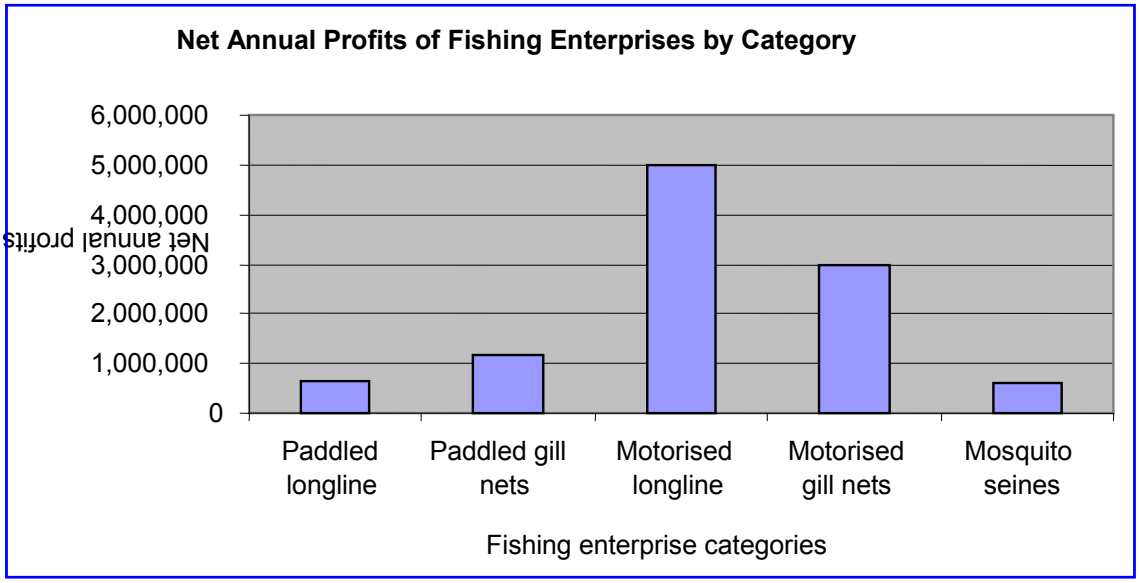
SOCIO-ECONOMIC RESEARCH REPORT 5

LAKE VICTORIA ENVIRONMENTAL MANAGEMENT PROJECT

ECONOMIC VIABILITY OF FISHING ENTERPRISES ON LAKE VICTORIA, UGANDA



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EXECUTIVE SUMMARY

Introduction

1. Fishing in Uganda largely developed into a commercially oriented activity as a result of the fish export trade that started in the late 1980's. Despite this rapid commercialisation, poverty levels among fishing communities have remained relatively high thus raising concerns about the profitability of fishing. An analysis of the costs, earnings and profitability of the various fishing enterprises in Uganda was undertaken to address this concern.

Methodology

2. The survey was carried out in five districts, namely Rakai, Kalangala, Mukono, Mayuge and Bugiri. Most boat owners/ renters who attended the community meetings participated in the interviews, yielding a total of 558 fishermen. The survey was administered through a combination of unit questionnaire interviews and data entry sheets.

Findings

3. The fishermen had a low educational attainment and lacked specialized training acquired in tertiary institutions, which greatly narrows their alternative sources of livelihood.

4. Gender inequalities in terms of ownership of or access to fishing assets existed in the fisheries sub-sector given the predominance of males among boat owners/ renters.

5. Investment costs for fishing were generally low except for gill netting and motorized operations that required high investment on gill nets and outboard engines.

6. Gill net fishing units had the highest depreciation costs (almost 93% of the fishing unit value) due to the high costs and relatively short useful life of gill nets. Consequently, gill net fishing unit owners had to invest heavily towards replacement of worn-out gill nets roughly 3 times each year.

7. Longline fishing units incurred the highest operating costs mainly due to high bait costs, which accounted for nearly 40% of the total operating costs.

8. Longline fishing units exclusively landed *L. niloticus* whereas gill net and beach seine fishing units caught both of *O. niloticus* and *L. niloticus.* The proportion of *L. niloticus* in the total catch increased with the level of operation.

9. Lake Victoria fishers are a "highly risk prone" group given that their revenues are heavily dependent on only 1 of the 3 commercial fish species. If the catches or prices of any of the 3 commercial fish species fall considerably, chances are high that fishing enterprises will go out of business.

10. The price of *L. niloticus* (Shs. 1,270/ kg) almost doubled that of *O. niloticus* and was higher than for *Mukene* by about 3.5 times.

11. Longline fishing units realized the highest gross revenues followed by gill net and beach seine fishing units for the reason that they exclusively catch the high valued *L. niloticus* and land relatively good catches.

12. Investments in fishing were profitable both in the short-run and long-run periods as revealed by the positive net profits realized by all types of fishing enterprises.

13. All types of fishing enterprises realized net profits that were sufficiently high to cover their investment costs within a period of one year. Additionally, as a function of investment, non-motorized fishing units had higher returns to investment than motorized ones.

Recommendations

14. Policies to increase further liberalization of the fishing input supply markets should be put into place to reduce monopolistic tendencies among suppliers of these inputs, which have resulted into high input prices particularly of gill nets and outboard engines.

15. The Uganda National Bureau of Standards should ensure that local manufacturers and importers of gill nets supply more durable gill nets so as to prolong the useful life of gill nets and hence reduce depreciation costs.

16. The Fisheries Department in collaboration with relevant partners should explore the feasibility of using artificial bait, which unlike the live bait can be recycled. This will substantially reduce the cost of bait, which accounts for 25-50% of the total operating costs.

17. The study recommends that motorized fishing unit owners purchase outboard engine brands and types with better fuel economizing attributes in order to minimize their fuel costs.

18. In view of the fishermen's low educational attainment and lack of specialized training, it is recommended that entrepreneur development programs designed to develop the fishermen's 'business abilities' be implemented.

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LIST OF ABBREVIATIONS

DFR	Department of Fisheries Resources
FAO	Food and Agriculture Organization
FMP	Fisheries Master Plan
IDRC	International Development Research Center
LVEMP	Lake Victoria Environmental Management Project
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
MFPED	Ministry of Finance, Planning and Economic Development
NARO	National Agricultural Research Organization
PMA	Plan for Modernization of Agriculture
UIA	Uganda Investment Authority

1.0 INTRODUCTION

1.1 Background

The challenges facing Uganda's Fisheries Sector this decade and beyond are formidable indeed. It must cope with the excessive pressure on the limited fisheries resource. It must achieve a significant growth in fish production not merely to improve fishers' incomes but also to reduce animal protein shortages in the local diets. It must be a major employer of the rapidly increasing jobless people and must compete on the world markets to earn foreign exchange that Uganda needs to fuel its economic growth. And it must do all this while reversing the degradation of the fisheries resources that threatens long-term production. To cope with these challenges, the Government has adopted the Plan for Modernization of Agriculture and more specifically the Fisheries Master Plan that aims at sustainably transforming the fisheries industry from small-scale subsistence levels to commercial levels so as to increase fish production for local consumption and export.

While the need for these policy guidelines is unquestionable, development strategies in the past decade have been dominated by an export market development bias and have largely ignored the fisheries harvest sub-sector. Moreover, the fish-harvest sub-sector contributes to the fulfillment of more national fisheries goals than any other fisheries sub-sector. It is estimated that there are up to about 75,000 fishermen in Uganda, who provide employment for 150,000 shore-based workers engaged in, for example trading, marketing and processing of fish. The fish landed by fisheries enterprises is not only widely affordable to many Ugandan's but also provides over 35% of the animal protein consumption (FAO 2001). Contrary to their image as 'tax evaders', many fishermen pay a significant portion of their income in tax. Taxes such as boat licenses, fishing permit, local registration, market dues and income tax provide a large share of the total revenues collected by Local Governments in the riparian districts of Uganda's lakes. On the basis of their valuable contribution to the national economy, Government and development partners' needs to broaden the focus of fisheries development to cover the fish-harvest sub-sector in addition to promoting fish export trade.

Given that fishing in Uganda is primarily a profit oriented activity, a critical question Government specifically needs to address in the process of 'modernizing' the fish-harvest sub-sector is; how to sustainably make fisheries enterprises more profitable? This requires a clear assessment of the costs, earning and profitability of the alternative fishing technologies used in Uganda's fisheries industry.

1.2 Research Problem

Apparently, there is a severe lack of up-to-date cost and earnings data of the alternative fishing technologies based on systematic empirical investigations. Specifically, the comparative advantages and disadvantages in terms of cost and earnings of the different fishing technologies remain largely unknown. In the absence of such information, fisheries planners are not equipped with essential knowledge of the most cost effective type of fishery to develop and strategies aimed at improving the profitability of fishing enterprises are likely to fail. This study therefore closely examines fishing incomes and costs and evaluates profitability of fisheries enterprises by scale of operation.

1.3 Objectives of the Study

The overall objective of the study is to examine the profitability of fishing enterprises by scale of operation. The specific objectives of the study are threefold:

a) To determine the cost, earnings and profitability of fishing enterprises by scale of operation.

b) To examine the distribution of earnings from fishing between boat owners/ renters and crewmembers.

c) To examine the factors that are responsible for the differences in the profitability levels by scale of operation.

1.4 Research Questions

The seven specific questions to which answers are sought are: -

1. How much of the total costs of the different fishing enterprises are independent of the day-to-day operations?
2. What are the relative capital and labor intensities of the different fishing enterprises.
3. How sensitive is the cost structure of the different fishing enterprises to fuel price increases?
4. What share of fishing revenues do crewmembers receive for their labor?
5. What types of gear are on the average more profitable?
6. Are the costs, earnings and profitability of fishing enterprises dependent on scale of operation?
7. Do the prices of fish and fishing inputs differ substantially among fishing enterprises to the extent that they have an effect on profitability?

1.5 Justification of the Study

The vision of PMA in relation to the fisheries sector is "poverty eradication through a competitive, profitable and sustainable fisheries sector". In regard to the fish harvest sub-sector, implementation of the PMA will inevitably involve making choices of the most cost-effective and profitable fishery to develop. This study by establishing the costs and earnings of different types of fisheries enterprises and their respective rates of return to capital will enable fisheries planners and developers to determine which fisheries enterprises to promote.

From a fisheries enterprise perspective, the study provides prospective fishers with information that will guide their investment decisions in the fisheries. They will know how much to expect from fishing and how long it will probably take them to recover their initial investment. For the existing fishers, this study represents an analysis of their financial performance and hence will help them identify available opportunities to maximize returns from fishing.

2.0 LITERATURE REVIEW

Existing socio-economic knowledge has contributed significantly to the understanding of the opportunities and constraints facing the fisher folk. Nonetheless, information on the profitability levels of investments in fishing is limited.

IDRC (1994) points out that investment requirement for fish production enterprises are small and fall within the reach of small-scale producers in the country. The Fisheries Master Plan (1998) reports that investments in fishing activities generate favorable returns to labor and capital as compared to agricultural activities. While these reports throw some light on the viability of fishing in relation to alternative non-fishing investments, they do not answer the critical question, "Is investing in fishing profitable"? A comparison of the 1989 and 2000 Frame Surveys indicates that there has been a substantial growth in fishing effort. This in turn suggests that the profitability levels over the past decade have been sufficiently high to attract continued investment.

Reynolds (1988) studied the costs and earnings of gill net fishing units targeting *O. niloticus* and *L. niloticus.* He concludes that investments in fishing are generally profitable with motorized fishing units realizing higher profits than non-motorized fishing units. However, as a function of investment, he found out that the rate of return to capital was higher for the non-motorized fishing units as compared to motorized fishing units. Reynolds (1998) however has some inherent weaknesses, which raise serious doubts about the accuracy of his data. Firstly, his findings were based on direct observations and informal discussions with key respondents rather than systematic surveys. Secondly, the "snap-shot" method of data collection related to catches, prices and day-to-day fishing expenses gives less weight to the reliability of the data.

Even without reference to the weaknesses in Reynolds (1998), a number of important changes have occurred since 1998, which have affected the economic performance of the fisheries sub-sector. Ikiara (2000) reports that the nominal fish prices over the past decade have followed an upward trend. The nominal fish price of *L. niloticus* for instance increased by fourfold between 1990 and 1995 (Namisi 1999). Catches statistics from the Department of Fisheries Resources (2000) indicate that fish production levels have declined implying a drop in catch rates of individual fishers. Furthermore, the Ministry of Finance, Planning and Economic Development (MFPED) in a series of Background to the Budget (1990 to date) shows that in the past decade there has been a general increase in prices of fuel, fishing gear and outboard engines. These changes have definitely affected the

economic performance of fisheries enterprises thereby warranting the need for an up-to-date cost and earnings study, which is a precondition for developing a more profitable fisheries sub-sector.

3.0 METHODOLOGY

3.1 Study Area

The 11 riparian districts of Lake Victoria, Uganda were geographically divided into three zones. Western zone- Kalangala, Masaka and Rakai, Central zone- Mpigi, Wakiso, Kampala and Mukono and Eastern zone- Jinja, Mayuge, Bugiri and Busia (See Map 1). Six districts (two from each zone)- Rakai, Kalangala, Mpigi, Mukono, Mayuge and Bugiri were randomly selected as a cross-section of the districts bordering Lake Victoria. This sampling procedure reduced geographical sampling biases.

Map 1: Districts Bordering Lake Victoria, Uganda

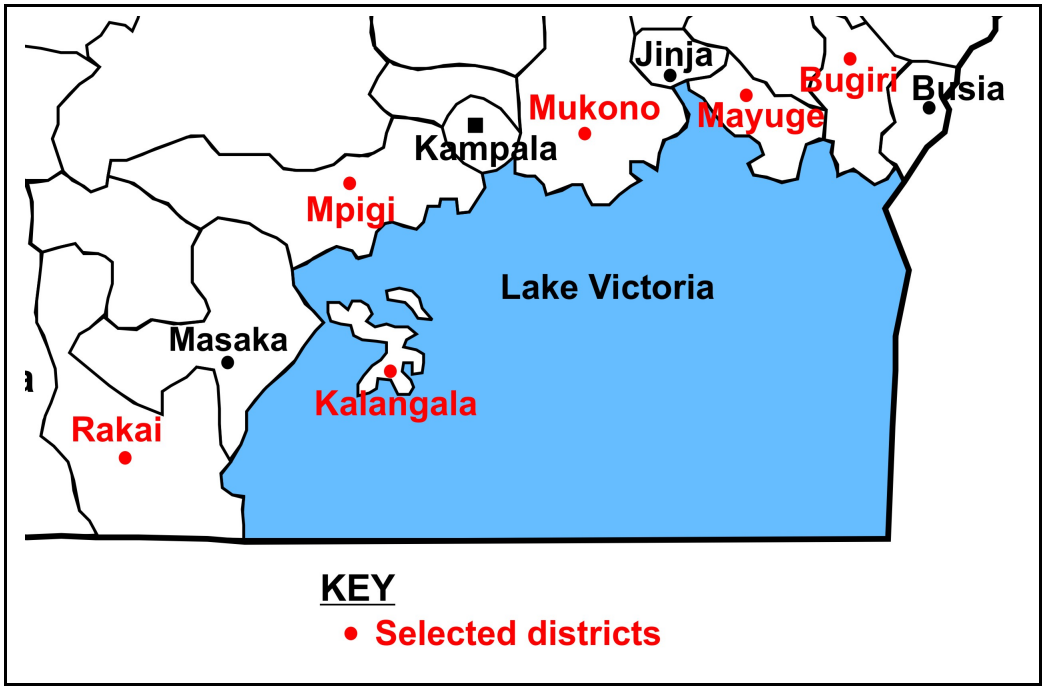


Table 1: Distribution of Sample Respondents by District

Zone	District	Frequency	Percentage (%)
Western	Kalangala	125	22.4
	Rakai	56	10.0
Central	Mukono	65	11.6
	Mpigi*	-	-
Eastern	Mayuge	190	34.1
	Bugiri	122	21.9
Total		**558**	**100**

*Selected but not surveyed

Source: Survey data

The selection of districts was followed by the selection of landing sites. On the basis of information provided by the Department of Fisheries in each district, a purposive sampling technique was used to select landing sites with relatively high levels of fishing activities in terms of number of fishers, number and types of boats and gears. This not only ensured that the landing sites selected for the study were representative of the wide variety of fishing technologies used but also facilitated the interception of the maximum number of respondents on any given day.

3.2 Sample Selection

Meetings were held with local leaders at the selected landing sites, during which the research team members introduced themselves, explained their mission and requested the leaders to mobilize the fishers for a community meeting. After the community meeting, all the available boat owners/ renters were requested to participate in the interviews. A total of 558 boat owners/ renters were interviewed from the selected landing sites.

3.3 Research Instrument

The survey was administered through a combination of unit questionnaire interviews and data entry sheets. Development of the instruments began in March 2001 with draft forms, which were reviewed and pretested by several key respondents. Following revisions, the survey began in Mayuge and Bugiri districts.

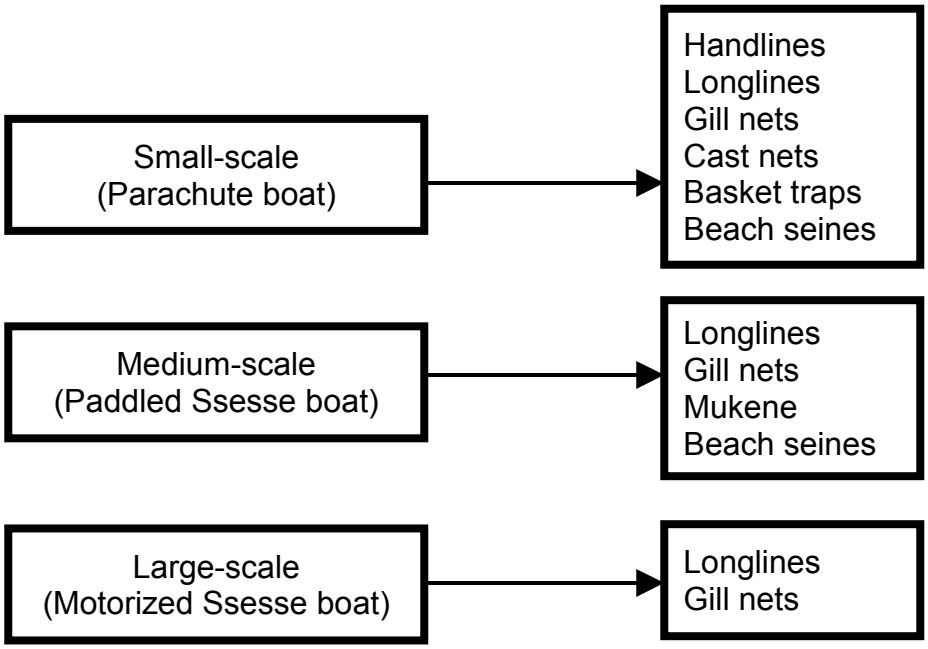
The unit questionnaire was used to obtain information related to the demographic characteristics of the sample respondents, boat, gear and operating characteristics. A total of 558 respondents were interviewed. The feasibility of using unit questionnaires, field researchers to record data over a long period and data entry sheets entered by sample respondents to obtain daily cost and earnings data of fisheries enterprises was assessed. A unit questionnaire was considered unsuitable for collecting information related to the various cash inflows and outflows of fishing enterprises over long periods due to the highly seasonal nature of the fishery. Following logistical considerations, the possibility of using field researchers to record daily cost and earnings data, over a significant period covering 6 districts at several landing sites was deemed cost ineffective. Two separate pilot surveys were conducted in Mukono and Mayuge districts with the aim of assessing the willingness and ability of the fisher folk to keep records of their daily costs and earnings in data entry forms specifically designed for fishing enterprises. The results showed that the majority of boat owners/ renters were not only willing but were also able to keep records of their daily costs and earnings.

On the basis of the pilot survey findings and logistical considerations, among the alternatives, sample respondents were asked to keep records of their daily catch, receipts and expenditures in the data entry sheets. Information on the data sheets was translated into Luganda, Lusoga, Swahili and Samia, whichever was appropriate for the selected landing sites. During field exercises, members of the research team demonstrated to the boat owners/ renters how to use the data entry sheets and finally asked them to keep their daily costs and earnings for at least a period of two months. The task was completed by visits made by field researchers after at least two month to collect the records. Of the 558 respondents who were provided with data entry forms, 327 data entry forms were completed and recovered, a positive response rate of 58.6%. Had it not been for the limited time, a longer period for keeping enterprise records would have been preferable.

3.4 Data Analysis

Fishermen were categorized into three strata based on the type of boat they owned/ rented. If a fisherman owned/ rented a small parachute boat (18ft or less), the surveys were coded as belonging to parachute boats. If a fisherman owned/ rented a paddled Ssesse boat (18ft or longer), surveys were coded Paddled Ssesse boats. Surveys of fishermen who responded that they owned/ rented Ssesse boats propelled by outboard engines were coded as belonging to motorized Ssesse boats. The relevance of this classification system was found in the fact that the majority of respondents easily understood and answered the set of questions related to boat characteristics and results show clear differences between categories. Boat size (length) and therefore the boat categories (parachute, paddled Ssesse and motorized Ssesse) are a suitable measure of scale (level of fishing inputs). Accordingly, the terms small-scale, medium-scale and large-scale were considered synonymous with parachute, paddled Ssesse and motorized Ssesse groups respectively and subsequently adopted for use in the study. Within each scale group, the fishermen were further stratified based on the type of fishing gear they own (See Fig. 1).

Figure 1: Classification of Fishing Enterprises based on Boat-Gear Characteristics



3.5 Analytical Framework

The basic unit of analysis is a fishing enterprise. Fishing enterprises are distinguished into three groups based on the level of operation. The seven research questions raised are answered by describing the cost structure of fishing operations, examining the sharing system between boat owners/ renters and crew members and analyzing the profitability of fishing enterprises. Thus, the analysis is divided into three related parts; cost structure, sharing system and profitability.

3.5.1 Cost Structure

Fishing costs are distinguished into fixed costs (FC) and variable costs (VC).

Fishing costs = FC + VC

Fixed costs are costs that do not vary with the level of production (catch) or fishing effort. Fixed costs are further classified into the costs of depreciation of fishing assets (DP) and opportunity costs (OP) on owned capital invested in fishing assets. To ensure that the amount of depreciation charged closely corresponds to the loss in value of fishing assets, two methods of computing depreciation were used, namely straight-line and declining balance method depending on the nature of the asset. For the boats and fishing gear (assuming other factors constant), the straight-line method was used essentially because these assets depreciate more or less evenly over their

useful life. By contrast, outboard engines depreciate more heavily when they are relatively new than when they are old and therefore a method that concentrates depreciation costs towards the beginning of the assets life- declining balance method was used.

FC = DP + OP

Variable costs are costs that vary with the level of production or fishing effort. The most important costs in the case of non-motorized boats are those spent on labor, market dues and food for the crew. Often the boat owner is also the operator and although no direct payment for his/ her labor is made, the opportunity cost of his/ her labor is estimated. In the case of motorized boats, fuel is also an important cost item. Other inputs such as dry cells, maintenance and cigarettes for the crewmembers account for a relatively small percentage of the total costs and are aggregated into "miscellaneous costs". Thus, variable costs are classified as:

Variable costs = Labor cost + Market dues + Food for crewmembers + other costs + Opportunity cost of labor.

The cost structure is described by expressing the various costs as a percentage of total costs and comparing the percentages by scale of operation. The proportion of labor costs to the total cost is used as an indication of the labor intensity of a particular type of fishing enterprise and proportion of fixed costs to total costs as an indication of the capital intensity. Fuel as a proportion of total costs is used to serve as an indicator of the vulnerability of fishing to rising fuel prices.

3.5.2 Sharing Systems

The sharing systems between the boat owners/ renters and crewmembers are established and the payment the crewmembers receive for their labor is determined. The implications the sharing systems have on income distribution and the amount of risk borne by the boat owner/ renter and crewmembers was assessed.

3.5.3 Profitability

Profitability is analyzed from the point of view of boat owners/ renters. They are in a business to earn a living and to do so the fishing enterprise must operate profitably. Two concepts of profit- the gross and net profit are considered. The gross profit is the difference between total revenues (TR) and variable costs (VC) or:

$$\Pi_{Gross} = TR - VC$$

For fishing enterprises to remain viable, the gross revenue must at least exceed the variable costs essentially because variable costs are day-to-day expenditures that must be incurred for the fishing unit to operate. Furthermore, since fixed costs have to be incurred whether the fishing unit goes to fish or not, in the short-run, the fishing unit will be prepared to operate as long as the variable costs are covered.

The net profit is the difference between the total revenues and total costs (TC):

$$\prod_{Net} = TR - TC$$

A situation in which the total costs (fixed costs inclusive) are not covered in the long run is not viable. More specifically, unless the gross profit is sufficient to cover depreciation (i.e. to provide for the eventual replacement of fishing assets), the boat owner cannot stay in business beyond the current economic life of fishing assets. In addition he/she cannot stay in business for too long if the net profit is not large enough to earn a return on the owned capital as high as he/ she can get from some other activity. Therefore a nonnegative net profit is a prerequisite for long-term viability of a fishing unit. In addition to the absolute magnitudes of gross and net profits, profitability is expressed in terms of the return to capital.

4.0 FINDINGS AND DISCUSSIONS

4.1 Socio-demographic Profile

The average age of the fishermen interviewed was 30.9 years. More specifically, the age of at least 50% of the sample respondents ranged between 25-36 years constituting mainly the youth. This tends to suggest that the youth are attracted to fishing possibly because incomes from fishing are above their opportunity cost or barriers of entry into the fishery particularly in terms of capital cost are not very restrictive. On the average, the fishermen had devoted 8.6 years in fishing.

At least 91.8% of the fishermen interviewed had at least attained some level of primary education. Of these, only 32.9% had advanced to the secondary school level. The percentage of fishermen who had advanced beyond secondary school level (University, Tertiary Institutes e.t.c.) was relatively insignificant. The fishermen's low educational attainment and lack of training in other specialties narrows the possibility of depending on other sources of livelihood.

In the sample, Baganda represented 31%, Basoga (16.8%), Basamia (13.4%) and Banyole (8.1%). Other significant tribes included the Itesot (6.1%), Bakenye (3%), Adhola (5.7%) and Jaluo (2.5%). Over 88% of the respondents were married. The rest were single (10%), widowed (0.5%) or separated (0.5%). There were only 13 (2.3%) female respondents who owned/ rented fishing boats. The predominance of males in the sample reflects gender disparities both in terms of ownership of or access to fishing assets in the fisheries.

4.2 Enterprise Characteristics

4.2.1 Boat-Gear and Operating Characteristics

In the sample, 83% of the fishermen owned fishing boats, the remainder (17%) rented them. The most widely used boat was of the parachute type (18ft or less), reported by 53.7% of the respondents. Other fishermen (46.3%) used boats of the Ssesse type (18ft or longer). Of the Ssesse type, nearly 31% were powered with outboard engines mainly of 15Hp although owners/ renters of outboard engines of 8-25Hp were also interviewed.

Various types of fishing gears are used in Lake Victoria's fisheries although gill nets were most common reported by 78% of the respondents. The prices of fishing inputs generally increase with the level of operation essentially because the sizes of boats and gears (hence unit price) used generally increase with the level of operation. Table 2 presents information on the unit price, salvage value and expected useful life of fishing assets.

Table 2: Unit Price, Salvage Value and Expected Useful Life of Fishing Units

Enterprise Level	Boat			Engine			Fishing Gear			
	Unit price (Shs)	Salvage value (Shs)	Useful life (years)	Unit price (Shs	Salvage value (Shs)	Useful life (years)	No. per boat	Unit price (Shs	Salvage value (Shs)	Useful life (years)
Small handline	60,000	0	2	.	.	.	7	180	.	.
Small longline	118,000	3,200	5	.	.	.	300	8,714	.	.
Small basket trap	45,000	0	5	.	.	.	20	2,167	.	.
Small cast net	110,000	3,000	5	.	.	.	1	63,333	0	1
Small gillnet	108,221	3,434	5	.	.	.	18	17,644	673	0
Small beach seine	105,000	1,500	5	.	.	.	1	300,000	30,000	8
Medium longline	268,889	14,667	5	.	.	.	700	75	.	.
Medium gillnet	231,730	32,432	5	.	.	.	45	19,196	833	1
Medium beach seine	244,000	19,000	7	.	.	.	1	295,000	28,333	7
Medium-Mukene	274,211	17,500	4	.	.	.	1	256,421	12,105	1
Large longline	348,000	10,000	5	2,050,000	383,333	6	700	90	.	.
Large gillnet	543,158	67,105	5	2,458,333	708,333	6	95	42,528	3,056	1

Source: Survey data

Fishermen using parachute boats mainly fished in shoreline (10%) and inshore (43.8%) waters. Fishermen using Paddled Ssesse boats fished mainly in inshore waters (25.3%) while some 6.6% fished in offshore waters. Almost all the fishermen operating motorized Ssesse boats (96%) fished in offshore waters. The relationship between boat type and fishing ground reflects limitations on small boats in exploiting distant fishing grounds and limitations of big boats in exploiting inshore grounds.

Generally, fishermen spend between 5-11 hours fishing per day. A comparison of gear type and hours spent fishing per day reveals that there are wide variations with gill netters spending the most time and beach seiners spending the least time.

Table 3: Duration of Fishing Trips (Hrs)

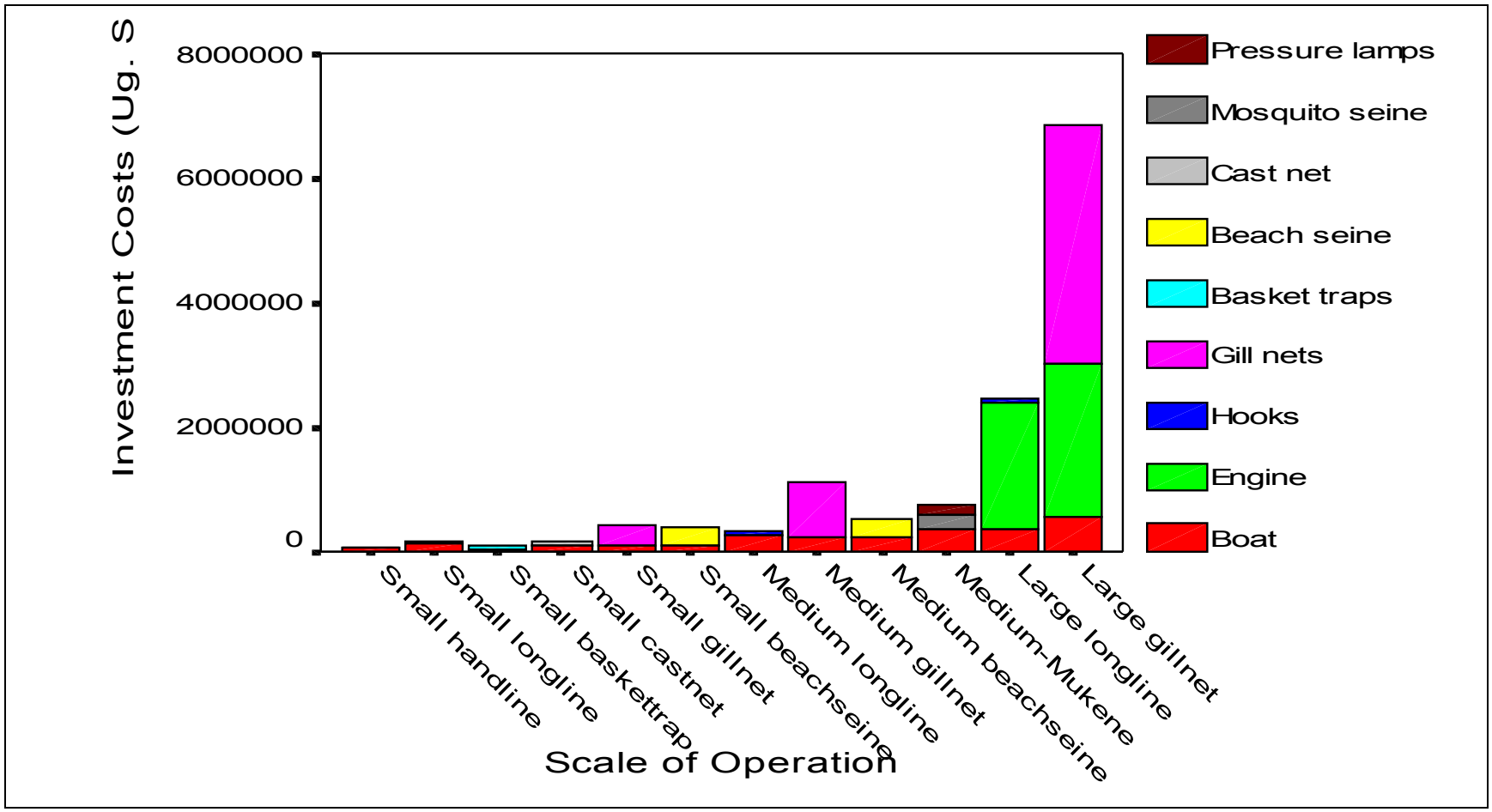
Scale of Operation	Gear Type	Duration (Hrs per day)
Small-scale	Handlines	6
	Longlines	5.3
	Gillnets	9.5
	Cast nets	8.7
	Basket traps	5.3
	Beach seines	5
Medium-scale	Longlines	7.5
	Gillnets	9.6
	Beach seines	7
Large-scale	Longlines	11.3
	Gill nets	10.7

Source: Survey data

4.2.2 Capital Investment

Fishermen's fishing assets mainly consisted of items such as boats, fishing gear, oars, outboard engines and pressure lamps. To reflect the investment requirements of fishing, the cost price was used to value the fishing assets. However, for purposes of assessing the returns to capital, the cost *less* depreciation method was used essentially because the cost price does not reflect the current value of the fishing assets for which profitability is analyzed.

Figure 2: Investment Costs per fishing Unit



Source: Survey data

Investment requirements for small to medium scale fishing units are comparatively low and increase modestly across the groups (See Figure 2). In contrast, investment requirements of large-scale fishing units are comparatively high as can be seen by the sharp increases in the investments costs over and above that of small to medium scale fishing units. Overall, gill net fishing units substantially had higher investment costs as compared to other fishing units.

Within the small-scale group, owners of gill net fishing units on the average invested Shs. 422,400 or about 2 times higher than for beach seine fishing units. On the other hand, owners of handline, basket trap, longline and cast net fishing units reported average capital investments ranging between Shs. 38,100 and Shs. 141,200. In the case of medium-scale fishing units, owners of gill net fishing units on the average invested Shs. 1,106,500 or about 2.5 times higher than for beach seine, longline and Mukene fishing units. Within the large-scale group, owners of gill net fishing units on the average invested capital to the tune of Shs. 6,530,100 or roughly 3 times higher than that for longline fishing units (See Table 4).

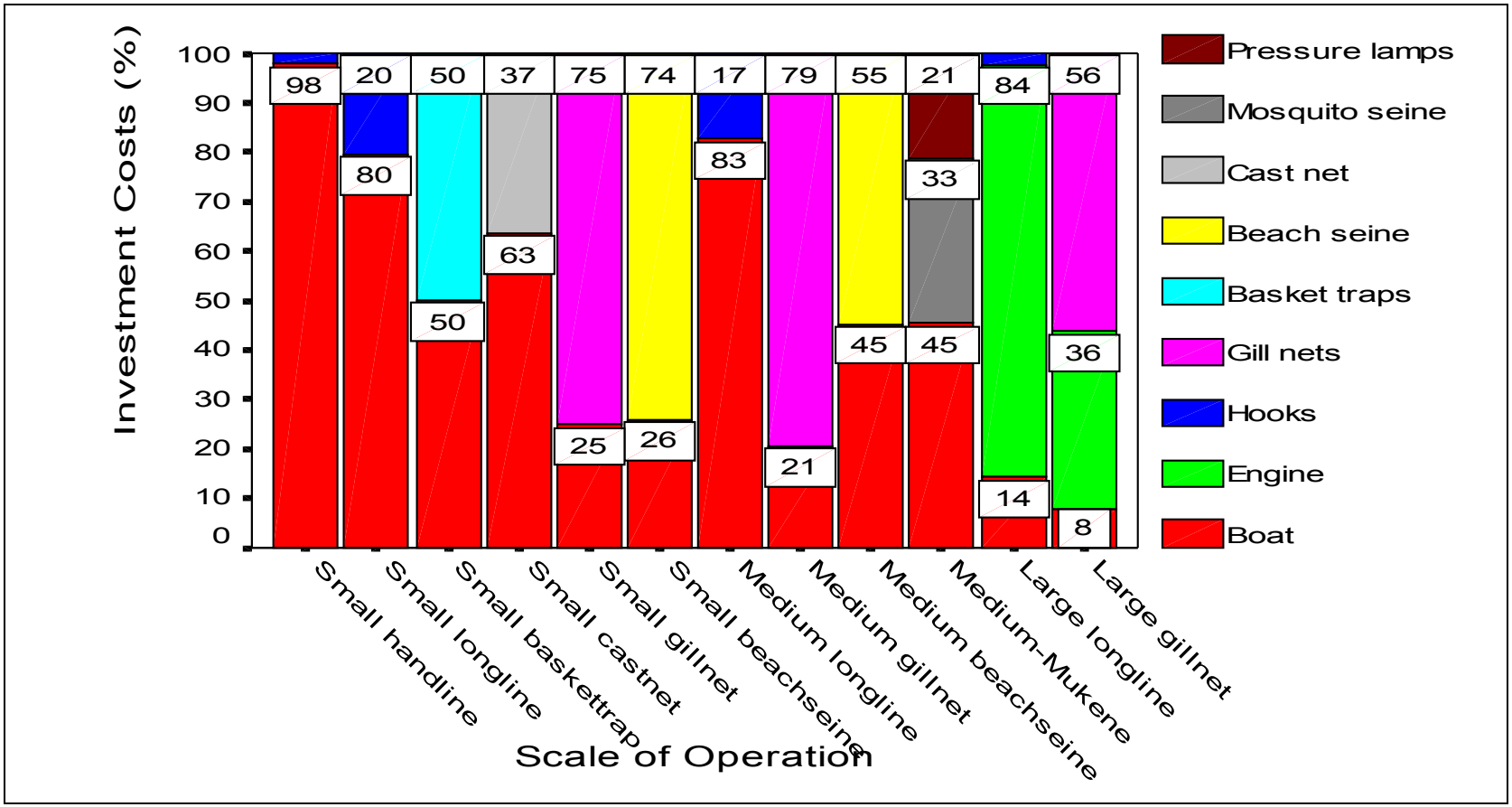
Table 4: Investment Costs of Fishing Units

Scale of Operation		Mean	S.E of Mean
Non-motorized	Small-scale handline	38,100	31,200
	Small-scale longline	120,286	33,555
	Small-scale basket trap	80,500	27,705
	Small-scale cast net	141,167	36,892
	Small-scale gillnet	422,372	78,748
	Small-scale beach seine	263,250	115,750
	Medium-scale longline	306,790	54,151
	Medium-scale gillnet	1,106,455	138,021
	Medium-scale beach seine	504,583	113,381
	Medium-scale Mukene	704,316	27,570
Motorized	Large-scale longline	2,069,357	435,305
	Large-scale gillnet	6,530,105	847,876

Source: Survey data

Information on the investment requirements of non-fishing investments of comparable risk was limited. Nevertheless, one generalization is that investment requirements for fishing except for gill net fishing units and motorized fishing units in particular are low. The considerably high investment levels of gill net fishing units as compared to other fishing units within the same group is a reflection of the fact that the cost of gill nets is extremely high. More specifically, for the non-motorized boats (Parachutes and paddled Ssesse boats), while boats contribute a significant portion of the total capital outlay, gill nets alone accounted for nearly 77% of the total investment. In the case of motorized boats, gill nets were still the most important element of investment accounting for almost 56% while the outboard engine contributed barely 36% of the total investment (See Figure3).

Figure 3: Relative Contribution of Fishing Assets to Total Investment.



Source: Survey data

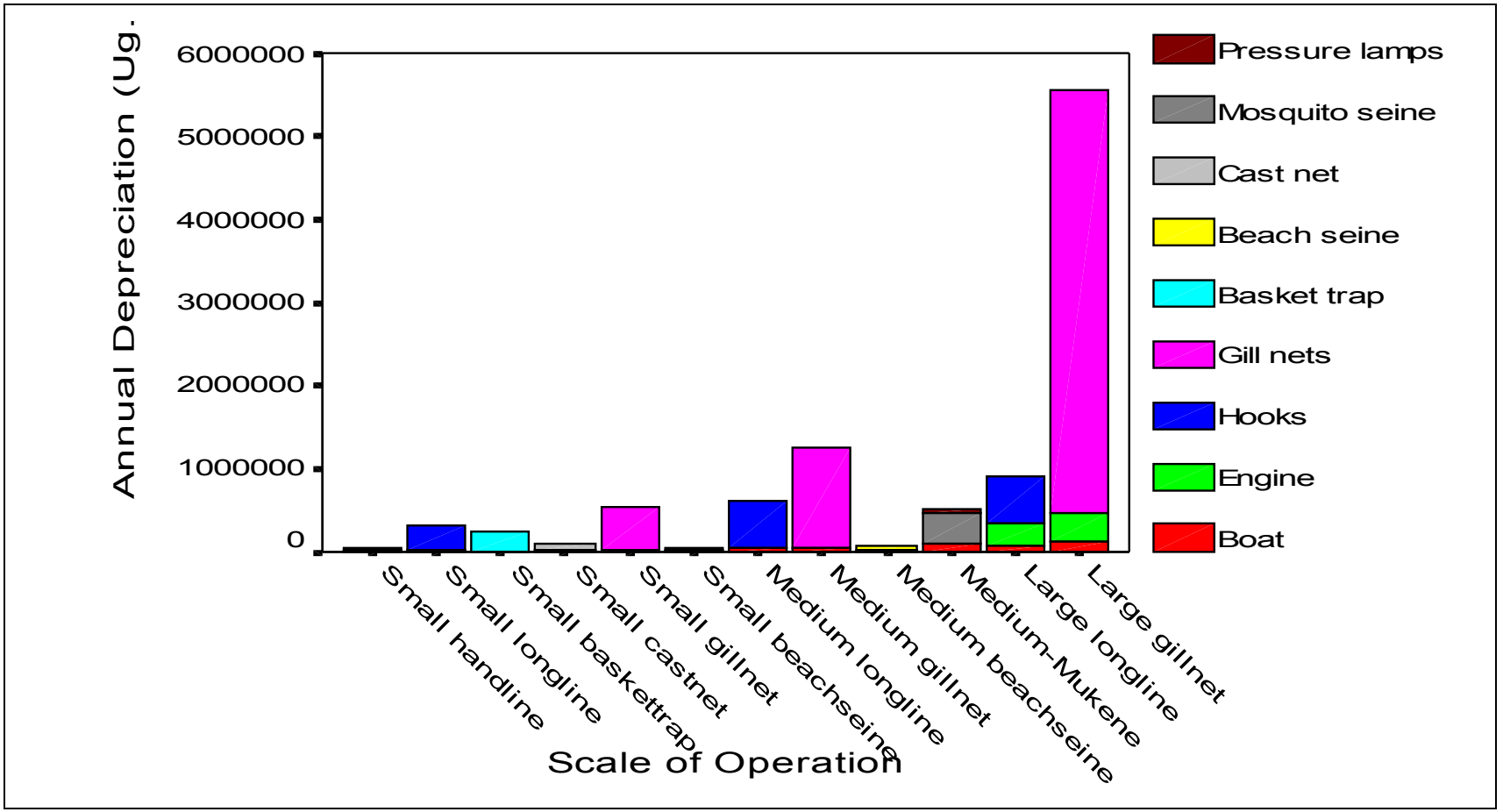
The considerably high cost of gill nets as a proportion of total investment is in turn a reflection of the relatively large quantities of gill nets used per boat (10-67) coupled with their significantly higher prices (Shs. 8,000-40,000) per net. On the other hand, the investment levels of other fishing units were relatively low mainly due to either the small number of fishing gear used (cast nets and beach seines) or low prices of fishing gear (longlines) or both small number and low prices (handlines and basket traps).

4.3 Fixed Costs

4.3.1 Depreciation

Generally, the annual depreciation costs largely follow the same pattern associated with the investment levels. Overall, gill net fishing units had the highest depreciation costs followed by longline and *Mukene* fishing units while beach seine fishing units had the least (See Figure 4).

Figure 4: Annual Depreciation per Fishing Unit



Source: Survey data

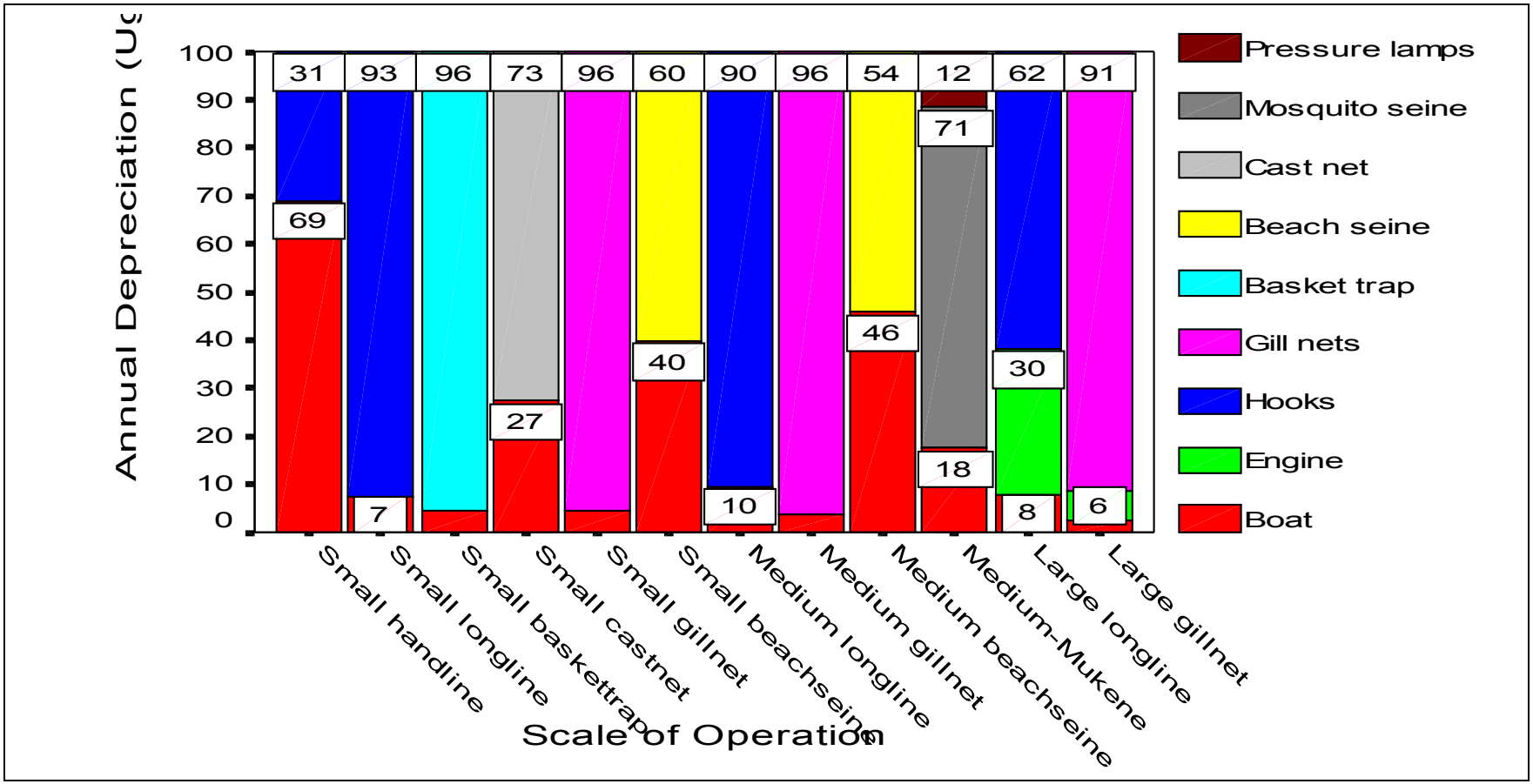
Within the small-scale group, gill net fishing units on the average depreciated by about Shs. 550,980 annually or nearly 2 times higher than for longline and basket trap fishing units. For the other fishing units (handlines, beach seines and cast nets) the average annual depreciation costs varied between Shs. 40,500 and Shs. 91,185. In the case of the medium-scale group, gill net fishing units depreciated by nearly Shs. 1,260,791 annually or about 2 and 17 times higher that for longline/ *Mukene* and beach seine fishing units respectively. Interestingly, medium-scale gill net fishing units each year depreciate by an amount about 1.5 times higher than for large-scale longline fishing units thereby strongly suggesting that depreciation is primarily dependent on the type of fishing gear rather than boat or outboard engine used. Within the large-scale group, gill net fishing units depreciated annually by about Shs. 5,264,200 almost exceeding that of longline fishing units by 6 times (See Table 4).

Table 5: Annual Depreciation Costs of Fishing Units

Scale of Operation		Mean	S.E of Mean
Non-motorized	Small handline	40,500	1,500
	Small longline	328,935	123,522
	Small basket trap	241,111	81,877
	Small cast net	91,185	7,965
	Small gillnet	550,980	72,767
	Small beach seine	46,264	7,486
	Medium longline	626,504	120,038
	Medium gillnet	1,260,791	122,592
	Medium beach seine	73,531	6,180
	Medium-Mukene	512,459	65,034
Motorized	Large longline	867,884	77,163
	Large gillnet	5,264,190	990,241

Source: Survey data

Figure 5: Relative Contribution of Fishing Assets to Total Depreciation



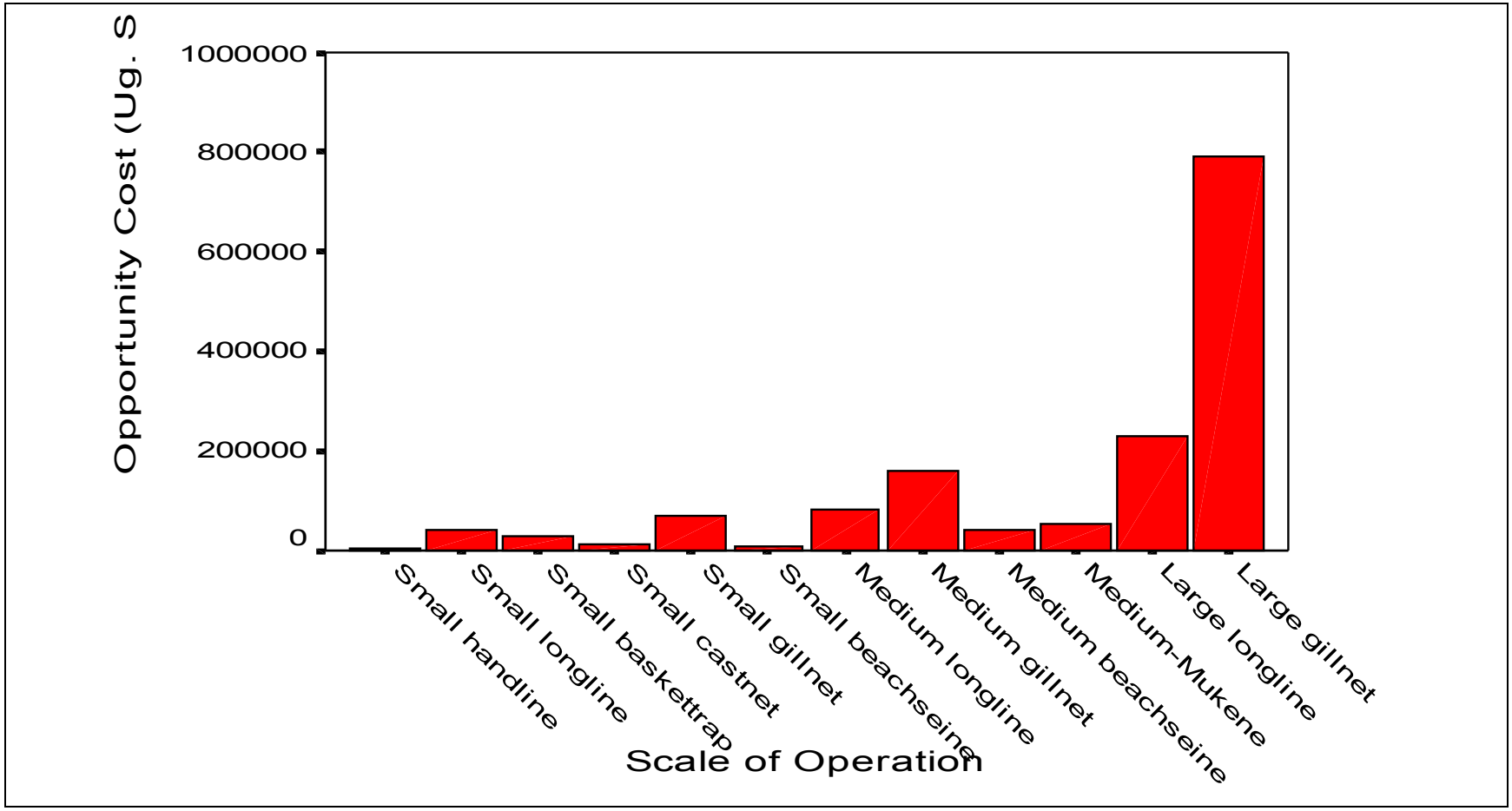
Source: Survey data

The comparatively high depreciation cost of gill net fishing units is to a large extent explained by the high depreciation costs of gill nets (94%), which is in turn a function of their high cost and relatively 'short useful life' (See Figure 5). The combined effect of the high cost and short useful life of gill nets is that fishing unit owners have to invest heavily (Shs. 225,000 -Shs. 1,500,000) towards replacement of worn-out gill nets 2-4 times a year. Moreover, the frequent damage of gill nets in rocky fishing grounds and by Crabs, loss of gill nets as a result of strong winds and rampant theft which was widely reported by the respondents further shortens the useful life of gill nets thereby increasing their depreciation costs. In the case of longline fishing units, despite the fact that longlines are very cheap, they have an extremely short useful life (2-8 weeks) and therefore necessitate rather modest and yet numerous investments in hooks annually. For the other fishing units, the relatively low level of depreciation is primarily attributed to either long useful life (beach seines) or low cost (handlines, cast nets and basket traps).

4.3.2 Opportunity Cost

The majority of the fishermen (65.5%) reported that farming was their best alternative non-fishing investment involving a broad spectrum of diverse small to medium scale crop and animal enterprises. While this information is useful in providing an insight towards the range of non-fishing opportunities that fishermen can engage in, it makes the estimation of a "standard return to capital" of non-fishing investments and subsequently the derivation of opportunity cost of fishing very complicated. Nevertheless, an indirect method involving the use of the prevailing interest on savings of Uganda Commercial Bank (12% per annum for the year 2001) was used. This method is admittedly not very practical but given the limited feasible alternatives, it was deemed the most suitable.

Figure 6: Opportunity Cost per Fishing Unit



Source: Survey data

The income foregone (Opportunity Cost) by fishing unit owners from non-fishing investments varies widely by the level of operation. However, gill net fishing units considerably have higher opportunity costs of owned capital as compared to other fishing units. For example, for large-scale fishing units, owners of gill net fishing units on the average 'sacrificed' Shs. 792, 600 annually from non-fishing investments or about 3.5 times higher than owners of longline fishing units and the trend is similar even for the other groups. Opportunity cost of own capital is directly related to the levels of investment. Since the interest foregone (12% per annum) is the same for all fishing unit owners, then the explanation for the wide variations in the opportunity cost seen in Figure 6 is differences in the investment levels across the different groups.

Table 6: Opportunity cost of Fishing Units by Scale of Operation

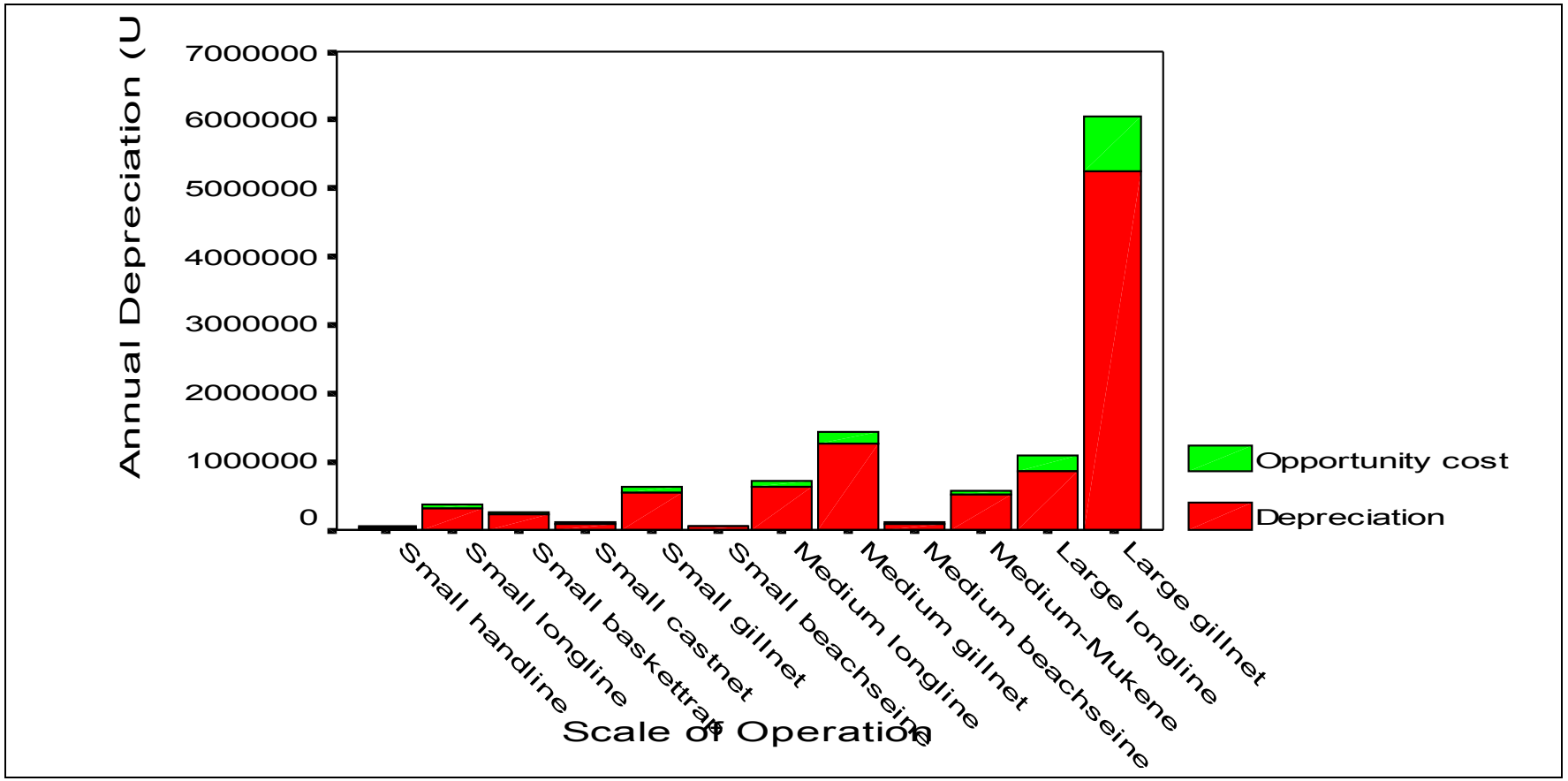
Scale of Operation		Mean (Shs)	S. E of Mean
Non-motorized	Small handline	4,860	180
	Small longline	39,970	15,323
	Small basket trap	28,613	9,534
	Small cast net	11,956	2,422
	Small gillnet	68,309	8,799
	Small beach seine	9,828	6,642
	Medium longline	82,512	14,918
	Medium gillnet	159,943	15,209
	Medium beach seine	42,070	11,446
	Medium-Mukene	52,038	2,911
Motorized	Large longline	227,891	31,437
	Large gillnet	792,642	127,878

Source: Survey data

4.3.3 Total Fixed Costs

Total fixed cost is a combination of total annual depreciation costs and opportunity costs which are directly related to the investment levels. Thus the variations in the total fixed costs seen in Figure 7 closely reflect the pattern for investment levels (See Figure 2).

Figure 7: Total Fixed Costs per Fishing Unit



Source: Survey data

Table 7: Total Fixed Costs of Fishing Units

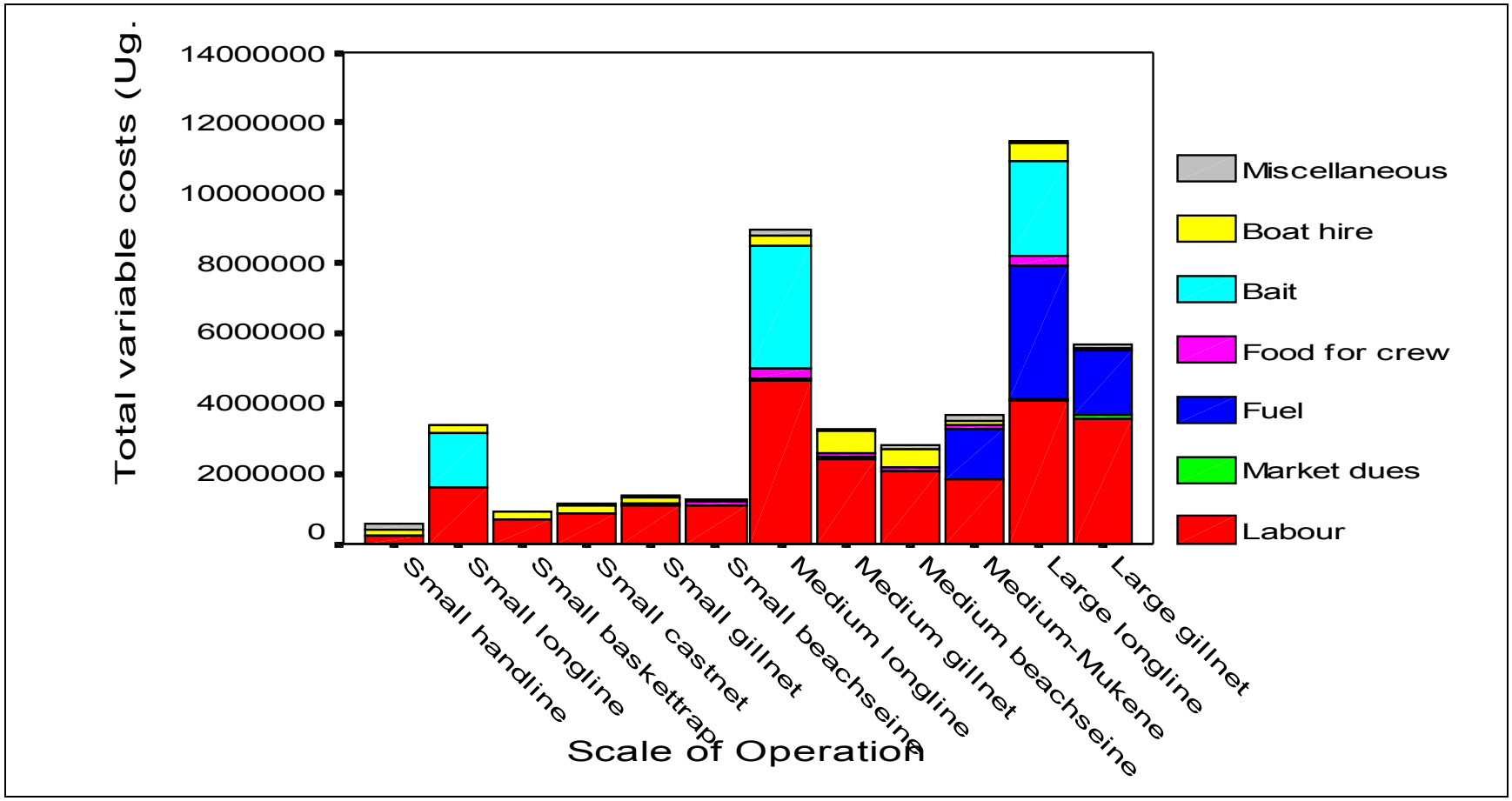
Scale of Operation		Mean	S. E of Mean
Non-motorized	Small handline	45,360	1,680
	Small longline	368,904	138,798
	Small basket trap	96,685	34,744
	Small cast net	103,141	10,154
	Small gillnet	619,288	81,555
	Small beach seine	56,092	14,128
	Medium longline	709,016	134,533
	Medium gillnet	1,420,735	137,724
	Medium beach seine	115,601	16,762
	Medium-Mukene	564,497	66,345
Motorized	Large longline	1,095,775	87,962
	Large gillnet	6,056,831	1,116,683

Source: Survey data

4.4 Variable (Trip) Costs

Quantitatively, the most important variable costs incurred by operators of non-motorized boats are those spent on labor, bait, boat hire, food for the crew and market dues. In the case of large-scale fishing units, fuel is also an important cost item. Other costs such as dry cells, maintenance and cigarettes for the crewmembers relatively contribute a small proportion of the total variable costs and are therefore amassed under miscellaneous costs. Large variations in the total variable costs exist both within and between the different groups (See Figure 8). However, longline fishing units considerably spend more money on day-to-day fishing expenses than other fishing units.

Figure 8: Variable Costs per Fishing Unit



Source: Survey data

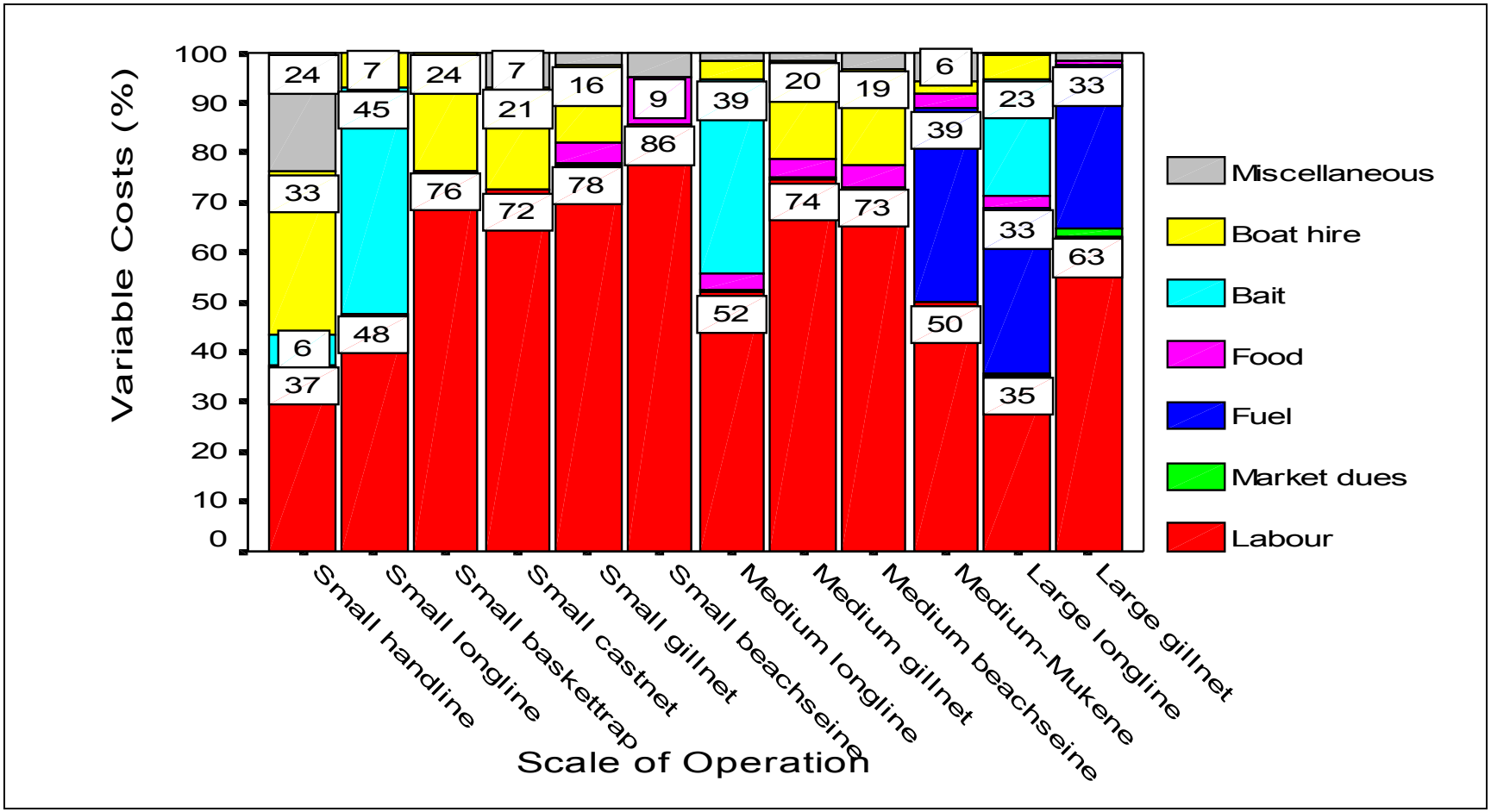
Within the small-scale group, owners of longline fishing units on the average spent roughly Shs. 3,223,703 annually to finance day-to-day operations exceeding that of beach seine and gill net fishing units by almost 3 times. On the other hand, operators of handline, basket trap and cast net fishing units on the average spent between Shs. 461,787 and Shs. 1,005,474 annually on day-to-day fishing inputs. For medium-scale fishing units, operators of longline fishing units on the average spent Shs. 9,287,326 annually on daily trip costs over and above that of gill net and longline fishing units by about 3 times. In the case of non-motorized boats for *Mukene*, fuel (in form of kerosene for lamps) forms a large part of variable costs. Interestingly, the annual operating costs of medium scale longline fishing units (excluding fuel costs) even exceeded that of large scale gill net fishing units (including fuel costs) by almost 2 times. Likewise, the annual trip costs of motorized Ssesse longline fishing units (Shs. 11,078,282) surpassed that of gill net fishing units by nearly 2 times (See Table 7).

Table 8: Variable Costs of Fishing Units

Scale of Operations		Mean	S. E of Mean
Non-motorized	Small handline	461,787	205,013
	Small longline	3,223,703	1,085,191
	Small basket trap	942,163	382,247
	Small cast net	1,005,474	58,863
	Small gillnet	1,201,197	92,939
	Small beach seine	1,277,899	238,859
	Medium longline	9,287,326	1,175,644
	Medium gillnet	2,704,367	337,081
	Medium beach seine	2,337,258	515,382
	Medium-Mukene	3,619,777	339,041
Motorized	Large longline	11,078,282	1,581,048
	Large gillnet	5,654,747	949,568

Source: Survey data

Figure 9: Relative Contribution of Inputs to Total Variable Costs



Source: Survey data

A look at the cost of the different fishing inputs notably labour and bait as a proportion of total operating costs helps explain the wide differences observed between longline and other fishing units. Operators of longline fishing units either bought the bait directly from suppliers or paid their crew to catch it. The cost of buying bait directly or cost of labor for bait collection accounted for between 23-45% of the total operating costs (See Figure 9). In addition, longline fishing units generally spent more on labour than other fishing units. For example, operators of medium scale fishing units on the average spent Shs. 5,250,300 annually on labour as compared to Shs. 2,434,100 and Shs. 2,038,800 for gill net and beach seine fishing units respectively.

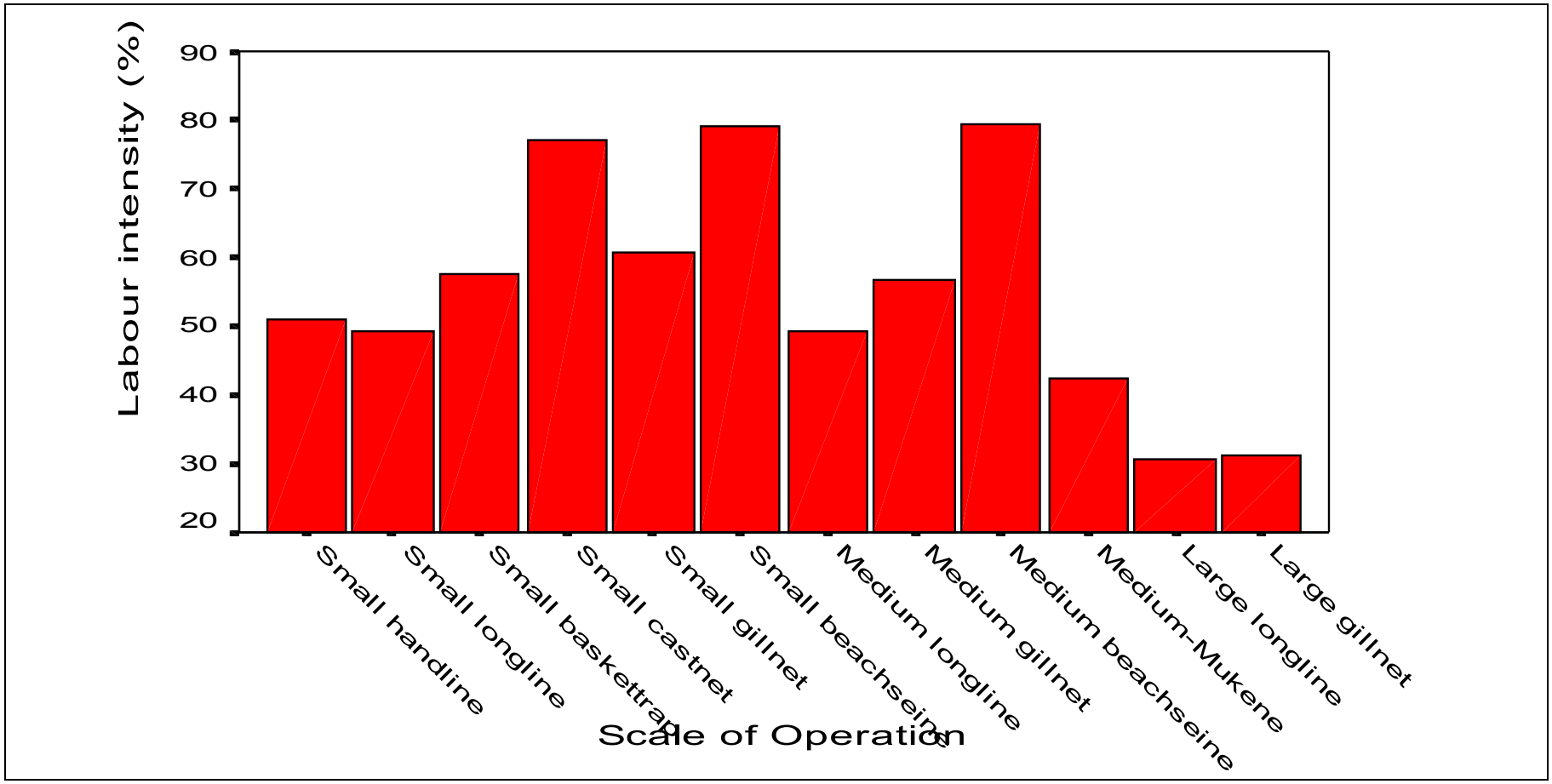
Given that fishing units will only operate if they can cover their variable costs, gill net fishing units with comparatively low variable costs are more likely to go for more trips (fishing intensity) than longline fishing units.

4.5 Cost Structure

4.5.1 Labour Intensity

The labour intensities of small to medium scale fishing units (paddled) were much higher than for large-scale fishing units (motorized). Specifically, for small to medium scale fishing units, labour accounted for 50-80% of the total costs while for motorized fishing units it constituted 30% of the total costs (See Figure 10). As might be expected therefore, labour intensity reduces with motorization.

Figure 10: Labour Intensity per Fishing Unit



Source: Survey data

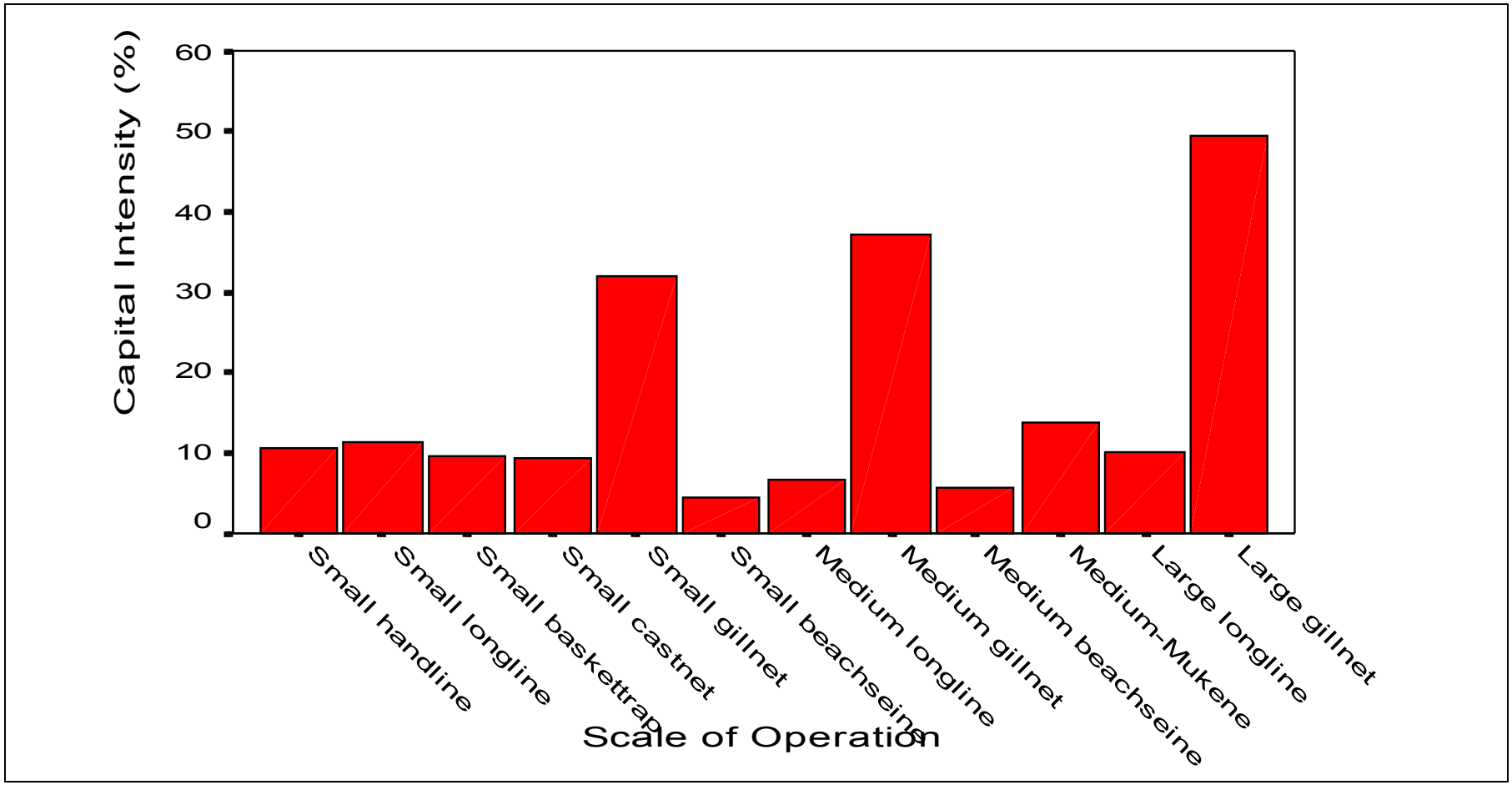
The apparent explanation is found in the fact that for small to medium scale fishing units to operate, crewmembers are essentially the only prerequisite. In contrast, for the large-scale fishing units to operate, in addition to crewmembers fuel is basically the other prerequisite. Accordingly, for small to medium scale fishing units to operate, labour is essentially the only cost item; hence labour accounts for the larger part of the total costs as compared to large scale fishing units.

As a comparison, for non-fishing investments of comparable risk (small to medium scale crop and animal enterprises), machinery is primarily used to substitute labour. In contrast, for fishing enterprises, motorization does not replace labour since the number of crewmembers per boat (2 or 4) is roughly a fixed quantity regardless of whether the boat is motorized or not. Given that for fishing units, labour is more or less a fixed quantity and the quantity of fishing gear can be varied, one possibility of increasing the labour efficiency is by increasing the quantity of fishing gear used per crewmember. Of course, the tendency to 'over invest' in fishing gear without being able to increase the net profits sufficiently to justify the added investment cannot be underrated.

4.5.2 Capital Intensity

Overall, gill net fishing units considerably had higher capital intensities with fixed costs accounting for 33-49.3% of the total costs as compared to only 4.5-15% for other fishing units.

Figure 11: Capital Intensity of Fishing Units



Source: Survey data

Capital intensity is primarily dependent on fixed costs, which are in turn essentially dependent on the investment levels. Thus, the higher capital intensities of gill net fishing units relative to other fishing units therefore reflect higher investment levels of the former as compared to the latter. One implication is that in the event that incomes from fishing are not large enough to justify the investments, owners of gill net fishing units will find it more difficult to liquidate their fishing assets.

4.5.3 Fuel Intensity

Overall, fuel accounted for about 32% of the total costs for fuel dependent fishing units. Specifically, Mukene fishing units had the highest fuel intensity followed by large-scale longline and gill net fishing units (See Figure 12). Stated differently, for every additional Shs. 100 increment in fuel prices, total costs of fuel will increase by 6.7% and 5.9% for Mukene and large-scale fishing units respectively.

Figure 12: Fuel Intensity of Fishing Units

Source: Survey data

The landing site prices of fuel were significantly higher than for urban prices implying that there are a few suppliers of fuel for fishing at landing sites (See Table 8).

Table 9: Comparison between Landing Site and Urban Fuel Prices

Fuel	Landing Site (Shs)	Urban (Shs)
Petrol	1,600	1,480
Kerosene	1,460	1,040

Source: Survey data

Consequently, fuel forms a large part of the total operating costs making fuel dependent fishing units particularly vulnerable to rising fuel prices. Moreover, fishermen do not increase the fish prices in response to increases in fuel prices. Another opportunity for reducing the vulnerability of fishing to fuel prices is by use of more 'fuel economizing' outboard engines. It was observed during the field visits that motorized fishing units use a wide variety of engine brands (Yamaha, Suzuki, Evenrode, Euro, Mercury e.t.c). If the fuel efficiency levels of the various engine brands are known, then fishermen can be advised to use outboard engines with the best fuel saving attributes even though it may necessitate additional investment costs.

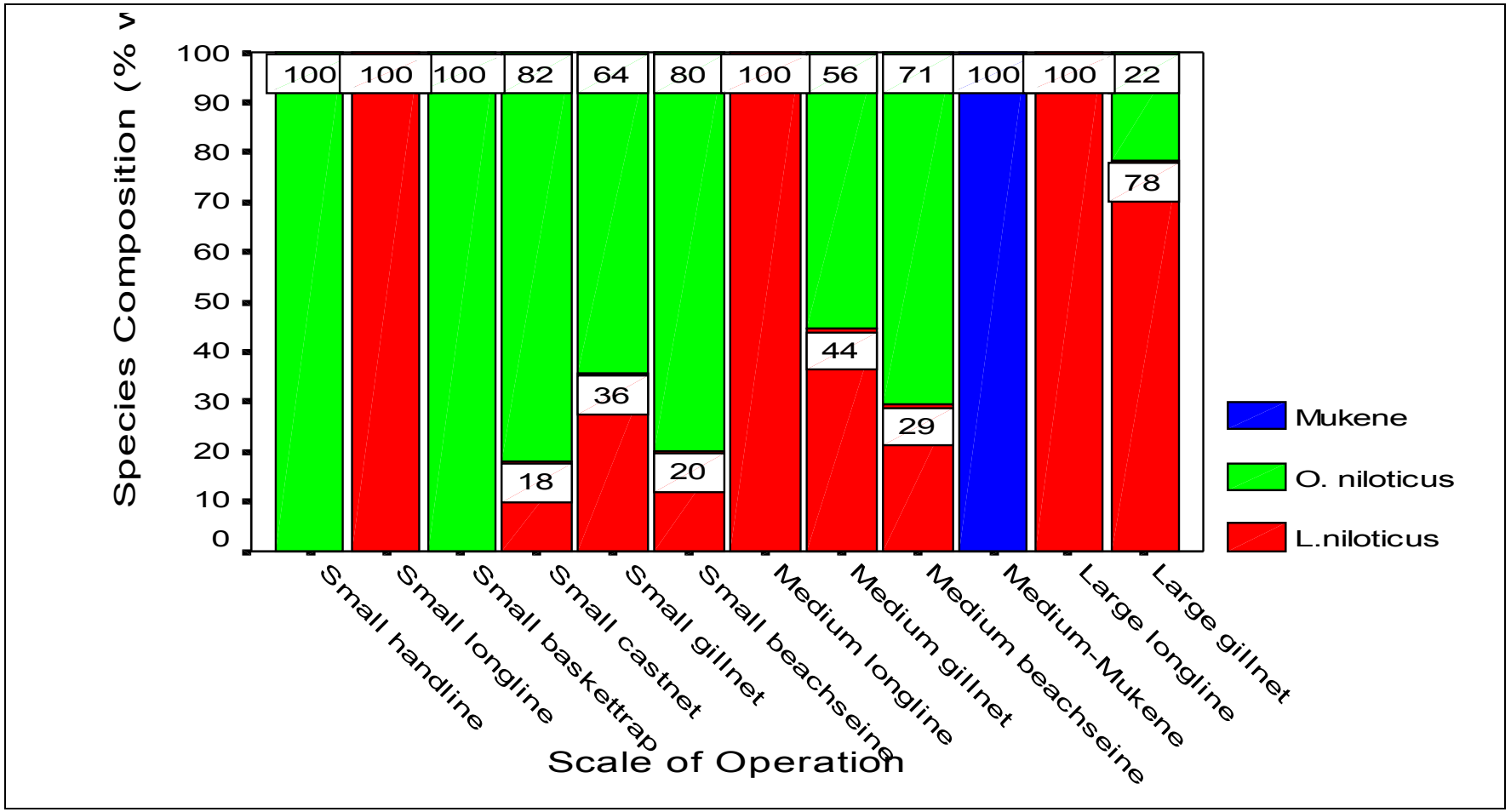
4.6 Profitability

4.6.1 Species Composition, Catch Rates per Boat and Prices

Species Composition of Catch

The proportion of *O. niloticus* and *L. niloticus* in the total catch at different levels of operation is more likely explained by location of fishing ground. The proportion of *O. niloticus* in the total catch decreased while that of *L. niloticus* increased with the level of operation. Gill net, cast net and beach seine fishing units targeted both *O. niloticus* and *L. niloticus* while longline fishing units exclusively landed *L niloticus.* Notable exceptions are those fishing units that use primitive fishing gear (handline and basket trap) that entirely catch *O. niloticus*. Figure 13 presents information on species composition of catch by weight. The explanation for the complete dominance of *O. niloticus* in the catches of basket trap/ handline fishing units and *L. niloticus* in the catches of longline fishing units is found in the fact that the former fish along shore line waters which mainly support *O. niloticus* while the latter use bait strictly suitable for *L. niloticus.*

Figure 13: Fish Species Composition of Total Catch (Kgs)



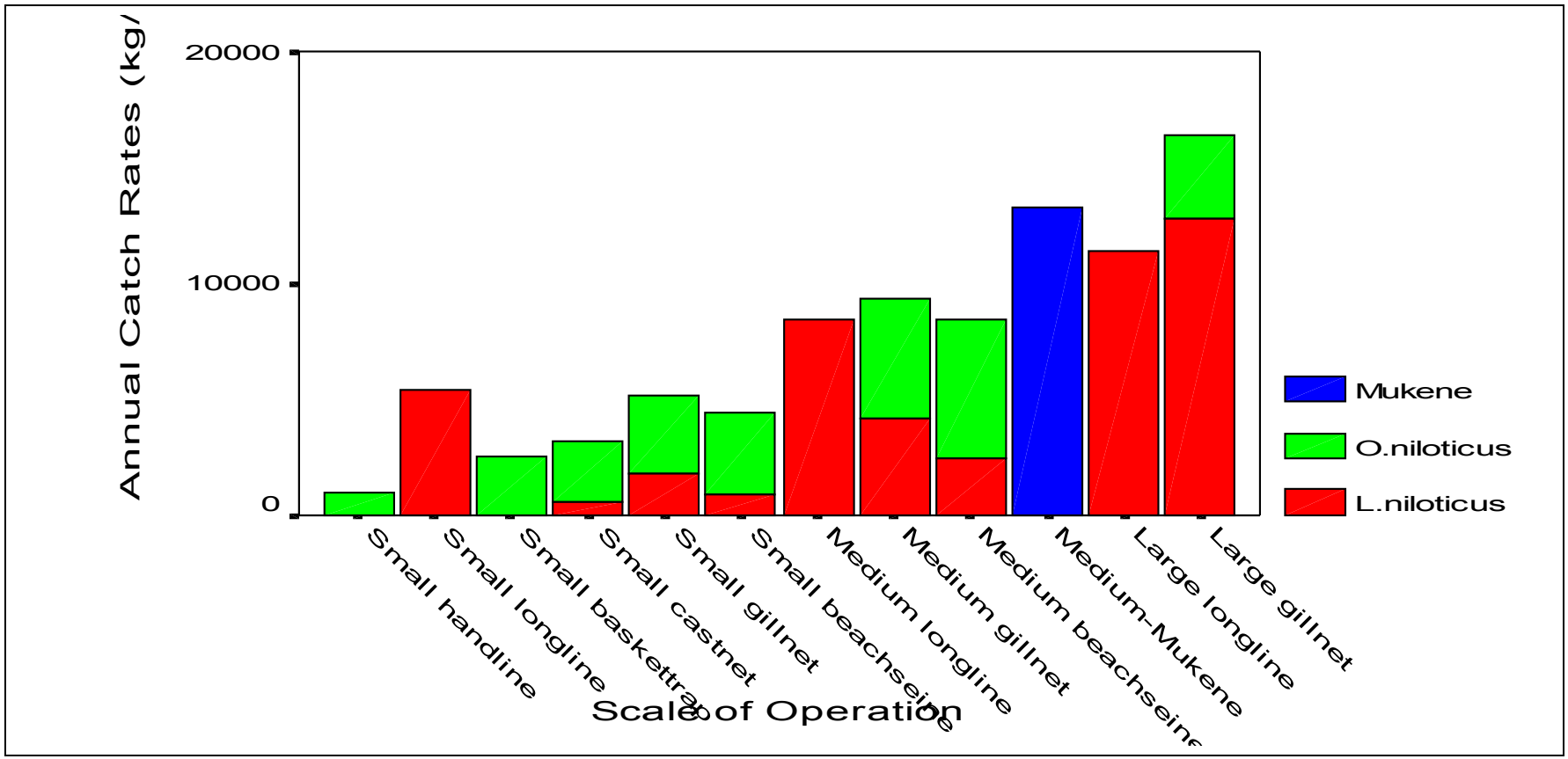
Source: Survey data

Considering that the revenue structure of most fishing enterprises is heavily dependent on only 1 of the 3 commercial species, the inference is that Lake Victoria fishers are a "highly risk prone" group. In other words, if the catches or prices of any of the three commercial fish species fall considerably, chances are high that many fishing enterprises will be adversely affected and probably go out of business.

Catch Rates per Fishing Unit

Generally, the catch rates increase with the level of operation. With the exception of *Mukene* fishing units, gill net fishing units landed the highest catch followed by longline and beach seine fishing units (See Figure 13).

Figure 13: Total Catch of *O. niloticus*, *L. niloticus* and *Mukene*.



Source: Survey data

Table 10: Total Catch (kgs) of *O. niloticus*, *L. niloticus* and *Mukene*

Scale of Operation		Mean	S. E of Mean
Non-motorized	Small handline	1,003.57	338.09
	Small longline	5,410.01	2,009.03
	Small basket trap	2,529.88	1,326.21
	Small cast net	2,789.42	154.43
	Small gillnet	3,551.42	276.33
	Small beach seine	3,998.85	1,186.65
	Medium longline	8,410.39	959.20
	Medium gillnet	6,040.74	727.12
	Medium beach seine	7,006.64	2,003.79
	Medium-Mukene	13,260.49	1,584.96
Motorized	Large longline	11,428.11	3,666.00
	Large gillnet	11,532.04	1,759.96

Source: Survey data

Fish Prices

The price per kg for *L. niloticus* (Shs. 1,270) was higher than that for *O. niloticus* and *Mukene* by 2 and 3.5 times respectively (See Table 11). Bearing in mind that; (a) price is largely determined by the interaction between supply and demand and (b) the demand of fish generally exceeds the supply, the logic is that the amount by which the demand exceeds the supply is higher for *L.niloticus* as compared to *O. niloticus* and *Mukene*. The export demand of *L. niloticus* particularly by European Union markets is to a large extent responsible for its additional demand hence higher prices.

Table 11: Average Price of *O. niloticus*, *L. niloticus* and *Mukene*.

	Price (Shs./kg)		
	L. niloticus	***O. niloticus***	***Mukene***
Mean	1270	660	360
Std. Error of Mean	23.60	7.21	11.32

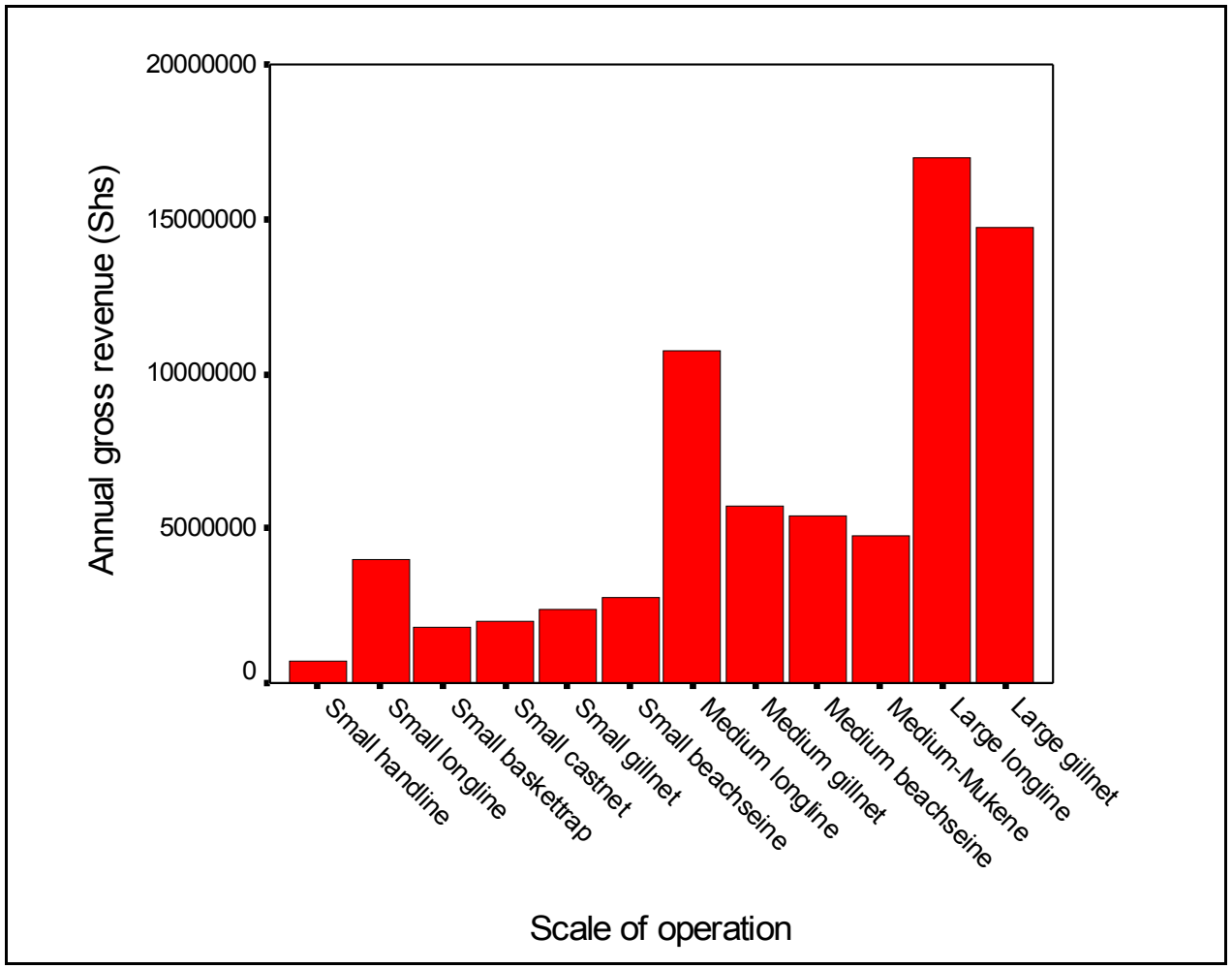
Source: Survey data

4.6.2 Gross Revenue

The gross revenue is the monetary value the fishing unit owner earns from his/ her fish sales. Overall, the gross revenue increases consistently with the level of operation with longline fishing units realizing the highest gross revenues followed by gill net and beach seine fishing units (See Figure 14).

For the small-scale group, longline fishing units on the average earned Shs. 6,195,733 annually from their fish sales or about 2.5 times higher than for gill net and beach seine fishing units. The annual total revenue of basket trap and cast net fishing units averaged Shs. 1,868,000 while handline fishing units earned the least (Shs. 699,116). In the case of medium-scale fishing units, longline fishing units averaged Shs. 11,223,541 annually or about 2 times higher than for gill net, beach seine and *Mukene* fishing units. Owners of large-scale longline fishing units on the average earned Shs. 17,006,300 annually or about 1.2 times higher than for motorized gill net fishing units (See Table 10).

Figure 14: Gross Revenue of Fishing Units



Source: Survey data

Table 12: Gross Revenue of Fishing Units

Scale of Operation		Mean (Shs)	S. E of Mean
Non-Motorized	Small handline	699,116	226,629
	Small longline	6,195,733	2,027,965
	Small basket trap	1,774,141	929,291
	Small cast net	1,961,837	123,655
	Small gillnet	2,410,280	208,317
	Small beach seine	2,742,896	627,678
	Medium longline	11,223,541	1,292,455
	Medium gillnet	5,751,698	650,341
	Medium beach seine	5,422,083	1,426,018
	Medium-Mukene	4,773,307	527,482
Motorized	Large longline	17,006,314	5,617,048
	Large gillnet	14,704,945	2,343,866

Source: Survey data

Since gross revenue is a product of total catch and fish prices, higher gross revenues reflect either larger quantities of fish landed or higher prices or both. The high gross revenues realized by longline fishing units are primarily explained by the fact that they exclusively caught the high valued *L. niloticus* and landed relatively good catches.

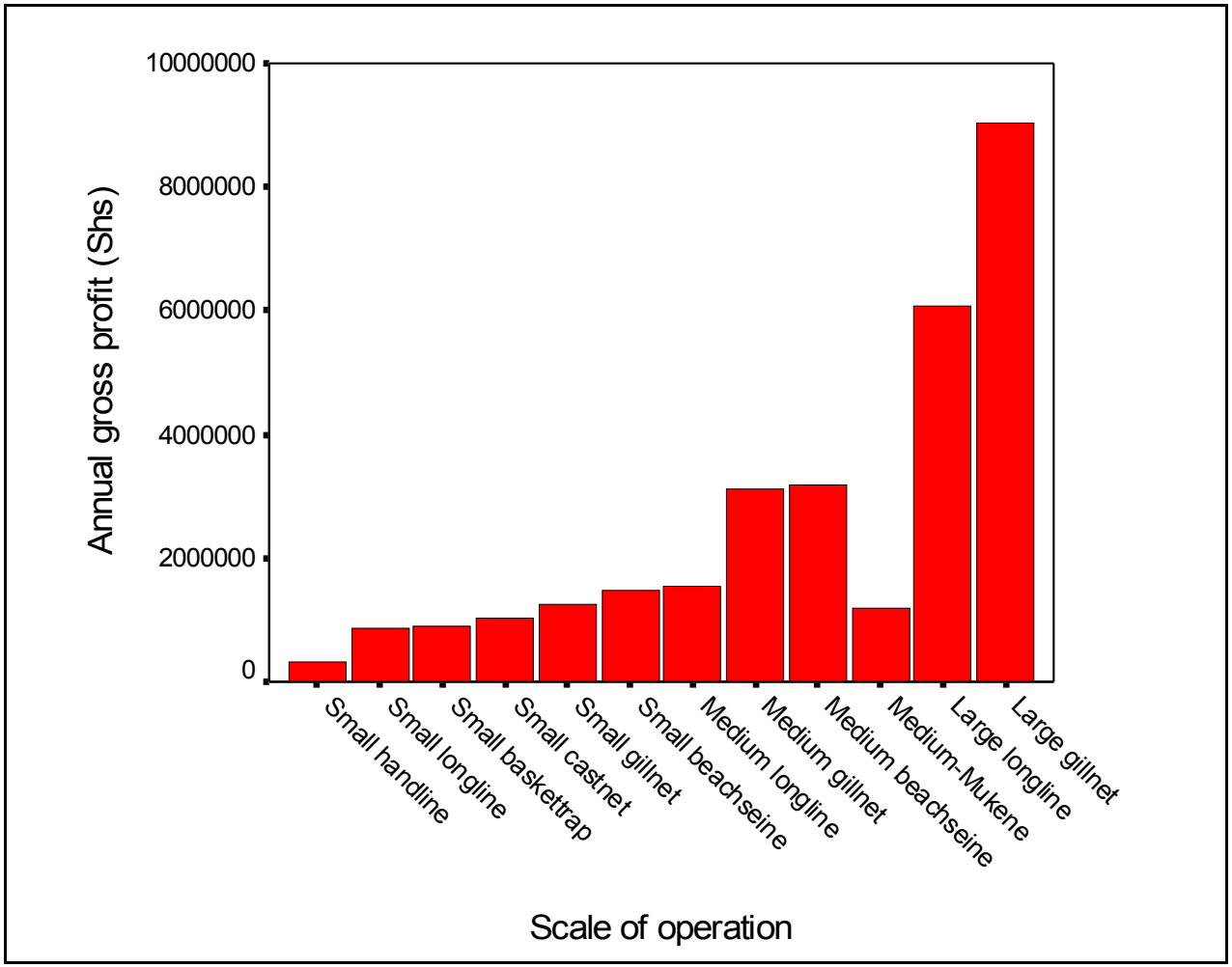
4.6.3 Gross Profit

Gross profit is the difference between gross revenue and variable costs. For fishing units to operate in the short run, gross revenues must at least exceed variable costs i.e a zero gross profit is the dividing line between operation and close down. All fishing units realized positive gross profits (See Figure 15) thus implying that investments in fishing are viable in the short run. In addition, the gross profit levels increase with the level of operation with

beach seine fishing units earning the highest gross revenues followed by gill net and longline fishing units.

For the small-scale group, the annual gross profit of beach seine fishing units averaged Shs. 1,464,997 or about 1.2 and 1.7 times higher than for gill net and longline fishing units respectively. Owners of cast net and basket trap fishing units on the average realized annual gross profits amounting to Shs. 894,171 while handline fishing units earned the least (Shs. 237,329). In the case of medium-scale fishing units, the annual gross profit of beach seine fishing units averaged Shs. 3,174,825 slightly exceeding that for gill net fishing units (Shs. 3,123,903) but doubling that of longline fishing units. For large-scale fishing units, gill net fishing units realized annual gross profits to the tune of Shs. 9,050,198 nearly 1.5 times higher than for longline fishing units.

Figure 15: Gross Profit per Fishing Unit



Source: Survey data

Beach seine and gill net fishing units enjoyed higher gross profits for the reason that they incurred relatively lower variable costs and earned relatively high gross revenues. On the other hand, longline fishing units realized the relatively lower gross profits despite earning the highest total revenues because their variable costs were considerably higher as compared to beach seine and gill net fishing units. Thus, for the same gross revenue, beach seine and gill net fishing units are more likely to cover their variable costs as compared to longline fishing units hence take more fishing trips. One conclusion is that beach seine and gill net fishing units are more viable than longline fishing units in the short run period.

Table 13: Gross Profit per Fishing Unit

Scale of operation		Mean	Std. Error of Mean
Non-motorized	Small handline	327,329	111,616
	Small longline	854,363	792,094
	Small basket trap	903,979	621,496
	Small cast net	1,036,362	98,474
	Small gillnet	1,251,749	131,413
	Small beach seine	1,464,997	388,819
	Medium longline	1,539,557	1,386,586
	Medium gillnet	3,123,903	441,643
	Medium beach seine	3,174,825	920,802
	Medium-Mukene	1,174,583	493,723
Motorized	Large longline	6,087,461	4,385,770
	Large gillnet	9,050,198	1,571,317

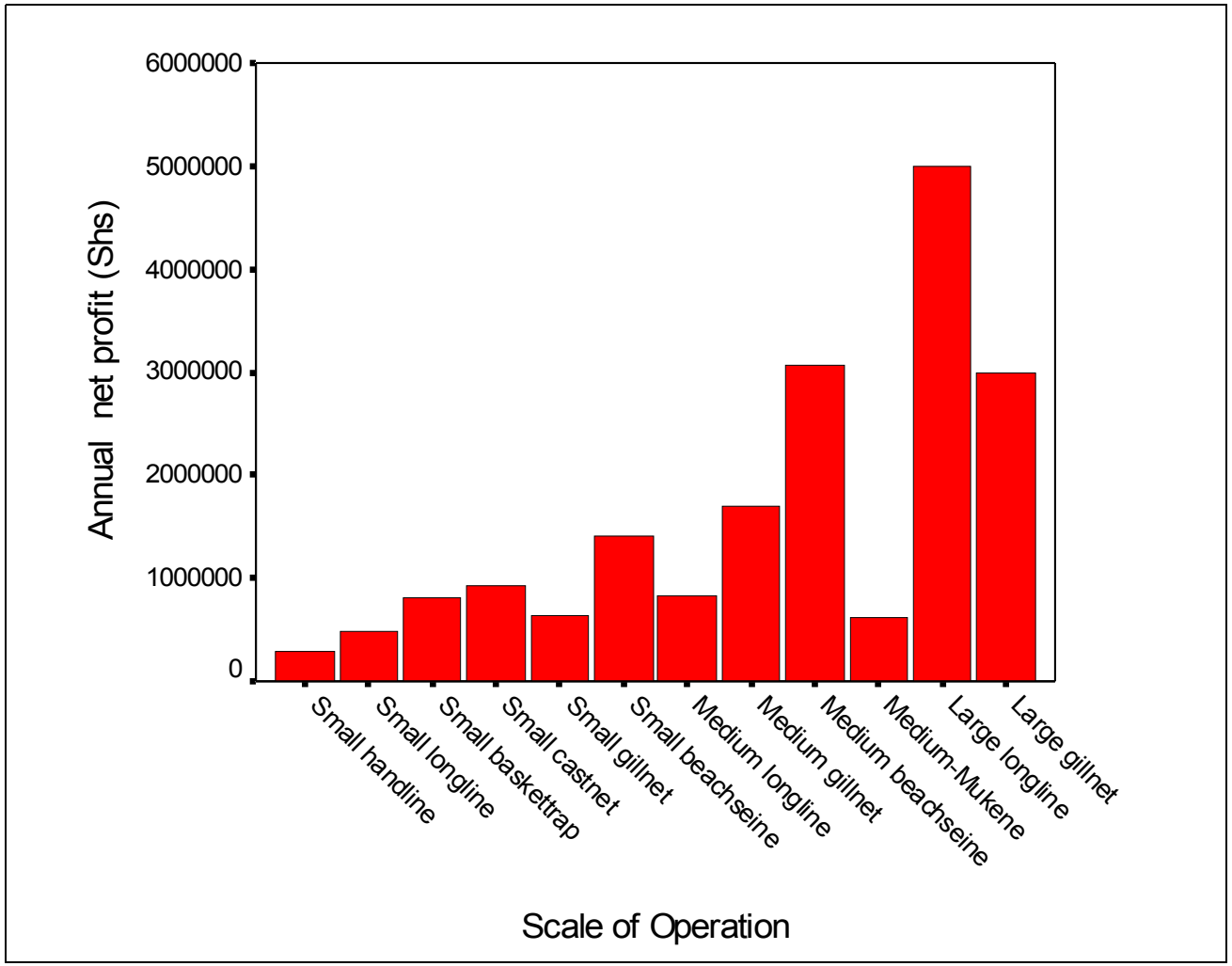
Source: Survey data

4.6.4 Net Profit

Net profit is the difference between gross revenue and total cost. A non-negative net profit is the precondition for long-term viability. All fishing unit realized positive net profits indicating that investments in fishing are viable in the long run. Overall, the net profits increase with the level of operation with beach seine fishing units realizing the highest net profits among non-motorized fishing units.

Within the small-scale group, beach seine fishing units earned the highest net profit (Shs. 1,408,904) annually or about 3 and 2.2 times higher than for longline and gill net fishing units respectively. The annual net profits of handline and basket trap fishing units averaged Shs. 463,600. In the case of the medium-scale fishing units, beach seine fishing units had the highest net profits (Shs. 3,059,224) or about 3.7 and 1.8 times higher than longline and gill net fishing units respectively. For large-scale fishing units, longline fishing units realized annual net profits amounting to Shs. 4,991,687 almost doubling that for large-scale gill net fishing units.

Figure 16: Net Profit of Fishing Units



Source: Survey data

Table 14: Net Profit of Fishing Units

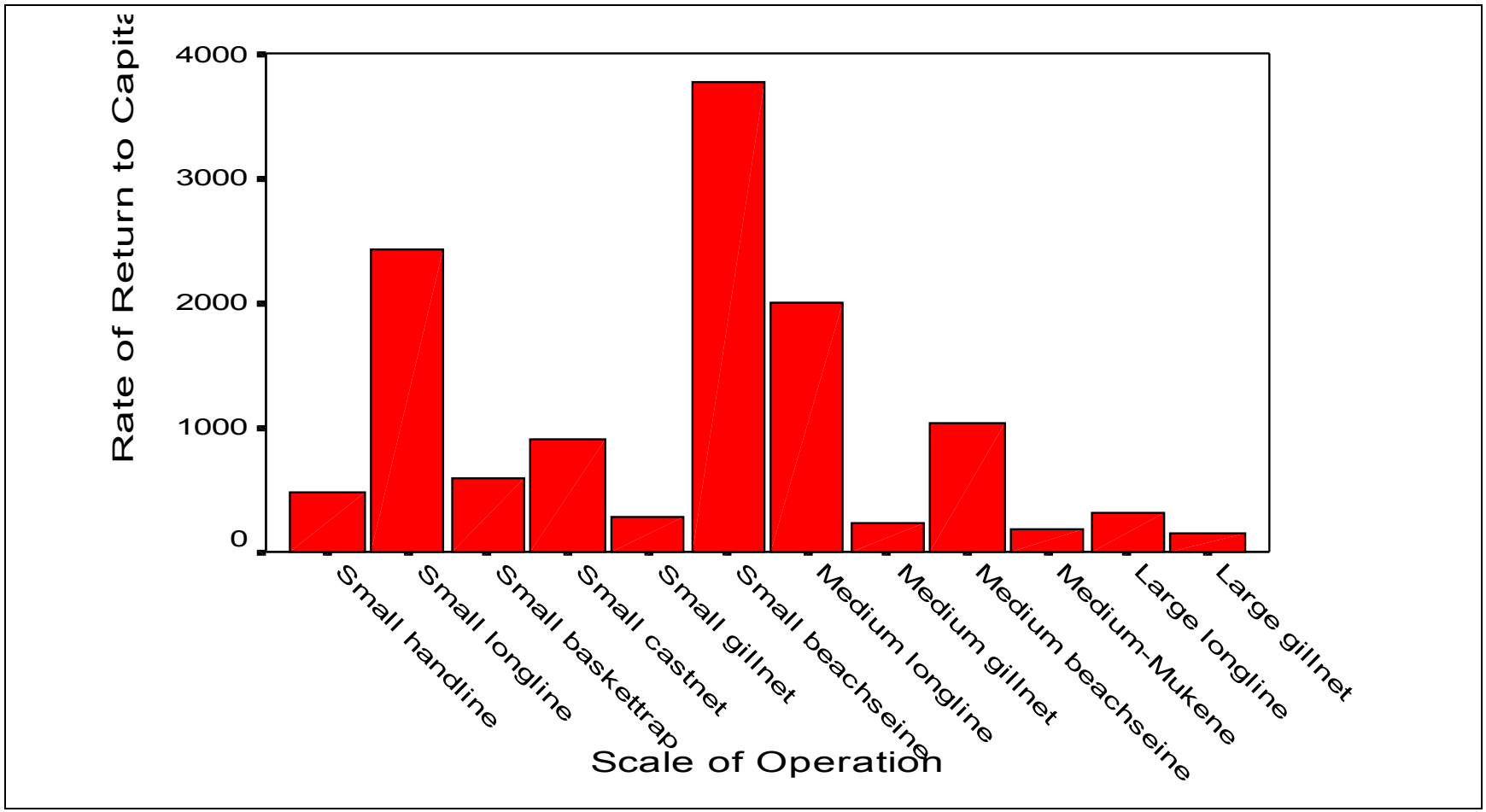
Scale of Operation		Mean	Std. Error of Mean
Non-motorized	Small handline	281,969	109,936
	Small longline	485,459	859,716
	Small basket trap	807,294	587,616
	Small cast net	933,221	95,049
	Small gillnet	632,461	145,524
	Small beach seine	1,408,904	402,947
	Medium longline	830,541	1,464,261
	Medium gillnet	1,703,168	473,514
	Medium beach seine	3,059,224	909,749
	Medium-Mukene	610,086	509,142
Motorized	Large longline	4,991,687	4,407,331
	Large gillnet	2,993,367	1,992,448

Source: Survey data

4.6.5 Rate of Return to Capital

Generally, the rates of return to capital of fishing enterprises were over and above 100% implying that the annual net profits realized by the fishing units were sufficiently high to cover their investment costs within a period of one year. As a function of investment, non-motorized fishing units considerably had higher rates of return to capital (1,190%) almost 5 times higher than for motorized fishing units (230%). Among non-motorized fishing units, longline fishing units had the highest rates of return to capital followed by beach seine and gill net fishing units while *Mukene* fishing units had the least. For motorized fishing units, the rate of return of longline fishing units (322%) almost doubled that of gill net fishing units (See Figure 17).

Figure 17: Rates of Return to Capital of Fishing



Source: Survey data

Table 15: Return to Capital of Fishing

Scale of Operation		%	S. E of Mean
Non-motorized	Small handline	473	32
	Small longline	2,419	1,127
	Small basket trap	591	519
	Small cast net	903	227
	Small gillnet	286	55
	Small beach seine	3,778	3,045
	Medium longline	1,997	1,377
	Medium gillnet	233	58
	Medium beach seine	1,034	246
	Medium-Mukene	188	115
Motorized	Large longline	306	322
	Large gillnet	154	84

Source: Survey data

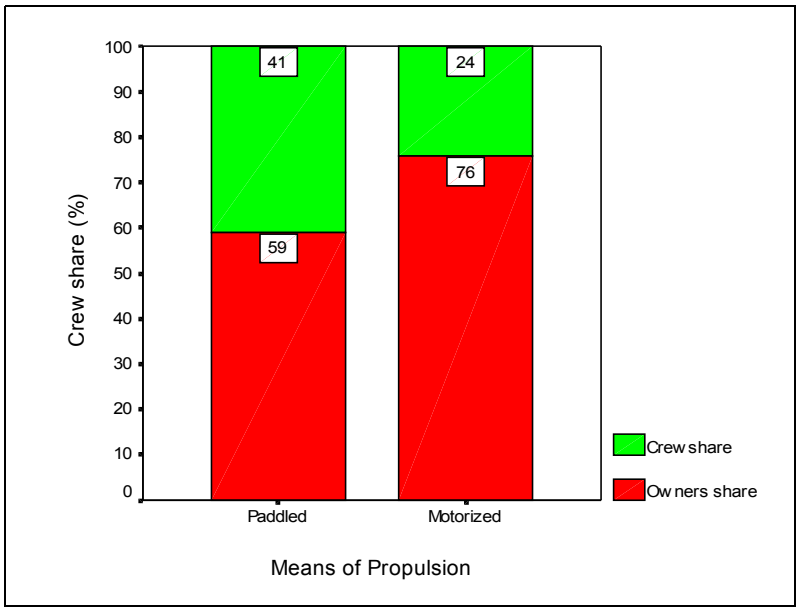
The high rates of return to capital of longline and beach seine fishing units are largely due to a combination of their relatively high net profits and low investment costs. On the other hand, the low rates of return to capital of other fishing units is due to their relatively low net profits and high investment costs.

4.7 Sharing System

Overall, crews operating non-motorized fishing units received a higher percentage of the gross revenue (41%) than those operating motorized fishing units (24%) although the latter earned higher incomes (See Figure 18). The variation in the share proportions arises due to differences in the sharing systems between non-motorized and motorized fishing units. The majority of the non-motorized fishing unit owners (77.6%) paid their crew a "% of the

gross revenue" whereas motorized (12.9%) and *Mukene* (9.5%) paid their crew a "% of gross revenue *less* specified cash costs".

Figure 18: Share Proportions between Fishing Unit Owners and Crewmembers



Source: Survey data

The "% of gross revenue" system is prevalent among non-motorized fishing units because they do not incur significant cash costs other than labour; hence the need to deduct cash costs before arriving at the crew share is not considered necessary. On the other hand, the "% of gross revenue *less* specified cash costs" system is most common among motorized and Mukene fishing units because they incur significant cash costs besides labour costs; hence warranting the need to subtract the cash costs before arriving at the crew share. However, in absolute terms, motorized fishing units pay their crews higher incomes for their labour because they realized higher gross revenues.

Table 16: Annual Income per Crewmember by Scale of Operation

Scale of Operation	Mean (Shs)	Std. Error of Mean
Non-motorized	711,260	46,939
Motorized	1,335,796	231,547

Source: Survey data

Under both systems based on market prices of fish, the crew bears part of both types of risk (low catches and low prices) and share the windfalls from both sources (high catches and high prices). Given that L. Victoria is an open access resource, the catches hence gross revenues realized by fishing units are expected to diminish in the long-run through excessive fishing efforts. Therefore, unless fishing effort is controlled, the respective crew shares will decline over the years. Furthermore, for motorized fishing units, unless the gross revenues exceed the specified cash costs, the crewmembers are not paid for their labour implying higher levels of risk.

5.0 Conclusions and Recommendations

Based on the findings, the following conclusions are drawn and recommendations made:

Conclusions

Most boat owners/ renters had a low education attainment and lacked the kind of specialized training usually acquired in tertiary institutions. There were also gender inequalities in terms of ownership or access to fishing assets in the fisheries sector as indicated by the predominance of males among boat owners/ renters.

Investment requirements for fishing except for gill net and motorized fishing units in particular were low. The extremely high cost of gill nets largely accounted for the higher investment levels of gill net fishing units. Gill net fishing units also depreciated much more than other fishing units due to the high cost and relatively short useful life of gill nets. Consequently, owners of gill net fishing units have to invest heavily towards the replacement of worn-out gill nets roughly 3 times each year. On the contrary, Longline fishing units considerable spent more money on day-to-day fishing expenses than other fishing units mainly because they spend reasonably large sums of money on bait and incurred higher labour costs.

Lake Victoria fishers are a "highly risk prone" group given that their revenue is mainly dependent on only one of the three commercial fish species. If the catches or prices of any of the three commercial fish species fall considerably, chances are high that fishing enterprises will go out of business. Longline fishing units exclusively landed *L. niloticus* whereas gill net and beach seine fishing units caught both *L. niloticus* and *O. niloticus*. The price of *L. niloticus* (Shs. 1,270/ kg) almost doubled that of *O. niloticus* and was higher than for *Mukene* by about 3.5 times.

Investments in fishing were profitable both in the short-run and long-run periods as revealed by the positive gross and net profits realized by all types of fishing enterprises. Overall, beach seine fishing units were the most profitable among non-motorized fishing units followed by gill net and longline fishing units. All types of fishing enterprises realized net profits that were sufficiently high to cover their investment costs within a period of one year. Additionally, as a function of investment, non-motorized fishing units are more profitable than motorized fishing units.

5.2 Recommendations

a) Government should put into place policy measures aimed at liberalizing the supply of fishing inputs particularly of gill nets and outboard engines in view of their high costs, which in turn is an indication of monopolistic tendencies among suppliers of these inputs.

b) The Uganda National Bureau of Standards should ensure that local manufacturers and importers of gill nets supply more durable gill nets so as to prolong the useful life of gill nets and hence reduce depreciation costs.

c) The study recommends that motorized fishing unit owners purchase outboard engine brands and types with better fuel economizing attributes in order to minimize their fuel costs.

d) The Fisheries Department in collaboration with Uganda Investment Authority should explore the feasibility of using artificial bait, which unlike the live bait can be recycled. This will substantially reduce the cost of bait, which accounts for 25-50% of the total operating costs.

d) Local Government authorities particularly at the Sub-county levels should encourage local private investors to invest in the supply of fuel for fishing operations at the landing sites. This will increase competition in the supply of fuel and ultimately reduce landing site fuel prices.

e) In view of the fishermen's low educational attainment and lack of specialized training, it is recommended that entrepreneur development programs designed to develop the fishermen's 'business abilities' be introduced.

f) The prime interest of this study was to examine the viability of fishing enterprises based on cost and earnings data. Further research on those factors that affect profitability other than costs and earnings should be carried out. Also research should be undertaken to establish why fisherfolk have remained poor despite earning positive profits as indicated in this study.

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Appendix 1

Socio-Economics Sub-Component
Lake Victoria Environment Management Project
FISHERIES RESOURCES RESEARCH INSTITUTE

STUDY OF THE ECONOMIC VIABILITY OF FISHERIES ENTERPRISES TO INCREASE THE INCOME LEVELS OF ARTISAN FISHERMEN

UNIT QUESTIONNAIRE

Name of Interviewer _____

Date _____

1. Landing _____

2. District _____

A. Personal Data

3. Name of Respondent _____

4. Age _____

5. Sex
[1] Male [2] Female

6. Tribe
[1] Itesot [2] Muganda [3] Musoga [4] Alur
[5] Adhola [6] Musamia [7] Mukenye [8] Mugwere
[9] Other [Specify] _____

7. Marital Status
[1] Married [2] Single [3] Separated [4] Widowed
[5] Other (Specify) _____

8. What is your level of education? (*Tick one*)
[1] No schooling [2] Primary [3] Secondary [4] Tertiary
[5] University [6] Other (Specify) _____

9. How long have you been at this landing? _____Years

B. Enterprise/Operating Characteristic

10. Do you own a boat?
[1] Yes=>*Go to Qu.13* [2] No=> *Go to Qu. 11*

11. If no, do you rent a boat?
[1] Yes [2] No

12. How much do you pay for renting the boat? Shs_____ (Per day/Week/Month)

13. What type of boat do you own/rent?
[1] Dug-out [2] Parachute [3] Ssese
[4] Other (Specify) _____

14. What is the approximate length of the boat? _____(Metres, Feet etc.)

15. Does the boat you own/rent use an outboard engine?
[1] Yes [2] No

16. If yes, do you own or hire the outboard engine?
[1] Own [2] Hire=>*Go to Qu. 17*

17. If hire, how much do you pay for hiring the outboard engine? Shs _____(Per day/Wk/Mnth)

18. What is the power rating of the outboard engine you own or hire? _____ HP

19. What type of fishing gear to you use?
[1] Handlines [2] Longlines [3] Gill nets [4] Basket traps
[5] Cast nets [6] Mosquito nets [7] Beach seines
[8] Other (Specify)_____

20. What is the most common gear size(s) you use? _____ (Mesh size, hook size etc.)

21. How many labourers operate your boat? _____

22. In what fishing ground does your boat most commonly operate?
[1] Shoreline [2] Inshore [3] Offshore [4] Bays
[5] Other (Specify)_____

23. How many hours per day does your boat spend fishing on the lake?

24. Indicate the level of your catch during the different month of the year:

Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Level of Catch												

Levels given as: Poor [1][2][3][4][5][6][7][8][9][10] Good

24. Category of fishing enterprise (For enumerator only)
[1] Stationary fishers [2] Parachute boat
[3] Non-motorized Ssese boat [4] Motorized Ssesse boat
[5] Other (Specify)_____

C. Fishery Related Taxes

25. How much do you pay for a fishing permit? Shs_____ (Per Month/Year)

26. How much do you pay for a boat license? Shs_____ (Per Month/Year)

27. How much do you pay for local registration? Shs_____ (Per Month/Year)

D. Constraints and Opportunities towards better earnings

28. What is your main constraint towards better earnings from fishing?

[1] Lack of capital	[2] Low fish prices
[3] Poor catches	[4] Rampant theft of fishing assets
[5] Seasonal changes	[6] High fuel prices
[7] High cost of fishing inputs	[8] Others (Specify)_____

29. Suggest one way in which your earnings from fishing can be improved?

[1] Gov't/NGO's should provide loans
[2] Improvement in marketing infrastructure
[3] Improved fisheries management
[4] Increased security
[5] Gov't should reduced taxes on fishing inputs
[6] Others (Specify)_____

Thank you

E. DATA SHEET FOR INVENTORY OF FISHING ASSETS PER UNIT

ITEM	QTY	UNIT PRICE (SHS)	EXPECTED USEFUL LIFE (YEARS)	SALVAGE VALUE (SHS)
Boat				
Engine				
Oar				
Hooks				
Twines				
Gill nets				
Basket traps				
Beach seines				
Cast nets				
Mosquito seines				
Pressure lamps				