HUMAN ACTIVITIES AND CONSERVATION OF *ALESTES BAREMOZE* SPECIES IN ALBERT NILE, UGANDA

BY

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A RESEARCH DISSERTATION SUBMITTED TO THE DIRECTORATE OF RESEARCH AND GRADUATE STUDIES IN PARTIAL FULFIMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF SCIENCE IN ENVIRONMENTAL SCIENCE AND NATURAL RESOURCES MANAGEMENT OF GULU UNIVERSITY

NOVEMBER, 2023

DECLARATION

I hereby declare that the proposal entitled, "Human Activities and Conservation of *Alestes baremoze* Species on Albert Nile, Uganda" is my original work and has never been submitted to this or any other institution of higher learning.

.....:..... 7th November, 2023

Titirach Scovia Kerali Date

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SUPERVISORS' APPROVAL

This proposal has been developed with our guidance as the supervisors of Gulu University, Faculty of Agriculture and Environment.



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DEDICATION

For everything he has done during my entire education, my dearest uncle Prof. Henry Kerali is honored with this work.

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May God bless Prof. Henry Kerali, Dr. Grace L Kerali, and Prof. Anthony Kerali (R.I.P) for their significant financial support provided to me during my studies. I am extremely grateful to my supervisors, Dr. Labeja Richard Louis and Dr. Kato Stonewall for their advice, time, and valuable comments, as well as for all their efforts to ensure that the research report was completed. I would like to express my gratitude to the academic staff of the Department of Environment of Gulu University for their encouragement, inspiration, and support throughout my entire course. I would also like to thank my beloved parents, Mr. Opio Patrick Robert Kerali (R.I.P), Mrs. Agwokotho Doreen, and Mrs. Celine Ocwi, my brothers and sisters for their advice and encouragement, and may the Almighty God bless them with good health and the ability to live longer. Lastly my sincere and heartfelt thanks go to all my friends especially Anyayo Florence, Okot Peter Byron, Norman Isaac, Etura Ambrose, Kinyera Morris, Joseph Drani, Ayungurwoth Faith, and many others for sharing information and believing in teamwork which has enabled me to submit this research report. I thank all of them for their valuable contributions.

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LIST OF ACRONYM

A.baremoze	*Alestes baremoze*
DRC	Democratic Republic of Congo
GDP	Gross Domestic Product
MAAIF	Ministry of Agriculture, Animal Industry and fisheries
MFNP	Murchison Falls National Park
NBI	Nile Basin Initiative
OC	Operation Commander
PDLG	Pakwach District Local Government
UBOS	Uganda Bureau of Statistics
UK	United Kingdom
UPDF	Uganda Peoples'Defence Forces

ABSTRACT

The study was carriedout between March- May 2022 in Albert Nile on human activities and the conservation of *Alestes baremoze* (*A. baremoze*) locally known as the *Angara* which is one of the highly prized fish species in Uganda. The study was conducted because it was found out that *A.baremoze* is one of the most disturbed and highly threatened fish species by human activities on Albert Nile. The objective of the study was to determine measures to minimize the impacts of human activities on *Alestes baremoze* species on Albert Nile, in Uganda. Qualitative and quantitative designs were used to determine human impacts on *Alestes baremoze* on Albert Nile. Respondents were selected using simple random method. Data was collected using questionnires and key informant interviews. Chi square test was used to compare variables. It was found out that youth contributed to the destruction of *Alestes baremoze* significantly ($P \leq 0.013$) and men (78%) were more actively involved in fishing than women on Albert Nile. Based on the findings, it is recommended that *Alestes baremoze* should be included among fish species that are regulated by the Ugandan law since its facing a serious threat of depletion. There should be affirmative action taken to involve youth fishermen in the conservation of fisheries resources.

CHAPTER ONE: INTRODUCTION

1.1 Background

The fishing industry is a very important source of food security and human nutrition. Global fish consumption has been continuously increasing. Ivan, *et al.,* (2020) for instance shows fisheries and aquaculture as a source of livelihood for 56.6 million people globally. It contributes about 17% of the animal protein to the human population. According to Ivan, *et al.* (2020), the global per capita fish consumption was 20 kg.

In Uganda, the fisheries and aquaculture sector significantly contributes to economic growth. The sector for instance in the financial year 2015-2016 contributed 3% to gross domestic product (GDP), directly employed over 1.2 million people, generated greater than 89 million USD in export earnings, and accounted for up to 50% of animal protein food (MAAIF, 2017). Uganda is richly endowed with natural water bodies, and fisheries play a very important role as a basis for subsistence and commercial livelihood. Lake Victoria is by far the largest and most economically significant of the national fisheries. Other large lakes such as Albert, George, Edward, and Kyoga as well as rivers such as Albert Nile and River Nile also contribute substantially to the annual national fish catch.

Alestes baremoze (*A. baremoze*) locally known as *the Angara* is one of the highly prized fish species in Uganda. It is uniquely endemic to Lake Albert and Albert Nile River and cannot be found elsewhere across the globe (Campbell, 2005). *A. baremoze* forms part of the special dish of the Alur and other West Nile tribes of Uganda. The fish is also of great interest to sport fishing tourists of the Murchison Falls National Park (Kemigisha, et at., 2010). Though Lake Albert and Albert Nile are uniquely the only habitats for *A. baremoze*, they are exposed to multiple

environmental changes including declining fish species diversity, hyper-eutrophication, hypoxia, and reduced fish catches (Wandera & Balirwa, 2010). Mbabazi, *et al.*, (2012) shows that *A. baremoze* fish populations have been subjected to climate changes and fishing pressure since the early 1950s, leading to declining fish population trends. For instance, even though historically *A. baremose* formed the most important commercial fish species in Lake Albert, recent catch assessment surveys between 2007 and 2013 revealed a sweeping decline in their contribution to the commercial catch from 72.7% in 1971 to less than 6% in 2013. Among the fishing community in Lake Albert and Albert Nile, over 50% of the illegal gillnets used target *A. baremoze*. Consequently, small pelagic fish species such as *Brycinus nurse* and *Neobola bredoi* have replaced the once booming *A. baremoze*, contributing to almost 80% of the fish catch on Albert Nile. Overfishing, environmental degradation, and redistribution of surface water have placed great stress on inland fisheries (Balirwa, *et al.*, 2003; Mbabazi, *et al.*, 2012). Human activities usually shift the balance among fish species, causing the extirpation of many indigenous species and the dominance of a reduced set of often introduced fish species. There is therefore a massive reshaping of fish communities in the world's freshwater over the past few centuries, with the pace of change quickening in the tropics. The concentration of people and cities around freshwater systems and increasing human demands for water have led to high levels of degradation and threats to biodiversity in freshwaters (Arthington, Dulvy, Gladstone, & Winfield, 2016). High population growth put increasing pressure on land and water resources as a result of increased land use, land use change, and habitat degradation through sedimentation, pollution, and eutrophication. The expanding population around the lake and fishing villages increase the demand for land for settlement and agriculture, leading to the removal of vegetative cover, wetland drainage, and further loss of habitats and ecosystem health (Biljana, *et al.*, 2016). Pollution from domestic waste

and agricultural inputs contributes to the deterioration of aquatic ecosystem health. Eutrophication supports invasive plants such as water hyacinth which might remain a permanent component of the ecosystem (Ogutu-Ohwayo, 2001).

The conservation of fish biodiversity, particularly *A. baremoze* in Lake Albert and Albert Nile is therefore of paramount concern. Kasozi, *et al.*, (2017) for instance suggest a culture of *A. baremoze* as a strategy for increasing their production. Nakiyende et al., (2013) in gillnet experiments obseve that the three-inch (76.2mm) gillnet mesh size is suitable for a sustained harvest of *A. baremoze.* Accordingly, they suggest that the optimal utilization of *A. baremoze* and probably other non-target fish species can be achievable through species-specific management strategies, coupled with species-specific licensing, and controlling the harvest of juvenile individuals, among others. This study will therefore contribute to addressing conservation gaps for *A. baremoze* in the Albert Nile, particularly in areas bordering the Pakwach District in West Nile, Uganda.

1.2 Problem Statement

The anthropogenic effects on fisheries include widespread catchment disturbance, riparian loss, water pollution, river corridor engineering, dams, and water diversions, extensive wetland drainage, groundwater depletion, aquatic habitat loss and fragmentation, the establishment of introduced alien species, and overfishing (Vörösmarty, *et al.*, 2010). In Albert Nile, a previous study by (Kamugisa *et al.*, 2010) suggests that the decline in *A. baremoze* fish catches could be due to increased fishing pressure from a growing human population, harmful effects of the predatory native *Lates niloticus* (*Nile perch*), and emigration to the protected parts of the Victoria Nile within Murchison Falls National Park. The declining fish species diversity and reduced catches in Albert Nile have forced the fishing communities to resort to poaching in the Murchison Falls National Park (MFNP), at the risk of being shot and killed (Kamugisa *et al.*, 2010). There is

a need to devise strategies for aquaculture and/or conservation of *A. baremoze* in the wild. The establishment of co-management under the 2004 fisheries policy saw the establishment of Beach Management Units to co-manage the fisheries resources with the government in partnership with other stakeholders (MAAIF, 2017). However, the extent to which human activities have influenced the conservation of fish species in Uganda is not established. This study focuses on Albert Nile to determine measures through which anthropogenic impacts on the conservation of *A. baremoze* species can be minimized. It's worth noting that *A. baremoze* is not existing elsewhere across the globe except on Albert Nile in Uganda. Therefore, if not well managed and its habitat not restored, the species will definitely get extinct. The communities will lose its nutritious value and economic benefits.

1.3 Study Objective

1.3.1 General Objective

To determine measures to minimize the impacts of human activities on *Alestes baremoze* species on Albert Nile, in Uganda.

1.3.2 Specific Objectives

1) To determine the anthropogenic impacts on the conservation of *Alestes baremoze* fish species on Albert Nile.
2) To ascertain the conservation methods adopted for the *Alestes baremoze* fish species on Albert Nile, in Uganda
3) To determine the fishers willingness to comply with the conservation methods for the *Alestes baremoze* species on Albert Nile in Uganda.

1.4 Research questions

1) What are the anthropogenic impacts on the conservation of *Alestes baremoze* fish species on Albert Nile?
2) What are the conservation methods adopted for *Alestes baremoze* fish species in Uganda?
3) To what extent are fishers willing to comply with the conservation methods for the *Alestes baremoze* species on Albert Nile in Uganda?

1.5 Significance of the Study

The study findings will inform policymakers at local, regional, and national levels on conservation strategies to minimize the anthropogenic impacts on different fish species. The findings will also provide a benchmark for further research into better ways of conserving fish species and understanding the impacts of human activities particularly *A. baremoze* in Albert Nile.

The findings will provide strategic recommendations that local community resource users, local government and central government will implement to ensure sustainable utilization of *A.baremoze* and other fisheries resource to enhance economic developments and improve community livelihoods.

CHAPTER TWO: LITERATURE REVIEW

2.1 Anthropogenic Impacts on the Conservation of Fish Species

The increase in human population, industrialization, and fertilizers used in agriculture are the major causes of heavy and varied pollution in an aquatic environment, leading to the depletion of aquatic biota (Manjare, Vhanalakar, & Muley, 2010). In Bangladesh for instance, 6,000 large and medium industries and 24,000 small industries were reported to be discharging effluents directly into the rivers without any regard for environmental pollution (Simul, Shafiqul, & Aysha, 2016). Dams and alteration of river flow patterns form one of the clearest threats by directly blocking, damaging, and reducing river and floodplain habitats (Vörösmarty *et al.*, 2010). Artificial lakes are created upstream and the dam wall usually acts as a barrier to upstream and downstream fish and invertebrate migrations, consequently fragmenting meta-populations. Human interventions, such as damming of major rivers and dredging of channels along the estuarine course, might weaken and even disrupt the Eco cline, reducing the original ecological functions, and impairing the sustainable use of estuarine resources and services (Blaber & Barletta, 2016). Shallow near-shore marine ecosystems are changing at an increasing rate due to a range of human activities such as urbanization and commercial development. The growing numbers of constructions and other physical and structural alterations of the shoreline often take place in nursery and spawning habitats of many fish and other aquatic species (Biljana, *et al.*, 2016). The reduction in species in Lake Victoria was attributed to over-exploitation through increased fishing capacity, use of illegal fishing gear, and poor enforcement of regulations (Njiru, Mkumbo, Van, & Der, 2010). According to Balirwa (2012), director of Research for Uganda's National Fisheries Resources Research Institute, the total catch of fish from the Albert Nile has fallen from around 120,000 tonnes per year in the 1990s to less than 60,000 tonnes. He attributes the decline to increasing human

population and in-migration and further states that humans over-fish and yet there is no replenishing plan to increase the fish stocks. The increased human activities around Albert Nile have negativelt impacted on the water quality and the aquatic biota including fishes. The pressure that urban areas impose on freshwater systems is increasing, by their insatiable need to supply water and food for domestic, production and industrial usage, emissions of untreated effluents and storm water runoff, and by the indirect effect of the surrounding infrastructure . Many major towns are located in the upstream of the respective catchments of major freshwaters, and have had profound impact on the aquatic life due to the inefficiency of sewage treatment causing contamination by raw sewage and other effluents. Due to chronic deficit of sanitation infrastructure across the entire river system, the problem of river contamination is likely to grow and become an important threat to the fish fauna. Additionally, the lake shores are being reclaimed for urban development, greatly affecting very sensitive habitats that harbor a large proportion of endemic fishes and decreasing the quality of several habitats (Reis, *et al.*, 2016) . Additionally, the discovery of oil and gas in the Albert Graben will have a potential impact and threat to the Albert Nile, its diverse fish species, and its fishery (Balirwa & John, 2010). Effects of human activities are shown as widespread catchment disturbance, deforestation, riparian loss, water pollution, dams and water diversions, extensive wetland drainage, groundwater depletion, aquatic habitat loss and fragmentation, establishment of introduced alien species, and overfishing (Angela, *et al.*, 2016)

2.2 Conservation Strategies for Fish Species in the Marine Environment

Fished populations can be rehabilitated by applying appropriate regulations such as catch-and-release, no-take zones in critical areas for breeding and recruitment, and even managed relocation and reintroductions (Cooke & Schramm, 2007). Recovery programs range from individual species to the fauna of entire river basins. In the UK, the conservation of vend ace and whitefish

(considered the rarest freshwater fishes) has involved the protection and improvement of their habitats and the establishment of a refuge population (Arthington, Dulvy, Gladstone, & Winfield, 2016). The Indian Fisheries Act of 1897 (modified in 1956) is a landmark in the conservation of fish (Singh & Akhtar, 2015). Besides the provision to monitor gears, mesh size, and observance of fishing or closed seasons, the Act also prohibits the use of explosives or poisons to indiscriminately kill fish in any water. Eyo & Akpatil, (1995) show that fishing gear subsidization and mechanization, fishing gear regulation, and adaptable fishing craft development are areas of limitations among other development of the Nigerian capture fisheries sector. Adeleke, Deborah, Moodley, & Simon (2020) reported that some countries such as Uganda, Nigeria, and Egypt have developed and adopted aquaculture-centered policies and strategic frameworks as a roadmap to guide development. Protection measures that fulfill conservation objectives include state-wide prohibitions on the taking of vulnerable species and state-wide bans on the use of destructive fishing gears, for example, scallop dredges, poisons, and explosives. Other types of measures that are designed for conservation purposes include the protection of important nursery and spawning habitats, the protection of threatened habitats (for example, intertidal reef communities), and the protection of habitats of vulnerable species (Bunting, 2001). In Uganda policy and regulatory measures are in place, including Fisheries Policy (2004) and the Fish Act, Cap. 197 (2000). The management of Albert Nile falls under the Ministry of Agriculture, Animal Industry, and Fisheries (MAAIF). MAAIF has a Department of Fisheries Resources which is responsible for regulation, law enforcement, and fisheries management services. Conservation measures help to protect species-rich habitats and threatened endemic species. Human activities and stressors that increasingly threaten freshwater fishes must be curbed to avoid a wave of extinctions. Freshwater recovery programmes range from plans for individual species to recovery of entire aquatic life.

Reducing risks to threatened fresh water species in aquatic habitats also requires conservation actions at multiple scales. Most of the world's larger economically important fisheries are relatively well-monitored and well-managed to minimize catch of the most endangered species in both realms (Arthington, Dulvy, Gladstone, & Winfield, Fish conservation in freshwater and marine realms: status,threats, 2016).

2.3 Compliance with Conservation Methods for Fish in Uganda

Achieving compliance in fisheries resource is challenging where enforcement capacity is limited and the incentives for rule-breaking are strong. MacKeracher, *et al.,* (2021) for instance shows that in Myannmar resource-dependent communities, improving compliance for effective resource conservation requires addressing broader issues of poverty, food security and the lack of alternatives. In Central Ghana, a study on the quality of compliance suggests that non compliance in fisheries may also be influeneced by economic and self interested motivations including a combination of social, political and environmental factors (Victor, Kofi, & Sender, 2023). Likwise, in Lake Victoria a study on enhancing compliance with fisheries regulation shows that existing economic environment and weak enforcement contribute to the low compliance (Etiegni, Ostrovskaya, Leentvaar, & Eizinga, 2011).

CHAPTER THREE: MATERIALS AND METHODS

3.1 Study Area

The study was conducted in the upper part of Albert Nile, Pakwach District in three sub-counties of Pakwach, Panyimur, and Dei. Pakwach District lies between altitude of 2,289'ft to 5,224'ft above sea level. The district's annual average temperature is 25.76°C (78.37°F) and typically receives bimodal rainfall of about 221.4 millimeters (8.72 inches) of precipitation per annum.The area is characterized by a Tropical wet and dry or savanna climate (Balye, 2022). The major economic activities in the district are fishing, agriculture, blacksmitting, and trade (Odokpou & Hillary, 2019). The poverty level of WestNile Sub Region in which Pakwach District is located is at 16.9% (UBOS, 2020). The household population of Pakwach District is estimated at 196,800. The coordinates of Pakwach are 2°27'43.0"N, 31°29'54.0"E (Figure 1).

The Albert Nile is located in the North Western part of Uganda. It flows 210 km from the north end of the Victoria Nile into the South Sudanese border at Nimule ,where it becomes the AL-Jabal River (McKenna, 2012) . It flows through Murchison falls National Park and devides the park into northern and southern sections. The Murchison Falls National park is used as a conservation site for *A. baremoze* because fishing is restricted in the area and the water is calm with no much human disturbance, making it a suitable breeding and multiplication ground for *Alestes baremoze.* The Albert Nile is important for fisheries mainly for the people living around the lake. Unique to it is *Alestes Baremoze* fish species. Other fish species in Albert Nile are *tilapia, Niger barb, Albert lates, electric catfish, giraffe catfish, elongate tiger fish, African tiger fish, marbled lungfish, Cornish jack, Bagrus docmak, African sharp tooth catfish*. The total annual fish catch is estimated at 31,384.8 tonnes (NBI, 2020).

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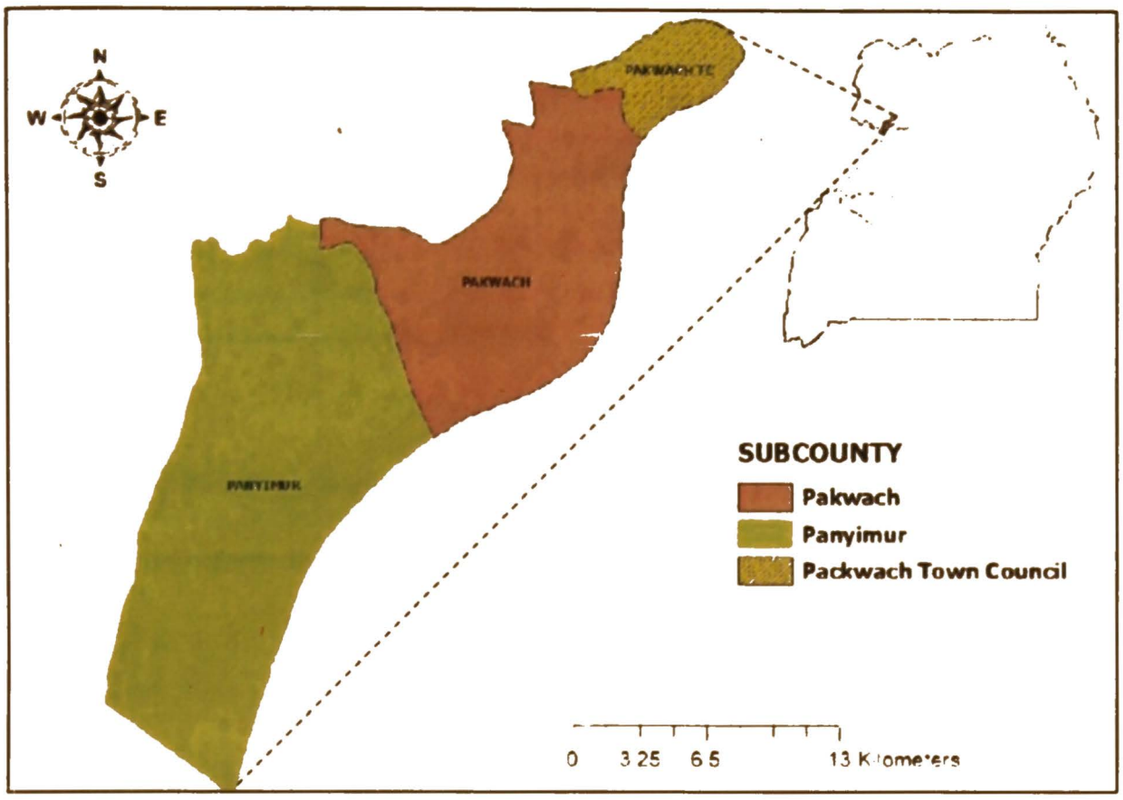


Figure 1: Map of Pakwach District Zoomed from Map of Uganda showing the three study sub-counties.

3.2 Study Design

A cross – sectorial study design was adopted involving the collection of both quantitative and qualitative data. Quantative data was collected from the study households and analysed using both descriptive and inferential statistics. Qualitative data were collected from the key informant and used to triangulate information generated from the quantitative data.

3.3 Sampling and Sample Size Determination

Simple random sampling approach was used to select fishing households. This was to give equal chances to all the households in each study village to participate in the study. The purposive sampling approach was used to select the study key informants. The criteria for purposive selection was based on their knowledge and experience on the subject matter. The key informants included

the area local councils I,II and IIIs, the Evironment and Fisheries Officers from Pakwach District Local Government, The Subcounty Fisheries Officers, the Operation Commander (OC) for the Fisheries Protection Unit of Uganda Peoples Defence Forces.

The appropriate representative sample size was determined using Krejcie and Morgan table (1970) derived basing on the following formula:

$$S = X^2NP(1-P) + d^2(N-1) + X^2P(1-P)$$

S = required sample size; X^2 = the table value of Chi-Square for 1 degree of freedom at the desired confidence level (3.841); N = the population size; P = the population proportion (assumed to be 0.5 since this would provide the maximum sample size); and d = the degree of accuracy expressed as a proportion (0.5). The household population (N) of Pakwach District is 196,800 (UBOS, 2020). Therefore, the target sample size was 382 households. However, only 377 households were interviewed and the remaining 5 households did not consent to participate in the study.

Multistage sampling was used to select the study villages. Accordingly, three sub-counties including Pakwach, Panyimur and Dei were chosen from Pakwach District because they have villages which are hotspots for *Alestes baremoze.* Four parishes were then chosen from each of the 3 sub-counties totaling to 12 study parishes. The choice of the four study parishes was due to their proximity to the Albert Nile and hotspots to *Alestes baremoze.* Three villages were selected from each of the 12 parishes making a total of 36 study villages. The target sample size were therefore equally rationed among the 36 study villages.

3.4 Data Collection Methods

The study household data were collected using questionnaires administered through face-to-face interview. Research assistants who administered the questionnaire were first trained to ensure quality data collection process. The questionnaire were then pre-tested after the training at household level prior to data collection. The household heads were interviewed and where household head was not available, the eledest person above the age of 18 years was interviewed. Consent forms were filled by all respondents prior to administering a questionnaire. Observation was applied to collect information that could not be obtained through interviews. Key informant interview guides were used to collect information from key informants given their knowledge and experience of *Alestes baremoze* and the study area. The key informant interviews were conducted to validate and triangulate information obtained from the fishing households survey. Secondary data was obtained through literature review of relevant and similar studies on *Alestes baremoze* and fish conservation measures.

3.5 Data Analysis and Management

The data was coded, tallied and analysed using Statistical Package for Social Scientists (SPSS) software. Descriptive statistics were generated and displayed in a tabular format as frequencies and percentages. Inferential Chi-Square statistic was used to test the relationship between the socio-demographic characteristics; adoption of conservation measures for *Alestes baremoze*; and respondents willingness to comply with the legal and policy measures for the conservation of *Alestes baremoze*. The Chi-Square p values were generated at 0.05 significant level to test the degree of significance in a relationship to derive a conclusion. Qualitative data were summarized using content analysis method and used to triangulate the information generated from quantitative data.

3.6 Research Dissemination Plan

The research findings was published in a peer-reviewed journal. Likewise, a policy brief was generated from the report to inform the local community through local council meetings at the sub-county and district levels. The researcher made effort to present the findings personally at the said council meetings after being granted permission.

3.7 Ethical Consideration

The researcher ensured that consent was obtained from all the respondents and anonymity observed. Furthermore, confidentiality was ensured in that information offered by the respondent was not to be passed on to another party without the consent of the respondent. Honesty and integrity were paramount as the researcher ensured that the right methods were used, and right data was presented without bias whether good or bad.

CHAPTER FOUR: PRESENTATION OF STUDY RESULTS

4.1 Socio-demographic Characteristics

Table 1 shows socio-demographic characteristic of respondents. Seventy-eight percent of the respondents were males and 21 were female. Most of the respondents (55%) were youth. The majority (43%) either did not get any formal education or attained only a primary education level. The most common religious group was Christian (88%), and the Alur tribe was not only the majority of the respondents interviewed but also the dominant tribe in the study area.

Table 1: Socio-demographic characteristics of respondents

Categories	Number (N=377)	Percent (%)
Sex		
Male	296	78
Female	81	21
Age of the respondents		
Youth (18-35 yrs)	207	55
Adults (36-50 yrs)	100	26
Elders (above 50 yrs)	70	19
Education Level		
Non & Primary	161	43
Secondary	142	38
Tertiary	74	20
Religion		
Christians	332	88
Moslem	41	11
Local Tradition	4	1
Tribe		
Alur	238	63
Jonam	108	29
Madi	12	3
Others (very minority presence)	19	5

4.2 Factors Affecting Conservation of *Alestes baremoze* on the Albert Nile

Table 2 shows effects of Human Activities on *Alestes baremoze* fish species on Albert Nile. Most respondents reported a decrease in human activities affecting the conservation of *Alestes baremoze* species on the Albert Nile. The human activities most cited as reducing include: the use of poor fishing gear (93%), catchment disturbance through quarrying (88%), immature fishing (87%), demand for *Alestes baremoze* (83%), poor fishing method (86%), Use of non-biodegradable fishing equipment like the monofilament plastic nets (81%), and Use of chemicals and pesticides (81%). However, the activities most cited to be increasing include urban/agricultural/sewage runoff (34%) and oil/fuel spills (49%) . The human activities cited impose varying effects on the conservation of *Alestes baremoze* species on the Albert Nile directly through overfishing or affecting the ecosystem and the survival of the fish species.

Table 2: Effects of Human Activities on *Alestes baremoze* fish species on Albert Nile

Variables/issues	Reduced		Increased	
	Frequency (N = 377)	%	Frequency (N = 377)	%
Immature fishing	328	87	49	13
Use of poor fishing gear	353	93	24	6
Overfishing	295	78	82	22
Contamination with pesticides and other chemicals	301	80	76	20
Demand/preference for *Alestes baremoze* fish species	312	83	65	17
Use of chemicals and pesticides	308	81	69	18
Quarrying, sand mining in the catchment (disturbance)	332	88	45	12
Urban/Agricultural/sewage runoffs	250	66	127	34
Settlements	291	77	86	23
Oil and fuel spills from the motorized boats	193	51	184	49
Use of bright solar light bulbs	294	78	83	22
Use of non-biodegradable fishing equipment like the monofilament plastic nets	306	81	71	19
Poor fishing methods	325	86	52	14
Industrialization	288	76	89	24
Noise from the water transport vessels	301	80	76	20
Waste disposal into the water bodies causes eutrophication	197	52	180	48
Size of fishing gear like hooks, nets, baskets	312	83	65	17

4.3 Conservation Measures Adopted for *Alestes Baremoze* on Albert Nile

Table 3 shows Conservation measures adopted for *Alestes baremoze* in Albert Nile. In-situ conservation measures for *Alestes baremoze* include fish cages, closed seasoning, recommended fishing gear, water zoning, fish lagoons, selective fishing to mention but a few. The conservation measures most adopted by the fishermen in the Albert Nile were selective fishing (57), legal hook sizes (54), controlled fishing (52), recommended boat size (50), and water zoning (45). Closed seasoning (3) and fish lagoons (1) were the least adopted conservation measures for the *Alestes baremoze* in the Albert Nile.

Table 3: Conservation measures adopted by the fishermen for *Alestes baremoze* in Albert Nile

Variables	Frequency (N = 377)	%
Fish ponds	65	17
Fish Cage	88	23
Closed seasoning	10	3
Fish lagoons	5	1
Legal hooks sizes ranging from 10 and above	205	54
Recommended boat size (above 28 feet)	190	50
Fishing at least 2 miles away from the shoreline (fish breeding areas)	97	26
Water zoning	171	45
Selective fishing	214	57
Controlled fishing	198	52
Supplemental feeding	135	36

Table 4 shows the influence of socio-demographic characteristics on fisher adoption of the conservation measures for the *Alestes baremoze* species in the Albert Nile. There was a significant relationship between the adoptions of fish lagoons (P=0.018 P), legal hooks sizes (P=0.022), fish stocking (P=0.032), restocking (P=0.046), and the education level of the respondents (Table 4). Likewise, there was a significant relationship between the use of recommended fishing gear and the age group (P=0.013). The results show that the respondents with a higher level of education were more likely to adopt the conservation measures for the *Alestes baremoze* species in the Albert Nile than those with a lower level or none. The use of recommended fishing gear was more common among the adults and elders than the youths for *Alestes baremoze* species in the Albert Nile.

Table 4: Socio-demographic characteristics and adoption of conservation measures for *Alestes baremoze* in Albert Nile

Variables	Gender		Age Group		Education Level	
	Chi^2	P Value	Chi^2	P Value	Chi^2	P Value
Fish ponds	0.00	0.964	2.14	0.343	1.41	0.494
Fish Cage	0.50	0.480	0.80	0.669	4.72	0.094
Closed seasoning	0.02	0.889	1.20	0.549	2.15	0.342
Fish lagoons	3.32	0.068	1.19	0.551	8.01	0.018*
Fish size limits	0.16	0.693	8.64	0.013*	0.54	0.762
Gear restrictions	0.74	0.391	0.11	0.947	7.60	0.022*
Recommended boat size (above 28 feet)	0.01	0.926	1.32	0.518	4.97	0.083
Fishing at least 2 miles away from the shoreline (fish breeding areas)	2.14	0.144	0.51	0.775	0.15	0.929
Water zoning	1.11	0.292	1.07	0.585	4.58	0.101
Catch limits	1.75	0.186	0.91	0.634	6.86	0.032*
Controlled fishing	0.03	0.853	0.47	0.790	6.17	0.046*
Closed seasons	1.08	0.299	0.48	0.788	3.15	0.208

*Significant ($P<0.05$)

4.4 Compliance with the Legal and policy Measures for Fish Species Conservation

The compliance by fishers to legal and policy measures for the conservation of fish species in the Albert Nile was as in the respondents' willingness to abide by those measures (Table 5). The legal and policy measures that the respondents were most willing to comply with include legal/recommended hooks (57%), catching fish sizes of at least 4 inches and above (54%), the ban on kokota sail nets (47%), and use of pressure lamps (45%) among others. However, only 6% of the respondents were willing to comply with the policy to reduce the number of boats on the Albert Nile (Table 5).

Table 5: Respondents' willingness to comply with the legal and policy measures for the conservation of fish species measures on Albert Nile

Variables	Frequency (N = 377)	%
Registration and licensing of fishing vessels by the competent authority	117	31
Use of legal/recommended hooks (sizes 10 and above)	214	57
Use of gill nets of 4 inches and above	167	44
Use of pressure lamps	169	45
Fishing at least 2 miles from the fish breeding areas	138	37
Catching fish sizes of at least 4 inches and above	204	54
Licensing fishmongers and sellers	163	43
Reducing the number of boats	23	6
Ban on the use of lampara nets	155	41
Ban on the use of monofilaments	91	24
Ban on the use of kokota sail nets	178	47
Ban on the use of bright solar bulbs for night fishing	148	39

Table 6 shows the sociodemographic characteristics of respondents that influence compliance with or willingness to observe the legal and policy conservation measures for the fish species in the Albert Nile. There was a significant relationship between the willingness to register and license fishing vessels (P=0.005), license fish mongers and sellers (P=0.041), observing a ban on the use of lampara nets (P=0.042), and the respondents' age group. The gender of respondents was significantly related to willingness to comply with the policy on catching fish sizes of at least 4 inches and above (P=0.030) and observation of the ban on monofilaments (P=0.028). The education level of respondents was also significantly related to attending sensitization meetings (P=0.014) and the willingness to comply with the policy on catching fish sizes of at least 4 inches and above (P=0.016).

Table 6 : Socio-demographic characteristics and respondents' willingness to comply with the legal and policy measures for the conservation of fish species on Albert Nile

Variables	Gender		Age Group		Education Levels	
	Chi^2	P Value	Chi^2	P Value	Chi^2	P Value
Registration and licensing of fishing vessels	0.09	0.765	10.77	0.005*	5.09	0.079
Use of the recommended fishing vessels	1.43	0.232	0.03	0.985	2.13	0.345
Attending sensitization meetings	0.69	0.406	2.72	0.256	8.55	0.014*
Use of legal/recommended hooks (sizes 10 and above)	0.02	0.892	4.31	0.116	3.45	0.178
Use of gill nets of 4 inches and above	0.19	0.911	0.88	0.928	2.01	0.733
Use of pressure lamps	0.69	0.407	0.36	0.835	1.46	0.482
Fishing at least 2 miles from the fish breeding areas	3.22	0.200	6.30	0.178	1.37	0.849
Catching fish sizes of at least 4 inches and above	6.99	0.030*	3.93	0.415	12.17	0.016*
Licensing fishmongers and sellers	1.78	0.183	6.41	0.041*	4.29	0.117
Reducing the number of boats	0.70	0.403	1.63	0.444	5.14	0.077
Ban on the use of lampara nets	0.08	0.783	6.33	0.042*	3.43	0.180
Ban on the use of monofilaments	4.82	0.028*	1.20	0.550	0.98	0.613
Ban on the use of kokota saine nets	1.57	0.210	1.26	0.533	2.10	0.349

*Significant ($P<0.05$)

CHAPTER FIVE: DISCUSSION

5.1 Factors Affecting Conservation of *Alestes Baremoze* Species

The anthropogenic factors affecting conservation of *Alestes baremoze* was modled using descriptive statistical design and the findings are discussed. Fishermen used poor fishing gears to capture *Alestes baremoze* fish species. The commonly used poor fishing gears included; monofilament plastics, *Kokota* seine nets and hooks. The hooks cause injury on *Alestes Baremoze* affecting its quality. Seine nets sweep all types of aquatic biodiversity, including floating vegetation where *Alestes baremoze* breed causing disruption in spawning. The use of monofilament plastics cause aquatic pollution, navigational hazards, alterations of the benthic environments and introduction of synthetic material into aquatic food web. The desire to use poor fishing gears by fishermen was due to the high demand for *Alestes baremoze* in the Albert Nile. This could be because food and income are the most common motivations for *Alestes baremoze* fishing in Albert Nile. This finding agrees with previous study by Tracy Mackeracher, 2010 on understanding non-compliance in small-scale fisheries which suggest that "the desire to meet basic needs can be a strong driver of illegal behaviour in communities dealing with poverty -particularly if there are few legal marine-based alternatives that provide similar financial profits". The finding also agrees with related studies by Mullainathan and Shafir 2013, which suggest that "the immediate drive to meet short term survival needs may limit fishers' capacity to consider the long-term effects of their actions".

However, due to implementation of legislation by the Fisheries Protection Unit of the Uganda Fisheries Protection Force (UPDF), the use of poor fishing gears reduced in Pakwach, Panyimur and Dei Subcounties. This result is consistent with findings from Vijayan *et al.*,(2000) which report a reduction in the use of poor fishing through enforcement of regulation on mesh sizes among

fishermen in Kerala state, India. A related study of impacts of fishing pressure on Nile perch fishery on Lake Victoria by Katurole and Wadanya (2000) agrees with the above results which states "that the use of gillnets of less than 127 mm (5 inches) and "other poor fishing gears" for Nile perch should be prohibited. Apart from catching high proportions of immature and illegal sized Nile perch, some of them ("other gears") also disrupt the biological and ecological processes of the fishery during their operation".

This is attributed to the sensitization of fishermen in Albert Nile on the need to use recommended fishing gears such as gill nets of 4.5 inches and above which only captures mature *Alestes baremoze.*

Findings from the study also revealed that immature fishing has reduced on Albert Nile. The high prevalence of poverty in the area was a driving force for immature fishing. Most *Alestes baremoze* on the market were ranging from 18-20 cm in length yet a matured *Alestes baremoze* should be 40-43 cm in length (Kasozi, Degu, Asizua, Mukalazi, & Kalany, 2014). However, a reduction in immature fising was possible with the licensing of fishermen to operate on Albert Nile. This measure reduced on the number seine nets that are notorious in the capture of immature *Alestes baremoze.*

The finding also agrees with previous study by Tesfahun (2018) which stated that human factors, such as fishing effort decide the catch volume and size distribution of the catch and also influence the size of the fish caught in Lake Koka, Central Rift Valley in Ethiopia. This is attributed to the strength of the committee members of the Beach Management Unit who are the grassroot controllers of all activities happening on Albert Nile. It also implies that the fishermen are compliant to the existing laws and regulations of management of aquatic resources to control immature fishing because it affects fish spawning and sustainability.

Results also indicate that the *Alestes baremoze* was present in less disturbed habitats. This finding has been observed in other studies conducted by Crislei *et al.,* (2022) which evaluated human pressure on aquatic environments stating that the structure of fish assemblage was affected by catchment disturbance. Agricultural land use in catchments generally modifies the substrate composition, reducing the presence of pebbles and gravel and increasing sedimentation. Such changes in the substrate lead to the predominance of soft bottoms in streams which alters species composition of *Alestes baremoze* (Crislei, Bruna, Mayara, & Rosilene, 2022). This can be attributed to the intense use of fertilizers, herbicides, and pesticides which have severe impact on the ecology of freshwater systems and represent a significant threat to the existence of highly sensitive fish species like *Alestes baremoze* (Van den Brink *et al.,* 2006).

Results also indicate that noise pollution from motorized boats had an impact on *Alestes baremose.* Excessive noise causes vibration and makes the water less suitable for *Alestes baremoze.* This finding agrees with other studies by Steven J. Cookea (2006) which states that noise leads to disappearance and depletion of *Alestes baremoze.*

5.2 Conservation Measures Adopted for the *Alestes baremoze* on the Albert Nile

Conservation success is often predicated on local support for conservation which is strongly influenced by perceptions of the impacts that are experienced by local communities and opinions of management and governance. The findings presented a significant relationship between level of education and the adoption of fishing lagoon, gear restrictions, catch limits and controlled fishing. The adoption of these measures were highest among educated people than the non educated ones. This could be because education is one of the most powerful human capacity tools that have a bearing on adoption of conservation measures. This finding agrees with other studies carried out by Busisiwe *et al.,* (2022) in KwaZulu-Natal, South Africa which suggests that

farmers' educational background becomes an important element that determines the readiness to accept and properly apply technologies. Majority of the respondents either attended primary education or non, implying that there was a low level of education among the fishing household heads and that low level of education increases the possibility of a fishers' rejection of emerging conservation measures which can lead to continuous depletion of *Alestes baremoze.*

Results also showed only one significant relationship between age group and the adoption of fish size limits and conservation measure while majority of the variables presented insignificant relationships with age group. The plausible reason might be that young people are more receptive to new conservation measures and ideal than the older fishermen. Older people who are already used to a particular way of doing things may not be interested in emerging conservation measures. This agrees with Busisiwe *et al.,* (2022) that indicate that long-term conservation investments and age are inversely related and that being older created a conservative feeling among farmers and hence resistance to change. This may imply the excess of workforce for implementing new conservation measures. Young fishers should be the main target of conservation to ensure a successful implementation of complex conservation measures.

5.3 Compliance with the Legal and policy Measures for Conservation of *Alestes baremoze*

This study showed that fishermen on Albert Nile greatly benefited from the *Alestes baremoze* and other fish species and had positive attitudes towards its conservation. The fishers willingness to comply with the conservation measures were, however, influenced by the socio-demographic characteristics. Findings indicated that the elderly persons (>45 years) responded more positively to conservation measures than the youth groups (Table 6). This could be because younger fisherermen might be more willing to fish illegally as a means to earn the income necessary to

pursue alternative livelihood opportunities. Results also indicate that respondents age group had a significant relationship with the willingness to register and license fishing vessels and the ban on lampara nets. This could be because the elderly depended more on fishing as their major economic activity compared to the youth. This finding agrees with previous study done by Oonyu (2009) which suggeste that more of the older people appreciated conservation programs more than the youth in the management of game resources.

This study has also shown that in Albert Nile, there is significant relationship between compliance with catching recommended fish sizes (20-25cm for *Alestes baremose*) and the ban on monofilament plastics among male respondents compared to the female respondents. This coud be attributed to more males engaging in the fishing activity because fishing is physically straining for women and requires fishers to be away from home for longer periods of time. Majority of the women however were engaged as fish mongers around Albert Nile and played a key role in the sale of *Alestes baremose* and other fish species.

On the importance of aquatic resources, findings indicate that the local communities greatly depended on the Fisheries resources for their livelihoods. This dependence might have partly been responsible for the greater conservation awareness among the fishermen as reported by Oonyu (2001), and their positive attitudes towards the conservation of the *Alestes baremoze* and other fish species because *Alestes baremoze* is the most preferred fish species of the Alur and only unique to Albert Nile in Uganda. It is evident, however, that not all fishermen around Albert Nile had positive attitudes toward the conservation measures being carried out by the Ugandan Government. For instance, some fishermen along Albert Nile in Pakwach and Dei subcounties had negative attitudes towards conservation programs due to the impoundment and arrests of illegal fishing

gears by the fisheries protection force. This created fear and luck of trust in any governemnet initiatives.

It was also noted that the youth, who were often better educated, valued the fisheries resources because of their direct economic benefits. This finding is contrary to that of Parry and Campbell (1992) who found that peoples' level of education had no effect on attitudes toward conservation of wild animals in Chobe National Park, Botswana. This difference could be because the most important factor that influenced attitudes of local communities in Chobe was problems from wild animals, whereas in Albert Nile, local people were more concerned with conservation of fisheries resource for their livelihood. From the findings of this study, people with low or no formal educational background were generally fishermen who sought to expand their capacities to fish and to have access to the fisheries resources. As a result, many, particularly those in the fishing villages, perceived the conservation measures as a threat to their activities.



CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

Human impacts have influenced the survival of Alestes baremoze tremendouslyin Albert Nile. Foe example, the fish population have been depleted over the last ten (10) years. The conservation measures adopted for *Alestes Baremose* were selective fishing, legal hook sizes, controlled fishing, recommended boat size, and water zoning. The fishermen on Albert Nile were willing to comply with the conservation measures however, the elderly showed more willingness to comply compared to other age groups, specifically the youths. The study will contribute to the pool of knowledge on conservation of *Alestes baremoze* in Albert Nile. In exploring the fishermens' adoption of conservation measures and compliance towards *Alestes baremoze* fishing regulations, the study revealed that rudimentary methods of fishing was common in Albert Nile, and that the level of fishing activity was beyond the capacity of local communities (what can be feasibly monitored by local communities). While sensitization can contribute to improving awareness and compliance, ensuring compliance over the long term will likely require addressing broader issues of poverty and food security in the Albert Nile areas.

6.2 Recommendations

6.2.1 Recommendation to the Local Fishermen and Leaders

i. Government should develop and implement law enforcement strategy to ensure fishermen along the Albert Nile should reduce illegal fishing through catch documentation and the use of recommended fishing gears. Catch documentation schemes (CDS) play a valuable role in mitigating illegal, unreported, and unregulated fishing. When implemented fully, these schemes help ensure that catch is legal and traceable.

ii. A restoration, rehabilitation and restocking programs should be developed and implemented

iii. The fishermen should operate under the mandates of the fisheries protection unit to conserve and rebuild fish stocks; they must adopt requirements for Conservation measure and not let fish trade issues take precedence over the primary goal of fish sustainability.

iv. The local leaders along Albert Nile should take precautionary approaches and develop standards that are more transparent and conservative to help in the adoption of conservation measures. These may include measures to recover depleted fish stocks such as fishing restrictions, and management objectives that ensure that fish stocks are sustainably managed.

v. Develop and implement standard operational procedures for fishing *A.baremoze*

vi. The local Authorities (Pakwach DLG) should recognize the importance of shore to shore fishing vessel tracking as a key instrument for monitoring, control, and surveillance of fishing activities. In addition, the district authorities should strengthen and accelerate efforts to enact and implement effective vessel monitoring scheme requirements while fostering regional approaches to support management of shared resources because there is transboundary issues between Uganda and Democratic Republic of Congo in Pakwach District.

vii. The Youth should actively participate in sensitization measures to improve on their knowledge and skills on the need to conserve fish species by adopting good fishing methods such as use of recommended gill nets for *Alestes baremoze.*

6.2.2 Policy Recommendations

- MAIF to include *Alestes baremoze* among fish species that should be recognized and regulated by the Ugandan law since its facing a threat of depletion
- Pakwach District Local Government to develop an ordinance and by laws on the conservation of *Alestes baremoze.*

6.2.3 Recommendation for further Studies

- Topics such as biology of *Alestes baremoze*, success rate for artificial multiplication should be explored in future to increase breeding of *Alestes baremoze*, fish pond for *Alestes baremoze* should be some areas of research by academicians.
- Future research should focus on exploring the willingness and ability of communities to engage with alternative livelihood opportunities that align with local values and needs. Ultimately, the insights gained from this study can provide guidance to inform the development of strategies to benefit *Alestes baremoze* and communities along the Albert Nile.

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APPENDICES

Appendix I: Data Collection Tools

QUESTIONNAIRE

SECTION A: BIODATA

1	GENDER *(Please tick)*	Male	Female			
2	AGE *(Please tick)*	Below 18	19-38	39-48	49-58	Above 59
3	EDUCATION LEVEL *(Please tick)*	Certificate	Diploma	Degree	Master's Degree	Others (Specify)
4	RELIGION *(Please tick)*	Catholic	Anglican	Muslim	Pentecostal	Others (Specify)
5	TRIBE *(Please tick)*	Alur	Jonam	Madi	Others (Specify)	

SECTION B: ANTHROPOGENIC IMPACTS ON THE CONSERVATION OF *ALESTES BAREMOZE* ON ALBERT NILE

6	Immature fishing has reduced in Albert Nile as a result of Licensing and revocation of licenses. *(Please tick)*	Yes	No
7	The use of poor fishing gear has been reduced as a result of monitoring by the Fisheries protection force. *(Please tick)*	Yes	No

APPENDICES

Appendix I: Data Collection Tools

QUESTIONNAIRE

SECTION A: BIODATA

1	GENDER *(Please tick)*	Male	Female			
2	AGE *(Please tick)*	Below 18	19-38	39-48	49-58	Above 59
3	EDUCATION LEVEL *(Please tick)*	Certificate	Diploma	Degree	Master's Degree	Others (Specify)
4	RELIGION *(Please tick)*	Catholic	Anglican	Muslim	Pentecostal	Others (Specify)
5	TRIBE *(Please tick)*	Alur	Jonam	Madi	Others (Specify)	

SECTION B: ANTHROPOGENIC IMPACTS ON THE CONSERVATION OF *ALESTES BAREMOZE* ON ALBERT NILE

6	Immature fishing has reduced in Albert Nile as a result of Licensing and revocation of licenses. *(Please tick)*	Yes	No
7	The use of poor fishing gear has been reduced as a result of monitoring by the Fisheries protection force. *(Please tick)*	Yes	No

8	Overfishing on Albert Nile has reduced as a result of the Aquaculture introduction as an alternative source of fishing. *(Please tick)*	Yes	No
9	Pollution & oil spills on Albert Nile have reduced as a result of appropriate legislation and policies hence the protection of *Alestes baremoze*. *(Please tick)*	Yes	No
10	Contamination of Albert Nile with pesticides and other chemicals has reduced as a result of sensitization of the fishing community. *(Please tick)*	Yes	No
11	Irrigation activities on Albert Nile have been reduced due to continuous monitoring of marine services. (Please tick)	Yes	No

SECTION C: CONSERVATION METHODS ADOPTED FOR THE FISH SPECIES ON ALBERT NILE

12. Are there conservation methods of *Alestes baremoze* adopted? Yes ☐ No ☐

13. If yes, what methods are being adopted to conserve *Alestes baremoze* on Albert Nile?

_____

14. If no, why?

_____

SECTION D: DETERMINE THE FISHERS' WILLINGNESS TO COMPLY WITH THE CONSERVATION METHODS FOR THE FISH SPECIES ON ALBERT NILE

15		Yes	No

	Do fishers follow the laws, and policies established in regards to fishing in Albert Nile? *(Please tick)*		
16	Are all the fishing vessels used in Albert Nile registered and licensed by the competent authority? *(Please tick)*	Yes	No
17	Do fishers use the recommended fishing vessels at all times during fishing in Albert Nile? *(Please tick)*	Yes	No
18	Is there an adequate sensitization on good fishing practices which has helped to conserve *Alestes baremoze* stocks in Albert Nile? *(Please tick)*	Yes	No
19	Do fishers on Albert Nile cooperate with the activities of the Fisheries protection force? *(Please tick)*	Yes	No

SECTION E: GENERAL ISSUES IN THE CONSERVATION OF FISH SPECIES

20	Is *Alestes baremoze* the preferred fish species in Albert Nile? *(Please tick)*	Yes	No

21. If yes, please state why it is preferred?

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22. If no, why?

Appendix II: Key Informant Interview Guide

INTRODUCTION

This interview aims to identify human activities that are impacting the conservation of *Alestes Baremoze* in the Albert Nile. This interview will focus on the conservation of *Alestes baremoze* species in Albert Nile, the fisher's willingness to comply with the conservation methods, and how human activities have generally affected the conservation of *Alestes baremoze* in Albert Nile in Uganda. This interview will take a maximum of 20 minutes and the respondent will not be compensated for the time spent.

SECTION A: BACKGROUND

1) What is your current position? _____

2) What is your current place of work or institution? _____

3) Which department do you represent? _____

SECTION B: ANTHROPOGENIC IMPACTS ON THE CONSERVATION OF *ALESTES BAREMOZE* ON ALBERT NILE

1) State the human activities that adversely affect the conservation of fish species.

_____

2) Can you explain how each human activity has affected the conservation of fish species?

_____

SECTION C: CONSERVATION METHODS ADOPTED FOR THE *ALESTES baremoze* ON LAKE ALBERT

3) Are there conservation methods *for Alestes baremoze* established in Albert Nile in Uganda?

_____

4) Who in your view is (are) responsible for the conservation of *Alestes baremoze* on Albert Nile?

SECTION D: DETERMINE THE FISHERS' WILLINGNESS TO COMPLY WITH THE CONSERVATION METHODS FOR THE *ALESTES BAREMOZE* ON ALBERT NILE

5) Are fishers willing to comply with conservation methods for *Alestes baremoze* on Albert Nile?

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6) If No, why do you think fishers are non-compliant with the conservation methods?

Appendix II: Informed Consent

Informed consent Form for QUESTIONNAIRES.

Title of the study: *Human activities and conservation of Alestes baremoze species on Albert Nile, Uganda.*

Investigator(s): Titirach Scovia Kerali

Institution(s): Gulu University

Introduction

I am Titirach Scovia Kerali, a student of Gulu University pursuing Masters of Science in Environmental Science and Natural resources Management, carrying out a study on *Human activities and conservation of Alestes baremose species on albert Nile, Uganda.* Your participation

in this study is voluntary. It is up to you to decide whether or not to take part in this study. If you decide to take part in this study, you will be asked to sign a consent form.

Purpose of the study:

The study seeks *to determine measures to minimize the impacts of human activities on Alestes Baremoze species on Albert Nile, in Uganda.* The findings of this study will help policy makers to put forward policies that will greatly encourage conservation of different fish species, create a benchmark for further research into better ways of conserving fish species and further understanding of the impacts of human activities, help future researchers as a source of literature for topics related to human activities, conservation of fish species and Alestes Baremoze.

Procedures:

The questionnaire will be self-administered by the investigator and answered by the respondents in an honest and truthful manner. Your participation will involve responding to the questionnaire.

Who will participate in the study?

You have been chosen to participate in this study because you are a community member of Pakwach District hailing from any of the following sub counties of Panyango, Pakwach and Wadelai whose village is located along Albert Nile. The questioonaire will last for approximately 15 Minutes and in total, 383 respondents will be interviewed.

Risks/discomforts:

There is no foreseeable risk of harm or discomfort that will arise from your participation in this study. Maybe the inconvenience as a result of time spent during the interview.

Duration of engagement:

The interview will take a period of 15-20 minutes. This is to ensure valid answers from all respondents are obtained , and avoid boredom.

Benefits:

The research participants will get feedback on findings and progress of the study, and any new information that affects the study participants (including incidental findings) will be made available to research participants.

Confidentiality:

Your responses to this study will be anonymous. Please do not write any identifying information on your questionnaire. Every effort will be made by the researcher to preserve your confidentiality including assigning code names/numbers for participants that will be used on all research notes and documents, keeping notes, interview transcriptions.

Alternatives:

Should you feel uninterested along the way having consented, you shall still be free to withdraw without giving a reason. You will not lose any benefit in case of any withdrawal.

Cost:

You will be provided with refreshments after the interview. Where the interview exceeds 40 minutes, you will be provided with a time compensation of ugx 5,000 after the interview.

Questions:

If you have questions at any time about this study, or you experience adverse effects as a result of participating in this study, you may contact the researcher on telephone number; 0787937625 or on email; scoviatitirac@gmail.com

Statement of voluntariness:

Your participation in this study is voluntary. It is up to you to decide whether or not to take part in this study. If you have any issues pertaining to your rights and participation in the study, please

contact the Chairperson, Gulu University Research Ethics Committee, Dr. Gerald Obai Tel: No., 0772305621; email: lekobai@yahoo.com/lekobai@gmail.com; or the Uganda National Council for Science and Technology, on plot 6 Kimera road, Ntinda, Kampala on Tel 0414705500.

Statement of consent

I have read and I understand the provided information and have had the opportunity to ask questions. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason and without cost. I understand that I will be given a copy of this consent form. I voluntarily agree to take part in this study.

Name .....Signature/thumbprint of participant.....Date .....

Name .....Signature of witness.....Date .....

Name.....Signature of interviewer.....Date.....

Appendix III: Informed consent Form for QUESTIONNAIRES (Translated Consent Form (Alur Version)

Title of the study: *Human activities and conservation of Alestes baremoze species on Albert Nile, Uganda.*

Investigator(s): Titirach Scovia Kerali

Institution(s): Gulu University

Introduction

An Nyinga otiye **Titirach Scovia Kerali** nyathin Kwan mi Gulu Yunivasity abe kwanu i kum Cwic Mu tyeku Wa man lembe i kum gira cwiya matung tung. Abe coku paru i bang lwak i kum

tic matung tung ma dhanu timu man yore mi gwoku/thindhu/kanu Angara i nam mwa mi Panyimur/Pakwach.

Paru peri i kum lembe eni pire tek ento etiye yeny peri ni miyu paru nyo ni kwetu. Tek iyenyo i mi paru peri i kum lembe eni, wakweyi ni kethu cingi i karatasi eni ni nyuthu nia i cwaku.

Purpose of the study:

Ngec maeni otiye ni nwangu yore mi jwigu nyoth man adwogi marac I kum Angara ni lubire ku tic matung tung ma dhanu obe timu I nam mwa mi Panyimur/Pakwach.

Paru ceke mabecu ma bi wok I kum somu maeni bi konyu jurucik/gamente ni wok ku cik ma ber maromu gwoku kit rec matung tung, kelo rieko manyen pi somu mir anyim ikum kite ma waromu thindhu/gwoku/kanu rec matung tung, ni kelo nyang I kum racu pa tic pa dhanu matung tung I nam man wi got, man ni konyu jukusoma matung tung mir anyim ni nyang I kum yore mi thindhu/gwoku/kanu kit rec matung tung.

Procedures:

Karatasi ma jukyewo pi gamu paru I bang lwak eni bikonyu jacok paru ni gamu lembe matung tung I bang dhanu. Wakwayu I mik paru peri I kum lembe eni ku thwolo cwiny.

Who will participate in the study?

Itiye acel ikind dhanu ma jugoyu wigi pi mio paru I kum lembe eni kum itiye ngati acel ma piretek I kabedu mi Pakwach, Panyimur nyo Dei ma nwangire I dhu nam mi Panyimur/Pakwach. Eromu tingu kare ma no, dakika 15 kende ni gamu penji eni ceke.

Risks/discomforts:

I kare mi gamu penji eni lembe ma romu bedu tek akeca upe ni lubire ku paru peri ma imiyu. Ento tim iwa kisa pi sawa/kare peri ma nok ma wanyothu eni.

Duration of engagement:

Eromu tingu dakika 15-20 ni daru gamu penji eni ceke kara wa romu nwangu paru ma cuu i bengi man kara kud enyoth sawa peri.

Benefits:

Dhanu mu miyo paru migi ikum lembe eni gi bi nwangu adwogi i kum lembe eni man tek lembe moku ujai gi bi nwangu atwonga ne.

Confidentiality:

Paru peri ikum lembe eni bi bedu amung. Kud I kyew nyingi I kum karatasi mi penji eni. Wabi temu ku yore ceke ni kethu dhanu ma gimiyu paru eni nyingi bi ngeyere ngo.

Alternatives:

Tek inwengiri nia ingey caku iromu daru ngo gamu penji eni ceke, itiye agonya ni jigu. Jigu gamu penji utiye peku ngo man fod de bi bedu ope tek lembe udiyi.

Cost:

Kubang ngati ma umiyu paru pare bi nwangu pii mir amadha. Tek penji ne ukadhu dakika 40 ibi nwangu sente 5,000 i ngey penji.

Questions:

Tek itiye ku penji moku ikum somu maeni nyo inwangu adwogi moku marac ingey penji ma igamu iromu goyu simu 0787937625 nyo icwal dwandi iwi yamu; scoviatitirac@gmail.com

Statement of voluntariness:

Miku paru peri ikum penji maeni utiye miyiri peri. Dong etiye in ni moku nyo I romu gamu penji eni nyo ungo. Tek itiye ku lworu moku I kum tweru peri mi wec, iromu goyu ni Jawikom mi Gulu Yunivasity thenge mi Bedu Atira I Kare mi Nwangu ngec, Daktari Gerald Obai 0772-305621 nyo

I cwal dwendi iwi yamu; lekobai@yahoo.com/leokobai@gmail.com nyo dul ma nenu lembe I kum rieko 0414705500

Statement of consent

Akwanu man anyang ikum lembe eni kilili. Anyang maber nia miku paru para I kum penji eni otiye miyiri man nia atiye agonya ni jigu gam I kare moku cii ma nwangu nia elari ri ungo kadok the lembe ne upe man fod bi bedu ope. Anyang bende nia abi nwangu karatasi mi kethu cing eni. Ayiyu ni miku paru para I kum lemb somu maeni.

Nyingi ..... Keth Cingi/Dii Cingi Madit..... Nindu .....

Nying sadeni .....Cing sadeni..... Nindu .....

Nyingi..... Cing Jara penji..... Nindu.....

Appendix iv: Informed consent FORM for key INFORMANT INTERVIEWS.

Title of the study: *Human activities and conservation of Alestes baremose species on Albert Nile, Uganda.*

Investigator(s): Titirach Scovia Kerali

Institution(s): Gulu University

Introduction

I am Titirach Scovia Kerali, a student of Gulu University pursuing Masters of Science in Environment and Natural resources Management, carrying out a study on *Human activities and conservation of Alestes baremose species on albert Nile, Uganda.* Your participation in this study

is voluntary. It is up to you to decide whether or not to take part in this study. If you decide to take part in this study, you will be asked to sign a consent form.

Purpose:

The study seeks *to determine measures to minimize the impacts of human activities on Alestes Baremoze species on Albert Nile, in Uganda.* The findings of this study will help policy makers to put forward policies that will greatly encourage conservation of different fish species, create a benchmark for further research into better ways of conserving fish species and further understanding of the impacts of human activities, help future researchers as a source of literature for topics related to human activities, conservation of fish species, and Alestes Baremoze.

Procedures:

The interview will be self-administered by the investigator and answered by the respondents in an honest and truthful manner. Your participation will involve responding to the interview questions.

Who will participate in the study?

You have been chosen to participate in this study because you are an officer working with Natural resources department, Fisheries Sector, community leader of Pakwach District. The interview will last for approximately 15 Minutes and in total, 10 respondents will be interviewed.

Risks/discomforts:

There is no foreseable risk of harm or discomfort that will arise from your participation in this study. Maybe the inconvenience as a result of time spent during the interview.

Benefits:

The research participants will get feedback on findings and progress of the study, and any new information that affects the study participants (including incidental findings) will be made available to research participants.

Confidentiality:

Your responses to this study will be anonymous. Please do not write any identifying information on your questionnaire. Every effort will be made by the researcher to preserve your confidentiality including assigning code names/numbers for participants that will be used on all research notes and documents, keeping notes, interview transcriptions.

Alternatives:

Should you feel uniterested along the way having consented, you shall still be free to withdraw without giving a reason. You will not lose any benefit in case of any withdrawal.

Cost:

You will be provided with refreshments after the interview. Where the interview exceeds 40 minutes, you will be provided with a time compensation of ugx 5,000 after the interview.

Questions:

If you have questions at any time about this study, or you experience adverse effects as a result of participating in this study, you may contact the researcher on telephone number; 0787937625 or on email; scoviatitirac@gmail.com

Statement of voluntariness:

Your participation in this study is voluntary. It is up to you to decide whether or not to take part in this study. If you have any issues pertaining to your rights and participation in the study, please contact the Chairperson, Gulu University Research Ethics Committee, Dr. Gerald Obai Tel: No., 0772305621; email: lekobai@yahoo.com/lekobai@gmail.com; or the Uganda National Council for Science and Technology, on plot 6 Kimera road, Ntinda, Kampala on Tel 0414705500.

Statement of consent

I have read and I understand the provided information and have had the opportunity to ask questions. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason and without cost. I understand that I will be given a copy of this consent form. I voluntarily agree to take part in this study.

Name .....Signature/thumbprint of participant.....Date .....

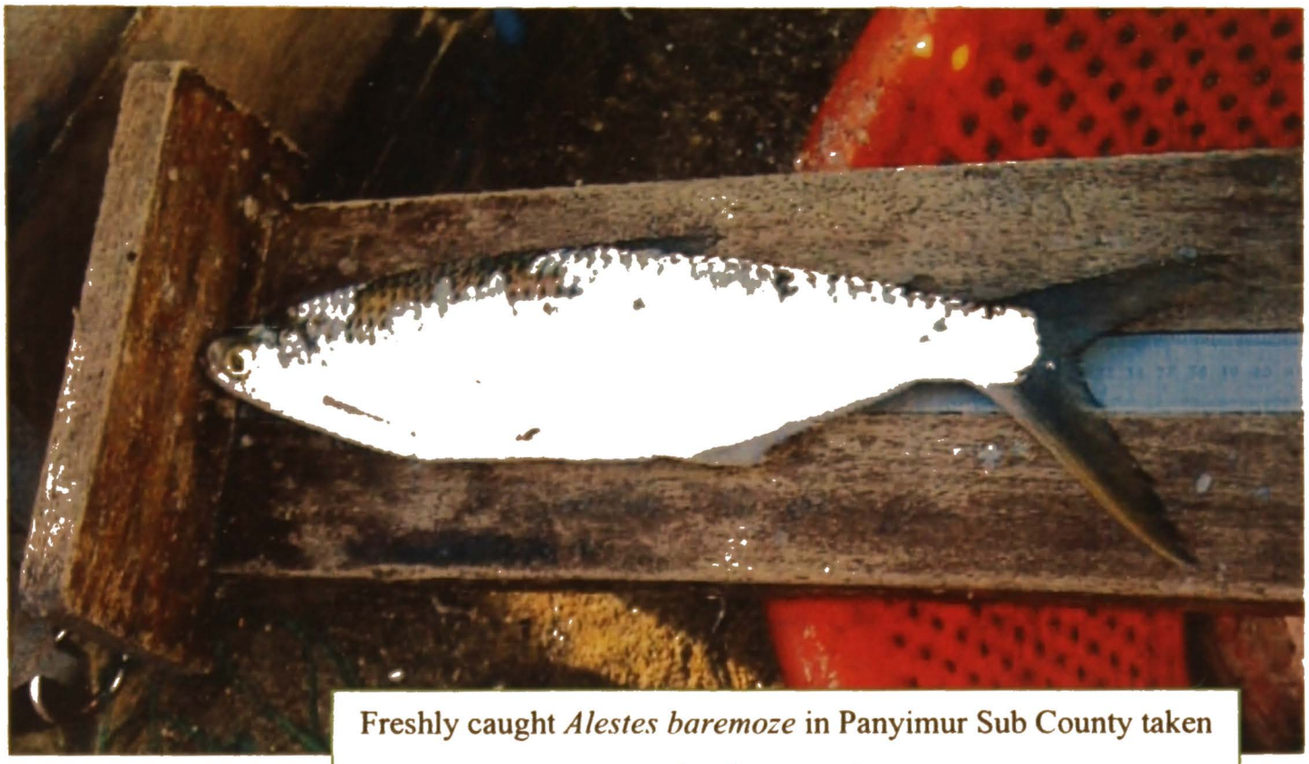
Name .....Signature of witness.....Date .....

Name.....Signature of interviewer.....Date.....

Appendix V: Selected Study Pictures



Freshly caught Alestes baremoze in Pakwach Sub County: Photo taken from the field



Freshly caught *Alestes baremoze* in Panyimur Sub County taken by the reseacher



Fresh *Alestes baremoze* being prepared for local preservation method in Pakwach Sub Couty.



Alestes baremoze being preserved by salting and sun drying by fish mongers in Pakwach Sub County