry out different activities but the main ones were fishing, gear preparation and splitting fish open for sun-drying, salting or smoking (Table 10). The highest proportions of respondents hired labor for fishing, namely 98.21%, 96.77% and 89.39% on Albert, Kyoga and Victoria respectively. This was followed by the respondents who hired labour for gear preparation and the lowest proportiions hired labour for splitting open fish for processing.

On average a respondent hired 4.2 workers for fishing, who received an average of Shs 13,200 each per day worked. Mukene workers' average earning was Shs 26,800 per day worked. The average number of workers hired for gear preparation was 4.3 persons and the earnng was Shs 6,000. For fish splitting, the average number hired was 1.8 and the earning was Shs 5,100.

The annual average total labour costs for the different fish species by water body were computed by combining the three types of labour costs (fishing, gear preparation and fish splitting), where they applied. In some cases, like in the light fishery, labour for splitting fish did not apply. The results showed that overall, the annual labour costs were highest for Nile perch (Shs 16,623,418) per boat, followed by that for tilapia (11,920,497) (Chart 7, Table 11). On Albert, labour costs were highest for Nile perch (Shs 14,325,690), on Kyoga for tilapia (Shs 18,203,640) and on Victoria for Nile perch (25,925,988)

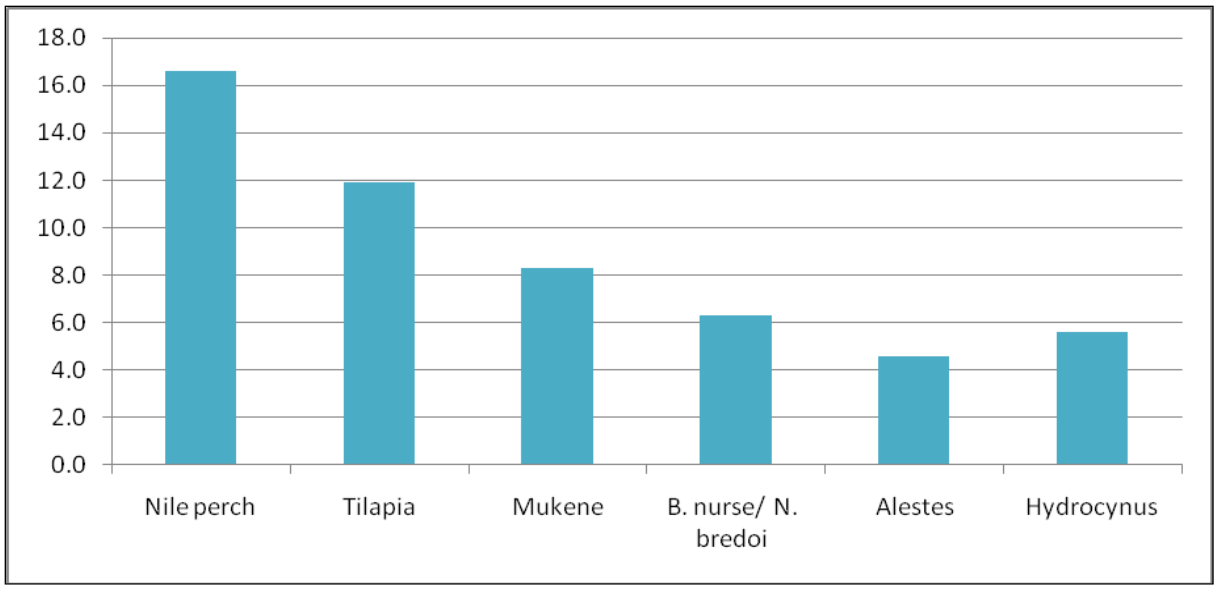


Chart 7: Average annual total labour costs per boat by species (Shs million**)**

4.2.5 Fishing gear

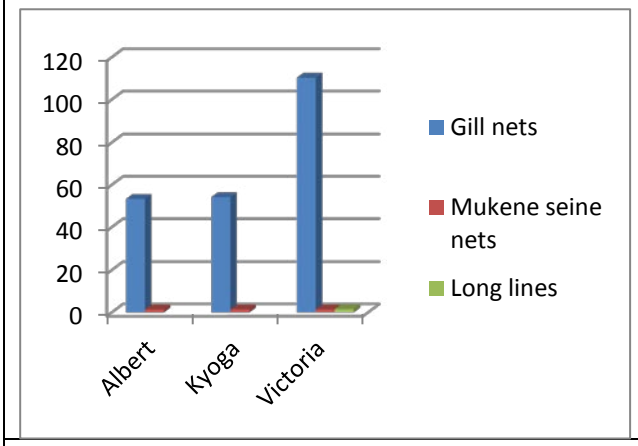
Multifilament gillnets were the most common gear type, used by 39.3%, 61.9% and 50.0% of the respondents on Albert, Kyoga and Victoria respectively. It targeted mostly Nile perch and tilapia (Chart 8, Table 12). The average numbers owned per respondent were 53.3 and 54.2 for Albert and Kyoga respectively but much higher at 110.3 for Victoria. The unit costs varied from size and mesh, with an average of Shs 50,817 and an average life span of 9.4 months.

Monofilament gillnets, an illegal gear type, were used by 4.8%, 16.1% and 3.4% of the respondents on Albert, Kyoga and Victoria respectively. It targeted mostly tilapia. The average number used was 31 pieces, costing Shs 33,771 and with a life span of 4.8 months.

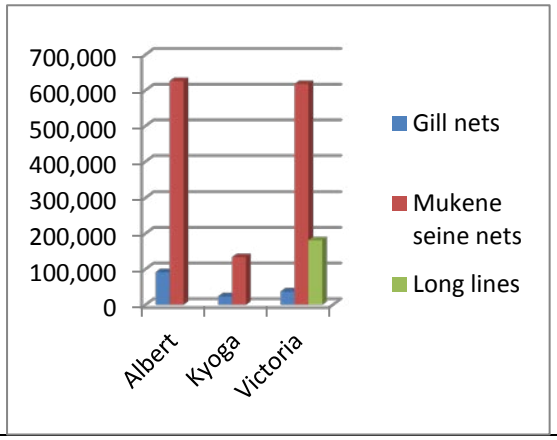
Mukene seine nets were used by 48.8%, 14.2% and 24.2% of the respondents on Albert, Kyoga and Victoria respectively. They targeted mukene on Kyoga and Victoria and *B. nurse/ N. bredoi* on Albert. The average number of units used was 1.4, costing Shs 459,173 per unit and with life span of 4.1 months.

Long lines, the main elements of which included hooks, head ropes, floats and bait, were mostly used on Lake Victoria. An average of 1.6 unis were used by the respondents, costing Shs 181,024 per unit and with life span of 2.4 months. The long lines targeted Nile perch and were mostly of hook size 9.

Other gear types observed on the lakes included single hooks, beach/ boat seines and cast nets. These were reported by limited number of respondents on Albert and Kyoga.



Average number of gear units owned



Average cost per gear unit (Shs)

Chart 8: Average numbers of gear owned and cost per unit

Gear data specific to the different species are given in Chart 9 and Table 13. The average annual gear costs were highest for the small pelagics, namely *B. nurse/ N. bredoi* at Shs 1,617,553 and mukene at Shs 1,018,814.

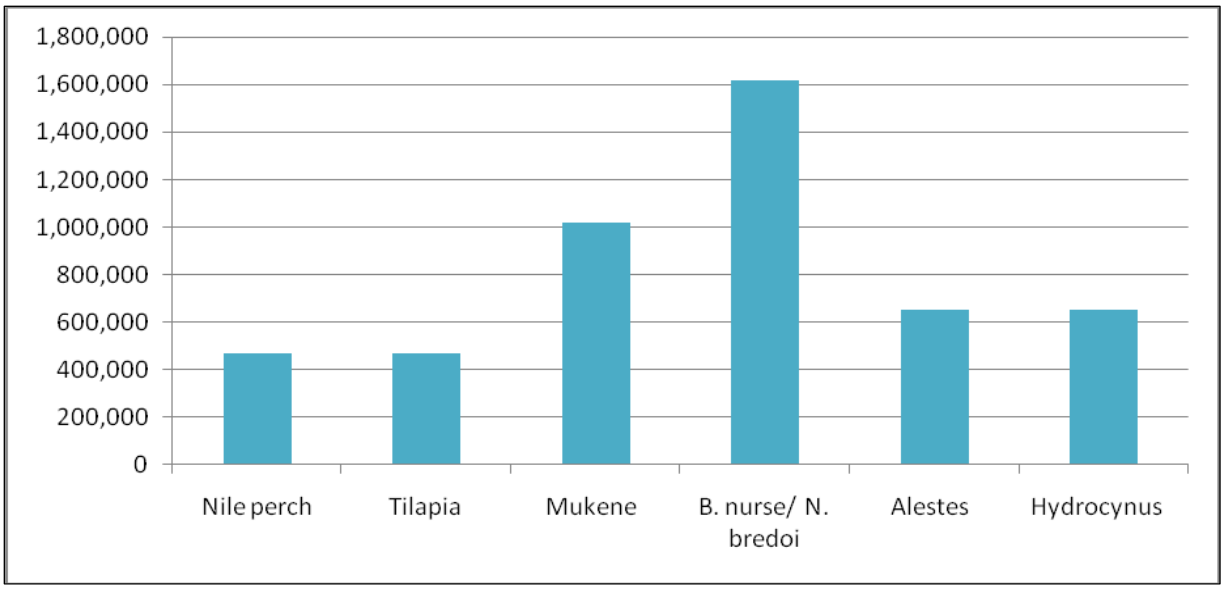


Chart 9: Average annual gear costs by species (Shs)

4.2.6 Floats, sinkers and anchors

Three main types of floats were found to be in use for keeping the nets from sinking, namely floats bought from shops, plant floats and plastic floats (Table 14).

Floats from shops, made of cork material, was the most commonly used by respondents on all the three lakes, estimated at 63.7%, 36.8% and 53.8% on Albert, Kyoga and Victoria respectively and 52.1% considering all three lakes. Their average cost was Shs 142,677 per boat and their lifetime was 9.0 months.

Plastic floats were moderately in use on Kyoga and Victoria and even less on Albert. These consisted of mostly used containers for water, juice and oil. The average cost per boat was Shs 44,519. Their average life time was 7.6 months.

Plant floats were made from aquatic vegetation like reeds. A few respondents used them on Victoria and Kyoga. They cost Shs 44.519 per boat and lasted about 5.3 months.

Sinkers used were mostly locally made by packing stones in plastic bags and wrapping them with strings. Their cost was Shs 80,746 per boat and they lasted about 8.1 months.

Metal anchors were used most by respondents on Albert (79.2%), followed by Victoria (29.9%) and least on Kyoga (0.7%), with overall usage at 36.3%. Its average cost was Shs 35,995 and life span was 5.0 years.

Stone anchors were most common on Kyoga, used by 8.9%, 77.4%, and 17.4% of respondents on Albert, Kyoga and Victoria respectively, with overall usage at 30.8%. The average cost was Shs 6,060 each, with life span of 5.9 years.

4.2.7 Other fishing expenses

For fishing operations to be carried out effectively, a number of small items are also required, constituting additional cost items. Fishers need to control these expenses in their operations as they contribute to reduction in profit. Data on the small fishing expenses revealed the following: (Table 15)

Ice was required by mainly fishers of Nile perch and to some degree traders of fresh tilapia who supplied fish processing plants or exporters of fresh fish. Its use was mostly on Victoria and respondents incurred expenditure of Shs 22, 850 on it per day.

Food for crew was reportedly provided mostly by respondents on Albert and Kyoga but less on Victoria. Crew needed to be provided food as part of the fishing preparations to enable them to work effectively during the fishing trips. Average expenditure on crew's food was estimated at Shs 14,952 per day. Crew food consisted mostly of cassava or maize meal with fish.

Charcoal was also required, as the crew often had to cook their food as opposed to eating from public places. The average expenditure on charcoal was Shs 1,813 per day.

Polythene sheets, also known as capella or kavera, were required for crew to cover themselves against cold or rain while out on the lake. It was a common practice to provide it on all the water bodies. The average expenditure on capella was Shs 16,749 per month.

Smoking was a common coping practice against the cold and the emotions in dealing with the dangers of fishing. On average, respondents spent Shs 4,667 per day on cigarettes.

Blankets were another important requirement to cope with the weather, provided mostly by respondents on Victoria. The average expenditure was Shs 35,074 per month.

4.2.8 Light fishery expenses

Light fishing, used for catching the small pelagics, namely *B. nurse/ N. bredoi* on Albert and mukene on Kyoga and Victoria, imposed other input requirements which constituted additional cost items (Table 16).

Lanterns were the main item in light fisheries, with an average of 5.3 units used per fishing unit. The average cost was Shs 85,667 and its lifetime was 3.2 years. On average, 6.8 litres of paraffin was used per fishing trip and at the cost of Shs 3,400 per litre, this amounted to expenditure of Shs 23,120 per trip.

Basin was another common item used for measuring and moving the fresh or dried fish. The average number owned by a respondent was 3.4 and its average cost was 5,359 and its life span was 2.2 months.

Drying nets were frequently used for improved drying of mukene, away from drying on sand. Most respondents used old nets for drying but the few who bought them paid Shs 44,000 per drying net.

Drying racks were also used in limited situations. Most of them were provided under government programmes, especially on Victoria and only a few on Albert. Users only had to pay user fees, estimated at Shs 5,000 per consignment dried.

4.2.9 Annual total costs

The various cost items identified above were examined for their significance on the different species fisheries and annual total costs computed (Chart 10, Table 17).

i) Nile perch average total cost of production per boat (non-motorised) was estimated at Shs 25,016,983 and it was highest on Victoria, (Shs 36,011,011), attributed to high labour costs.

ii) Tilapia average annual total cost of production per boat was Shs 18,665,587 and it was highest on Kyoga (Shs 27,053,849), due to high costs of gear.

iii) Mukene average total annual cost was Shs 21,129,148 and it was higher on Victoria (Shs 27,324,739), due to large scale of operations compared to Kyoga.

iv) *B. nurse/ N. bredoi* averageannual total cost was 14,854,780 and the species were reported on Albert only.

v) *Alestes* average annual total cost was Shs 12,868,192, also reported on Albert only.

vi) *Hydrocynus* average annual total cost was Shs 10,725,377 and it was also Albert specific.

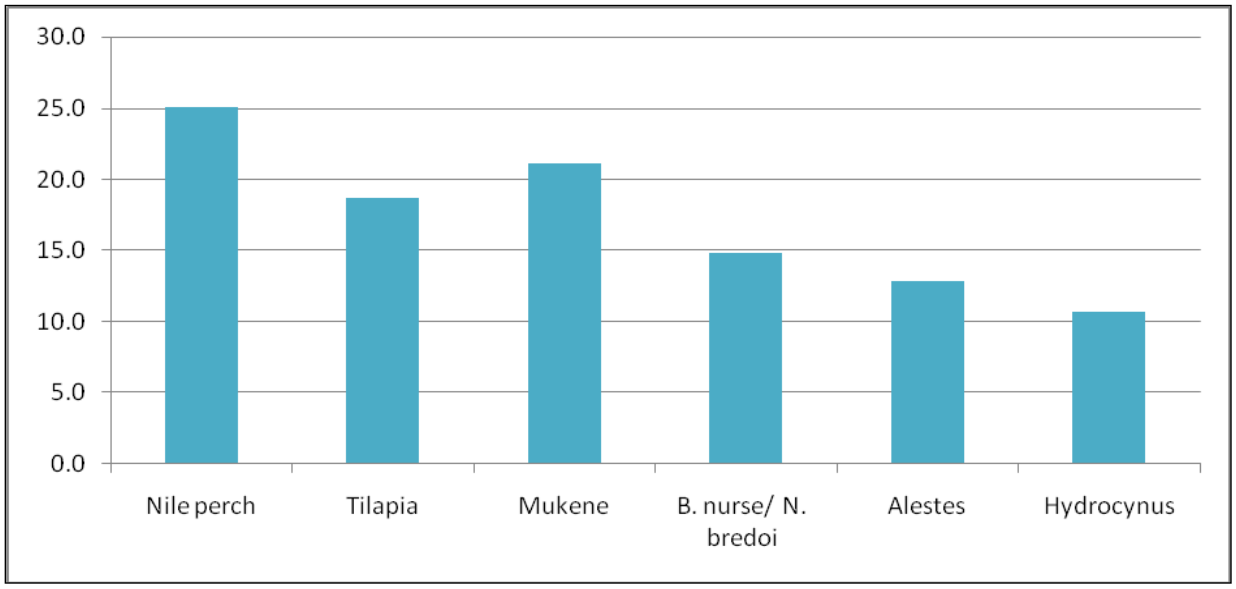


Chart 10: Annual total costs per boat by species (Shs Million)

4.3 Sales revenues

Revenues of fishers were depended on their catches and the prices they were able to obtain, given by the types of market they can access. In this section, data on fish catches and prices are presented. Information on the markets is presented in the subsequent section.

4.3.1 Fish catches

For most species, catches are not uniform throughout the year but there are low and high seasons of catch. The data revealed the following: (Chart 11, Table 18)

i) Average catches per boat and per day for Nile perch were 24.7 kg and 89.2 kg during low and high seasons respectively. The highest catches were reported on Albert.

ii) Tilapia average daily catches per boat were 16.7 kg and 55.8 kg for low and high seasons respectively. The highest average catches were reported on Albert.

iii) Mukene average daily catches per boat were 6.6 and 20.4 basins for low and high seasons respectively. Higher average catches were reported on Victoria than on Kyoga.

iv) *B. nurse/ N. bredoi* average daily catces per boat were 17.1 and 73.5 for low and high seasons respectively. The species were recorded on Albert only.

v) *Alestes baremose* average daily catches were 12.6 and 52.4 heads of fish during low and high seasons respectively. The species was recorded on Albert only.

vi) *Hydrocynus* average catches were 34.9 and 171.5 heads of fish during low and high seasons respectively. The species was recorded on Albert only.

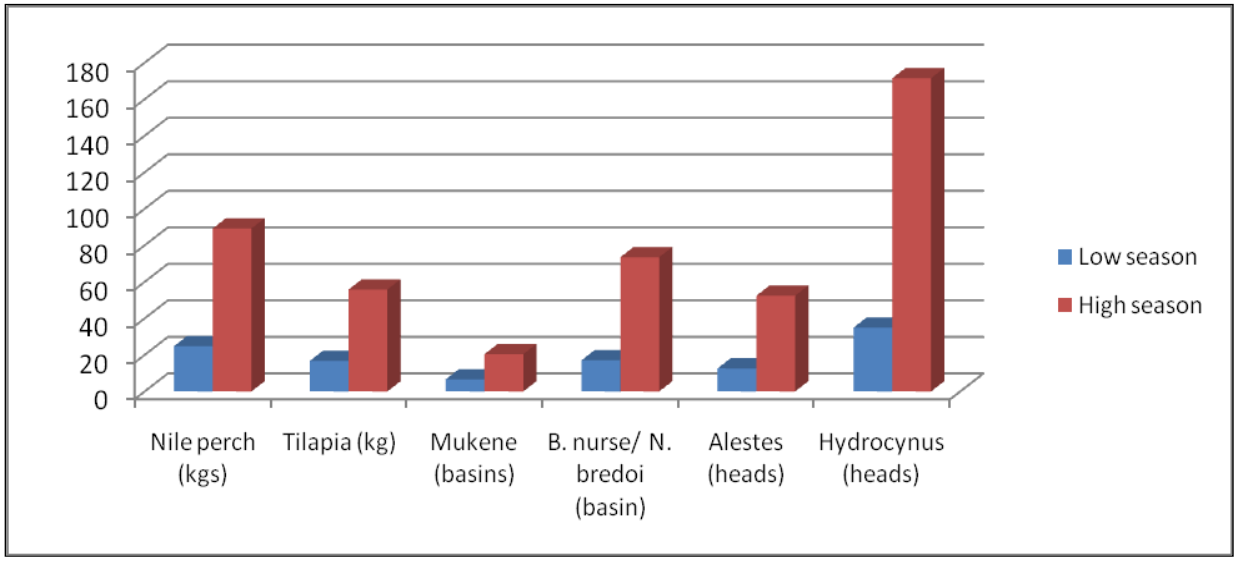


Chart 11: Mean catch per boat per day by species for low and high catch seasons

4.3.2 Fish prices

Fish prices for the different commercial species during low and high catch seasons were reported as follows: (Chart 12, Table 19)

i) Nile perch average prices were Shs 6,094 and 4,764 per kg. during low and high catch seasons respectively. The highest prices were reported on Victoria.

ii) Tilapia mean prices were Shs 4,422 and 3,659 per kg. for low and high seasons, being highest on Victoria.

iii) Mukene mean prices were Shs 21,784 and 16,927 per basin during low and high seasons respectively. Higher prices were reported on Victoria than on Kyoga.

iv) *B. nurse/ N. bredoi* average prices were Shs 11,819 and 8,997 per basin during low and high catch seasons respectively.

v) *Alestes baremose* average prices were Shs 5,429 and 4,571 per head of fish during low and high seasons respectively.

vi) *Hydrocynus* average prices were Shs 5,200 and 2,732 per head during low and high seasons respectively.

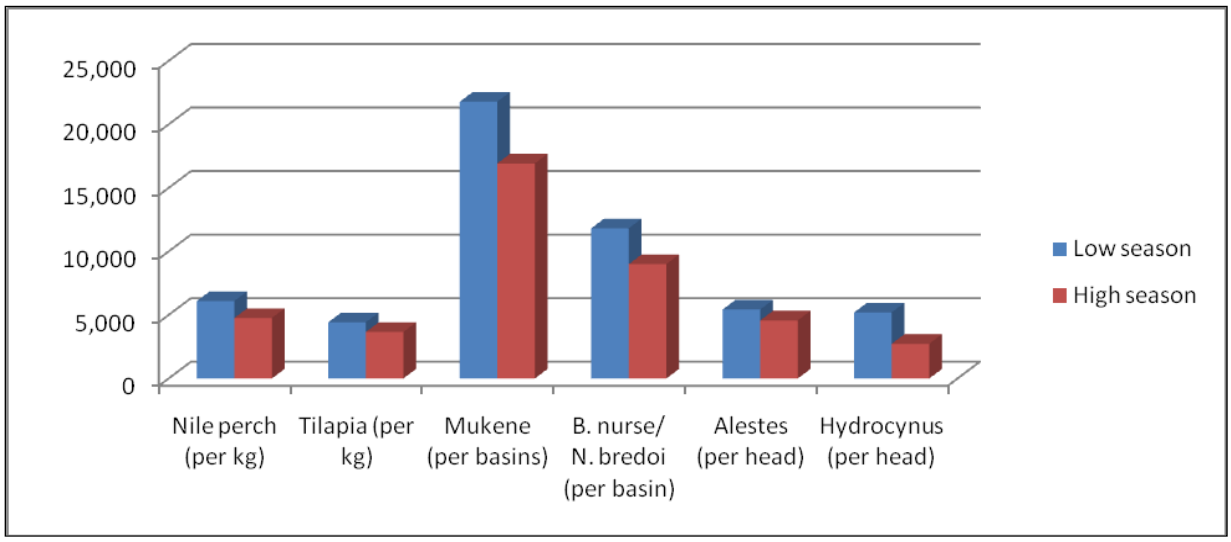


Chart 12: Mean fish price by species for low and high catch seasons (UGX)

4.3.3 Daily revenues

Based on average catches and prices during low and high catch seasons, average daily revenues per boat have been computed as follows: (Chart 13, Table 20)

i) Nile perch daily revenues per boat were computed at Shs 150,725 and 424,949 for low and high catch seasons respectively. The highest revenues were on Victoria.

ii) Tilapia daily revenues per boat were Shs 73,700 and 204,050 for low and high seasons respectively. The highest revenues were on Victoria.

iii) Mukene average revenues were Shs 143,774 and 344,363 during low and high catch seasons respectively. It was higher on Victoria than Kyoga.

iv) *B. nurse/ N. bredoi* average revenues were Shs 202,105 and 661,280 during low and high catch seasons respectivley.

v) *Alestes* average revenues were Shs 68,405 and 239,520 during low and high catch seasons respectively.

vi) *Hydrocynus* average revenues were Shs 181,480 and 468,538 during low and high catch seasons respectively.

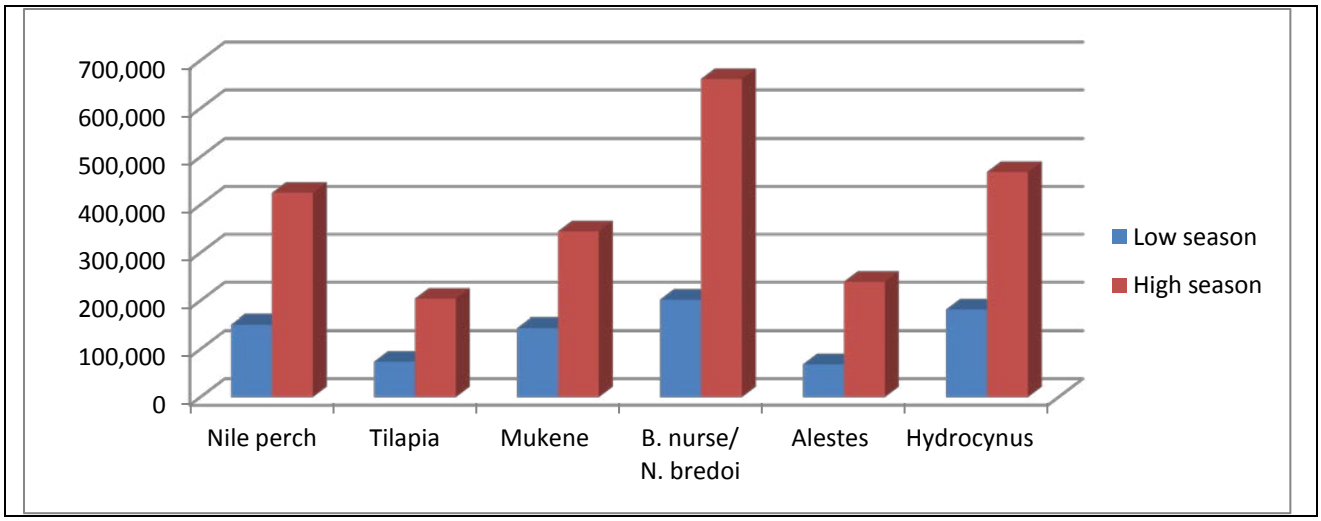


Chart 13: Average daily revenues per boat by species (Shs)

4.3.4 Annual revenues

Average annual revenues have been computed from the daily average revenues for the different species and water bodies. The assumption used was that the low catch season was on average for 8 months while the high catch seasons lasted 4 months. Highlights of the results were as follows: (Chart 14, Table 21)

i) Nile perch average annual revenue was Shs 63,451,614, the highest being Shs 87,813,787 on Victoria, due to the large scale of the fishery.

ii) Tilapia average revenue was Shs 29,993,427 and the highest was Shs 38,738,007 on Albert.

iii) Mukene average annual revenue was Shs 57,975,840 but it was higher on Victoria (Shs 93,298,400), due to the large scale of the fishery there.

iv) *B. nurse/ N. bredoi* average annual revenue was 92,342,467, reported only on Albert.

v) *Alestes* average annual revenue was 32,615,267, also only on Albert.

vi) *Hydrocynus* average annual revenue was Shs 72,063,160, only on Albert.

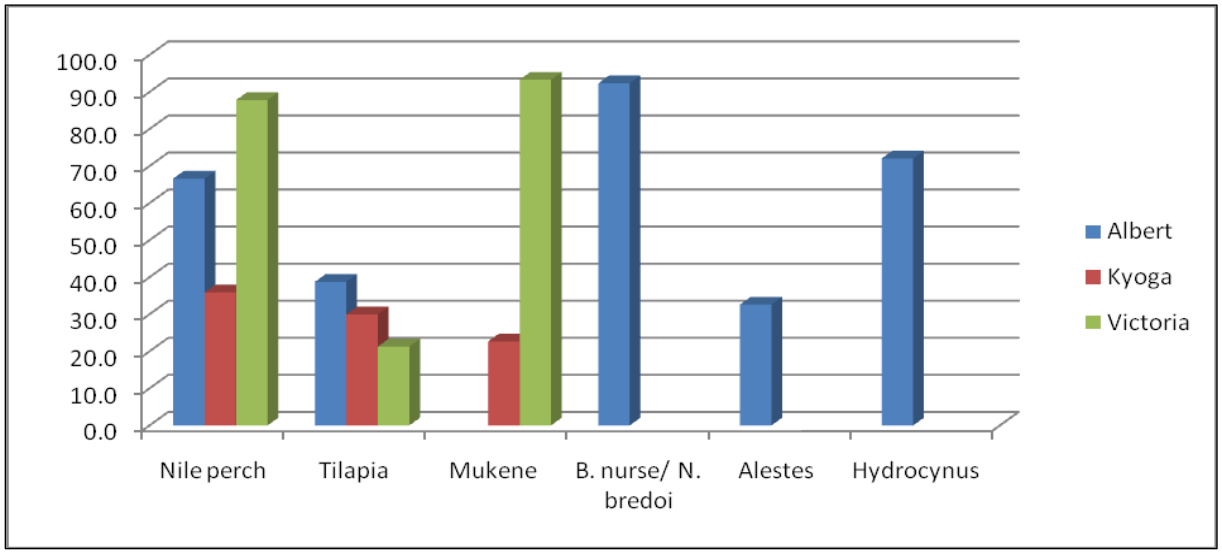


Chart 14: Average annual revenues per boat by species and water body (Shs million)

4.4 Profitability indices

4.4.1 Annual profits

Average annual profits were computed from the average annual revenues (Table 21) less average annual total costs (Table 17), to give gross profits before taxes. The results are given in Chart 15 and Table 22: Highlights of the results were as follows:

i) Nile perch average annual profit was Shs 38,434,631 and the highest was Shs 51,802,776 on Victoria, due to the favourable Nile perch stocks there.

ii) Tilapia average annual profit was Shs 26,735,060, the hgihest being Shs 26,735,060 on Albert, attributed to the stocks and level of activities.

iii) Mukene average annual profit was Shs 36,846,693 and the highest was Shs 65,973,661 on Victoria.

iv) *B. nurse/ N. bredoi* average annua profit was Shs 77,487,687, reported only on Albert.

v) *Alestes* average annual profit was Shs 19,747,075, reported only on Albert.

vi) *Hydrocynus* average annual profit was Shs 61,337,783, also reported only on Albert

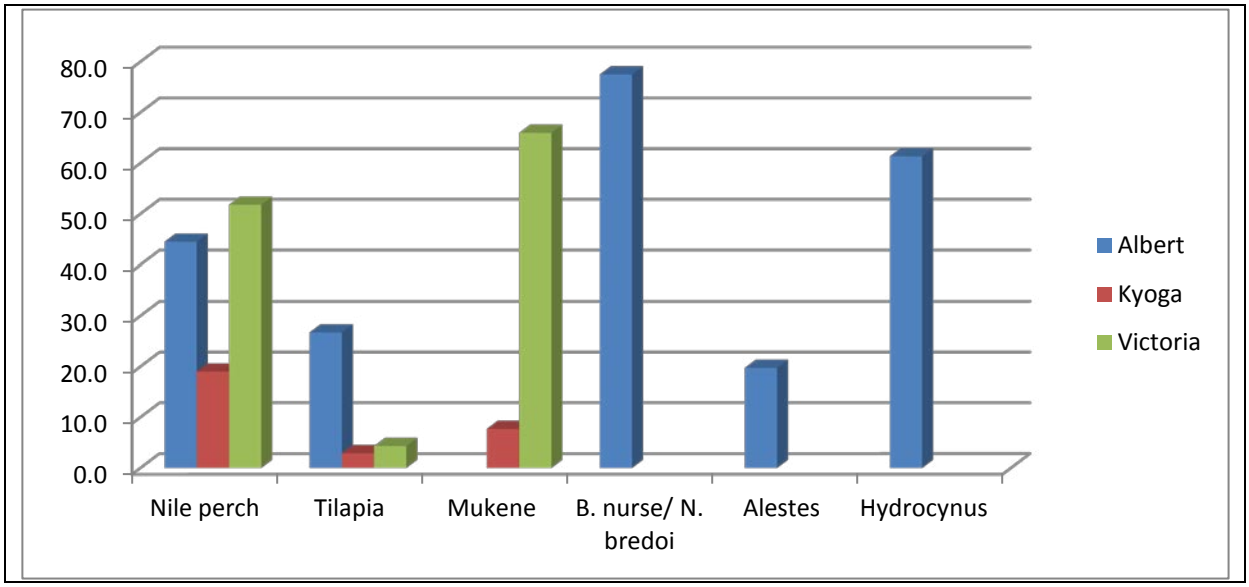


Chart 15: Average gross profits per boat by species and water body (Shs million)

4.4.2 Perceived incomes of fishers

Average annual gross profits were compared to what the fishers perceived as their incomes from fishing the different species. Generally, respondents reported lower incomes than the data revealed. The results of perceived incomes (Chart 16, Table 23) were as given below:

i) Nile perch average annual reported income was Shs 34,251,773.

ii) Tilapia average annual reported income was Shs20,759,579.

iii) Mukene average annual reported income was Shs 12,033,343.

iv) *B. nurse/ N. bredoi* average annual reported income was Shs 13,226,198.

v) *Alestes* average annual reported income was Shs 20,751,852.

vi) *Hydrocynus* average annual reported income was Shs 23,219,101.

While wide variations existed in the profits for the different species computed from the data, perceived incomes of fishers were within a narrow margin.

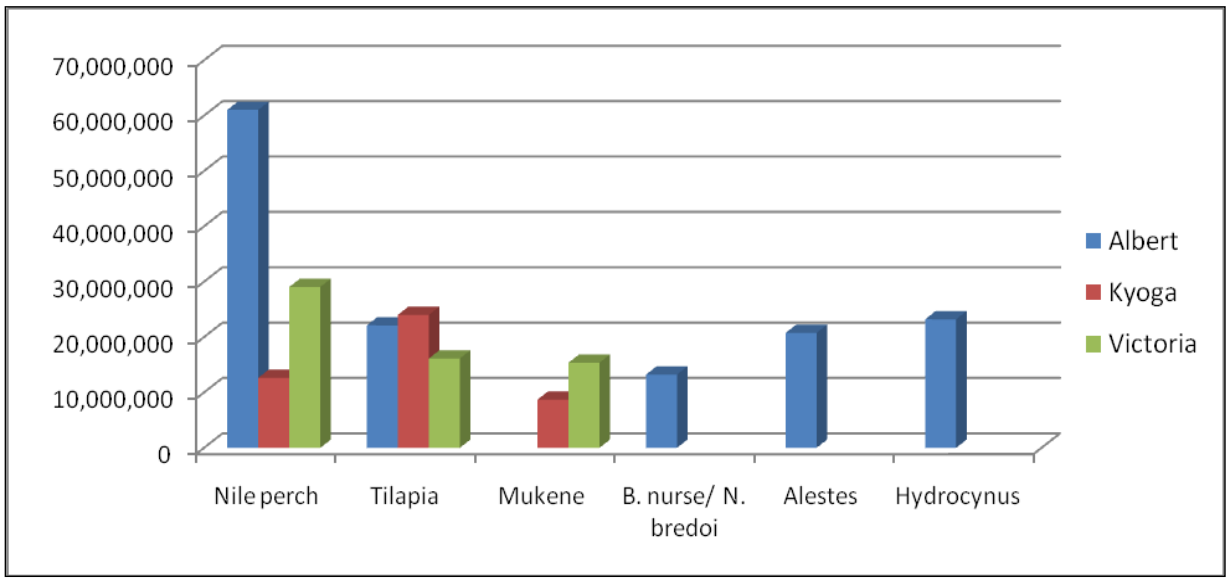


Chart 16: Average annual incomes by species and water bodies as reported by respondents (Shs)

4.4.3 Break-even points

BEP has been defined as the level of catch at which costs and revenue are equal and as a result, there is no net loss or profit and the enterprise has "broken even." Applying the procedure given in the methodology, BEP has been computed using total annual costs and average fish prices data. The results showed high BEP for Nile perch (4,608 kg per year) and tilapia (4,619 kg per year) and low BEP for the small pelagics, namely mukene (1,092 basins per year) and *B. nurse/ N. bredoi* (1,427 basins per year).

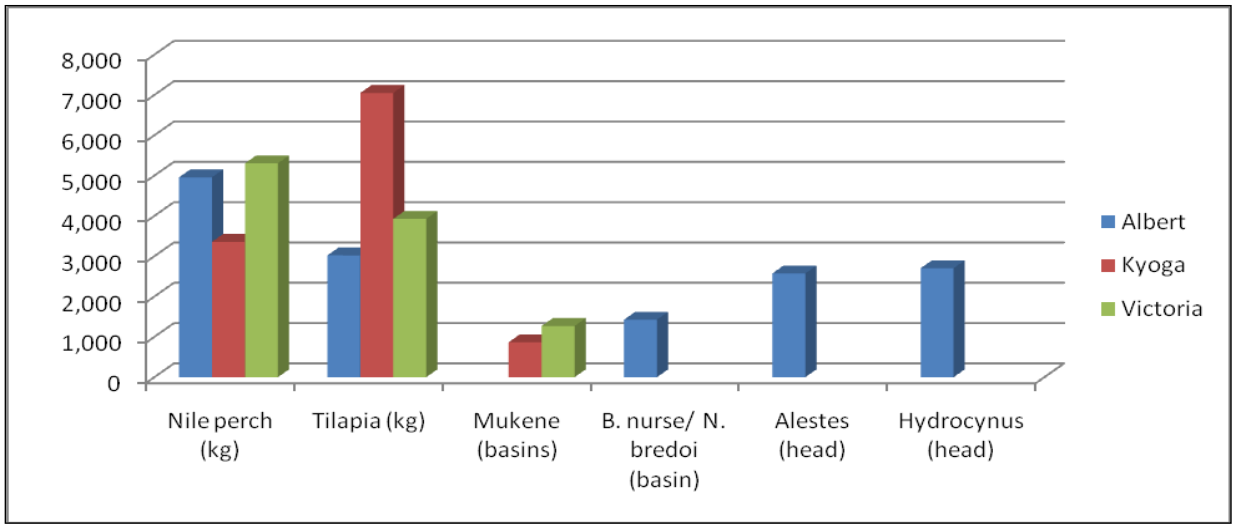


Chart 17: Break-even points by species and water body in a year

4.4.4 Pay-back period

PBP has been defined as the period of time required for the return on an investment to "repay" the sum of the original investment. The results revealed that PBP was lowest for *B. nurse/ N. bredoi* (0.2

months) and the highest was for tilapia (7.0 months). PBP in months for the other species were Nile perch (1.3), mukene (0.8), *Alestes* (3.4) and *Hydrocynus* (1.1) (Chart 18, Table 25).

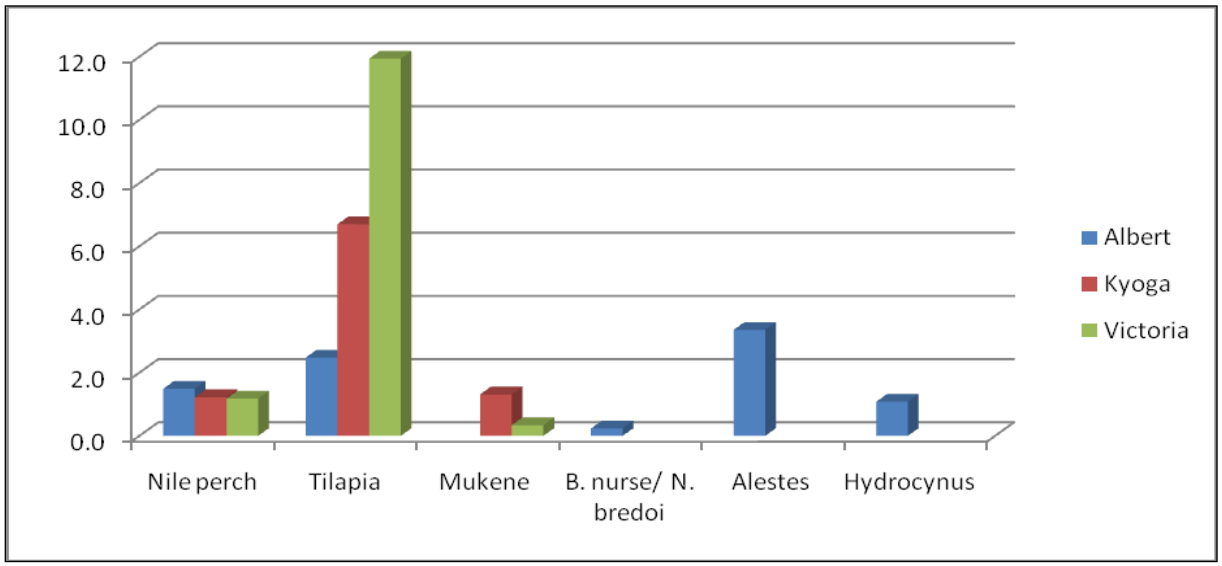


Chart 18: Payback periods by species and by water body (Months)

4.4.5 Profitability drivers

For fishing enterprises to realize their business potential, a number of conditions are necessary for the fishers. Majority of respondents considered high demand (89.1%), effective enforcement of fisheries regulations on their fishing grounds (67.3%) and access to input supply (65.9%) to be the most important conditions required for them to make money (Chart 19, Table 26). Access to credit was not considered so vital for fishing business.

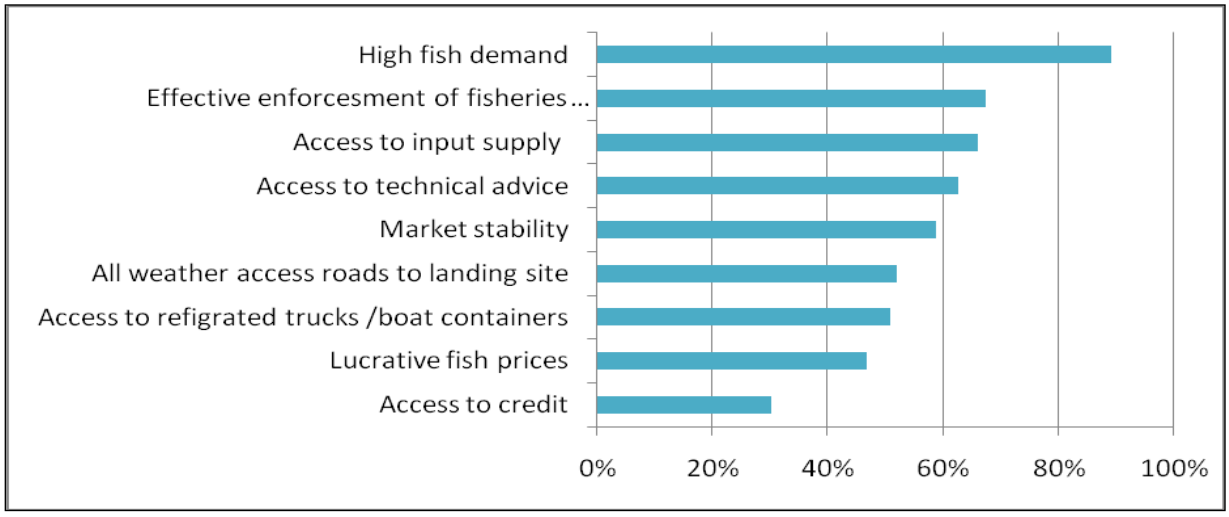


Chart. 19: Proportions of respondents who considered the factors important for profitability

4.5 Market access

4.5.1 Main buyers of fish

As the first step in addressing fishers' access to market, the buyers of fish from fishers were identified. The results revealed that local traders were the main buyers (55.6% of respondents), followed by direct consumers (21.1%). Other buyers were factory agents or the industrial processors themselves, regional traders and artisanal processors (Chart 20, Table 27).



Chart 20: Main buyers of fish by water body

The most common destinations where the fishers sold their fish were the beach markets (83.5%), followed by markets in another district (10.0%). Other destinations included other local markets not at the beach and regional markets (Chart 21, Table 28).

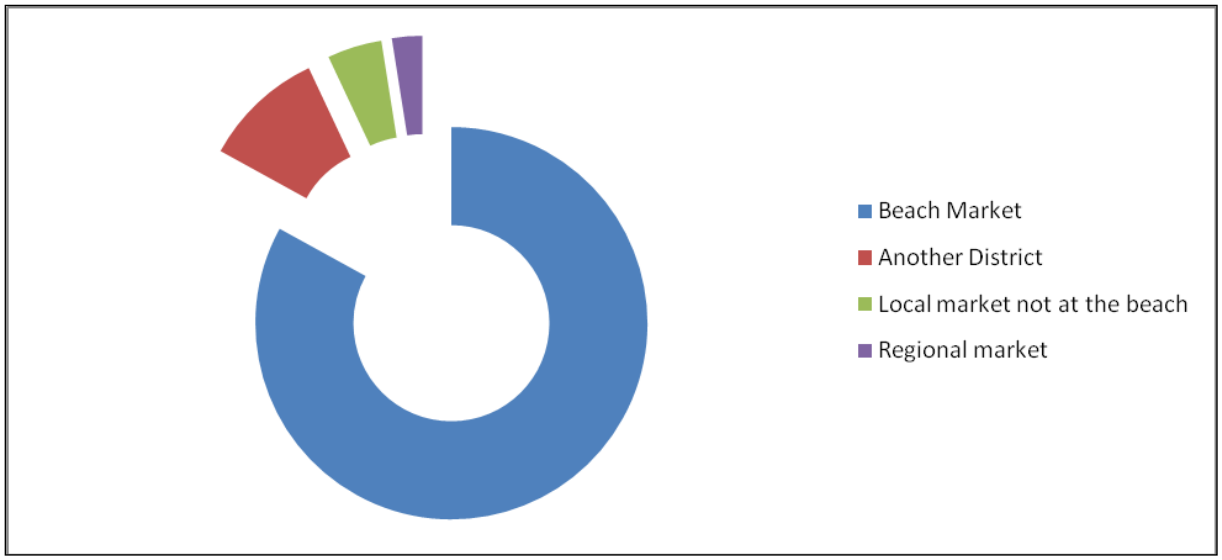


Chart 21: Respondents who sold their fish at the different markets

4.5.2 Means of transport

Means most commonly used in transporting fish to the market were boats (31.6 of respondents) and hired trucks (27.5%). Others included public vehicles (24.0%), motor cycles (18.7%) and own vehicles (3.0%) (Chart 22, Table 29).

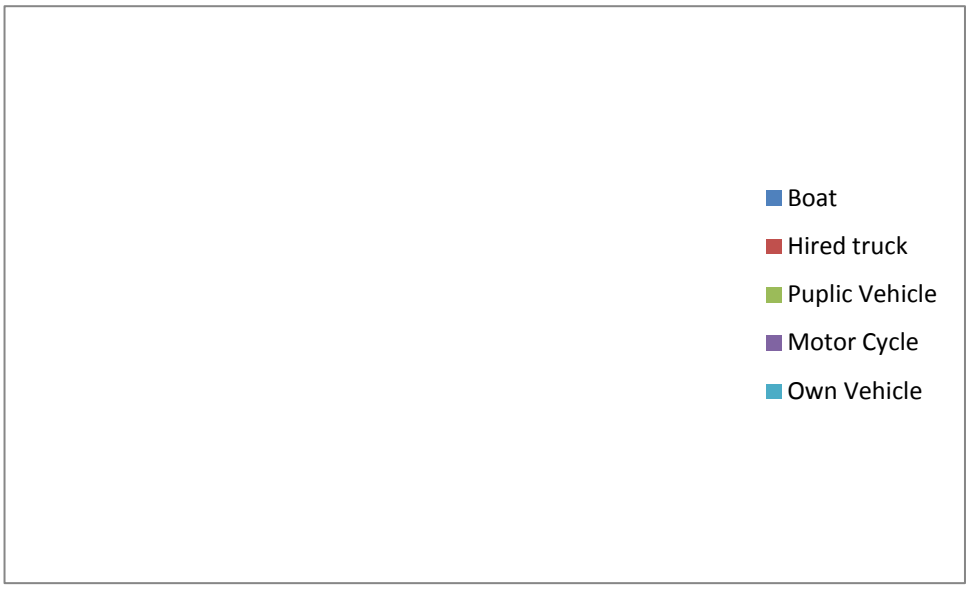


Chart 22: Respondents' most commonly used means of transport for fish

The main market destinations of respondents were examined and are presented in Table 30. For Albert, most respondents sold their fish to Panyimur (33.3%), Kampala (14.3%) and Ssebagoro, Kaiso and Bundibugyo (each 9.5%) (Table 30). While Panyimur was an important market for processed fish for both domestic and regional markets, Kampala was more important for *B. nurse/ N. bredoi* as raw material for animal feed production.

Kyoga fish was destined mostly for Soroti (19.4%) mostly fresh and processed, to Gulu in similar forms (19.4%) and to DRC through Bwera as sun-dried/ salted fish (16.1%). mukene went to Kampala (6.5%) while some tilapia exports also went to Kenya through Busia (6.5%).

The main destinations for Victoria fish were Kampala, Jinja, Bwera and Busia.

4.5.3 Transaction costs

Generally, fishers who sold fish away from the beach markets made on average 2.1 trips to the market every week, the highest average being on Victoria (3.2) (Table 31). The average distance to the market was 3.6 km, with the highest average on Kyoga (4.9 km). Average transport costs per year was Shs 8,373,990, with the highest on Victoria (Shs 12,929,931) and average fish movement permit (FMP) annual cost was Shs 3,588,789, the highest being on Kyoga (Shs 6,249,107).

5. DISCUSSION

5.1 Characteristics of fishers

Gender disparity revealed in the composition of fishers is attributed to social factors as well as the unequal access to resources for investment into fisheries. This has implications for distribution of benefits accruing from fish production, with women being adversely affected. Education is important as a determinant of quality of life, so the low levels of education among fishers revealed by the data could hinder their ability to be knowledgeable and informed, to communicate and to maintain their hygiene and health. It would also affect fish production by limiting their capacity to acquire skills. Through education, fishers would be able to adopt improved technologies and management approaches for fisheries resources, fish production, processing including value addition and market access.

5.2 Production costs

The average number of days fished is a measure fishing time, a factor of production and it was determined at 5 per week. This reveals that fishers put in almost their full working days in fishing to maximize their profits. Fishers should be encouraged to allocate time to other livelihood activities to relieve the pressure on fish stocks.

Different fishers targeted different fish species with distinct value chains, resulting in differences in production, processing and marketing. This explains why there are variations in costs and revenues, leading to different profit performances.

The average number of boats owned per fisher varied with the water bodies and were higher on Kyoga and Victoria than on Albert, depicting higher investments on those water bodies. This could be attributed to the diminishing fish stocks, requiring more effort to maintain the catch levels. The higher boat costs observed on Albert and Victoria were attributed to the timber types used, boat sizes and craftsmanship applied.

Motorisation of fishing was highest on Victoria, followed by Albert because of the sizes of the water bodies and distances to fishing grounds as well as the rough water conditions frequently experienced during fishing on those water bodies. The engines, as well as fuel, were more expensive on Albert than on Victoria, due to the distance of Albert from Kampala where they were supplied from.

Labour was the highest cost item, constituting up to 50% of total costs. Proportions of other cost items were crew expenses (32%), light fishery items (9%), gear (5%), boat (2%) and small implements (2%). This shows that fishing is primarily a labour intensive enterprise. Interventions to minimise costs shuld, therefore, address labour.

Light fishing, used for catching the small pelagics, imposed other input requirements which constitute additional cost items.

5.3 Sales revenues

Catch data presented were key determinants of the revenues and profits of fishers. For most species, catches were not uniform throughout the year but exhibited low and high seasonal variations, with low seasons lasting about eight months in a year. The proportional rises in catch between low and high catch seasons were highest for Nile perch and *Alestes.*

Prices were the other determinants of profits and they also varied with catch but inversely. During high catch seasons, fish prices fell because of the increased supply on the market and the reverse happened during low catch seasons. However, the variations were little between the low and high catch season, except for the small pelagics and *Hydrocynus*. This depicted price inelasticity in the major species, namely Nile perch and tilapia. This shows that fish demand continues to be high relative to supply even during the season of high fish catches.

5.4 Profitability indices

The high annual gross profits for *B. nurse/ N. bredoi* was associated with the bundant stocks of the species. For *Hydrocynus*, it was due to to high demand for the sun-dried fish in DRC. Similar, the high profits for Nile perch was attributed to the prices offered by the export market for chilled fish fillets. For mukene, despite the abundace stocks, low fish prices and high post harvest losses kept the profits low. Tilapia has suffered from low catches and catching of immature fish before it reached high priced sizes.

BEP depended on TC and fish price, so that species with low TVCs and those with high prices tended to have low BEPs while species with highTVCs and low prices had high BEPs. Therefore, high BEP for Nile perch and tilapia could be attributed to the high TVCs while for the light fisheries, it was mainly a problem of low fish prices.

The generally short payback periods were attributed to the fact that in fisheries, capital investments were not the main cost items but rather the variable costs, namely labour, which was the main cost item.

5.5 Market access

The results revealed that local traders were the main buyers of fish from the producers, followed by direct consumers. At the same time, the most common destinations where the fishers sold their fish were their own beach markets, followed by markets in other districts. The challenge of selling primarily to local traders is that they are small, usually buying small quantities of fish because they have limited capital, their transport means are bicycles or motorcycles which carry small quantities and travel short distances and their clients are local consumers who buy little quantities of fish at a time. Fishers should, therefore, target bigger and more lucrative markets than those presented by the local traders.

Transportation remained the highest transaction cost item, implying that this is an area requiring intervention to improve market access to fishers.

6. CONCLUSIONS AND RECOMMENDATIONS

The research provided economic returns for fishing enterprises on Lakes Albert, Kyoga and Victoria and strategies for enhancing market access in order to improve incomes of fishers. Based on cost and revenue data, annual gross profits, Break-even points and Pay-back periods were computed.

Annual gross profits before taxation were highest for Ragoge/ muziri (Shs 77.5 mill) and Ngasia (Shs 61.3 mill). Moderate profits were revealed for Nile perch (Shs 38.4 mill.), tilapia (Shs 11.3 mill.) and mukene (Shs 36.8 mill.).

Break even points for Nile perch and tilapia was 4.6 tonnes per year, mukene (1,091 basins) *B. nurse/ N. bredoi (*1,427 basins) and *Hydrocynus* (2,704 heads).

Pay back period for Nile perch was 1.3 months, tilapia 7.0 months, mukene 0.8 months and *B. nurse/ N. bredoi* 0.2 months. The pay back periods were low because investments were not the main cost items in fish production but labour, which is not included in pay back period computations.

The factors fishers considered most import for profitability of fishing business were high fish demand (89.1%), effective enforcement of fisheries regulations (67.3%) and access to input supply (65.9%). Availability of refrigerated trucks/ boats and access to credit were not considered so important (30.1%).

Considering fishers' access to market, the main buyers of fish were local traders (55.6%), direct consumers (21.1%) and factory agent/industrial processors (12.8%). Fishers sold mostly at their beach markets (83.5%) and in other districts (10.0%). Respondents' most commonly used means of transport for fish were boats (31.6%) and hired trucks (27.5%). The main market destinations for Albert were Panyimur and Kampala, for Kyoga were Soroti and Gulu and for Victoria were Kampala and Jinja.

On average, respondents made 2.1 trips to the market per week, covering a distance of 3.6 km to the main markets and incurring annual transaction costs of Shs million 8.4 and 3.6 on transport and Fish Movement Permit respectively.

Fishers have a chance to achieve high income levels compared to other rural producers in the economy. However, to compensate for declining stocks and catches especially of Nile perch and tilapia, it is recommended that they should apply a combination of high price markets and high value products.

Stable stocks of the small pelagics are also opportunities for high incomes but fishers should guard against high cost production and economic as well as physical post-harvest losses, triggered mainly by weather variations.

They should operate in groups to minimize their costs by purchasing gear in bulk and hiring transport to markets jointly. Through the groups, they would also be given training in business management to improve their decision making.

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8. APPENDICES

8.1 APPENDIX 1: Data Tables

Table 1: Educational achievements of respondents by water body

	Albert	Kyoga	Victoria	All
None	7.2%	8.4%	6.1%	**7.2%**
Incomplete Primary	57.5%	41.7%	41.1%	**46.8%**
Complete primary	13.2%	14.9%	23.3%	**17.1%**
Incomplete Secondary	15.0%	27.9%	23.7%	**22.2%**
Complete Secondary	5.4%	5.2%	5.0%	**5.2%**
Tertiary	1.8%	1.9%	0.8%	**1.5%**
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Table 2: Average number of days fished in a week by species and water bodies

	Albert	Kyoga	Victoria	All
Nile perch	5.5	4.7	4.9	5.0
Tilapia	4.7	4.8	5.0	4.8
Mukene		4.2	4.7	4.5
B. nurse/ N. bredoi	5.1			5.1
Alestes	5.3			5.3
Hydrocynus	5.0			5.0
All species	**5.1**	**4.6**	**4.9**	**5.0**

Table 3: Proportions of respondents who targeted the different species by water body

	Albert	Kyoga	Victoria	All
Nile perch	11.9%	29.0%	43.1%	28.0%
Tilapia	17.6%	56.8%	32.2%	35.5%
Mukene		14.2%	24.7%	19.5%
B. nurse/ N. bredoi	48.2%			48.2%
Alestes	7.1%			7.1%
Hydrocynus	13.7%			13.7%
Others	1.5%			1.5%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Table 4: Characteristics of main boat types owned by respondents

Lake	Main boat type	Average number owned	Cost per boat (Shs)	Period before repair begins (Months)	Repair costs (Shs/half year)	Life span (Years)
Albert	Congo barque	1.5	636,336		97,807	3.1
Kyoga	Ssese	1.6	656,429	5.0	73,140	4.1
	Parachute	1.9	347,514	12.7	59,250	3.6
Victoria	Ssese	2.0	989,571	15.0	198,449	4.2
	Parachute	1.1	207,045	8.75	45,860	2.9
All	Congo barque	1.5	636,336		97,807	3.1
	Ssese	1.8	823,000	10.0	135,795	4.2
	Parachute	1.5	277,280	10.7	52,555	3.3

Table 5: Average annual boat costs of operation by species and water bodies (Shs)

	Albert	Kyoga	Victoria	All
Nile perch	400,884	306,385	737,840	481,703
Tilapia	400,884	215,032	163,115	259,677
Mukene		306,385	400,884	369,384
B. nurse/ N. bredoi	400,884			400,884
Alestes	400,884			400,884
Hydrocynus	400,884			400,884

Table 6: Proportions of respondents who fished with outboard engines

	Proportion
Albert	29.8%
Kyoga	2.1%
Victoria	31.4%
All	**21.1%**

Table 7: Outboard engine costs

	Engine power	Cost per engine (Shs)	Years before repairs begin	Repair cost (Shs per week)	Life span of engine (Years)
Albert	<10 HP	4,087,800		123,826	9
	10-20 HP	8,963,200		89,188	10
Victoria	<10 HP	3,184,615	4	67,667	11
	10-20 HP	5,521,300	2	118,532	10

Table 8: Average cost of fuel

Lake	Ouantity of petrol used (L. per day)	Cost of petrol (Shs per L.)	Ouantity of engine oill used (L. per day)	Cost of engine oil (Shs per L.)
Albert	19.0	5,363	0.9	15,947
Victoria	33.4	4,043	1.4	10,844

Table 9: Types and characteristics of oars

	Small oars				**Large oars**			
Lake	Number of oars	Cost per oar (Shs)	Repair cost per oar (Shs per month)	Life span (Months)	Number of oars	Cost per oar (Shs)	Repair cost (Shs per month)	Life span (Months)
Albert	2.5	7,952	3,111	9.1	3.9	13,899	7,891	7.7
Kyoga	3.0	11,485	3,284	13.1	2.4	13,265	3,759	12.2
Victoria	3.6	5,997	2,031	6.6	2.2	9,932	3,222	8.0

Table 10: Costs of labour by type and water body used in fish production (Shs)

	Fishing workers			**Gear preparation workers**		**Fish splitting workers**	
	Number	Payment (Shs per day)	Payment (mukene workers) (Shs per day)	Number	Payment (Shs per day)	Number	Payment (Shs per day)
Albert	4.4	11,630		2.3	5,003	1.8	3,808
Kyoga	3.9	11,204	31,237	2.7	4,437	1.9	2,908
Victoria	4.4	16,899	22,378	7.8	8,557	1.8	8,625

Table 11: Average annual total labour costs per boat by species and water body (Shs**)**

	Albert	Kyoga	Victoria	All
Nile perch	14,325,690	9,618,577	25,925,988	16,623,418
Tilapia	6,239,142	18,203,640	11,318,708	11,920,497
Mukene		4,049,500	12,524,354	8,286,927
B. nurse/ N. bredoi	6,262,036			6,262,036
Alestes	4,623,273			4,623,273
Hydrocynus	5,549,942			5,549,942

Table 12: Average numbers, unit costs, repair costs and life spans of gear types by water body.

		Albert	Kyoga	Victoria	All
Multifilament gillnets	Number used	53.3	54.2	110.3	72.6
	Unit cost (Shs per unit)	91,629	23,667	37,156	50,817
	Repair costs (Shs per month)	49,667	22,483	36,774	36,308
	Life span (Months)	7.5	10.0	10.7	9.4
Monofilament gillnets	Number used	59.5	29.6	5.6	31.6
	Unit cost (Shs per unit)	27,500	32,923	40,889	33,771
	Repair costs (Shs per month)	36,667	33,000	13,667	27,778
	Life span (Months)	5.7	4.0	4.7	4.8
Mukene seine nets	Number used	1.4	1.4	1.4	1.4
	Unit cost (Shs per unit)	626,235	133,667	617,619	459,173
	Repair costs (Shs per month)	133,274	15,500	152,397	100,390
	Life span (Months)	4.0	4.6	3.7	4.1
Long lines	Number used			1.6	1.6
	Unit cost (Shs per unit)			181,024	181,024
	Repair costs (Shs per month)			85,000	85,000
	Life span (Months)			2.4	2.4
Hooks	Number used	2,603.8	468.4	17.8	1,030.0
	Unit cost (Shs per unit)	1,328	16,520	450	6,099
	Repair costs (Shs per month)	81,250	16,333	3,000	33,528
	Life span (Months)	5.9	3.2	1.7	3.6
Beach/ boat seines	Number used	1.0	1.0	1.7	1.2
	Unit cost (Shs per unit)	115,000	250,000	586,250	317,083
	Repair costs (Shs per month)	60,000	60,000	51,250	57,083
	Life span (Months)	2.0	24.0	11.9	12.6
Cast nets	Number used	23.0			23.0
	Unit cost (Shs per unit)	22,500			22,500
	Repair costs (Shs per month)	20,000			20,000
	Life span (Months)	5.0			5.0

Table 13: Average annual gear costs by species and water body (Shs)

	Albert	**Kyoga**	**Victoria**	**All**
Nile perch	650,269	280,486	473,206	467,987
Tilapia	650,269	280,486	473,206	467,987
Mukene	--	189,390	1,848,238	1,018,814
B. nurse/ N. bredoi	1,617,553	--	--	1,617,553
Alestes	650,269	--	--	650,269
Hydrocynus	650,269	--	--	650,269

Table 14: Floats, sinkers and anchors used for fishing

		Albert	**Kyoga**	**Victoria**	**All**
Floats from shops	Cost (Shs per boat)	209,207	45,069	173,604	142,627
	Life span (Months)	10.1	13.9	3.1	9.0
Plastic floats	Cost (Shs per boat)	42,413	26,844	66,536	45,265
	Life span (Months)	7.0	9.0	6.9	7.6
Plant floats	Cost (Shs per boat)	68,800	29,494	35,264	44,519
	Life span (Months)	7.0	1.6	7.4	5.3
Sinkers	Cost (Shs per boat)	152,119	13,802	76,324	80,749
	Life span (Months)	7.2	11.5	5.7	8.1
Metal anchors	Number owned	1.6	1.0	1.9	1.5
	Cost of each (Shs)	43,733	4,177	60,076	35,995
	Life span (Years)	5.2	5.6	4.3	5.0
Stone anchors	Number owned	6.1	2.0	1.4	3.2
	Cost of each (Shs)	6,108	4,177	7,896	6,060
	Life span (Years)	5.2	5.6	3.4	4.7
Ropes for anchors	Number owned	1.5	1.6	1.7	1.6
	Cost of each (Shs)	15,000	5,354	21,315	13,890
	Life span (Years)	2.5	4.8	10.3	5.9

Table 15: Other fishing expenses

	Albert		Kyoga		Victoria		All
	N	Mean	N	Mean	N	Mean	Mean
Ice (Shs per day)					10	22,850	22,850
Food (Shs per day)	131	14,154	109	7,851	10	22,850	14,952
Capella (Shs per month)	130	16,946	142	19,189	96	14,111	16,749
Charcoal (Shs per day)	45	2,507	11	1,227	18	1,706	1,813
Cigarettes (Shs per day)	135	2,850	57	3,321	50	7,830	4,667
Blankets (Shs per month)	3	19,000			54	51,148	35,074
Total		**55,457**		**31,588**		**120,495**	**96,105**

Table 16: Costs and life spans of items specific to light fisheries

	Albert	Kyoga	Victoria	All
Number of lanterns	3.6	6.2	6.1	5.3
Unit cost lantern	85,000	86,000	86,000	85,667
Life span lantern years (years)	3.1	2.7	3.8	3.2
Quantity of paraffin used per trip (litres)	4.7	6.9	8.8	6.8
Cost of paraffin (Shs per litre)	3,600	3,400	3,200	3,400
Number of basins	2.7	2.7	4.7	3.4
Unit cost basin	5,248	5,100	5,729	5,359
Life span basin (months)	2.8	1.7	2	2.2

Table 17: Annual total costs per boat by species and water body (Shs)

	Albert	Kyoga	Victoria	All
Nile perch	22,126,007	16,913,930	36,011,011	25,016,983
Tilapia	12,002,947	27,053,849	16,939,964	18,665,587
Mukene		14,933,556	27,324,739	21,129,148
B. nurse/ N. bredoi	14,854,780			14,854,780
Alestes	12,868,192			12,868,192
Hydrocynus	10,725,377			10,725,377

Table 18: Mean catch per boat per day by species and water body for low and high catch seasons

	Low season				High season			
	Albert	**Kyoga**	**Victoria**	**All**	**Albert**	**Kyoga**	**Victoria**	**All**
Nile perch (kgs)	28.5	15.2	30.5	24.7	118.3	58.3	91.0	89.2
Tilapia (kg)	22.7	17.1	10.2	16.7	68.4	62.1	36.8	55.8
Mukene (basins)		3.0	10.2	6.6		9.6	31.1	20.4
B. nurse/ N. bredoi (basin)	17.1			17.1	73.5			73.5
Alestes (heads)	12.6			12.6	52.4			52.4
Hydrocynus (heads)	34.9			34.9	171.5			171.5

Table 19: Mean fish price by species and water body for low and high catch seasons (Shs)

	Low season				High season			
	Albert	**Kyoga**	**Victoria**	**All**	**Albert**	**Kyoga**	**Victoria**	**All**
Nile perch (per kg)	4,686	6,193	7,403	6,094	4,240	3,880	6,172	4,764
Tilapia (per kg)	4,191	4,682	4,393	4,422	3,753	2,991	4,233	3,659
Mukene (per basins)		19,100	24,468	21,784		15,290	18,565	16,927
B. nurse/ N. bredoi (per basin)	11,819			11,819	8,997			8,997
Alestes (per head)	5,429			5,429	4,571			4,571
Hydrocynus (per head)	5,200			5,200	2,732			2,732

Table 20: Average daily revenues per boat by species and water body (Shs)

	Low season				**High season**			
	Albert	**Kyoga**	**Victoria**	**All**	**Albert**	**Kyoga**	**Victoria**	**All**
Nile perch	133,551	94,134	225,792	150,725	501,592	226,204	561,652	424,949
Tilapia	95,136	80,062	44,809	73,700	256,705	185,741	155,774	204,050
Mukene		57,300	249,574	143,774		146,784	577,372	344,464
B. nurse/ N. bredoi	202,105			202,105	661,280			661,280
Alestes	68,405			68,405	239,520			239,520
Hydrocynus	181,480			181,480	468,538			468,538

Table 21: Average annual revenues per boat by species and water body (Shs)

	Albert	Kyoga	Victoria	All
Nile perch	66,620,147	35,920,907	87,813,787	63,451,614
Tilapia	38,738,007	29,974,967	21,267,307	29,993,427
Mukene		22,653,280	93,298,400	57,975,840
B. nurse/ N. bredoi	92,342,467			92,342,467
Alestes	32,615,267			32,615,267
Hydrocynus	72,063,160			72,063,160

Table 22: Average annual gross profits per boat by species and water body (Shs)

	Albert	Kyoga	Victoria	All
Nile perch	44,494,140	19,006,977	51,802,776	38,434,631
Tilapia	26,735,060	2,921,118	4,327,343	11,327,840
Mukene		7,719,724	65,973,661	36,846,693
B. nurse/ N. bredoi	77,487,687			77,487,687
Alestes	19,747,075			19,747,075
Hydrocynus	61,337,783			61,337,783

Table 23: Average annual incomes by species and water bodies as reported by respondents (Shs)

	Albert	Kyoga	Victoria	All
Nile perch	61,043,743	12,652,065	29,059,510	34,251,773
Tilapia	22,117,433	24,020,929	16,140,376	20,759,579
Mukene		8,700,877	15,365,809	12,033,343
B. nurse/ N. bredoi	13,226,198			13,226,198
Alestes	20,751,852			20,751,852
Hydrocynus	23,219,101			23,219,101

Table 24: Break-even points by species and water body in a year

	Albert			Kyoga			Victoria			All		
	Average prices (Shs per unit)	Total costs (Shs per boat)	BEP (units per year)	Average prices (Shs per unit)	Total costs (Shs per boat)	BEP (units per year)	Average prices (Shs per unit)	Total costs (Shs per boat)	BEP (units per year)	Average prices (Shs per unit)	Total costs (Shs per boat)	BEP (units per year)
Nile perch (kg)	4,463	22,126,007	4,957.7	5,037	16,913,930	3,358.3	6,788	36,011,011	5,305.5	5,429	25,016,983	4,608.0
Tilapia (kg)	3,972	12,002,947	3,021.9	3,837	27,053,849	7,051.7	4,313	16,939,964	3,927.7	4,041	18,665,587	4,619.1
Mukene (basin)				17,195	14,933,556	868.5	21,517	27,324,739	1,269.9	19,356	21,129,148	1,091.6
B. nurse/ N. bredoi (basin)	10,408	14,854,780	1,427.2							10,408	14,854,780	1,427.2
Alestes (head)	5,000	12,868,192	2,573.6							5,000	12,868,192	2,573.6
Hydrocynus (head)	3,966	10,725,377	2,704.3							3,966	10,725,377	2,704.3

Table 25: Payback periods by species and by water body

	Albert			Kyoga			Victoria			All		
	Investment costs	Annual profits	PBP (Months)	Investment costs	Annual profits	PBP (Months)	Investment costs	Annual profits	PBP (Months)	Investment costs	Annual profits	PBP (Months)
Nile perch	5,520,162	44,494,140	1.5	1,939,180	19,006,977	1.2	5,087,878	51,802,776	1.2	4,182,407	38,434,631	1.3
Tilapia	5,520,162	26,735,060	2.5	1,630,265	2,921,118	6.7	4,305,352	4,327,343	11.9	3,818,593	11,327,840	7.0
Mukene				843,563	7,719,724	1.3	1,854,238	65,973,661	0.3	1,348,900	36,846,693	0.8
B. nurse/ N. bredoi	1,513,065	77,487,687	0.2							1,513,065	77,487,687	0.2
Alestes	5,520,162	19,747,075	3.4							5,520,162	19,747,075	3.4
Hydrocynus	5,520,162	61,337,783	1.1							5,520,162	61,337,783	1.1

Table 26: Proportions of respondents who considered the factors important for profitability

	Albert	Kyoga	Victoria	All
High fish demand	89.1%	-	-	89.1%
Effective enforcesment of fisheries regulations	72.3%	69.5%	59.9%	67.3%
Access to input supply	-	31.8%	100.0%	65.9%
Access to technical advice	58.2%	75.0%	54.2%	62.5%
Market stability	62.2%	57.9%	56.1%	58.7%
All weather access roads to landing site	44.4%	37.3%	74.2%	52.0%
Access to refigrated trucks /boat containers	25.4%	59.5%	67.9%	50.9%
Lucrative fish prices	50.0%	44.7%	45.5%	46.7%
Access to credit	24.7%	27.0%	38.8%	30.1%

Table 27: Main buyers of fish by water bodies

	Albert	Kyoga	Victoria	All
Local traders	50.0%	66.4%	50.4%	55.6%
Direct consumers	38.4%	7.2%	17.8%	21.1%
Factory agent/Indurstrial processors	3.0%	11.8%	23.5%	12.8%
Regional traders	7.9%	9.9%	7.6%	8.5%
Artisanal processors		3.9%	0.8%	2.4%
Others	0.6%	0.7%	0.0%	0.4%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Table 28: Respondents who sold their fish at the different markets

	Albert	Kyoga	Victoria	All
Beach Market	89.0%	73.0%	88.4%	83.5%
Another District	4.3%	20.9%	4.7%	10.0%
Local market not at the beach	5.5%	2.7%	5.4%	4.5%
Regional market	1.2%	2.0%	1.6%	1.6%
Others		1.4%		1.4%
Total	100.0%	100.0%	100.0%	100.0%

Table 29: Respondents' most commonly used means of transport for fish

	Albert	Kyoga	Victoria	ALL
Boat	34.8%	6.8%	53.3%	31.6%
Hired truck	34.8%	40.9%	6.7%	27.5%
Puplic Vehicle	8.7%	50.0%	13.3%	24.0%
Motor Cycle	17.4%		20.0%	18.7%
Own Vehicle	0.0%	2.3%	6.7%	3.0%
Others	4.3%	-	0.0%	2.2%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Table 30: Main market destinations by water body

Albert		Kyoga		Victoria	
Market	Proportion of respondents	Market	Proportion of respondents	Market	Proportion of respondents
Panyimur	33.3%	Soroti	19.4%	Kampala	
Kampala	14.3%	Gulu	19.4%	Masaka	
Ssebagoro	9.5%	DRC	16.1%	Mukono	
Kaiso	9.5%	Kamuli	9.7%	Jinja	
Bundibugyo	9.5%	Kampala	6.5%	Iganga	
Singlar	4.8%	Busia	6.5%	Busia	
Rwanda	4.8%	Arua	6.5%	Bugiri	
Hoima	4.8%	Bweyale	3.2%		
Bwera	4.8%	Amuria	3.2%		
Bugoigo	4.8%	Kumi	3.2%		
		Bukedeya	3.2%		
		Nakasongola	3.2%		
Total	**100.0%**		**100.0%**		

Table 31: Transaction costs in fish marketing by water body

	Albert	Kyoga	Victoria	All
No. of trips to market per week	1.5	1.7	3.2	2.1
Distance to the main market (Km)	2.9	4.9	3.1	3.6
Transport costs	5,541,682	6,650,357	12,929,931	8,373,990
FMP costs	2,273,885	6,249,107	2,243,375	3,588,789

8.2 APPENDIX 2: Landing sites sampled, by water body

Water body	Landing site	No.of Respondents
L. Albert	Ntoroko	24
	Dei	32
	Walukuba	41
	Nkondo II	28
	Mbegu	43
	Sub-total	**168**
L. Kyoga	Kigingi	26
	Kambatani	29
	Muremu	16
	Namasale	24
	Wansolo	30
	Kikaraganya	10
	Kagwara	20
	Sub-total	**155**
L. Victoria	Kasekulo/Tubii	32
	Diimo	27
	Ssenyondo	28
	Gerenge	35
	Kiziru	43
	Koko	33
	Nakirimila	31
	Wakawaka	35
	Sub-total	**264**
Total		**587**

8.3 APPENDIX 3: Questionnaire

National Fisheries Resources Research Institute

Costs-benefit analysis of fishing enterprises to improve fishers' incomes on Lakes Kyoga, Albert, Victoria, Edward and George

QUESTIONNAIRE FOR BOAT OWNERS AND MANAGERS

The purpose of this survey is to assess and monitor the costs and earnings of fishing enterprises to improve incomes of fishers

1. Date of interview _____
2. Name of interviewer _____
3. Lake _____
4. District _____
5. Sub-county _____
6. Landing site _____
7. Name of respondent _____
8. Sex of respondent: [1] Male [2] Female
9. Educational level: [1] None [2] Incomplete Primary [3] Complete Primary
   [4] Incomplete Secondary [5] Complete Secondary [6] Tertiary
10. Average number of days fished in a week: _____
11. What fish species do you mainly target?
    [1] Tilapia [2] Nile Perch [3] Mukene [4] Muziri
    [5] Others (Specify) _____

Production costs

12. Do you own or rent a boat?: [1] Own [2] Rent
13. If you rent a boat, how much do you pay per day? _____ (Shs per day).
14. If you own a boat, give relevant information in table below

Type of boat	**Number**	**Unit cost**	**Repair costs** *(Shs/half yearly)*	**Life span** (*Years)*
Ssesse				
Parachute				
Congo barque				
Other (specify).				

15. Do you use outboard engine(s)? [1] Yes [2] No
16. If Yes, give information on the engines used.

Engine Horse power	**Number**	**Cost per engine**	**Repair costs** *(Sh/week)*	**Lifespan** *(Years)*
Less than 10				
10 to20				
Above 20				

17. Give information on fuel used per fishing trip:

	Quantity *(Litres/ day* ***)***	**Cost** (*Shs/ litre)*
Petrol		
Engine oil		

18. Give information on oars owned.

Oar Size	**Number**	**Unit cost**	**Repair costs** *(Sh/month)*	**Lifespan** (*months)*
Small				
Large				

19. Give information on number of workers deployed and their payments per day:

	Number	**Payment** *(Shs/ worker/ day)*
Fishing		
Net preparation		
Splitting fish open		
Other (specify) _____		

20. Give the types and numbers of gear(s) you use

Gear Types	**Number**	**Unit cost** *(Shs/unit)*	**Repair costs** *(Sh/month)*	**Life span** (*Months*)
Gillnets - multifilament				
Gillnets - monofilament				
Long lines				
Small/ mukene seines				
Beach/ boat seines				
Cast nets				
Others (specify) _____				

21. How much did you pay for the boat license last year? _____ Shs

22. How much did you pay for boat registration last year? _____ Shs

23. Give information on the type of floats and sinks used:

Floater Type	**Number**	**Unit cost**	**Lifespan** (*Months*)
Floats from shops			
Plant floats			
Plastic materials			
Other floats (specify) _____			
Sinkers (specify) _____			

24. Give information on the types of anchor used:

Anchor Type	**Number**	**Unit cost**	**Lifespan** (*Years*)
1 Metal			
2. Stone			
3. Other (specify) _____			

25. What other important fishery related expenses do you incur apart from the ones mentioned above

Expenses	**Cost**
Food (per day)	
Capella/ kavera (per month)	
Charcoal/ firewood (per day)	
Cigarettes (per day)	
Blankets (per month)	
Other (specify) _____	

Revenue data

26. What are your average weekly catches and prices for the main species fished during high and low seasons?

Fish type	**Low season**		**High season**	
	Catches	**Prices**	**Catches**	**Prices**
Nile perch (kgs)				
Tilapia (heads)				
Mukene (basins)				
Muziri (basins)				

Ragoge (basins)				
Alestes (angara) (heads)				
Hydrocynus (ngasia) (heads)				
Bagrus. bayad (lanya)				
Other (specify) _____				

Mukene/ muziri/ ragoge fishers only

27. Give information on the expenses used in mukene/ muziri/ ragoge fisheries

Item	**Number**	**Unit cost**	**Repair costs** *(Shs per week)*	**Life span**
1. Lanterns				
2. Basins				
3. Drying nets				
4. Drying Racks				
5. Candles/ todoma				
6. Others (specify) __				

28. Average quantity of paraffin used per fishing trip: _____ Litres.
29. Average cost of paraffin: _____ Shs/litre.
30. Average expenditure on repairs of lanterns: _____ Shs/ week.

Incomes from fishing *(All respondents)*

31. Give your average income from fishing per fishing trip for low and high catch seasons::

Low season	**High season**

Fish marketing

32. Who are the main buyers of your fish?

    [1] Direct consumers [2] Local traders [3] Artisanal processors

    [4] Factory agents/Industrial processors [5] Regional traders

    [6] Other (specify) _____

33. \Where do you sell your fish?

    [1] Beach market [2] Local market not at the beach [3] Another District

    [4] Regional market [5] Other [specify] _____

34. If you sell away from the beach, give the name of your main market: _____
35. Give distance to your main market:

[1] Less than 5 km [2] 5-10 km [3] 10-50 km [4] Over 50 km

36. By what means do you mostly transport fish to the market?

[1] Bicycle [2] Motor Cycle [3] Public vehicle [4] Own vehicle

[5] Hired truck [6] Boat [7] Other (specify) _____

37. Give the number of trips to the market per week: _____

38. Give your transportation cost per trip: _____ Shs

39. Give your fish movement permit costs per trip: _____ Shs

Business environment

40. Indicate the availability of the following business conditions :

	[1] Yes [2] No
Stable market	
High demand	
Lucrative prices	
Access to credit	
Access to technical advice	
All weather access	
Access to refrigerated trucks/ boats or containers	
Effective enforcement of fisheries regulations	

Thank you for your information