Learning and Application of Indigenous Knowledge by The Fishers of Kigungu landing Site on Lake Victoria (Uganda)

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DECLARATION

I ***Sam Patrick Ogwang*** declare that the content of this thesis is my own original work and has never been presented for the award of any Degree in any other University.

Signature of Candidate:..... Date: .....

Supervisor's Declaration

We as ***Supervisors*** confirm that this work is by the above named candidate.

Internal Supervisor:

Name: **M/s Kekimuri Joan** Signature.....Date.....

Principal Supervisor:

Name: **Dr.F.J Muyodi** Signature.....Date.....

DEDICATION

To my Uncle, Superintendent Patrick Ewan (Uganda Police Force) for his parental support through my life todate.

And To My Family

My Wife, Jennifer and Sons ,Henry and Emmanuel

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ABSTRACT

This study describes and analyses the modes of transfer of indigenous fisheries knowledge and skills among the fisher community of Kigungu Landing site. It also looked at how the local knowledge held by fishers about the ecology of Nile Tilapia and Nile Perch fishes of Lake Victoria compares with the existing ecological scientific literature about those fishes. The study aimed at addressing the gender characteristics and roles in fishing, pedagogical principles and modes of learning in the fishing vocation, and to compare the ethno-ecological information provided by fishers with the existing scientific literature about the fishes mentioned. Data were obtained by interviewing fishers and landing site women using standardized interviews and participant observation. Twenty one (21) fishers and 8 women were interviewed respectively. The information collected from respondents included teachers of the vocation, age at joining the vocation, learning contents, modes of knowledge transfer and reproductive season, feeding, migratory behaviors and habitat of Nile Tilapia and Nile Perch and the indigenous science of navigation in the lake. The motivation for this research was to seek information about how fishers learnt the vocation?; how they found their way to and from the fishing grounds; and how they located fish stocks before they could set their fishing gear. We still know very little if any how fishers apply indigenous knowledge in fisheries and how they interpret weather

(nature) in relation to fishing and how such knowledge is preserved and passed on to the next generation. Findings from this study revealed that Fishers comprised of only male while a few women provided employment and auxiliary services to fishers. Both male fishers and women were youths. The teachers of the vocation were close relatives (fathers, brothers, friends and uncles) and the fishers joined the vocation at the ages of as early as 10 to 30 years old. Learning was by doing through interaction with others, assisted by physical demonstration and verbal instructions from skills masters. Fishers used celestial bodies and land objects to trace their way in the water. Local ecological knowledge held by most fishers agreed with available scientific literature about these fish species; however the reproductive biology of Nile perch, a fish they (fishers) know very well could not be established amongst them. The present study highlighed some contribution that the local fishers of Kigungu landing site could make to improve the formal training of vocational fisheries scientists in formal training institutions and in the management of fisheries recourses. It further provided a hypothesis to be investigated in future research whether living close to urban dwellings limited the transfer of indigenous knowledge among such community. Further it recommended future studies to find out why fishers olderthan 40 years were absent from Kigungu landing site and a possible explaination if this absence had something to do with limited indigenous knowledge (reproductive biology of Nile perch) and scarcity of indigenous fishing gear at the landing site.

ACRONYMS

BMU	Beach Management Units
BTVET	Business Technical and Vocational Education and Training
GPS	Global Positioning Systems
ILO	International Labour Organization
IK	Indigenous Knowledge
IKS	Indigenous Knowledge Systems
MVP	Masters in Vocational Pedagogy
VET	Vocational Education and Training
SPSS	Statistical Programme for social scientists
TEK	Traditional Ecological Knowledge

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CHAPTER ONE

1.0 INTRODUCTION

This chapter presents the background information to the study. It provides definitions for the term 'Indigenous knowledge, and its integration into the management of fisheries rsources. The chapter further presents a theoretical approach to indigenous knowledge transfer based on "Siituated Learning" theory of Lave and wenger. The objectives of the present study and its guiding research questions are also presented.

1.1 Background to the Study

In an attempt to develop an understanding of indigenous knowledge systems (IKS) in fisheries education and management to promote sustainable fishing, there is need to answer the following questions. What is indigenous knowledge (IK)? What special contribution can it make to sustainable fishing? How can this contribution be incorporated into fisheries education?

Semantic definitions of the term "indigenous" include; "originated and produced, growing, living, or occurring naturally in a particular region or environment"(Williams & Muchena, 1991:52).

Hornby (1974:433) in Oxford Advanced Learners Dictionary defined the term *indigenous* as "native, belonging naturally"

Conceptual definitions may include; "Integrated system of cognition, beliefs/values, and practices with contextual information system and comprehensive in dimensions of application"

There is no universally accepted term for the category of knowledge referred to in the present work. It is variably referred to as traditional knowledge, local knowledge, indigenous knowledge, traditional ecological knowledge (TEK), or, as Indigenous Knowledge Systems (IKS), indigenous technical knowledge, ethno-science, local science, traditional science, people's science, and village science (Williams & Muchena, 1991:51). Each has to some extent different emphasis, but the essence of the category is knowledge that is usually oral and specific to a particular place and a particular group of people. An important aspect of IKS is that it covers the whole range of human experiences. The dimensions of IK include physical sciences and related technologies (agriculture, ethnobotany, ethnoecology, medicine, climatology, engineering, irrigation), social sciences (politics, the military, economics, sociology, and ethnology), and humanities (communications, arts and crafts, local epistemology and belief systems).

For the purposes of this research, the term indigenous knowledge systems, or IKS, will be used to denote "the local

knowledge that is unique to a given culture or society which accumulates over generations of living in a particular environment that enable the community to achieve stable livelihoods in their environment"[1]. IKS is the basis for local-level decision making in agriculture, health care, food preparation, education, natural-resource management, and a host of other activities in rural communities.

Following the introduction of Nile perch (*Lates niloticus*) to lake Victoria and lake Kyoga in the late 1950s and 1960s, catches of Nile perch increased dramatically by the early 1980s followed by a drastic decline in population of several indigenous fish species (Balirwa, Chapman, Chapman, Gheb, Lowe-McConnel, Seehausen, Wanink, Welcomme, & Witte, 2000:240). Lack of involvement of the local fishing communities in fisheries management has built distrust and non co-operation with the central government fisheries staff which has met with great difficulties (Cowx, Van der Knaap, Muhoozi, & Othina, 2003:305-308). Involvement of local communities in the management of fisheries has been practiced successfully in Malaysia, Vietnam, Cambodia and Thailand for quite some time (Nasuchon & Charles, 2010:164-166).

The introduction of Beach Management Units (BMUs) to co-manage fisheries formally between fishing communities and Government of Uganda has been implemented on Lake Victoria and

[1] This is the working definition for the present study

other major lakes in Uganda. This top-down approach ("foreign knowledge") to fisheries management has failed and today, indigenous efforts are being sought in an attempt to better manage the fisheries resource[2]. Integrating traditional and local ecological knowledge into resource conservation is most likely to be successful if the knowledge holders are directly engaged as active participants in these efforts (Charnley, Fischer, & Jones, 2007:14). Foreign knowledge does not necessarily mean modern technology, it includes also indigenous practices developed and applied under similar conditions elsewhere. Such amalgamations of knowledge and experience of different types are then likely to be adopted faster and applied more successfully.

1.2 Statement of the Problem

Even today, Ugandan fishing industry is characterized by indigenously trained fishing communities. Fishers have close ethnic backgrounds and share common cultural practices and languages (with exception of only a few immigrants who get adapted and absorbed into the culture of the local fishing community). Because fishing is the source of livelihood here, the practice and knowledge are closely guarded and the knowledge carefully passed on from generation to generation by the skilled members of the community, especially the "community of practice" (Lave & Wenger, 1991:92).

[2] This is considered a general knowledge in fisheries management

One fascinating gap in knowledge of the indigenous pedagogy of fishing is "man's relations to the ecology of fishes"(Bergmann, Hinz, Blyth, Kaiser, Rogers, & Armstrong, 2004). One wonders how fishers find their way to and from the fishing grounds (where only water and sky and their horizon are visible) and how they locate fish stocks before they can set their fishing gear. We still know very little if any how fishers apply indigenous knowledge of fisheries ecology and the interpretation of weather (nature) in relation to fishing and how such knowledge is preserved and passed on to the next generation. These questions created the curiosity which provided the motivation to do this research.

1.3 Theoretical Framework

Indigenous education may in this chapter's domain be characterized as vocational education where one has a Socio- cultural responsibility to continue the tradition. Indigenous education may be considered as a progressively continuous process consuming inputs to process outputs and back again. Vocational education and training may be viewed as the process of forming skills in an individual to make him/her employable or self employed in the world of work (Lutalo-Bosa, 2007:4).

The present research is guided by "*situated learning*" theory of knowledge acquisition by Jean Lave. Lave argues that learning as it

normally occurs is a function of the activity, context and culture in which it occurs (i.e., it is situated). This contrasts with the classroom fisheries vocational learning activities which involve knowledge which is sometimes abstract and out of context. Social interaction is a critical component of situated learning -- learners become involved in a "community of practice" which embodies certain beliefs and behaviors to be acquired (Lave & Wenger, 1991:92).

A community of practice is defined as " groups of people who make diverse contribution to an activity and learn how to do it better for their lives and their community as they interact regularly" (Lave & Wenger, 1991:98). As the beginner or newcomer moves from the periphery of this community to its center, they become more active and engaged within the culture and hence assume the role of expert or old-timer. Furthermore, situated learning is usually unintentional rather than deliberate. These ideas are what Lave and Wenger (1991:29) called the process of "legitimate peripheral participation."

A community of practice is not merely a club of friends or a network of connections between people. Fisher's communities have an identity (i.e. fishing) defined by a shared domain of interest. Membership therefore implies a commitment to the domain, and therefore a shared competence that distinguishes fishers from other people. Further, in pursuing their interest in their domain, fishers engage in joint activities and discussions, they help each other, and

share information. Wenger argued that members of a community of practice are practitioners. They develop a shared repertoire of resources: experiences, stories, tools, and ways of addressing recurring problems. In the fishing vocation, the range of skills that can be developed with adult guidance or peer collaboration exceeds what can be attained alone.

A summary of theoretical frame work.

Inputs:	**Process:**	**Output:**
A family consisting of responsible, skillful and competent parents with children to be taught lifelong skills.	Integration of children in everyday family activities accompanied with demonstration, instructions and assignments.	Educated young men and women with household, family and community work and responsibility.
Communities of close ethnicity existing in a locality, practicing similar skills and knowledge application.	Initiating children into practical specific skills such as fishing, pottery, craftsmanship, herbal medicine blacksmithing by members of the community.	A disciplined young generation who are knowledgeable in life.

A person needs to be situated in a family or in a community which practices certain skills to address a their problems. This becomes a learning environment to acquire skills, knowledge and attitude of the society he/she lives in. As one grows and is absorbed into the community as parents, they continue the cycle of mentoring the emerging young persons.

1.4 Objective of the Study

This research is centered on the following objectives

1.4.1 General Objectives

The present study aimed at recording and interpreting the pedagogy of indigenous knowledge held by Kigungu fishers about the ecology and reproduction of the two commercial fish species; Nile Perch (*Lates niloticus*), and Nile Tilapia (*Oreochromis niloticus*) on Lake Victoria. It also addressed the differences and similarities between information provided by the fishers and compared such information with published scientific biological data about those fishes.

1.4.2 Specific Objectives

1 To identify the demographic characteristics (age, education, ethnicity) and roles in fishing.

2 To identify possible pedagogical principles and modes of learning in indigenous education and training in fishing.

3 To compare the ethno-itchthyological information provided by the local fishers with the existing scientific biological data about the fishing gear used, fish ecology and biology of the major commercial fish species , Nile Tilapia (*Oreochromis niloticus*) and Nile Perch (*Lates niloticus*), (Lung'ayia,

1994:122; Njiru, Ojuok, Getabu, Muchiri, Cowx, & Okeyo Owuor, 2006:255) on the Ugandan side of Lake Victoria.

1.5 Research Questions

The present study aimed to record and interprets local knowledge held by fishers of Kigungu landing sites. It looked at learning of the art and science of fishing and ethno-ecology of fishes. It further discussed the differences and similarities between information provided by the fishers, and compared such information with published biological data. In this sense, the present study was guided by the following questions.

1. (i) What are the demographic characteristics in the fishing community (i.e. their age, ethnicity and roles in fishing)?

   (ii) When do the young recruits join the fishing vocation?

2. (i) How are the training sessions conducted?

   (ii) Who are the teachers in the vocation?

   (iii) How is weather interpreted in relations to fishing?

3. (i) Is the ethno-ecological information from fishers analogous with biological literature?

Would it be possible to obtain new insight and future research guidelines based on the information gathered from fishers of

Kigungu? Ethno-ecological studies may also help in promoting dialogue and cooperation between fishers and scientists (Silvano, MacCord, Lima, & Begossi, 2006) and (Pomeroy & Williams, 1994).

1.6 Scope of the Study

The present study was conducted within a period of five months and confined itself to the fishing community of Kigungu Fish landing site on Lake Victoria.

The study examined the socio-cultural explanations of pedagogy in the fishing vocation. It identified the learners and teachers not forgetting the didactics employed and the roles of gender in transfer of indigenous knowledge.

The study also focused much attention to the indigenous and modern training tools (fishing gear and methods) used in the fishing vocation.

Further, the present study first identified and explored ethno-ecological information about the major commercial fishes of Lake Victoria, before comparing it with the existing scientific fisheries biological literature.

1.7 Significance of the Study

Answers to the fore going questions would potentially contribute to enhancing the vocational education and fisheries biological databases about indigenous knowledge of fishing on Lake Victoria and would show to fishery scientists some ways in which local fishers' knowledge can be useful to co-management initiatives. To date little use is made of the fisher's indigenous knowledge in management decision making process (Bergmann et al., 2004). In doing this, the study hopes to improve mutual understanding between fishery scientists and local fishers in Uganda therefore helping these fishers to get more involved in managing the fisheries resource. Besides increasing the available ethno-ichthyological information on Lake Victoria, the research findings will be one of the first ethno-ichthyological studies involving Kigungu fishing communities.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Vocational Education

Vocational Education is a field of knowledge oriented towards trades, occupation and profession (pge.2)[3]. Gordon, Wilbert, McCaslin, Parks, & Castro (2009:1) defined Vocational education as "*a practically illustrated and attempted job or career skill instruction*". As such, a variety of components fall under the vocational education umbrella: agricultural education, business education, family and consumer sciences, health occupations education, marketing education, technical education, and trade and industrial education. It consists of education focused towards training and learning to work, and learning is by doing. Muhoozi (2008) stated that vocational education is what developing countries need as it prepares one to directly enter an occupation without further training.

Professional training of fishermen is something which many countries lacked as a vocation. The common misunderstanding is that vocational education has to do with the civil, electrical, architectural and other engineering courses including carpentry and

[3] NOMA programme Document. (2008). *Programme for Masters Degree in Vocational Pedagogy: Kyambogo University, Akershus University College-Norway and Upper Nile University- Southern Sudan: Kyambogo University.*

joinery. However, in Uganda (BTVET)[4] and some other countries such as Russia (BarentsObserver, 2002) fishing is recognized as a vocation with social and economic significance. The general conference of the ILO Office (1966) considered that vocational training of fishers should be of a standard equivalent to that provided for other trades, occupations and industries. The ILO Office (1966) further proposed the objectives of vocational training of fishermen as follows among others:

i. To improve the efficiency of the fishing industry and to secure general recognition of the economic and social significance of fishing to the national economy;

ii. To provide training and retraining facilities commensurate with the current and projected manpower needs of the fishing industry for all the various fishing occupations;

iii. To assist the entry into employment of all trainees after completion of their courses;

iv. To improve the standards of safety on board fishing vessels,

In vocational pedagogy, learning in a training institution and learning in a work place flips one another over a pivot (Mjelde, 2006a:32). Learning through practice is common in both situations, but learning at a vocational school is a simulation of what happens

[4] BTVET: Business Technical and Vocational Education and Training

at work places. Here, work of the mind is formed by the work of the hand, a characteristic feature of vocational training (Lutalo-Bosa, 2007; Mjelde, 2006a:79). Mjelde (2006a:33) further stated that vocational pedagogy is dynamic and its diversity changes with technological developments where old vocations die and are replaced by new ones. Vocational pedagogy enables young adults to make the transition into working environment and guarantees enough qualified people in the future (Lutalo-Bosa, 2007). It forms skills in an individual that he/she can apply in the world of work.

2.2 Learning Vocational skills informally

Indigenous education entails learning a vocation from the skilled masters. Based on case-studies of how newcomers learn in various occupational groups which are not characterized by formal training, Lave & Wenger,(1991:29-43) suggest that legitimate peripheral participation is the key. Their case-studies include traditional midwives in Yucatan, tailors in Liberia, butchers in supermarkets, and quartermasters in the US Marine Corps.

Atherton (2010:1) interpreted the concept of legitimate peripheral participation as;

- It is **legitimate** because all parties accept the position of "unqualified" people as potential members of the "community of practice"

- **Peripheral** because they hang around on the edge of the important stuff, do the peripheral jobs, and gradually get entrusted with more important ones

- **Participation** because it is through doing knowledge that they acquire it. Knowledge is situated within the practices of the community of practice, rather than something which exists "out there" in books.

It is in the researcher's opinion that his interpretation of the concept best describes what may be similarly seen in many indigenous skills vocations. Day by day, the learners see what their superiors do and learn from what they see. The apprenticeship system of indigenous education involved a pupil observing with keenness what an adult was doing and copied the skills and there is no clear cut between learning and working (2009: 5-6)[5].

Atherton (2010:1) stated that there is no one boundary to the community of practice, and the position of "master" is only one instance of it and is not held by a particular figure. He emphasized that communities of practice overlap, so that someone who is "central" in one may be peripheral in another. For present purposes, the diagram presented in Figure 2.1 will serve.

[5] Okello, B. (2009). The History of Technical Education in Uganda: 1877-2005. Unpublished.

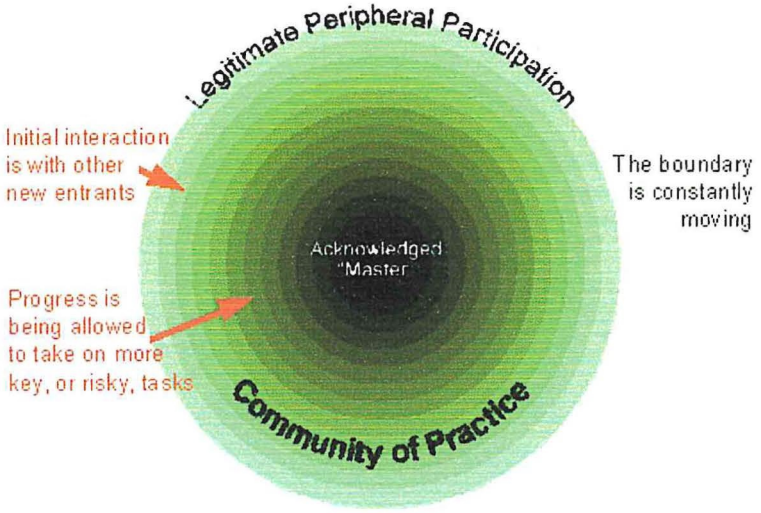


Figure 2. 1: An illustration of legitimate Peripheral Participation, adopted from (Atherton, 2010:1)

The teachers in the indigenous vocational education consisted of two categories (2009:5-6)[6]. The skills and knowledgeable teachers of technical work who transferred knowledge through apprenticeship, where learning was by doing. The second category were those teachers with basic knowledge of administration, law, medicine, and religion, and they transferred knowledge through proverbs, riddles, games, songs and idioms.

2.3 Indigenous Versus Modern Fisheries Knowledge

African indigenous education is the African way of knowing where teaching and learning and acquiring of knowledge and skills happens from homes and the local community. Indigenous knowledge (IK) is

[6] Okello, B. (2009). The History of Technical Education in Uganda: 1877-2005. Unpublished.

used at a local level to assist the communities in decisions concerning food security, human and animal health, education, natural resource management and other vital activities (Gorjestani, 2001:1; Grenier, 1998:4). This form of practical training existed informally in Africa before the introduction of formal education by the missionaries (Ssekamwa, 1997).

African indigenous systems of education revolved around families, clans, the tribe and the regions. The teachers were the parents and adult members of the community gifted and skillful in a particular technology (Namuli, 2002; Ssekamwa, 1997). The learners were the children who were introduced into life sustaining skills. This enabled them to be self-reliant and useful to the community. Teaching had no set time table or curriculum, but was done whenever and wherever necessary. Adults would carry along with them the young ones as they go for an activity and the learners would be taught while doing the job. Like Mjelde (2006a:22) stated, here, one learns through one's own activities in a work situation and through interaction with others. The quantity and quality of the IK that individuals possess vary. Age, education, gender, social and economic status, daily experiences, outside influences, roles and responsibilities in the home and community, profession, available time, aptitude and intellectual capability, level of curiosity and observation skills, ability to travel and degree of autonomy, and

control over natural resources in a way influences one's degree of indigenous knowledge (Grenier, 1998:3).

2.4 Traditional Ecological Knowledge

Traditional Ecological Knowledge (TEK) is defined as "the knowledge base on plants, animals, climate change and other fields of knowledge possessed by both indigenous and local people over many hundreds of years through their direct contact with the environment (Charnley et al., 2007:15). "Traditional ecological knowledge" is a cumulative body of knowledge and beliefs, handed down through generations by cultural transmission, about the relationship of living beings (including human beings) with one another and with their environment. Fishermen's indigenous knowledge of fishing resources is especially important to support fisheries management in developing tropical countries, due to the lack of research and biological data on exploited fishing resources in a local or regional scale (Johannes, Freeman, & Hamilton, 2000; Silvano et al., 2006).

Unfortunately modern Africans tend to invest little faith in developing indigenous knowledge (Ngara, 2007:7), however, there is a need to revisit the African traditional ways of knowing to harmonize the past with the present so that we can be able to establish the true basis for indigenous fishing pedagogy in the informal "world". The lack of involvement of the fishing communities can only be seen as a

retrograde step. Cowax et al.(2003:205) recognized that central government management created an atmosphere of distrust leading to non-cooperation of local fishers with the fisheries departments, and no support for the statistical data collection procedures within the fishing communities. Furthermore, over-fishing and the use of damaging or illegal fishing gears are in part a reflection of the failure of centralized management strategies.

The fact that so much effort is now being invested into understanding the basis for indigenous natural resources management indicates that the negative attitudes commonly held about indigenous knowledge during the colonial era have begun to change. A case in point is the establishment of the beach management units (BMUs) for the management of fisheries resources on Lake Victoria in the three riparian states of Uganda, Kenya and Tanzania. In addition, BMUs are now operational in most lakes (for example, Kyoga, George, Edward, Albert and Kwania) of Uganda. The expectation is that the citizens and government share responsibility in fisheries management as an active partners in fisheries planning, management and development (MAAIF, 2003:10). Breilid (2009:142) recognized that, the lack of respect for local or indigenous knowledge and the assumption by western scientist that western epistemology and scientific discourse is superior is a serious obstacle to sustainable development because they fail to meet human development needs and at the same time to protect nature and the

ecosystems. The Asian Tsunami disaster of 2005 destroyed all the fishing equipment and all the harbors in the coastal areas of Sri Lanka. Following the disaster, *Amarasiri* addressed the loss of traditional knowledge:

> I argue that the traditional fishing sector that provided livelihood for the poor and the marginalized communities in the country's littoral, should be assisted not only to restore their livelihood, technology and know-how of traditional fishing but also to bring back the vigor of the culture that embodied the much valued folk wisdom coming down from many generations *Amarasiri* (2005:1).

Fishing in the wild waters of giant lakes, seas and oceans is a skillful technique which has developed over time from the crude traditional methods of using hands, feet, woods, bones and later on spears and modern hooks and fishing nets (Brandt, 1972:185-204). Modern fishers equipped with electronic fish-finders, predetermine fish abundance and location in the fishing grounds before deploying their fishing gears. Our forefathers too knew in their own ways how to predict fish abundance, the knowledge of which can still be traced to a few descendants of these "traditional" fishers.

The African ways of knowing are grounded in the indigenous African cultural traditions, history and ecology (Ngara, 2007:7).

While modern systems which use Sonar as fish-finders, global positioning systems (GPS) for position location and weather station reports to determine the conditions in the sea, these equipments are affected by the environmental conditions and other factors that render questionable and unreliable information produced[7]. But, the indigenous systems may prevail and are sometimes accurate. One can however regard this knowledge as unauthentic and unreliable since some of it cannot be verified by scientific methods.

Governments commonly manage fisheries through legal and administrative measures which Abila et al .,(2000:318) called the "command and control regime". The system regulates when, where, who and how fishing activities are carried out. Following the introduction of Nile perch in lakes Victoria and Kyoga, the commercial catches of indigenous fish species has never returned to its peak, with some species becoming extinct. Currently, the catches of Nile perch itself have drastically gone down. The communities themselves recognize that the fishery is overexploited but unless they are informed of the status of the stocks in relation to catch statistics, and the health of the fish ecology in the lakes cannot be expected to respond to calls to reduce the amount of fish harvested. The failure of state organs to regulate fisheries has prompted re-thinking into new strategies for fisheries management (Abila et al., 2000:318).

[7] Personal experience on the use of the mentioned electronic equipments in fisheries science.

With the support of the fishing communities the sustainability of the fishery can become an achievable objective by, for instance, adhering to agreed-upon fishing methods and patrolling of certain parts of the lake. Local fishers who have worked in fisheries their entire lives have knowledge about fisheries, and may be willing to share information, participate in the identification of problems, help with implementing plans and be involved in monitoring of illegal fishing (Nasuchon & Charles, 2010:164). They can also help researchers monitor fisheries recourses by recording their catches. The incorporation of the local fisher's knowledge into scientific fisheries investigation is thus paramount in the management of the fisheries resources in Uganda.

Very little information however, exists, if any at all about the indigenous education in the fishing communities of Lake Victoria and the incorporation of their local knowledge in the management of the fishery. The study was therefore purposively designed to explore how knowledge and skills of the fishers of Kigungu fish landing sites on Lake Victoria in Wakiso District are transferred to the young fisher recruits (learners) and how they use these in the "African way" to sustain their livelihoods. By "African ways", the present study means fishing using locally made fishing gear, using local indigenous knowledge of finding fish stock locations, navigation and position location in the lake, fish preservation techniques and resource conservation measures and understandings.

CHAPTER THREE

3.0 MATERIALS AND METHODS

In this chapter information on the study area, the study design, sampling techniques and the method of statistical data analysis are discussed. All these efforts was to elucidate and show accurately the logical steps and processes followed during this study.

3.1 The Study Area

This study was conducted at Kigungu fishing village, which is situated along Lake Victoria in Entebbe peninsula, Entebbe Municipality (Wakiso District).

Figure 3. 1: Google map showing the location of Kigungu landing site on Lake Victoria.

The village is located at the extreme south-western end of Entebbe peninsula, between longitudes 32° 25' 05" and 32° 25' 25" East and latitudes 0° 02' 00" and 0° 02'15"East. It is approximately ten kilometers south of Entebbe just adjascent to Entebbe International Airport runway (Figures 1).

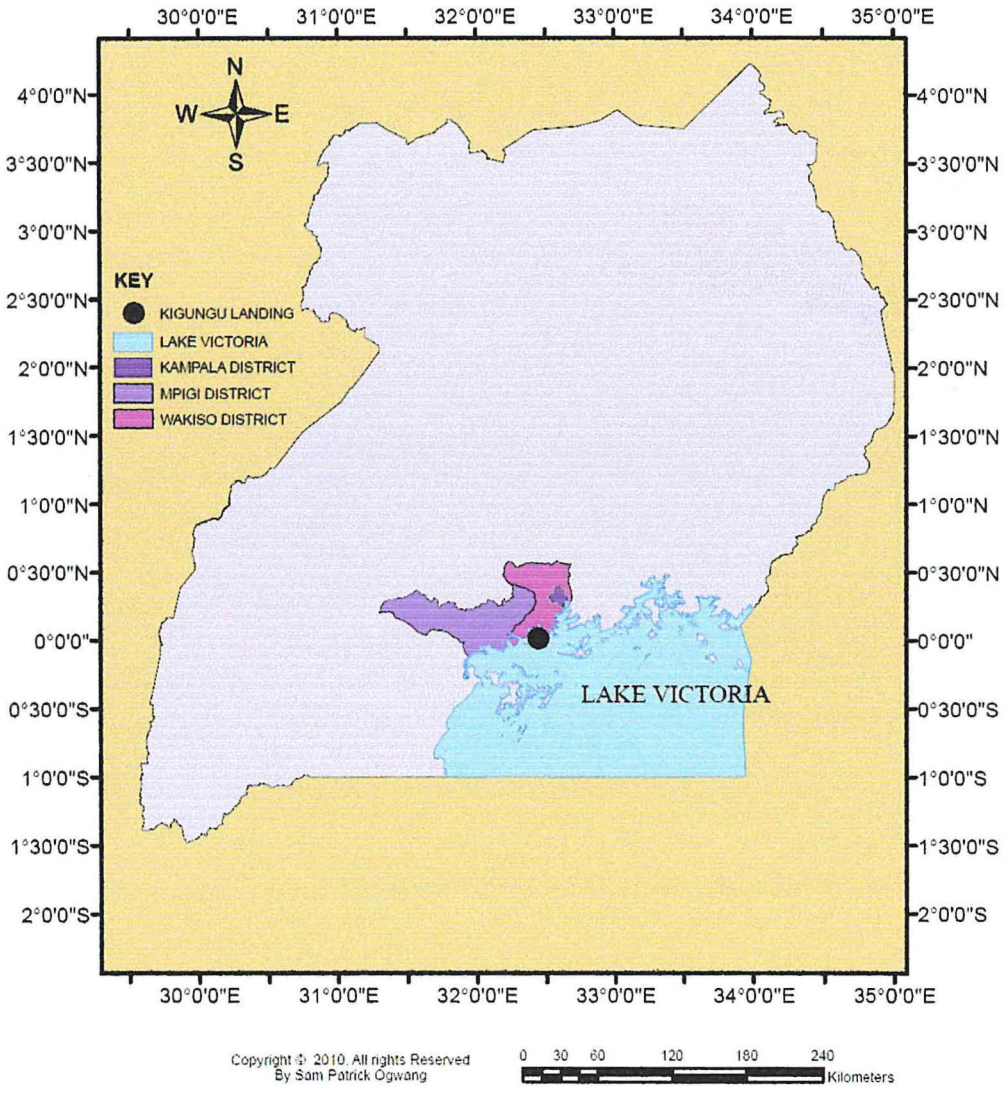


Figure 3. 2: A geographical map showing the loaction of Kigungu landing site

According to LaBonte, (2008:1), the first Catholic missionaries (Father Lourdel Mapera and Brother Amans) were believed to have first set foot on the Ugandan mainland at Kigungu on 17th February 1879. This could indicate that Kigungu landing site though a small growing town, is an is old fishing village, one of the reasons why it attracted this study.

3.2 The Study Design

This research employed qualitative research methods. It was conducted in two phases. The first phase comprised of interviews with each of the twenty nine target respondents (21 fishers and 8 women). The interview method was used because of its advantages: data collection is simple, rigorous, it allows for statistical analysis and it allows for comparable surveys elsewhere (Lozada, Ladio, & Weigandt, 2006:376). Questions about teaching and learning the art of fishing, ecology and biology of fishes were conducted on key fishers who had been in fishing for over 5-10 years. This was so because they were expected to have a great deal of experience and they should be familiar with fishes and fishing on this lake.

In the second phase, the participant observation was employed. The researcher accompanied the fishers (on three different fishing expeditions) to their fishing grounds and observed fishing in action.

Particular observational interest was paid to the fishing gear used, where and how they set the fishing gears in relations to the weather and how they maneuver their way to and from the predetermined fishing ground. In this phase the researcher randomly[8] sampled three fishing crews to follow on their different fishing expeditions.

3.3 The Sampling Procedure

A random sampling technique as described by Crawley (2005:10-11) was adopted in this study. A sample size of 21 adult male (from 18 years old and above) fishers and 8 adult landing site women was used. The study used respondents of not younger than 18 years because someone below 18 years is recognized as a child in Uganda (Uganda Constitution, 1995:156). There exists a clear division of labor in vocational education(Mjelde, 2006a:33). In this regard, female respondents were interviewed to triangulate the information given by male fishers about fish reproductive seasons and women participation in fishing. All women interviewed at least processed fish in one way or another. The list of all adult active fishers registered in the office of the beach management unit (BMU) was extracted. All their names were then written each on a piece of paper and rolled up. All the paper balls were put in a box and shaken thoroughly.

[8] From the 50 fishers sampled, a similar procedure will be followed to pick the five fishers to be accompanied to the fishing grounds.

The choice of which fisherman to be interviewed was done by drawing at random each paper from the box, one after another and the names of 25 fishers recorded in the "sample list". The randomly selected fishermen were then contacted in advance (with the help of the chairperson, beach management unit) to arrange for an interview schedule. This was done so because fishers tend to jump from their boats after a fishing expedition to their recreational drinking joints and it would be difficult to catch up with them in such places. There was no registry of women at the landing. The choice of which woman to interview was based on the activity in progress as the researcher came across them one at a time. Hotel operators, fish smokers, fish deep fryers, fresh fish retailers and bar operators were among the female respondents.

3.4 Methods of Data Collection

Data were gathered using both standardized interviews and observation. This was because of need for first-hand information from the "horse's mouth"[9]. The interview further allowed to ask for clarifications on areas of particular interest. The standardized interview questions covered but not limited to the following areas were;

1. Teaching and learning the indigenous knowledge of fisheries,

[9] First hand words received from the respondent directly.However in the present study respondents' language was translated into English for the researcher because of language barrier.

2. Role of women in fishing,
3. Ecology and Biology of the commercial fishes of L. Victoria, (Specimen Nile Tilapia and Nile Perch was presented to each interviewee to confirm the species the researcher meant).

All these questions were asked as uniformly as possible to every interviewed fisher, who was allowed ample time to answer. The nature of research and objectives was briefly explained to each interviewee before requesting for his/ her permission to be interviewed. With this procedure, the present study aimed to gather quantitative collective ethno- ecological information that was analyzed quantitatively. Artisanal[10] fishers offered rich and unknown sources of both theoretical and practical information which they observe concerning the behavior, food, habitat, reproduction and behavior of fish species (Eraldo, 2000, p. 90). In the course of the interview, some fishers provided informative data on issues which were not asked. Such data when relevant are presented and discussed appropriately.

The present study was further expected to gather the didactics (teaching methods) of knowledge and skills transfer among the fishers from which the researcher was able to discuss and compare with the modern principles of vocational pedagogy.

[10] Small scale fishers

Observational study involved following fishers on three fishing trips to their fishing grounds. Particular attention was focued on how they locate fishing grounds and fish stocks, the fishing gears and methods used and how they trace their way back to the landing site after fishing (marine navigation) and any other activities they perform while in the water such as fishing rituals, if any. This observation assisted very much to triangulate the information given during the interviews.

3.5 Treatment of Data

The qualitative data gathered from the present study was analyzed thematically. The data from each respondent was read several times to identify common themes that relate to the research questions in the present study. Common ideas and patterns that appeared repeatedly in the data were then identified and coded into themes according to each research question. Where it was seen necessary, tables, charts, frequencies distribution and percentage analysis was also employed. The assumption here was that, the information given by most fishers is a representation of the common cultural knowledge spread to the community. Further, ethno-ecological information about the fishing gear, ecology and biology of fishes and sea navigation was tabulated side by side with the scientific and biological data from the existing literature for logical comparison.

To properly quantify, tabulate and compare the answer of each interviewed fisherman, the study selected information of broader scope, referring to general and similar answers and counting how many fishermen mentioned that information. Therefore the sum of all fishermen that mentioned such general response was used to calculate the percentages shown in figures plotted in Chapter four, according to procedures from other ethnoichthyological surveys (Silvano & Begossi, 2005:377).

3.6 Statistical Data Analysis

The data gathered from the present study was analyzed thematically using a qualitative data analysis software "HyperResearch version 2.8.3". The programme was used to code the themes and to generate frequency of occurrences of each theme[11] Thematic data from Hyperresearch was then exported into SPSS version 17, a program with a capacity to analyze both qualitative and quantitative data. Where seen necessary[12] an alternative data analysis programme "Startsoft STATISTICA" version 8 was used. The programmes were used to display graphical information and perform the respective statistical analysis comparison variables and or to look for significant differences between them. Such analyses included analysis of

[11] A theme in this study is "One single word or group of words" which stands for the various words given by several respondents in response to particular question.

[12] The age and sex of respondents was best analysed by ANOVA and displayed as Box plots (Figure 4.3) using STATISTICA.

variance test (ANOVA), Binomial test; Chi-squared test, and Mann-Whitney test (Zar, 1984).

Nonparametric tests do not require assumptions about the shape of the underlying distribution (WINKS, 2010). The data are assumed to be a random sample. They also allow use of ordered or unordered numeric categorical variables (ordinal or nominal levels of measurement). One way ANOVA was used because the samples were randomly independent, and the assumption for normal distribution could be relaxed given the large sample size of the data used. To convert string variables to numeric variables, the "Automatic Recode procedure", which is available on the Transform menu of the SPSS window was used.

The choices for the above mentioned statistical programs were based on the researchers' competency of the application, but otherwise all statistical data analysis programmes performs the same function and in most cases give similar results (based on my own experience).

Although sometimes the same fisherman gave more than one answer for the same question (e.g. learnt fishing techniques from both father and friends), The study considered those samples as independent, as it is believed that one answer would not be influencing the other, even when both answers were given by the same person. Similar reasoning for the analysis was used by Silvano (2006:377).

CHAPTER FOUR

4.0 RESULTS

This chapter presents findings in chronological order based on the research objectives and research questions. To enable easy readability of information contained in the data, simple graphical and table presentations are included. In addition descriptive interpretation elaborating on the contents of some tables and figures are subsequently preceded by the respective figures or tables.

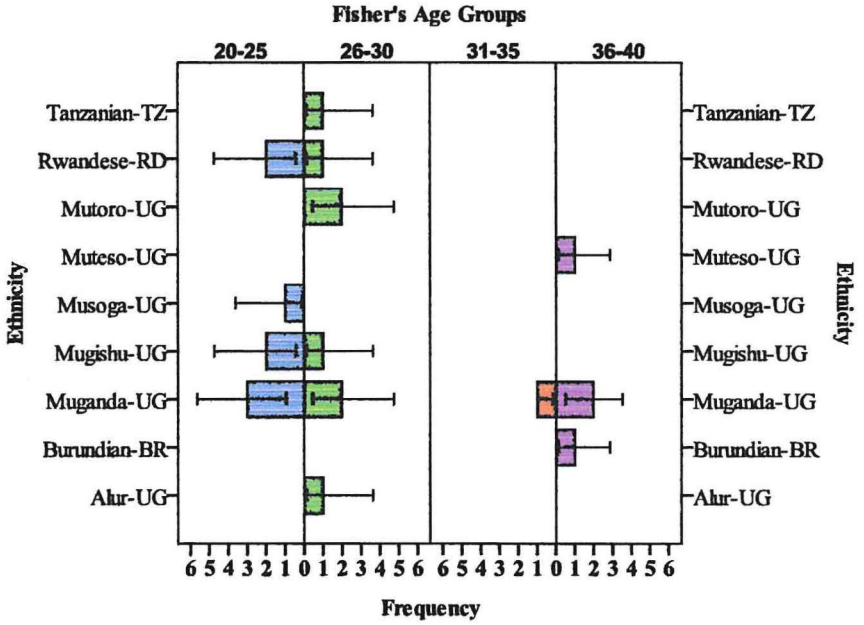
4.1 Demographic Characteristics and Roles in Fisheries

This section presents the information on data collected from both active male fishers and female respondents who were involved in active fisheries and fisheries related auxiliary services respectively. The information comprised of the age, ethnic and formal education characteristics of the population under the present study.

Both male fishers and women were interviewed on the different roles played by women in fishing and findings are also presented here.

4.1.1 Age and Ethnic Composition of Fishers

In Figure 4.1, generally most of the fishers were within the youth age bracket (20 to 30 years) with exception of only 4 fishers in the 36 to 40 year age bracket.



Error bars: 95% Confidence Interval

Figure 4. 1: Age frequency and ethnic backgrounds of Fishers at Kigungu Landing Site. Abbreviations, UG, TZ, RD and BR indicate countries from which the fisher originated as Uganda, Tanzania, Rwanda and Burundi respectively.

Fishers with ages ranges 20 to 25 and 26 to 30 years contributed the highest frequency of 8 each. There was only one respondent in the age bracket of 31to 35 years. This is a strange finding, that none of the fishers interviewed was 40 or above 40 years old and yet such elders are surposed to be the knowledge coustodians.

Ugandan nationalities dominated the fishers' ethnic composition with Baganda tribe leading with frequency of 8, followed by Bagisu with a frequency of 3. Batoro had a frequency of 2 while each of the Itesots, Alur and Basoga contributed a frequency of 1 fisher at Kigungu.

4.1.2 Ethnic Composition of Women at Kigungu Landing Site

In Figure 4.2, as would be expected, the majority (7) of the women were Ugandan citizens however, the ethnic distribution is not a national representative but, mainly the tribes in the Central and Western Uganda which surrounds Lake Victoria. In the sample too was a single Tanzanian national.

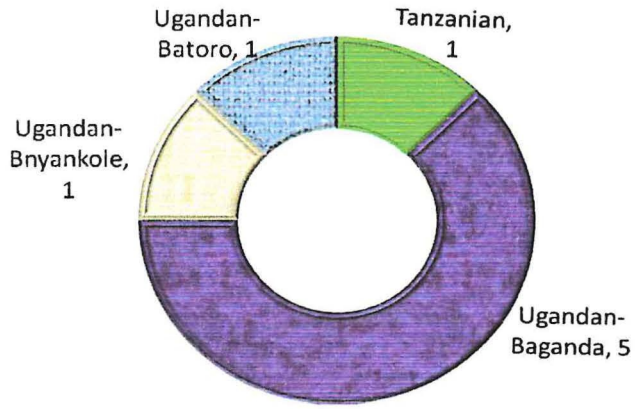


Figure 4. 2: Ethnic Composition of Female Respondents at Kigungu Landing Site

From Figure 4.3, it can be deduced that all respondents fell within the youth age bracket (20 to 35 years), and females seemingly were relatively older than male (mean age = 28.69 and 30.38 years respectively, Appendix I).

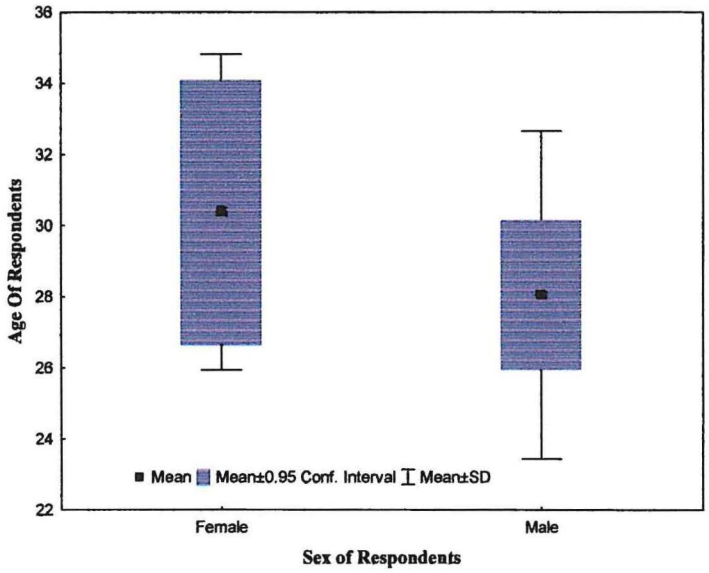


Figure 4. 3: Age Composition of Fishers' and Female Respondent's at Kigungu Landing.

However, there was no significant difference between the ages of male fishers and females who provided different fisheries auxiliary services (Appendix II, ANOVA, p = 0.230).

4.1.3 The Formal Education Levels Before Joining the Fishing Vocation

Figure 4.4 depicts general characteristics of education levels of the fishing community of Kigungu. Almost half (ten) of the male respondent had completed basic (up to Primary seven) education before joining the fishing vocation, where as six attended the Primary level education but dropped off before sitting for the Primary Leaving Examinations.

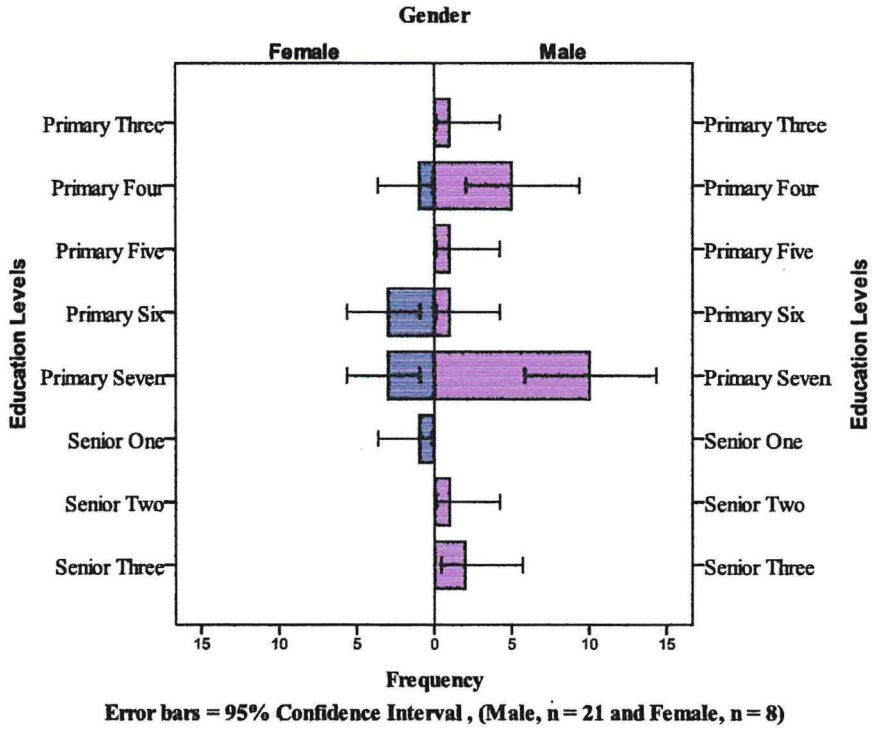


Figure 4. 4: Education levels of fishing community of Kigungu Landing Site.

Three (3) of the male fishers did attend some secondary education (2 stopped in Senior Three and 1 stopped Senior Two). On the female respondents, 4 attended upper Primary education (4 in Primary six and seven) but, the other half stopped in lower Primary levels (Primary three and four).

A Mann-Whitney statistical analysis (α_2 = 0.05) for possible difference in education levels did not show significant difference between the gender education levels (Appendix III, IV: Z = -1.311, p = 0.218).

4.1.4. Roles of Women in Fishing

From Figure 4.5, there was no case of a women involved in active fishing activity. Fishers however recognized the importance of women in supporting fishing activity. Data presented below were gathered from both male and female respondents.

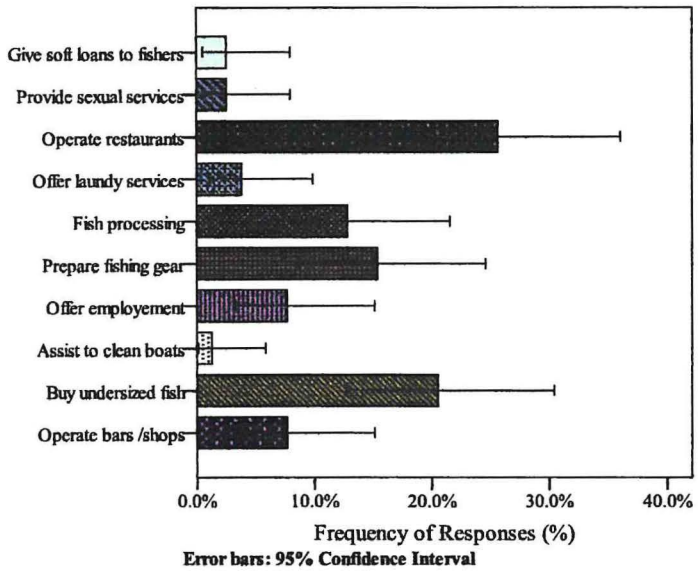


Figure 4. 5: Different roles played by women in supporting fishing activities at Kigungu landing site.

Operation of eating houses / restaurants ranked highest by 25.6%, followed by purchase of undersized fish (20.5%), preparation of fishing gears (15.4%) and involvement in fish processing (12.8%). Much as women from Kigungu do not go fishing, a few who own fishing boats employed (7.7%) casual male fishers to do the job. Operation of bars and drinking houses accounted for 7.7% and all other activities ranked below 5% with women's participation in

cleaning boats with 1.3% (Appendix V). A finding of special interest in the present study is that 3% of the respondents stated that some women provided sexual services to male fishers, however only one female fish smoker confessed to provide the service whenever she had no alternative source of income.

4.1.5 Why Women Do Not Go Fishing

In Figure 4.6 traditional beliefs were the commonest reason why women do not go fishing with (48%) frequency.

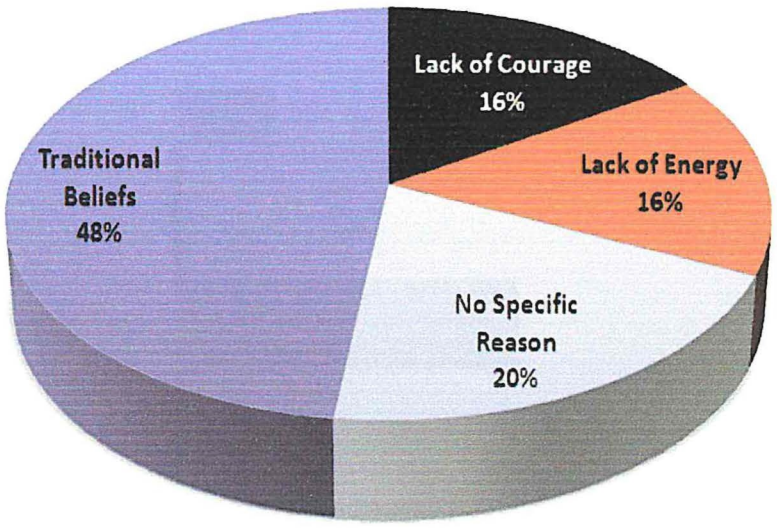


Figure 4. 6: Summary of reasons why women do not fish at Kigungu

Lack of energy and courage accounted for 16% in each case, while 20% of the respondents did not have specific reasons why women did not go fishing. Traditional beliefs included requirements by water spirits ("Jaja" Mukasa who do not want to see naked women),

menstruating women not allowed to come in contact with fishing gear, mother of twins should not meet with rainbow and culturally women are associated with bad luck.

4.2 Transfer and Acquisition of Indigenous Knowledge

4.2.1. Age of Fisher Recruits

Figure 4.7 indicates that 57% of the fishers joined the vocation at teenage age, while 33% joined during their early youth and 10% were in their transition to adult hood.

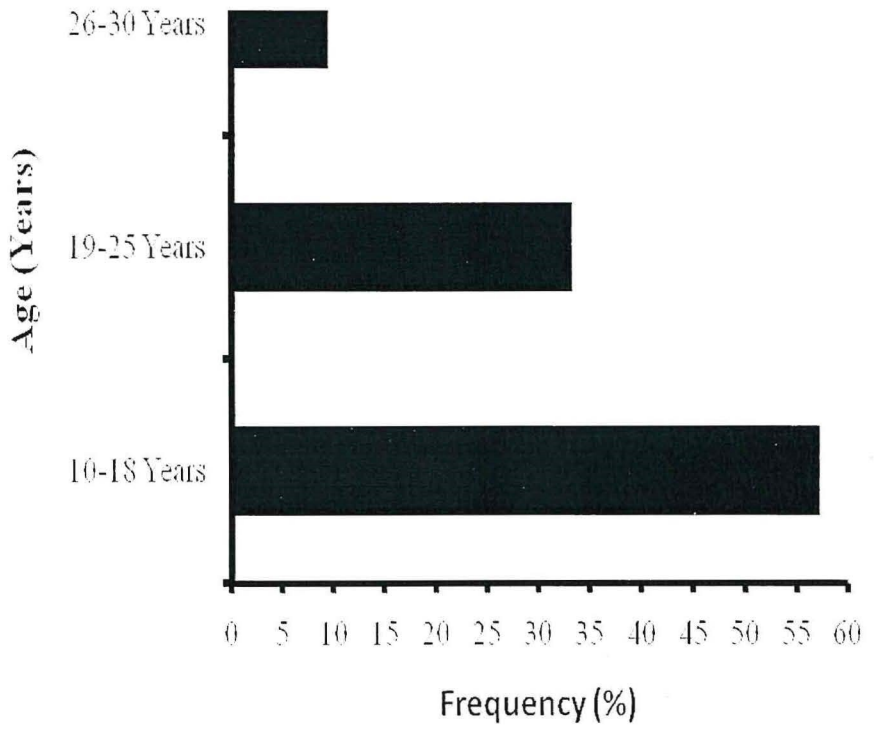


Figure 4. 7: Ages at which different fishers joined the fishing vocation.

4.2.2. Indigenous Knowledge Transmitters

In Figure 4.8, fishers acquired fishing techniques through male teachers which comprised of the fathers (4%), brother (4%), the uncles (18%) and the friends which contributed the highest percentage (64%) of teachers.

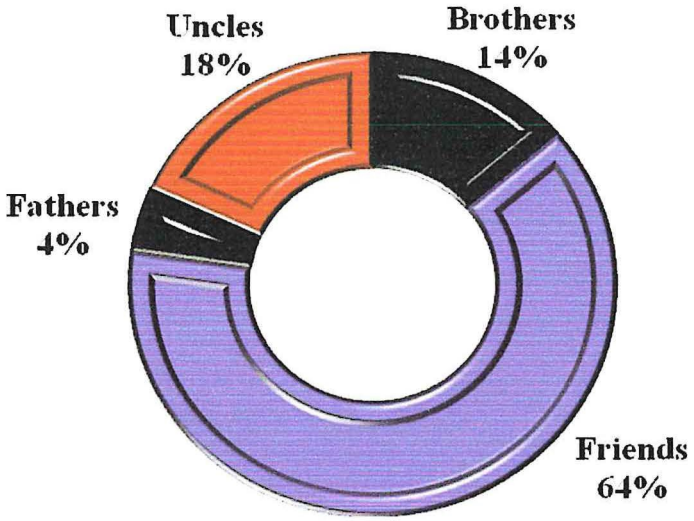


Figure 4. 8: The teachers in the fishing vocation. Fathers comprised biological and grand fathers while brother included cousins too.

There was no mentioning of either mothers, sisters or aunties among the fisheries knowledge custodians. Genderwise, family disivison of labor seemed to have had much influence on who transferred knowledge to who. Like male fishers learnt from fellow male elders, some women stated that they learnt fish processing business through their sisters or aunties whom they lived with.

4.2.3. Learning Contents

From figure 4.9 below, Gear included fish traps, seine nets, fish nets, fish hooks, lamps & boats. Safety at sea embraced locating & mastering of water depth, underwater rocks, swimming, good relations at sea with fellow fishers and keeping watch of accidents.

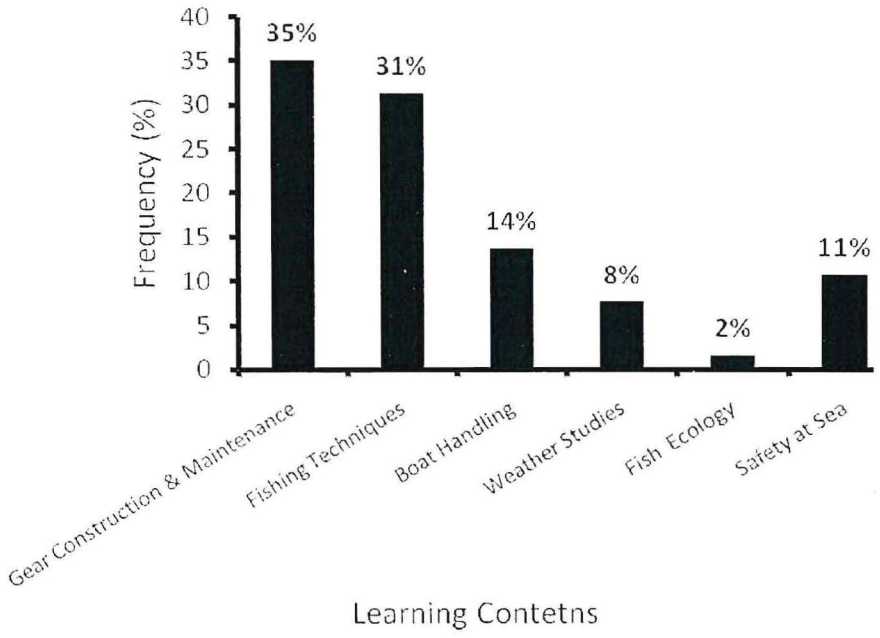


Figure 4. 9: Various skills studied in the indigenous fisheries vocation.

In the present study, boat handling included boat maintenance, engine mounting, Sailing, navigation, and engine trouble shooting. The present study revealed that the indigenous fishers' education has a very rich "curriculum" to train an "all-round" fisher. Much attention has been paid to gear construction and maintenance (35%), fishing techniques (31%), boat handling (14%)

and safety at sea (11%). Weather studies (8%) and fish ecology has got limited attention (2%).

4.2.4. Modes of Knowledge Transfer

All cases encountered revealed that knowledge acquisition involved a close association of learners with their instructors. All the learners in this vocation have some formal education either at Primary school level or secondary. Knowledge was passed to the learner by verbal instructions which were not written. A learner could be sent to collect gear construction, repair or maintenance materials and or would give a hand to the master (instructor) in any activity related to fishing or in preparation for fishing. An Alur fisher had this to say about how he learnt the skills[13].

The master would perform an activity in the presence of and together with the learner. In this way the young recruits learnt the skills of the vocation. Learning was by doing and on the job. Unlike in formal education, the learners did not pay any money. However, when asked, one fisher related the value of the work he would do during the learning process to fees equivalence. A contradicting finding here is that, In fact others gained from their learning. A 23

[13] *"I used to stay with my uncle, he was a fisher man. He would send me to bring "pisu" (braiding needles) and "tol milo" (Nylon) to repair the cast net; "Hold this end, and please watch carefully what I am doing, tomorrow you will repair this net alone, you will tie it on that granary; one day he cautioned me. One holiday, I begun to accompany him to the water and I learnt to row the boat while he casts the net in the water and I just got myself casting the net too"(One or the respondent at Kigungu landing site).*

year old respondent had this[14] to say when asked whether he liked fishing as a job.

Most of the fishers interviewed had trained at least another fisher. They emphasized the "no-fees" training for every recruit and they could show interest to continue training at no fee. Further, the present study reports that all the trainees in this vocation were either very close friends or biological relatives to their skills masters (see Figure 4.8).

Graduation

Elderly fishers from Bugiri landing site in Bugiri District had some kind of "graduation" through which they underwent after training. The process involved taking the new fishers in a boat with cooked food deep in the lake. The new fisher then wore the skull of a big Nile perch on their necks (as necklace) while holding the saucepan containing hot sauce on their right hand and hot potato, "matoke" (banana) or cassava on the left as they sung ("*enyanja yandetela okuvuba*" repeteadly-, literally translated as "The lake caused me to come fishing") while drumming as they danced in the boat. There after the granduand seeps a little water from the boat and the ceremony ends.

[14] *I like this job, because I started earning even before I mastered all fishing techniques,when we sell the fish, they (masters) give me some money but, my fellow friends whom I left at school do not earn even 500(UGX) and they beg from their parents.*

4.3. Ethno- Ecological Knowledge of Fishers

4.3.1. Direction Finding in Water

A visual appreciation of Figure 4.10 reveals that the fishers generally used all the three aids to find their desired directions in the lake. A binomial test on the above data did not show any significant differences in preference of either aid for another.

There was no significant difference between the use of celestial bodies and land objects (Appendix VI: Binomial, p = 1.00), celestial bodies and wind direction (Appendix VII: Binomial, p = 0.856) or between land objects and wind direction (Appendix XIII: Binomial, p = 0.856).

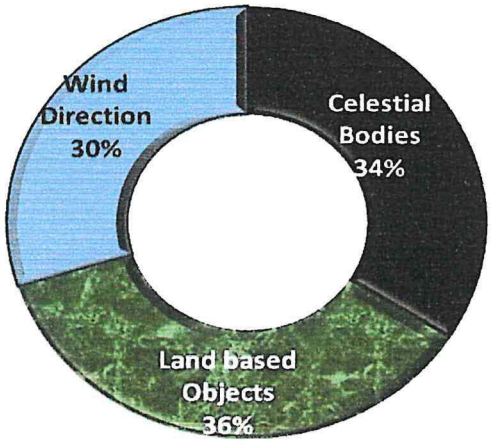


Figure 4. 10: Percentage frequency distribution of the preferences of fishers in using different aids to finding direction in water.

Within each category of aids; land objects, celestial bodies and wind direction, there were natural or anthropogenic elements of each which fishers used to specifically find their direction in water.

Elements of aids which were included in the land object category comprised of lights from Maryland High school which is located just on the shores of lake Victoria adjacent to Kigungu landing site, on the west Entebbe International Airport and State house Entebbe. All these places are seen at greater heights from the lake. The lights from these places are much concentrated in number and intensity and are relatively higher and brighter than the ordinary residential lights that surrounds the landing site.

The wind category comprised of four different kinds of winds locally known by the fishers as:

i. **Nkoma:** which blows very violently from the East to West for just a short time (0.5 to 1 hour), but it is associated with very good catches after it "dies"[15].

ii. **Omugundu:** blows from West to East just "normally".

iii. **Embuyaga:** blows from North towards the lake (South) and it is usually very warm with dusty smell.

iv. **Omuyanja:** This is a very cold-moist wind which blows from Tanzania side (South) towards the land (North). This is the

[15] In this study is used to mean, when the wind stops blowing completely and the Lake becomes calm .

wind one feels on immediate visit to Kigungu landing site from around 0900 hours to 1300 hours.

Wind generally is a very important weather feature in determining the success of a fishing expedition. It has a great impact on the fish catch. According to fishers of Kigungu, very strong wind endangers fisher's lives and most of them do not go fishing while fairly strong wind coupled with warm temperature gives very good catches. Such wind they said dislodges and makes fishes mobile, eventually increasing their chances of encountering fishing gear. Calm winds and very cold waters affect fish physiology and thus fish do not move, reducing their chances of getting caught.

Elements of celestial bodies included the Sun, Stars and the Moon. The sun is used in two major ways to determine direction in water. When night fishers reach their fishing grounds usually at around 1700-1900 hours, the Sun will be setting on the West. The fishers align the Sun-set direction on the West with their direction of setting the fishing gear (Nets or Hooks). In one of the fishing expeditions we participated in, the fishers left the Sun set rays behind them as they set the nets directly opposite the Sun's direction. But, we came from the landing to the fishing ground with the Sun on our starboard. The following morning the net was retrieved beginning from the last point of setting towards the end of the net (East - West direction) and at the end of the net, the boat was turned to face right (North) and we headed straight to the landing

site where we came from (Appendix XIII), this time again leaving the rising sun on our starboard.

One other way through which fishers used the Sun to orientate their boat towards the landing in the early morning is the ability to tell the Eastern direction by exploiting the "emambiya", a Luganda word for Zodiacal light (see Appendix XII), a cast of orange light rays from above the eastern Horizon which is seen from about 2 to 3 hours before sunrise.

Fishers also used the morning stars which they locally called "Alfajiri". It rises from the East at around 2200 hours to 2400 hours with very bright lights. By around 0300 hours to 0400 hours, the star is almost overhead, but it never crosses over before day break. Fisher kept this star constantly on their starboard when departing from the fishing ground and moved northwards until they begun to see land based light mentioned above.

Another Star of importance is what fishers called "Nakakaga", a descriptive name for it being a group of six stars which is seen overhead by 2400 - 0100 hours. The stars served as a clock to indicate the beginning of a new day and hence preparation to begin removing the fishing gears and the catch from the water.

Meanwhile the new moon is used to indicate the North- South direction by aligning its sharp points with an imaginary "string". Fishers also associated the new moon phase with abundance in

catches of Tilapia. Further, the new moon phase also triggered a shift from setting the fish nets / hooks to target Nile Perch from the surface (pelagic) to the bottom (demersal) waters.

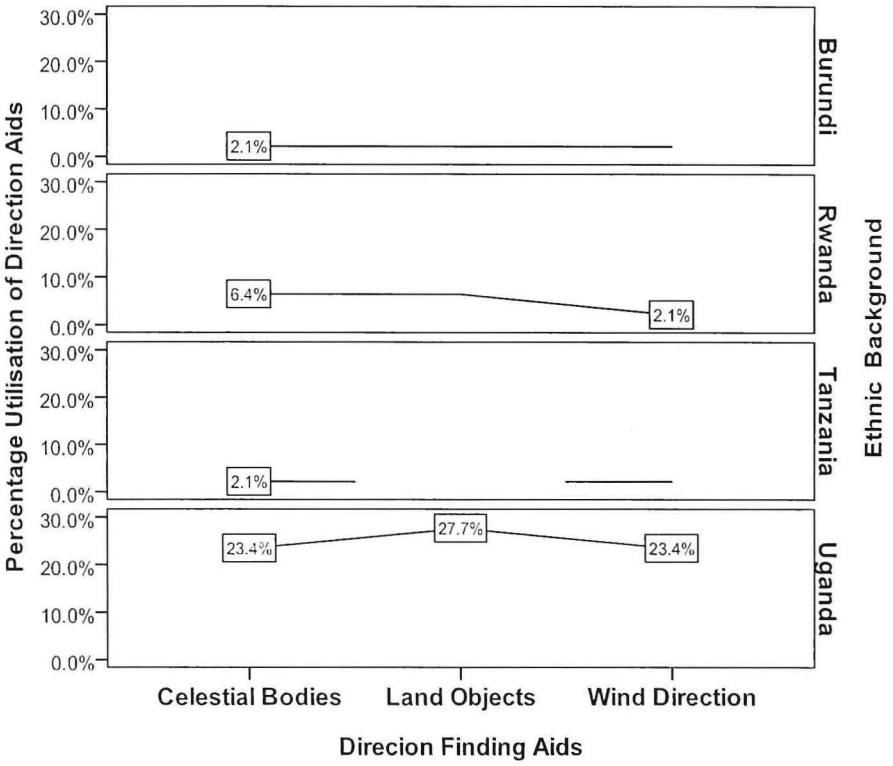


Figure 4. 11: Association of Direction finding aids to Ethnic backgrounds of Fishers of Kigungu.

As illustrated in figure 4.11, there was no association of ethnic background with the use of particular aid to find direction. All fishers employed the different aid whenever necessary.

A Chi-Squared test (cross tabulation) to determine the relationship between the use of different direction-finding aids and ethnic origin did not reveal any positive relationship (Appendix IX, & X and Appendix XI: Chi-square, $p = 0.911$, Correlation, $p = 0.55$).

However, Ugandan fishers seemingly used all the three aids more than other fishers nationals and they also used land objects relatively more than (27.7%) celestial bodies and wind direction.

4.3.2. Ecology and Biology of Fishes

(Fishers versus Scientific Knowledge base)

In this sub section, the knowledge held by fishers about the biology, ecology and general fishery of the two commercial fish species, Nile Tilapia (*Oreochromis niloticus*) and Nile perch (*Lates niloticus*) is presented in Table 4.1 alongside with the scientific documentations in an attempt to draw conclusion from the indigenous knowledge held by fishers about their resources and resource utilization.

Table 4. 1: Ethno-ecological Information Given by Fishers Compared to The Existing Scientific Literature.

Fish Species	Bio-ecological Information by Fishers	Bio-ecological Scientific Literatures
Nile Perch (***Lates niloticus***)	➢ **Habitat**	➢ Adults inhabits deep waters while juveniles shallow waters (FAO, 2010a; Njiru, Budeba, & Wandera, 2005)
	➢ Demersal -offshore,	➢ In habit deeper waters (Pingle, 2005)
	➢ Juvenile found in shallow waters	➢ Occupy all part of the lake and Juvenile in shallow water (AquaticCommunity, 2006)
	➢ Open Pelagic -offshore,	
	➢ Sandy and Rocky grounds-offshore	
	Diet	➢ Adults feeds on fishes and juveniles are planktivores (FAO, 2010a)
	➢ Young Nile perch,	➢ Its own members, Tilapia, Mukene, Prawns and dragon fly nymphs (Ogutu-Ohwayo, Twongo, Wandera, & Balirwa,

		1994)
	➢ Young Ngege, ➢ Clarias species, ➢ Haplochromis species, ➢ Worms , Insects (Lake flies)	➢ Feed on fish , insects, crustaceans and juveniles eats planktons (AquaticCommunity, 2006; Shen, 2008)
	Reproductive Season, Migration and Schooling Patterns	
	➢ February-March, ➢ April – July ➢ They form schools and are believed to migrate in some seasons. **NB:** *Only three fishermen and two women could tell the breeding season of Nile Perch.*	➢ Breed all year round (AquaticCommunity, 2006) ➢ Spawn most of the year (Shen, 2008) ➢ Breeds throughout the year with peaks in March- May and October to December (Njiru et al., 2005) ➢ 16-20 days spawning cycles (SRAC, 2005) ➢ Commonly found in high densities, a sign that they school (AquaticCommunity, 2006)
Nile Tilapia (*Oreochromis niloticus*)	**Habitat**	➢ Prefers to live in shallow waters (FAO, 2010)
	➢ Shallow, muddy and rocky bays inshore	➢ Shallow vegetated habitats (Balirwa, 1998), 5-20m deep (Fishbase, 1983) ➢ Deeper waters (Njiru et al., 2006)
	Diet	➢ Omnivores feeding on aquatic plants, peryphytons, detritus, benthic fauna (FAO, 2010)
	➢ Algae, ➢ Insects ("Ebisekera"- Luganda) ➢ Worms and Grass	➢ Vegetation, detritus and animal foods (Balirwa, 1998) ➢ Grazes from muddy, rocky surfaces and macrophytes (Jangawe, 2007). ➢ Insects, fish, detritus, mollusks, algae (Fishbase, 1983; Njiru et al., 2006)
Nile Tilapia (*Oreochromis niloticus*)	**Reproductive Season, Migration and Schooling Pattern**	➢ Female may spawn continuously (FAO, 2010)
	➢ January, ➢ April-May-June, ➢ August- September,	➢ March – August (Lung'ayia, 1994). ➢ T. Zillii, June-september, peek in July (Akel, 2007) ➢ Breeds in July – August (Njiru et al., 2005; Njiru et al., 2006)

	➢ Every month at emergence of a new Moon ➢ They form schools and are believed to migrate in some seasons.	➢ Breed all year round (Balirwa, 1998) ➢ April-may (Ogutu-Ohwayo et al., 1994) ➢ March- May and November-December (Njiru, Okeyo-Owuor, Muchiri, & Cowx, 2003)
General Ecology	**Endangered/ Extinct Fishes** ➢ Labeo Species (Ningu-Luganda) ➢ Barbus species (Nkisinja- Luganda), ➢ Haplochromis species (Nkejje- Luganda), ➢ Tilapia species (Mulende, Empongo - Luganda), ➢ Bagrus species (Semutundu- Luganda) ➢ Nile perch (Mputa-Luganda)	➢ Bagrus spp ,Labeo spp, Barbus spp,Haplochromis spp (Pingle, 2005) ➢ Nile perch, (Balirwa, Chapman, Chapman, Cowx, Geheb, Kaufman, Lowe-McConnell, Seehausen, Wanink, Welcomme, & Witte, 2003; Pingle, 2005) ➢ Oreochromis esculentus,Tilapia rendalli (Chege, 1995; IUCN, 2006)
	Possible Reasons for Fish Extinction **(see Figure 4.12 below)** ➢ Nile perch predation, ➢ Use of illegal fishing gears, ➢ Aquatic environmental degradation, ➢ Overfishing (*very few response*), ➢ Fish Migration, ➢ Water Spirits (Jaja Mukasa) insulted ➢ Weather changes	➢ Overfishing (Njiru et al., 2006) ➢ Use of illegal gears (Njiru et al., 2006) ➢ Clearance of wetlands (Njiru et al., 2006) ➢ Nile perch predation (Animal Welfare Institute, 1983; Mwalo, 1994; Ogutu-Ohwayo et al., 1994) ➢ Nile perch predation, environmental changes, overfishing (DuHamel, 2004; Lucas, 1997) ➢ Environmental degradation, overfishing, use of illegal gears (Pingle, 2005) ➢ Over fishing, exotic species introductions, ➢ deleterious land use practices, and pollution (Marcela, 1996)
	Selecting Fishing Grounds ➢ Based on guess work, ➢ Based of previous catch records, ➢ Follow other fishing crew who may have some good guess.	➢ Based on guess work and use of electronic fish finders.

The fishers' local knowledge and scientific recorded data about the habitat, and feeding ecology of Nile Tilapia and Nile perch were in agreement in most cases. Unanimous agreement amongst fishers and recorded scientific literature about endangered/ extinct fish species of lake Victoria were too in agreement. However, information about possible reasons for fish extinctions amongst the fishers were in parts different from those recorded by fisheries scientis. Both agreed that Nile perch predation was the most responsible for extinctions. The scientific reasoning that overfishing and using bad fishing gear causes fish extinction was a rare reason amongst the fishers. The fishers instead attributed fish extinctions to fish migration or fish going into hiding or water spiritual powers ("jajas")[16] denying fishers from getting good catches. They claimed[17] that fish give birth to very many young ones and thus cannot be exploited to extinction through over fishing.

Figure 4.12 indicates that Nile perch predation on various fish species (*see Table 10 above*) accounted for the most reasons (40%) held by fishermen for extinction of fishes from Lake Victoria followed by fish migration (20%), overfishing (15%) and use of bad / illegal gears (12%). Other reasons such as weather changes (3%), aquatic pollution (6%), and possible fish catch hindrance by water spirits (3%) were among the possible reasons for fish extinction.

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[16] Common local names for water spirits believed to own parts of the Lake Victoria.

[17] We equate this lake to the "world bank", where money can not get finished, and so fish can not be depleated from the lake. This was a common phrase given by many fishers in response to questions about fish extinction.

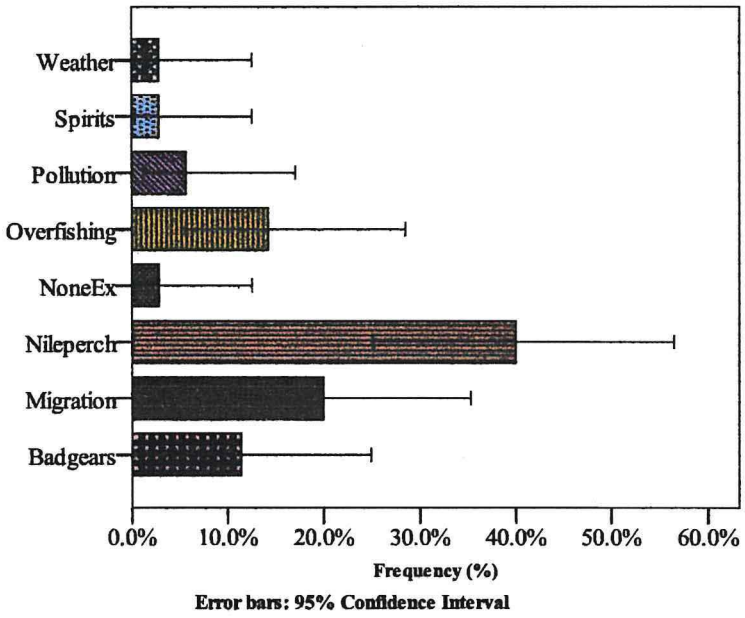

Figure 4. 12: Different reasons held by fishers of Kigungu for fish species extinction from Lake Victoria (Ugandan waters).

An interesting finding from this study revealed that a section of the fishers (3%) did not believe that fish can get extinct, but can only migrate to other parts of the lake where they could not reach. Further, they believe that water spirits such as "Jaja Mukasa", "Jaja Mugato" and another Jaja believed to be a "Mermaid" owns some parts of the lake and once fishers "misbehave" in the lake, the ("Jajas") can cause none or poor catches to result, a phenomenon they said might cause the sensation of fish extinction. A testimony from an experienced fisher revealed that the Mermaid one time owned the waters of Lwenge landing site in Bugiri (One of Ugandan districts along the shore of northern Lake Victoria) and could block the landing with sudds (floating vegetation) and cause poor catches until the elders of the landing could sacrifice a male sheep.

CHAPTER FIVE

5.0 DISCUSSION

This chapter presents a chronological interpretation and gives a discussion on the findings of the present study in the order in which they are presented in chapter four.

5.1. Gender Characteristics and Roles in Fisheries

Here, findings from section 4.1 are discussed and its implication related to the transfer on vocational indigenous fisheries knowledge and fisheries management.

5.1.1 Age and Ethnic composition

In chapter Four, Figure 4.1, the composition of fishers of Kigungu comprised a multi cultural group from Uganda, Tanzania, Rwanda and Burundi with Baganda tribe forming majority of fishers, probably because they are the native tribe in the region (Mukasa, 2010:1). Similar findings have been reported from a study in the lagoon fishing communities of Lagos state where, the Ijebu tribe who were native of Lagos state dominated that fishing community while the migrant fishers were fewer (Fergene, 2008:11).

The diversity in ethnic communities of fishers at Kigungu could be attributed to the migratory nature of fishermen in search for fish bumper harvest (Aburto, Thiel, & Stotz, 2009:647 & 652). Seasonal fish migrations are the major causes of fishermen migration (Fergene, 2008:11; Nkwanta, 2004:1; Torell, Tobey, Thaxton, Crawford, Kalangahe, Madulu, Issa, Makota, & Sallema, 2006:806). However, Shimizu (2003:32) argues that fishers migrate not only to increase their income absolutely, but to improve on their standard of living. Kigungu being a relatively developed modern landing site could have attracted some fishers with the preceding reasoning. These migrations could have diluted the community of ethnic tribe of Kigungu, leading to loss of some ethno-ecological knowledge about some fish species reported in section 5.3.2. The fact that indigenous knowledge is culturally specific and locally bound could explain why the ethnic diversity reported here could have not enriched the indigenous knowledge base at Kigungu.

Nirmale, Sontakki, Biradar, Metar, & Charatkar,(2007:379) studied fisherfolk community of Maharashtra in Mumbai (India) and reported that most of the fishers belonged to the middle age (youth) category within the 20-30 years age bracket. Ochiewo et al (2010:194) also found that 88% of the most economically active fishers of southern coast of Kenya were between the age bracket of 19-40 years. It is most likely therefore that active fishers are always youth. This could be due to the energy associated with this youthful

age brackets. Fin fish fishery exploitation has been characterized by both young and old fishers (Ochiewo et al., 2010:194); however, the present finding could indicate a change in the fishing pattern. During the present study, it was witnessed that fishers go deep offshore in search for fish and to comply with the legal requirements. The change in fishing ground from near inshore to far offshore could have deterred the old fishers in the mainland from fishing. This could also have implication on the transfer of indigenous fisher's knowledge since the elders whom Diamond (2001) described as our "library" are excluded from active fishing.

5.1.2 The formal fisher education

Education is the key component of Uganda's poverty eradication strategy. At the age of 6, a child is expected to enroll in Primary school (Namuli, 2002:1). This could explain why all the fishers interviewed had some formal education before joining the fishing. The present finding is in conformity with those of (Tzanatos, Dimitriou, Papaharisis, Roussi, Somarakis, & Koutsikopoulos, 2006:515), who found that, 64% of fishers in Greece had at least finished preliminary school level and only 5% had attained education past high school level. Similarly 66.7% of sea cucumber fishers in the South coast of Kenya were reported to have attained Primary education while 8.3% reached secondary education (Ochiewo et al., 2010:194). One of the reasons for joining the fishing vocation in the

present study was to search for money to finance school fees, an indication that some fishers joined the vocation as a last resort. However, the level of formal education of resource users has an implication on the management of such a resource.

Genio Jr (2007:822) discovered that fishers with higher levels of education had a positive outlook on the management of coastal environment. Much as the western classroom based system of education has been criticized to delink the learners with the traditional environment, it probably takes precedence in most family households in African. But, the monetary costs associated with western system of education is what trades it off in favor of indigenous education. Jangawe, (2007:4) stressed that indigenous knowledge is however, threatened as formal schooling takes over and that, as a potential successor (children) go to school, they have a choice between abandoning western education and being a traditional fisher man or joining modern school and getting a formal career. This is a portrayal of exactly what the present study witnessed as something common with most of the respondents interviewed from Kigungu had they not failed to get school fees.

5.1.3 Roles of women in Fishing

The present study (Figure 4.5) revealed a number of key roles played by women at the fisher's community level at Kigungu landing site. Food preparation in restaurants/ eating houses (25.6%) and retail

purchase of fish (20.5%) ranked highest. The complex demands on women's labor and time imposed by changing physical, economic and social environments and circumstances have greatly diversified their economic role although the gender based household division of labor appear not to have changed. In Figure 4.5, most of the roles are inclined towards economic gain. No woman was actively involved in fishing at Kigungu, but they did both pre and post harvest fisheries activities of preparing fish nets and boats to fish processing and marketing. A similar finding was reported by Baio (2010:314) in Sierra Leone, Touray (1997:46-47) in Gambia and Williams(1997:33) in Nigeria. These studies confirmed that women dominated post capture processes and are involved in fishing ancilliary services.

Women play significant roles both in artisanal and industrial fisheries. In most fishing communities, women play a key role in fisheries and in maintaining households and communities, yet, they remain largely invisible, and their roles, unacknowledged (ICSF, 2010:1). Much as women are not involved in active fishing, they play pivotal roles in fishing. Fishing is a demanding job in terms of time and energy. During data collection in the present study, fishers were seen to come out of the lake and start preparing their nets ready for the next trip before they could go for meals and alcoholic drinks and back again to the lake. This means a fisher needs some helping hands to prepare food, process fish, market it and probably purchase more fishing inputs. Findings from similar studies reported above together with those of the present study could suggest that fishing

can never be profitable and economically sustainable without the participation of women as auxillary service providers.

5.1.4 Why Women Do not go Fishing

Traditional beliefs were the most (48%) important reason why women do not go fishing while lack of energy and courage accounted for each 16% and some fisher respondents (20%) did not have specific reasons why women did not go fishing. Traditional beliefs were much linked to water spirits ("Jaja" Mukasa who do not want to see naked women). Also women in their monthly periods are not allowed to come in contact with fishing gear. Further a mother of twins are not surposed to come into "contact"[18] with rainbow while, some respondents believed that women are naturally associated with bad omen. Some fishers however confirmed to have witnessed women fishing in the company of their husbands, but from the islands of Lake Victoria. This is a contradiction to the reasons put forward by the fishers of Kigungu.

From personal experience, local women in Teso, Lango and Kumam in the northern and eastern regions of Uganda accompany men to harvest fish from the swamps during dry season. Similarly, Touray (1997:47) reported that some women in Gambia go out along the river banks and streams, in small, paddle powered canoes to harvest wild oysters and bivalve species. Swamps are shallow and

[18] Visual contact with the rainbow at very close range

can be accessed on foot. In addition, they are not exposed to disturbing wave action as is always experienced in the lake.

A number of reasons could however, be advanced for little women's involvement in active fishing. Women fisherfolk live in the same harsh conditions of the fishing communities where they bear the burden of household management. Women in most cases do not receive any technological education or improvement as do fishermen. The collection of fishes from swamps is more of gathering than hunting. Gathering is seen as a female role while hunting is typical of men (Pfeiffer & Butz, 2005:243). Much as the data is not presented in this report, most of the women respondents were housewives and this could suggest that the social/ family traditional division of labor could have an influence on the absence of female fishers at Kigungu landing site. In addition, family disivison of labor according to gender seemed to have had much influence on who transferred knowledge to who. Like male fishers learnt from fellow male elders, some women stated that they learnt fish processing business through their sisters or aunties whom they lived with.

5.2. Transfer and acquisition of Indigenous Knowledge

5.2.1. Age of Recruitment of Fishers

The present study found that majority of the fishers (57%) joined the vocation at teenage age, while 33% joined during their early youth and 10% were in their transition to adult hood. This suggests that

the knowledge is passed on at quite an early age. In their study on cultural transmission of ethnobotanical knowledge Lozada et al. (2006:381) found that majority of their intervewees had learned about medicinal and edible plants in their childhood. Probabily the success of indigenous knowledge transmission is based on this early age training "syndrome" which enables one to build a lifelong experties. However an indigenous community should comprise of both the young and old. Analysis of variance by Case et al., (2005:361) between plant knowledge categories and informant age groups indicated that the youngest informants (18–30) had the lowest levels of knowledge in all categories. Being a lifelong learning experience, indigenous knowledge seems to accumulate with ones age.

5.2.2. Indigenous Knowledge Transmitters and mode of Transfer

Unlike in the formal fisheries education where both gender can participate in imparting knowledge to the learners, fishers of Kigungu did not have opportunity to be educated by women. All teachers were male and close family relatives with exception of friends which supprisingly constituted the highest percentage (64%). Knowledge was transferred through verbal instruction and demonstration. Lozada et al. (2006:381), Nwonwu (2003:4) and Case et al., (2005:360) also found similar findings that cultural knowledge

transmitters was vertical within family lines, but with female teachers dominating. Women and men have separate relationship with biodiversity and gender dominance in knowledge transmission should be linked to the kind of vocation. Pfeiffer & Butz (2005:243) and (Dahl, 1989:5) pointed out that men are the big game hunters while women gathers plants and small animals. This could suggest the disparity in gender dominance in knowledge transmission between the present study and those of Lozada et al. (2006). Like in the present study, they also found that the teachers too consisted of mother, grandmother, father and uncles.

Nwonwu (2003:4) studied the techniques of trap making and trap fishing in Nigeria and noted that with the exception of females, anyone who was interested in learning the techniques could easily go to the specialists to be taught, and he similarly found that the knowledge specialists were not paid fees for teaching others. The knowledge of trap making too was transferred from father to son like for the present study. Generally, the mode of knowledge transfer identified in the present study is what (Mundy & Compton, 1993:3) coined as "deliberate instruction", where parents teach the children, craftsmen instruct apprentices, elders guide the young people, and adolescent undergo initiation rites. Jangawe (2007:5) suggested that both men and women should be involved in indigenous knowledge transfer and dissemination.

The present study is in conformity with findings from similar studies above in that, the indigenous knowledge is not documented since most of those who possess it are older people who cannot read or write. Most indigenous knowledge is not written down, but are held in people's heads and passed down through generations by word of mouth and practical training (Msuya, 2007:4; Mundy & Compton, 1993:1). Even now that educated youths are engaging in fishing, it is still not documented. The knowledge is transmitted from person to person only by word of mouth and through practical demonstrations. This mode of indigenous knowledge (IK) transfer could pave way for knowledge extinction due to lack of records. Msuya (2007:4) pointed out that lack of written memory on indigenous knowledge has led to its marginalisation to the extent that any one practising IK is looked down as outdated and considered primitive.

These findings could suggest that the vertical transmission of knowledge has something to do with preservation and custody of knowledge among close ethnic family lines. It is only in rare situations that a close and trusted friend who is not a relative will be taught the techniques (Nwonwu, 2003:4). However, one can argue that this vertical knowledge transmission could have a diminishing impact of the knowledge richness and diversity.

> *An old woman has just died in this village in Kenya. She was the last person to know of a forest plant that could be used to*

treat epilepsy attacks. She had no children and no pupils. Now her wisdom is gone forever (Mundy & Compton, 1993:1).

5.2.3 Learning Contents

Figure 4.8 showed the rich fishers' curriculum contents which seemed to have been designed to prepare one for life skills and survival in the waters in their struggle to earn a living from the water resources. Gear construction and fishing techniques looked to be pillars of the learning contents in the fishing vocation, they ranked highest. The indigenous fishers curriculum content was not in any way different from what we find at a formal fisheries training institution. Gear constructions, application, survival skills, fish conservation and processing are cross cutting learning contents in the indigenous and formal fisheries curriculum. However, the two systems of education differ in the knowledge generated.

Charnley (2007:15) stated that western scientific knowledge is not necessarily utilitarian and are driven by theoretical models, whereas, traditional ecological knowledge (TEK) is driven by a desire for utilitarian information that will help people survive and maintain a natural resource- based livelyhood.

The question worth asking is thus: Why do it seem like fishermen never put their hard earned money into gainfull investment and why do formally trained fisheries graduates do not

actively get involved in fishing? The future of traditional fisheries can be shaped by the attention given to their special problems and by recorgnition of their unique values. Economically, traditional fishermen are weak yet they are important contributors to the food supply in developing countries (Press, 1988:2).

Suprisingly, the fishers of Kigungu learnt fishing gear construction, but during data collection for the present study, no traditional gear was seen in used. This could suggest that machine made fishing gear are repplacing the traditional gear and in addition, the fisheries regulations regards traditional gear as destructive and illegal. Dahl (1989:2) pointed out that even where subsistance activities have continued, new technologies have replaced old ones, and the old knowledge has been superfluous even where it would still be useful. Probably the fishers see no point in going back to the old technology such as using hand woven net and traps when new nylon nets are readily available and more efficient.

5.2.4 How is the Science of fishing Learned

Generally all fishers when asked about how they learned the fishing mentioned they had learnt by observing what their teachers (skills masters) did and by following their (teacher's) instructions. Grant & Berkes (2007:169) in their study of Carebbean fishers found that fishers used three strategies to transmit knowledge: apprentiecship,

mentorship and information sharing. Like in the present study, Grant & Berkes, (2007:169) also found that fishers who initially learned from their fathers or family members contributed to only a small percentage (13%), compared to those who learned by observing other knowledgable fishers (53%).

In the present study, learning was by doing and participant observation and knowledge accumulated through personal experience and repeated practice as they interact later with other fishers. Fishers worked aboard fishing vessels with other experienced fishers. This was some kind of apprenticeship training. This finding agrees with those of Lozada et al.(2006:382) and Grant & Berkes (2007:168-170). Experience seemed to play a great part when it comes to learning vocational skills. The social environment gives fishers access to the knowledge system and this can provide updates to the knowledge base (Grant & Berkes, 2007:169).

Daly & Mjelde, (2002:197) emphasised that experiential social learning plays a major role in learning about the material and technical environment as well as social and cultural human relations to physical surroundings in a workshop learning. They further stated that if a learner has not experienced a specific aspect of life , his or her understanding remains incomplete, untill everyday life introduces the specific experience that gives depth of comprehension to the generalising world. Much as instructional learning was witnessed in this study, (Mjelde, 2006a:191) stressed that;

"to make learning significant, one must go beyond the classroom walls and that real working knowledge grows through the analysis of multi-facetted everyday life".

Indigenous learning by doing and participant observation aids the process of remembering, a precondition for learning (Nilsson, 2008). Its holistic oriented approach facilitates knowledge retention. Though there is not very rapid increase in competency, a very large increase in competence is a reality after some time (Nilsson, 2008). This could justify why learning through friends contributed the greatest percentage in this study, as one is more free with peer friends than father or even brother.

Further, compared to school based learning, the new fishers seemed to find more meaning in what they learnt as the oucomes and benefits were immediate[19], therefore they put much interest in what shaped their lives as adult fishers. Regi Enerstvedt in Mjelde (2006a:76) emphasised that the length of hours spent in pure schooling away from practical working life is one of the main problems in the present day school system. This ideology could be borrowed to conduct apprentieschip based learning of fisheries vocational courss in formal institutions. The "no fees" training and the possible pre-

[19] Proceeds from sale of fish caught during their training

graduation earnings from the sale of fish during the training period could have been strong motivators for the mastery of this trade, since the recruits really saw the true "meaning" of wha they were learning. Further, Williams & Muchena, (1991:55) suggested that inservice training programms could provide opportunities for making agricultural professionals concious of indigenous knowledge and would provide them wih skills to identify, collect and develop indigenous knowledge into contemporary useable formats.

5.3. Ethno-ecological Versus Scientific Knowledge Base

5.3.1 Finding Direction in water

Generally, none of the various methods used by fishers to find their direction in water proved scientific. The indigenous knowledge held by fishers of Kigungu to find direction in water were varied and seemed to be very local, especially with the use of wind and land based lights. According to my knowledge, the science of sea navigation is not common to many researchers and finding relevant articles in scientific journals is some information yet to be published.

Fishers used wind features (direction and temperature), celestial bodies (sun, moon and stars) and land based lights to find their way out of the water. Such knowledge seemed to have developed with constant and consistent prolonged interaction with

the environment. Navigation in the lake is a challenging activity without means such as marine compass to locate one's position. Marine navigators have used wind purposely to power their boats but not for direction finding. Wind is also known to affect vessel movement and taking of dead reckoning in navigation (Bowditch, 1995:483; Grant & Berkes, 2007:165).

Unlike for wind and land based objects, the fishers of Kigungu used celestial bodies (stars, moon and sun), although the principles could not be verified with the scientific Celestial navigation. Similar to the finding in this study, fishers of Tamilnadu (India) also used the stars as clocks to indicate the time of day/night (Santhanam, 2006:5) . The northern Vikings are believed to have done their navigation by use of wind direction aided by weather vanes (TheVikingNetwork, 2000:1). The Vikings used the northern star (Polaris) to find their latitude (Marlys, 2004:1). This fact could justifies why the fears Vikings never invaded Africa, where they would not be able to sight the Polaris and hence lose their sailing direction. In the present finding, the fact that the use of celestial bodies in sea navigation was common among the diverse cultural fishers is an indication that the knowledge is culturally spread among many nations, however how this came about calls for further research.

5.3.2 The Biology and Ecology of Commercial Fish Species

Ethno-ecological knowledge of the fishers about the ecology and biology of Nile Perch and Nile Tilapia was in general conformity to the established scientific literature. Response to questions about fish feeding, habitat, reproductive seasons, and fish extinctions agreed in most cases with the existing biological scientific literatures. For example, many researchers (Balirwa, 1998; Fishbase, 1983:2; Jembe, Boera, & Okeyo, 2006; Njiru et al., 2006; Ogutu-Ohwayo et al., 1994; Shen, 2008:1) have already documented the diets of Nile perch and Nile Tilapia and possible reasons for fish extinctions in lake Victoria , many of which include all that the fishers mentioned in the present study.

Although it dealt with supposedly more knowledgeable and experienced fishermen, the present study observed an overall lack of knowledge about fish reproductive patterns, especially Nile perch with a high market value in Uganda. According to Diamond (2001), older people in traditional or illiterate societies are the equivalents of our libraries, accumulating and transmitting indigenous environmental knowledge. In this sense, respondents in the present study were all youths, suggesting a possible explanation that the young fishers of Kigungu might be gradually losing their local itchthyological knowledge.

The findings further pose a possible question; does the observed lack of fishermen's knowledge of reproduction of a major commercial fish species (Nile perch) indicate decreases in the abundance of the fish? Similar findings were reported by UNESCO (2009:49) where younger people at Majagua (Venezuela), displayed less knowledge by age than adults, indicating a delayed learning phase about the usefulness of varieties of flora in their locality, a deficiency attributed to their movement into a non-traditional habitat which had historically less familiar flora. The fact that none of the fishers used (and only a few had seen) traditional fishing gear at Kigungu could suggest a possible effect of habitat change.

This particular finding suggests that youths and young adults in Kigungu migrating fisher community are experiencing a "delearning" trend (failure to learn knowledge that is normally acquired by such individuals under traditional conditions). Whether this is associated with their closer contact with urban centers is a question that requires further in-depth scientific research. A possible support for this reasoning could be related to a study about knowledge of medicinal plants among ethnic communities of Manus Island (Papua New Guinea), it was discovered that people in the village identified significantly more medicinal plants than those in town center (Case et al., 2005:362). UNESCO (2009:88) attributed this diminishing contact with nature and the traditional environment to the current adoption of western life styles including classroom

based education and use of western technology by younger generation.

A similar weakening in linkages between older and younger generation in among Malawi fishers was also reported by Kalanda-sabola, Henry, & Kayambazinthu (2007:22), suggesting erosion of traditional knowledge systems as a result of breakdown in traditional communication network. There is however, evidence that fishers can tell the reproductive season, breeding habitats, feeding grounds and season of fish abundance. Cultural diversity and intermarriages could be one explanation for the little ecological knowledge reported in this study. When family members speak different indigenous languages, it may be very difficult to pass on common names that do not translate between different family members' languages (Case et al., 2005:361). The fishers of Grenada, Eastern Caribbean were capable of telling reproductive season, breeding habitats, feeding grounds and season of fish abundance with exception of the reproductive season of one fish species, Swordfish (Grant & Berkes, 2007:165). This failure to tell the exact breeding season of certain fish species by fishers could be a focus for the integration of scientific researchers and traditional fishers in the management of a common resource.

Fishermen's knowledge recorded here sometimes disagrees with the scientific literature. For example, very few fishers agreed that overfishing could lead to fish extinction, however a majority of

fishermen attributed fish extinction to fish migrations and punishment from water spirits ("Jaja Mukasa" and "Jaja Mugato" among others) as a result of disobedience by fishers to conform to "spirit regulations". Cases of water spirits has been reported in many studies. These beliefs have a serious fisheries management implication and calls for mutual dialogue between the fishers and managers to harmonise their knowledge gaps in the utilization and conservation of the resource. In a study by Kalanda-sabola et al., (2007:21) fishers had restricted sacred places in Lake Chilwa (Malawi) where no one would fish from, otherwise their boats would be delayed mysteriously in that area or they would get lost. Only elders would visit those places with sacrifice to spirits incases when catches were poor. Silvano (2006:382-383) argued that such discrepancies in knowledge provide new insights to be investigated by biological research, thus improving the existing knowledge base.

Further in the present study, fishers did not have a defined system of finding fish or detecting fish abundance in the water. They all based on guess work or previous days catch. However, in a study by (Grant & Berkes, 2007:166) on fishers of Grenada, eastern Caribbean, knowledge of 'folk oceanography' gave fishers clues of where to find fish. Such knowledge included the presence / absence of sea birds, seawater color, and current strength and direction.

5.4 Conclusion

The present study aimed to identify gender characteristics (age, education, ethnicity and roles) in fishing and to find out pedagogical principles and modes of learning indigenous fisheries knowledge. It further sought to identify the indigenous fisheries knowledge held by fishers about the ecology and biology of two of the commercial fishes of lake Victoria and to compare such information with the existing scientific literature.

In an attempt to address the above objectives, the present study revealed that the fishers of Kigungu were dominated by Ugandan youths of Baganda ethnic tribe between 20 to 30 years and no one was as old as 40 years and above. This particular finding has raised a new research question about fishers of Kigungu; what happened to the elderly fishers and how does this compare with other landing sites?

At Kigungu, fishing was generally men's work while women, in addition to processing and marketing fish gave auxiliary services to the fishers and some employed the male fishers on their personal boats. Most of the new fisher recruits joined the fishing vocations at ages as early as 10 to 18 years and none started fishing above 30 years. Learning was by doing initially through peripheral participation in a community of practice. In this context, learners acquired knowledge and skills through interacting and co-operating

with others. Such environment seemed to have created a stage where actions, words and meaning were integrated in the learning process. Male friends and uncles formed the most knowledge and skills transmitters.

Fishers learnt the art of fishing using fish nets, hooks, lamps, boats and oars. However, most of these were of modern technology and machine made. No traditional fishing gear were found at the landing site. The recruits were trained skills on fish gear construction and maintenance, fishing techniques, fish ecology, sea navigation and safety among other subjects. Most of the fishers' indigenous knowledge about ecology of Tilapia and Nile perch agreed with the scientific biological literature with exception of only few conflicting reasons on possible fish extinctions and reproductive biology of Nile perch.

Findings from the present study have a lot of information for fisheries scientists and managers when devising management measures. It would help to achieve the necessary involvement of the stakeholders (in this case, the fishermen), in the design and implementation of these measures, such as closed fishing seasons, mesh size regulation and protected area fishing. Applying fishers' knowledge in management may not be an easy task, due to differences between fishers' and researchers' knowledge base and perceptions. The agreements observed in the present study between fisher's and scientists' knowledge about fish diets, habitat and

reproductive season of Tilapia may be a starting point to devise a 'common ground' knowledge, which would be understandable to both. This study suggests that local fishermen's knowledge has the potential to improve understanding of reproduction and conservation of Lake Victoria fishes. Furthermore, the ethno-biological approach and methods here reported could also be useful to the study and management of several other poorly known tropical fisheries, thus helping to improve dialogue and mutual understanding between fishers and researchers.

The fact that all fishers joined the vocation willingly, meant they saw some meaningfulness in the trade. Probably the immediate gain in terms of the catch and sales of the catch motivated the learners.

The strengths of the indigenous knowledge education among other things, however is in its sustainability. It has provided employment, income and fish for many generations. It should continue to provide these for future generations, thereby contributing significantly to sustainable development and the promotion of local culture.

Its weakness is that as development progresses and more and more people are formally educated, fewer people will want to engage in fishing because of its tedious nature. In addition, some of the traditional male elders who possess the knowledge of fishing gear-

making and fishing are growing old and dying. With their children taking to formal education and urban life, it could become less likely that the knowledge of fishing gear-making, such as, trap and trap fishing can be retained and transferred.

5.5 Recommendations

To The Education Managers

From the present study, young fishers learnt by working together with their trainers and benefited from what they did at the end of a fishing trip. A similar principle of learning should be adopted by vocational institutes if Government and institutional owners can provide vocational institutes with practical materials and tools to encourage production learning and learning by doing.

The kind of short term and demonstration trainings practiced by the fishers of Kigungu could be incrporated in formal school vocational trainings. Modular[20] Production learning would be an option and the materials so produced could be sold and students given a portion of the proceeds as motivation.

Vocational schools should emphasise on students commuting from homes so as to dis-allienate them from the day to day indigenous life long learning experienced from homes and

[20] Trainings broaken into short and complete tasks which aimes at producing a tangible and valuable piece of material at the end of each training session.

communities around them. This will capacitate the learners to identify local problems which can be solved by incorporating vocational knowledge and skills gained through training.

Similar to the indigenous fishing vocation where a fisher recruit went to their uncles and friends to get on the job trainings, vocational institutions should liaise with industries to offer students apprentieschip trainings on the job for better skills mastery through interaction with knowledge masters at work places.

In the present study, fishers joined fishing as way to look for formal school fees and they were trained to fish free of charge. Government should reduce training fees or should completely sponsor vocational students to encourage formal skills training and productivity.

To The Fisheries Managers and Researchers

Iindigenous knowledge about fisheries should be documented by researchers to preserve such knowledge in data bank which can be refered to by the younger generation and resource users and managers.

Fisheries researchers should always incorporate local fishers who uses the fisheries resource in scientific data collection to broaden and enrich the knowledge of the resource management and utilization.

A comparative and an investigative study should be done to identify the distribution of elderly fishers (above 40 years) and their contribution to the custody and transfer of indigenous knowledge among the fisher communities on Ugandan waters. Such studies will bring out the missing link about the elderly fishers witnessed in this study.

Women should be encouraged to participate in active fishing by providing them with adequate informal training in fishing skills and survival at sea.

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APPENDICES

Appendix I: ANOVA - Descriptive Statistics (Age of Respondents)

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	8	30.38	4.438	1.569	26.66	34.09	24	40
Male	21	28.05	4.61	1.006	25.95	30.15	22	37
Total	29	28.69	4.607	0.855	26.94	30.44	22	40

Appendix II: ANOVA Test (Age of Respondents)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	31.38	1	31.38	1.505	0.23
Within Groups	562.827	27	20.845		
Total	594.207	28			

Appendix III: Ranks Mann-Whitney U Test: Gender Education Levels

Gender	N	Mean Rank	Sum of Ranks
Education Level			
Female	8	18.19	145.5
Male	21	13.79	289.5
Total	29		

Appendix IV: Mann-Whitney Test Statistics

	Education Level
Mann-Whitney U	58.5
Wilcoxon W	289.5
Z	-1.311
Asymp. Sig. (2-tailed)	0.19
Exact Sig. [2*(1-tailed Sig.)]	0.218

Appendix V: Roles of Women in Fishing

Roles	Frequency	Percent	Valid Percent	Cumulative Percent
Operate Bars/Shops	6	7.7	7.7	7.7
Buy fish rejects	16	20.5	20.5	28.2
Cleaning boats	1	1.3	1.3	29.5
Employ fishers	6	7.7	7.7	37.2
Prepare Fishing gear	12	15.4	15.4	52.6
Fish processing	10	12.8	12.8	65.4
Do Laundy	3	3.8	3.8	69.2
Operate Restaurants	20	25.6	25.6	94.9
Provide Sexual Serveice	2	2.6	2.6	97.4
Offer Softloans	2	2.6	2.6	100
Total	78	100	100	

Appendix VI: Results of Binomial Tests for preferred use of either Celestial Bodies or Land Objects in Direction Finding by Fishers of Kigungu

		Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)
LANDCEL	Group 1	Land objects	17	0.52	0.5	1.000[a]
	Group 2	Celestial bodies	16	0.48		
	Total		33	1		

a. Based on Z approximation

Appendix VII: Results of Binomial Tests for preferred use of either Celestial Bodies or Wind in Direction Finding by Fishers of Kigungu

		Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)
CELWIND	Group 1	Celestial bodies	16	0.53	0.5	.856[a]
	Group 2	Wind direction	14	0.47		
	Total		30	1		

a. Based on Z approximation

Appendix VIII: Results of Binomial Tests for preferred use of either Land Objects or Wind in Direction Finding by Fishers of Kigungu.

	Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)
Group 1	Land objects	16	0.53	0.5	.856[a]
Group 2	Wind direction	14	0.47		
Total		30	1		

a. Based on Z approximation

Appendix IX: Ethnic Background * Direction Aid- (Cross tabulation Analysis)

			Direction Aid			Total
			Celestial Bodies	Land Objects	Wind Direction	
Ethnic Background	Burundi	Count	1	1	1	3
		Expected Count	1	1.1	0.9	3
	Rwanda	Count	3	3	1	7
		Expected Count	2.4	2.5	2.1	7
	Tanzania	Count	1	0	1	2
		Expected Count	0.7	0.7	0.6	2
	Uganda	Count	11	13	11	35
		Expected Count	11.9	12.7	10.4	35
Total		Count	16	17	14	47
		Expected Count	16	17	14	47

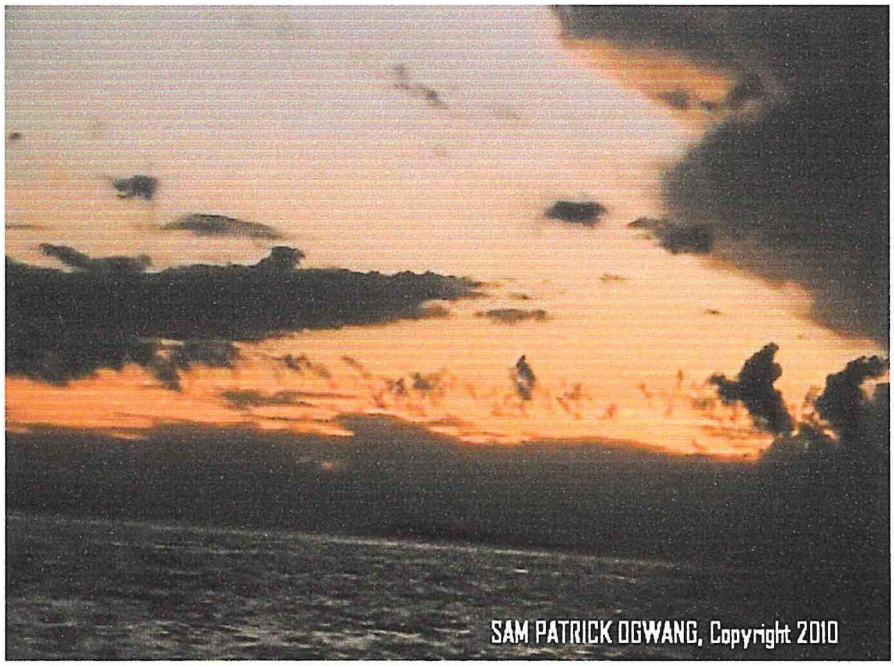
Appendix X: Chi-Square test: Ethnic background- Direction Aid

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.089[a]	6	0.911
Likelihood Ratio	2.866	6	0.825
Linear-by-Linear Association	0.303	1	0.582
N of Valid Cases	47		

Appendix XI: Ethnic Background * Direction Aid (Nonparametric Correlation Analysis)

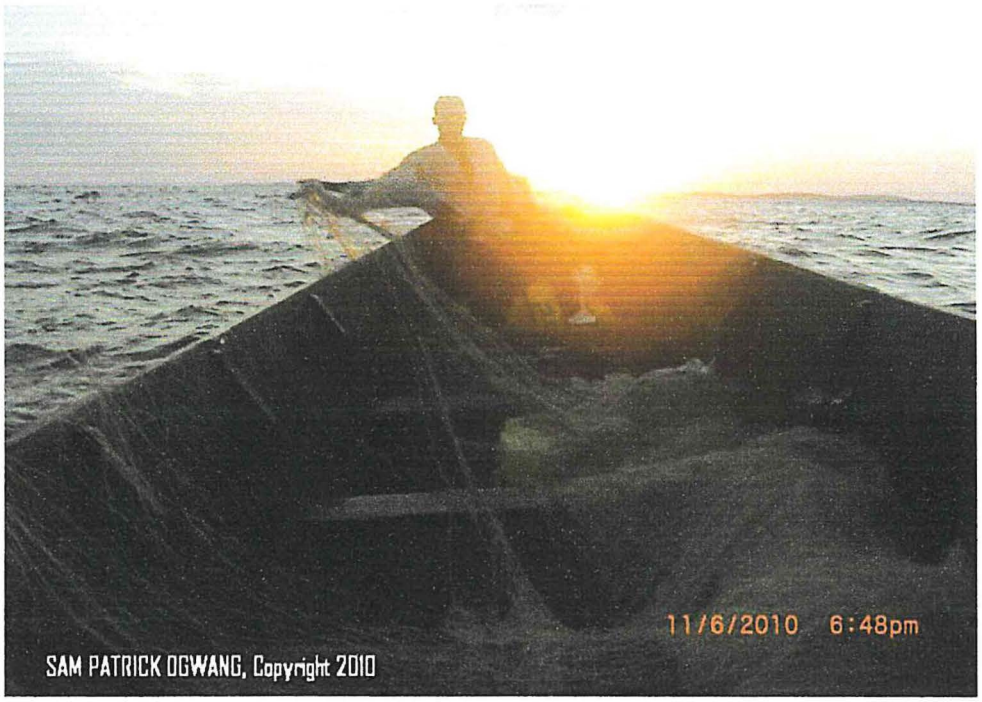
			Direction Aid	Ethnic Background
Spearman's rho	Direction Aid	Correlation Coefficient	1	0.088
		Sig. (2-tailed)	.	0.557
		N	47	47
	Ethnic Background	Correlation Coefficient	0.088	1
		Sig. (2-tailed)	0.557	.
		N	47	47

Appendix XII: "Emambia" Zodiacal lights cast by rising sun over the East Horizon.



Source: Field Photo 2010

Appendix XIII: Setting fishing gear in alignment with Sun set direction



Source: Field Photos 2010

Appendix XIV:

Interview Guide:

Kyambogo University, Department of Art and design.

Masters in Vocational Pedagogy (2009-2011)

Learning and Application of Indigenous Fisheries Knowledge by The Fishers of Kigungu landing Sites on Lake Victoria-Entebbe (Uganda)

Introduction

Dear respondent, I am a student of Kyambogo University pursuing a Masters Degree in Vocational Pedagogy. I am conducting a study on Indigenous Fisheries Knowledge on Lake Victoria- Entebbe-Kigungu landing site.

Specifically, I would like to invite you to participate in interviews as part of this research. As a participant in this study, your role is to help me get a better understanding of indigenous knowledge of fishing by answering the following questions. I also have to assure you that all data you will provide is protected and your identity is anonymous. The data will be used for analysis and presentation to Kyambogo University academic units only for the purpose of this study.

A. Teaching and learning the knowledge and skills of fishing

Age.....Nationality.....Education.....

1. When did you begin to fish?.....
2. Why did you join the fishing?.....
3. How did you learn to fish?.....
4. Who taught you the techniques of fishing?.....
5. What did you learn?.....
6. Where did you learn the fishing (classroom)?.....
7. What did you use for learning to fish (training tools)?.....
8. Are the tools locally made?.....if yes, How?.....
9. Did you pay some money to learn the fishing?.....
10. Have you taught some friends how to fish (transfer that knowledge)?.....
11. If yes, What do you teach them (learning content)? .....
12. Do you enjoy fishing (motiva.....if Yes, how?.....
13. Are there some women fishing on the lake? Yes.....No.....
14. If yes, what do you think about it, is it proper?.....
15. If no, why?.....
16. What else do women do to assist you in fishing?.....

C Ecology and Biology of commercial fish species on Lake Victoria

(Samples of Nile perch, Tilapia and Mukene will be presented to fishers during interview)

1. Which fish is this (local/ common name)?..... .....

2. What is its usefulness? .....

3. Do you catch it during the day or during the night?.....

4. How do you catch it (fishing gear and techniques)? .....

5. Where do you catch it (fishing grounds)?.....

6. In which months are the catches abundant (seasonal occurrence)?...

7. Does it form schools (fish social behavior)? .....

8. From where does it come and to where does it go (migratory behavior)?.....

9. Where does it live (habitats)? .....

10. What does it eat (feeding habits)?.....

11. Do other fishes or animals eat it (predators)? .....

12. When does it appear with eggs (reproductive season)?.....

13. Which indigenous fishing gears do you use to date? .....

14. Why do you still use these gears? .....

15. Which modern fishing gears do you use? .....

16. How do you compare these gears (ecology, resource management, efficiency)?.....

D Fishing Techniques

1. At what time of the day do you normally go fishing?.....

2. How do you decide to place a fishing gear at a particular point in the water?.....

3. If yes, how do you relocate your gear for harvesting?.....

4. Are there other signs which indicates the presence of fish in a water body?.....

5. How do you trace your way back to the landing after fishing?.....

6. How do you determine direction in the water?.....

7. What weather features are important in the fishing?.....

8. How do you interpret each weather element in relations to fishing?.....

9. Do you care to see fish in the water for tomorrow's children?.....

10. How do you ensure fish is conserved for tomorrow's fishers?.....

11. Are there some fish species which have disappeared from the lake since you started fishing?.....if yes, whaich are they?.....

12. What do you think led to their disappearances?.....

13. What should be done to stop fish disappearance?.....

E Specific questons to women

1) How old are you?
2) Which is your tribe?
3) What is your highest education qualification?
4) What is your occupation?
5) When did you join the business?
6) How did you join the business?
7) Which fish species do you trade on?

8) In which months is the species abundant?

9) In which months do they appear with eggs in the "stomach"?

10) Apart from the above species, which other fish species are landed here?

11) In which months are they abundant?

12) Do you go fishing in the lake?

13) If yes/ No, Why or why not?

14) Are there some restrictions which prevent women from fishing?

15) What is women's contribution to fishing?

16) Which other business do you have/ plan to have?