

**ROLE OF BEACH MANAGEMENT UNITS IN IMPLEMENTING
FISHERIES POLICY:
A CASE STUDY OF TWO BMUs IN LAKE VICTORIA, TANZANIA**

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ABSTRACT

The change in Lake Victoria fisheries management from centralized to co-management was to address challenges posed by the former management system. This led to the establishment of Beach Management Units (BMUs) a fishers' association. However, declining fish stocks and claims of poverty within fisheries communities raises concerns about the impacts of co-management in implementation of fisheries policy. This study addresses these concerns by examining the specific functions and activities of Beach Management Units (BMUs) that are related to regulating fisheries and poverty reduction among the fishers' communities using data collected from two BMUs in Lake Victoria Mwanza, Tanzania. Findings reveal that BMUs have formulated regulatory measures to manage the fishery but have been ineffective in implementing some of the measures. On the other hand, BMUs have no poverty eradication schemes and lack skills and expertise to tackle the challenges posed by poverty. The inability of the BMUs to tackle these challenges threatens the sustainability of the fisheries given that most riparian communities entirely depend on the resources for their livelihood.

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ABBREVIATIONS

BMU	Beach Management Unit
ERP	Economic Recovery Program
ESAP	Economic and Social Action Program
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
IFMP	Implementation of a Fisheries Management Plan
KII	Key Informant Interview
LVEMP	Lake Victoria Environmental Management Project
LVFO	Lake Victoria Fisheries Organization
MDGs	Millennium Development Goals
NBS	National Bureau of Statistics
NESP	National Economic Survival Program
NGO	Non -Governmental Organization
PRS	Poverty Reduction Strategy (2001-2025)
RPF	Rolling Plan and Forward Budget
TZS	Tanzania Shillings
UN	United Nations
URT	United Republic of Tanzania
USD	Unites States Dollar
WB	World Bank

1 INTRODUCTION

Lake Victoria is Africa's largest lake with a total surface area of 68,800km². The lake has a catchment area of 193,000 km² (Uganda 30,880 km², Kenya 42,460 km², Tanzania 84,920 km², Rwanda 21,120 km² and Burundi 13,510 km²) with a rapidly growing population of over 35 million people. The lake's water is shared by three countries Kenya 6%, Tanzania 51% and Uganda 43%. Its fisheries are dominated by three species, the Nile perch (*Lates niloticus*) Dagaa (*Rastroneobola argentea*) and Nile tilapia (*Oreochromis niloticus*). The value of catch at beach level is estimated at more than USD 550 million and an export value of USD 260 million (LVFO, 2013). In Tanzania, the lake is shared by three administrative regions of Mwanza, Mara and Kagera. The lake is important to the economy as it contribute over 60% of the total fishery contribution to the GDP which has been between 2-3% annually (NBS, 2012). It also a source of cheap protein compared to beef and chicken, employment, income and water for domestic and industrial use.

The failure of rain-dependent agriculture and open access nature of the fishery coupled with unemployment and limited alternative livelihood options attracted young people and people originally not fishers into fishing for economic reasons (Kateka, 2010). This influx into the fishery has complicated fisheries management as evidenced by the wide range of socio economic conditions and changes in the fishing techniques (Onyango, 2004). According to Medard and Geheb (2000) this influx of people contributed to uncontrolled and illegal fishing practices posing risks to the sustainability of the resources and the livelihoods of the people directly depended on the fisheries.

These challenges and many others contributed to efforts of reforming the dominant, top-down managerial approach towards a co-management arrangement, where the government and the riparian communities share responsibilities and authority in the management of the fisheries resources. That was over a decade now but there is still limited information on the impact of this arrangement in the implementation of fisheries policy particularly on regulating fishers and reducing poverty among fishers. Different opinions exist about the success of co-management systems. This study aims to analyse the effects of co-management by studying two BMUs in Lake Victoria, Tanzania.

1.1 Objectives of the study

The broad objectives of the study are to examine specific functions and activities of the BMUs that regulate fisheries, with a focus on poverty reduction among the fisher communities.

1.2 Significance of the study

Involving the local people in managing the fisheries resources is a step forward in helping them improve the benefits they derive from the fisheries. However, the question of how to involve local communities has a major influence on the final outcome. In Lake Victoria, the formation of BMUs as co-management institutions has opened a new chapter in management. It is important to know the extent to which these BMUs have had an impact on the livelihood of the fishers and stock sustainability given the current status of the fishery.

The aim of the study is to contribute to improving the fisheries policy on the challenges posed by stock decline and poverty, and how through fishers' perceptions BMUs achievements and

challenges in implementation of the fisheries co-management can be strengthened. It should also give insights that will improve government's objective of enhancing economic growth through sustainable utilization of fisheries resources as discussed in Tanzania development vision 2025 (URT, 2000).

1.3 Limitations of the study

The time allocated for data collection in this study was short and limited the scope and scale of data collection and analysis. Further, isolating the effect of management methods from other sources of change is very difficult. Therefore the study mainly focuses on the perception of interviewees.

1.4 Overview of co-management in Lake Victoria

1.4.1 The concept of co-management

Pomeroy and Berkes (1997) define fisheries co-management as a partnership arrangement in which government agencies, the community of local resource users (fishers), external agents (non-governmental organisations, academic and research institutions), and other stakeholders share responsibility and authority for decision making over the management of a fishery (Figure 1). Co-management is intended to be a dynamic partnership using the capacities and interest of local fishers and complimented by the ability of the state to provide enabling legislation, enforcement and other assistance (Jentoft, 1989).

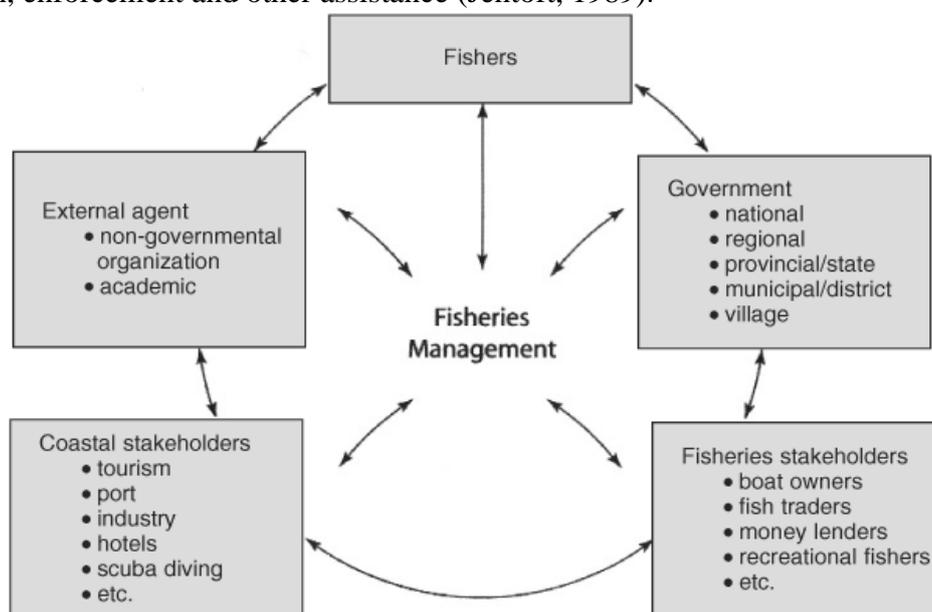


Figure 1. Fisheries Co-management (Pomeroy and Berkes,1997)

Pomeroy's definition entails that co-management should be not be viewed as a single management strategy and there is no single model of co-management. Co-management is not a regulatory technique but should be seen as a flexible management structure in which action in participation, rule-making, conflict management, power-sharing, dialogue, decision-making and development among resource users, stakeholders and government is provided and maintained. Based on the variation in roles and the level of power sharing between partners, Sen and Nielsen (1996) distinguish five major types of co-management; *instructive-*

minimal exchange of information between government and fishers, *consultative*- consultation between the partners, but the government makes final decision, *cooperative*-government and fishers cooperate as equal partners in decision making processes, *advisory*- fishers advise the government and seek government's approval of their own decisions and *informative*-government has delegated authority to make decisions to fishers committees that are responsible for informing the government of these decisions.

1.4.2 *Historical management of Lake Victoria*

Management of Lake Victoria began with traditional or “customary” management during the 18th century when responsibility and authority was in the hands of the traditional leadership who controlled exploitation of resources (Owino, 1999). Fishing was mainly informal without written policy and regulation but was rooted in the community's culture and limited only to the riparian communities (Schlager and Ostrom, 1992). The catch was sufficient for own consumption and barter trade. Through this management system fishers were able to participate in making decisions on the operations and management of the fisheries (Pinkerton, 2003).

Formal management of the lake fisheries began during colonial times with enactment of Fish Ordinance which introduced licensing and boat registration and was later amended to cover regulations on gillnets, trawl nets and long lines (Kateka, 2010). These regulations aimed at generating revenue to the colonial government and it opened the fishery to non-riparian communities. After independence the central government continued to exercise full responsibility and authority in fisheries management. However, the transformation brought by Nile perch fishery in the late 1970s and structural adjustment programmes in the 1980s (Abila and Jansen, 1997) and the failure of centralized management system led to a rethink of a new fisheries management structure where local resource users and other stakeholders have a say in management (Medard and Geheb, 2000).

Co-management began in Tanzania in the late 1990s under the Lake Victoria Environmental Management Project (LVEMP) where a committee of five fishers from each landing site, named Beach Management Units (BMUs), were formed around the Mwanza Gulf. This was then extended to other landing sites and by the year 2000 there were about 511 BMUs in all riparian districts (Hoza and Mahatane, 2001). However, these BMUs lacked a clear operational guidelines and institutional framework. This led to the reformation of the BMUs in 2006 during the Implementation of a Fisheries Management Plan (IFMP) project carried out from 2004-2010 (Ogwang', et al, 2009). This saw a reduction in the number of BMUs to 433 in the Tanzanian part of the lake. The reformed BMUs were supported with the Fisheries Act No. 22 of 2003 and the principal Fisheries regulation of 2009 and have clear operational guidelines and institutional framework in the National BMU Guideline. The co-management arrangement for the lake is still consultative where setting management objectives is still the prerogative of the government with little or no consideration for local knowledge (Njaya, 2007). This new arrangement was anticipated to empower local communities in exercising their new legal rights in a responsible manner by taking care of the fisheries resources, raising productivity and their incomes and improving fisheries dependent livelihoods.

However, the increased pressure on the fishery resources, illegal fishing practices and growing concern that fisheries communities are the poorest despite the increased earnings accrued from the sector over the last decade have generated divergent opinions on the impact

of co-management in fisheries management. In some studies Ogwang' et al (2009) reported that BMUs have been effective in the elimination of illegal fishing methods, collection of revenue on behalf of the local government and have actively participated in the fisheries decision making processes. They further stated that the involvement of the resource users in the management has not only empowered them but also improved their livelihoods. However, Nunan (2010) found that co-management has failed to control migration of fishers. Onyango and Jentoft (2007) point out that unlike the traditional or customary institutions the BMUs have not been able to tackle the challenges of overfishing and illegal fishing practices because their formation was not grounded on the socio-cultural environment in which they exist. Drawing from experience of co-management in Africa, Hara *et al* (2003) report little evidence on the effectiveness of co-management in sustainable fisheries. This is also supported by Onyango (2004) that co-management has had very little success in fisheries management.

More so Sterner and Segnestam (2001) argue that economic growth regardless of what it is based on, does not automatically solve the problem of poverty and fisheries sustainability at the same time. They argue that though that there is a close relationship between poverty, depletion of natural resources and environmental degradation, the relationship is complex and can only be understood from studying the type of management system in place, the poor people groups that are affected and how poverty is defined. On the other hand, according to Onyango (2009) poverty problem in small scale fisheries is a wicked problem that cannot be understood from the income-expenditure nexus but rather from an ecological, social and institutional context. These divergent opinions on co-management act as a catalyst for studying BMUs and consequently generate information on the performance of BMUs in fisheries management.

1.5 The National BMU Guideline

The rules of procedure for the BMUs are provided in the National BMU Guideline which was developed within the context of FAO Code of Conduct for Responsible Fisheries and the Harmonized Beach Management Unit Guidelines on Lake Victoria (URT, 2005). The BMU guideline supports the national government development objectives of poverty eradication, gender equity and social inclusion in decision making processes that affect the sustainability of natural resources and livelihood of people dependent upon these resources through empowering the fisheries communities in fisheries planning, management and development and provide a clear outline for community participation in these processes. The guideline among many other issues provides understanding on the structure and functions of the BMUs as well as mechanism for establishing and operating fisheries co-management on inland and marine waters of Tanzania.

1.6 The BMU structure

A BMU is made up of the assembly and committee (Figure 2). The assembly includes all persons engaged in fisheries activities at beach level. The members include boat owners, crew members, managers/supervisors, artisanal fish processors and traders, fishing gear and equipment dealers/repairers, boat makers and agents of industrial fish processors operating at the beach. The committee consists of 9-15 elected officials who are responsible for the day to day running of the BMUs. The committee has a chairperson, secretary, treasurer, storekeeper and any other post as agreed by the BMU assembly. Within each BMU committee there have

to be at-least three sub-committees responsible for fisheries management, financial management and environmental protection. However more sub-committees can be formed depending on the need of respective BMUs.

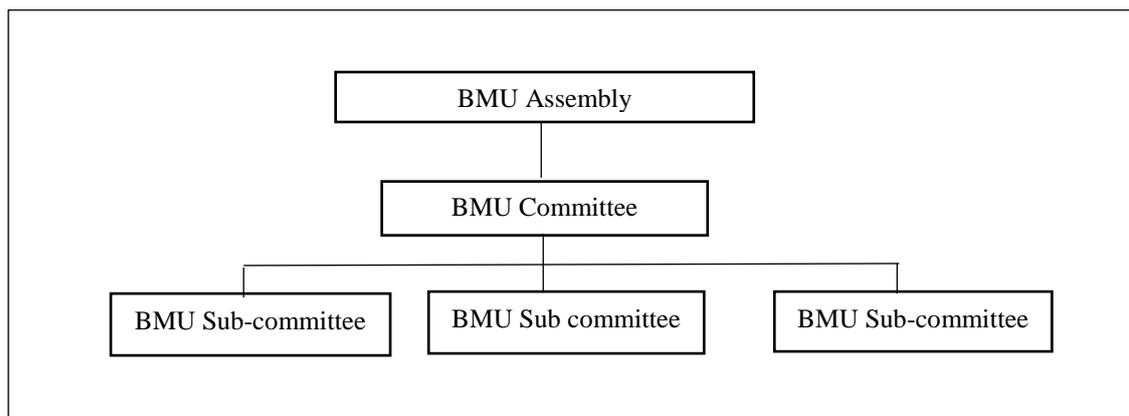


Figure 2. BMU organizational structure

1.7 Roles of BMU executive committee

The executive committee of the BMU is the unit that oversees day to day operation of the BMU and is also responsible for ensuring that the roles and objectives of the BMU are met. The BMU roles include but are not limited to the following (URT, 2005);

- a) Identify wider development interventions at Village level from the BMU plan and make financial proposals for their support by the BMU.
- b) Propose by-laws for endorsement by the District Authorities and enforce them.
- c) Assist in the collection of fisheries data on catch, effort and socio-economic information using agreed formats. Undertake Monitoring, Control and Surveillance in collaboration with the relevant authorities to reduce harmful and illegal fishing practices.
- d) Collaborate with the Director of Fisheries, TAFIRI and or Local Authority, to identify fish breeding areas on the basis of indigenous knowledge and identify and clearly demarcate them as breeding and nursery areas.
- e) Promote the improved handling and marketing of fish including construction of associated infrastructure and improved access to market information.
- f) In collaboration with the relevant authorities, ensure that harmful and illegal fish trading practices are eliminated from within the jurisdictional area of the BMU.
- g) Raise awareness of HIV/AIDS amongst BMU members and their families and attract interventions to reduce its impacts.

1.8 IFMP Project and BMU Training

Implementation of a Fisheries Management Plan (IFMP) was a regional project implemented by the Lake Victoria Fisheries Organization (LVFO) partner states of Kenya, Tanzania and Uganda from 2004-2010. Its main purpose was to assist these countries achieve LVFO's main mission of contributing to the sustainable economic growth, resources use and development of the fishery dependent communities of the Lake Victoria Basin. The main focus of the project was to: establish strong institutional mechanism for coordination and implementation of fisheries management, provide mechanism for dialogue and consensus on fisheries management measures, strengthen fisheries related policies, laws and regulations, promote community participation in management of fisheries through Beach Management

Units, improve social infrastructure especially fish landing sites and develop strategies to improve livelihood of the fisher folks. In order to achieve this objectives the project financed both research and fisheries management activities. However, much focus was on the capacity building for the BMUs executive committee members where various training such as; fisheries management, fisheries co-management, financial management, formulation and implementation of work plans and reporting, leadership and governance and conflict management were conducted. It was expected that the BMU executive committee will disseminate the training received to non -executive members so that all fishers are aware of their responsibilities in implementing fisheries policy and in particular addressing the key challenges of poverty and illegal fishing practises that threatens the sustainability of the fisheries resources. It is therefore necessary to examine and generate information on how the BMUs have performed in implementing the National Fisheries Policy.

2 METHODOLOGY

It is a challenge to measure the effectiveness of existing management structures that rely and interact with dynamic systems both qualitative and quantitative methods are used in the study, as no counterfactual is available. Hard data are analysed using quantitative methods, but in addition qualitative data were collected through interviews to further support the analysis.

2.1 Study design

Information for the study was generated in two ways. One way was gathering as much information as possible through reviewing relevant published and unpublished literature from journal articles, reports and government documents. This was done before and during data collection and during report writing. The second phase involved data collection in the study area. This involved interviews with members of fisheries stakeholder groups (boat owners, crew members, artisanal processors and traders) and community leaders. During this phase information was generated was used in understanding the mechanism put in place by the BMUs in regulating fisheries and activities which are pro-poverty alleviation. National poverty reduction strategies were also reviewed to see their impacts within the communities.

2.2 Study tools

The specific tools used in this survey were structured questionnaires and Key Informant Interviews (KIIs). The structured questionnaire was administered to individual fishers, boat owners, fish processors and traders to get individual perceptions on the study topic while KIIs were limited to experts and community leaders to produce a general view of the study objectives, and to confirm and complement the information obtained from the questionnaire. These tools were used because they are relatively simple to administer and manage, generate large amount of data quickly, facilitate cooperation between respondent and interviewer, and facilitate immediate follow-up for omission that may occur during interviews.

2.3 Study area

The survey focuses on two BMUs (Kayenze and New Igombe) in Ilemela and Magu districts respectively in the Mwanza region, Tanzania. The BMUs were selected because unlike others

they are more developed and have benefitted a lot from project activities through capacity building and landing sites development carried out in these landing sites.

2.4 Sample size and sampling procedure

Sixty-two (boat owners, crew, artisanal processors and traders and fish agents) responded to the questionnaire (Appendix I) and eight representatives of local BMU and village leadership were interviewed according to the schedule in Appendix II. Both random and non-random sampling techniques were used. Random sampling was used to select respondents for questionnaire and non-random used for selecting local leadership representative and this was done in order to target those individuals with the best knowledge of the study topic. KIIs comprised community leader, ward fisheries officer, BMU chair and one knowledgeable fisher from the community. Table 1 shows the distribution of respondents by occupation and data collection method.

Table 1. Distribution of sample respondents by occupation by study tools

Questionnaire		Key informant	
Respondent occupation	Number	Respondent occupation	Number
Boat owner	14	Ward Fisheries Officer	2
Crew	23	Village Leader	2
Fish Trader/agent	22	BMU chairperson	2
Fish Processor	3	Knowledgeable individual	2
Total	62	Total	8

2.5 Validity of the data

Data validity is often a challenge when collecting information on some topics that are considered sensitive such as income and illegal fishing. In this survey, the challenge of validity was addressed right from the data collection stage. Phone calls were made to respondents on the open ended questions which required more explanations. Also responses given were cross checked with other sources of data and other interviewees to ascertain the validity of the response given. This was important to guard against exaggerations and under-reporting of income from fisheries.

2.6 Data processing and analysis

Completed questionnaires from the field were recorded and checked against the codes for verification. Quantitative data from the BMUs were combined and analysed using SPSS (Version 16), summaries of the data were generated as frequencies, means and percentages and presented in tabular forms and charts. More elaborate statistical analyses of variable relationships were done for selected data, using mainly cross tabulations. For the KIIs, content analysis method was used to analyse qualitative information, particularly recorded dialogues which were broken into meaningful themes or tendencies.

Responses on the assessment of BMU performance on fisheries management activities were subjected to further analysis using a chi-square to test whether there is significant difference between the expected frequencies and observed frequencies and also to assess whether there is a significant difference between the two BMUs in undertaking the activities. This is important because chi-square tests enable the testing of formal hypothesis about frequencies. Statistical significance in this case implies that the differences are sufficiently unlikely to be

due to chance alone, but instead may be indicative of systematic factors, e.g. actions done by the BMUs. Further analysis was done on how the respondents' backgrounds may affect attitudes towards BMUs success using Ordered Logit Analysis. This tool allows the effects of background variables on attitudes to be tested and hypothesis about their sign and size to be tested.

3 RESULTS

3.1 Respondents demographic characteristics

The sample respondents' social characteristics on literacy rate was given due consideration in the study because literacy is as an important factor in measuring socio economic and political development in any society. In Tanzania, the literacy rate particularly for those without post-secondary education is measured by their ability to read both Kiswahili and English sentences. Respondents were asked about their level of education and the majority (77%) indicated that they have completed primary education, 16% have post primary education. Level of education of respondents is illustrated in Figure 3.

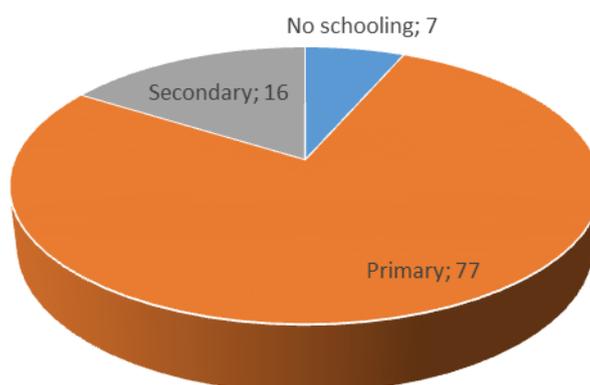


Figure 3. Level of education attained by respondents

However, comparison between occupation in the fisheries and level of education indicates artisanal processors are disadvantaged, as illustrated in Table 2. When compared by gender, responses indicate that women in fisheries seldom go beyond primary education, as seen in Table 3 below.

Table 2. Level of education by fishers' occupation

Respondent	No of respondents	No schooling (%)	Primary (%)	Secondary (%)
Boat owner	14	0	79	21
Crew	23	9	78	13
Fish trader/agent	22	5	77	18
Fish processors	3	33	67	0

Table 3. Level of education by gender

Level	No of respondents	No schooling (%)	Primary (%)	Secondary (%)
Male	47	4	77	16
Female	15	14	80	6

3.1.1 Characteristics on assets ownership

Assets ownership is a good measure of household well-being and ability to access wealth resources sufficient enough to provide basic needs. Findings show that over 80% of respondents do not own bank accounts, as illustrated in Figure 4. However, comparison between ownership status and occupation show low ownership of bank account, no fish processors have either a bank account or livestock and the ownership status among boat owners is better than for other stakeholder groups, as demonstrated in Figure 5.



Figure 4. Assets and ownership status of fishers



Figure 5. Assets ownership by occupation

However, further analysis by gender reveals that women generally do not own bank accounts and livestock. Only those separated, widowed and very few in marriages indicated to co- own land and house with husbands as illustrated in Figure 6.

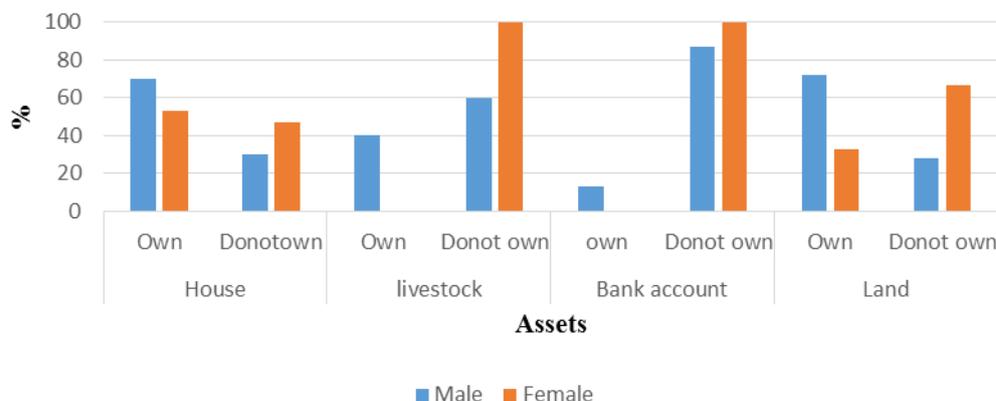


Figure 6. Cross tabulation of assets ownership by gender

3.1.2 Respondent access to food and drinking water

Access to food is not a problem among fishers as majority (68%) of fishers usually get food to eat, as illustrated in Figure 7. The majority (70%) of those not having food to eat are crew members. Analysis between frequency of having food and gender indicate women do not experience problem of missing food, as data in Table 4 show. On source of water for drinking, 69% get water from shallow wells, 16% from water taps and 15% from the lake.



Figure 7. Frequency of getting food to eat

Table 4. Frequency of food consumption by gender (%)

	No of respondents	Always (%)	Missing sometimes (%)
Male	47	64	36
Female	15	80	20

3.1.3 Prevalence of diseases

Fishing communities are often considered vulnerable to water borne diseases and HIV/AIDS either due to inadequate health facilities/services within the landing site or fishers awareness on health and hygiene. This is true from the fishers responses which indicate that at least each household have had one member of the household affected by one or more of the following diseases; typhoid, bilharzia, diarrhoea, typhoid and malaria in the last twelve months.

3.2 Social characteristics of landing sites

Information on availability and accessibility of social services and facilities to the BMUs members were sought. Findings, as illustrated in Table 5, show that some services/facilities are lacking.

Table 5. Existence of social facilities and services at the landing site

Social facility/service	Status
Access road	Available
Public transport	Available
Piped water	Not available
Electricity	Not available
Shops	Available
School	Available
Health facility	Available
Credit facility	Informal savings groups
Main source of income	Fishing

3.3 Fishers knowledge on poverty

Poverty is a contentious issue which differ from one country to another and between individuals. The United Nations (1998) and the World Bank (2008) provide the international poverty indicators which include; income of less than \$1.25 a day, inability to acquire the basic goods and services necessary for survival with dignity, low levels of health and education, poor access to clean water and sanitation, inadequate physical security, lack of voice and insufficient capacity and opportunity to better one's life. In Tanzania, the National poverty line indicators are daily income of less than \$1, inability to respond to uncertainties, inability to access health care, less education and lack of capital and human assets (URT, 2012). Responses from the key informant interviews on poverty are not far from the indicators used in defining poverty as 88% view poverty as lack of basic necessities such as food, shelter, education and water while the remaining percent regard it as having low income unable to meet one's need which is in agreement with the former understanding. However, when asked on the category of fishers who they think are poor 62% indicated artisanal traders and processors and 38% mentioned crew members.

3.4 Sources and levels of income

Fishers were asked about the main source of income for their household and 86% indicated fisheries, 13% farming and 1% petty businesses. This also concurs with responses from KIIs indicating that main income activity is fisheries. However when asked about the number of income sources a slight majority (53%) of fishers indicated to have one source of income, 37% have two sources while 10% have three sources of income. Comparison between occupation and sources of income show that over 50% of crew, fish traders and processor

with exception of boat owners have one source of income. While none of the fish processors have a third source of income. Number of income sources by occupation is illustrated in Table 6.

Table 6. Number of income sources by occupation

Occupation	No of respondents	One source (%)	Two sources (%)	Three sources (%)
Boat owner	14	14	64	22
Crew	23	57	35	8
Fish Trader/agent	22	73	25	2
Fish Processor	3	67	33	0

Fishers were also asked on their daily income from the fisheries. This was also verified against the records kept by some fishers given their unwillingness to disclose their income. It was revealed that income varies between fisheries, occupation, seasons and number of vessels owned. From the responses and records seen from boat owners they have a minimum income of 3,000 and a maximum of 220,000 TZS a day equivalent to \$1.87 and \$137.5 respectively at a conversion rate of 1 USD= 1600 TZS at the time of the survey. Crew members get minimum and maximum of \$0.6 and \$68.75 a day respectively. These incomes are what each party get after overhead/fishing costs has been covered. Several different payment methods exist. Some share equally between the boat owner and the crew, while others have specific days in a week in which either boat owner or crew pocket all the income generated in that day. There are certain instances where boat owners and crews have incurred losses with no income at all due to poor fish catches.

The artisanal fish traders and processors have a minimum income of \$0.6 and maximum of \$93.75 depending on the size of the capital and business. However the fish agents did not reveal how much they get but it is believed that they get more than other members of the fisheries. Further analysis of fisheries reveal that boat owners and crew targeting Nile perch had relatively higher minimum income of \$2 compared to \$0.6 of those targeting sardines.

3.5 BMUs effort in managing fisheries and poverty reduction

In managing the fisheries resources the BMUs are expected to have in place a mechanism that support the sustainable utilization of the resources and poverty alleviation through improved planning and resource management. Fishers' views were collected to understand whether these objectives have been achieved or not and 98% acknowledged their BMUs having rules/by-laws that regulate fisheries. Conflict resolution and controlling illegal fishing are the major reasons why fishers think that their BMUs have formulated rules, as detailed in Figure 8 below. This is also supported by responses from key informants, who indicated that BMUs have managed to have make some achievements through formulating by-laws, controlling illegal fishing and migrants and also have improved the hygiene conditions at their landing sites. Despite having this in place, the fishers indicated BMUs to be constrained by lack of working tools and equipment, inadequate capacity to enforce measures and awareness, and lack of support from other stakeholders.

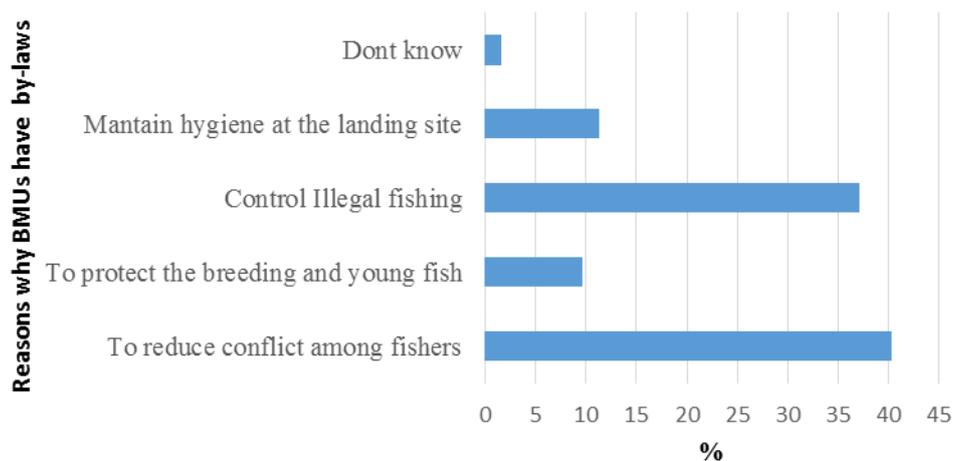


Figure 8. Fishers' perception on why BMUs have formulated rules

On addressing the issue of poverty, the BMUs are supposed to have a savings scheme and also self-help projects that are beneficial to all the members. However, responses from key informants indicate that although there exist both formal and informal savings schemes at the landing sites none are operated by the BMUs. Similarly the BMUs have not initiated income generating projects to provide alternative source of income to fishers to address the challenges of poverty. The attempts to establish income projects have been constraints by lack of skills and expertise within BMU leadership.

3.6 Assessment of BMU performance

Fishers were asked to rate performance of BMUs in undertaking a number of activities. Over 60% of fishers indicated BMUs were effective in formulating laws, arresting offenders and prosecuting offenders and keeping inventories. However, BMUs ratings are low in data collection and development of self-help projects (Table 7 columns 1 to 3). Further analyses were done on the responses given by the fishers using a chi square test to assess whether or not there is relationship between perception/attitude of fishers towards BMU activities. The assumption is that one who answers 'very effective' and 'somehow effective' supports the view that BMUs have shown some effectiveness. On the basis of this it is possible to test the hypothesis that more than half think BMUs have been effective. The tested hypotheses were:

H_0 More than half the population think BMUs have been effective.

H_1 Less than half the population think BMUs have been effective.

The hypothesis is tested using a chi-square test statistic and the result are reported in table 7 (and in full detail in Table A1 Annex III). The results are presented as p-values (Table 7 column 4). A p-value is the estimated probability of obtaining a chi-square value greater than or equal to chi-square figures, if equal proportions of the population think the BMUs have been ineffective. If a p-value is low then the probability of obtaining a chi-square greater than or equal to the calculated chi-square given that the null-hypothesis is true, is not sufficiently small to justify rejecting the null-hypothesis

Similar analysis was also done to assess the difference in attitudes towards the BMUS success for the two BMUs involved in the study. The tested hypotheses were:

- H₀ There is no difference between BMUs in undertaking the activities
H₁ There is difference between BMUs in undertaking the activities.

The results are presented in the last column of Table 7, in a similar way as before (full detail can be found in Table A2, Annex IV)

Table 7. Fishers rating on BMUs and chi square calculations for activities and BMUs

Activity	No	Very effective (%)	Somehow effective (%)	Not effective (%)	p-value for perception	p-value for BMUs
Formulating by laws	62	90	10	0	.000	1.000
Patrolling fishing grounds	62	18	44	38	.075	.037
Prosecuting offenders	62	76	22	2	.000	.313
Confiscating bad gears	62	61	31	8	.000	.641
Resolving conflicts	62	95	5	0	.000	.072
Arresting offenders	62	79	18	3	.000	.151
Collecting revenues	62	63	21	16	.000	.006
Conducting meetings	62	10	73	17	.000	.003
Data collection	62	27	60	13	.000	.449
Keeping inventory	62	81	16	3	.000	.151
Initiating development projects	62	16	57	27	.000	.000

It is evident that the BMUs have been effective in carrying out most activities for implementing fisheries management but they have not been able to do much in addressing the challenge of poverty among the fishing communities. Fishers noted that the BMUs do not operate a saving scheme and neither advocate for its members to join some of the formal saving schemes around the landing sites operated by micro finance institutions. Responses from key informants indicate that only the Kayenze BMU established an income generating activities but because of poor management and change of leadership this project did not continue. The informal savings schemes existing among fishers are operated by fishers themselves and are most common among women and those dealing in sardines. However, these BMUs on different occasions had won tenders to collect revenues on behalf of the local government and through this made both monetary and labour support towards construction of village nursery school and dispensary.

Ordinal regression analysis was used to determine whether key background, such as gender (male and female), education (no schooling, primary education and secondary education) and occupation (boat owner, crew and fish trader), have an impact on attitudes towards performance of BMUs. The results are reported in Table 8. Pseudo R Square measure the different models goodness of fit to the data. The pseudo R square is a relative measure of fit, ranging from 0, indicating a very poor fit, to 1, indicating a very good fit. Positive signs of estimated parameters indicate a positive effect of the variable on satisfaction with the BMU effect and a negative sign indicates that the variable has a tendency to reduce satisfaction with the BMU. The hypothesis that the true parameter is zero is tested for all parameters and the results indicated by asterisk (***) for p-value <0.001, ** for p-value <0.01, * for p-value <0.05 and no asterisk for non-significant parameters).

Results in Table 8 indicate that respondent background affects his/her attitude towards performance of BMUs in some activities. For instance, those with primary education are less satisfied with BMU performance in data collection and initiation of projects than those with

secondary education and those who never went to school. On the other hand, those who are new in the fishery are more positive with the performance of BMUs in project initiation/development than those who have been in the business for a longer time.

Table 8. Ordinal regression results on perceived BMU performance in activities

	Years in Fishery	Age	Gender	Boat owners	Crew	Fish Trader	No Schooling	Primary education	Pseudo R square
Formulation of by-laws	0.095	-0.109	17.965	-17.818	-0.797	0.262	1.928	0.623	0.165
Patrolling fishing ground	0.025	0.013	-0.434	1.285	0.514	-0.485	-0.355	-0.984	0.13
Confiscation of gears	-0.118	-0.088	17.942	0.409	-0.976	0.068	-15.689	-1.206	0.189
Prosecuting offenders	0.02	-0.058	-34.285	3.626	3.246	2.771	-33.326	-33.82	0.152
Arresting offenders	1.523	-3.644	44.689	-41.279	-78.317	-30.494	14.083	-26.334	0.248
Resolving conflicts	-0.025	-0.131	-34.585	37.396	18.109	18.295	-29.941	-18.471	0.208
Collecting revenues	0.042	-0.012	19.13***	-20.28***	21.793***	-20.877	-20.143	-0.981	0.179
Conducting meetings	0.037	0.016	-0.192	16.45***	16.052***	16.434	-18.188	-1.082	0.084
Data collection	0.1	0.023	-1.146	16.674***	16.697***	16.825	-1.63	-2.742*	0.159
Keeping inventory	2.133	-6.982	-0.261	15.165	-118.028	-110.618	76.75	-101.198	0.248
Project initiation	0.143*	-0.07	-1.252	16.771***	17.4***	18.035	-0.939	-2.55*	0.262

Note: *** for p-value <0.001, ** for p-value <0.01, * for p-value <0.05

3.7 Fishers views on improving BMU performance

Fishers suggested that BMUs performance can be improved through provision of working facilities, enhanced cooperation with other stakeholders and creating awareness to BMU leadership among others, as seen in Table 9.

Table 9. Fishers suggestion on improving BMU performance

Measures	%
Create more awareness to BMU leaders and fishers	8
Control corruption among BMU leaders	5
Provision of working facilities like boats to BMU	61
Improve security to those fighting illegal fishing practices	7
BMUs should have meetings with others fishers as stipulated in the guideline	8
Improved cooperation with other stakeholders	8
Provision of allowances to BMU executive members	3
Total	100

4 DISCUSSION

Fisheries co-management is an approach that has been adopted internationally in response to the perceived failure of centralized management of fisheries in preventing the decline of fish stocks and the lack of government agencies to effectively manage fisheries resources and tackle socio economic issues arising from the fisheries (Nunan F. , 2006; Njaya, 2007).

The poverty situation in Lake Victoria communities is multi-dimensional that differs from one group to another from deprivations to capabilities social exclusion inequality and rights based issue (Ogwang' *et al.*, 2009; Onyango, 2009; Onyango and Jentoft, 2010). The continued poverty in the fisheries sector provided the ground for the formation of co-management with the thought that empowering the locals in resource management enhances the access and rights of pro-poor to natural resource management and supporting their participation in policy and governance processes which are crucial for poverty reduction. Within the Lake Victoria formation of BMUs was a positive step towards achieving this (Onyango and Jentoft, 2007). A BMU mandate is to ensure orderly, safe and effective use, management and operation of fish landing sites. Also to initiate credit and savings schemes for fishers, develop and implement income generating projects with the aim of reducing fishing pressure and effort on the lakes resources, raise awareness of and provide training to its members in fishing techniques, the marketing and processing of fish, and support cooperative and fishers' self-help groups among many others.

Lake Victoria, Tanzania has over 400 BMUs. However this survey focused only on two BMUs in two different districts. These two were selected because they benefitted a lot from the IFMP project in terms of landing sites development as well as capacity building for the BMU executive committee members hence they provide a better avenue for examining the success or failures of BMUs in implementing fisheries policy. Thus it was important to collect both social demographic characteristics of fishers as well as information on the performance of BMUs in implementing fisheries policy.

Findings on literacy level shows that over 70% of those involved in the fisheries have attained primary education but there are fewer females than males in post primary education. This is similar to findings by Onyango *et al.*, (2005). However, this is not surprising given the low enrolment rate of girls compared to boys in secondary schools over the years (NBS, 2010). On assets ownership, generally fishers own assets such as land, house and livestock but not bank accounts. However, comparison on assets ownership across the fisheries categories indicates that boat owners and fish traders are more advantaged than others and this can be attributed to low income earned by crew and the fact that most artisanal processors in the fisheries are women who are culturally deprived of assets ownership in these communities (Onyango *et al.*, 2005).

Within the fishing communities some social services or facilities such as electricity and piped water are not available and this is a case in most rural areas given the disparity between urban and rural areas (URT, 2012). However, compared to 2005 there are no significant changes in terms of services availability Onyango *et al.*, (2005).

About 15% of the respondents use the lake water for drinking. Though information whether or not they boil the water before use was not asked it is difficult to verify the safety of the water but going with the finding that at least one member of the respondents household has

suffered from water borne diseases in the previous years it is likely that they might be drinking untreated water.

Health issues and in particular HIV/AIDS is a social problem that have been documented to affect migrant communities as well as those engaging in fisheries. Though information on HIV/AIDS was not collected in this survey, figures have often shown that prevalence rates within fishing communities of Lake Victoria are 4.5 to 5.8 times higher than the general population (LVFO, 2006) which stands at 6% for women and 4% for men (URT, 2012).

Income earned in the fisheries varies between fisheries with those engaging in Nile perch fishery having relatively higher income compared to the dagaa. This concurs with the findings of Onyango (2009) and Masanyiwa *et al.* (2012) that Nile perch fishers are better off than sardines fishers. However, with an average monthly fishing days of between 18 to 25 it is likely possible that fishers earnings could also vary between months thus making estimation difficult to a business that also suffers from poor record keeping. But it provides substantial information on income poverty between fishers and across fisheries.

On the BMU performance it is evident that they have enacted by-laws/rules to manage the fisheries and according to fishers' perception the BMUs have achieved some impact in regulating fisheries such as controlling migrant fishers, controlling illegal fishing practices and improving landing site hygiene. This perceptions of fishers are also supported by findings of hypothesis testing which revealed that the BMUs are effective in carrying out some activities and this also differs between BMUs. This findings supports (Ogwang' *et al.*, 2009) that there are some achievements by BMU but contradict findings that co-management has not been effective in fisheries management (Hara *et al.*, 2003). BMU institutions have not performed to expectations (Onyango and Jentoft, 2007) and (Nunan, 2010) assertion that BMUs have failed to control migration of fishers. It is therefore evident that though they may be unable to perform effectively in every activity as stipulated in their guideline but this cannot be generalized as a complete failure by all BMUs in implementing fisheries policy. Moreover it is worth noting that co-management should not be viewed as a single strategy to solve all problems of fisheries management, but rather a process of resources management that matures, adjust and adapt to changing conditions over time (Pomeroy *et al.*, 2011). Despite the efforts observed in regulating fisheries very little have been done by these BMUs in addressing the challenges posed by poverty reduction as they do not have single program to address this challenge. They also lack skills and expertise to come up with any poverty reduction strategy. Some poverty initiative plans such as revolving funds where fishers lend money to one another have been advanced by fishers themselves and is common among the female than male fishers see also (Onyango, 2004). The formal savings and credit schemes operated in some landings are extension of Micro Finance Institution and NGOs with no BMUs initiative. The BMUs too have failed in encouraging their members to join this schemes. The members to these schemes are mainly boat owners, middle class women dealing in dagaa trading and processing and some other business found around the fishing communities (Mlingwa and Luomba, 2011).

The poverty reduction schemes evident in the fishing communities such as National Economic Survival Program (NESP), Economic Recovery Program (ERP), Economic and Social Action Program (ESAP), Rolling Plan and Forward Budget (RPF), Poverty Reduction Strategy (PRS 2001-2025) and Millennium Development Goals (MDGs 2000-2015) and most recently 'Kilimo Kwanza' initiative: a Kiswahili version of agricultural improvement are extension of national and international strategies aimed at bridging the

development gap between the urban and rural areas. However, these measures too have made very little impact on poverty alleviation. This is evident by the fact that since 1991 to 2007 the fraction of poor people in Tanzania and in particular rural areas have declined very little by only 5% (NBS, 2010). In this regard, poverty reduction still remains a challenge not only to BMUs but also to experts working towards its alleviation and this could be due to the misconception of what it means to the locals, constraints and options available to them. However, Onyango (2009) asserts that addressing poverty in small scale fisheries requires multi-approach targeting the ecological, social and institutional context under which the problem occurs. The improved access to water, education and health and efforts made in malaria, HIV/AIDS and gender disparity are to a larger extent evident in urban than rural areas where over 70% still live in poverty (Ministry of Foreign Affairs, 2013).

Inability of the BMUs to conduct meetings, collect data, initiate projects and patrol fishing grounds, coupled with the lack of savings and investment culture among many fishers have severe impact on the livelihood of the local resources users on poverty reduction and stock sustainability where majority of fishers depend on fisheries for their household income. These shortcomings can be attributed to the fact that BMUs were largely supported and capacitated by the IFMP project and once the project ended there have been very little support from the government in terms of capacity building and mentoring and also the new BMUs leadership comprises individuals without training and skills to implement the fisheries policy (Ogwang' *et al.*, 2009).

Though this is not the key point in this study but it is worth highlighting that some of the challenges facing BMU in implementing the fisheries policy could be due to the way it was formed and structured. In forming co-management, Ostrom (1990) states that the state imposed BMU upon fishing communities. This resulted into fishing communities seeing BMUs as extension of the Fisheries Division responsible for the implementation of the state's laws and regulations resulting into non- realization of the management objectives (Geheb *et al.*, 2007). According to Onyango and Jentoft (2007), the BMUs do not have no exclusive ownership rights on the fisheries given the open access nature of the fisheries. The Fisheries Division still has powers to develop, regulate and enforce decisions that promote sustainable utilization while local government is in charge of issuing fishing licence making BMUs control of fishing impractical (Onyango and Jentoft, 2007). According to Ogwang' *et al.* (2009), the BMUs are still constrained by lack power to exercise full authority on fishers, inadequate facilities and expertise and sustainable funding sources to fully undertake their roles in the implementation of fisheries policies as a key a stakeholder in co-management.

5 CONCLUSION

Based on the fishers' perceptions it is evident that the BMUs have formulated by-laws/rules, implements fisheries management measures and fishers are also aware of the importance of these regulatory measures to the management of the fishery. However, some of these measures have not been implemented to the satisfaction of the fishers and this is expected given the fact that co-management process is inherently adaptive and relies on systematic learning and progressive knowledge accumulation for improved fisheries management. The findings are contrary to views held by some scholars that the BMUs have not been effective in fisheries management. However, it is recommended that further research is required to cover many BMUs and other co-management stakeholders in order to have a holistic view not covered by this case study. The focus should be on both science and governance so as to strengthen scientific data collection, development of perception and practice of equality of partners between government and fishing communities in management and enabling establishment of sustainable institutions.

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REFERENCES

- Abila, R. (2005). *Impacts of international Fish Trade: A case study of Lake Victoria Fisheries*. Rome: FAO.
- Abila, R.O and E.G Jansen. (1997). *From Local to Global: The Fish Processing and Exporting Industry on the Kenyan part of Lake Victoria-its Structure, Strategies and Socio economic Impacts*. Oslo: University of Oslo.
- Hara, M., and J. Raakajer Nielsen. (2003). Experiences with fisheries co-management in Africa. In J. R. D.C Wilson, *The Fisheries Co-management Experience: Accomplishments, Challenges and Prospects*. Kluwer Academic Press, Dordrecht.
- Hoza., R.B and Mahatane., A.T. (2001). Establishment of collaborative fisheries management in Tanzania part of the Lake Victoria. *LVEMP Tanzania Scientific Conference* (pp. 234-248). Dare-s salaam: LVEMP.
- Jentoft, S. (1989). Fisheries co-management: Delegating government responsibility to fisheries organisation. *Marine policy*, 13(2), 137-154.
- Kateka, A. (2010). *Co-management challenges in the Lake Victoria Fisheries. A context approach. Doctoral Dissertation*. Stockholm: Gothernburg University.
- Kim Geheb., Modesta Medard., Mary Kyangwa and Carolyne Lwenya. (2007). The Future Change: Roles, dynamics and Future for Fishing Communities in the Management of Lake Victoria Fisheries. *Aquatic Ecosystem Health and Management*, 467-480.
- LVFO. (2006). *HIV/AIDS in the Fisheries Communities of Lake Victoria: A strategic Action Plan*. Jinja: LVFO.
- LVFO. (2013). *Regional Frame survey Report*. Jinja: LVFO.
- Masanyiwa, Z.S, Kulwijila, M and Namwata, B. M.L. (2012). Impacts of Artisanal Fishing to the Livelihoods of Small Scale Fishing Communities in Lake Victoria in Ukerewe District, Tanzania. *International Journal of Research in Chemistry and Environment*, 2(3), 75-83.
- Medard, M and Geheb, K. (2000). Fisheries management in the social domain: perspective from Tanzania Lake Victoria fishery. In K. a. Geheb, *The Co-management Survey: Co-managerial perspective for Lake Victoria's fisheries* (pp. 116-134). Jinja: LVRFP.
- Ministry of Foreign Affairs. (2013). *Draft Country Policy Paper-Tanzania*. Dare-s salaam: Government of Tanzania.
- Mlingwa, S and Luomba, J. (2011). *Financial market Analysis of Existing Micro-Finance Institutions on Dagua Fishery in Lake Victoria* . Jinja: Unpublished Report.
- NBS. (2010). *Tanzania Demographic and Health Survey*. Dar-es salaam: Government of Tanzania.
- NBS. (2012). *The Status of Economic Growth in Tanzania*. Dar-es salaam: URT.
- Njaya, F. (2007). Governance Challenges for the Implementation of Fisheries Co-Management: Experiences from Malawi. *International Journal of Commons*, 1(1), 137-153.
- Nunan, F. (2006). Empowerment and Institutions . *World Development*, 1316-1332.
- Nunan, F. (2010). Mobility and Fisher folk livelihoods on Lake Victoria: Implications for vulnerability and risk. *Geforum*, 41(5), 776-785.
- Ogwang', V.O, Nyeko, J. I and Mbilinyi, R. (2009). Implementing Co-management of Lake Victoria's Fisheries. *Africa Journal of Tropical Hydrobiology and Fisheries*, 12, 52-58.
- Onyango, P. (2004). *Reforming Fisheries Management: A Case study of Co-management in Lake Victoria, Tanzania. M.Sc. Thesis Norwegian College of Fisheries Science*., Tromso: University of Tromso.

- Onyango, P. (2009). Re-configuring Poverty: The Wickedness Perspective. *African Journal of Tropical Hydrobiology*, 12, 9-18.
- Onyango, P., Mrosso, H and Mwanahamisi, S. (2005). *The Socio economic Baseline Survey for Lake Victoria Tanzania*. Jinja: Unpublished report.
- Onyango, P.O and Jentoft, S. (2007). Embedding co-management: Community-based Fisheries Regimes in Lake Victoria, Tanzania. *International Conference on Community Based Approaches to Fisheries Management*. (pp. 38-42). Dhaka: The World Fish Centers.
- Onyango, P.O and Jentoft, S. (2010). Assessing Poverty in Small-Scale Fisheries in Lake Victoria Tanzania. *Fish and Fisheries*, 11, 250-263.
- Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge: Cambridge University Press.
- Owino, J. (1999). *Socio-economics of the Lake Victoria Fisheries: traditional and Centralized systems of the Lake Victoria Fisheries in Kenya*. Nairobi: IUCN Eastern Africa Programme Report .
- Pinkerton, E. (2003). Towards specificity in complexity: Understanding co-management from a social perspective. In D. N. Wilson, *The Fisheries co-management experience: accomplishment, challenges, and prospect*. (pp. 62-77). Dordrecht: Kluwer Academic Publishers.
- Pomeroy, S. R, Joshua E. C and Nielsen, J. R . (2011). Conditions for succesful Co-management: Lessons Learned in Asia, Africa, the Pacific and WIDER Caribbean. In R. S. Andrew, *Small Scale Fisheries Management-Frameworks and Approaches for the Developing World* (pp. 115-131). London: CAB International.
- Pomeroy., R. and Berkes., F. (1997). Two to tango: the role of government in fisheries co-management. *Marine policy*, 21(5), 465-480.
- Schlager, E and Ostrom E. (1992). Property rights regime and natural resources: A conceptual analysis. *Land Economics*, 68(3), 249-262.
- Sen, S and J. Nielsen. (1996). Fisheris Co-management: a comparative analysis. *Marine policy*, 20(5), 405-418.
- Sterner, T and Segnestam, M. (2001). *The Environment and Poverty*. Stockholm: SIDA.
- URT. (2000). *Tanzania Development Vision 2025*. Dare-s salaam: Government of United Republic of Tanzania.
- URT. (2005). *National Guidelines for Beach Management Units*. Dare-s salaam: Government of United Republic of Tanzania.
- URT. (2012). *Poverty and Human Development Report*. Dare-s salaam: Government of Tanzania.
- URT. (2012). *Tanzania National HIV/AIDS and Malaria Inidicator Survey 2011/12*. Dare-s salaam: Government of Tanzania.
- World Bank. (2008). *World Development Report*. New York: World Bank.

ANNEX I: STRUCTURED QUESTIONNAIRE

STRUCTURED QUESTIONNAIRE

Introduction

The Researcher is conducting a case study on examining the role of Beach Management Units (BMUs) in implementing fisheries policy on stock sustainability and poverty reduction among the fishers' communities. Your response is critical in strengthening performance of BMUs in regulating fisheries as well as improving fishers overall livelihood.

Name of landing site _____ Date _____

Demographic characteristics

1. Age of respondent _____
2. Gender of respondent [1] Male [2] Female
3. Marital status [1] Single [2] Married [3] Divorce/separated [4] Widowed/er
4. Main occupation in the fishery [1] Boat owner [2] Crew [3] Fish Agent/ Trader [4] Fish Processor [5] Other _____
5. What is your level of education [1] No schooling [2] Primary [3] Secondary [4] Tertiary [5] University [6] Other specify _____
6. How many years have you been involved in fishery _____
7. Which fish species do target [1] Nile perch [2] Dagua [3] Nile perch and Tilapia [4] Other specify _____

Income and livelihood

8. How many sources of income do you have _____
9. What is the main household income [1] Farming [2] Fishing related activities [3] Other _____
10. What is the percentage contribution of fishery to your household income _____
11. What is your daily average income from the fishery _____
12. How many days do you spend in fisheries related activities in a month _____
13. What is the status of fishery income in the last 5 years [1] Increasing [2] Decreasing [3] No change [4] Not sure
14. What is the reason for the change in income [1] More fish [2] Less fish [3] Fish prices gone up [4] Fish prices down [5] bought new gears [6] Other _____
15. What is trend in fish catches in the last five years [1] Increasing [2] Decreasing [3] No change [4] Not sure
16. What is the main reason for the change [1] Too many fishers/boats/net/traders [2] Fishing regulations are not obeyed [3] Environmental change [4] Other specify _____

17. Is there a savings scheme operated by BMUs for fishers [1] Yes [2] No

18. If yes, what are the services offered by the schemes _____

19. How often do your household get enough to eat [1] Always [2] Some of the times [3] Infrequently [4] Never

20. What is your main source of drinking water [1] Lake [2] shallow well [3] Tap water [4] river [5] rain water [6] Other specify _____

21. Do you get enough to eat compared to 5 years ago? [1] Yes [2] No

22. Do you own any of the following?

	Assets	Yes/No
1	Land	
2	Bank account	
3	Livestock	
4	House	

23. Has any member of your household suffered from the following illness in the last year?

	Disease	No
1	Typhoid	
2	Bilharzia	
3	Diarrhoea	
4	Cholera	
5	Malaria	

Fisheries management measures

24. Are there rules/by laws from the BMU about fishery [1] Yes [2] No

25. Why has the BMU developed rules/by-laws? [1] To reduce conflict among the fishers [2] To protect the breeding and young fish [3] To promote sustainable fishery [4] Other _____

26. How can you rate the performance of BMU in the following activities?

Function		[1] Very effective [2] Somehow effective [3] Not effective
1	Formulating by laws	
2	Patrolling fishing ground	
3	Confiscating bad gears	
4	Prosecuting offenders	
5	Arresting offenders	
6	Resolving disputes/ conflicts	
7	Collecting revenue	
8	Conducting meetings	
9	Data collection	
10	Keeping inventories	
11	Initiating development projects	

27. What do you see as a major constraint for BMU in implementing management measures? [1] Inadequate knowledge on fisheries issues [2] Inadequate capacity to enforce measures [3] Corruption [4] Lack of support from other stakeholders/government [5] Other specify _____

28. Do you think the BMU is an effective management system for the lake? [1] Yes [2] No

29. In your own view how can the BMUs performance be improved?

Thank you very much

ANNEX II: KEY INFORMANT INTERVIEW
KEY INFORMANT INTERVIEW

Introduction. This research is examining the role of BMU in reducing poverty and improving stock sustainability among the fishers’ communities. Your response is important in identifying opportunities for improving stock sustainability and poverty reduction.

Name of interviewee _____ Occupation _____

Date _____ Landing site _____

1. How many years have you lived in this village _____

2. Infrastructure at landing sites

Facility/service	Availability	Number
Access road		
Public transport		
Piped water		
Electricity		
Shops		
Schools		

3. Main source of income for majority of people at the village
[1] Fishing [2] Farming [3] Livestock keeping [4] Business specify _____

4. Credit facilities operating at the village
[1] Formal institutions [2] Informal institutions [3] No such facilities

5. Primary health facilities at the village
[1] Government health center [2] Government Dispensary [3] Private health facility
[4] Medical store

6. What is your understanding of poverty?

7. What group of fishers do you think are the most poor?
[1] Boat owners [2] Crew members [3] Artisanal traders and processors’ [4] Other
specify _____

8. What action has the BMU taken/initiated to manage the fishery? (**Tick 3 most**)
[1] Formed by laws/rules [2] Controlled migrant fishers [3] Confiscated illegal fishing gears [4] Conducts patrols [5] Created awareness to fishers [6] Other specify_____
9. What development programs and projects have the BMU initiated
[1] Established income generating activities [2] Runs a credit and savings schemes for fishers [3] Established fines/levies and other charges for fish and offenders [4] Other specify_____
10. What achievements have the BMUs had in fishery since its formation
[1] Illegal fishing practices have reduced [2] Controlled migrant nature of fishers [3] Resolved conflict among fishers [4] Established savings and credit services [5] Improved sale of fish [6] Resolved the issue of faulty weighing scale [7] Improved hygiene at the landing site [8] Other specify_____
11. How can the BMUs performance be improved

Thank you very much

ANNEX III: OBSERVED AND EXPECTED COUNTS ON CHI SQUARE
CALCULATIONS

Table A1: Observed, expected counts and residual calculations on BMU performance

Activity	Response	Observed N	Expected N	Residual
Formulating by laws	Very effective & Somehow effective	62	62.0	.0
	Not effective	0	0	.0
	Total	62	62	
Patrolling fishing grounds	Very effective & Somehow effective	38	31	7.0
	Not effective	24	31	-7.0
	Total	62	62	
Confiscating bad gears	Very effective & somehow effective	57	31	26.0
	Not effective	5	31	-26.0
	Total	62	62	
Prosecuting offenders	Very effective & Somehow effective	61	31	30.0
	Not effective	1	31	-30.0
	Total	62	62	
Arresting offenders	Very effective & Somehow effective	60	31	29.0
	Not effective	2	31	-29.0
	Total	62	62	
Resolving disputes/conflicts	Very effective & Somehow effective	62	62	.0
	Not effective	0	0	.0
	Total	62	62	
Collecting revenues	Very effective & Somehow effective	52	31	21.0
	Not effective	10	31	-21.0
	Total	62	62	
Conducting meetings	Very effective & Somehow effective	51	31	20.0
	Not effective	11	31	-20.0
	Total	62	62	
Data collection	Very effective & Somehow effective	54	31	23.0
	Not effective	8	31	-23.0
	Total	62	62	
Keeping inventories	Very effective & Somehow effective	60	31	29.0
	Not effective	2	31	-29.0
	Total	62	62	
Initiating projects	Very effective & Somehow effective	45	31	14.0
	Not effective	17	31	-14.0
	Total	62	62	

ANNEX IV: OBSERVED AND EXPECTED COUNTS ON CHI SQUARE
CALCULATIONS

Table A2: Observed, expected counts and residual calculations by BMUs

Activity	BMU	Rating	Observed	Expected	Residual
Formulating by laws	Kayenze Ndogo	Very effective & Somehow effective	31	31	.0
		Not effective	0	0	.0
		Total	31	31.0	
	Kayenze	Very effective & Somehow effective	31	31	.0
		Not effective	0	0	.0
		Total	31	31.0	
Patrolling fishing grounds	Kayenze ndogo	Very effective & Somehow effective	15	19	-4
		Not effective	16	12	4
		Total	31	31.0	
	Kayenze	Very effective & Somehow effective	23	19	4
		Not effective	8	12	-4
		Total	31	31.0	
Confiscating bad gears	Kayenze ndogo	Very effective & Somehow effective	29	29	.5
		Not effective	2	2	-.5
		Total	31	31.0	
	Kayenze	Very effective & Somehow effective	28	28	-.5
		Not effective	3	3	.5
		Total	31	31.0	
Prosecuting offenders	Kayenze ndogo	Very effective & Somehow effective	31	31	.5
		Not effective	0	0	-.5
		Total	31	31.0	
	Kayenze	Very effective & Somehow effective	30	30	-.5
		Not effective	1	0	.5
		Total	31	31.0	
Arresting offenders	Kayenze ndogo	Very effective & Somehow effective	31	30	1.0
		Not effective	0	1	-1.0
		Total	31	31.0	
	Kayenze	Very effective & Somehow effective	29	30	1.0
		Not effective	2	1	-1.0
		Total	31	31.0	
Resolving conflict	Kayenze Ndogo	Very effective & Somehow effective	31	31	.0
		Not effective	0	0	.0
		Total	31	31.0	
	Kayenze	Very effective & Somehow effective	31	31	.0
		Not effective	0	0	.0
		Total	31	31.0	