THE IMPLICATIONS OF FISHING ACTIVITIES ON FISH PRODUCTIVITY IN

LAKE VICTORIA (CASE STUDY OF BUGUTO FISHING VILLAGE) IN

MAYUGE DISTRICT

NAMES: TAKUWA NUUBU (BEM/0828/21/DU)

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DEDICATION

This research report is dedicated to my parents Mr. And Mrs. Habibu Mwami who have played every big role towards the completion of my studies.

I also dedicate this report to Mr. Tigawalana Bakali and Haji Hamuza Kagere who supported me financially. Long live all of you.

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ABSTRACT

Lake Victoria is the second largest lake in the world measuring about 6880km^2. The lake has a shoreline of 3450 km and a catchment area of 258,700km^2. The lake is regarded a shallow lake with an average depth of 40m and maximum depth of 84m. The reports on the fisheries resources of the lake estimate the annual landings of the lake fisheries to be between 400,000 and 500,000 million tons yielding between US $ 300 and 400 million. These fish landings are harvested by about 100,000 fishermen who depend directly on the fish (Ndawula, 2000) Apart from the lake providing fish for food, it also acts as a medium of water transport to the three riparian countries (Uganda, Kenya, Tanzania), it also provides employment to the people, domestic and industrial use as well as hydro-electricity. The objectives of the research include; to identify the impacts of the preservation and fishing methods used on fish/aquatic life in the lake, to determine the causes of the reduction of fish catches on Lake Victoria, and to find out solutions of over coming over fishing on Lake Victoria.

The methods that were used to collect data include, secondary data, focus group discussions, and questionnaires. The research revealed that, of all the great lakes, lake Victoria has the highest population concentration on it's fringes, this has resulted into serious human impacts on the eco-system through intense agricultural activities (cultivation, like stock and fishing), sporadic settlements, and urbanization, the consequences have been loss of animal and plant life (aquatic life). Aquatic life has become endangered due the bad fishing methods used and hence less guarantee to continued fish production. The researcher recommended that emphasis to promote community awareness, extension services, security on the lake should be provided by both government and Non Government Organizations to mitigate the deteriorating environmental conditions, generally the situation calls for reversal to the increasing stress on the eco-system.

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GDP   -   Gross Domestic Product

LVEMP -   Lake Victoria Environment Management Project

FIRRI   -   Fisheries Resource Research Institute

CPUE   -   Catch per Unit of Effort

Haplochromines/Rastreneobole argentea-(Mukene)

Lung Fish – mad fish (mamba/Kamongo)

Oreochromis niloticus- Nile Tilapia

Late niloticus- Nile perch.

CHAPTER ONE

1.0   INTRODUCTION

Fish provides an important food item to millions of people of the world. Fish forms a cheap source of protein especially where animal keeping is difficult.

In Uganda the major source of fish is lake Victoria. Lake Victoria is the second largest lake in the world, next to lake superior, measuring $68800km^2$ (scholtz et.al 1990). The lake has a shoreline of 3450 km and a catchment area of 258.700 km^2. The lake is regarded a shallow lake with an average depth of 40m and a maximum depth of 84 km. The deepest part is towards the middle of the lake. The lake is boardered by three reparian states Kenya (6%) Tanzania (15%) and Uganda (43%).

Besides the lake providing food (fish) for the reparian states, it also acts as a medium of water transport among the 3 states. The lake provides water for domestic and industrial use as well as hydro electricity in Jinja Uganda.
Tourists also visit the Lake for sports, fishing and scientific work mainly Taxonomy of numerous fishes and liminological studies.

The reports on the fisheries resources of the lake are a source of great controversy. Intelligent guesses from fisheries statistics of the three reparian states, estimate is that, the annual landings of the lake fisheries is between 400,000 and 500,000 million tons yielding between US $ 300 and 400 million. These fish landings are harvested by about 100,000 fishermen who depend directly on the fish and another more than 2 million who work on fisheries related activities.

Besides the few table fishes such as the Nile perch and Nile tilapia, the lake harbours several other species. It is believed that before the introduction of the Nile perch and bad fishing methods into the lake, in the late 1950s, the

lake had diverse species of fish numbering more than 250. This great assemblase of fish is worth acknowledging.

The main economic activity in Bugoto is fishing. There are both small scale and commercial fisheries in Bugoto. Lake Victoria is the leading producer of fish in Uganda. For long, it has inhabited so many fish species, which include Tilapia, Nile-perch, Haplochromine clarias, lungfish, catfish.

Researchers (Fisheries resource research institute) in Jinja have found it out that the number of fishing canoes on lake Victoria have been increasing since the early 1990's. This has been the result of the increasing demand for fishery resources hence leading to considerable pressure on the fishery resource.

Preliminary findings from a four-year survey on the lake (Victoria) indicate that there is a depletion of fish stocks near the shoreline. (Muhoozi, 2002)

The survey reveals that the number of fishers on the lake increased from 129,305 to 175,890, and the fishing crafts / vessels from 42,483 to 52,479 and gill nets from 655,053 to 984,084 between 2000 and 2002. It was discovered that the number of landing sites had increased (Ogutu, 2004).

In Uganda, fish is the leading export, hence fish generates a lot of foreign income.

1.1 BACK GROUND

In the North Pacific Ocean, Japan, has an out standing fishing industry and today is the world's leading fishing nation. Almost three millions are directly dependent upon fishing for all or part of their living in this country. According to (Bukenya 1994). Every Japanese village fronting the sea has some type of fishing activity. The intensive development and high yield of Japanese fishery industry are dependent on a combination of factors, which include:

- The methods used for fishing are modern and efficient.
- The pressure to exploit all other available sources of food to support her millions of people.

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In Uganda, more than 18% of the total area covered by open waters and swamps has a great potential for fish production. Commercial fishing, however, only started in 1990, after the introduction of gill nets for use on lake Victoria, prior to this, fishing was on a subsistence basis involving hooks, spears, and poison. Today fishing is an important activity and widely accepted as a major source of food for people, out of the 56 districts in Uganda, more than 27 are involved in fish production the major ones being Mukono, Mayuge, Masaka and Kampala districts (Kichodo 2001) in Uganda over 15 million people around lake Victoria have been attracted to fishing activities.

Un fortunately, the fishing activities for survival and other reasons have led to environmental degradation.

The recorded export of fish brought US $ 90 million to Uganda in 2002; this is the highest contribution to the economy, of any agricultural export economy. The remarkable contribution of wild fish to the economy can only increase and lead to poverty reduction if the management of fisheries resources involves fisheries communities, including the poor and the women, in policy implementation, regulations and decision making.

The increasing demand for fishery resources has led to considerable pressure on the lake. The fishery has under gone tremendous changes; new actors have moved into the fishing industry, some of them have introduced fish harvesting methods previously un known on the lake such as cast nets, basket traps and beach seines. This has come as a result of high population around lake Victoria shores and also the fish marketing sub-sector has under gone significant development capacities and expansion in domestic and export demands for fish.

1.2   STATEMENT OF THE PROBLEM

The demand for fish has been high for both home consumption and export. This has forced fishermen to increase the types of gears on the lake, which were previously un known for example the cast nets, basket traps and beach seines. These fishing gears, which capture both mature and immature fish.

The fisheries resources of Uganda and the waters in which they live are a common property resource held in trust by government on behalf of the people of Uganda. It means that the state retains over-roll mandate for taking care of these resources for the benefit of it's people now and in future as per the constitution, however, the fisheries resources and the many livelihoods they support in Uganda are threatened by the use of illegal and destructive fishing gears and methods. These are especially destructive when used on fish breeding grounds, one of the most damaging effects is the capture and dealing in immature / baby / young fish.

The increasing human population has led to substantial increases in the number of fishermen, landing sites and fishing boats. This problem of too many people chasing few fish has in turn created problems of over fishing and resource depletion. Also the methods used for preserving fish which include fish smoking create more problems to the lake shores, since people clear the papyrus around the lake shore and use it for smoking of fish and making of baskets for carrying fish to the markets, this leaves the lake shores cleared and yet the fish breed around the lake shores, this has created problems to the fish industry since there is no sustainable fishing, hence leading to lake environmental degradation.

The over riding objective of this research is to find out the fishing methods, fish preservation methods and their implications on the aquatic life.

1.3 OBJECTIVES

1. To identify the impacts of the preservation and fishing methods used on the aquatic life in lake Victoria.
2. To determine the causes of the reduction of fish catches on lake Victoria.
3. To find out solutions of over coming over-fishing on lake Victoria.

1.4 RESEARCH QUESTIONS

1) How have fishing gears affected the fish numbers / diversity in the lake?
2) What are the causes of low fish catches on lake Victoria.
3) What can be done to combat fish exploitation on lake Victoria?

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1.5 SIGNIFICANCE OF THE STUDY

Fish is an important resource to both the human well-being and the economy yet the fish catch has reduced over time due to improper fishing methods used on lake Victoria. Therefore my study will help to save the over exploitation of fish stock in the lake.

The study will also help the government come up with a more comprehensive policy on how to implement and enforce the use of more efficient fishing methods on the lake like big sized gill nets which will in turn minimize over harvesting of fish.

The study will be the basis of other research that will be carried out in future and lastly the study will give non-government organizations (NGOS) a base line study that will be used in the evaluation of use of efficient conservation technology.

1.6 SCOPE OF THE STUDY

The study was carried out in Bugoto fishing village found in Kigandaalo Sub County, Bunya County, Mayuge district. 120 fishermen were interviewed, 2 fisheries staff, the elders (3) and 5 Lcs were also interviewed.

The study mainly focused on the methods of fishing used and the causes of fish reduction on lake Victoria. The study identified efficient fishing methods, which can promote sustainable development in the fishery industry.

The research was also intended to assess the benefits that the local people will derive from the use of more efficient fishing gears. The need for sustainable fishing on lake Victoria is acute and the local people themselves can well tackle it in self-help fashion with active support from the government. The basic aim is to protect the environment in which they live.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 IMPORTANCE OF FISHERIES RESOURCE

The fisheries of Uganda, harvested entirely from fresh water bodies, constitute an important resource and contribute to the nutritional welfare of the people. The fisheries sector makes a significant contribution to the Gross Domestic product (GDP) and generates substantial incomes for the thousands of Ugandans engaged in fish harvesting, processing, distribution and marketing.

Fish is a high quality animal protein, and Uganda has a reasonably abundant supply of this food item. It is now reckoned that fish contribute more than 50% of the total solid animal protein intake for national population (The state of environment report for Uganda, 1994).

It should also be noted that the per capita consumption of fish by fisher folk communities along the major water bodies and by the urban population exceeds the national average, for example, it has been estimated that annual per capita consumption of fish in Kampala and the Fisher folk communities around lake Victoria (Uganda) is of the order of 50-60kg/yr 82, almost four to five times the national Household expenditures, export earnings and nutritional purchases. Household expenditures, export earnings and nutrition purchases provide a steady source of income to those engaged in the exploitation of Uganda's fisheries resources. The direct expenditures on fish by the various consumers also generate multiplier income effects in other sectors.

The Ugandan average household expenditure on fish is about 3.29% of the total disposable income. The fisheries resource is known to provide significant employment opportunities. An estimate places the number of directly employed persons at 75,000 with an additional 500,000 employed as a result of fisheries activities giving an employment multiplier of 6.7 time (state of the environment Report for Uganda, 1994)

And finally another study has suggested that for rural populations living near lake shores and on Islands in the lakes, there are about 73,000 individuals working directly as small scale fishing unit owners or as crew, with an additional 300,000 people thought to be employed directly through secondary, and tertiary activities related to fisheries exploitation such as processing, trading, boat building, fishnet making and repairs and the provision of various support services.

2.2 THE IMPACTS OF FISHING METHODS AND GEARS ON THE AQUATIC LIFE.

Trawling is a highly mechanized and indiscriminate fishing method. Trawlers are well-equipped vessels fitted with trawl nets and driven by powerful engines. The trawlers are not only indiscriminate but they also destroy gears belonging to the local fishermen. Despite the fact that trawling is illegal, the practice has become prominent of late due to high demand of Nile perch for export. In 1960s and 70s trawling in lake Victoria was first carried out for research and stock assessment purposes.

There has been stiff competition between the local fishermen who use simple methods of fishing and the trawlers since the 1970s.

USE OF UNDER SIZE MESH (NET)

Dunga beach, near Kisumu in March 1997 (Table 1 below), reveals that 34% of the Nile perch caught were juvenile. This clearly indicates that illegal mesh sizes are being used. The reasons for catching Juvenile fish can be attributed to high demand on mature fish from the fish processing factories (Abila and Jansen, 1997). The main way to satisfy the demand from the local market is to target the juvenile Nile perch, which is too small for the needs of the fish processing factories. An additional factor contributing to the use of illegal gear is the high price of gear with legal and recommended mesh size.

Table 1: Fish caught at Dunga Beach, during 1997.

Date	Medium size (kg)	Juvenile size (kg)	Total (kg)	% of juvenile caught
5/3 /1997	151	135	286	47
7/3/1997	213	139	352	39
9/3/1997	104	80	184	43
11/3/1997	355	78	433	18
Total %	825	432	1255	34

Source: Survey-Data(Owino 1999)

In the same report, it is quoted that the average mesh size used in the lake has reduced from 12 inches in 1981 to 6 inches in 1996.

(Muhoozi and Kamanyi 2001) revealed that the use of nets of mesh sizes less than 127 mm (5 inches) increased from 15.9% in 1996 to 50.4% in 1998, there was an indication that the fish catches and fish landings were showing some recovery during 1998 and 1999 as shown by the increase in mesh size from 0.6 to 0.02 kg in 1998 to 0.76 and 0.01 in 1999 in the artisanal fishery.

The catch rates and the average weight of fish caught in the gill net fishery continued to decline; the proportion of immature fish landed had exceeded 90% by 1999. Therefore this calls for urgent measures to reduce the capture of immature fish. Many of the traditional fishing grounds are already over exploited and expansion of fish production has a very limited scope. According to (SEDAWOG 1999), A sizable number of fishermen still invest their money and capital in the fishery. The decline in fishery will in the long run have important consequences on fishery dependant communities.

Over the years, degradation of lakeshore resources has been going on due to human induced activities, human activities notably fish smoking, boat construction and cooking at the landing sites impacts the tree and forest cover along the shores and Islands (Kulyangingi, 2001).

2.2.1 THE FISHING METHODS AND TECHNIQUES USED ON LAKE VICTORIA.

TRAWLING:

This is one of the destructive gears used for fishing in fish breeding areas (near the shoreline). The fisheries act (revised in 1991) of the laws of Kenya bans trawling in Nyanza gulf and within 5 nautical miles from the point of the entire shore line which in reality is the entire Kenyan portion of lake Victoria, since Uganda and Tanzania have already imposed a complete ban on trawling in their waters, the whole lake Victoria is legally free from trawling. In practice however, trawling is continued, (Mbuga, 1998), (Abila, 1997), (Owino, 1999) and (Bokea, 2000) all attest. In the technique of trawling, a boat drags a large net through the water. Midwater trawling is when the net is somewhere in the water column. It is called bottom trawling when the net is dragged along the lake floor. Many of the most important fish species are caught with the bottom trawl. The fact that trawling which should be very easy to stop considering the size and visibility of the vessel involved has never ceased.

FISH POISONING.

Catching fish using poisonous chemicals is even a more recent practice; the practice came to lime light only in 1997-1999, when government banned fishing to curb fish poisoning. The origin of the poisoning problem is not well known. However lake Victoria fisheries research project-conducted studies in 1998 and 1999 to determine the nature of the chemicals used, the origin of poisoning problem and factors facilitating it's spread.

TEMBEA:

Tembea, which is a form of drift net fishing, has caused havoc to a section of the traditional fishery. Tembea boats are normally in fleets.
According to Jansin (1999), the tembea, fishing techniques constitute a revolution in lake Victoria fishery, with important social-economic impacts. The first most negative effect of tembea is that it destroys gears of traditional fishing boats, especially gill nets and long lines set out on lake Victoria, secondary,

tembea have greatly increased fishing efforts to an extent that may not be sustainable. The initial tembea boats caught up to 1200kg of fish daily (Jansen 1991). This has gone down remarkably as a result of the over exploited fishing grounds but tembea may still get over 5 times the quantity of fish caught by a traditional boat of the same size.

SEINING

Seine nets are often used to catch schooling fish for example mackerel are most easily caught this way. These are upper-water –column fish that swim large distances. A small boat some times two boats, sets off from the mother ship and carries a relatively small-mesh net with it that is set around the school of fish. If the net is a "purse" seine, a string on the bottom is then pulled tight so that the bottom of the net can be closed off. The net is then hauled in until most of the fish are in a small area of water. The fish are then generally brailed out (removed from the water) large quantities of fish are generally caught by seines (Joe, 1994). The pumps themselves often damage the fish.

A modification of the seining method is often practiced from shore. The "**mother ship**" becomes some form of landside attachment (people, vehicles) and the net after setting, is hauled to shore by either the people or a vehicle

GILL NETTING.

Gill netting involves stretching out a net, which intercept fish. The net can be set at any level in the water column by manipulating the rope length and by the use of anchors and floats. Placement is often chosen to intercept natural fish migrations. The fish do not see the net and simply swim into the net once their gills go through the net, they can no longer escape and they drown (Joe, 1994)

CAST NETS.

Cast nets, or variations thereof are usually used by the artisan fishermen. These are simply thrown out to lake from land or a small boat; the weights around the net cause them to sink and trap (catch) the fish.

HOOKING METHODS

LONG LINING.

Long lining is simply the use of a long fishing line with lots of hooks, usually evenly spaced along the line. This method can be used on rougher grounds (bottom) which should not be used by a trawl. This system has many important benefits over trawling, including the potential for size and species, selectivity by proper choice of hook-size, and bait, lower energy costs and less damage to ocean bottoms. Placing the bait onto the numerous hooks is very labor-intensive. New forms of mechanical or semi mechanical baits have been developed that replace the tremendous effort involved in hand baiting. It is also labour- intensive to remove the bait and fish from the line as it is hauled back on board.

Hooks used for long lining must be of the appropriate size for the fish that is sought. The choices of hooks size and tail can be to make this form of fishing very selective also, since each hook is designed to catch fish above a certain size, this technique is particularly effective in avoiding undersized fish.

OTHER TECHNIQUES.

A number of more un usual techniques may also be used(Joe, 1994), spears and harpoons (the latter, sometimes with a bomb implanted in them) may be used for catching fish. In Mediterranean, fishermen sometimes simply denote a bomb in the water and then collect all the dead fish usually of lower quality.

A wide variety of other catch methods are used for shellfish. These animals often live below the ocean floor and thus require techniques like surface dredging (e.g. of scallops) or raking and togging to recover the product, a dredge has steel teeth that scrape and stir up the ocean floor. The fish are then caught in a large steel bag behind the dredge; high discard rate must be expected (Joe, 1994).

There are many other methods used to catch fish as well as a variety of other traps. Most of these methods have been adapted over time to specific fish and local fishing conditions. And important resource for testing nets and other fishing gears is fume tank using this, the behavior of model nets can be studied at various water flow rates.

2.2.2 METHODS OF PRESERVING FISH.

Various methods are used to preserve fish traditionally in Uganda, e.g. sun-drying, salting, and brining (developed in western Uganda near the salt lakes). Frying on lake George near markets requiring fish with a two-day shelf life. Smoking where along multi-month shelf life is needed. Industrial filleting and freezing for export is relatively new and has contributed to a massive increase in volume and value of processed fish. Of all the methods of preserving fish, smoking is the most popular (Vivian 1995). Ancient methods of smoking fish were used to preserve the food product. Modern smoking is more generally done to meet consumers' organoleptic requirements; the process takes from a few hours to a few days. In most cases, the product must still be refrigerated to survive on the shelf; and even then the smoked fish may not last much longer than does fresh fish. The spoilage of smoked fish often is due to molds.

Two methods dominate; soft-smoked or express' i.e., fish that is smoked for 3-4 hours and has a short 1-4 day shelf life, and hard smoked fish i.e. fish that is smoked for up to 18 hours with a 3-4 month shelf-life.

The purpose of smoking is not to improve the flavour of fish, as in the most European countries (Vivian 1995). The Ugandan domestic and export markets have now a pronounced taste for fish smoked the traditional way on wood fuel until it is very dark and relatively dry with a strong hint of residual rancidity.

THE USE OF PAPYRUS TO SMOKE FISH

Papyrus can be used as an alternative to wood fuel for smoking fish. The product is as acceptable as fish smoked by wood fuel. Smoking with papyrus offers no immediate premium to the fish smoker but some net profit advantages may arise where costs can be reduced by it's use and when quality improvements can be obtained.

In locations where papyrus and wood fuel are both abundant there is no perceived advantage to fish smokers in smoking with papyrus and papyrus is rarely seen as a possible alternative to wood fuel, even in areas of wood fuel scarcity.

The weight of papyrus needed to smoke fish is appreciably lower than the weight of wood fuel needed to produce the same volume of out put. About 2kg of papyrus fuel is required to produce 1kg of smoked fish as compared with a ratio of 3:1 for wood fuel. The lower density of papyrus however, requires that more frequent stocking be under taken with a larger volume of fuel. Wood fuel has an advantage for fish smokers that it enables them to stock the kiln less frequently and to leave it unattended over night

2.3   CAUSES OF FISH CATCH REDUCTION ON LAKE VICTORIA

There is a general decline in fishery resources in lake Victoria as a whole mainly due to over exploitation this can be related to the increasing populations in the lake regions (Gomez, 1990) and demands for fish. The bulky of the fishery comes from in shore waters, with in 50km from the shore. In the lake, the natural stocks of the tilapia were exploited quite intensively. In recent years their stocks have shown a sharp decline believed to be due to the disturbance of the seabed by the destructive beam trawl.

According to (Muhoozi and Kimanyi, 2001) analysis of types of boats, mode of operation, fishing gears and methods and target species for different boat categories was conducted during 2000 to July 2001 at 25 selected fish landing sites on lake Victoria, 10 sites were from the eastern zone, 9 western zone and 6 central. Size of major target species Oreochromis Niloticus (Nile tilapia), Lates (Nile perch) and rastreneobola Argentea (Mukene) were taken for various fishing gears, gear-sizes and fishing methods for the different categories of boats.

The results showed an increase in fishing boats along side the catches and Cash Per Unit of Effort. The catches for example increased from about 17,000 metric tones (mt) in 1983 to a maximum of 132,400 (mt) in 1990 along side increase of fishing boats from 3000 to 8000 and Cash Per Unit of Effort from 9 to 36 mt per boat during the same period. Further increase in boats from 8000 in 1990 frame survey to 15,462 in 2000 survey resulted in decline in fish catches from 132,4000 to about 100,000 mt and Cash Per Unit of Effort (CPUE) from 36 to about 14 during the same period.

Another factor which is responsible for the decline in fish catches on lake Victoria is the increasing number in the fish processing plants from 3 in 1990, to 11 in 2000. During the same period there has been increased use of long line, beach seine, cast nets, traps in different boat categories. In that period there was a decline from 85% to 60% in boat categories using gillnets.

Also the increases in fishing effort and destructive methods among other factors are responsible for the decline in annual fishery yield on lake Victoria. It is recommended that fishing boats be reduced to 8,000.

By 1960s stocks of the native tallapine and other large species of lake Victoria had been reduced by over fishing. Nile perch and four tallapine species were introduced into lake Victoria basin in 1950's and early 1960's to improve on the declining fishery as stocks of native species declined rapidly or disappeared altogether. Of more than 300 native species, only Rastrineobola Argentina (Mukene) remained abundant. Haprochromines dropped from 80% of the fish biomass in lake Victoria in 1970's to less than 1% in 1980's and about 200 species were feared extinct. The rapid reduction, especially in Haprochromine species, conceded with a cascade change that began with sudden increase in populations of the introduced predator, the Nile perch. The effects of hypoxia and intense predators probably interacted with competition between native and introduced species. Further aggravating the decline of some of the native fish species.

CHAPTER THREE

3.0 METHODOLOGY & STUDY AREA

3.1 STUDY AREA.

Bugoto fishing village is found in Mayuge district, Bunya County, Kigandalo Sub County. Mayuge district is located in the south-eastern region of Uganda longitudes $33^\circ10E$, $34^\circ00E$. Latitudes $0.06N$, $10^\circ12N$.

Bugoto is located in the Eastern part of the district and it is about 20 miles from the main road. It is bordered by Nankoma, Nduwa and Wakawaka-villages.

3.1.1 POPULATION SIZE AND GROWTH

According to the population census of 2001, the population size of Bugoto is 33,000, Bugoto has the highest population growth rate in Bunya County. The population growth is estimated to be 3.0 percent per anum. Bunya County has a total population of 128,056.

3.1.2 CLIMATE

Climate refers to the average long-term weather conditions based on indices such as temperature, precipitation or interaction of solar (sun) energy, moisture with earthly systems.

3.1.2.1 RAINFALL

Bugoto receives rainfall through out the year, on average it receives 1,200mm annually making inexpensive, rain fed agriculture possible, this explains why agriculture is the main economic activity in the area.

The rain distribution is as follows, the long rains occur between early March to mid June, and the short rains between August to October. (Akello, 1990)

3.1.2.2 TEMPERATURES

The temperatures of Bugoto are considerately moderate with an annual average of 20^0C. The annual temperature range is 22^0 C. This is very low range especially when compared to tropical savannah climate where the variations can be as high as 10^0C. The temperature peaks are in the months of January to March and October to December, the former being higher. The same pattern is true for the percentage sunshine. Cloudiness depress the temperature slightly.

3.1.3 TYPES OF SOILS

Bugoto village is characterized by clay loamy soils and sandy loamy soils such soils are supporting the growth of maize, millet, rice, beans, Soya beans, cow peas, groundnuts, cassava, potatoes and yams.
The area is characterized by gently low land, which minimizes excessive soil erosion.

3.1.4 VEGETATION

The vegetation of Bugoto falls the existing rainfall relief pattern. The vegetation is a relic original vegetation, where by there are remnants of communities related to the mixed savannah woodland climax. The common species include pennisetum fire, Cyprus, Serial herb, Papyrus, Muvule tree, Mahogany and wet land several grasses.
However, due to the increased demand for agriculture, residential and fuel wood, most of the vegetation has been cleared.

3.1.5 DEFORESTATION

The loss of indigenous vegetation and cover through conversion to agriculture, settlement, firewood, for cooking and smoking fish, has reached an alarming scale in Bugoto, this is attributed to population increase through immigration of displaced persons from recently troubled districts of Kumi and Soroti as well as increasing demand for fuel wood in the nearby urban areas of Iganga, Jinja and Bugiri.

3.1.6 ETHNIC COMPOSITION

Bugoto is predominately occupied by the Basoga whose language is Lusoga, however, in Bugoto there are people who came from different parts of the country, for example the Bagishu from Mbale, the Itesotis from Soroti and Kumi and also the Basamya from Busia, thus different languages are spoken, however, Lusoga is dominant.

3.1.7 LOCATION OF MAYUGE DISTRICT
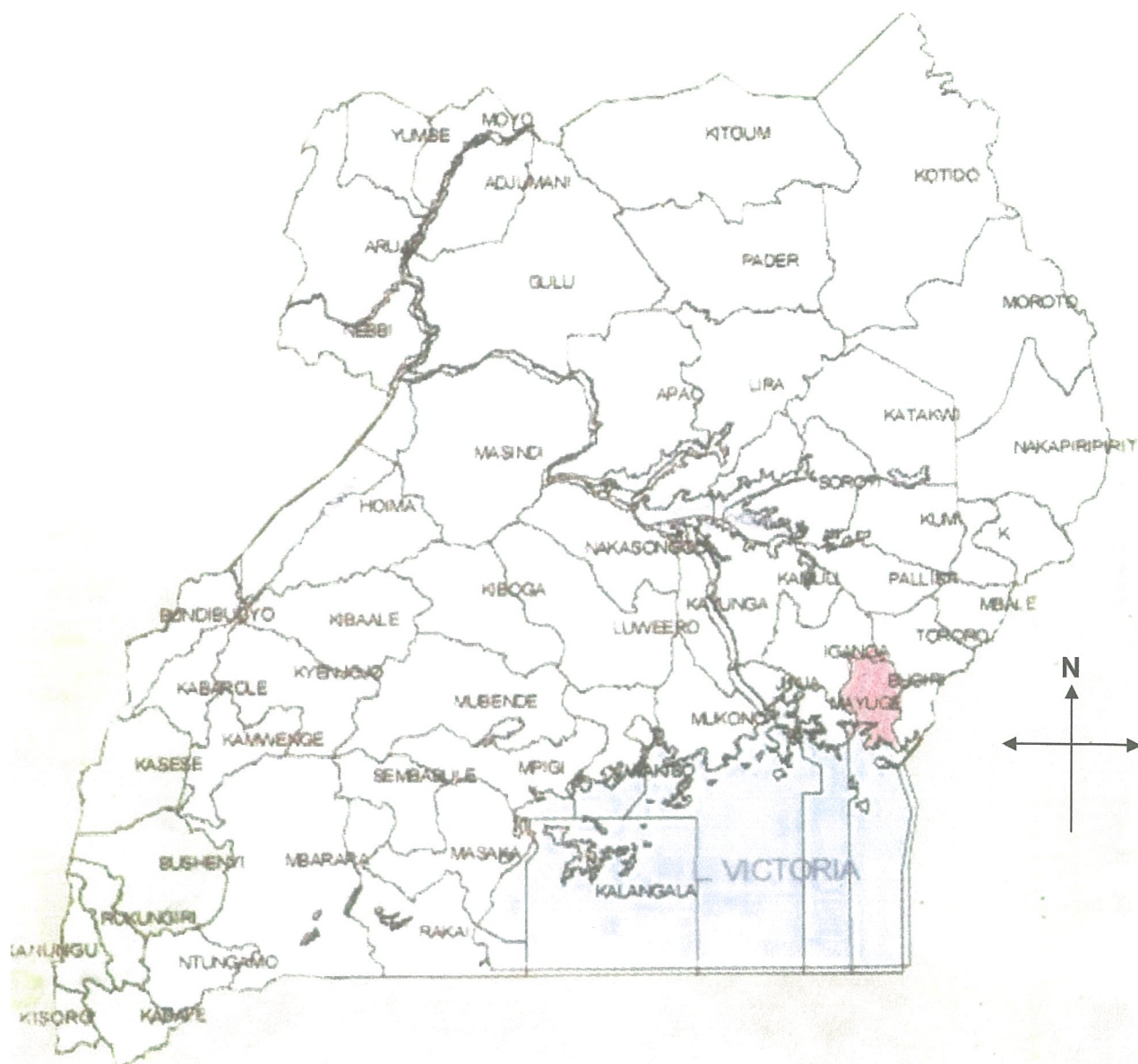
KEY

Mayuge District

3.2 RESEARCH DESIGN

Since the population of Bugoto fishing village is high, the research did not tackle the entire fishing village; therefore, a sample was used to represent the population of the fishing community. The background information about the area was got from the elders living with in the village.

3.3 DATA COLLECTION METHODS

3.3.1 SECONDARY DATA

Library and fisheries department information were used to supplement my findings.

3.3.2 OBSERVATION

The researcher was moving around the lake to see exactly what takes place on the ground for example the types of gears used on the lake, the kind of fish harvested, preservation methods and quantity.

3.3.3 GROUP DISCUSSION

The researcher used focus group discussions with the fishmongers to supplement on the questionnaires that were administered.

3.3.6 QUESTIONAIRES

Interviews schedules were also administered to different categories of people like, fishermen, fisheries staff, LCs, Elders.

3.4 DATA PROCESSING ANALYSIS

The research was analysed by use of both qualitative and quantitative analysis. Quantitative analysis involved simple descriptive statistics like percentages, pie charts and average.

4.0 PROBLEMS WHICH THE RESEARCHER FACED DURING THE STUDY

There was a problem of language barrier, fear from the community to deliver correct information about the illegal fishing gears which they use, since they thought, the government would arrest them. Bugoto being a remote area, transport was difficult The researcher was faced with financial barriers since the money to carry out the research was not enough to collect all the needed data.

CHAPTER FOUR

4.0 PRESENTATIONS AND DISCUSSION OF RESEARCH FINDINGS.

4.1 INTRODUCTION

The variables which the research concentrated on included the fishing activities that take place in Bugoto fishing village for example the fishing methods and gears used, the fish preservation methods and the consequences of using the above methods on the aquatic life in Lake Victoria also the solutions of overcoming overexploitation of fish on the lake were suggested.

## 4.2 THE IMPACT OF FISHING ACTIVITIES ON THE AQUATIC LIFE

Human activities notably house construction, fish smoking, boat construction, construction of basket for carrying fish and cooking at the landing site impact the vegetation cover along the lake shore.

The interviews showed that 98% of the fisher community were aware of the benefits derived from the vegetation cover around the lake shore (forest /tree, grass, papyrus) according to the respondents 72% agreed that due, to some fishery related activities some plant species had reduced more than others in the vicinity of most landings.

Most respondents said that the most reduced tree species were Muvule (36%), Musizi (22%). Among the fishery related activities which had significant impact on the lakeshore vegetation were construction of houses (44%) and boats (22%) emerged upper most. Other activities such as fish smoking (14%), cooking (7%), construction of baskets for carrying fish (5%).
Generally there was extensive reduction of the vegetation cover around the lakeshores

Plate 1: Fishing activities at Bugoto Landng site
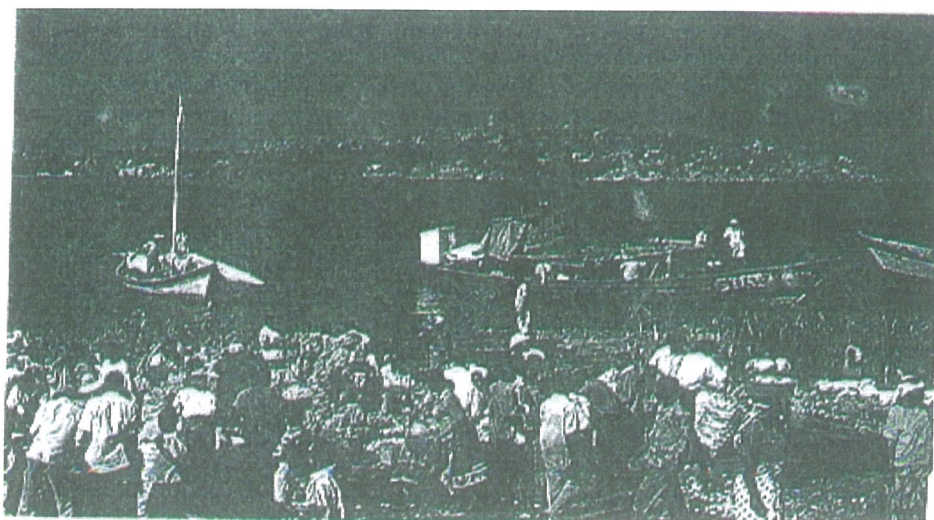
Source: By the Researcher

TABLE 2: ACTIVITIES THAT AFFECT THE LAKE SHORE VEGETATION

ACTIVITIES	Number of respondents	PERCENTAGE
House construction	62	52
Boat construction	27	22
Fish smoking	17	14
Cooking	8	7
Basket construction	6	5
Total	120	100

Source: By the Researcher

4.2.1 THE COMMONEST TYPES OF FISHING GEARS USED

TABLE 3: THE COMMONEST GEARS USED IN BUGOTO.

Types of gears	Number of people	Percentage Response
Gill nets	25	21
Cast nets	10	8.3
Hooks	10	8.3
Beach Seines	40	33
Monofilaments	30	25
Mosquito nets	5	4.2
Total	120	100

Source: By the Researcher

The above results have been further illustrated in figure 1 below.

FIGURE 1: TYPES OF GEARS USED IN BUGOTO FISHING VILLAGE
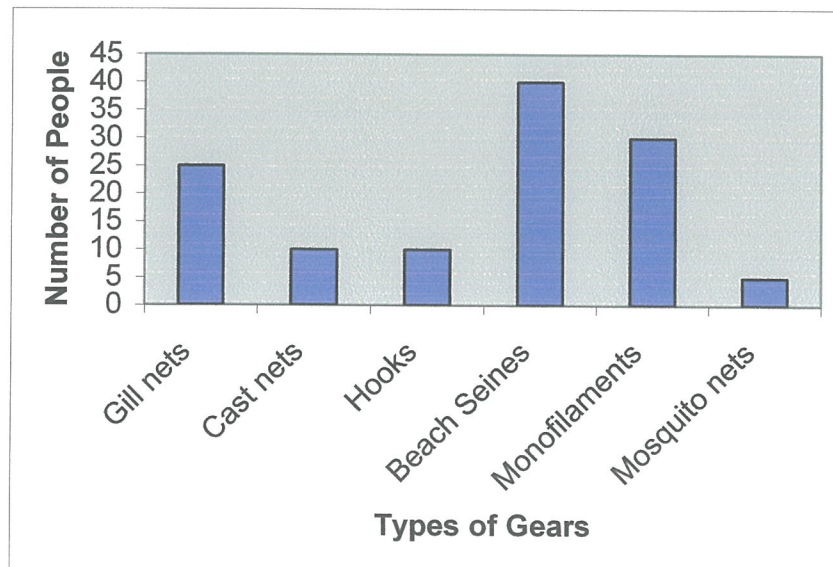
Source: By the Researcher

FIGURE 1, above shows that many people use beach-seines for fishing followed by mono- filaments, both of the mentioned fishing gears above are non selective gears and are illegal according to the Uganda fish act 1969.

There is increasing theft on lake Victoria, hence the above gears (beach seines and monofilaments) being active gears, they can be easily monitered and hence reduce on the chances of being stolen.

Some people also said that they prefer the above gears to others because they have a high catchability as compared to passive gears like the gill nets. Also some people said the active gears are cheap.

4.2.2 THE FISH PRESERVATION METHODS USED IN BUGOTO FISHING VILLAGE.

This was tackled by interviewing fish processors of fish and the results were as below:

TABLE 4: THE FISH PRESERVATION METHODS USED IN BUGOTO FISHING VILLAGE

METHODS OF FISH PRESERVAION USED	NUMBER OF RESPONDENTS	PERCENTAGE RESPONSE
Smoking	72	60%
Sun drying	33	27%
Salting	15	13%
Total	120	100

Source: By the Researcher

Table 3, above shows that 60% of the people in Bugoto use smoking as the preservation method.

They argued that they use smoking because in most markets (local markets) around, people prefer smoked fish to any other type of preserved fish. When asked on how they preserve (smoke) fish, they said that they use pit kilns for smoking fish with the aid of firewood, and papyrus. They use pit kilns because the raw materials used in smoking of fish (firewood) and papyrus) is easily accessed.

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27 percent of the people interviewed said that they use sun drying; species preserved using this method is the Hyprochromine (Mukene).

Then 13% use salting method for preserving the fish. When interviewed on how they handle their wastes after fish dressing, they said they dispose off in the lake.

Plate 2: Fish processors at Bugoto

Source: By the Researcher

4.3 THE CAUSES OF LOW FISH CATCHES ON LAKE VICTORIA

TABLE 5: THE CAUSES OF LOW FISH CATCHES ON LAKE VICTORIA.

This was tackled by use of oral interviews, 40 people were interviewed.

Causes of low catches	Number of respondents	Percentage Response
Illegal fishing gears	60	50
Increased fishing effort / canoes	37	30
Destruction of the fishing grounds	15	12.5
Inadequate staffing at the fish landing sites	9	7.5
Total	120	100

Source: By the Researcher

The above results have been illustrated in the bar graph below.

FIGURE 2: A CAUSES OF LOW FISH CATCHES ON LAKE VICTORIA.
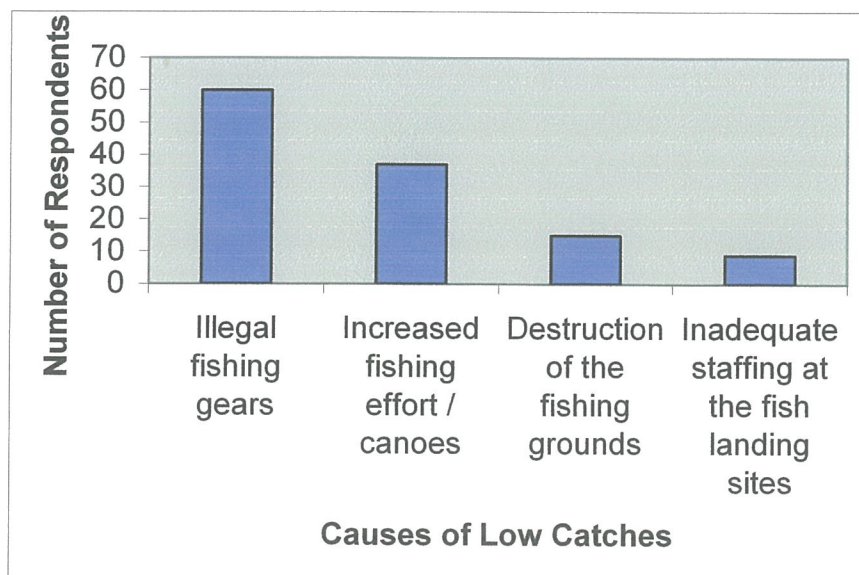
Source: By the Researcher

The results revealed that the leading cause of fish reduction in lake Victoria is use of illegal fishing gears / methods, which is illustrated in figure 2 with the highest percentage. This was followed by increased fishing effort (37%) then destruction of fishing grounds (12.5%) and lastly inadequate staffing.

4.3.1 ILLEGAL FISHING GEARS

Most of the fishermen revealed that they prefer using illegal gears because these gears are active gears and hence can easily be monitored and can not be stolen. Over the years, theft on lake Victoria has been a problem to fishermen nd is on the increase.

Also some fishermen prefer using illegal gears because of their high catchability, since these gears are small sized mesh, they are non selective, they catch both mature and immature fish hence increasing the catchability.

Others prefer illegal gears because they are cheap. Illegal gears are set in shallow waters where fish breed and end up destroying the fish breeding grounds around the lake shores , this has resulted in low fish productivity on lake Victoria.

4.3.2 INCREASED NUMBER OF CANOES/EFFORT

The researcher found out from secondary data that preliminary findings from a four year study on lake Victoria indicate that there is depletion of fish stocks near the shore line.

The survey indicated that the number of fishers on the lake increased from 121,305 to 52,479 and fishing crafts from 42,483 to 52,479 between 2000 and 2002. It was discovered that the number fishing landing sites had also increased (LVEMP, 2003).

The increase in fishing canoes has been attributed to the increase in human population on the lake shore fringes and the increasing demand for fish by the fish processing factories.

4.3.3 DESTRUCTION OF THE FISH BREEDING GROUNDS

As said earlier, fish breeds around the lake shores, the research revealed that most of the fisheries activities interfere with the fish breeding grounds. Some of these activities include harvesting of papyrus and firewood for smoking fish and for cooking, timber for boat construction and grass for house construction and also papyrus for construction of fish carrying baskets.

All these activities involve the fishers to clear the lake shores in search of these raw materials this has greatly affected the fish productivity in lake Victoria.

4.3.4 INADQUATE STAFFING

There is inadequate staffing of the fisheries officers at the fish landing sites. The tusks expected by the fisheries officers are many how-ever their number is limited, there is usually only one fisheries officer per gazetted beach, yet the number of fishermen per landing site is increasing day after day, this large number cannot be handled by only one fisheries staff for proper fisheries management.

4.3.5 MEASURES OF OVER-COMING OVER EXPLOITATION OF FISH ON LAKE VICTORIA

TABLE 6: MEASURES OF OVER-COMING OVER EXPLOITATION OF FISH ON LAKE VICTORIA IN BUGOTO FISHING VILLAGE

MEASURES	NUMBER OF PEOPLE	PERCENTAGE RESPONSE
Incentives	60	50
Extension	30	25
Awareness	15	12.5
Monitoring	15	12.5
Total	120	100

Source: By the Researcher

This was further illustrated by use of a bar graph as seen below.

FIGURE 3: MEASURES THAT CAN BE USED TO MINIMIZE OVER-FISHING ON LAKE VICTORIA
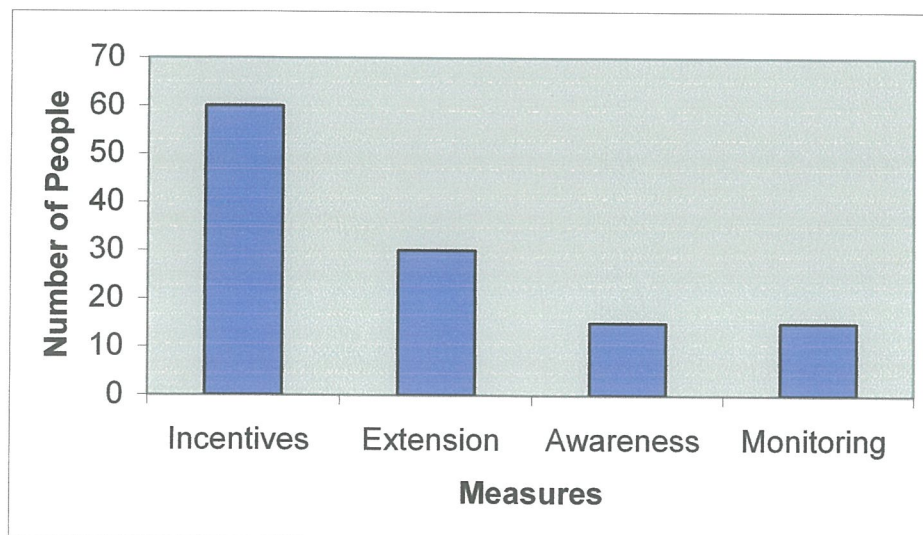
Source: By the Researcher

4.4.1 PROVISION OF CREDIT AND SECURITY ON THE LAKE

Most of the people in Bugoto advocated for the provision of credit, they said that people are willing to use legal gears but the gears are very expensive, so they the fishermen can not afford. Therefore if credit facilities can be availed to them with no interest rates and use them other than the illegal gears.

More so there is insecurity on the lake in that they keep their gears in the water with the better management hence the increasing trend of theft on lake Victoria hinders them to use the recommended gears which are passive gears, and in most cases are left in the lake over night they said if the government could provide them with enough security on the lake they can use the passive gears effectively.

4.4.2 EXTENSION SERVICES.

About 25% of the people supported the idea of extension worker and they said they should be based at the fish landing sites and continue to inspect and supervise the day to day work of fisheries management.

For example Law enforcement on the lake, educating the fishing community better methods, better preservation methods and the importance of sustainable fishing.

4.4.3 AWARENESS AND EDUCATION

12% of the respondents said that it is awareness that can boost fisheries in Bugoto fishing village. They reported that people may not be aware of the issues of sustainable fisheries and it's benefit.

Awareness campaign covers a wide geographical area, related to the extent of the problem and tend to rely heavily on mass media such as posters, newspapers and radios to teach the public sustainable development. To be effective mass media should be supported by local actions such as local meetings and discussions.

4.4.4 MONITORING

12% of the people supported the idea of monitoring the gears and the incentives; they reported out that human beings need to be monitored especially where there are incentives such that there is compliance. Monitoring will help in comparison of the base line data and evaluation exercises.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 CONCLUSIONS

Following the analysis and interpretation of research findings, the following conclusions where made.

The increasing effort and destructive methods among other factors are responsible for the decline in the annual fishery yield on lake Victoria. This has resulted into serious degradation of the lake Victoria environment.

Artisanal fishers, fish in shallow in shore waters using the non-selective fishing gears. Other human activities like house construction, firewood harvest for fish smoking and papyrus for making of baskets which are used to carry fish to the markets, have played a very big role in the destruction of the lake shores which are favourite grounds for fish breeding this is responsible for the declining trend of fish catches on lake Victoria. Some of the measures which can be used to improve on the fish productivity on Lake Victoria include provision of credit and security on the lake, monitoring, education and awareness.

5.1.1 THE IMPACTS OF FISHING ACTIVITIES ON FISH PRODUCTION

The major fishing activities which impact on the aquatic life include the harvesting of firewood and papyrus for cooking, smoking fish, papyrus for constructing fish carrying baskets, timber and grass for house construction and so many others.

The above activities have left the lakeshores open and this has affected the fish catches on Lake Victoria.

5. 1.2 CAUSES OF LOW FISH RODUCTIVITY

The major causes of low fish productivity include use of under size meshed gears for fishing, increase in the number of canoes and fishing effort on the lake which is caused by human population around the lake fringes and the high demand for fish by fish processing factories.

Another factor responsible for the low fish productivity is the destruction of fish breeding grounds by fishers' activities.

5.1.3 MEASURES OF OVER-COMING LOW FISH PRODUCTION ON LAKE VICTORIA

The measures which can be used to minimize the deteriorating fish productivity on the lake are as follows; provision of credit/incentives to the local people, provision of extension workers/services on the gazetted fish landing sites, creation of awareness and education in the community as this will help the people to know the importance of sustainable fishing.

5.2 RECOMMENDATIONS

The views expressed by the fisher community in Bugoto fishing village as out lined below suggest that if government provided an enabling environment, there will be sustainable fisheries.

5.2.1 RECRUITMENT OF ENOUGH FISHERIES OFFICERS

The government should recruit enough fisheries officers on the landing sites as this will aid in the proper fisheries management in addition the fisheries staff should be well facilitated as this will reduce the corruption mentality in the fisheries officers.

5.2.2 SECURITY

Government should provide enough security on the lake, as this will combat gear theft, which is on the increasing trend on Lake Victoria.

5.2.3 USE OF PARTICIPATORY APPROACH

Co- management should be strengthened to involve stakeholders, the government should allow and encourage the local fishing communities through their organizations to observe, implement and enforce the fisheries regulations as stated in the fisheries act.

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APPENDIX 1

QUESTIONNAIRE 1.

TO ELDERS AND LC[S]

1. When did this village evolve into a fishing village?

2. How many fishing canoes did it begin with?

3. Was fish for home consumption or for commercial?

4. Can you give a rough estimate of the population it started with?

5. How do you comment on the previous catches and today's / now day's catchers

6. What is the major economic activity in this area?

QUESTINAIRE II

DIRECTED TO FISHERMEN

1. Age

    10 – 19 years ☐

    20 – 30 years ☐

    31 – 40 years ☐

    41 – 50 years ☐

2. Sex

    Female ☐

    Male ☐

3. Which is your occupation

    Fisherman / woman ☐

    Farmer ☐

    Businessman ☐

    Others (specify) ☐

4. What is your level of Education?

    None ☐

    Primary ☐

    Secondary ☐

    Tertiary ☐

5. What type of fishing gear do you used?

    Gill nets ☐

    Hooks ☐

Cast nets ☐

Beach Seines ☐

Monofilaments ☐

Others(specify) ☐

6. For gill nets and Hooks please state the size

Hooks ☐

Gill nets ☐

7. Is the fishing gear legal/lawful?

Yes. ☐

No ☐

I don't know ☐

8. How far from the shoreline do you cast your nets/gears?

With in 100 metres ☐

Within 200 metres ☐

Beyond 200 metres ☐

9. What is the means of propulsion to the fishing grounds?

Hand propelled ☐

Wind propelled ☐

Engine propelled ☐

Others (specify) ☐

10. Why do you prefer the above fishing gear to others?

Cheap ☐

Has high catchability ☐

It is lawful ☐

It is easily monitored ☐

Others (specify) ☐

11. What type of fishing craft do you use?

Canoes ☐

Rafts ☐

On foot ☐

12. What is the main material used in the construction of the fishing craft.

Timber ☐

Buoyant trees ☐

13. What is the source of raw material mentioned above?

Cut from the shore line ☐

Timber from the forest reserve ☐

Others (specify) ☐

14. What is your target species?

Tilapia (Ngege) ☐

Nilo perch (Mputa) ☐

Lung Fish (Kamongo/Mamba) ☐

Silver Fish (Mukene) ☐

Others (specify) ☐

15. About how much do you catch per day?

    10-20kg ☐

    21-30kg ☐

    31-40kg ☐

    41-50kg ☐

    Others (specify) ☐

16. Is it decreasing or increasing?

    Increasing ☐

    Decreasing ☐

17. If decreasing why?

    Bad fishing gears ☐

    Many fishing canoes ☐

    Introduction of exotic species in the lake ☐

    Others (specify) ☐

QUESTIONNAIRE III

TO FISH PROCESSORS/PRESERVERS

1. What is the fish preservation method used?

   Smoking ☐

   Salting ☐

   Sun drying ☐

   Chilling ☐

2. What is the source of energy/material used?

   Sun/wind ☐

   Firewood ☐

   Salt ☐

   Ice ☐

3. In case of firewood, how do you access it?

   Buy from venders ☐

   From government forest reserve ☐

   From own plantations ☐

4. What type of smoking kiln do you use?

   Improved chorker kilns ☐

   Pit kilns ☐

   Mud and wattle kilns ☐

5. What are the fish carrying containers used?

Papyrus Baskets ☐

Polythene Baskets ☐

Others (specify) ☐

6. In case of papyrus Baskets, for how long is the Basket used?

For only one trip to market ☐

3-5 trips ☐

6-10 trips ☐

More than 10 trips ☐

QUESTIONNAIRE IV

TO THE FISHERIES STAFF.

1. How many fishermen are in Bugoto fish landing site?

2. How many fishing canoes are in Bugoto fishing village?

3. According to daily statistics collected and recorded, on average how much does each canoe harvest every day?

4. Is it on the increase or decrease

5. Are there any possible reasons for the noted trend?

6. Are there any illegal fishing gears used?

7. If yes what are they?

8. Are there any measures put in place to combat the fishing illegalities?

9. What problems do you face in carrying out your duty please list the major ones?

10. Can you propose solutions for the above problems?

    If yes, please list them.