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DEPARTMENT OF ENVIRONMENTAL SCIENCES

IMPACTS OF BEACH SEINES AND CASTNETS ON THE ENVIRONMENT AT KIGUNGU FISHING GROUND ON LAKE VICTORIA IN WAKISO DISTRCT, UGANDA

BY

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ACRONYMS

ARDC	:	Agriculture Research Development Center.
FAO	:	Food and Agriculture Organisation.
MAAIF	:	Ministry of Agriculture, Animal Industry and Fisheries.
DFR	:	Department of Fisheries Resources.
NARO	:	National Agriculture Research Organisation.
FIRRI	:	Fisheries Resources Research Institute.
LVFO	:	Lake Victoria Fisheries Organisation.
US	:	United States.
GPS	:	Geographical Positioning Systems.
EU	:	European Union.
HACCP	:	Hazardous Analysis Critical Control Point.
MD	:	Meshes Deep.
FTI	:	Fisheries Training Institute.
ACR	:	Average Catchability Rate.
CN	:	Cast Net.
BS	:	Beach Seines.
BMU	:	Beach Management Unit
MUK	.	Makerere University Kampala
KIU	.	Kampala International University

DEFINITIONS

Fishing gear	:	Its any kind of engineering structure, mechanically Constructed for fish capture.
Fishing method	:	These are the techniques used in removing fish From water bodies
Active fishing gears Or methods	:	These refer to any gear or method which is skillfully Manipulated or operated by man to capture fish In the fishery waters. (Oluka Levi, 2001).

DECLARATION

I Nabbongo Henry of **Reg. No. BEM/ 0525/21/EU** do declare that the work presented in this report is original unless otherwise stated and has never been presented in any institution for the award of a degree or its equivalent.

Signed ..... Date 18th/ Oct / 2025

Nabbongo Henry

Research Candidate.

Signed ..... Date 18/ Oct / 2025

FOR **Mrs. Abesiga Nancy Twesige**

Supervisor.

DEDICATION

I do hereby dedicate this research work to my dear parents: Father Mr. James Kiirya Kalyamukozi and my late mother Mrs.Kasoga Joyce Kalyamukozi and my beloved wife (Mrs. Irene Nabbongo) plus my beloved children (Cohen, Reagan, Precious, and Fortunate)

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MAY THE ALMIGHTY GOD BLESS THEM ALL!!

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF PIE –CHARTS

MAPS

LIST OF PHOTO – PLATES

MAPS:

ABSTRACT

A study to investigate the impacts of Beach Seine and Cast net gears was carried out at Kigungu Fish Landing Site on Lake Victoria in Wakiso District Uganda. The major valuables considered included the design, construction, operation, catchability, efficiency and impacts of Beach Seines and Cast Nets. In order to investigate the above, a research was designed and it was used. Method for data collection includes; Visits to programmed places (Libraries, Research and Training institutions, Government offices, Kigungu Fish Landing Site), Questionnaires , Physical Observations and Experimental Fishing. Results indicate that Beach Seines and Cast Nets are Active Fishing gears and these can either be single or multipannel by design. Results also indicate that these gears (Beach Seines and Cast Nets) have a high Catchability rate. It was also revealed that these gears are highly efficient in this Fishery. It was also discovered that these gears have some advance impacts on the fish stocks exploited.

In view of the above, it was concluded that beach seines and cast nets have a negative impact on Lake Victoria Fisheries, (Kigungu Fishing ground). It is therefore recommended that the following be done: A temporary ban on the use of these gears should be imposed, alternative fishing gears that promote conservation and sustainability of the fishery resources should be used, elaborate research based on this topic should be under taken in all fishery waters for Uganda and the region and also environmental studies of this nature should be initiated and promoted in various institutions of learning for thorough assessment of the changes in the Aquatic eco system and effective control and management of the aquatic resources by respective governments or states.

CHAPTER ONE.

INTRODUCTION AND BACKGROUND TO THE STUDY.

1.1 Global perspective of fisheries resource

Fisheries have substantial social and economic importance. It's estimated that 12.5 million-people globally are employed in activities related to fishing. The value of fish traded internationally has been estimated at US$40 billion per annum for the early nineties. The total production from capture fisheries and aquaculture during the same period reached and oscillated around a total mass of 100 million tons.(**Neiland , A.E- etal – 2005**)

However, at present, a large proportion of the world's exploited fish stocks are fully exploited, over exploited, depleted or in need of recovery and many are affected by environmental degradation, particularly in the in the inland and coastal areas. Major ecological damage, which may not always be reversible, and economic waste, is already evident in many cases.

New technological developments, such as geographical positioning systems (GPS), rador, echo sounders, more powerful vessels and improved processing methods (e.g. surimi), continue to enhance the ability of fishers to exploit more living resources more intensively, potentionary increasing the severity of the problem.

The existing status of the world's living aquatic resources is probably a result of a failure of a present source of fisheries governance to achieve responsible and effective management of fisheries in most countries. Fishers, fisheries management authorities and fisheries scientists, as well as those responsible for indirect impacts such as environmental degradation must accept shared responsibility for the existing unsatisfactory status responsibility to ensure that joint measures are taken to reverse these trends. It's important for fisheries managers to realize that when resources are being over exploited or exploited in an irresponsible manner, a failure to act will have negative consequences in the future.

(. Chimatiro- s- etal 2005)

1.1.2 Developed Verses Un developed:

Developed Fishers, use new technological developments such as geographical positioning systems (GPS), radar, echo sounders more powerful vessels and improved methods (e.g. Surimi) continue to enhance the ability of fishers to exploit more living resources more

intensively, potentially increasing the severity of the problem. The gears used include: trawl nets, Trammel nets, Seine nets, Jigs, e.t.c.

The less developed fishers on the other hand are still in use of the primitive fishing gears and methods which include: Traps, Basket nets, Spears, Harpoons, while others are in use of artisanal gill netting, long lining, trawling e.t.c of which some of them are detrimental to art artisanal Fishery.

The vessels used include dug out canoes, wooden planked canoes, rafters e.t.c

Generally the developed have the capacity of even taking long off-shore commercial fishing trips while the less developed are mostly artisanal fishery.

(Khalifa, U-e Tal 2005)

1.1.3 Africa's case:

Throughout Africa, the occurrence of large a large number of in-land or fresh water lakes, rivers and other aquatic habitats such as swamps and flood plains of different sizes and forms and containing a wide variety of fish populations have provided man with the opportunity to exploit fish for food, income and livelihoods in general for many centuries. Fish, fishing and fisheries are an integral part of the culture and economy of many peoples and countries in Africa, with significant historical linkages, which provide an important back-drop to more recent fisheries development programmes pursued by national governments. For example, in Egypt there are many ancient carvings which show fishing in the river Nile. Today, Egypt has the largest in-land fisheries production in Africa (**293,000 tonnes).**

In Nigeria and other countries of the lake Chad Basin, archaeological research has revealed that the local economy over 2,000 years ago centered on an integrated system of farming and fishing on the influent rivers and flood plains. Today, the lake Chad Basin produces over 100,000 tonnes of fish valued at US$40 million and contributes to the livelihoods of thousands of people.

In eastern and southern Africa, the Great lakes of the Rift valley have long supported riparian fishing communities, and today the fisheries remain an important part of national economies for example in Uganda, the fisheries of Africa's largest water body, Lake Victoria, currently yields un known tones of fish worth over US $ 90million in exports. For Malawi, another Great lake Malawi represents an important part of the economy.

(Ladu, B.M.B- etal 2005).

Over all, today, it is estimated that the in-land fisheries of Africa produce 2.1 million tonnes of fish, which represents 24% of the total global production from inland waters. In comparison to marine fisheries, inland fisheries production is relatively small representing only 6% of global production. In Africa, marine fisheries production (20 million Tonnes) is also much larger compared to inland fisheries (2.1 million tonnes). However, this simple comparison of gross production between marine and inland fisheries can be misleading, for it can be shown that inland fisheries in Africa generate a wide variety of benefits (such as income and food and underpin the livelihoods of millions of people. This is the case in many countries because inland fisheries are diverse and widely distributed, they can be exploited quite easily using simple technologies and are often well-integrated with farming and other economic activities in other wards, inland fisheries are available and an integral component of the lives of many people throughout Africa, and have an important contribution to make sustainable development, including economic growth and poverty reduction.

However, there are concerns that inland fisheries in Africa are increasingly under threat from factors such as environmental change (both man made and natural) and over exploitation (due to over fishing)

There is also wide spread recognition at all levels of society and inland fisheries. An important first step must be for all stakeholders to build a common and strategic understanding of the importance of inland fisheries for Africa, to reach a consensus on how to address the main challenges through various strategic investments.

(Nyeko, D etal 2005)

1.1.4 Regional Case:

An east African fishery is carried out in lakes, rivers and other aquatic habitat such as swamps. The lakes include Lake Victoria, Tanganyika, Turkana, Edward, George, Kyoga, Albert e.t.c The Rivers include; River Nile, Tana, Aswa, e.t.c

Most of the region's fisheries activities are concentrated on L.Victoria, which is the largest lake in the region.

Lake Victoria has a surface of 68,800 km^2 and a catchment area of 284,000 km^2" is the world's second largest fresh water body (second only to Lake Superior of North America in size, and the largest in developing world.. It has a shoreline of approximately 3,500 km long.

The lake touches the Equator in its northern reaches, and lies between latitude $0^0.7^1$N - 3^0 S and $31^0.8^1$E – $34^0.8^1$ E. It is a relatively shallow lake with an average depth of 40metres and a maximum depth of 80 meters.

The countries of Kenya, Úganda and Tanzania border the lake and control 6%, 45% and 49% of the lake surface respectively. The gross economic product in the lake basin is between US$ 3-4 billion annually, and supports an estimated population of 30 million people with incomes in the range of US$ 90 – 270 per capita per annum. The lake catchments thus provides for the livelihood of about one third of the combined population of the three countries, and about the same proportion of the combined gross domestic product. It is estimated that the present value of annual export earnings from the fishery is at the extent of about US$600 million, which represents revenue to the lake community of US$ 240 – 480 million per annum (Lake Victoria Fisheries Organisation, 1999).

Over the years, there has been increased fish production from lake Victoria. In Uganda, yields rose from 10,000 metric tonnes in 1980 to 132,400 metric Tonnes in 1989. From that period the catches have been gradually reducing than in 1995 the catch was 106,000 metric Tonnes. In Tanzania, annual catch has risen from 146,000 metric in 1988 to 231,600 metric Tonnes in 1989 to 190,000 metric tonnes in 1993.

The increase has led to the establishment of fish processing plants along the shore of Lake Victoria, which targets the international fish markets of Europe and Asia.

The numbers of fish processing industries in the region are as follows: Kenya (12), Uganda (10), Tanzania (12).

Of the various uses/benefits from lake Victoria, it is fish that receives the most attention. Most of the fish found in the lake, other than the recent introductions, lived between 2 million and 10, 000 years ago in the west flowing rivers that later flooded to form the lake. The lake has since experienced explosive speciation particularly amongst the haplochromine cichlids, estimated to comprise over 300 species. This burst of speciation has been in response to the change form river to lake conditions. Although similar phenomena happened in other lakes, in lake Victoria it happened much more recently, more rapidly and with fewer opportunities for ecological isolation in different types of habitats **(LVFO – 1999).**

The catchment area of the lake Victoria is slowly being degraded due to deforestation. The increase in human population in the riparian area has put pressure on the forests for agriculture land, timber, firewood and habitation. This deforestation coupled with bad agricultural practices has degraded the soil leading to siltation along the river into the lake.

Agro-chemical and industrial effluents are now polluting the lake, while defforetation, soil erosion and increasing human and livestock population have all contributed to increased nutrient loading because of changing land use patterns, sewage effluents from urban centers and fisher communities around the lake also contributed to the big nutrient load which In turn has brought about Eutrophication by a factor of five. Eutrophacation has increased algal populations, caused deoxygenating of deep water and created conditions favorable for the growth of noxious weeds such as water hyacinth, wetlands, which normally filter the water before entering the lake, are under stress. Wetlands are reclaimed for agricultural, industrial development and human settlement while others are drained to control human disease vectors. Some are excessively harvested for making mats, baskets and chairs. Many of the wetlands have received too much pollution to the extent that they cannot perform their filtration function efficiently. Therefore, pollution normally retained by wetlands enters the lake unchecked, thus further contributing to the deterioration of our lake water.

With in the last 30 years (1960 – 1990s), the native tilapia (oreocromicism esculents), previously a fish of the greatest commercial importance in Africa virtually disappeared from lake Victoria, but still found in small quantities within the satellite lakes. Other fish species that have deelined drastically include the migratory species and the harplochromine cichlids.

At the same time both Nile perch (Lakes Niihcus) and the Nile Hiopia (creocromis niloHcus) have established them selves in the lake Victoria. Locally known as daaga/omena/mukere'' now features prominently among the commercial catches.

Even those established commercial speeds currently in the Lake Victoria are threatened due to open access and increased human population pressures on the Lake. **(Lake Victoria, fisheries Organisation, 1999)**

1.1.5 Uganda's case:

Uganda is endowed with a rich diversity of aquatic natural ecosystems. They are important sources of fish and cover about 20% of the country's surface area.

The aquatic ecosystem comprise rich hydrological network of streams that combine to form rivers and feeds into five major lakes (Victoria, Albert, Kyoga, Edward and George). There are about 160 minor lakes in addition to numerans wetlands. The river Nile is the major drainage system. **(Nyeko.D, 2004)**

The major commercial species include Nile perch (lakes Niloticus), Nile Tilapia (oreochromis noloticus): Mukene (Rastrineobola argentea), Alestes baremose, Hydrocynus spp, clarias mossambicus, and bagrus docmac, protopterus Aetheopicus. There are also the moon fishes locally known as '' Ngara'' and Ngasa'' with scientific names of Alestes baremose and hydrocynus respectively and the 'Barbels'' known as Barbus spp. However expertise in fish taxonomy to enable elimination of taxa to species level especially for harpochromines is wanting.

Consequently, precautionally management present bolder moves towards serious stock enhancements and aquaculture even in smaller ecosystems such as the myriad of minor lakes. **(Nyeko D, 2004).**

Uganda is estimated to have the capacity to produce about 300,000 metric tones of fish annually on a sustainable basis.

The maximum catches ever realized were 245,000 metric tones in 1990 after which catches have declined .The catch level in 1999 was about 220,000 metric tonnes. Artisan fishermen who are estimated at 136,000 in 1997 wholly dominate the fisheries. Over 700,000 people are involved in related activities. There are also people involved in industrial fish processing, fish net making, fishing equipment trade, fisheries research, extension services and administration.

Average annual per - capita consumption estimated at 10kgs accounting for more 50% of the average annual protein intake for an average Ugandan diet. It constituted one of the major sources of income and an important export commodity. Fish export revenues have risen from under US $1 million to over US $ 30 million per annum in the last ten years. There exist, hoever, market distortions related to international trade in fish and fishery products largely due to lack of market research information.

Consequently Nile perch with obvious superior biochemical nutritional attributes compared to other products is marketed almost at the price equivalent to that of trash fish. A resource that is under valued is bound to be over exploited and subsequently depleted. **(Nyeko, O 2004)**

1.1.6 Constraints: of the sector:

- Resource depletion caused by over exploitation of fish stocks.
- Non-compliance with regulations and inadequate control of catches.
- Illegal transportation of fish to foreign factories (estimated to be worth around US $ 60,000)
- Illegal fishing, poaching and piracy;
- Inadequate attention to the problem of resource depletion will result in rapid reduction in fish production with resulting implications for incomes and diet on a local and national scale, the ability to sustain the growth of in exports;
- Fisheries sector suffered from quality related problem; EU banned fish exports for 18 months as from march 1999 because of the use of poisons in L.Victoria in catching fish;
- The EU requires that exports comply fully with strict quality assessment standards (HACCP) and that a competent Authority to monitor and control compliance;

- Exports from Uganda, as opposed to the surrounding competitors, encounter high freight rate charges, adding some 30% to the cots and fuel prices. This leaves Uganda enterprises in a less competitive position faced with competition from other East African States and price paid to producers are ultimately lower than prices paid to producers from competing countries, hence the movement of around one quarter of fish caught by Uganda fishers to neighboring countries.
- Aquaculture has yet to expand to its full potential owing to lack of capital, security and cost of transport;
- Aquaculture provides potential for investment but possibly on a larger commercial scale but attracting investment appears to be a problem

(Nyeko, D. 2004)

1.1.7 Kigungu Fish Landing Site:

Kigungu fish landing site, the base for this research project (map 1) is found on lake Victoria and located at latitudes 0^0 04^1 S and longitudes 32^0 18^1 E. It has an irregular shoreline with a small, sheltered bay. Its bottom is muddy and fringed with vegetation **(Oijen – etal – 1982)**

The area receives rainfall throughout the year, which is almost entirely balanced by evaporation (talling 1966). The mean surface temperature is about 25^0C while the temperature of deeper waters is about 23^0C.

A population of about 700 people live in the landing site where fisheries is one of the most important economic activities.

Fisheries managers, ecologists and Research scientists have always debated and made analysis on whether a considerable number of fisheries collapses are caused by over fishing of fishery resources or environmental changes consequently, it was declared that the principal underlying cause of such collapses was "excessive over fishing of fishery resources by various active fishing gears and methods" (FAO 1995 a).

In the artisonal fisheries, the most destructive active gears comprise seine nets, cast nets, lampara nets, trawl nets, e.t.c

These gears impact adversely on the bio diversity (i.e. collection of genomes, species and ecosystems occurring in geographically defined region), and the entire aquatic ecosystem (i.e. a dynamic complex of plant, animal and micro-organisms communities and their non living environment interacting as a functional unit).

Conservation and sustainability of fisheries resources can literally be achieved through effective and practical application of integrated fisheries management principles; which are basically the ecosystem management approach (Arico 1998), adaptive management approach (Holling 1998), and precautionary management approach (Garcia 1994).

A major focus of this research is on adaptive management portfolio, which probes the fishery system experimentally or through research on impact of active fishing gears on the fisheries resources exploited on lake Victoria at Kigingu fishing ground.

1.2 Statement of the problem:

Fishing has been going since time immemorial, but the increasing interaction between man and the lake due to increased human population, has resulted in degradation of the lake eco system and depletion of the biodiversity particularly kigungu fishing ground.

The majority of gears and methods operated actively by the fishers are usually destructive to the fishery. Usually illegal fishers choose sheltered and inaccessible bays to perpecuate their vices. To make this worse, the most destructive illegal gears are frequently used in breeding and feeding grounds of fish. This interferes with the courtship behaviour of the fish and leads to the fry being orphaned hence causing a catastrophic mortality (consequently the collapse of the fishery).

Many people at kigungu and the country at large perceive fisheries resources as ownerless, infinite, bountfull, beyond numeration, voiceless to register stress and a common property to satisfy curinally and pecuniary desires of human beings. So, the fisheries resources become vulnerable. Both the poor and the rich, day and night hunt for fish.

While the provisions of the Fish Act 1964, are relevant, its mode of application has effectively reduced its effectiveness to the minimum. For example, section 33, subsection (i) is 99% invoked to convict culprits for a fine not exceeding Ug shs 10,000 regardless of the volume of fish seized and exhibited in court. This has encouraged the increasing number of habitual offenders of fisheries laws and Regulations, as they do not provide

deterent penalties. The tragedy of the common property pre exposes the fisheries resources to abuse in disregard of common sense. The fishers and consumers like fish and eat fish regardless of its maturity hence providing a potential market for immature fish. The perpetrators are resolute, fearless, fierce, and have a network to beat the department of fisheries resources enforcement arm. Some politicians at times secrifice fish for sympathetic votes: Even some public servants secrifice fish for selfish ends - and some local authorities sacrifice fish to beef up their coffers. All this has lead to the degradation of the fishery resource in Uganda including Kigungu fishing ground

Rules and Regulations have been in acted by parliament to regulate the use of the fishery resources. This is by regulating the types and sizes of fishing gears and methods through monitoring, control, and surveillance (MCS) at both national and regional levels, by the department of fishery resources (DFR).

The current Fish Act, Chapter 197, was lifted from the 1951 Ordinance. The Laws (Revised Edition) (Commencement of Principal Laws) Instruments, 2003 No. 69, revised the former Fish Act, Chapter 228. The Fish Act 1964 has since been amended by Act No.3 of 1967 and supplemented by a number of relevant statutory instruments.

Enough sensitization of the fishers and the local leadership about the fragility of the fishery eco systems is paramount, despite its being God given.

Justice and fair judgment should be practiced for culprits infringing the intergrity of the voiceless yet important living entities of nature - the fish and their critical environment. We should reflect on the repercussions of the acts of infringement in relation to the lives and well fare of the people, to the environment its self, the national heritage and economy of the country.

Circumventing lope holes to promote and support fisheries sustainability for the present and future generations.

1.2 Scope of the Research

This research, based on only **beach-seines**, and **cast-nets**, is carried out at Kigungu fishing ground on Lake Victoria on objectives given below and within a specific time frame and allocated project resources.

1.4 Objectives

1.4.1 General Objectives

To assess environmental impacts of beach-seines and cast-nets on Lake Victoria fisheries; and propose mitigation measures.

1.4.2 Specific objectives

1.4.2.1 To find out the design, construction and operation of beach-seines and cast-nets.

1.4.2.2 To describe the catchability of beach-seines and cast-nets.

1.4.2.3 To find out and assess the efficiency of beach - seines and cast-nets.

1.4.2.4 To find out the impacts of beach seines and cast nets on the fish stocks exploited.

1.5 Justification

Beach-seines and cast-nets are popular, easily adaptable and most effective traditional active fishing gears that are used in the artisanal fisheries of Uganda for catching a variety of fish species. Unfortunately, their commercial use is condemned under the Fish Act, for they alter or destroy aquatic ecosystem, fish fauna and flora (**MAAIF/DFR 2004**).

Indiscriminate capture of fish by these gears raises concern over conservation and sustainability of fish stocks on Lake Victoria (**Okaronon 1985**). This concern, therefore, calls for a specific research into environmental degradation caused by these gears.

1.6 Significances and Benefits of the research:

This research exposes and analyses the current status of beach-seine and cast-net fisheries on Lake Victoria focusing mainly on impacts caused by these gears on the fishery resources.

The data and information obtained in this research would be useful for:

- Formulation of effective regulatory measures for the control and management of beach-seine and cast-net fisheries in Uganda in particular, and the Region in general.
- Supplementing any future elaborate researches based on this topic.
- Packaging for use by Fisheries Managers, Law-markers, Fisheries Socio-Economists, Fisheries students and other stakeholders in the Fisheries and Fisheries-related Industries

CHAPTER TWO

LITERATURE REVIEW

2.1 The Fisheries Industry

In Uganda, primitive fishing, employing various traditional gears, existed many centuries ago. Spears, arrows, fishing pots, fish traps and crude fishing methods, such as hand-catching of fish in swallow waters of lakes, rivers and swamps; fish poisoning with local herbs and other toxins were in use. The technology was very low, unproductive and generally in appropriate fishing activity was at a subsistence level. **(Graham, 1929)**

In the early C20th, foreign traders (Belgians, Italians, British, Indians e.t.c introduced gill nets made of various fiber material, such as cotton, hemp and flax. That marked a technological advancement in the local fisheries. Subsistence fishery was gradually transformed into artisanal fisheries **(Hicklin, 1961).**In mid 1950's, foreign traders introduced the Japanese nylon gillnets, replacing other fiber materials. The nylon gillnets became more popular, easily adaptable, durable and effective than other gear in the fishery. In the subsequent years, various modern gears were introduced and adapted for commercial exploitation of various fish species in the major and minor water bodies. In the early 1980s the lake Victoria multi species fishery collapsed; the three fish species fishery (comprising Lates niloticus, oreochromis niloticus, Rastrineobola argentea) emerged and dominated the present – day commercial fisheries. Since 1987, the catches of other fish species (Bagrus, Barbus, Clarias, Mormyurus, Protopterus, Synodontis, e.t.c) dwindled to about 3% of the total landed catches. The annual fish production on lake Victoria increased from 10,000 tones in 1980 to about 132,000 tones in 1989. Annual fish production has risen rapidly from 60,000 tones in 1962 to the present level of about 220,000 tones worth over U shs. 110 billion at the landing sites. Foreign exchange earnings amounted to US$ 100 million in 1995/96, thus making the sub-sectors the second largest forex earner after coffee (anatable vibrant recent development in the national economy). Supply of balanced diet to the presently increasing population of Uganda, which was 19,262,000 in 1995 projected to be 20, 438,450,in 1996.Fish consumption per capita was 12kg per annum in 1995, but this varies from the district to district, year to year and these are indications that fish consumption will increase as fishing gear and equipment become more available and modernized, hence the decreasing trend will be reversed. Employment opportunities in the

fishing industry increased. In 1998, the industry provided a fishing employment to an established 20,750 house- holds (or 2% of the population).

Also 28,500 families were employed in the ancillary activities and fisheries service sector at the leading sites. Countrywide, the industry directly employed 70,000 fishermen and 100,000 people in ancillary activities **(Grebovol 1987).** The fisheries department also estimated 78,000 full time fishermen with between 200,000 – 500,000 people employed in secondary and tertiary activities In 1988, about 26,000 canoes were deployed in the capture fisheries of which 10% were motorized. In 1996, about 34,000 canoes were deployed in the capture fisheries of which about 15% were motorized and 85% non- motorized. This trend shows increasing fishing effort by increased number of fishermen estimated to be 136,000 in 1996.

2.2 Process of fishing in Uganda:

This varies from gear to gear and the skills of the fishermen. However, the most common gears are the gill nets and the method is gill netting.

Gill netting major technological process involves pre - setting preparations, setting hauling and disposal of the catch:

2.2.1 Pre setting preparations:

Normally, these preparations take place at the fish-landing site at convenient hours of the day. A fleet of gill nets is prepared for setting by identifying damaged; missing components are electrified so that the gill net is restored into good shape.

Then, the fleet is packed into the canoe, arranging the float line and buoy line at the stern and the stinker line with anchor line at the fore while the netting is in the middle.

The canoe eventually sets to predetermined fishing ground to set the fleet.

2.2.2. Setting a fleet of gill net:

Preferably at dusk, a fleet is on the leeway to avoid fleet entanglement in water. First, one end of the fleet is secured to the anchor lines, and lowered to a desired depth. The first marker buoy is also set, then the float and the sinker are uniformly released into water. Towards the end of the setting, the last end of the fleet is fixed on the last anchor line and mark buoy and the fleet is to catch fish passively, normally over night.

2.2.3 Hauling a fleet:

At dawn, hauling is done first by dis engaging anchor line and hauling nets in a fleet one by one by removing caught fish, and eventually on hauling the last net, the marker buoy is removed. The gear is then packed in the middle of the canoe.

2.2.4 Disposal of the catch:

The catch is removed from the canoe, and disposed off at fish landing site. The gear is also removed and spread on the beach for drying or preparation for the next setting.

2.2.5 Design of fishing gears globally:

The examples of fishing gears used in the fishery industry include:
Gill nets and entangling gears, falling gears, lift nets, dredges, trawl nets, seine nets, surrounding nets, traps, hooks and line, wounding gears and miscellaneous.

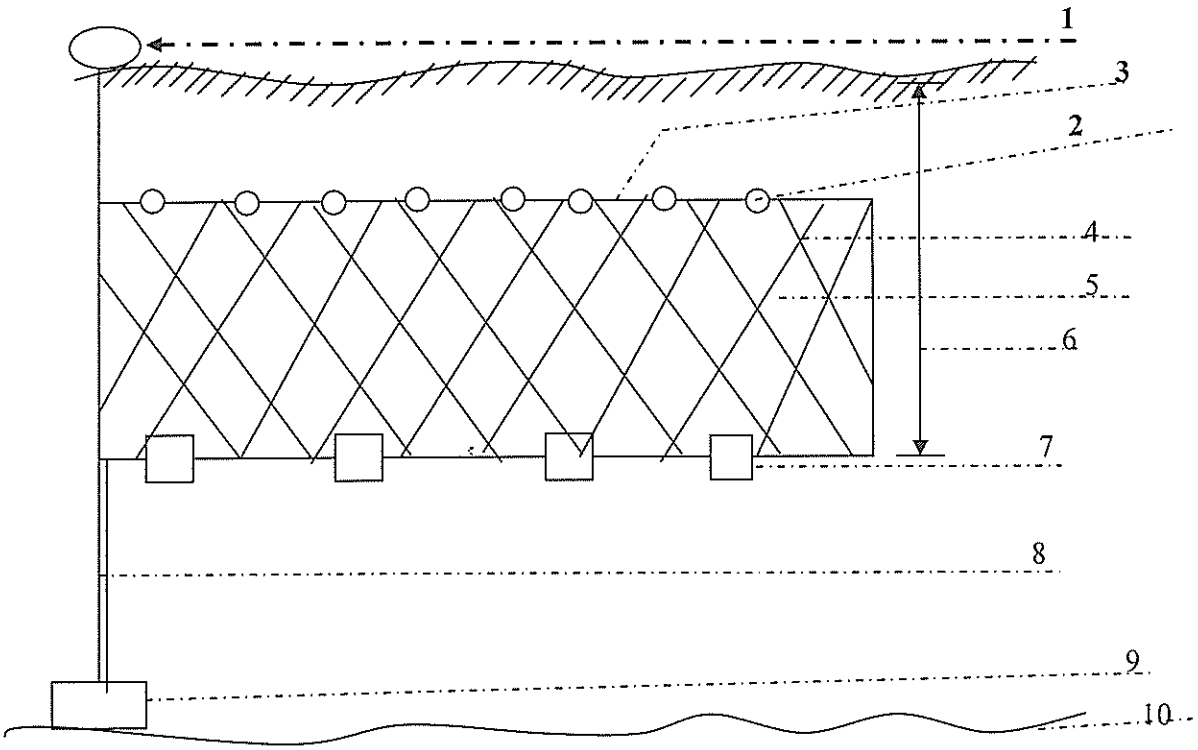
2.2.5.1 - Gill net design

However, gill nets are currently a major and popular gear widely used (80%) in the artisanal fisheries for fish capture in the major water bodies.

Their webbing is either hand braided or machine made using nylon monofilament twines, or in rare cases, other suitable fiber materials such as sisal.

Rigging is normally done using plastic floats or buoyant wood stems and sinkers (stones wrapped in polyethylene papers). Mounting is by complete stapling method, using hanging ratios ranging from 0.5 to 0.6 that give scope for both gilling and entangling of fish. Technologies in mounting vary from place to place. Recent technology, widely used in the major water bodies involves joining two nets to double the depth (making 52 meters deep) of the net fleet. This technology has proved productive, but its impacts in the fishery are yet to be assessed.

After all the above process, then this means that such a gear is ready for preparations awaiting setting. The settings can either be Pellagic or Dermasal as will be seen in fig 1(a) **(Oluka Levi – 2001)**

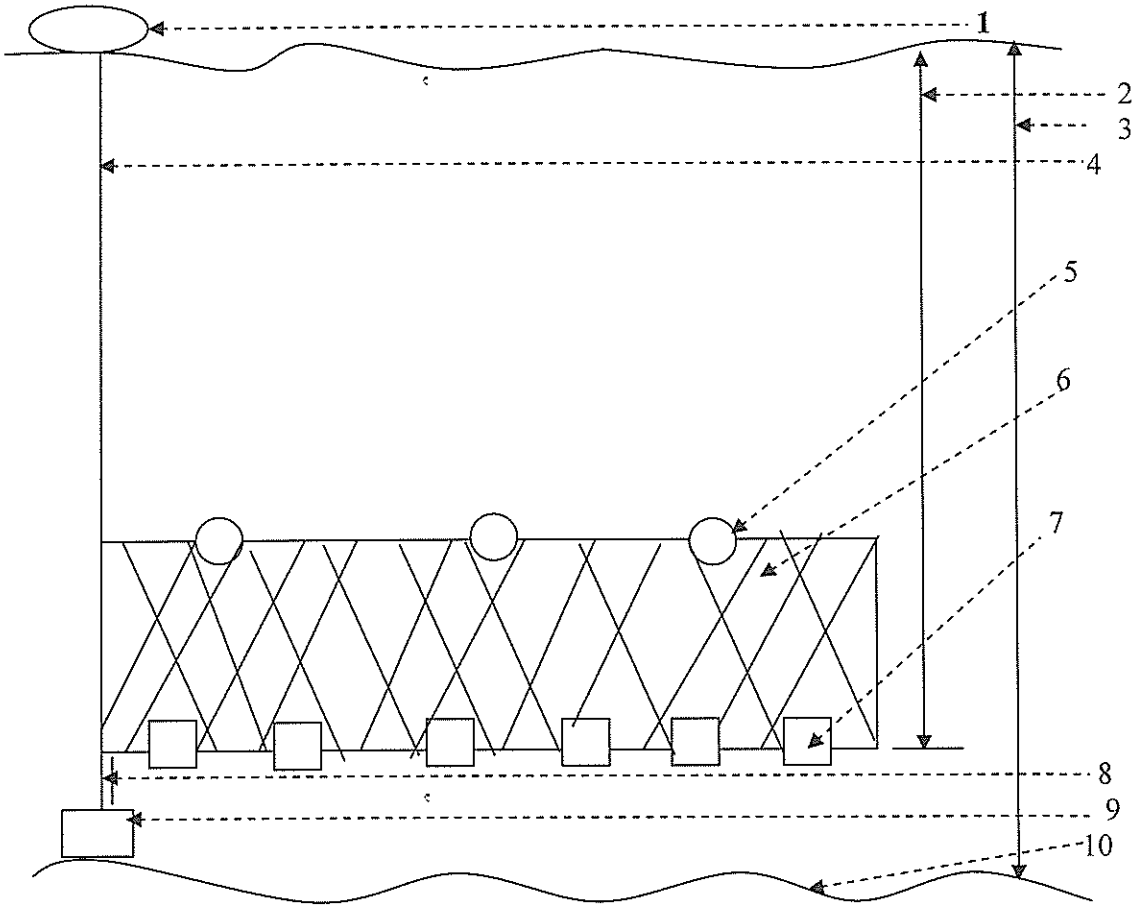


1 Fig. 1 Pellagic gill net 0..0.00

1. Mark buoy
2. Floats
3. Float line (head line)
4. Twine of varying plies (e.g. 2, 3, 4,8,6,12,9,etc)
5. Net webbing
6. Fishing depth e.g. 15metres
7. Sinkers
8. Anchorline
9. Anchor
10. Water bottom

(Oluka Levi, 2001)

Fig.2 Dermasal gill net:



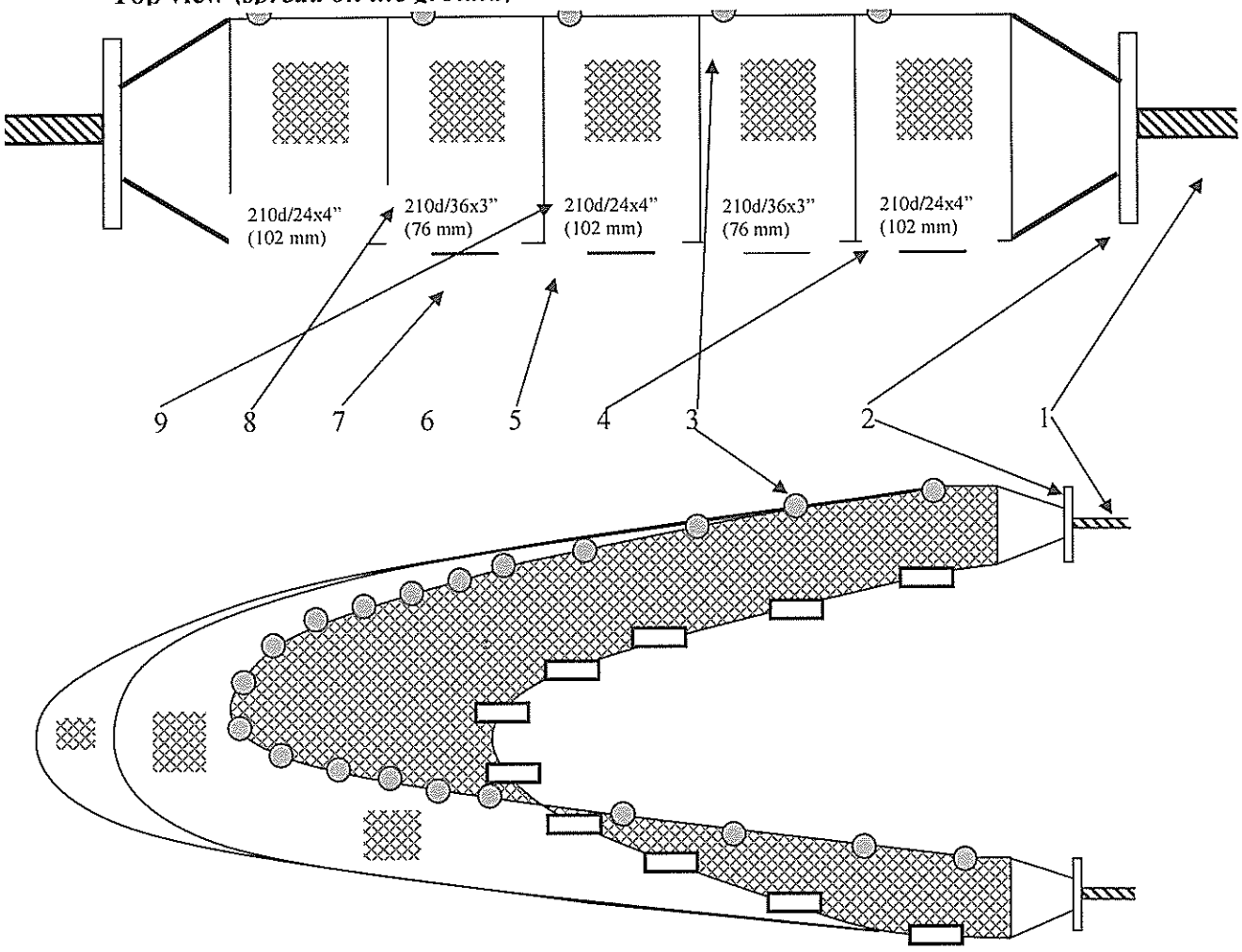
1. Mark buoy
2. Fishing depth
3. Water depth
4. Buoy line
5. Floats
6. Mesh webbings
7. Sinkers
8. Anchor line
9. Anchor
10. Water bottom

(Oluka Levi, 2001)

1 2.2.5.2

2 **Fig. 3: Design of a multi-panel beach-seine**

Top view (*spread on the ground*)



Side view (*in mode of operation*)

Key:

1. Warps
2. Stakes
3. Floats
4. Wing
5. Sinker line (ground line)
6. Float line (main line)
7. Sinkers
8. Skirts
9. Bag

(Luka Levi, 2001)

The sinker-line is rigged with baked clay, cement, lead or stones wrapped in polyethylene papers for convenience of attaching them to the sinker- line. The quantity and type of the sinkers also vary according to the intended use (e.g. inshore shallow setting or offshore deep setting).
The warps (100 – 300m long) attached to the stakes (wooden bars fixed to the net width/depth) are made of natural fiber material e.g. sisal rope or synthetic fiber material, e.g. nylon rope **(Prado 1991) (Ref. Tab. 1)**

Tab. 1: Data sheet of a beach-seine

Fishing Units		**Particulars**	
Name of the gear		**Seine – net**	
Type of gear		**Beach - seine**	
Country – water body		**Uganda – Lake Victoria**	
Locality/Fishing ground		**Wakiso – District Kigungu**	
Main fishspecies		**Oreochromis, Lates niloticus**	
Fishing ground: Bottom topography		**Sandy**	
Depth		**1 – 5m**	
Fishing Vessel: Type		**Wooden – planked Ssese canoe**	
L. O. A		**5m**	
Crew		**2men**	
Net webbing particulars	**Wing**	**Bag**	**Skirt**
Material	**Nylon**	**Nylon**	**Nylon**
Knot type	**Sheet bend**	**Sheet bend**	**Sheet bend**
Colour	**White**	**White**	**White**
Twine – size	**210d/24**	**210d/48**	**210d/36**

Mesh - Size		4''(101mm)	2''(51mm)	3''(76mm)
Hanging ratio		0.6	0.6	0.7
Stretched ratio		64m	4m	36m
Ringing Particulars	Floats	Sinkers	Stakes	Mark buoy
Number	60	80	2	1
Material	PVC	Stones	Wooden	Plastic

(Oluka Levi 2001)

Beach-seine operation commences by pre-setting preparations **(Ref. Photo-plate 2)** that involve thorough check of the gear to ascertain correct rigging; then the gear is shot by a crew of normally 2 men aboard a canoe which is paddled off the beach on a straight course; the first warp is paid out continuously until its full length is released and held by a group of two or more men positioned at the beach; the canoe slowly curves to follow a semi-circular course while the gear is simultaneously and quickly set astern the canoe: one wing first, then the skirt and the other wing, the canoe men hand-over the second warp to another group of beach-seines positioned at another nearby spot (about 30m abeam) on the beach; finally the canoe abandons the gear, and is paddled faster towards the beach.

The gear is evenly and speedily pulled towards the beach **(Photo-plate 3)** and a group of men jump into shallow waters and quickly tuck in the sinker-line to prevent escape of diving fish underneath the net, while another group of men holds the float line reasonably high up to prevent jumping fish from escape. The gear is finally landed onto the beach and the catch is later disposed of.

2.2.5.3 Cast-net

A cast-net is a conical-shaped gear, weighted at the periphery with small-sized lead sinkers, and has a casting rope at the throat terminal **(Fig. 3)**.

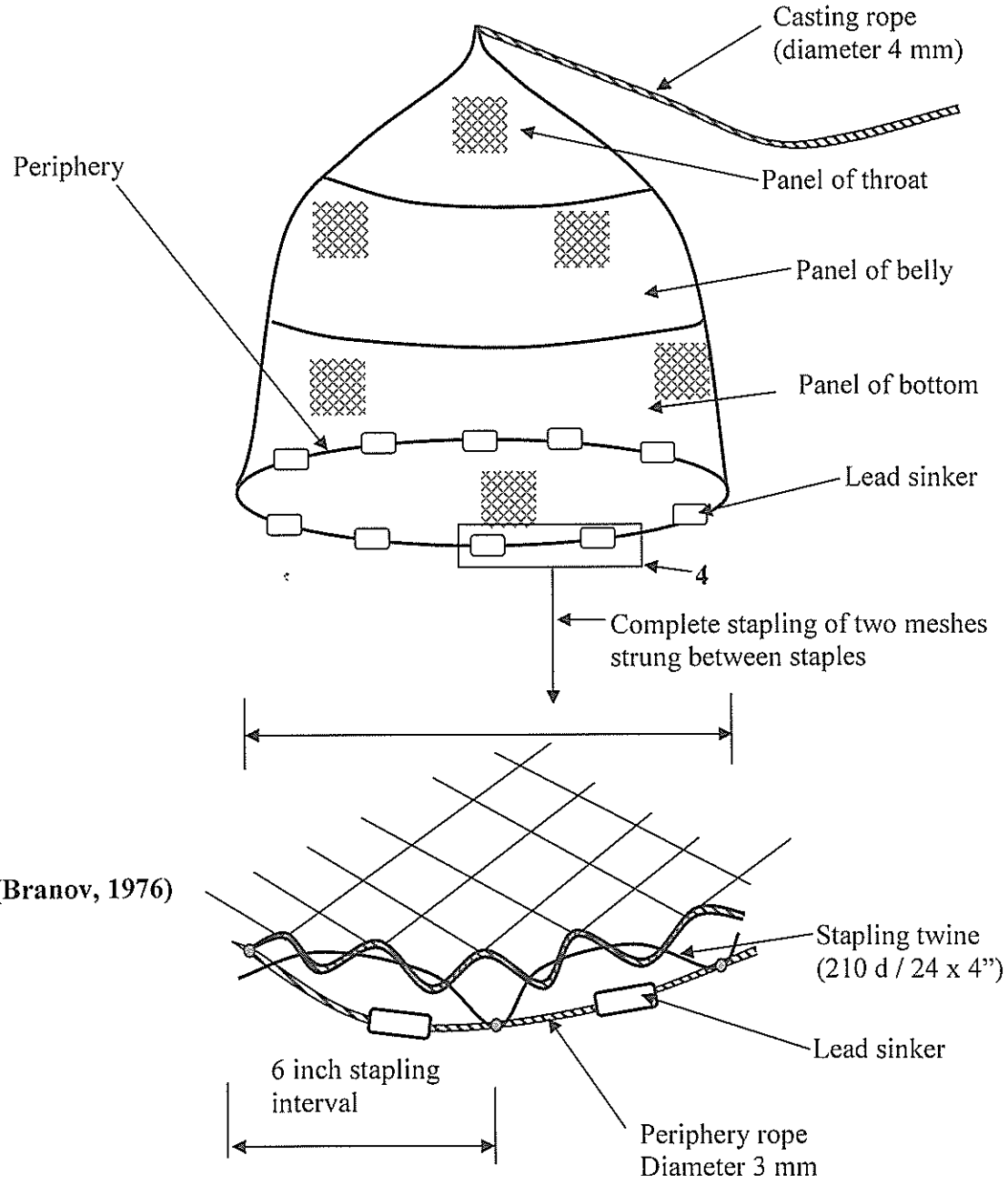
Cast-nets encountered at the project area varied by design and size: (3 – 5m in length).

Cast-nets are constructed using a braiding needle, nylon twine: 210d/6 or 210d/9; nylon rope (diameter 3 – 4mm) and panel of nylon webbing bearing mesh-sizes of 2" – 3", and tapered into a conical shape. For a multi-panel cast-net the following specifications are common: 210d/3 x 3" at the bottom panel, 210d/4 x 3" at the belly panel, and 210d/4 x 4" at the throat panel

(Ref. Table 2.

Fig. 4: Design of a multi-panel cast-net

3



(Branov, 1976)

Tab. 2: Data sheet of a cast-net

Components	Specifications
• Name of gear	• Cat-net
• Type of gear	• Multi-panel cast-net
• Country / water body	• Uganda / Lake Victoria
• Landing site / locality	• Kigungu / Wakiso District
• Shape	• Conical
• Material of webbing	• Nylon webbing
• Type of knot	• Sheet-bend
• Twine size	• ply 3, ply 4
• Mesh-size	• 3", 4"
• Total weight	• 3kg
• Colour of net-webbing	• White
• Stretched length of net	• 2.5 meters
• Periphery length (Circumference of periphery)	• 10.8 meters
• Mode of operation	• Active
• Principle of operation	• Entrapping underneath and entangling
Fishing ground nature: • Average depth • Bottom nature	 • 5 – 10m • Sandy and muddy
• Effective fishing (time of	• Both day and night in calm waters

(Operation)	
• Target fish stocks	• Tilapia species, Nile perch
• Catchability rate	• High
• Fishing season	• All year round

During operation, a cast-net is skillfully cast aboard a small canoe, which is paddled by a crew of normally 2 men (**Ref. Photo-plate 6**). The gear is cast from the canoe carefully avoiding entanglement with other objects. In the process, the gear spreads like an umbrella and falls on the water surface, thus covering a large water surface area equal to that of the circumference of the cast-net, and quickly sinks by the weighted periphery. Fish is caught by entanglement in the meshes of the net; the gear scoops the catch when its periphery quickly closes due to up thrust forces induced as the gear is pulled up or retrieved by the casting rope; finally the catch is emptied into the canoe (**Baranov 1976**)

2.2.6 Construction of different fishing gears globally:

2.2.6.1 Gill net construction:

Netting twines of various thickness or ply e.g. 2,3,4,6,8,9,12,15,18,24, e.t.c are used to make net webbings.

This is done either by hand braiding or machine weaving using the multi shuttle machines known as looms. Nylon gill nets of various technical specifications e.g. 210d / 3 X 5'' (127mm) X 90m – 26 MD or 210d / 9X7'' (177mm) X 90m – 26MD – blue – e.t.c are factory manufactured e.g. by the Uganda Fishnet manufacturers, Kampala, or by either foreign companies from Korea, Taiwan, China, Japan, Tanzania, U.K, Russia, U.S.A, e.t.c and finally mounted for the gill nets fishery.

I.e 210d / 9X7'' (177mm) X 90m – 26MD – blue –

The above specification means that;

210d – characterizes the twine numbering system. In this system, d – means denier systems. In this system, 9000m of a given yan of twine, weighs 210gms in standard conditions.

9 - Is the twine thickness or ply

7'' - means the mesh size with 7''

where 1inch = 25.4mm

therefore 7'' = 177mm

90m - This is the length of a fully stretched gill net before mounting. It's also a standard measure for a gill net.

26 MD – This means 26 meshes deep. When a gill net is hang on the flame lines, the total number of meshes depth wise is 26 l.e the width of a vertically stretched gill net contains 26 mashes.

This is also a standard measure. 26 mashes deep is a standard measure for a gill net.

Blue – This is the colour of a grill net. Acolour of a grill net may also be white, brown, Khaki, etc.

2.2.6.2 Beach seine net construction:

Beach seines are economically lucrative, popular, easily adaptable and most effective active gear used in the artisanal fishery for catching a variety of fish species.

Their net webbing is mostly hand braided using either natural fiber (e.g. sisal), or synthetic materials (e.g. nylon). The machine made nylon net webbing is scarce and expensive.

Twine – sizes and mesh – sizes of their net – webbing considerably vary from panel to Panel typically as follows: at the wings 210d/24x5'' (127mm) at the skirts; 210d/36x4''(101mm); at the bag: 210d/ 60x3''(76mm). Such a design permits easy screening of fish through the wings and concentration and retention of the catch in the bag that bears a very small mesh – size but thick twine.

2.2.6.3 Global Lift net construction:

A lift net is a conical net constructed from knotless nylon net webbing bearing hexagonal meshes. Its bag net mesh-sizes from 5-10 mm.

It is effectively operated in conjunction with light on a dark calm night. A pair of two canoes joined together by planks forming a catamaran is used in this fishery.

The middle of one of the planks., is lit another lamp, mounted on a small rift connected to the canoe by a rope of about 15m long is also lit and slowly pulled towards the canoe, thus, drawing attracted school of fish above a set lift net, which is quickly scooped up and lights simultaneously extinguished.

The fishing process is repeated in the same or another site. Fishermen at kitobo on L. Victoria have adopted this method.

This method targets Rastrineobola argentea (mukene) other fish, such as orcochromis niloticus and lates Niloticus are by catch in this fishery.

2.2.6.4 Cast net construction:

Cast nets are constructed using abrading needle, nylon twine: 210d/6 or 210d/9: nylon rope (diameter 3-4mn) and panel of nylon webbing bearing mesh sizes of 2'' – 3'' and tapered into a conical shape. For amult – panel cast net, the following specifications are common: 210d/3x3'' at the throat panel.

(Ref Table 2)

2.2.7 Operation of different gears:

2.2.7.1 Fish traps operation:

Various designs of fish – traps especially the traditional funnel – shaped ones are used for catching fish species, such as clarias, Barbus, schilbe, etc in mashy shallow water of lakes, rives and swamps.

They are made of local materials such as twigs of certain plants such as bamboo or papyrus reeds, etc.

The trap strategically set in form of a barrier permits free and voluntary entrance of fish induced to enter but hinders their escape by a structural device or valve.

2.2.7.2 Beach seines operation:

Effective operation of the gear is done on dark calm might's in relatively shallow clear sandy beaches where fish normally congregate to breed or shelter.

The gear is set aboard a canoe, which is paddled off the beach on a straight cause rather perpendicular to the beach.

The warp is continuously paid out until the full length is released and held by slowly curves to follow a semi circular path, and quickly the gear is set a stern the canoe, one wing first, then the skirt and wing. The canoe men hand over the other warp to another group of beach

seines positioned at another sport on the beach; and the canoe finally abandons the gear and is paddled faster towards the beach.

The gear collectively done by those two groups of beach – seines, who evenly and hastily pull the warps to wards the beach. Other fisherman approach the net and quickly tuck in the seine line to prevent the escape of diving fish underneath the net while others hold the float line reasonably high to prevent jumping fish from escape. Finally the net is landed on to the beach, the catch is disposed of and the operation is essentially repeated in the same or another site depending on the fishing conditions at that moment.

2.2.7.3 Cast net operation:

Effective cast netting is done on dark, calming nets or during day – time in shallow or deep off share waters. Ideal fishing grounds are: soudy beaches, shallow and rocky sports or muddy bottom of the take share where fish normally aggregate to shelter, breed or spawn.

When cast – netting, the gear is skill fully cast by hand into the water to cover an owe, and any fish swimming beneath it is trapped as the net falls to the bottom or as the weighed periphery closes due to up thrust forces, the net is then quickly howled by the casting rope and the catch captured into the canoe. Several casting at short intervals of about 20 minutes can be made in accordance with the operational conditions.

2.2.7.4 Operation of long lines:

The fishery gradually developed way back in 1980's for effective exploitation of predatory fish. In some areas, it provided a good alternative for gill nets were either scarce or unaffordable.

Atypical gear comprises a long length horizontal main line(100 – 300m) rigged with either small nylon rope(dia – 3 – 4 mm) or nylon mono filament twine of diameter: 100mm – 200mm or nylon multifilament cord of ply 36 – 60, on which short snood carrying baited fish hooks are attached. However, slight variations in the dimension, rigging and operation of this gear exists in certain fishery areas.

Preparation of the gear for setting starts by baiting the fish – hooks with the natural baits (small fish, small slices of meat, earth worms, inserts e.t.c) at convenient hours of the day (morning or afternoon), they carefully and systematically coiling the rigged line into a

large basin or other similar container. This work is normally under taken by 1or2-hired men at the landing sites normally under take this work.

A crew of 2-3 men set the gear late in the afternoon. Setting is done on the lee way to avoid gear out entanglement due to wind or water current drift effect: One man controls the canoe by slowly paddling it up on a straight course or semi – circular path, while the other sets the gear by first paying out the anchor line, then the buoy line; the gear is there after left to fish passively overnight.

Hauling is normally done early in the morning by retrieving the gear and instantly removing the catch from the hooks; but in case of some difficulties, the catch is removed at the landing site.

Depending on the crew work schedule or fishing regime, another setting is prepared after the catch disposal.

2.2.8 Catch ability of various gears:

2.2.8.1 Long lines:

The catchability of long lines chiefly depends on the fish – hook sizes used for targeting particular fish species, choice of proper baits for target fish species, design of the gear, fish abundance in the fishing ground, fish behaviour, fishing ground characteristics, seasonality of the operations, fishermen's skills, etc.

2.2.8.2 Gills net catchability:

This is the rate of the quantity of fish caught per gill net per day. The catchability rate varies from gear to gear, period to period of fishing and they are influenced by certain catch ability technical factors of the gear, correlated with the biological nature of the fish. However, catch ability of gill nets chiefly depends on the colour of the gear in relation to the colour of local waters, thickness of the twines, target fish species, mesh sizes, fishing ground or fish abundance in the ground, season of the year, fisher men's skills etc.

2.2.8.3 Seine nets cacthability:

The catch ability of beach seines depends on the nature of the ground, mesh sizes, twine thickness, skills of the fishermen, manpower, season of the year, depth of the waters, size of the net, firmness of the bag, etc.

2.2.8.4 Cast net catchability:

Their catch ability depends on the ground or the nature of the fishing ground, depth of the water, number of panels, size of the periphery, length of the net, season of the year, weather, etc

2.2.9 Efficiency of various gears:

2.2.9.1 Fish – **traps:**

The fishing efficiency of such traps depends on the value and positioning of the height of the entrance, essentially in places where fish regularly congregate. The catch is released through the vent.

2.2.9.2 Long lines:

The fishing efficiency of long lines depends on the shape of the hook, the size of the hook, Angle of attack, fishing ground hydrometallurgical conditions, proper choice of rigging materials, type of bait, target species, etc.

2.2.9.3 Gill net:

The fishing efficiency of Gillnets depends on the size of fish that encounter a net, Area of the net fishing a certain zone of the water, fish density or abundance behaviour of fish to wards stimuli, position of the net relative to the direction of the fish motion, velocity of fish etc.

Types of fish motion include random or chaotic, especially at spawing or breeding period.

Vertical or horizontal migration and movement pattern caused by mainly the changes in water temperature, salinity, plankton distribution in water, fish ecosystem, etc.

2.2.9.4 Cast nets efficiency:

Its efficiency depends on: fish density of abundance, position of the net relative to the direction of the fish motion, thickness of the twine in relation to the size of the fish targeted, nature of the ground, season of the year, etc.

2.2.9.5 Beach seines:

Their efficiency depends of the size of fish that encounter a net, area of the net fishing a certain zone of the water, fish density of abundance system of the net in relation to the direction of the fish motion, season of the year nature of the ground etc.

2.3.0 Consequences of fishing on the environment:

2.3.1 Reduction in Bio - diversity:

Some of the fishing gears / methods like beach seines, gill nets of less that 5'' (127mm) mesh size have every low degree of size selectivity, there fore detrimental to the fishery.

Un modified beach seines indiscriminately capture fish of all sizes and age groups e.g. juvenile Nile perch, a target fish species or tilapia species a by catch on lakes Victoria, kyoga, and albert, massive over fishing of fish stock by this gear there fore occurs. This results into depletion of fish stocks in the fishing ground. **(Nabbongo 2002).**

When some of the Active fishing methods like beach seines, set gill nets, cast nets, drifting gill nets, etc, are operated in liltoral waters, where fish breed, spawn and shelter, such sites become vulnerable to destruction by the dragged gear, Aquatic macrophytes are also destroyed. Dragging gear also scares away fish in this fishery, thus fish ecosystem is greatly disrupted. **(Oluka Levi 1997)**

Cast nets in principle catch fish by entanglement, so small mesh sized cast nets catch high proportions of immature fish. Cast netting inshore destroys fresh water communities (benthos organisms) and breeding, spawning and nursery ground of fish; disturbs ecosystems this occasionally causing mouthbreeders to spit their brood. Tikapia species are excessively depleted feeding habits of fish are adversely altered; occasionally resulting into involuntary migration of fish to other safer areas. This ultimately alters fish distribution pattern in the fishery.

Fishing methods which use light, lift nets, Lampala nets, etc attract mukene or by catch, Nile perch, Nile tilapia. Light interferes with size selectivity of mukene nets. When lift nets of 5mm mesh size, operated in shore, capture a large quantity of immature ratrineobola Argentea, especially during the period when new cohorts are recruited into the fishery.

Hooks on piercing fish muscles, injures and inflict pain to fish. Use of small sized gill nets, seine nets and traps for catching baits (e.g. clarias carsonii) for certain target fish species (e.g. lates niloticus) results into cropping of immature fish hence detrimental to the fishery and the environment at large.

(Claude Nedelec and J.Prado, 1990).

CHAPTER THREE

RESEARCH METHODS AND MATERIALS

3.1 The Research Area.

The research was undertaken at Kigungu fish-landing site located on Lake Victoria at latitude 0^0 4.8'N and longitude 32^0 25.5'E (**Ref. Map.1**)

The area has an irregular shoreline with a small sheltered bay. Its bottom is muddy and fringed with vegetation.

The area receives rainfall throughout the year, which is almost entirely balanced by evaporation (**Talling 1966**). The mean surface temperature is about 25^0C while the temperature of deeper waters is about 23^0C.

The water depth of the fishing ground ranges from 1-3m in the inshore to about 15 - 20m in the offshore waters. This creates ideal conditions for beach-seining in the shallow waters of the beaches, when seining for fish stocks, such as *Oreochromis* species (Tilapia) *Lates niloticus* (Nile perch) S*ynodontis, Protopterus, Bagrus docmac,* Labeo victorianus, and others (**Witte 1995**).

A population of about 700 people live in this landing site where fisheries activities form one of the major economic activities of the area (**Wakiso 2001**).

3.2 Materials

The research was conducted using the following materials:

- Hired facilities:
  - Beach-seines and cast-nets.
  - Canoes and crew
  - Weighing scale
  - Measuring devices (ruler, tape measure)
- Stationery
- Data recording forms (**Field Statistical Forms**)

3.3 Methodology

3.3.1 Visits to programmed places

Visits were made to:

- Libraries at KIU, MUK, FTI, DFR, MAAIF, FIRRI and British Council to

  Collect necessary qualitative data and information for the project.

- Government offices: MAAIF, District Fisheries Office Wakiso, Kigungu

  Fisheries Office to extract necessary data and information from files, reports and other publications.

- Kigungu fish-landing site to conduct the research.

3.3.2 Questionnaires

Structured questionnaires were designed and used for extracting quantitative information from particular respondents, such as Fisheries personnel, local opinion leaders and elders, fishing community (**Ref. Appendix III**)

3.3.3 Physical observations.

Observations were made at the project area on:

- Design and construction of beach-seines and cast-nets
- Operation of beach-seines and cast-nets.
- Commercial fish species caught by beach-seines and cast-nets.
- Quality of landed catches by beach-seines and cast-nets.
- Spot assessment of impacts of those gears on the fishery resources

  Exploited.

3.3.4 Experimental fishing

Experimental beach seining and cast netting were done for generation of project research data (**Ref. Tab. 3**).

Gear operation procedures (**Ref. 2.1.1 and 2.1.2**) were followed during experimental fishing at the project area using the provided project materials (**Ref. 3.2**).

CHAPTER FOUR

PRESANTATION AND DISCUSSION OF RESEARCH FINDINGS.

4.1 Fish catches by active fishing gears

Tab. 3: Experimental catch data by beach-seines (BS) and cast-nets (CN) used at the project area.

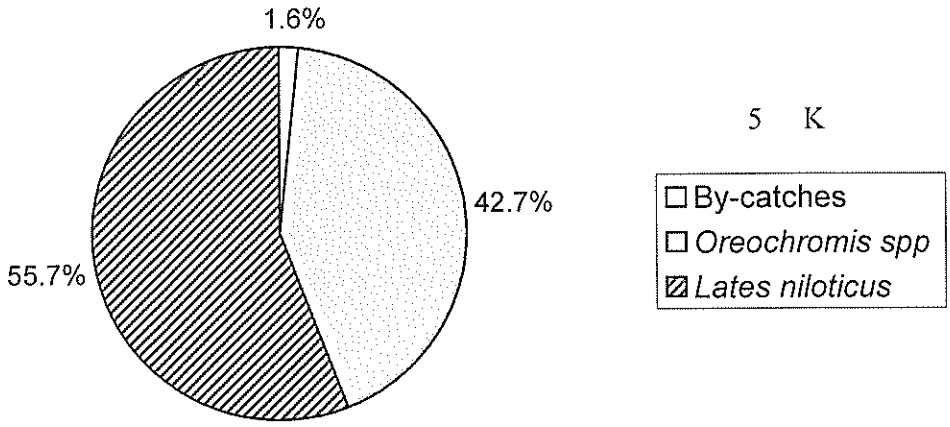
Sampling Dates	Gears sampled		Fish catches			
			Lates niloticus	*Oreochromis Spp.*	By-catches	Total
	Type	No.	Wt (Kg)	Wt (Kg)	Wk (Kg)	Wk (Kg)
9/02/05	BS	2	81.5	66.4	6.6	154.5
	CN	2	25.6	22.8	2.1	50.5
14/02/05	BS	2	100.7	81.1	5.4	187.2
	CN	2	24.8	20.6	1.1	46.5
19/02/05	BS	2	250.4	129.0	6.3	385.7
	CN	2	33.9	26.8	2.3	63.0
21/02/05	BS	2	164.2	111.3	1.4	276.9
	CN	2	40.5	61.1	0.9	102.5
24/02/05	BS	2	132.4	161.6	3.3	297.3
	CN	2	34.6	44.4	1.4	80.4
28/02/05	BS	2	125.2	120.6	2.8	248.6
	CN	2	60.9	62.2	1.2	124.3
3/03/05	BS	2	120.0	144.4	4.4	268.8
	CN	2	86.6	28.9	1.8	117.3
9/03/05	BS	2	200.7	148.6	5.6	354.9
	CN	2	98.6	61.8	1.9	160.3
11/03/05	BS	2	186.6	122.6	4.3	313.5
	CN	2	49.8	38.2	2.1	90.1
14/03/05	BS	2	102.8	88.6	4.4	195.8
	CN	2	66.6	27.4	1.2	95.2
16/03/05	BS	2	99.6	100.2	3.3	203.1
17/03/05	CN	2	55.6	26.6	1.6	83.8
21/03/05	BS	2	114.8	144.8	3.6	263.2
	CN	2	63.5	72.6	0.9	137.0
23/03/05	BS	2	196.6	49.6	4.1	250.3
	CN	2	72.3	28.8	1.1	102.3
TOTAL	BS	2	206.9	128.7	3.9	339.5
	CN	2	88.7	42.9	1.8	133.4
Total 14 days	**BS**	**28**	**2082.4**	**1597.5**	**59.4**	**3739.3**
Total 14 days	**CN**	**28**	**802.0**	**565.1**	**21.4**	**1386.6**

4.2 Abundance of fish stocks 1

Tab. 4: Relative abundance of fish spp. caught by beach-seines (Data extracted from Tab.3.)

Fish spp	Total wt (kg)	Percentage	Degrees
Lates niloticus	2082.4	55.7%	200.5^0
Oreochromis spp	1597.5	42.7%	153.8^0
By-catches	59.4	1.6%	5.7^0
Total	**3739.3**	**100%**	**360^0**

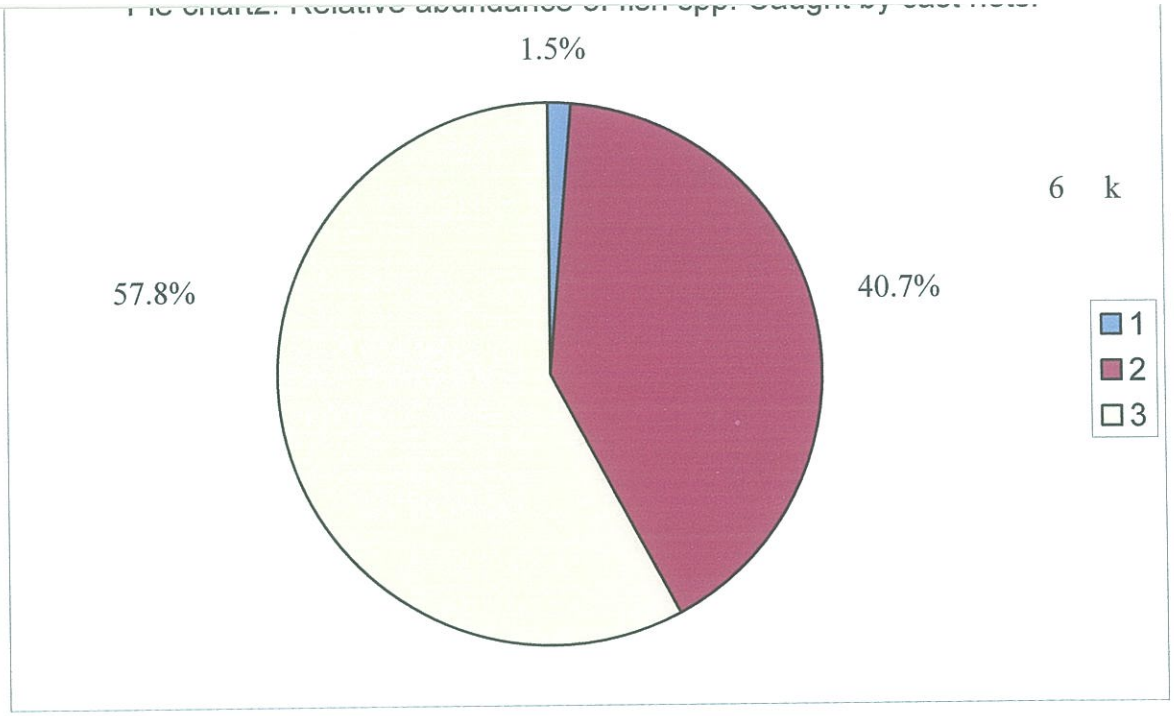
Pie-chart1: Relative abundance of fish spp. caught by beach-seines



Tab. 5 Relative abundance of fish spp. caught by cast-nets (Data extracted from Tab.5).

Fish spp	Total wt (kg)	Percentage	Degrees
Lates niloticus	802.0	57.8%	208.1^0
Oreochromis spp	565.1	40.7%	146.5^0
By-catches	21.4	1.5%	5.8^0
Total	**1388.5**	**100%**	**360^0**

Pie chart2: Relative abundance of fish spp. caught by cast nets.



1. By – Catches
2. Oreochromis spp.
3. Lates niloticus

NB. Formula:

Relative abundance (RA):

R.A = $\frac{\text{wt (kg) of a fish spp.}}{\text{Total wt (kg) of all fish spp.}}$ x 100%

Or

R.A = $\frac{\text{wt. (kg) of a fish spp.}}{\text{Total wt (kg) of all fish spp.}}$ x 360^0

4.3 Catchability of active fishing gears 1

Tab. 6: Average catchability rate (A.C.R) of beach-seines and cast-nets (Data extracted from Tab.3).

Sampling Day No.	Gear		Total wt of fish catches (kg)	C.R.
	Type	No.		
1	BS	2	154.5	77.3kg/BS/day
	CN	2	50.5	22.3kg/CN/day
2	BS	2	187.2	93.6kg/BS/day
	CN	2	46.5	23.3kg/CN/day
3	BS	2	385.7	192.9kg/BS/day

		CN	2	63.0	31.5kg/CN/day
4		BS	2	276.9	138.5kg/BS/day
		CN	2	102.5	51.3kg/CN/day
5		BS	2	297.3	148.7kg/BS/day
		CN	2	80.4	40.2kg/CN/day
6		BS	2	248.6	124.3kg/BS/day
		CN	2	124.3	62.3kg/CN/day
7		BS	2	268.8	268.8kgBS/day
		CN	2	117.3	134.4kg/CN/day
8		BS	2	354.9	177.5kg/BS/day
		CN	2	160.3	80.2kg/CN/day
9		BS	2	313.5	156.8kg/BS/day
		CN	2	90.1	45.1kg/CN/day
10		BS	2	195.8	97.9kg/BS/dy
		CN	2	95.2	47.6kg/CN/day
11		BS	2	203.1	101.6kg/BS/day
		CN	2	83.8	41.9kg/CN/day
12		BS	2	263.2	131.6kg/BS/day
		CN	2	137.0	68.5kg/CN/day
13		CN	2	250.3	125.3kg/BS/day
		BS	2	102.2	51.1kg/CN/day
14		CN	2	339.5	169.8kgBS/day
		BS	2	133.4	66.7kg/CN/day
Total	**14 sampling days**	CN	-	154.5	1869.0kg/BS/14days
Total	**14 sampling days**	BS	-	50.5	690.2kg/CN/14days
A.C.R		**BS**	-	-	187.2
		CN	-	-	46.5

Formula for:

- Catchability Rate (CR):

$$CR = \frac{\text{Total wt. of fish landed by a particular gear}}{\text{Total number of the same gears used on that specific day}}$$

- Average Catchability Rate (ACR):

$$ACR = \frac{\text{Total CR of a particular gear}}{\text{Total No. of sampling days}}$$

4.4 Abundance of Fish Stocks 2

The project results show that the commercial fish species caught by beach-seines and cast-nets were *Lates niloticus, Oreochromis* species and by-catches. The catchability varied as reflected on the Pie-charts 1 and 2, thus: the beach-seines caught 55.7%, 42.7% and 1.6% of *Lates niloticus,* Oreochromis spp. and by-catches respectively, while the cast-nets caught 60.4%, 38.0% and 1.6% of *Lates niloticus, Oreochromis* spp and by-catches respectively. It is evident that cast-nets heavily exploited *Lates niloticus* in the offshore waters and *Oreochromis* spp in the inshore waters. Beach-seines generally exploited fishery resources in the inshore waters of the fishing ground where such resources were considerably abundant.

Abundance of the fish stocks was naturally controlled by the availability of fish feeds in the fishing ground, fish migratory pattern, ecological and environmental factors such as water temperature, habitat conditions, etc.

4.5 Catchability of active fishing gears. 2

Both beach-seines and cast-nets caught fish with varying degrees of success. This variation is reflected in the data for catchability rate that ideally showed one beach-seine catching 133kg of fish per day and a cast-net 49.3kg. of fish per day (**Ref. Tab. 6**). These catch values are high and show that these gears are highly efficient in the fishery, thus, land big catches daily, but depending on ecological and environmental factors.

The catchability and efficiency of these gears depend chiefly on the following techno-ecological and environmental factors:

- Abundance of fish stocks in the fishing ground.

- Size or density of a fish school scooped by the gear.
- Velocity of the fish at the fishing ground.
- Migratory pattern of the fish.
- Seasonality of the catches.
- Size of the gear.
- Surface area fished by the gear.
- Hydro-meteorological conditions of the fishing ground.
- Design and constructi ıe gear.
- Skillful operation of the gear.

4.6 Impacts of active fishing gears

Beach-seines and cast-nets, as shown by the results:

- Indiscriminately catch a variety of fish species. This fact is attributed to their low degree of size-selectivity.
- Destroy fresh-water aquatic organisms, and fish habitat, particularly when they are operated in the inshore waters.
- Deplete fish stocks particularly *Oreochromis* spp. and *Lates niloticus*.
- Adversely alter the feeding habits and migratory pattern of fish in the fishery zone.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

- The design of beach-seines and cast-nets bear small mesh-sizes that catch immature fish species.
- The commercial fish species caught by beach-seines and cast-nets comprised *Lates niloticus* and *Oreochromis* species.
- The average catchability rates of beach-seines and castrates were extremely high; indicating that these gears are very efficient and effective in the fishery, therefore they land bulky catches at short intervals of their operation. For that matter, there is a reduced post-harvest loss of catches when these gears are in use, despite the fact that they cause great damage to the resources through indiscriminate fishing and massive destruction of the biomass.

5.2 Recommendations

- A temporary ban on the use of beach-seines and cast –nets should be imposed until conclusive research results on their rationality are produced and analysed for re-assessment of the implications.
- Alternative fishing gears that promote conservation and sustainability of fishery resources should be used at the project area rather than adapting such destructive gears.
- Elaborate research based on this topic should be undertaken for generation of more reliable data and information needed for formulation of effective control and management policies on beach-seines and cast-nets in all fishery waters of Uganda and the Region.
- Environmental studies of this nature should be initiated and promoted in various institutions of learning for thorough assessment of the changes in the aquatic ecosystem and effective control and management of the aquatic resources by respective governments or states.

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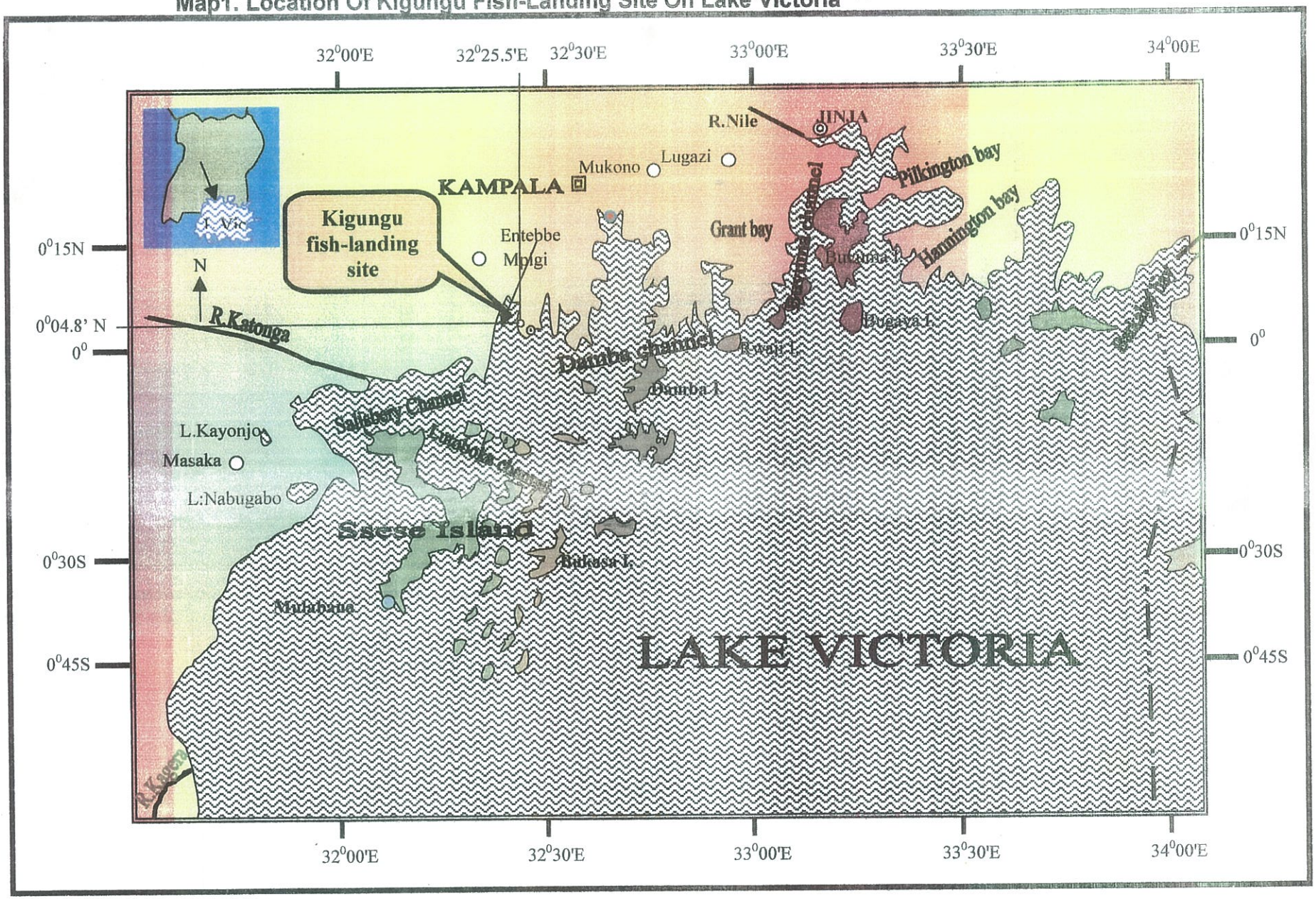
Map1. Location Of Kigungu Fish-Landing Site On Lake Victoria



Appendix III: Questionnaires

Questionnaire model 1: Respondent: Local administrative authorities and opinion leaders.

Sample of questions

- When and how was this landing site established?
- How is that landing site administered and managed?
- What is the current population at this landing site?

Questionnaire model 2: Respondents: Fishers

Sample of questions

- Which type of fishing gears and methods do you use to catch *Lates niloticus* on a commercial scale?
- What factors cause the high catches of *Oreochromis niloticus* and *Lates niloticus* using beach-seines and cast-nets?
- How do you construct and operate beach-seines and cast-nets?
- What are the impacts of beach-seines and cast-nets?
- What is your assessment on the economic viability of beach-seines and cast-nets?
- What is the potential for beach-seines and cast-nets fisheries on Lake Victoria, particularly at this fishery area?

Appendix IV Photo Plate

Photo Plate 1:Net Webbing of a beach seine

Photo Plate 2:Presetting preparations for beach seining

Photo Plate 3:Hauling of a Beach Seine

Photo Plate 4;Inshore fishing ground occasionally used for cast netting

Photo Plate 5:Preparation of a cast net for casting into inshore waters

Photo Plate 6:Casting operation in the offshore fishery waters