



**NILE BASIN INITIATIVE/NILE EQUATORIAL LAKES SUBSIDIARY  
ACTION PROGRAM**

**LAKES EDWARD AND ALBERT FISHERIES PILOT PROJECT**

**CONSULTANCY SERVICES FOR FISHERIES STUDIES AND LAKE  
MANAGEMENT PLAN PREPARATION FOR LAKES EDWARD AND  
ALBERT**

**INTEGRATED LAKES MANAGEMENT PLAN (ILMP) FOR  
THE FISHERIES AND ECOSYSTEMS OF LAKES EDWARD  
AND ALBERT**

**FINAL REPORT**

**VOLUME 1: INTEGRATED LAKES MANAGEMENT PLAN  
(ILMP)**

**Submitted to**

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## ACRONYMS AND ABBREVIATIONS

AU	African Union
ADB	African Development Bank
BMU	Beach Management Unit
CBO	Community-Based Organization
CES	Catch Effort Survey
Cm	Centimeter
CPUE	Catch Per Unit of Effort
CS	Co-Management Structures
CSO	Civil Society Organization
DBA	Data-Base Administrator
DO	Dissolved Oxygen (in water)
DRC	Democratic Republic of Congo
DWD	Directorate of Water Development
E	East (Compass direction)
EAC	East African Community
EC	Electrical Conductivity (in water)
EU	European Union
FAO	Food and Agriculture Organization
FDG	Focus Group Discussion
FFMP	Fisheries Framework Management Plan for Lake Tanganyika
FIMS	Fisheries Information Management System
GEF	Global Environment Facility
H <sub>2</sub> S	Hydrogen Sulfide
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
HYDROMET	Hydro-meteorological (Project)
IFMP	Integrated Fisheries Management Plan (for Lake Victoria)
ILM	Integrated Lake Management (Project on Lake George)
ILMP	Integrated Lakes Management Plan
ILMP-A	Integrated Lake Management Plan for Lake Albert Basin
ILMP-E	Integrated Lake Management Plan for Lake Edward Basin
JPC	Joint Permanent Commission (between DRC and Uganda)
JTC	Joint Technical Committee
KBO	Kagera River Basin Organization
Kg/ha	Kilogram per Hectare
Km	Kilometer
LABAMA	Lake Albert Basin Management Authority
LABIMO	Lake Albert Basin Integrated Management Organization
LEBAMA	Lake Edward Basin Management Authority
LEBIMO	Lake Edward Basin Integrated Management Organization
LAGBIMO	Lake George Basin Integrated Management Organization
LAKIMO	Lake Kyoga Integrated Management Organization
LC	Local Council (in Uganda)
LEAB	Lakes Edward and Albert Basin

LEABIMO	Lakes Edward and Albert Integrated Basin Management Organization
LEAF	Lakes Edward and Albert Fisheries (Pilot Project)
LTR	Lake Tanganyika Research (Project)
LVFO	Lake Victoria Fisheries Organization
M&E	Monitoring and Evaluation
MC	Ministerial Council
MCS	Monitoring Control and Surveillance
MFI	Micro-Finance Institutions
mg/L	milligram per Liter
mls	milliliter
mm	millimeter
MSY	Maximum Sustainable Yield
N	North (Compass direction)
NBI	Nile Basin Initiative
NC	National Committee (of LEABO)
NELSAP	Nile Equatorial Subsidiary Action Program
NEMA	National Environmental Management Authority
NGO	Non-Governmental Organization
NO <sub>3</sub> -N	Nitrates
OAU	Organization of African Unity
OVI	Objectively Verifiable Indicators
PA	Phenolphthalein Alkalinity
PC	Personal Computer
PEAP	Poverty Eradication Action Plan
pH	Unit Measure for Alkalinity or Acidity
PNV	Virunga National Park
PSC	Policy Steering Committee
QENP	Queen Elizabeth National Park
RES	Regional Executive Secretary
RSF	Regional Stakeholders' Forum
S	South (Compass direction)
SOPs	Standard Operating Procedures
SO <sub>4</sub> <sup>2+</sup>	Sulfates
STATA	Statistical Package (for Fisheries Catch Effort Data Analysis)
SWOT	Strengths, Weaknesses, Opportunities, and Threats
TAC	Total Allowable Catch
TL	Total Length (for fish)
TN	Total Nitrogen
TOR	Terms of Reference
ToT	Training of Trainers
TSS	Total Suspended Solids
ug/L	microgram per Liter
UN	United Nations
UNDP	United Nations Development Program
UNCED	United Nations Conference on Environment and Development
UNECE	United Nations Economic Commission for Europe

UNEP	United Nations Environment Program
UNESCO	United Nations Education Scientific Organization
UNICEF	United Nations International Children Emergency Fund
UPE	Universal Primary Education
USD	United States Dollars
WMZ	Water Management Zone
IWRM	Integrated Water Resource Management
W	West (Compass direction)
WB	World Bank
WG	Working Group
WHO	World Health Organization



## EXECUTIVE SUMMARY

The Integrated Lakes Management Plan (ILMP) is the major output of the Lakes Edward and Albert Fisheries (LEAF) Pilot Project. LEAF is part of NELSAP's mission of implementing the Natural Resources Management Program (NRMP) that is aiming at eradicating poverty, promoting economic growth, and reversing environmental degradation in the Nile Equatorial Lakes region so that the people can improve the quality of their lives. The objectives of LEAF Pilot Project are, therefore, specifically to (a) provide plans for an improved ecological balance and greater biodiversity in the ecosystems of the two lakes, (b) develop a detailed environmental and social management plan, (c) provide detailed statistics on poverty and fisheries activities, (d) provide plans for harmonized fishing policies and laws between DRC and Uganda, and (e) prepare an Integrated Lakes Management Plan and Investment Projects. The last component, (e), is the subject of this Final Report.

The key problems and issues in the catchments of the two lakes and affecting sustainable exploitation and management of their fishery and water resources were identified in the Diagnostic and Feasibility Reports. These were related mainly to poverty, inadequacies in policy, laws and institutions; declining biodiversity, over fishing; degradation of river banks and lake shores; water quality deterioration, water level fluctuations and climatic changes; land degradation, deforestation, poor mining and quarrying; civil wars, population displacement and conflicts in resource use; poor public and stakeholder participation, poor information generation, dissemination and poor management practices. The root and immediate causes of these problems were also identified. Besides the weaknesses and threats that were summarized in Diagnostic and Feasibility Reports, the SWOT analysis brought out the socio-economic and environmental strengths and opportunities that exist within the ecosystems of Lakes Edward and Albert.

Despite these danger signals, the situational analysis revealed that the status of the ecosystems of Lakes Edward and Albert is not yet alarming and that the observed trends can easily be reversed if the ameliorative measures recommended in this report are put in place despite the existing poverty, poor socio-economic conditions, and weak institutional and operational status. In addition, the ecosystems of the two lakes still have a rich fish base and relatively unpolluted waters. Other natural resources in the basin of the two lakes include fertile lands, rich wild life, stable wetlands, forests, rich biodiversity, many untapped minerals, rich sources of solar, wind and hydro power, available human capital, accessible markets in the region and overseas, good political will, and positive support from development partners. A significant development in the Lake Albert basin is the recent large scale oil prospecting which is expected to lead to commercial oil production in the next couple of years.

Various management options were identified and assessed before recommending a combination of holistic, ecosystem, adaptive, precautionary, policing, proprietorship, and co-management/partnership management approach for adoption over time and space within the environment of Lakes Edward and Albert. The proposed strategic ILMP is, therefore, based on a sense of direction in modern ecosystem management particularly in lake and river catchments. This has been referred to as '*integrated management framework*' where there is adoption of a shared vision of the environmental resources, pursuance of a common integrated strategy to

achieve the shared vision, taking of concrete steps to prevent and mitigate threats, sharing responsibility to address complex trans-boundary issues, and development of innovative new partnerships. It is on these understanding that the vision, mission, policy, and general principles, and operational, legal, and institutional frameworks were developed for the ILMPs of the two lakes. It is also on the same understanding that the proposed institutional mechanism for the implementation of the integrated management has been structured.

Integrated lake management plans are therefore proposed in this report to address the observed problems and issues. The Report is presented in two volumes. The first Volume presents the Integrated Lakes Management Plans for Lake Edward and the second for Lake Albert (ILMP). The second Volume presents the proposed Investment Projects. This has been done in accordance with the objective of NELSAP to promote joint projects for the Governments and the people of DRC and Uganda. The two Governments have demonstrated their willingness to cooperate through their joint participation in the preparation of this study. The ILMPs are proposed under two separate transboundary lake management mechanisms namely the Lake Edward Integrated Management Plan and the Lake Albert Integrated Management Plan to address specific issues unique to each lake basin. The reason for this is that the two lakes are distinctly different in their geology, geomorphology, ecology, biodiversity and each lake has its own unique socio-economic and management problems and issues. Hence, two bodies are proposed to manage the implementation of the ILMPs namely the Lake Edward Basin Management Authority (LEBAMA) and the Lake Albert Basin Management Authority (LABAMA). Through LEBAMA and LABAMA as the institutional and operational frameworks, the ILMPs for the two lakes will be implemented in a collaborative manner with the national stakeholder organizations for the lakes namely the Lake Edward Integrated Basin Management Organization and the Lake Albert Integrated Basin Management Organization which will be expected to operate at national, district and community level in each catchment within the two countries for the purpose of benefiting the two riparian countries equitably.

A national stakeholders' mechanism for implementation of management programs for the Lakes Edward and Albert Basins at national level is proposed. This will be called the Lakes Edward and Albert Basin Integrated Management Organization (LEABIMO). LEABIMO would be a bottom-up organization, formed by a conglomeration of the national institutions, organizations and individuals. The organization proposed will be a grouping of stakeholders at various levels all of whom have deep interest in the lakes and their resources. The body will enable various stakeholder groups to meet and discuss problems and issues related to the utilization and management of the fisheries, water and other resources of the two lakes. At national level, the National Lake Edward and Albert Basins Management Organization (LEABIMO) will be the direct link to the Joint Technical Committee, while the lower bodies will hierarchically link to each other right from the BMU/UGREP. LEABIMO will facilitate operational linkages with the Joint Technical Committee (JTC) of the two transboundary bodies namely, the regional Lakes Edward Basin Management Authority (LEBAMA) and the Lake Albert Basin Management Authority (LABAMA).

Further, possible mitigation measures and solutions to the above problems and threats are provided in the proposed Investment Projects with budget estimates and possible sources of financing.

Major outputs of the ILMPs are (a) the creation of an enabling environment through legislation and harmonization of laws, (b) establishment of a sustainable institutional framework for joint management of the shared natural resources, (c) the promotion of integrated, sustainable, and balanced development, management, and utilization of environmental resources for the benefits of the present and future generations, (d) the promotion of local community participation at all stages of the project implementation, and (e) the implementation of joint projects by the stakeholders in the two countries. Preference in the investment plans are being given to projects that will demonstrate positive impacts on biodiversity, poverty, quality of life, and on the quality of the environment (water, land, and air), and those that will involve cross-border partners. The initial focus of the ILMPs is laid on harmonization of regulations, institutional establishment, biodiversity conservation, pollution control, environmental education, improvement in data collection statistical system, monitoring and evaluation of trends in the development, management, and utilization of the natural resources, and promotion of regional cross-border cooperation. Recommendations are made to enable the implementation of the ILMPs in the immediate and for the future.

# **1. INTRODUCTION**

## **1.1 Background to the Study**

The genesis and rationale for formulation of Integrated Lakes Management Plan (ILMP) to manage the Lakes Edward and Albert basins and fisheries is that about 73% of the people depend for their life on the ecosystems of the two lakes. The aquatic environment provides nutrition, livelihood, minerals, medicine, building materials, and aesthetic benefits like tourism, sports, and aquarium products. The area also binds the people together through beliefs, practices, and traditions. It is also a medium for transportation and communication. The natural resources of the basin facilitate trade, commerce, and economic growth. They also have special physical and biological features some of which like the hot springs, snow capped Mount Rwenzori, and deep escarpments are found only in the region. However, the two ecosystems are facing serious environmental threats of various kinds.

The study has, therefore, developed this ILMP to address the issues diagnosed in the Feasibility Report. It is the objective of the ILMP to ensure the sustainability of the fisheries of the two lakes and their ecosystems. Inter alia, the purpose of developing the ILMP for Lakes Edward and Albert is to reduce poverty amongst the riparian communities, guarantee their livelihoods, ensure food security, improve employment opportunities, and protect the environment. The ILMP is not being developed in isolation. The preparation of the ILMPs has been built on ongoing efforts of the two Governments through the departments of Fisheries, Environment, Water Resources Management, Agriculture, parastatals, NGOs, and others working in the area. The ILMP is making proposals to integrate existing national, regional, and international conventions, protocols, and agreements into the management structure of the lake basins and the fisheries of the two lakes. This will be accomplished through the establishment of a viable system for the management of the lake fisheries and restoring the ecosystem to contribute to the development of sustainable fisheries. Mobilization and involvement of the stakeholders at local, regional, and international levels will play a big role in the planning, management, control, enforcement, and surveillance process employing Integrated Lake Management Plans (ILMP) to address issues raised in the environmental threats.

The ILMP has taken due cognizance of existing policies, laws, institutions and development policies of the DRC and the Republic of Uganda. It was, therefore, developed using existing institutional and legal frameworks targeting the management of natural and fisheries resources in the two countries. Consequently, the ILMP has updated and harmonized existing policies, institutions, laws, and regulations where necessary.

## **1.2 Methodology for the preparation of the Integrated Lakes Management Plan (ILMP)**

The development of the ILMPs was a continuous process during the study but hinged on information derived from the various thematic studies. The work of all the consultants was fed into the preparation of the ILMP and the exercise was coordinated by the Team Leader and the Deputy Team Leader. The Log frame used spelt out the objectives, activities, outputs, verifiable indicators, time frame, and persons responsible for each action. The study worked out elements of an integrated lakes management system which would be expected to operate at four levels namely, at the community (BMU) level, district level, national level, and regional level. Further, the study proposed structures, organs, membership, personnel/staffing, mandates, roles and functions of the four tier management system.

The major perceived problems and issues in the Lakes Edward and Albert Basins were identified through questionnaires administered to selected key stakeholders as well as through direct observations by the study team, personal interviews, discussions, and meetings conducted by the consultants. Responses from the respondents were not subjected to detailed analysis as only summaries of average positions were obtained. The problems and issues covered the area of interest of the LEAF study including those associated with poverty and livelihoods, land use, water pollution and catchments environment, biodiversity, fisheries, fish quality, fisheries socio-economics, biostatistics, hydrology, fishing infrastructure, fish landing hygiene and public health, policies, laws and institutions. These issues were identified as national issues pertaining to either the DRC or Uganda, but they all have trans-boundary impacts in the two riparian countries.

However, although these issues were not prioritized by stakeholders, they were all rated as important and therefore of high priority on the basis of the following criteria:

- i. Threat to the natural resource base particularly threat to the fisheries;
- ii. Threat to the ecological balance of the lakes ecosystem;
- iii. Threat to the natural beauty and tourist attractions of the lakes;
- iv. Threat to the water quality and water quantity of the lakes;
- v. Threat to the livelihoods of the riparian communities;
- vi. Point - source or non-point source origin of the problem;
- vii. Consequences if no action is taken to address the problem;
- viii. Affordability or cost implications of mitigating the problem; and
- ix. Geographical extent or spread of the problem.

### **Outputs of Integrated Lakes Management Plan (ILMP)**

Output 1: A diagnostic assessment report based on the collected and analyzed data prepared: Volume I of the Report;

Output 2: An integrated development and management framework proposed;

Component 1: A summary of development issues of the sector

Component 2: Appropriate development axes (Strategic Plans)

Component 3: Short and medium term action program

Output 3: Two priority projects that are sustainable, poverty focused, gender sensitive, and environmentally friendly prepared;

Component 1: Carry out technical, financial, and socio-economic study;

Component 2: Determine technical, financial, and socio-economic parameters including the funding requirements in local and foreign costs;

Component 3: Assess the global impacts and economic returns of these investments.

Output 4: Potential sub-sector partners, conceivable funding arrangements and possibility for public/private partnership specified;

Output 5: Proposals for the creation of a Lakes Edward and Albert Authority inclusive of structure, modes of operation and sustainability made;

Output 6: Proposals for a harmonized fishery statistics system and the setting up of a computerized database at the NELSAP level prepared;

Output 7: Investment plans for water resources development and management in the catchments formulated.

### 1.3 Overview and Structure of the Report

A Mid-Term Diagnostic Report was submitted by the Consultant to the Client in August 2007. It provided vital baseline information on the ecosystem functions in the two lakes; their fisheries and biodiversity, fish quality problems, hydrology, socio-economics of the fisheries, catchments environment and status of policies, laws and institutions in the basins of the two lakes. The findings provided in the Mid Term Diagnostic Report, therefore, form the scientific and information basis for identification of key problems and issues in the basin of the two lakes as well as recommendations to mitigate the observed problems. Investment projects to address the observed key issues were proposed on the basis of the recommendations made in the Feasibility Report submitted by the Consultant to the Client in March 2008. Further, proposals for research and capacity building including training were made where necessary in addition to an institutional framework for implementation of the recommended investment and research projects. Inter alia, the findings in the Diagnostic and Feasibility Reports provided the necessary information for formulating this Integrated Lakes Management Plan and the Fisheries Management Plan for the lake basin which is structured as follows:

**Chapter 1** provides an introduction giving highlights of the genesis of the LEAF Project, its purpose, and expected outputs. **Chapter 2** covers the situational analysis of the

project area, its demographic characteristics, its main socio-economic activities, the value of the lakes basin, adverse impacts of the current trends, and relationship between poverty and environment and trans-boundary issues. It also summarizes the key findings of the eight thematic study areas covering Biodiversity, Fisheries Biology, Water Quality and Catchments Environment, Hydrology and Water Resources, Civil Engineering and Infrastructure, Fisheries Socio-Economics, Fisheries Statistics and Policy, Laws and Institutions. Details of the findings were given in the Mid Term Diagnostic Report. A summary of the simplified analysis of the main stakeholders in the lakes basin is also given. It summarizes the major threats identified in the Lakes Edward and Albert Basin during the study. The root and secondary causes of these problems are also given. **Chapter 3** gives options for sustainable development and management of the fisheries and the ecosystems. **Chapters 4** proposes strategic approach to achieving the set vision for the Lakes Edward and Albert basin and spells out the mission, desired changes, strategic action statements and general principles. **Chapter 4** further, focuses on the proposed strategic goals and objectives leading to action programs that have been proposed for implementation in the short (5 years), medium (10 years), and long-term (15 years). **Chapter 5** proposes the Integrated Lake Management Plan for Lake Edward Basin (ILMP-E). It gives the general principles for the management of the and specific strategic instruments and actions to address each of the observed issues. It proposes the establishment of a regional transboundary institutional mechanism for the sustainable management and development of the Lake Edward Basin, including its structure and linkages. In **Chapter 6** the rationale for developing a separate ILMP for Lake Albert is provided and this is followed by a presentation of a lake management plan for the lake. **Chapter 7** gives aspects of the new concept for the management of lakes involving Beach Management Units and managing lakes on the basis of catchments. Aspects of planning for Integrated Lake Management, revenue generation, rights of access to environmental resources / property rights, conflict resolution and monitoring and evaluation are given in this chapter. **Chapter 8** provides conclusions and recommendations. **Chapter 9** is a proposal for setting up a National stakeholders' mechanism for the management of Lakes Edward and Albert Basin. However, this arrangement is not included in the regional management mechanism as it has been argued that combining this with the regional mechanism would lead to duplication of roles and overlap of activities. Hence, it is now suggested that the stakeholders' management mechanism belongs to the national governments and its implementation should be national using district and community settings. However, it is recommended that this arrangement should have close links with the proposed regional management which is recommended for the two lakes.

## **2. SITUATIONAL ANALYSIS**

### **2.1 The Lakes Edward and Albert Basin (LEAB)**

#### **2.1.1 The Basin and its Water Resources**

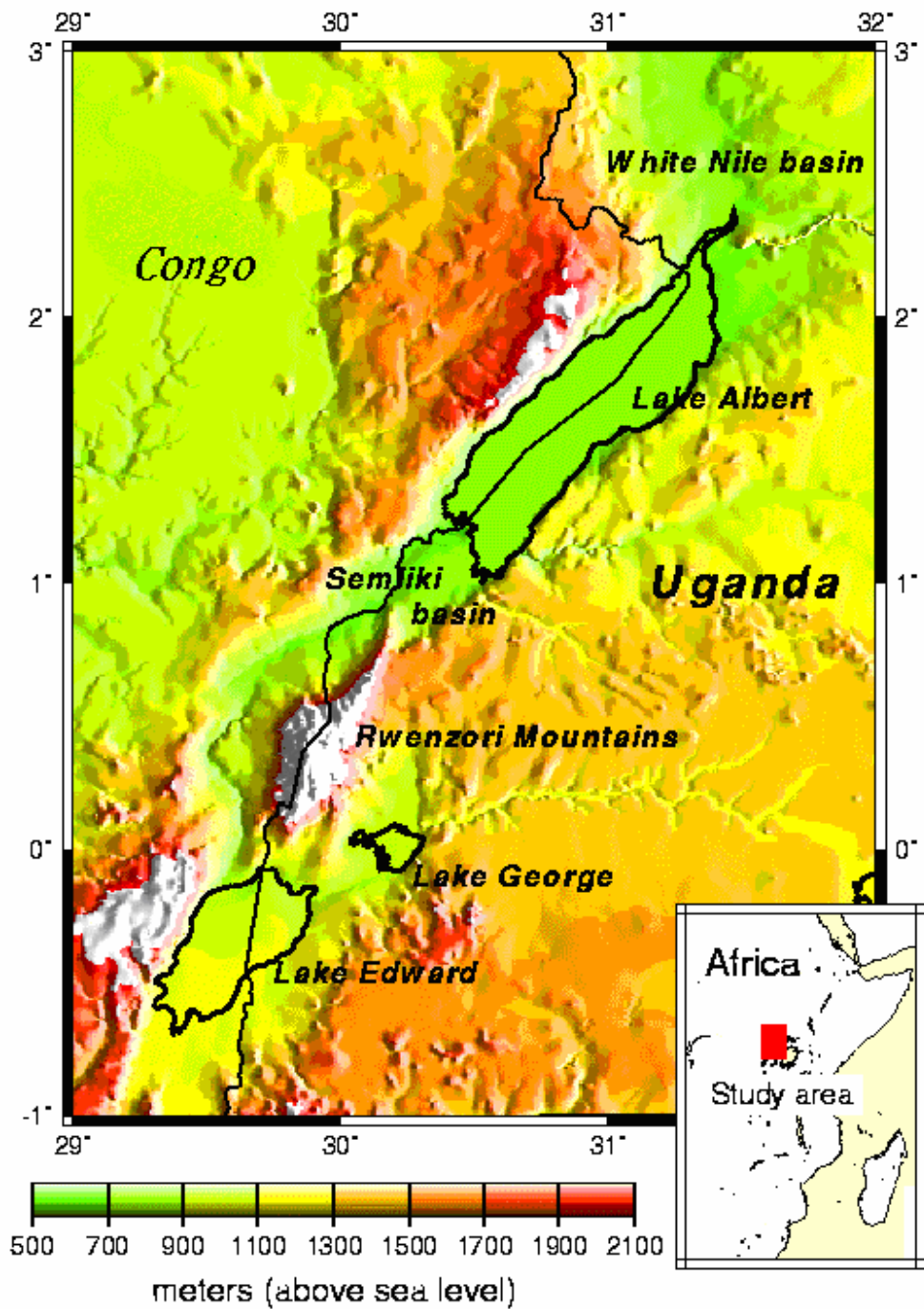
The LEAF project area is shown in **Fig.1.1** and **Fig. 1.2** covering Lakes Edward and Albert Basin. These two lakes are rift valley lakes shared by the Democratic Republic of Congo and the Republic of Uganda.

Lake Edward is the smallest of the Great Lakes of Africa. It has a mean lake level of 920 meters (m) whose western border is the Mitumba - Kyavirimu mountain range that towers up to 3,117 meters above sea level. The southern and eastern shores are flat lava plains. The Ruwenzori Mountains lie 20 km north of the lake. The lake is 90 km long and 40km wide. Its average depth is estimated at 34m (near Ugandan shoreline), with a maximum of 120 m towards the Congolese side. Lake Edward basin is about 12,000 square kilometers. The Semliki River is the only outlet with its Rwindi- Rutshuru tributaries that empties into Lake Albert. Lake George, to the northeast empties into Lake Edward through Kazinga Channel. Lake Edward is fed by the Nyamugasani, the Ishasha, the Rutshuru, and the Rwindi Rivers. It is enclosed by two national parks, the Queen Elizabeth National Park (QENP) in Uganda and the Virunga National Park (PNV) in the Democratic Republic of the Congo (DRC).

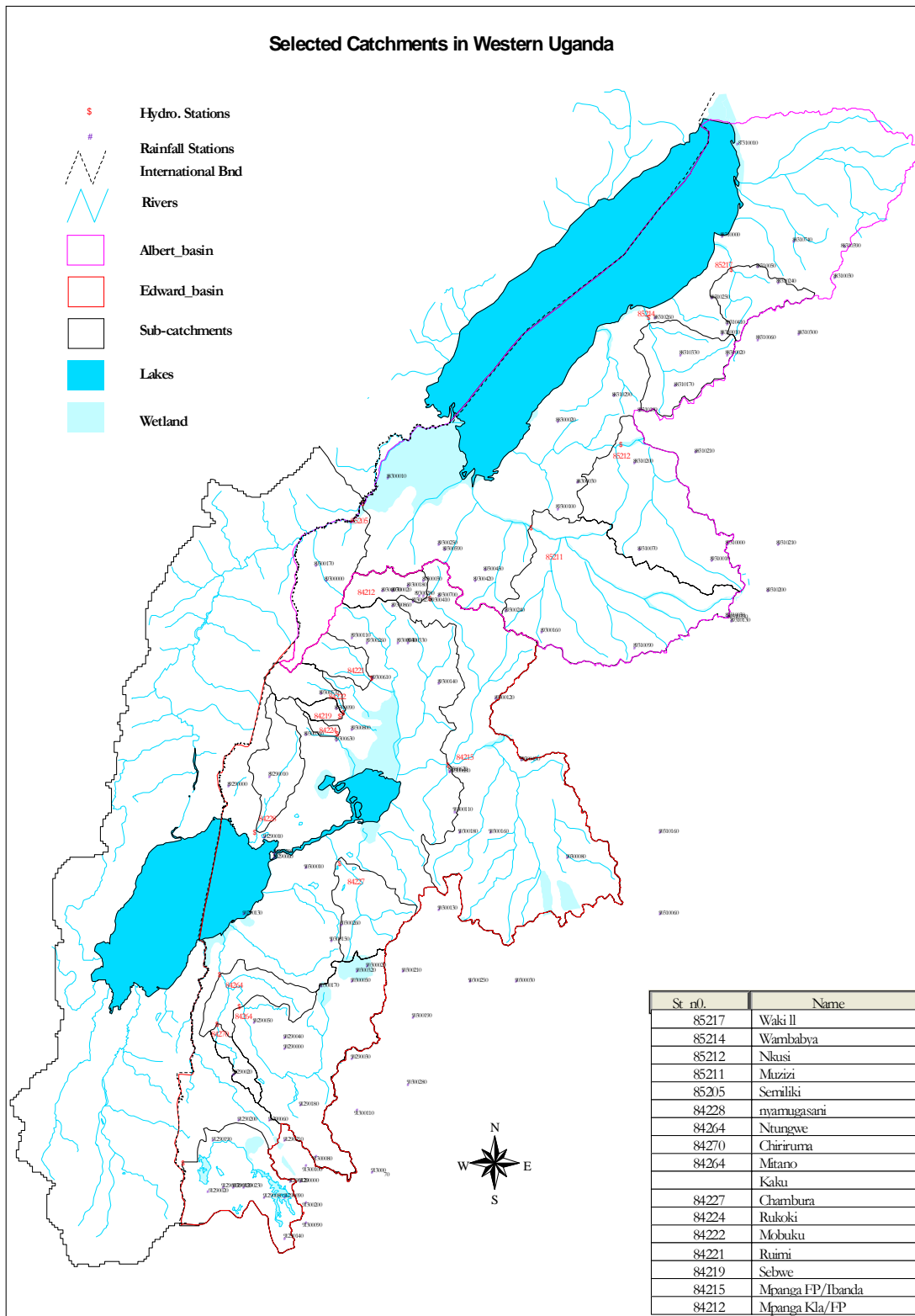
Lake Albert on the other hand is situated in the center of the central African plateau on the border between Uganda and the Democratic Republic of Congo, and is the northernmost of the chain of lakes in the Great Rift Valley. It lies at an altitude of 620 m above sea level. It is 160 km long and 35 km wide. It is relatively shallow with an average depth of 25 m and a maximum of 58m towards the Congolese border. The lake receives water from Lake Edward through the Semliki River in the south, from the Nile River in the north, which ultimately comes from Lake Victoria to the southeast and from other rivers such as the Waki, Muzizi, Nkuzi, Wambabya, Chambura and others. Its outlet, at the northernmost tip of the lake, is the Albert Nile which becomes known as the White Nile when it enters Sudan. At the southern end of the lake, where River Semliki comes in, there are swamps. Further south (30 km) loom the mighty Ruwenzori Range, while a range of hills called the 'Blue Mountains' tower over the northwestern shore.

It is therefore seen that the water resources in the catchment of LEAB are recognized as international waters and therefore, trans-boundary water resources with cross-cutting interests and impacts since without adequate water in quantity and quality all other interventions in water related activities cannot be achieved. Hence, there is need for an Integrated Water Resources Management approach in the basin of LEAB in order to ensure that water and other resources are equally shared and wisely used for the well-being of all peoples in the basin.





**Fig. 1.1:** Map of Lakes Edward and Albert Basin (Source: Wikipedia 2006)



**Fig. 1.2: Catchments of the Lakes Edward and Albert Basin in Uganda**

## 2.1.2 Demography

### 2.1.2.1 The Population within the Lake Edward and Lake Albert Basin (LEAB)

**Table 1.1** shows the characteristics of the majority of human population in lakes Edward and Albert basins. The people on both sides of the two lakes are of the same ethnic stock. The social indicators of the communities in the basin, such as access to health care and safe drinking water, education, nutrition level, and sanitation are lower than national indicators. Water supply and sanitation, health and diseases, transportation and communication and the presence of refugees are huge problems; hence poverty has remained rampant amongst the small holder farming and fishing communities.

**Table 1.1: Location, Population, and Land area of the LEAF Pilot Project.**

Riparian country	Lake Edward		
	District/Province	Population	Area (km <sup>2</sup> )
DRC	North Kivu	3,564,434	59,483
Uganda		1,275,662	37,966
Uganda Districts	Bushenyi	376,361	4,026
	Kanungu	160,708	1,281
	Kasese,	343,601	31,205
	Rukungiri	394,992	1,454
<b>Lake Edward Total</b>		<b>4,840,096</b>	<b>97,449</b>
Lake Albert			
DRC	Orientale	5,566,000	503,239
Uganda		1,309,119	
Uganda Districts	Bundibugyo	116,566	2,338
	Hoima	197,851	5,492
	Kibaale	417,218	1,827
	Masindi	260,796	9,236
	Nebbi	316,688	2,891
<b>Lake Albert Total</b>		<b>6,875,119</b>	<b>21,784</b>
<b>Total for both countries and lakes</b>		<b>11,715,215</b>	<b>119,233</b>

Unlike Lake Albert, Lake Edward lies completely within the Virunga National Park in DRC and the Queen Elizabeth National Park in (Uganda) and does not have extensive human habitation on its shores, except at Ishango in DRC in the north, home to a park ranger training facility. About two-thirds of its waters are in the DRC and one third in Uganda. Apart from Ishango, the main Congolese settlement in the south is Vitshumbi, while the Ugandan settlements are Mweya and Katwe in the north-east, near the crater lake of that name, which is the chief producer of salt in Uganda. The Mweya Safari Lodge is the main tourist facility, serving both Lake Edward and Lake Katwe. The

nearest cities are Kasese in Uganda to the north-east and Butembo in DR Congo, to the north-west, which are respectively about 50 km and 150 km distant by road.

This study revealed that population sizes at the landing sites fluctuate according to fishing seasons, ranging between 1,000 and 4,000 people. However, at Katwe on Lake Edward and Panyimur on Lake Albert, the number often rose to 10,000 people. Fluctuations in populations at the landing sites were caused by in and out migrations of short and long term nature. Migration was primarily a livelihood strategy adopted by the communities to access sources of food and income. The main factors responsible for migrations among the fishing communities were:

- a) Catch fluctuations, when people were attracted to the landing sites during high seasons and they depart during low seasons.
- b) Search for better market for catch.
- c) Crop seasons, when people returned to their villages to attend to their crops during planting, weeding, and harvesting seasons.
- d) For '*mukene*' fishers, lunar cycles determined whether the fishers would be active at the landing sites during the dark phase of the moon, or were unable to fish and move out during the full phase of the moon.
- e) Episodes at the landing site or elsewhere, such as cholera outbreak or insecurity in the neighbouring country.

However, migration also has negative effects on fisheries management and development as outlined below:

- a) Hinders effective planning and provision of social services to the communities, such as health and education.
- b) Constrains fisheries management as fishers often move with illegal fishing gears and methods from one place to another.
- c) Hinders the operations of BMUs as their stability is affected by the frequently changing memberships.
- d) Often leads to insecurity and theft of gears as the migrants may include criminal characters.

The majority of the fishers were adult males while women constituted a very small percentage. Their ages ranged between 25 to 60 years and most of them were married. The dominant tribes on Lake Edward were the Banyankole and Batoro in Uganda and Nande in DRC, while on Lake Albert; the main communities were Alur and Banyoro in Uganda and Alur and Hema in DRC.

The population was found to be literate but the literacy level for most of them was limited to reading in local languages, writing ability being quite limited. Ability to read and write in English or French was still low among the fishers. Low levels of education and literacy is an indicator of poverty. It hinders the fishers' capacity to understand issues relating to fisheries management, environment management, fish quality and fish

business management. It also limits their capacity to acquire the skills necessary to modernise their fishery operations.

On average, the households had 2-3 male and also 2-3 female children of below 18 years and fewer children of above 18 years. Most of them were in Primary schools but a few were not in school and others in secondary and higher institutions.

### 2.1.3 Main Stakeholders in the Lakes Edward and Albert Basin

**Table 1.2** shows the major stakeholders identified in the Lakes Edward and Albert basin. Each stakeholder has either positive and or negative contribution in the basin.

**Table 1.2: Main Stakeholders in the Lakes Edward and Albert Basin**

<b>Stakeholder Group</b>	<b>Positive Role in the lake basin</b>	<b>Negative Impacts in the in the lake basin</b>	<b>Recommended Interventions</b>
1. Fishers	Play role in Implementation, Education, Sensitization, Monitoring, Surveillance, Enforcement, data collection, tax collection, research data collection	Biodiversity loss; Over fishing and decimation of fish stocks	Formulate Conservation measures, Formulate sustainable Fishing regulations, Enforce Regulations.
2. Farmers	Play role in Implementation, Education, Sensitization, Monitoring, Surveillance, Enforcement, data collection, tax collection, research data collection	Land degradation, siltation of waters, chemical and physical pollution of waters.	Formulate soil and water management regulations, Enforce sustainable agricultural practices.
3. Livestock keepers	-----	Land degradation, siltation of lake waters and loading of lakes with nutrients which can lead to organic pollution (eutrophication) and algal blooms	Formulate and enforce livestock management regulations for sustainable practices.
4. Hunters and Poachers	-----	Decimation of wild life and loss of biodiversity	Formulate and enforce wildlife management regulations
5. Forest loggers and fuel wood collectors	-----	Decimation of tree species and loss of biodiversity	Control de-forestation, Carry out tree planting extensively.
6. Hoteliers	Implementation, Education, Sensitization, Monitoring.	Pollution through domestic effluent, oil and solid waste	Formulate waste management regulations and enforce them.
7. Tourists	Implementation, Education, Funds	Pollution through solid waste	Formulate waste management regulations and enforce them.
8. Central	Planning, Financing,		

governments	Budgeting, Monitoring, Oversight, Coordination, Implementation, Training	----- --	
9. Local governments and Urban Authorities	Planning, Financing, Budgeting, Monitoring, Oversight, Coordination, Training and Implementation.	----- -	
10. NGOs and CBOs	Planning, Financing, Budgeting, Monitoring, Oversight, Coordination, Sensitization		
11. Lake transporters	Implementation, Education, Sensitization, Monitoring.	Pollution through solid waste and oil	Formulate waste management regulations and enforce them.
12. City, Town, Municipality and Fish landing inhabitants	Planning, Financing, Budgeting, Monitoring, Oversight, Coordination, Sensitization	Solid waste, sewage and chemical pollution	Formulate waste management regulations and enforce them.
13. Food processing industries	Implementation, Education, Sensitization, Monitoring.	Solid waste pollution, Effluent and organic pollution	Formulate waste management regulations and enforce them.
14. Other industries including oil and chemical industries	Implementation, Education, Sensitization, Monitoring.	Chemical pollution of rivers and lakes; physical damage to landscape; injury and displacement of wildlife	Formulate waste management regulations and enforce them.
15. Road contractors	Implementation, Sensitization, Monitoring.	Siltation of waters, oil pollution, solid waste pollution.	Formulate and enforce sustainable road construction procedures, Enforce waste management regulations.
16. Scientists	Research, Implementation, Education, Sensitization, Monitoring.	----- ----	
17. Academicians	Research, Implementation, Education, Sensitization, Monitoring, Data collection	----- ----	
18. Students	Research, Implementation, Education, Sensitization, Monitoring, Data collection.	----- ----	
19. Traditional groups	Research, Implementation, Education, Sensitization, Monitoring.	----- ---	
20. International community	Funding, Research, Monitoring and Sensitization	----- ---	

### 2.1.4 Strengths, Weaknesses, Opportunities and Threats (SWOT) Encountered During Diagnostic Survey

The ecological and socio-economic setting of the study area was established through the diagnostic survey which identified the existing strengths, weaknesses, opportunities, and threats in the Lake Edward and Lake Albert basins as shown in **Table 1.3**. The weaknesses and threats showed what factors exist on site that would debilitate or undermine the implementation of any proposed projects within the two basins. On the other hand the survey identified strengths and opportunities that would positively affect proposed projects thus enhancing the livelihoods of the communities in both countries. The projects being proposed to be implemented under the ILMP have, therefore, been designed to take into account the strengths, weaknesses, opportunities and threats existing in the project area. These are listed for the various sectors as follows:

**Table 1.3: Strengths, Weaknesses, Opportunities, and Threats in LEAB**

<b>Strengths</b>	<b>Weaknesses</b>	<b>Opportunities</b>	<b>Threats</b>
<ol style="list-style-type: none"> <li>1. Large clean fresh water bodies free of pollution and chemical contamination;</li> <li>2. Good stable endemic stocks of fish in the lakes;</li> <li>3. Good arable fertile lands;</li> <li>4. Large almost virgin forests with high value timber trees;</li> <li>5. Rich miner deposits;</li> <li>6. Large numbers of experienced fishermen;</li> <li>7. Human capital - availability of labour</li> <li>8. Availability of large local, national, regional and international markets</li> </ol>	<ol style="list-style-type: none"> <li>1. Poor knowledge of the biology, ecology and population dynamics of the fish stocks;</li> <li>2. Poor lake shore infrastructure for transportation, storage and preservation offish;</li> <li>3. Poor accessibility by the fisher folk to financial resources;</li> <li>4. Poor organization of the fisher folk and fish traders;</li> <li>5. Poor road accessibility;</li> <li>6. Poor marketing;</li> <li>7. Poor regional policy, legal and institutional framework;</li> <li>8. Poor</li> </ol>	<ol style="list-style-type: none"> <li>1. Availability of a rich base of natural resources in the two lake basins including land, water, wetlands, forests, wildlife, minerals, solar, wind and hydro power;</li> <li>2. Large potential market in East Africa, in the Eastern DRC and in the Southern Sudan;</li> <li>3. Good political will;</li> <li>4. Positive support from development partners;</li> <li>5. Presence of the Nile Basin</li> <li>6. Initiative, NELSAP and other regional initiatives;</li> <li>7. The return of peace to the Southern Sudan;</li> <li>8. War and civil strife fatigue amongst the riparian countries;</li> </ol>	<ol style="list-style-type: none"> <li>1. High rates of poverty</li> <li>2. High post harvest losses;</li> <li>3. High potential for oil and chemical pollution from the oil fields in Ugandan part of the Lake Albert basin;</li> <li>4. High rates of deforestation in the catchments;</li> <li>5. High pollution potential from mining;</li> <li>6. High potential for eutrophication from agro-chemicals and organic substances from farms and deforested areas in the basin;</li> <li>7. High insecurity and civil strife in the lake basins;</li> <li>8. Conflicts, ethnic and on the lakes,</li> <li>9. Political uncertainty,</li> <li>10. High piracy on the lakes;</li> <li>11. Use of illegal burned fishing gear and methods;</li> <li>12. Unreliable rain patterns;</li> <li>13. Frequent and longer droughts and floods;</li> <li>14. High incidence of</li> </ol>

	enforcement; 9. Poor technological development;	9. Successful multi-party elections in the DRC; 10. On going negotiations between the Government of Uganda and the Lord's Resistance Army;	HIV/AIDS, water born and vector born diseases; 15. Decline in lake water levels; 16. Infestation by water weeds particularly the water hyacinth.
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### 2.1.5 The Environment of Lakes Edward and Albert Basin

The geo-physical characteristics that define the environment of LEAB are given in above Sections. The environment encompasses many ecosystems which are nationally and globally significant for their biodiversity and physical features. The major problems and issues that were identified during the Diagnostic Survey and whose details appear in the Diagnostic Report are listed below in **Table 1.4** as the key issues to be addressed in the basin of Lakes Edward and Albert.

**Table 1.4: Aggregated Major Problems and Issues in the Lakes Edward and Albert Basin (Numbers do not denote prioritization)**

Major perceived and observed problems and issues in the Lakes Edward and Albert Basin	Priority	Recommended mitigation measures and Investments
1. Poverty	High	Put in place poverty alleviation programs for the rural poor
2. Declining Fisheries (over fishing)	High	Control fishing pressure through enforcement of appropriate laws and regulations
3. Civil wars and population displacement	High	Put in place conflict resolution mechanisms
4. Land Degradation	High	Control land degradation through enforcing the use of sustainable agricultural practices
5. Deforestation	High	Control deforestation through enacting enforceable laws and encourage forestation
6. Shortage of Energy	High	Forster use of sustainable energy alternatives
7. Wetland Destruction	High	Formulate sustainable wetland use policies and laws and enforce them
8. Degradation of River Banks and lake Shore	High	Formulate and enforce catchments management laws and regulations
9. Water Quality deterioration	High	Improve land use practices, public hygiene and manage effluents and wastes
10. Water level fluctuations	High	Better planning and improved land use management
11. Poor Mining and Quarrying	High	Formulate mining law and enforce them



12. Conflicts in Resource use	High	Rationalize resource use equitably
13. Inadequacies in Policy, Laws and Institutions	High	Up date and harmonize policies and laws and put in place effective institutions
14. Prevalence of Diseases and Pests	High	Improve disease control, surveillance and treatment of patients
15. Poor public and stakeholder Participation	High	Involve public in all planning, implementation and monitoring of projects
16. Poor information Generation, dissemination and Management	High	Improve information gathering, storage and dissemination
17. Climatic Changes	High	Improve planning and forecasting

The major thematic problems identified were quite similar. However, several are different in their own ways since each theme has peculiar attributes particularly for land use, water quality and pollution, water quantity, fisheries and biodiversity, policies, laws and institutions. However, general cross cutting issues such as socio-economics, diseases, conflicts, poverty, gender and refugees have similar attributes such as their main root causes, immediate or secondary causes and impacts. The identification of these issues leads to identification of their root causes and logically to finding interventions to address them. Aggregated root causes of these problems were identified and are shown in **Box 1.1** whilst their secondary causes (which could also be called immediate causes) are shown in **Box 1.2** below. Secondary causes of the major perceived problems and issues are of national origin. Specific problems and issues identified in each study theme appear in the Feasibility and Diagnostic Survey Reports and are summarized below.

### **Adverse Impacts of Current Trends**

The study of the current status of the ecosystems of Lakes Edward and Albert shows that the increase in human population in the basin of the two lakes that is accompanied by the associated socio-economic activities is resulting into the deterioration of water quality, destructive fishing practices, degradation of the environment, and depletion of resources that are otherwise renewable, loss of habitats and endemic species. Diseases affect human productive capacity. Habitats and resources degradation and loss of biodiversity affect resource productive capacity and intrinsic resiliency, which in turn affect income, food adequacy and security, water quality, natural defense against calamities and future potential uses.

If these current trends in resources depletion, environmental degradation, and water quality deterioration that are being caused by human activities are not changed, the socio-economic status of the communities living in the two basins could begin to deteriorate drastically because of the following reasons:

- (a) Food security will be undermined as populations of fish and other edible resources crash due to unsustainable and destructive practices;
- (b) Economic dislocation will result for those whose jobs are related to the fisheries and nearby land resources because the environment will no longer be able to generate sustainable livelihoods;

- (c) Public health will be compromised by increased dangerous waste levels in the waters within the basin;
- (d) Infrastructures will deteriorate as pressures of population increase undermine the ability to provide adequate infrastructure levels;
- (e) Aesthetic and recreational values of the environment will be lost;
- (f) Conflicts on the use of the resources and inaccessibility will intensify and lead to social strife;
- (g) Pressure on the two Governments for health and social services, food adequacy, and infrastructures will increase and become difficult to cope with and to compensate for the loss of environmental resources and values; and
- (h) Other sources and means of economic development will not be able to compensate for the irreversible damage that will have been done to the ecosystems of the two lakes.

**Box 1.1: The root causes of the major problems**

- ❖ Poverty;
- ❖ Limited livelihoods;
- ❖ Population pressure;
- ❖ Wars and civil strife;
- ❖ Inadequate and or inappropriate policies, laws and institutions;
- ❖ Political interference;
- ❖ Corruption;
- ❖ Inappropriate mining and urbanization; and
- ❖ Climatic and Hydrological changes.

**Box 1.2: The Secondary Causes**

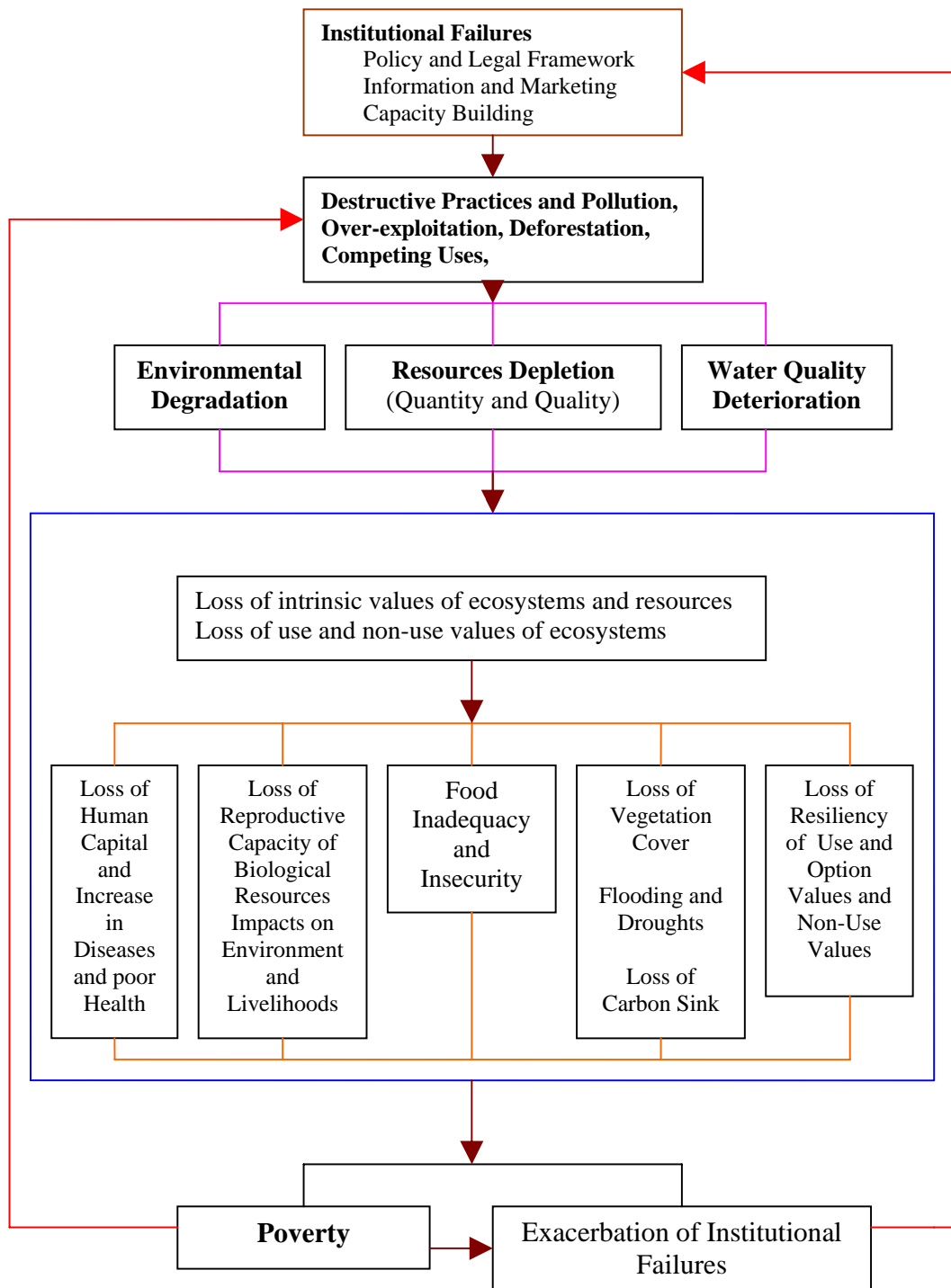
- Ineffective planning;
- Weak legislation;
- Inadequate implementation;
- Weak political will;
- Weak enforcement;
- Inadequate human capacity;
- Inadequate financial resources;
- Weak private sector involvement;
- Erosion of traditional norms;
- Insufficient sensitization;
- Insufficient knowledge;
- Unsustainable land use practices; and
- Unsustainable fishing practices.

Based on the issues in **Table 1.6** and the root causes in **Box 1.1** and the immediate causes in **Box 1.2** and the trends for environmental degradation, water quality deterioration, and resources depletion, the cycle of events will be as in **Fig.1.3** below.

Institutional failures namely Policy and Legal Framework, Information and Marketing, and Capacity Building often lead to Destructive Practices and Pollution, Over-exploitation, Deforestation, and Competing Uses. These practices then result into environmental degradation, water quality deterioration, and depletion of natural resources. The overall result is reflected in loss of intrinsic values of ecosystems and resources as well as loss of use and non-use values of the ecosystems. This is visibly expressed in, for instance:

- Loss of human capital and increase in diseases and poor health,
- Loss of reproductive capacity of biological resources and their impacts on the environment and livelihoods,
- Food inadequacy and insecurity
- Loss of vegetation cover, flooding and droughts, loss of carbon sink, and
- Loss of resiliency of use and option values and non-use values.

The ultimate consequence is poverty that obviously sustains the vicious cycle by exacerbating institutional failures. The best is to break the cycle and get out.



**Fig. 1.3: Vicious Cycle Resulting from Unsustainable Environmental Practices**

### **2.1.6 Water use and water demand issues in the Lake Edward and Lake Albert Basin**

It is difficult to estimate water demand for all activities in the LEAB Basin as no specific studies have been done on this basis. Further criteria for demand in the two riparian countries have not been agreed nor harmonized and consequently keep changing depending on the level of economic growth of the countries and within the basin. The competing uses of water in the basin of the two countries are therefore:

Water use for production purposes in the basin include:

- water for water supply;
- water for crops;
- water for livestock;
- water for wildlife;
- water for fisheries and aquaculture.

Non consumptive water uses in the basin are:

- water for rural industries and sanitation in the small rural growth centers as well as in district headquarters;
- water for hydropower generation;
- water for mining;
- water for tourism;
- water for transport;
- water for ecosystem function.

### **2.1.7 Food Availability**

The main food types for fishers were cassava flour and ‘*matoke*’, consumed with fish and beans. Generally, there was limited food production at the landing sites. This was because either the landing sites were within the game parks where agriculture was not allowed or the soils were unsuitable for crop production. On Lake Edward, the main food supply sources to the landing sites were Kasese, Bunyaruguru and Rukungiri. Similarly, on Lake Albert food came from farming areas several kilometers away from the landing sites.

Food availability fluctuated from season to season, with more people having less than sufficient food during the months of January to March on Lake Albert and July to September on Lake Edward. Inadequate food and unbalanced diet are indicators of poverty among fishing communities.

### **2.1.8 Human Diseases and Sanitation**

With respect to diseases, most families were found to suffer from malaria, followed by diarrhea on both Lakes Edward and Albert.

Different categories of health facilities were identified within the fishing communities, including private, NGO and public facilities, as well as traditional and spiritual healers. However, most respondents reported receiving health services from public and private health facilities. Performance of public health facilities, as reported at the landing sites, was hindered by the long distances and poor access roads to the District Hospitals where drug replenishments were obtained and lack of willingness of staff to serve at these remote landing sites.

The use of health services provided by traditional medicine men and spiritual healers is an indicator of poverty among fishers, just like prevalence of infection with various types of diseases is an indicator of poverty.

The main sources of drinking water to the households were piped water for Lake Edward (48.3%) and the lake for Lake Albert (45.2%). Other sources included shallow well, piped/tap, spring/river and rainwater. Ownership and use of latrines were examined with regards to sanitation. The data revealed that the majority of the respondents had latrines and those who did not have them used the bush.

### **2.1.9 Socio-Economic Development in LEAB**

Fishers owned a variety of types of wealth assets. A few reported owning houses, mostly of the semi-permanent types but some also owned permanent and temporary houses. The radio was the most commonly owned wealth item but others included bicycles, land, and vehicles. Among those who owned land, the majority put it to crop production while other uses included grazing animals and leasing for the use of others. Some land also remained unused. Most fishers reported owning chickens and ducks but others also owned goats and sheep, pigs, and cattle. Low wealth ownership is an indicator of poverty.

A growing level of facilities and services were available at many of the landing sites, including schools, health centers, and water supply, provided under the broad policy of Government under PEAP. These facilities are not limited to fishing communities but serve the entire villages, parishes, or sub-counties within which they are located. Most of them are within distances of less than 5 km from the landing sites.

Urban and industrial developments within the two basins are also taking root. The towns of Masindi, Hoima, Fort Portal, Bundibugyo, Bushenyi, and Rukungiri on Ugandan side and Mahagi Port, Kisenyi, Kasindi, Kyavinyonge, Rwindi, and Vitshumbi on the DRC side are growing rapidly and are becoming the drivers of economic growth with about 70% of the incremental economic activity in the lake basin taking place in these towns. Thus, the traditional resource-based activities like fisheries, aquaculture, forestry, and agriculture are found taking place side-by-side with activities like cottage industries, trade, commerce, inland water transport, tourism within the basin. Large size industries like Hima Cement Factory, mining industries, and the prospective oil exploration are being consolidated in the basin as economic giants.

The potential for economic opportunities in the towns, industrial locations, and in the fishing villages is a strong attractive force that will fuel immigration from often depressed rural areas. The increasing level of immigration will, in the near future, demand employment, housing, energy, food, water, and other goods and services, thereby presenting a substantial development challenge in the two basins.

At present, fisheries provide the main source of income to the household and landing site communities. Considerable revenues are also generated from the landing sites through landing site tenders, landing fees, fish movement permits, as well as boat license fees. Revenues from the landing sites contribute significantly to the sub-county and district revenues. However, limited plough-back of public revenues into the fisheries hinders progress of development within the fishing communities

Artisanal fishing and subsistence small holder farming are the main economic activities of the riparian communities.

## **2.2 Biological Diversity in the Ecosystems of LEAB**

In Section 3.2.1 of the Terms of Reference (TOR), the detailed tasks to be undertaken by the Consultant on Fish Biology and Biodiversity were:

- to identify the main factors affecting aquatic biodiversity;
- to make an inventory of existing and threatened aquatic biodiversity and map out habitats;
- to conduct taxonomic studies of endangered species;
- to prepare plans for the propagation and conservation of threatened species;
- to undertake trophic studies in fish to determine lakes productivity and provide models of these relationships;
- to determine the tolerance of surviving species to environmental conditions;
- to draw up conservation plans for the surviving species;
- to establish a database on fisheries in the two lakes.;
- to prepare plans for training and research in relevant institutions in the two countries.

The Consultant, has provided, through the Diagnostic and Feasibility Reports, information on the fisheries and biodiversity of the two lakes including information on the status of ecological balance and lake productivity in Lakes Edward and Albert, with emphasis on improved ecological balance, fish and aquatic productivity and greater biodiversity in the two lakes based on the biological, physical, chemical, and socio-economic data collected, documented, and analyzed in this study. Biological diversity existing within the ecosystems of the two lakes has over time developed a unique trophic relationship. As required in the TOR, the reports provided laid emphasis on aquatic biodiversity whilst providing highlights of the components of terrestrial biological diversity as identified. These are therefore, summarized below.

**Table 1.5** below shows the diversity of Algae in selected stations in Lakes Edward and Albert. This table shows the algal composition as well as species prevalence in the different sites. The Diagnostic and Feasibility Reports gave a detailed analysis of these algae in terms of distribution and abundance. Hence, only highlights of the key findings are given here.

**(a) Algae**

Lake Albert has a much richer diversity of algal species, both the blue greens and the green algae, than Lake Edward. These are dominated by *Microcystis* which is the most abundant alga, with mean counts of 7.5 million cells per ml of sample but other groups include *Planktolyngbya*, *Anabaena*, *Cylindrospermum*, *Merismopedia*, *Chroococcus* and others. *Microcystis* is a phyto-toxin producer and could be one of the factors causing fish kills in Lake Albert. The green algae include types such as *Chlorococcum*, *Ulothrix*, *Ankistrodesmus*, *Scenedesmus*, *Pediastrum*, *Synecocystis* and *Tetraedon*. Diatoms are least abundant of the three types of algae and include *Nitzschia*, the commonest with other types being *Diatoma* and *Navicula*. Diatoms, the preferred fish food, are more abundant in Lake Edward than in Lake Albert.

**(b) Zooplanktons**

The Zooplankton is widely found in the two lakes and in all the sites. Cyclops and Nauplii are the commonest Copepods. *Diaphanosoma* and *Moina* are the most abundant Cladocerans. *Keratella* and *Brachionus* are the commonest rotifers. The shallow lagoons and the shallow inshore stations had more Zooplankton than the deep off-shore stations. Lake Edward was found to be richer in zooplankton than Lake Albert.

**(c) Benthos**

The mollusks are the commonest components of the benthos in the two lakes particularly in the inshore stations. The mollusks are composed mainly of gastropods such as *Bullinus*, *Biomphalaria*, *Mellanoidae* and *Bellamya*. There were also several insects and worms as part of the benthos.

**(d) Submerged Aquatic Weeds**

The bottom of the shallow inshore waters of Lake Albert is clogged with submerged aquatic weeds identified as *Najas pectinata* (Najadacea) and *Vallisneria spiralis* (Hydrocharitacea).

**(e) Littoral Microphytes**

These were identified as water hyacinth, sedges, papyrus, *Typha*, the Ambatch, palms and several bushy thickets.

**(f) Aquatic birds**

There are many species of birds the white egrets, cormorants, herons, pelicans, terns and others dominate the sky.



**(g) Dry land Albertine vegetation**

The basin surrounding Lake Albert includes *Acacia-Combretum* savannah with thickets, thick bush, forests, open grassland, savannah, and swamps. The commonest tree vegetation is composed of *Combretum molle*, *Terminalia glaucescens* and *Albizia*. The grassland vegetation is characterized of the *Hyparrhenia rufa*

**h) Fish Species**

Lake Albert: Of the twenty-four (24) fish species caught during experimental fishing of the study on Lake Albert, the Nile perch (*Lates macrophtalmus*) was, in all cases, the main species caught at the two sampling locations of Lake Albert. At Butiaba (19 samples), the following species are the most important in populations: *Hydrocynus forskahlii*, *Oreochromis niloticus*, *Barbus bynni*, *Auchenoglanis occidentalis* and *Brycinus nurse*. The last species is a small fish and is rarely caught by commercial fishermen. At Tchomia, (7 samples), the othe important species caught are *Barbus bynni*, *Oreochromis niloticus* and *Auchenoglanis occidentalis*. At Butiaba where the commercial fisheries uses mostly gillnets with 4.5 inches and above, it was noted that the fish catch is very low from the meshes from 4.5 to 6 inches. The use of mesh size 2.5 and 4 inches allowed getting information on total catches of *Lates* and *Hydrocynus* which may or may not be sexually mature. Smaller mesh size (1" and 1.5") catch mostly *Alestes nurse*, which is a small fish. This species lives in the very shallower waters not fishable with gillnets.

A summary of the inventory of fish species found in the two lakes is given in **Table 1.6** and **Table 1.7** below. This is by no means exhaustive as many of the fish species were not caught due to the diverse habitats and the habits of small species to hide amongst vegetation. The listing in the tables does not signify commercial importance as it reflects to some extent only species prevalence in the lake habitats.

Fish population dynamics was also studied by looking at the size or weight frequency of individuals in each species as an indirect indication of the population structure; growth parameters; size of fish at first maturity and studying trophic relationships. From the measurements of total length and weight of a number of individual in each species, it is be possible to calculate the growth parameters of the species using the equation { $\text{Log } W = \log a + b \log \text{LT}$ } where the weight (W), the total length (LT), 'a' and 'b' are parameter characteristics of the species. Curves with clear trends were only described for three species namely, *Lates macrophtalmus*, *Hydrocynus forskshalli* and *Brycinus nurse*.

**Table 1.5: Mean counts (x1000) of Plankton, Zooplankton and Benthos in some selected stations in the Lakes Edward and Albert Basin**

LAKE EDWARD					LAKE ALBERT									
STATIONS	Katwe			Kyavin yonge	Butiaba			Tchomia		Mahagi				
	SITES													
Plankton/Organism	1	2	3	1	1	2	3	1	2	1	2	3	4	5
<b>Blue Green Algae</b>														
<i>Microcystis</i>	2,160	2,600	215	555	67	2	31	46.6	360	1.02	0.234	1.6	2.2	2.3
<i>Chroococcus</i>	-	2	0.46		3.3	-	-	0.1	-	0.2	0.17	0.36	0.22	0.3
<i>Merismopedia</i>	32	-	0.389		2.8	0.18	0.44			0.164	1.34	0.64	0.4	-
<i>Cylindrospermum</i>	17	6.7	0.48		0.345	-	0.2			-	-	-	-	0.02
<i>Planktolyngbya</i>	50.6	28.6	0.29	2.6	0.006	0.025	0.33	0.24	2.	0.008	0.03	-	0.08	0.08
<i>Linnothrix</i>										-	-	-	-	20
<i>Coelosphaerium</i>					0.33	-	0.06							
<i>Plectonema</i>				0.2										
<i>Ellipsoidon</i>				1.2	-	0.001	-							
<i>Anthrospira</i>					0.002	-	0.001			0.003	-	-	-	-
<i>Aphanothece</i>	-	-	1	4										
<i>Aphanocapsa</i>										0.060	-	-	-	-
<i>Anabaena</i>	33	-	0.11		270	60	13			0.006	-	-	-	-
<i>Cosmarium</i>					0.001	-	-							
<i>Cymbella</i>					0.001	-	0.001							
<i>Pseudanabaena</i>					0.003	-	0.004							
<i>Oscillatoria</i>					0.002	0.007	0.003			0.001	-	-	-	-
<b>Green Algae</b>														
<i>Chlorococcum</i>					0.002	0.005	0.003			0.001		0.04	0.24	0.1
<i>Ulothrix</i>										4	40	-	-	20
<i>Tebelaria</i>					0.001	-	-							
<i>Synedra</i>								400	-					
<i>Ankistrodesmus</i>					0.001	0.013	-	0.02	0.02	-	0.02	-	-	0.02
<i>Agmenellum</i>	-	8	-		-	8	-							
<i>Selenastum</i>	-	4	-		0.004	1.3	0.009							

<i>Actinastrum</i>	-	-	1		-	-	0.33							
<i>Cyclotella</i>								0.02						
<i>Eremosphaera</i>	-	0.2	-		0.002	0.001	0.001							
<i>Pediastrum</i>	1	-	1		0.33	-	0.33			0.039	0.11	-	-	0.020
<i>Synecocystis</i>					0.002	0.003	0.004			-	-	-	0.02	-
<i>Chlorella</i>	0.33	-	0.34		0.33	-	0.33							
<i>Tetraedon</i>					0.001	0.001	0.001							
<i>Ellipsordon</i>								0.02		-	-	-	0.002	-
<i>Crucigenia</i>										-	-	-	-	0.08
<b>Diatoms</b>				1,600										
<i>Nitzschia</i>	17	4.3	5.15		3.4	2.2	2.5	0.02	10	-	-	0.12	0.62	0.08
<i>Melosira</i>						6				3	-	-	-	-
<i>Synrdra</i>										7	-	-	-	-
<i>Diatoma</i>	0.33	0.03	0.03							0.003				
<i>Navicula</i>	-	0.007	0.007					0.02	-	0.001				
<i>Monostyla</i>												0.001		
<b>ZOOPLANKTON</b>														
<b>Copepoda</b>														
Cyclops	2.100	1.100	0.260	0.300	0.210	0.350	0.990	0.038	0.019	0.041	0.205	2.657	12.596	0.141
Nauplii	1.800	1.900	0.050	0.023	1.400	0.460	0.600	0.462	0.231		0.020	0.001	0.067	1.134
<b>Rotifera</b>									-					
<i>Keratella</i>	0.510	0.077	0.030	0.024	0.022	0.060	0.035	-	0.083	0.002	0.001	0.017		0.007
<i>Brachionus</i>	0.370	0.066	0.001	0.003	0.012	0.016	0.003	-	0.006		0.002	0.021		0.005
<i>Bosmina</i>				0.003	0.001	-	-							
<i>Trichocerca</i>	0.001	0.004	-											
<i>Filinia</i>	-	0.060	-											
<b>Chaoborus</b>				0.003										
<i>Ostracoda</i>	-	-	0.001		0.002	0.002	0.001							
<i>Monostyla</i>	0.001	0.020	0.001								0.002			
<i>Asplanchna</i>	0.002	-	0.013		0.001	-	0.003				0.002			
<b>Cladocera</b>														
<i>Daphnia</i>	-	-	0.001	0.009	0.002	0.002	0.001							
<i>Diaphanosoma</i>	0.018	0.001	0.002		0.002	0.001	0.007							
<i>Moina</i>	0.002	0.003	0.001		0.003	-	0.005			0.001		0.001		
<b>Insects</b>														

<i>Caoborus larvae</i>					0.001	-	0.001							
<b>Ostracoda</b>					0.003	-	0.001	0.005	0.003					
<b>Benthos</b>														
<i>Hexagenia, Ephemeridae</i>	0.001	-	-		0.001									
Gastropoda- Melanoidae	0.015	-	-		0.016			-	0.004					
Gastropoda- Biomphalaria					0.002			-	0.002					
Bulinus	0.007	-	-		0.007									
Gastropoda- Gabiella sp	0.376	-	-		0.132									
Gastropoda- Bellamya spp					0.059			-	0.021					
Bivalves-	0.005	-	-		0.006			-	0.009					
Povilla nymphs	0.003	-	-		0.008									
Chironomid larvae	0.006	-	-		0.009	-	-	0.005	0.003					
Helocordulia (Dragon fly nymph) Libellulidae					0.002									
<i>Tubifex</i> sludge worm (Oligochaeta)	0.004	-	-		0.022									
Leeches	0.003				0.001									

**Table 1.6: An Inventory of the Fish species found in Lake Edward**

<b>Species</b>
<i>Haplochromis sp</i>
<i>Bagrus docmak</i>
<i>Barbus altianalis</i>
<i>Oreochromis leucostictus</i>
<i>Oreochromis niloticus</i>
<i>Protopterus aethiopicus</i>
<i>Clarias gariepinus</i>
<i>Tilapia zilli</i>
<i>Haplochromis nigripinnis</i>
<i>Haplochromis squamipinnis</i>
<i>Haplochromis mylodon</i>
<i>Haplochromis taurinus</i>
<i>Haplochromis schubotzi</i>
<i>Haplochromis pappenheimi</i>
<i>Schubotzia eduardiana</i>
<i>Astatotilapia sp</i>

**Table 1.7: An Inventory of the Fish species found in Lake Albert**

<i>Lates macrophthalmus</i>
<i>Hydrocynus forskahlii</i>
<i>Oreochromis niloticus</i>
<i>Barbus bynni</i>
<i>Auchenoglanis occidentalis</i>
<i>Brycinus nurse</i>
<i>Alestes baremose</i>
<i>Synodontis schall</i>
<i>Bagrus bayad</i>
<i>Alestes macrolepidotus</i>
<i>Tilapia zilli</i>
<i>Haplochromis mahagiensis</i>
<i>Schilbe intermedius</i>
<i>Lates niloticus</i>
<i>Leptocypris niloticus</i>
<i>Malapterurus electricus</i>
<i>Oreochromis leucosticus</i>
<i>Neobola bredoi</i>
<i>Polypterus senegalus</i>
<i>Sarotherodon gallilaeus</i>
<i>Barbus prince</i>
<i>Hydrocynus vittatus</i>
<i>Haplochromis avium</i>
<i>Haplochromis wingatii</i>

The analyses of gonad status in the different species using the data collected, the size of fish at first maturity was estimated at about 24 cm and 30 cm for males and females of *Lates macrophtalmus*, 30 cm and 32 cm respectively for males and females of *Hydrocynus forskahlli*, and 7 cm in both sexes in for *Brycinus nurse*. More data are needed for *Oreochromis niloticus*, although it can be said that individuals after 30 cm are generally mature.

Stomach contents of macrophage species were examined and the results revealed that *Brycinus nurse* feeds mainly on *Povilla*, the most common Ephemeroptera in the lake. *Brycinus nurse* is also the main food for *Lates macrophtalmus*. Other important foods for *Lates* are the Crustacea, *Caridina*, Haplochromines species, *Neobola bredoi* and other small fish.

Lake Edward: A total of fifteen (15) fish species was caught in the experimental gill-nets operated on Lake Edward. The Haplochromine species are not easy to distinguish in the field but eight (8) species were identified. Some 40 species offish are known to live in Lake Edward and its tributaries but only 14 species were seen in the sampling sites, of which six are of economic importance namely, *Bagrus docmak*, *Barbus altianalis*, *Oreochromis leucostictus*, *Oreochromis niloticus*, *Protopterus aethiopicus*, and *Clarias gariepinus*.

Besides the Haplochromine species which are not fished commercially, *Bagrus docmak* is the main species caught with experimental fishing nets. The second species is *Barbus altianalis*. *Oreochromis leucostictus*, a detritivore and a phytoplanktivore species, is normally found in lagoons and shallow water but was once caught in large numbers in the pelagic zone off Katwe. The sample at Kyavinyonge, DRC is too small (two samples) to draw any conclusions. The catch was made up mostly of Haplochromine species, followed by *Barbus altianalis*, *Tilapia zilli*, *Oreochromis niloticus* and *Bagrus docmak*

From the data collected, it was possible to draw Length Weight Relationship curve for only *Bagrus docmak*. Size at first maturity was calculated only for *Barbus altianalis*, *Oreochromis leucostictus* and *Oreochromis niloticus* as follows: 23 cm and 25 cm for males and females for *Barbus altianalis*, 15 cm in both sexes for *Oreochromis leucostictus*, and 20 cm in both sexes for *Oreochromis niloticus*.

Stomach content of macrophages species examined in the field and revealed that *Bagrus docmak* was the main predator in Lake Edward. It feeds mostly on Haplochromine species. Most of the Haplochromines feed on invertebrates and zooplankton. Larger Haplochromines species (*Haplochromis squamipinnis*) are piscivorous.

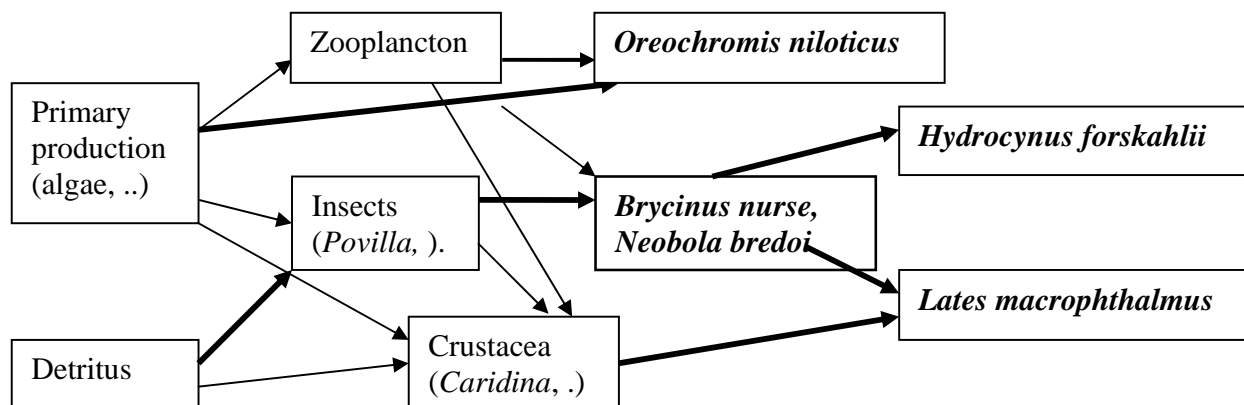
#### (i) *Mammals*

Large mammals include primates (Olive Baboon in particular), ungulates, and large carnivores. Small mammals include terrestrial rodents, insectivores (moles, shrews, and hedgehogs), small carnivores, and bats. In the past there were many species of mammals like the hippopotamus, elephant, buffalo, and Uganda kob. The area

has in the recent years been subjected to intense grazing with cattle which has reduced grass cover extensively and displaced many wild life species.

## ii) Trophic Relationships in Lakes Edward and Albert

Trophic relationships in the two lakes are complex as shown in Fig. 1.4. The algae are the primary producers in both lakes, using sunlight energy to fix carbon to produce carbohydrates and thereby releasing oxygen into the water. These organisms are therefore extremely important as all other forms of life in the lakes depend on them. The two lakes are rich in algae and in some areas there is over production of these tiny plants. The zooplankton and aquatic insects depend on the algae directly for food. Many other forms of fauna use the algae as sources of food for example, the Crustacea, and all the snails types as well as some fish species like the *Oreochromis* and *Haplochromis* group. Further, all the young stages of all the fish in the two lakes depend on the algae for food. The zooplankton on the other hand, is preyed upon by insects, snails and many species of fish. Fish are at the top of the food web as the primary predators before they too are predated upon by other predatory fish species (like the Nile perch) and man.



**Fig. 1.4: Trophic Relationship Leading to Fish Production**

## 2.3 Catchment Environment

In Section 3.2.2 of the Terms of Reference (TOR), the detailed tasks to be undertaken by the Consultant on Catchment Environment were:

- to review available literature related to water quality and quantity, selecting and gauging determinants and sampling sites;
- to prepare sampling schedules, carry out analytical quality control, establish changes, causes and effects of water quality deterioration and catchment degradation;
- to prepare plans for strengthening national institutions;

- to develop a water balance model for the lakes and formulate investment plans for water resources development and management in the area, taking into consideration Lake George which is connected to Lake Edward;
- to analyze how fishing activities and Wildlife National Parks impact on the environment;
- to analyze the impacts of oil prospecting/drilling in the Lake Albert region and propose remedial measures;
- to draw up plans for management of watersheds of the two lakes.

**(a) Water Quality**

The Consultant, has provided, information on water quality and the state of the catchment environment through the Diagnostic and Feasibility Reports. Hence, only highlights of the results and observations made are provided below.

The waters of Lakes Edward and Albert are facing increasing pollution threats arising from human activities. Unsustainable land use practices including deforestation cause soil erosion. Many pollutants and contaminants are discharged into the water bodies from riparian towns, rural growth centers, fish landings and small scale industries. These degrade water quality and affects negatively, both aquatic plants and animals including fish.

The results from DO, Temp., EC, pH profiles, measurements of Chlorophyll *a* and Secchi Depths and laboratory analysis of Total and Faecal Coliform indicate that both lakes have low levels of pollution with a few localized pollution “hot spots”. Very low values of DO occur in the bottom waters at the confluence of Kazinga Channel and Lake Edward and near Vitschumbi in DRC where high chlorophyll ‘a’ counts and shallow secchi depth measurements were recorded. The bottom offshore waters of Lake Albert are also devoid of oxygen. These reflect an accelerated nutrient loading from expanding human activities in the catchments of Lake George and Kazinga Channel that is drained into Lake Edward in addition to indicating serious sewage discharge directly into the area. The Total and Faecal Coliform counts at these locations were also very high at 4000 and 2000 per 100 mls respectively. The other high counts of 157 and 8 per 100 mls were at the Inshore Station near Katwe Fish Landing. Other areas of the two lakes are still safe. Shallow areas at the entrance of River Semliki into Lake Albert and entrance of Victoria Nile near Wanseko Fish Landing also contain high algal concentrations (11 – 18 ug/L), but these could be due to the swampy environment at these locations in addition to nutrients arriving from the catchments of the two rivers.

The DO in most parts of the two lakes is above 4 mg/L level, and they can therefore support the lives of fish and other organisms. The mean value in Lake Edward is 7.4 mg/L with the exception of the bottom waters in the areas where the Kazinga Channel enters the lake near Mweya Hotel and near Vitschumbi. The mean value in Lake Albert is 8.2 mg/L except for the deeper waters of the lake (over 40 m) where readings showed levels between 0.15 and 0.51 mg/L. The high Temperature recorded averaging over 26°C enhances biological activities especially enzymatic and biochemical reactions that are



temperature dependent. Besides influencing the solubility of gases in the water, this level of temperature also increases the rate of chemical reactions and evaporation.

Apart from the bottom waters of Lake Albert at the mouth of River Semliki where the conditions are acidic (i.e. values between 4.67 and 6.72 units), the rest of the waters of the two lakes have pH values averaging 8.5. This is being attributed to leaching of volcanic soils from the rift valley catchments, and in the case of Lake Albert, also due to inflows from hot springs (Matagi, 2002). The high levels of pH and EC recorded, which are similar to previous records (Talling, 1965 and Matagi, 2002) indicate that the lakes are moderately alkaline. The isolated acidic case in southern Lake Albert could be due to the papyrus swamps through which River Semliki flows before entering Lake Albert.

Chlorophyll 'a' measures algal biomass. The values recorded in most parts of the two lakes, ranging from 6.3 to 10.0 ug/L in Lake Edward and from 9.9 to 18.2 ug/L in Lake Albert do not signify excessive eutrophication. However, Chlorophyll 'a' level was extremely high at the confluence of Kazinga Channel with Lake Edward at Mweya Hotel Pier (150.6 ug/L) and this could lead to eutrophication and algal blooms. Sechi Depth was also shallowest (21 cm) at this same location compared with other locations in Lake Edward (135 to 208 cm).

Lake Edward has low level TSS (> 15 mg/L) except for the high level of over 50 mg/L encountered at the entry of Kazinga Channel into the lake at Mweya Hotel. Since TSS is associated with plankton abundance, the high level obtained near Mweya, indicates localized eutrophication. The high figures (> 400 mg/L) of Total Alkalinity obtained at all sampling stations is a sign that the lake is saline or has dilute saline water. This is pertinent in that the values of Phenolphthalein Alkalinity (PA) were found to be high (between 50 and 90 mg/L) at most sampling stations.

Total Nitrogen (TN), Nitrites, and Nitrates were found to be between 0.5 to 2.19 mg/L for TN, and 0.002 mg/L for Nitrite and 0.02 mg/L for Nitrate at all other Sampling Stations except at the entrance of Kazinga Channel into Lake Edward where it was at 4.2, 0.008 and 0.03 mg/L for TN, Nitrite and Nitrate respectively. These are the direct indicators of agricultural, industrial, and domestic sewage runoffs laden with organic matter from the catchments. Levels of Nitrates in excess of 5 mg/L  $\text{NO}_3\text{-N}$  usually indicate pollution by human or animal waste, or fertilizer run-off, besides levels of Nitrates in excess of 0.2 mg/L  $\text{NO}_3\text{-N}$  tend to stimulate algal growth and indicate possible eutrophic conditions (Chapman, 1992). In the case of Lake Edward, there is a green soup of algae near Mweya Hotel where the values were found to be 0.02 mg/L and 0.04 mg/L  $\text{NO}_3\text{-N}$  in the surface and bottom waters respectively indicating serious pollution.

Measurement of Sulphates ( $\text{SO}_4^{2+}$ ) averaged at 30 mg/L at practically all Sampling Stations in Lake Edward. Although Sulphates are major components of proteins, they are not generally associated with eutrophication directly, and they are easily broken down to Hydrogen Sulphide ( $\text{H}_2\text{S}$ ) in water.

***(b) Contaminants of Water and the Catchments***

The following were identified as the major types of pollutants being discharged onto the catchments that later in one form or another find their ways into Lakes Edward and Albert:

- Domestic Wastes comprising food waste, waste water, house rubbish, faeces and urine from homes, schools, hospitals, restaurants, hotels and prisons;
- Storm water, land runoffs, and soil erosion from towns, villages, roads, cleared and deforested lands;
- Livestock and wildlife wastes from homes, farms, and the National Parks;
- Agricultural wastes such as farm wastes, burning of farm wastes, food processing wastes, fertilizers, and pesticides;
- Bush and forest fires resulting into gaseous wastes and soil erosion;
- Wastes from mining and smelting of mineral ores;
- Combustion of fossil fuels from vehicles and other engines, and oil spills;
- Wind-blown soils from agricultural, livestock, wildlife, deforestation, roads, and arid areas particularly in Fishing Villages; and
- Volatilization from domestic and agricultural waste disposal sites on land.

***(c) Sources of Water Contamination and Environmental Pollution***

Towns and villages within the lake basin were found to play a major role in generating pollutants in form of domestic wastes that end up the two lakes. Domestic wastes were rated to contribute 40% of the pollutants entering the lakes whilst agricultural wastes and substances contribute 17% and industrial contaminants were rated to contribute 12.4%. Diffuse sources of contamination contribute 29%. The big industries like the Kasese Cobalt Company Limited and Hima Cement Factory near Lake Edward and the oil exploration companies on the shores of Lake Albert have greatly minimized their pollution effects through putting in place appropriate mitigation measures so far. In the case of oil, unless stringent adherence to mitigation measures are adhered to, environmental degradation and water pollution could take place during exploration, drilling, extraction, transportation, distribution, and usage. Common oil pollutants are alkanes which include gases, gasoline, naphtha, kerosene, gas oils, and some residual oils; cycloalkanes which are solvents and aromatics. Oil pollutants could arise from tanker accidents, transportation, terrestrial operations, seepages from the lake bottom and ships' accidents. Meanwhile Uganda has provided measures to reduce or avoid oil pollution from the current operations on Lake Albert (Hardman Resources 1998 and Hardman Petroleum Africa Limited 2006).

Fishing activities have been identified as being partly responsible for deforestation within the catchments. It is reckoned that about 56% of the riparian households rely on wood for fuel and 44% rely on charcoal as their primary means of cooking. Fish smoking relies solely (100%) on fuel-wood. Miskell (1989) estimated that the total annual wood consumption as fuel wood, for fish smoking within the Lake Edward basin amounted to 6,883 m<sup>3</sup> in the Fishing Villages, with a further 11,893 m<sup>3</sup> consumed by the public enclaves and other villages within the catchments in Uganda where the population was

estimated at 19,930 people. Considering the population of 11,715,233 people within the catchments of Lakes Edward and Albert in both DRC and Uganda, and the fact that there is no other source of fuel for cooking and smoking fish, the total amount of wood being used as fuel and for smoking fish is estimated at about 11 million m<sup>3</sup> per year. Other vegetative resources taken from the catchments include building poles, wood for boatbuilding, papyrus (*Cyperus papyrus*) for thatch, and fish net floats cut from the ambatch tree (*Aeschynomene elaphroxylon*).

Although measurements of wildlife biomass were not made during this study, it is believed that excessive increase in the biomass of large mammals in the grasslands of QENP and PNV will result into (a) an increase in the amount of solid, liquid, and gaseous waste generation through direct fecal and urine inputs into the lakes and the drainage systems, (b) creation of bare ground and dust, and (c) enhancing soil erosion. Hippopotami, in particular, have a powerful influence on both terrestrial and aquatic ecosystems. Their intense grazing and trampling often reduces grass cover in some instances to bare earth for several miles inland of the lakes.

## **2.4 Hydrology and Water Resources of Lakes Edward and Albert**

The TOR required the Consultant to assess the water resources potential of the lakes basins; develop a water balance model for the lakes and formulate investment plans for water resources development and management in the area.

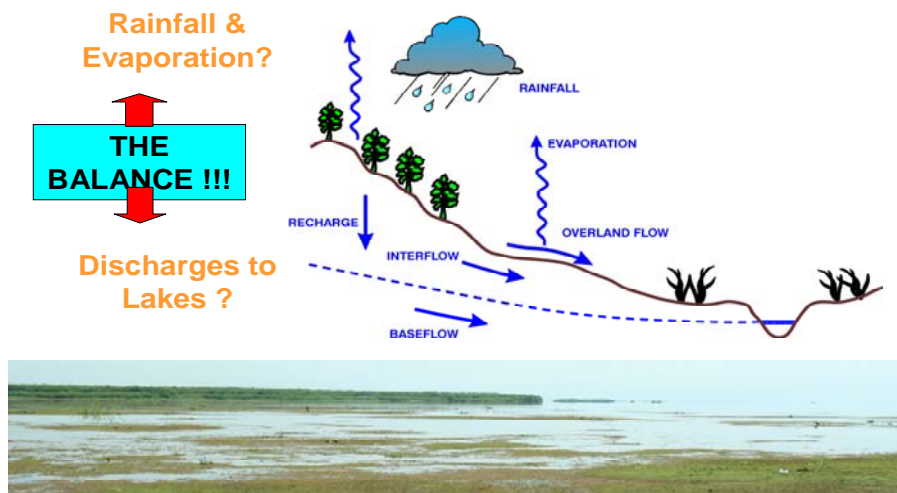
Following the compilation and quality control of hydro-meteorological data indicating location of rainfall stations that were gauged and for which previous data have been collected (HYDROMET 19.), it was possible to determine precipitation and evaporation as well as discharges to the lakes from seven (7) gauged catchments on the Ugandan side of the two basins (**Fig. 1.5**). These included Mobuku at Fort-Portal Kasese Road, R. Waki II at Biiso – Hoima, R. Mpanga at Kampala Fort Portal Rd., R. Mitano at Kanungu Rwensama Rd., R. Muzizi at Kyenjojo Hoima Rd., R. Nkussi at Kyenjojo Hoima Rd., R. Wambabya at Buseruka., R. Mpanga at Fort Portal Ibanda Rd., and R. Chambura. In addition, supplementary runoff data were compiled from Annual Reports of the Department of Hydrological Survey (1955, 1959, and 1960). Data were also extracted from summaries of HYDROMET meteorological data for Kazinga Channel, R. Semliki from Ishango, R. Semliki from Ngamba in the DRC, R. Semliki from Bweramule, R. Kaku from Mumwalo swamp, Nyakatonzi, Kasese, Masindi, Kabale, and Kyenjonjo. The data generated were used to calibrate the NAM model before using it to compute the runoff at the gauging stations selected. Rainfall and evaporation data for the period 1950 to 2000 were, therefore, generated and used to plot the time series of the discharges for Mitano, Mpanga, Mobuku, Kasese, Waki, Muzizi, Nkuzi, Wambabya, and Chambura.

The hydro-meteorological network is currently virtually non-existent within the DRC. Key monitoring stations inside the DRC were discontinued after 1957. This negatively impacts on the length of the common record that can be used to derive water balance

computations. After fitting a rating curve to concurrent records of stage and discharge on Lake Edward, discharge time series of its outflow at Ishango can be extended from the observed record in 1938–1947 using the record of observed lake levels for the period 1948–1978. The record of water balance computations attempted for the two lakes is therefore for the period 1938–1978 where sufficient data are available.

The status of the Hydro-meteorological network in Uganda deteriorated significantly after the year 1978 and has not sufficiently recovered since. Concurrent rainfall and rainfall data has not been collected in the period 1978 to date for most of the catchments. In addition, there are no known bathymetric surveys for Lakes Edward and Albert.

**Water Balance Modelling Concepts**



**Fig. 1.5: Inflows visa avis out flows in water modeling concepts**

**Methodology for determination of the lakes water balance**

Determination of the Water Balance of a Lake requires that the total inflow to the lake (**Fig. 1.5**) should be equal to the outflow and the change of storage. This is expressed (assuming that subsurface inflow and seepage from the lake can be neglected) by the following equation:

$$I + R + P = O + E + S \quad \dots\dots\dots (1)$$

Where  
 I: is the inflow from the upstream lake  
 R: is the runoff from the catchment of the lake excluding the catchment of the of the upstream lake

- P: is the rainfall on the lake surface
- O: is the outflow from the lake
- E: is the evaporation from the lake surface
- S: is the change in storage (storage at the beginning of the time interval minus the storage at the end)

In general equation (1) can be used to derive the outflow and the change of storage (or the lake level). If all variables of the equation can be derived or some of them can be directly measured then the two sides of the equation usually result in different values. A study of the discrepancies will indicate either that the subsurface inflow or outflow is significant or inaccuracies in the derivation of some of the variables. In situations where rainfall, evaporation and runoff are not available from the land areas, the water supplied from the catchment of a given lake excluding the inflow from the upstream lake can be deduced from the other elements of equation (1). This water supply can be referred to as “Net Basin Supply” (NBS) and can be represented by the equation

$$\text{NBS} = \text{R} + \text{P} - \text{E} \quad \dots\dots\dots$$

(2)

Substituting equation (2) into Equation (1) the net basin supply can be expressed with the variables available for earlier periods by applying the relationship:

$$\text{NBS} = \text{S} + \text{O} - \text{I} \quad \dots\dots\dots$$

(3)

Hence the net basin supply can be derived from the change of storage, which is obtained from the lake levels using the lake capacity curves, and from the lake outflow. The lake outflow is commonly observed at a stream gauging station or derived with an adopted water level- outflow relationship.

In the Water Resources study, emphasis was placed on compilation and quality control of hydro-meteorological data indicating location of rainfall stations for which data has been collected. Hence, the Rainfall onto and evaporation from the lake surfaces plus discharges to the lakes from all gauged rivers around the lakes was generated or calculated for the following 7 gauged catchments.

Station Number	Name of river
84222	Mobuku at Fort-Portal Kasese Road
85217	R. Waki II at Biiso - Hoima
84212	R. Mpanga at Kampala Fort Portal Rd
84215	R. Mpanga at Fort Portal Ibanda Rd
84267	R. Mitano at Kanungu Rwensama Rd
85211	R. Muzizi at Kyenjojo Hoima Rd
85212	R. Nkussi at Kyenjojo Hoima Rd
85214	R. Wambabya at Buseruka
84227	R. Chambura

The source of data was the Hydrology Departments of the Ministries responsible for water in and the Meteorology Departments in Uganda. It was observed that the largest number of stations with observations occurred in the period 1950 to 1980, which was the period of the HYDROMET Project. The situation is the same with respect to evaporation data. In addition, supplementary Runoff data has been compiled from annual reports of the Department of Hydrological Survey (1955, 1959, and 1960). River gauging stations for which data do not exist in the archives of the Department of Water Resources Management were extracted from other publications and summaries of HYDROMET meteorological data from the following:

Station/Gauge No.	Name	Situation
842/01	Kazinga Channel	Levels in Kazinga channel Katunguru
842/02	Semliki	Flow data from Ishango at outlet of lake Edward in the DRC
842/03	Semliki	Flow data at Ngamba in the DRC
842/04	Semliki	Flow data at Bweramule
842/45	Kaku	Flow data below Mumwalo swamp- outlet of lake Mutanda
Station No.	Name	Year of available record/ status
09029008	Nyakatonzi	1960 – 1968
08930063	Kasese	1962-1968
08831003	Masindi	1962-1968, 1968 – 1981. Fragmented with many gaps
9129000	Kabale	1961- 1981. Fragmented with many gaps
8930079	Kyenjojo	1961- 1981. Fragmented with many gaps

One of the main interests of the study was the discharge of water to the lakes. The study, therefore, concentrated on the stations nearest the river mouths. However, in instances where the main catchment is also gauged upstream, discharges have also been computed from the various sub-catchments of each river. Hence, a number of rainfall models such as the Sacramento Soil Moisture Accounting Model (SAC-SMA) or the NAM model were proposed for application. One of these is the NAM Model. NAM like the Sacramento Model is classified as a Conceptual Model with the following characteristics:

- Lumped (the entire catchment is considered as a single unit with uniform properties).
- The flow of water through the system is conceptualised into a number of reservoirs.
- The parameters partly reflect the physical properties of the catchments.

After calculation and calibration, the calibrated model was then used to compute the runoff at the gauging stations for a given period depending on the availability of data. The application was able to generate rainfall and evaporation data for the period 1950-2000. Consequently, the time series of the discharges for Mitano, Mpanga, Mobuku, Kases, Waki, Muzizi, Nkuzi, Wambabya, Chambura, river catchments were plotted.

Key monitoring stations inside the DRC were discontinued after 1957. This negatively impacts on the length of the common record that can be used to derive water balance computations. After fitting a rating curve to concurrent records of stage and discharge on Lake Edward, discharge time series of its outflow at Ishango can be extended from the

observed recordings of 1938–1947 using the record of observed lake levels for the period 1948-1978. The record of water balance computations attempted for the three lakes is therefore for the period 1938 1978 where sufficient data are available.

Hence, the monthly water balance of Lakes Edward and George are shown in **Table 1.8** shows that the monthly balances are good estimates of water balance in Lake Edward but not very precise on the annual timescale. Runoff could have been under-estimated while outflow could be over-estimated. There is also a difficulty in determining actual variation of lake area with depth due to lack of bathymetric data. The influence of wetlands surrounding Lake George on these balance estimates would also merit more detailed study. Therefore the conclusion from this study therefore is that the water balance of Lakes Edward and George cannot be determined to a more reasonable degree of precision until appropriate investment in an optimum hydro-meteorological network and continuous water resources monitoring assessment are made for period of at least 30 years.

**Table 1.8: Monthly water balance of Lakes Edward and George (mm over 2,590 km<sup>2</sup>)**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Year
<b>Balance (1960-1977)</b>													
Gauged runoff	58	43	52	76	94	57	46	48	67	93	114	97	845
Ungauged runoff	105	78	94	137	170	103	83	87	121	168	206	175	1,526
Rainfall	29	40	71	110	75	43	43	71	83	76	99	53	792
Ishango outflow	132	110	112	112	130	128	120	109	106	115	126	144	1,444
Evaporation	176	171	188	158	167	144	143	144	153	161	150	163	1,918
Storage change	-60	-60	-23	65	63	-55	-79	-26	23	68	114	-5	24
Balance	-56	-60	-60	-12	-21	-14	-12	-21	-11	-7	29	23	-223

On the other hand, the results of the water balance for Lake Albert are presented in the form of a comparison between inflows i.e. gauged tributary inflows, rainfall, and outflow, including evaporation & storage change. The period 1960-1977 has been selected as this is the period for which most measurements are available. The results in **Table 1.9** show that the monthly balance may be a good estimate but not very precise on the annual timescale. Some components of the water balance e.g. rainfall could be over estimated while measurement errors in the Kyoga and Albert Nile have the potential to influence overall balance greatly due to their relatively larger magnitudes.

**Table 1.9: Monthly water balance of Lake Albert (mm over 5,300 km<sup>2</sup>)**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Year
<b>Balance (1960-1977)</b>													
Inflow at Paraa	636	549	608	853	638	638	665	672	661	664	669	680	7932
Semliki	80	66	73	81	96	83	87	89	89	89	95	91	1020
Local inflow	45	37	41	45	54	46	49	50	50	49	53	51	569
Rainfall	21	34	73	132	107	56	65	88	90	119	123	33	941
Panyango outflow	712	628	671	645	674	656	678	692	689	727	734	766	6482
Evaporation	168	164	180	150	156	138	128	136	149	154	146	160	1829
Storage change	-151	-110	-61	36	64	-2	27	93	71	95	119	-93	86
Balance	53	4	5	279	1	31	33	-22	-19	-54	-59	22	274

Several fishing villages and landing sites have poor water supply and sanitation facilities. This contributes towards increased pollution. Deforestation and encroachment on riverbanks have severely degraded the catchments and increased siltation and sediment loads in all rivers. There are wide disparities in the capacity to manage the water resources of the basin between Uganda and the DRC. Uganda has instituted management reforms to address issues of catchments based water resources management strategies and required support to implement these proposals while in the DRC, no such system is in place.

## **2.5 The Fisheries of Lakes Edward and Albert**

The TOR required the Consultant to analyze the current situation of fisheries statistics and propose a survey model (sampling plan and analytical method); propose a computerized database to be established that will assist the fisheries administrations to improve their statistics on Lakes Edward and Albert.

The Consultant, has provided, information on the state of the fisheries of Lakes Edward and Albert through the Diagnostic and Feasibility Reports. Hence, only highlights of the results and observations made are provided below.

### **2.5.1 The Status of the Fisheries of Lakes Edward and Albert**

Since the creation of the Fisheries Resources Department in 1950 in Uganda, the Central Government was responsible for collecting and compiling fish production and marketing data from monthly and annual returns received from Districts. The Department carried out periodic surveys, monitoring, and evaluation for on spot ground 'truthing'. After decentralization in 1998, the fisheries sector was put fully under the charge of the various Districts. The data collection function has since become ineffective because of the low response of Districts, which cite under-facilitation and under-staffing as the reasons for the laxity. Data available for both lakes from 1961 show that the fish landed in Lake Edward fluctuated from highs of 13.2 metric tones in 1975 to lows of 5.5 metric tones in 1990. In Lake Albert, the catches fluctuated between highs of 24.2 in 1970 to lows of 2.3 metric tones in 1985. Data for the most recent years are not available since the onset of decentralization in Uganda.

In the DRC, there is supposed to be daily data gathering at each landing site, collecting data on daily catch, price, boats and fishing equipment with periodic reports (Month/Quarter/Year) being submitted to the Territoire. Official statistics on fishery production are available for only 17 years over the period 1950 to the present. They show that fish production from Lake Edward fluctuated between 6,520 metric tones in 1994 to lows of 1,773 metric tones in 1950. In Lake Albert, fish catch oscillated between 19,440 metric tones in 1990 and lows of 1,794 metric tones in 1950. Fisheries management is in the process of being transferred from the Ministry of Environment to that of Agriculture.



Unlike in the DRC, fishing effort is controlled in Uganda with specified number of canoes and known numbers of nets annually. Maximum Sustainable Yield (MSY) for Lake Edward was estimated to lie between 15 metric tonnes and 16 metric tonnes per annum while that for Lake Albert was estimated to lie between 25 and 34 metric tonnes per year (Ssentongo 1989). While no lake-wide assessment of population structure and dynamics of commercially exploited fish stocks in Lakes Edward and Albert have been undertaken in the recent years, Ssentongo (1989) recorded a production rate of 59 kg/ha for Lake Albert and 86 kg/ha for Lake Edward.

### 2.5.2 Frame Surveys

There were 338 fishing boats (canoes) on Lake Edward and 5,764 fishing boats (canoes) on Lake Albert recorded on the Ugandan side of the lakes. In the DRC, the numbers of boats (canoes) recorded were 1,416 for Lake Edward and 3,610 for Lake Albert but some of the sites in the DRC were inaccessible due to rebel activities. The number of fishermen on both sides for Lake Edward was recorded as 3,894 and for Lake Albert, it was 27,597. The main fishing gear used on the two lakes in the two countries included 'bigoro', hook and line, traps, gillnets (deep), gillnets (floating), scoop net, long lines, small seine, small seine ('muziri') beach seine, hand lines, basket traps, perforated basins, and cast nets. A total of five (5) Fish Landing Sites were recorded as functional on the shores of Lake Edward in Uganda and seventeen (17) on the DRC side while seventy seven (77) were identified on Lake Albert in Uganda and seventy (70) on the DRC side.

### 2.5.3 Catch Assessment Surveys

A Catch/Effort survey aiming at collecting current information on total catch and fishing effort was carried out using a spatio-temporal sample for data collection. In this study catch was defined in terms of weight of fish landed while Fishing Effort was measured in fishing boat-days. Catch Per Unit of Effort (CPUE) was computed as catch per fishing boat per day.

An analysis of the fish composition and fish characteristics in the commercial fishermen's catches in Lake Albert provides information on the most targeted species as well as the maturity state of the fish caught. This further provides information on the most vulnerable species. At Butiaba in Uganda, the fishermen use gillnets of mesh size of 4.5 inches. At Tchomia in DRC, the fishermen use gillnets of mesh size beginning with 2.5 inches and long lines. *Lates macrophtlamus* is clearly the most targeted commercial species. The mean weight for individuals caught for this species is 1,345 grams. The second most important species is *Hydrocynus forskahlii*, with a mean individual weight of 381 grams. Larger fish are rarely caught. These are followed by *Oreochromis niloticus*, and *Bagrus bayad* at Butiaba. In Tchomia, *Hydrocynus forskahlii*, *Bagrus bayad*, *Alestes baremose*, and *Oreochromis niloticus* are the next most important species.

From the length frequency distribution of the fish caught, it is possible to obtain information on the size of fish at first maturity for different species. Hence, it will be possible to know whether the fish caught are likely to have reproduced at least once

before they are harvested. So far, it was observed that a significant part of the catch of *Lates macrophthalmus* had not reproduced before being caught.

On Lake Edward, the commercial fisheries at Katwe use mostly gillnets with mesh size of 4.5 inches and long lines. The data on catch composition were collected from Katwe Fish Landing Site as it was possible at Katwe to generate information on the targeted species as well as the size of individuals. The result of the analysis provided information on the size of the fish at first maturity for different species. This can reveal whether the captured fish are likely to have reproduced at least once before being harvested. The most targeted fish by commercial gillnets in Lake Edward at Katwe, and therefore the most vulnerable are *Oreochromis niloticus* and *Bagrus docmak*. At Kyavinyonge, they are mainly *Oreochromis* (Tilapias), *Barbus altianalis* and *Bagrus docmak*. *Protopterus aethiopicus* and *Clarias gariepinus* which are caught with long-lines also dominate. It was observed that a significant part of catch of the Tilapias (*Oreochromis niloticus*) landed at Katwe were largely mature as they mature after 20 cm, whilst some *Bagrus docmac* were immature. There is, however, no scientific basis for declaring *Bagrus docmac* immature although those measuring less than 30 cm could be immature.

#### 2.5.4 Trends in Commercial Catches

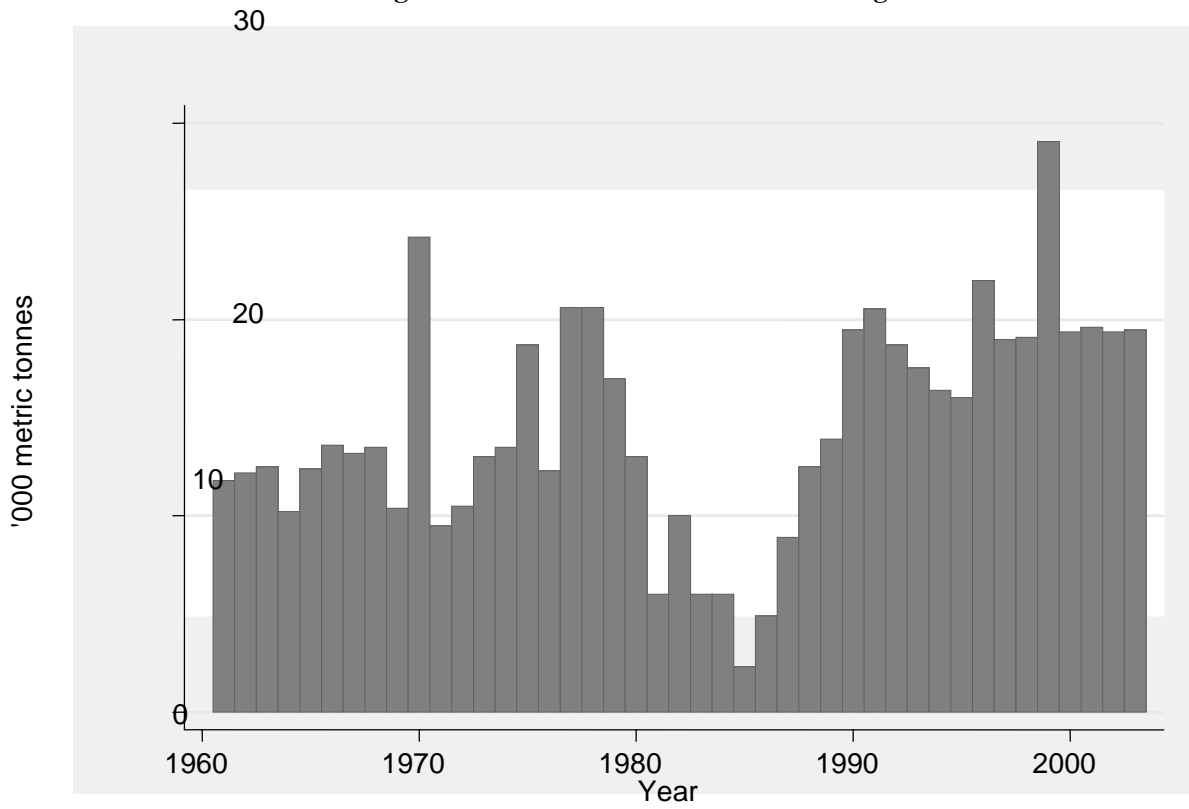
The trends for the available fish catch data for Lakes Albert and Edward in Uganda are graphed in **Fig. 1.6** and **Fig. 1.7** respectively and the ones for DRC are in **Figs.1.8** and **Fig. 1.9** as histograms since data for a number of years are not available for the two lakes particularly in the DRC. According to the records available, the data for Lake Edward and Lake George have always been combined in Uganda.

Information for the recent years is not available the decentralized Districts in Uganda no longer collect and submit such information. The data, in general, show considerable fluctuations from year to year. While the ones for Lake Albert show low positive but not statistically significant trend, the ones for Lake Edward show statistically significant low negative trend.

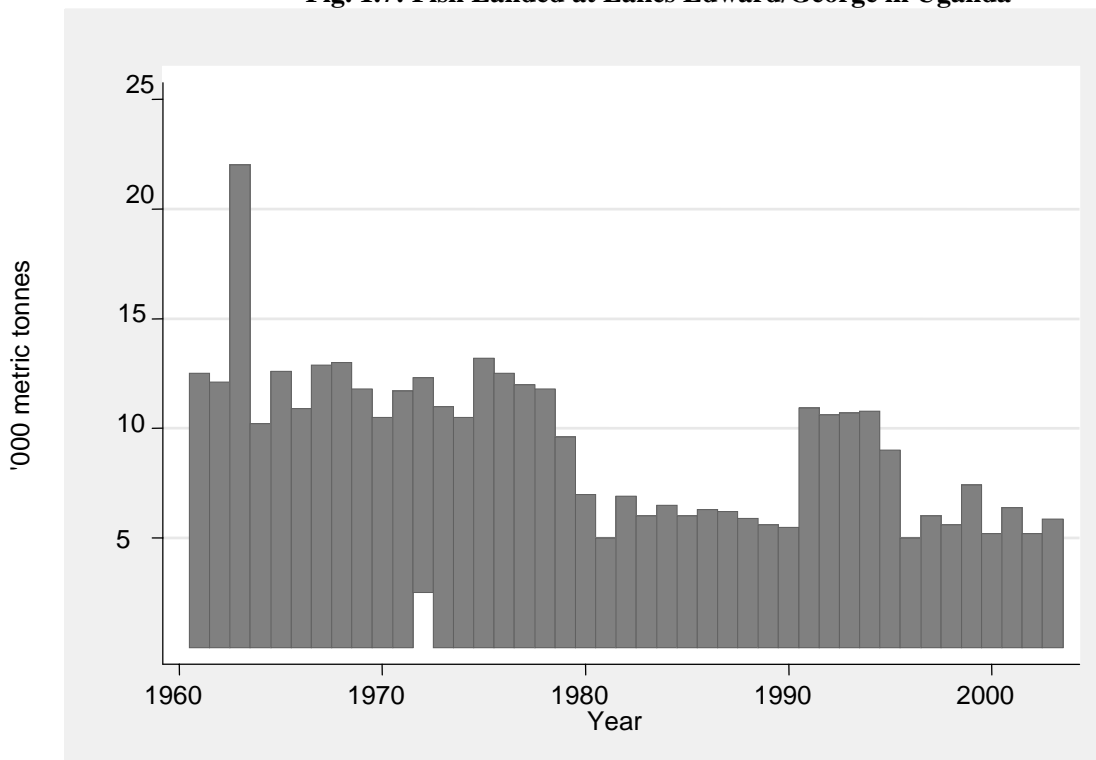
Official statistics on fishery production are available for only 17 years over the period 1950 to the present. The paucity of the data does not allow any meaningful statistical tests for trend.

The main issues of concern regarding the collection and management of fisheries data in the two lakes are that (a) the old systems of fisheries statistics have broken down as a result of the decentralisation policy in Uganda and as a result of civil war in DRC, and the fisheries which are now under the jurisdiction of a multiplicity of Districts, Local Authorities which at present are not interested in fisheries statistics; and (b) a fisheries officer of one type or other is in charge of each landing site, singly or in combination with others, and who do not, as a rule, have any equipment or stationery that can be used for data collection; regular data collection and submission do not appear to be part of the work of fisheries staff, and data are collected mostly for specific projects.

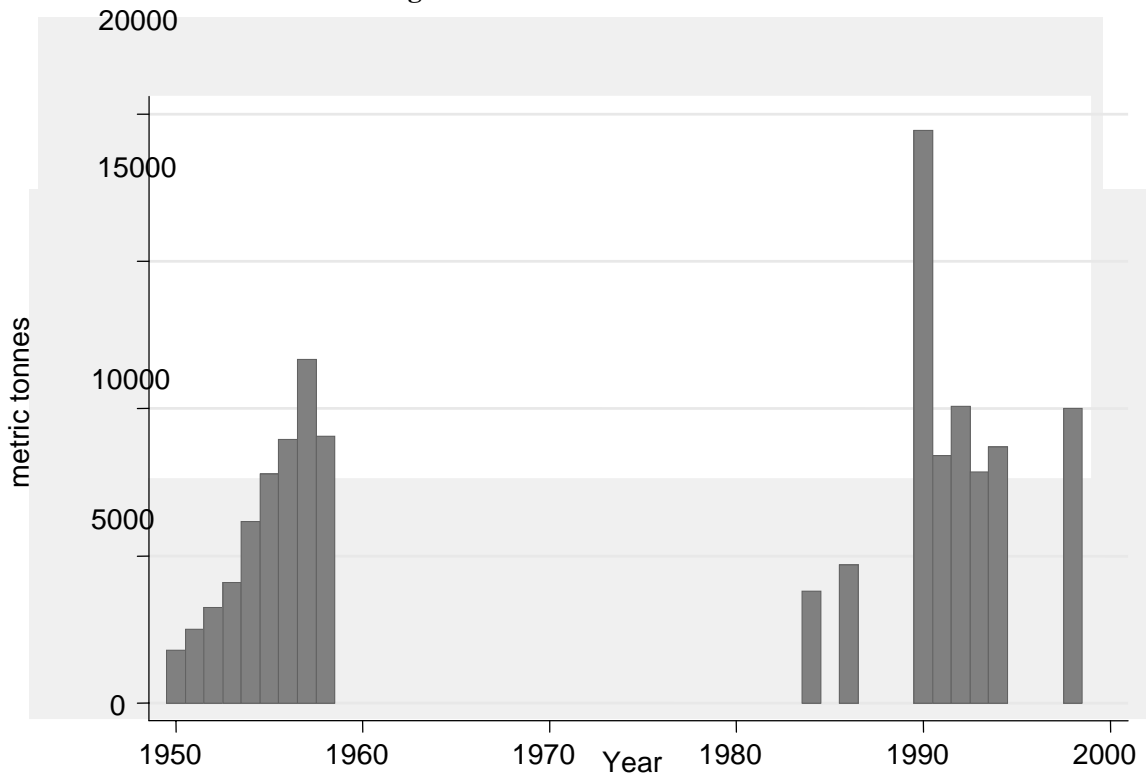
**Fig. 1.6: Fish Landed at Lake Albert in Uganda**



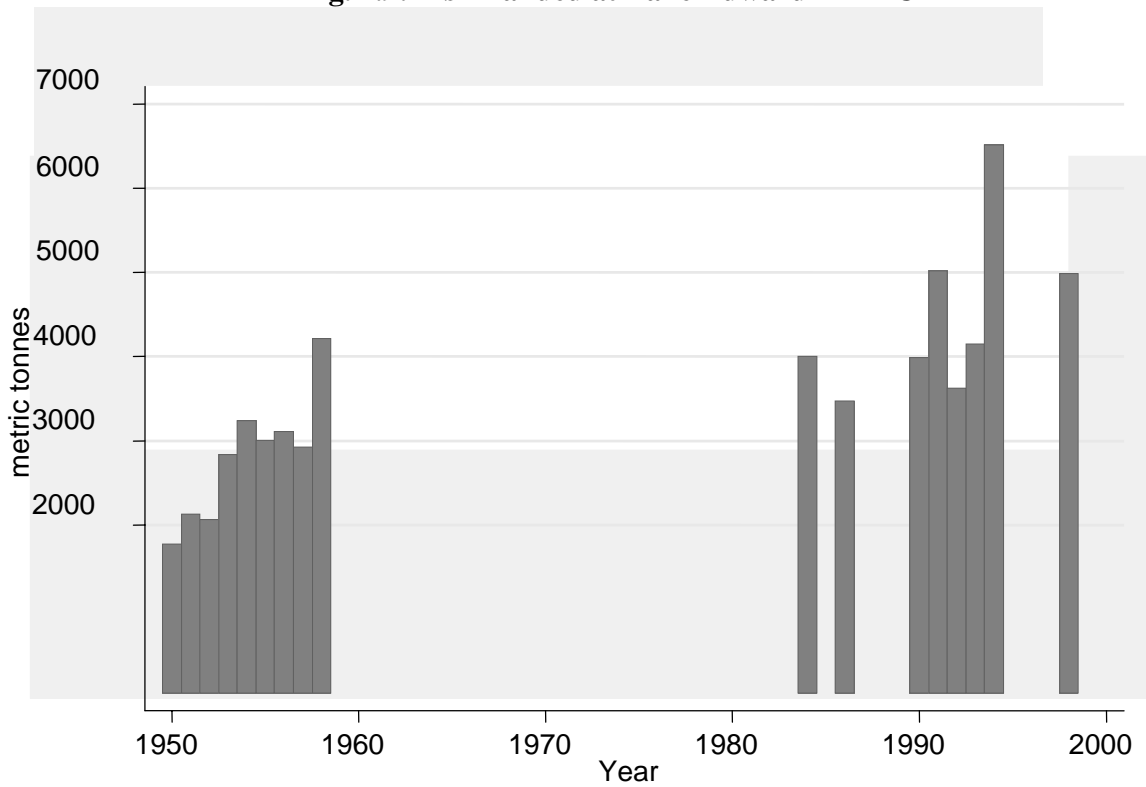
**Fig. 1.7: Fish Landed at Lakes Edward/George in Uganda**



**Fig. 1.8: Fish Landed at Lake Albert in DRC**



**Fig. 1.9: Fish Landed at Lake Edward in DRC**



## 2.6 Socio-Economics of the Fisheries

The TOR required the Consultant to analyze the social and technical organization of the fisheries communities (organizational modes, water use, demographic aspects, health and education); conduct a gender analysis of the sector and assess the marketing channels, demand and supply for fish and fish products, post-harvest loss estimation and means of its reduction; in collaboration with the fisheries expert, to propose measures to be undertaken to improve public health and hygiene at fish landing sites; propose micro-finance requirements of the fishing community and to propose measures to address constraints experienced especially by women. The socio-economist will also pose alternative income-generating activities that will reduce the pressure on the fisheries resources.

The Consultant, has provided, information on the state of the socio-economics, livelihoods and fisheries of Lakes Edward and Albert through the Diagnostic and Feasibility Reports. Hence, only highlights of the results and observations made are provided below.

About 73% of the people living in the basins of the two lakes derive their livelihood from fishing. Fishing is mainly traditional and artisanal. The main fishing devices being used are dormant gill nets, beach seines, hooks, and traps. Most of fishing units use plank canoes (70% in 1988 on Lake Albert), but many traditional fishermen use dug out canoes for fishing. Less than 25% of the boats are motorized and the rest use paddles.

The data on fish processing revealed that smoking continued to be the most important processing method on Lake Edward, while on Lake Albert, it was salting/sun-drying. Processed products were kept mainly in the house, reflecting lack of storage facilities. Wood and salt were the most commonly used processing materials.

Most of the traders dealt in fresh fish, the majority obtaining their supplies directly from fishers and trading within short distances. They used public transport and had access to good access roads, weighing scales and some forms of stores.

The expenditure patterns of the fishers revealed that food, health care, and education were given high priority; shelter was given medium priority while investment was given low priority. Most fishers slept on mattresses alone but others used beds plus mattresses or papyrus mats. Firewood was the most common fuel for cooking, followed by charcoal and paraffin. Concerning alternative income sources, it was difficult for fishers on Lake Edward to identify and take advantage of alternative livelihood opportunities. This was because the landing sites were in the game park were important activities such as cattle rearing and farming were prohibited under the game park regulations. The available alternative livelihood sources include trade in mixed merchandise, apiary, goat, poultry, and duck rearing. Utilization of these alternative income sources was, however, hindered by lack of knowledge and lack of capital. Even on Lake Albert where the landing sites were not in a game park, fishers took little advantage of alternative income sources to supplement fishery incomes, despite expressing desires to do so.

Lack of income diversification among fishers is a factor that limits them to poverty. To enable them begin alternative income activities, the fishers required training. Other resources identified included capital, source of energy, and good access roads.

The levels of investments in fish catching, processing, and trading was generally low. The equipment used were of low value and this was attributed to lack of capital and the low returns on fishery activities given the drastic catch declines experienced on the lakes in recent years. Most fishers raised their capital from their own savings previously accumulated, while others obtained loans or received transfer payments from relatives. Various forms of saving and credit schemes were reported at the landing sites but these were generally unsatisfactory due to lack of capital and poor management. An exception was the Village Bank at Panyimur, which was considered adequately funded, with donor support, and properly managed. However, the response of fishers to the services provided was reported to be poor. Most fishers did not have bank accounts and for the few who had, the accounts were either at the District Headquarters or in another District altogether. Lack of investment resources, credit facilities, and saving practices hinder fishers from walking out of poverty.

In summary, the results of the study revealed low socio-economic conditions of the major stakeholders dependent on the fisheries of Lakes Edward and Albert. The issues to be addressed in the ILMP are, therefore, categorized as follows:

- a) Lack of community-based organisations in DRC, with legal backing to participate in fisheries management and development under a co-management approach.
- b) Frequent conflicts within the leadership of the fishing communities in Uganda involving Beach Management Units, Local Councils, Fisheries staff, Market tenders, Police, and District Officials which retard operations and development at the landing sites.
- c) Rapid migration of fishers, caused by catch fluctuations, search for better market, crop seasons, lunar cycles in the case of mukene fishers or episodes at the landing sites such as cholera outbreak, insecurity, etc. This hinders effective planning and provision of social services, constrains fisheries management, hinders the operations of BMUs and often leads to insecurity and theft of gears.
- d) Unplanned settlements that do not allow for proper housing and sanitation conditions at the landing sites, posing a health risk.
- e) Low levels of education and literacy among fishers, which limits their capacity to understand issues relating to fisheries and environment management, fish quality and fish business management. It also hinders them from acquiring the skills necessary to modernize their fishery operations and improve production. There are added concerns with the poor quality of education provided under UPE, the distant educational facilities and low school enrolment rates at some landing sites, all of which are factors which work to trap children within the poverty sink.

- f) There is rampant infection with various types of communicable, water-born, and other diseases, notably malaria, diarrhea, bilharzias, cholera, and HIV/AIDS on Lakes Edward and Albert. Performance of public health is hindered by the long distances and poor access roads to the district hospitals where drug replenishments are obtained and lack of willingness of staff to serve at the health centers at the remote landing sites. Use of the services provided by traditional medicine men and spiritual healers is an indicator of poverty among fishers.
- g) Data on sanitation revealed that the majority of the respondents had latrines and those who did not have them used the bush. Poor source of water and poor sanitation are conditions of poverty.
- h) Fishers experience low fish catches for most periods of the year and seasonal fluctuations. Other situations are characterized by low fish prices received by fishers at many of the isolated landing sites. These factors promote poverty among fishers.
- i) Poor and unreliable supply of fishing inputs, particularly on Lake Edward, where gear is obtained mainly from outside the district. This has negative impact on productivity of the fishers, thus leading to poverty.
- j) The species targeted by most respondents are tilapia and '*ragoge/muziri*' for Lakes Edward and Albert respectively. Since '*ragoge/muziri*' is a species for the poor, this is an indicator that most fishers on Lake Albert will remain trapped in the category of poor fishers.
- k) Significant post harvest losses, reflected in fall in fish prices, loss of quality and of products.
- l) Most of the operators sell their fish to local traders and direct consumers. However, local traders and consumers do not offer the highest prices. Inability of the majority of fishers to access markets offering high prices away from the beaches is a factor of poverty among the fishers.
- m) Poor access roads and means of transport to many landing sites and unsafe transport boats hinder the marketing of fish and delivery of supplies to the fishing communities.
- n) Limited participation of women in the various fisheries activities and the low share of women in the benefits from fisheries activities mean that women are less able to work their way out of poverty. Overall, the estimates of wives' shares of benefits from household fisheries activities were reported to be 30-40%.
- o) Low levels of wealth accumulation among fishing communities, coupled with limited facilities for savings and credit available to fishing communities, are poverty factors.
- p) Food availability for the fishing communities fluctuates from season to season, with more people having less than sufficient food during the months of January to March on Lake Albert and July to September on Lake Edward. Inadequate food and unbalanced diet are indicators of poverty among fishing communities.
- q) Alternative income opportunities on Lake Edward are limited, due to game park regulations. Even on Lake Albert where the landing sites are not in a game park, fishers take little advantage of alternative income sources to supplement fishery

- incomes. Low involvement by fishers and their wives in alternative income activities, even where they exist, is a factor that holds them to poverty.
- r) Limited knowledge of and compliance with fisheries management regulations are attributed to unclear positive impacts of fisheries management measures to the fishers, among other reasons.
  - s) Lack of by-laws governing fishing and promoting dialogue among the different types of fishers under the BMU system has been the source of intense conflicts between fishers of ragoge/muziri and Nile perch/tilapia over the use of light fishing on Lake Albert.
  - t) Lack of reading culture and limited reading materials for the information to fishers. Fishers regard the best way of getting information about fisheries to be meetings/baraza followed by the radio.
  - u) Lack of harmonization in fisheries laws and regulations between Uganda and DRC and mechanisms for coordinating cross-border fisheries management and development is resulting in unregulated cross-border fishing and fish marketing on the lakes.

## **2.7 Fisheries Infrastructure**

The TOR required the Consultant to analyze the current situation of basic and fisheries infrastructure at the principal landing sites; analyze the current production system with a view to proposing improvements; propose suitable designs of required infrastructure to meet the public health and hygienic requirements at the principal landing sites on Lakes Edward and Albert.

The Consultant, has provided, information on the state of the fisheries infrastructure of Lakes Edward and Albert through the Diagnostic and Feasibility Reports. Hence, only highlights of the results and observations made are provided below.

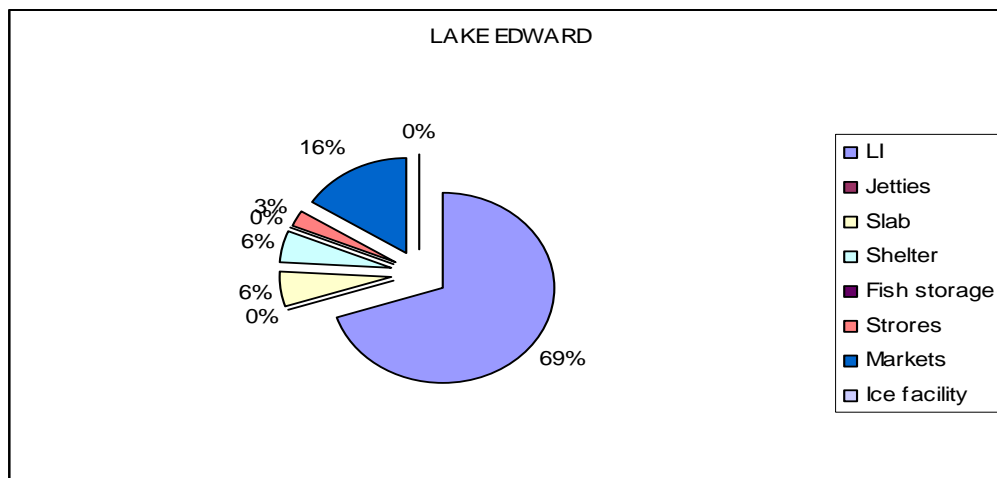
The findings of the study revealed a number of key issues in civil works and infrastructure that should be addressed for fisheries management plan and development of an integrated management plan of the lakes Edward and Albert

The current fish landing infrastructures are generally poor and need upgrading, rehabilitation, or new construction. See **Figs. 1.10** and **Fig. 1.11**. The landing sites are not organised, canoes land every where at the beaches, and large number of canoes land nearly at the same time. Constructing large jetties may not be economical in the development of artisanal fisheries. Washing of fish is currently done on the ground without required hygiene practices and this could be the source of many diseases. As observed at many landing sites, there is no electricity hence lack of cooling system or ice facilities close to landing sites. Because of poor landing infrastructures, the fishes are off-loaded, washed on the ground and put into boxes for sale without the minimum hygiene required. The means of transport used to move fishes from landings to the markets are bicycles, public transportation, and private vehicles, and in some cases the buyers have to travel long distances before reaching the consumers. Appropriate landing

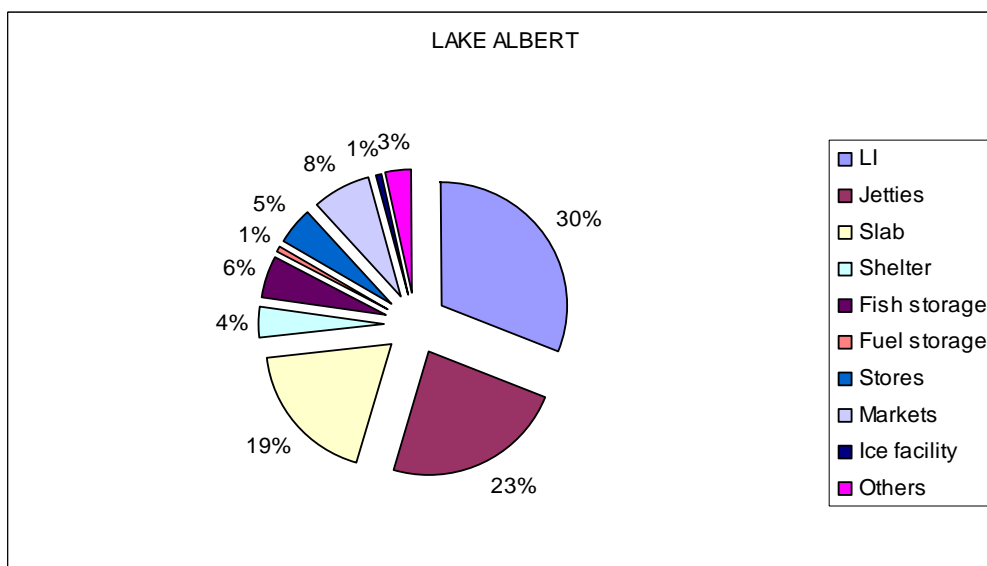


infrastructures including slab, clean water supply, public toilet facilities, storage facilities, power supply should be designed and constructed to ensure fish quality and sanitation.

The fish processing methods used at the landings are mainly smoking, sun-drying and salting. Fish processing method used at the Lake Edward is smoking (47%) and it is the same at Lake Albert (40%). Other fish processing methods encountered are frying and chilling, however ice facilities are lacking at all landings except at Butiaba because there is an ice plant located near the landing site. The basic requirements for fish processing are kiln for smoking, slab or drying racks for sun-drying, ice facilities for chilling, and storage facilities for finished products.



**Fig. 1.10: Landing Infrastructures and Handling Facilities at Lake Edward**



**Fig. 1.11: Landing Infrastructures and Handling Facilities at Lake Albert**

Roads play an important role in fish marketing. Absence of roads linking landing sites to the markets is a major barrier to flow of products. According to the findings the state of the roads is globally poor around Lakes Edward and Albert. The access roads need rehabilitation with proper water drainage and feeder roads should be constructed within the fishing villages. The situation is worse in DRC than in Uganda.

The findings show poor sanitary infrastructures existing at many landings and insufficient health centres. It was also observed at all landing sites that residents lack appropriate procedures for waste management. There were cases of poor disposal of faecal matter that ended up polluting water. The lack of public toilets, clean and safe water, used water drainage system, solid wastes management that exists in the Fishing Villages do lead to precarious hygienic conditions. It was also observed that waste water was simply emptied directly into the lake and the solid wastes were dumped everywhere which increase the degradation and pollution of environment. Access to drinking water is low at many landing sites and Fishing Villages and it is one of the major indicators of good hygiene and sanitation practices. The latrines are either lacking and/or they are not sufficient. The inhabitants either go to neighbouring houses with latrine facilities, use public conveniences where they exist or go into the bush.

In addition, artisanal fish processing techniques being practiced heightens the degradation of sanitation conditions. Public hygiene should, therefore, lay emphasis on pest control as well as cleaning of the environment and improving the sanitary condition of processing areas through proper evacuation of waste and used water, and by giving people access to drinking water and adequate lavatories. Fish processors should be helped through the provision of improved processing facilities and be taught processing technologies in order to avoid risks of product alteration associated with poor processing and storage.

## **2.8 Policy, Legal, and Institutional Frameworks**

The TOR required the Consultant to analyze both the legislative and regulatory frameworks governing fisheries policy, management and research in the two countries in the context of prevailing international protocols and conventions; undertake an assessment of the principal institutions involved in the sector with a view to making recommendations for harmonization of regulations between the two countries; propose an institutional arrangement for the management of the water and fishery resources of Lakes Edward and Albert.

The Consultant, has provided, detailed information on the state of the policy, legal and institutional framework prevailing in the basin of Lakes Edward and Albert in the Diagnostic and Feasibility Reports. Hence, only highlights of the observations made are provided below.

### **2.8.1 Status of Policy and Legal Frameworks**

The legal systems of the two countries are fundamentally different. Uganda's legal system is based on Common Law, whereas the DRC Legal System is based on Civil Law and Customary Law. A comparison of the legislation of both countries reveals that the Ugandan legislation on environment and water resources management is more comprehensive and advanced than that in DRC.

The DRC fisheries policy was made in 1986 and was aimed at increasing production to supply domestic markets and increase exports, improve incomes and the welfare of population and develop regional and international cooperation. The basic strategies retained to achieve the objectives are the reorganization of producers, the promotion of private initiative, pollution control, and enhancement of product quality. Since the elaboration of this policy, the socio-political and economic context has changed and it requires to be urgently updated to take into account the need for effective participation of fisher folk in the management and the development of fisheries and biodiversity, and the integration of fisheries in local development strategies. In DRC fisheries are governed by the 1937 framework law which dates back to the colonial period and regulates, among other things, fishing permits, industrial fishing, protected fish zones, and introductions of species.

In Uganda, fisheries policies are guided by the provisions of the 1995 Constitution and the National Fisheries Policy of 2004. The overall goal of the National Fisheries Policy is to ensure increased and sustainable fish production and utilization by properly managing capture fisheries, promoting aquaculture and reducing post-harvest losses. A further 13 policy areas are also identified covering: Sustainable management and development; Decentralization and community involvement in fisheries management; District, sub-county and community co-operation in fisheries management; Institutions and funding mechanisms; Investment in fisheries; Planning and policy-making; Information; The environment and fisheries; Aquaculture; Post-harvest fish quality and added-value; Fish marketing and trade; Human resource development; and Research. In the legal and regulatory field, Uganda fisheries are still governed by the 1964 Fish and Crocodiles Act, which regulates the use of fishing vessels, fishing permits and the introduction of some species. These regulations were amended in some of their articles in 1967, 1972 and 1996 particularly with regards to fishing licenses, fishing, and processing activities. A draft Fisheries Bill has been prepared to update and co-ordinate the pieces of legislation.

Both countries are party to a number of regional and international conventions /protocols that promote sustainable natural resource management such as the UNICEF Conventions, the Ramsar Convention and the FAO Code of Conduct for Responsible Fisheries. Of special significance is the 1990 Protocol on Fisheries between the two countries that remains unimplemented and is to be revived under the Joint Permanent Commission (JPC) according to the decision of the JPC in 2007.

### **2.8.2 Status of Institutional Framework**

Both countries have Fisheries departments under the Ministry responsible for agriculture. However while in Uganda, the fisheries department is responsible for both regulation, law enforcement and fisheries management services, DRC has two separate institutions; the fisheries department that handles law enforcement and the National Service for Promotion and Fishery development that handles fisheries management services. Both countries have decentralised Fisheries staff but the inadequate budgetary provisions impacts negatively on their ability to provide technical back up services, build capacity at local government level, and monitor local communities. The decentralized structures also suffer from poor staffing levels, lack of equipment / funding and corruption.

.There are no formal dispute resolution mechanisms between the two countries to resolve disputes/conflicts relating to access to fisheries resources although the political leadership from both countries plays a key role in this on an ad hoc basis through cross border meetings.

With regard to community participation, BMUs in Uganda are playing a key role in mobilizing and sensitizing local people for active participation in managing fisheries activities and thereby supplementing the efforts of the public sector and advisory/extension services.

At the political level there exists an institutional mechanism for cooperation between DRC and Uganda called the Joint Permanent Commission that was established in 1986 to boost relations between the two countries. However, due to strained relations and armed conflicts between the two countries in the nineties, the Joint Permanent Commission had last met in 1997 in Kinshasa, and during the recent meeting of the Joint Permanent Commission held from 12-15 December 2007, a number of decisions were taken pertaining to co-operation in management of trans-boundary living resources. The key decisions relating to management of fisheries resources were that the 1990 Protocol on Fisheries should be updated and implemented by ensuring that the fisheries experts meet to put in place a law to regulate fisheries.

### **2.8.3 Property Rights**

A key mechanism for achieving sustainable fisheries management policies is the provision of secure and transferable access rights within statutory management plans that provide a stable legislative framework. The fisheries of Lakes Edward and Albert do not have uniform legal controls in place to prevent entry or harmful and illegal fishing practices. Both countries need to consider defining property ownership rights within the fisheries and the transferability of these property rights through the use of existing traditional institutional arrangements and the adoption of various restrictive measures to enhance control of fisheries resource access.

#### **2.8.4 Identified Policy, Legal and Institutional Issues**

The findings on the policy legal and institutional frameworks of the two countries reveal a number of issues that include:

- (a) The lack of clear strategic and updated regional instruments to regulate and promote sustainable and integrated management of the two lakes in general and of fish resources in particular;
- (b) The low capacity of central and local administrations as regards technical support and enforcement of regulations.
- (c) Limited consultations between the existing structures and low participation by NGOs and operators of the fish industry;
- (d) The limited participation of communities in the development and management of fisheries resources,
- (e) The limited regional consultation on the trans-boundary shared resources,
- (f) The lack of harmonized laws and regulations in the two countries in the fields of fisheries and the environment,
- (g) The lack of secure access rights to the fisheries and the transferability of these property rights through the use of existing traditional institutional arrangements and the adoption of various restrictive measures to enhance control of fisheries resource access, and
- (h) Existence of deficiencies that include inadequate budgetary allocation to fisheries sectors; inadequate funding for research; lack of human resources and equipment; poor to non-existent enforcement of fisheries regulations, and insufficient linkage between central administration and field agents at local level.

### **3. OPTIONS FOR SUSTAINABLE DEVELOPMENT AND MANAGEMENT**

#### **3.1 General perspectives for management**

Fisheries and environmental management is basically the application and implementation of all the rules, regulations, conditions, methods, and other measures, which are required to rebuild, restore, or maintain any fishery and environmental resources and the catchments environment, as qualified by relevant environmental, economic, and social factors that have been discussed in **Section 2**, including the livelihood and food security needs of fishing communities, and taking into account fishing patterns and the interdependence of stocks and any generally recommended national or international minimum standards. Problems with the current fisheries and environmental management regimes are (a) top down approach and lack of legitimacy, (b) poor institutional arrangements which include paucity of technical skills and financial resources, (c) lack of enforcement capacity in all areas, and (d) the open access in resource exploitation leading to economic and biological over-fishing, deforestation, terrestrial and aquatic pollution. Participatory management that involves stakeholders' participation, decentralization of management, rights-based management, trusteeship system and co-management arrangements of the BMUs type could be better options. The current shift in this study is towards the need to meet development goals and to address poverty and food insecurity within the framework of conservation and management of fisheries and environmental resources and the protection of the ecosystems of the two lakes.

A large number of conceptual perspectives and management styles for natural resources have been generated in recent debates (Charles 2001 and Charles 2002). Section 4 therefore provides an overview of these options, which, where appropriate, the ILMP will incorporate into its structure. A combination of flexible 'top down' and 'bottom up' approach is being emphasized because it provides the main theoretical inspiration to the ILMP for Lakes Edward and Albert. Once the options listed below have been assessed and since the main problems in the management of the ecosystems of Lakes Edward and Albert were reviewed and summarized in **Sections 1 and 2**, the management structure to be presented in **Section 4 and 5** should be able to remedy the problems identified and capable of implementing the investment projects being identified and recommended.

#### **3.2 Ecosystem Management**

Ecosystem management is a process that integrates biological, social, and economic factors into a comprehensive strategy aimed at protecting and enhancing sustainability, diversity, and productivity of the natural resources. Ecosystem management:

- a) does not focus primarily on deliverables as in fisheries management but rather regards intergenerational sustainability as a precondition,
- b) establishes measurable goals that specify future processes and outcomes necessary for sustainability of all the environmental resources,

- c) relies on research performed at all levels of ecological organization in the basins of the two lakes,
- d) recognizes that biological diversity and structural complexity strengthens ecosystems against disturbance, and supply the genetic resources necessary to adapt to long-term change with a tendency to stability,
- e) avoids attempts to freeze ecosystems in a particular state of configuration since change and evolution are inherent in ecosystems,
- f) recognizes that ecosystem processes operate over a wide range of spatial and temporal scales, and their behavior at any given location is greatly affected by surrounding systems, and there is no single appropriate scale of timeframe for management,
- g) values the active role of humans in achieving sustainable management goals through sensitization, training, and education, and
- h) acknowledges that current knowledge and paradigms of ecosystem functions are provisional, incomplete, and subject to change, hence management approaches must be viewed as hypotheses to be tested by research and monitoring programs.

### **3.3 Adaptive Management**

Although adaptive management can be described as ‘muddling through’ under the conditions of risk and uncertainty, it does not postpone action until enough is known, but acknowledges that time and resources are too short to defer some action. When these limiting factors are linked to the contextual conditions of resource fluctuations and scarcity, incidence of habitat and biological production changes, potential irreversibility, and growing demands as are being experienced in the Lakes Edward and Albert basins, the need for adaptive management becomes apparent. Basically it is a process in which incremental adjustments occur. Ecological variations within the nature of the environment and fisheries of Lakes Edward and Albert require flexible management systems that have the ability to absorb perturbations.

Adaptive management requires regulations that can permit quick adjustments in the resource exploitation pressure to be undertaken, but at the same time promoting long-term sustainability of the fisheries and other resources. The adaptive management cannot work well in a central government system since the system takes a longer process and time to change rules although its effective implementation requires organizational leadership and political support, coupled with skilled advocates and champions at the field level. However, in the presence of well trained and informed BMU officials, the adaptive management would be most appropriate under such a co-management approach since the decisions to change regulations and by-laws would be made by the communities. The approach is also necessary when it comes to monitoring changes taking place in resource exploitation resulting from the effect of e.g. gear regulations and mesh sizes limitation on fish production. Such actions could be taken either by the Lake Management Authority or the Departments responsible for fisheries routinely or as may be deemed necessary. This is one of the reasons for monthly and annual reporting of accurate fish catch statistics.

### **3.4 Precautionary Management**

Precautionary approach to management of environmental resources can be described as a set of agreed cost-effective measures and actions, including future courses of action, which ensures prudent foresight, reduces or avoids risk to the resources, the environment, and the people, to the extent possible, taking explicitly into account existing uncertainties and the potential consequences of being wrong.

The resources of Lakes Edward and Albert basins and particularly the fisheries are faced with numerous variations arising from anthropogenic activities, multi-species fisheries, fishing gears and methods, lack of accurate fisheries statistics, complexity of biotic systems, and climate changes on which basic researched facts are lacking. The need to deal explicitly with such uncertainty in order to reduce risks to the resources and their environment, and indeed to the fishing communities, requires significant changes towards precautionary approach in the fields of science, technology, and fishery management. Such changes are required in order to effectively deal with the unprecedented shift in policy and international relations and with the metamorphosis of public perceptions and political demands resulting from the 1982 UN Law of the Sea Convention, UNCED and its Agenda 21.

The concept of precautionary action within the Lakes Edward and Albert basin would, therefore, aim generally at improving conservation of the environment and the resources by reducing the risk of inadvertently damaging them. More specifically, it would aim at helping decision-makers and regulators to take a safeguarding decision, when the scientific work is inconclusive but a course of action has to be chosen. In addition, it would intend to promote a more equitable balance between the short-term considerations (which is leading to the present environmental degradation and over-fishing) and long-term considerations such as the need to conserve resources for future generations. It would also aim at promoting inter-generational equity by reducing the cost of present decisions for future generations and by counteracting the effects of current high economic discount rates which provide a strong incentive to over-fish, maximizing the discounted net benefits from a stock and, *de facto*, and giving preference to present consumption over future consumption. By comparison, and despite the fact that it would theoretically aim at sustainability, conventional fishery management addresses primarily, and rather inefficiently, the issue of inter-generational equity and allocation of resources between present users. The concept of precautionary action would also directly benefit present generations of fishers and consumers if fishery authorities and industry actively promote its implementation by other economic sectors whose activities damage resource productivity, fishing communities' livelihood and consumers' health.

### **3.5 Holistic Management**

Historical fishery management has generally been crisis-based rather than proactive. However, there is a growing national and international recognition of the need to develop an ecosystem-based approach to fisheries management in response to the challenges and shortcomings of traditional resource management approaches in sustaining aquatic and



catchments ecosystems. The intention of holistic management is ultimately to go beyond single objective or sector management (e.g., fisheries) to consider multiple objectives in a more holistic environmental management context. In order to better address fisheries and multiple trophic relationships, the holistic approach analyzes exploited aquatic ecosystems, where ecosystem trophic mass balance analysis is combined with exploring past and future impacts of fishing and environmental disturbances. This takes into consideration the need to cope with uncertainties and complications through the use of multi-disciplinary approaches.

Both the multi-species fisheries and the extensive ecosystems of the two lakes need to be understood and managed holistically as one system. This is the essence of having harmonized regulations for the management of the ecosystems of the two lakes.

### **3.6 Proprietorship or Use Rights Management**

Beach Management Units are being established to co-manage the fisheries in Uganda where the fisheries resources can eventually be mediated through the allocation of property rights to the users. Similar arrangement can be adopted in the DRC. Open access regimes that are currently operating in DRC on both Lakes Edward and Albert but only on Lake Albert in Uganda function in an open access mode under broad conditions of state resource ownership and regulation. They virtually guarantee a situation of resource over-exploitation. Fish harvesters, even where limited by quota and/or effort restrictions, will each race to garner as much of the resource as they can, with the ultimate result of declining returns for all.

Limited access arrangements in fisheries of Lakes Edward and Albert may be particularly effective when constituted as fishing rights allocated at the BMU level. Incentives are thereby created to use resources within proprietorship rights in a sustainable fashion through the application of BMU catch and access controls and the use of BMU enforcement mechanisms. The future sustainability of Lakes Edward and Albert fisheries requires a transformation of the present rather open-access regimes into one that allocates fishing rights to communities within their respective territories.

### **3.7 Management through Policing**

Responsible fisheries need an effective monitoring, control, and surveillance (MCS). The failure of fisheries management is often attributed to the inability of authorities to enforce compliance with their management regulations and to monitor accurately the behaviour and performance of the fishers. This study revealed that the fisheries administration of the two countries have been labouring under financial, staffing, and operational shortcomings that severely limit their ability to provide adequate MCS services. The study offers the reminder that such shortcomings are not likely to be resolved in any meaningful way over the near-term. In this connection, greater use of co-management arrangements in relation to MCS activities may offer substantial advantages in terms of cost-reduction and efficiency gains. BMUs will need to assume a greater share of the responsibility for monitoring, control, and surveillance. In the case of the overall

ecosystem and resources management, it will be necessary to use existing community level authority structures and customary practices to facilitate self-policing and shared responsibilities for MCS activities.

The benefit of policing through co-management or the BMU system is that the conservation measures necessary to exploit the environmental resources on a sustainable basis would become a community responsibility in addition to having reduced cost of enforcing fisheries regulations.

### **3.8 Partnership or Co-Management**

Failure to manage people effectively has turned out to be the main limiting factor in fisheries management today. No matter how well-designed fisheries harvest regulations or habitat protection measures appear to be, if fishers or polluters can find a way around them, management efforts are frustrated. But when communities or organizations of fishers are included as partners in the planning, design, and implementation of the regulations, when they participate in protecting habitat, and even more, when they are part of the crafting of the very policies which underlie management decisions, they grant full legitimacy to the regulations, and are the strongest advocates, monitors, enforcers, and implementers of management decisions. Community/NGO partners may even help agencies re-conceptualize a problem and develop a better strategy for attacking it. Recognition of the importance of these kinds of partnership roles in fisheries management is reflected in Paragraphs 6.13 and 6.16 of the Code of Conduct for Responsible Fisheries.

Involving communities or NGOs in management may also be the only way that enough resources can be mobilized to manage effectively. The understanding of natural systems has evolved to the point that we know we need to develop management systems which reflect the complexity and diversity of what is being managed. The study revealed lack of flexible governance structures and resources in the two countries to achieve this. Governments will, therefore, never be able to achieve this ambitious task alone. A growing literature shows how important aspects of this challenge are already being met through partnerships.

The partnership or co-management approach, as the case with BMUs in Uganda, can lead to lower transaction costs at the planning and implementation phase because fishers can provide reliable data on the abundance and composition of species, can help managers to interpret large-scale changes in abundance and the environment, can suggest hypotheses about relationships which scientists can then test, can assist scientists with the most effective sampling techniques and sites for ongoing monitoring or research, in addition to providing information on fishing patterns, catches, and the status of the resources. The success of the arrangement will depend very much on political commitment on the parts of the two Governments as the support will need the enactment of appropriate legislations and adequate technical and financial resources.

## **4. STRATEGIC LAKE MANAGEMENT PLANS (ILMPs) FOR LAKE EDWARD AND LAKE ALBERT**

### **4.1 The New Sense of Direction through ILMP**

The international consensus on the need for integrated approaches for managing water resources has led to a development of integrated frameworks and strategies. The development of management plans for lakes and their drainage basins is part of the 'integrated management' agenda. Challenging questions, however, arise in regard to what integration actually means within the context of planning processes and systems, and for the management plans themselves. The limited literature on lake management planning emphasizes the need for a lead agency for planning and implementation. A relevant question is how to streamline lake management planning with the planning by local governments, national government departments and other stakeholder groups.

The integrated lake management efforts in Uganda have led to the development of lake management plans that build on, and complement, existing local government processes and plans. Lessons from early lake management experiences indicate that implementing lake management plans has not succeeded as exemplified by the Lake George and Lake Kyoga experiences. It is therefore necessary to establish clear linkages in the planning processes within the plans themselves and between lake management structures and local governments in order to ensure sustainability of the management plans, guarantee coordination and ascertain resource mobilization. The development of lake management plans is expected to strengthen existing local government planning systems, by providing a forum for sharing information, ideas and lessons. Integrated lake management planning also supports the introduction of local governments to participatory, community-based planning, as well as promoting inter-sectoral coordination.

It is proposed to develop two separate Integrated Lake Management Plans for Lake Edward and Lake Albert. The basis for this is that Lakes Edward and Albert are distinct entities found in two geological formations separated by the Rwenzori Mountains in the Albertine Rift as described in the Diagnostic and Feasibility Reports. Lake Edward has a mean lake level of 920 meters (m) whose western border is the Mitumba - Kyavirimu mountain range. The Ruwenzori Mountains lie 20 km north of the lake. The lake is 90 km long and 40 km wide. Its average depth is estimated at 34m (near Ugandan shoreline), with a maximum of 120 m towards the Congolese side. Lake Edward basin is about 12,000 square kilometers. The Semliki River is the only outlet with its Rwindi-Rutshuru tributaries that empties into Lake Albert. Lake George, to the northeast empties into Lake Edward through Kazinga Channel. Lake Edward is enclosed by two national parks, the Queen Elizabeth National Park (QENP) in Uganda and the Virunga National Park (PNV) in the Democratic Republic of the Congo (DRC).

Towns and villages within the Lake Edward Basin were found to play a major role in generating pollutants in form of domestic wastes that end up the two lakes. Domestic wastes were rated to contribute 40% of the pollutants entering the lakes whilst agricultural wastes and substances contribute 17% and industrial contaminants were rated

to contribute 12.4%. Diffuse sources of contamination contribute 29%. The big industries like the Kasese Cobalt Company Limited and Hima Cement Factory are found in the Lake Edward catchment and generate pollutants which enter the ecosystem.

Although measurements of wildlife biomass were not made during this study, it is believed that excessive increase in the biomass of large mammals in the grasslands of QENP and PNV will result into (a) an increase in the amount of solid, liquid, and gaseous waste generation through direct fecal and urine inputs into the lakes and the drainage systems, (b) creation of bare ground and dust, and (c) enhancing soil erosion. Hippopotami, in particular, have a powerful influence on both terrestrial and aquatic ecosystems. Their intense grazing and trampling often reduces grass cover in some instances to bare earth for several miles inland of the lakes.

The fishery of Lake Edward is important through a harvest composed primarily of Tilapia (*Oreochromis niloticus* and *O. leuostictus*), Catfishes (*Bagrus docmac* and *Clarias lazera*), Lungfish (*Protopterus aethiopicus*) including some minor species such as *Burbus altianalis*, *Hydrocynus forskalii*, *Mormyrus kanume* and Haplochromine spp.

Lake Albert on the other hand lies at an altitude of 620 m above sea level. It is 160 km long and 35 km wide. It is relatively shallow with an average depth of 25 m and a maximum of 58 m towards the Congolese border. The lake receives water from Lake Edward through the Semliki River in the south, from the Nile River in the north, which ultimately comes from Lake Victoria to the southeast and from other rivers. Its outlet, at the northernmost tip of the lake, is the Albert Nile. The eastern side of Lake Albert is surrounded partly by the Murchison Falls National Park, Bugungu Game Reserve and the Kaise Tonya Game Reserve. The eastern side of Lake Albert on the Ugandan part is also now the scene of oil exploration and commercial oil production is actually expected in the next couple of years. Hence, the two lakes have characteristically different fauna and flora in their biodiversity as a consequence of the interaction between their hydrology and ecology. The evolutionary adaptations of both lakes are different as evidenced by *Hydrocynus* and some haplochromine species which are present in Lake Albert but absent in Lake Edward.

Further, analysis of the existing fisheries and environmental conditions in the two lakes show differences. Similarly, the threats and adverse impacts of the current trends on the ecosystem of the two lakes were quite distinct. Hence, the Integrated Lake Management Plans being developed need to identify appropriate management options for each lake basin. Therefore, it is evident that a new approach or paradigm must be adopted by the riparian countries for the development and management of the two lakes. The study has revealed the following through the various reports so far presented (the Diagnostic Report, the Feasibility Report and now the Final Report), that there is urgent need in each ecosystem to:

- ensure sustainable use of the available terrestrial and environmental resources;
- preserve species and habitats that are of ecological, social, or cultural significance but which may be threatened;

- protect the ecosystems of the two lakes, human health, and society from risks occurring as a consequence of human activities;
- develop economic activities in catchments and the aquatic environment of the two lakes that contribute to economic prosperity and social well-being while safeguarding ecological values;
- implement rural, national, regional, and international instruments relevant to the management of the terrestrial and aquatic environment of the basins; and
- communicate with all the stakeholders in order to raise public awareness, strengthen multi-sector participation, and to obtain support for the sustainable development of the terrestrial and aquatic environment of the two lakes.

Therefore, it is deemed necessary to provide separate management plans for each lake although many aspects of management will be similar. The management plans that are being developed should, therefore, incorporate the following principles in their programs and action plans in the two riparian countries:

- a) There is need for the DRC and Uganda to adopt a shared vision about the environmental resources of Lakes Edward and Albert;
- b) Both the DRC and Uganda should pursue a common integrated strategy to achieve their shared vision which can be undertaken at all levels of the two Governments with the participation of multi-sector stakeholders to ensure public support;
- c) Both countries should take concrete steps to prevent and mitigate threats to the aquatic and terrestrial environments through their own national and local efforts;
- d) Both countries should share responsibility to address complex trans-boundary fisheries and environmental threats which are beyond the capacity of any single Government, agency, development partner, or other group to deal with;
- e) The two riparian countries should develop innovative partnerships to (i) bring the communities and central Governments together to resolve trans-boundary issues, (ii) promote the participation of civil society and all stakeholders, (iii) mobilize the strength of the private sector to provide efficient and sustainable environmental and fisheries solutions, and (iv) address environmental and fisheries issues of Lakes Edward and Albert ecosystem collectively by working together regionally and with development partners to implement international conventions.

#### **4.2 General Principles for the Proposed Organizational Framework for the ILMPs for Lakes Edward and Albert**

The proposed ILMPs are intended to be integrated but involving interactive processes which will promote coordinated development and management of the fisheries, water, land and natural resources in Lake Edward and Albert Basin so as to maximize economic and social benefits in a sustained and equitable manner for the peoples of the DRC, Uganda, down stream and upstream countries and indeed the global community. The Integrated Lake Management Plans (ILMPs) are essentially, cross-cutting in all aspects, inclusive of sub-sectors in Integrated Water Resource Management (IWRM). Hence, all aspects of lake based and land based activities must be managed to ensure adequate quantities of water of good quality if not the ecosystem of LEAB will perish with all its

fauna and flora. There is therefore a need to have adequate water in sufficient quantity and of good quality at all times. Therefore, it is essential to have in place an effective and efficient institutional and management structure for implementation of the ILMPs for Lakes Edward and Albert.

**a) Policy Framework**

Lake Basin Management Frameworks are negotiated, agreed upon, and established to promote integrated and balanced multiple water uses among member countries. By working together, through informed dialogue, the countries develop agreed rules and strategies for sustainable uses of water and the other environmental resources for the intended purposes. And through on-going cooperation, the potential for conflict over the increasingly scarce environmental resources can be greatly diminished and hopefully avoided.

There are many international river and lake basin organizations. Together, they cover a wide surface of the earth and manage the freshwaters and their resources. Like the River Nile basin, they include many nations some of which lie entirely within the shared basins. Despite the obvious and growing potential for discord, to-date negotiated outcomes on sharing water and other trans-boundary resources have been preferred.

The benefits of joint strategic planning for development and management are to assist change to take place in response to changes in the internal and external environment of the lakes. Joint management is critically important for such shared resources where (a) there is a high level of complexity in water resource management, (b) there is great variability in the hydrologic cycle, (c) many different stakeholders need to be satisfied, (d) issues are often highly political, (e) the context of water resources management is undergoing rapid change, and (f) there is need to have sustainable use of land and water for the long term.

It is against this background that the ILMPs for Lakes Edward and Albert Basin are being prepared for the DRC and Uganda under the auspices of the Nile Basin Initiative. The formation of a mechanism to manage the action programs being proposed under the ILMPs should, therefore, be sealed in an Agreement on Cooperation for the Sustainable Development and Management of the Lakes Edward and Albert Basin resources. By agreeing to plan together, both DRC and Uganda will recognize the need to cooperate in all fields of basin development and resource management, lake navigation, flood control, fisheries, agriculture, power production, and environmental conservation.

**b) Legal Framework**

It is evident that the existing legislative frameworks of the two countries as they pertain to fisheries and environmental resources of Lakes Edward and Albert basin are inadequate and warrant significant revision. However since revision of laws requires lengthy consultations as well as parliamentary approval, the countries should explore adopting common management measures on the basis of the existing legal framework and other international best practices such as the implementation of the FAO Code of Conduct for Responsible Fisheries, the United Nations Convention on Environment and

Development, and the Millennium Development Goals. This would, e.g., be the basis of a Protocol for fisheries to regulate both lakes. The use of technical and other measures to regulate fishing should be supported by alternative enforcement schemes that provide for close involvement of fishers folk and local communities in surveillance and control activities.

Meanwhile, arrangements should be initiated to review and harmonize the national legislations regarding the two lakes such that when a country is enforcing its national laws, it would also be enforcing the harmonized regional regulations. It will be the main objective of one of the Strategic Goals to provide, through harmonized legislation, favourable environment in which the management of the two lakes and their fisheries will be carried out given the need for regional action at catchments level. This will involve the review and update of the existing policies and legal frameworks of the two countries with the view to harmonizing them to facilitate implementation

Harmonization of the fisheries regulations of the two countries is an important strategy that would greatly facilitate the implementation of a fisheries management plan for Lakes Edward and Albert. In particular, emphasis should be placed on the following three specific measures:

- (a) Development of a common framework of fisheries regulations;
- (b) Harmonization of standards for monitoring, control and surveillance systems of the fisheries and other environmental resources.
- (c) Development of legally recognized co-management frameworks for integrated management of the two lakes with public-private partnerships. This should allow for participation of civil society and, where relevant, private industry should develop, implement, and monitor the performance and impacts of integrated lake management plans.

It will also be necessary that (i) the use of technical and other measures to regulate exploitation of resources should to be supported by alternative enforcement schemes that provide for close involvement of the stakeholders and local communities in surveillance and control activities; (ii) the regime of sanctions provided for in fisheries legislation of the two countries should be subjected to thorough review and revision in consultation with the local fishermen and other stakeholders, (iii) there should be need to address issues relating to national privatisation and investment priorities of the two countries in the code of conduct regulating the harmonized resources management on Lakes Edward and Albert.

Fisheries regulations in the DRC should be revised to include provisions for banning the introduction of any non-native species of fish and aquatic plants, limiting the number of industrial fishing licenses that can be issued, and reviewing the fishing restrictions that are based on classification of seasons / fishing units. There is also a need for “joint” or “inter-agency” patrols to implement Monitoring Control and Surveillance (MCS). It should be ‘joint’ in the sense that BMUs, and all relevant districts, the Lake Management Organizations, and enforcement personnel would come together for periodic patrols. The

operational patrol on Lakes Edward and Albert can be strengthened by procuring monitoring, communication, and surveillance equipment to optimize operations and harmonize enforcement measures.

#### **4.3 The Shared Vision and Mission of the Integrated Lake Management Plans for Lakes Edward and Albert**

##### **a) Vision**

The environmental resources of the ecosystems of Lakes Edward and Albert are a natural heritage that safeguards sustainable and healthy food supply, livelihood, property and investment, and social, cultural, and ecological values for the people of DRC and Uganda, while contributing to economic prosperity and accessibility to regional markets thereby promoting a peaceful and harmonious co-existence for present and future generations. If this is the conceptual view from both countries, then the shared vision must represent a common understanding, views, and wishes of the people of DRC and Uganda regarding the ecosystems of Lakes Edward and Albert. It must be how the stakeholders see the environmental and socio-economic status within the two lakes and their catchments in the long term, perhaps at the end of twenty five to fifty years. Achieving the vision will take time, strategies, and resources to implement a set of action programs. More importantly, it needs the collective political will and regional cooperation between the two Governments, the people of DRC and Uganda, and other stakeholders to implement the planned action programs.

Taking cognizance of public perceptions and political demands resulting from the 1982 United Nations Law of the Sea Convention, the 1992 United Nations Conference on Environment and Development and its Agenda 21, the 2002 Millennium Development Goals, and the recognition of the importance of fisheries management as reflected in the Code of Conduct for Responsible Fisheries, the following can be adopted as the shared vision of Lakes Edward and Albert Basin:

***“An environmentally sound and economically prosperous Lakes Edward and Albert Basin”.***

##### **b) Mission**

The mission is an expression of the immediate aim of the ILMP arising from the conviction or sense of calling which is the shared vision. It is a statement describing what the region will undertake to implement the ILMPs in order to achieve the vision. In addition, the mission statement affirms the purpose and function of the stakeholders for one common purpose. It has a focus on the job at hand with an orientation towards future goals. DRC and Uganda can, therefore, adopt the following mission to guide the implementation of the ILMPs for Lakes Edward and Albert:

***“To promote and coordinate sustainable development, utilization, and conservation of the resources of the Lakes Edward and Albert Basin for the mutual benefit of the people of the DRC and Uganda”.***



**c) Strategic steps for the Proposed ILMPs for Lakes Edward and Albert**

The ultimate goal of the proposed ILMPs is to improve the quality of life of the people of DRC and Uganda generally, and of the people within the Lakes Edward and Albert Basin in particular. There must therefore be improvement in the institutional and operational frameworks through the ILMPs. The proposed Integrated Lakes Management Plans for Lakes Edward and Albert must therefore address and incorporate within their management structures the issues and recommendations earlier proposed in the Diagnostic and Feasibility Reports. This call for well coordinated implementation of the ILMP activities at regional, national, and local level is desirable to achieve the objectives of the plan systematically and within a given timeframe. In addition, regional, national, and local counterpart plans of action focusing on priority issues and areas that are of social, economic or of environmental significance should provide a platform for action. Hence, based on the key issues and problems identified in the study including the findings illustrated in the Diagnostic and Feasibility Reports, the following institutional improvements are recommended to be incorporated into the ILMPs of the two lakes.

- i. Develop separate Integrated Lake Management Plans for Lake Edward and Lake Albert to address specific issues unique to each lake basin. Although the “building blocks” for these ILMPs will be different, their ingredients and operational mechanisms will be similar;
- ii. Establish functional **Transboundary Mechanisms** to implement the ILMP for Lake Edward and Lake Albert separately. It is proposed that these be called the **Lakes Edward Basin Management Authority (LEBAMA)** and the **Lake Albert Basin Management Authority (LABAMA)**. **LEBAMA** and **LABAMA** should have structures for implementing ILMP programs and projects at national level;
- iii. **LEBAMA** and **LABAMA** should each have a regional secretariat and be empowered with executive powers to over see the fisheries and environmental aspects of management and development of the lake basins. However, consideration should be given to have only **ONE** joint **Regional Secretariat** to coordinate and oversee the operations of both **LEBAMA** and **LABAMA**. This implies the need for requisite resources and capacities for technical and specialized staff as well as funds and equipment for the two Authorities.
- iv. Develop national policy, institutional and supporting legislation to guide the implementation of the ILMPs in the participating countries;
- v. Adopt catchment based institutional arrangements for management of environmental resources like fisheries, water supply, land, forests and wild life areas;
- vi. Established local inter-agency, multi-sectoral coordinating mechanisms to implement sustainable area development programs;
- vii. Facilitate local agencies like BMUs in Uganda and UGREP in the DRC to manage their fisheries and environmental resources.

## **5. THE PROPOSED INTEGRATED LAKE MANAGEMENT PLAN FOR LAKE EDWARD BASIN (ILMP-E)**

### **5.1 General principles for the management of Lake Edward**

The Action Programs of the ILMP will be based on the prescriptions of global, regional, and national instruments relevant to environmental resources and their supporting ecosystems. The ILMP is going to be implemented by all the different stakeholders working in partnership or in concert with each other. These will include but not limited to individual men and women, public and private sectors, civil societies, academic, research, and development institutions, local and national authorities, non-governmental organizations, the two riparian governments and their national agencies, development partners, the United Nations and international agencies. It will emphasize self-reliance and sustainability through building capacity in the two countries in order to promote regional self-reliance to manage the terrestrial and aquatic environment and their resources in order to achieve the shared vision.

The following general principles are, therefore, essential for implementation of the ILMP activities and for achieving the expected outcomes.

- a) The ecosystem of Lake Edward and its environmental resources shall be managed to ensure preservation and conservation of the ecosystems and the quality of life of the people within the basin;
- b) The right to development must be fulfilled so as to equitably meet development and environmental needs on sustainable basis;
- c) Management of the environmental resources and the activities affecting them shall respect natural processes and systems;
- d) Beneficial uses of the environmental resources shall be encouraged and adverse uses avoided or minimized;
- e) Basic linkages between sustainable management of environmental resources, poverty alleviation, and protection of the aquatic and terrestrial environment shall be respected;
- f) Civil society and the private sector shall be recognized as a vital partner in joint efforts with Government, intergovernmental bodies, international agencies, and bilateral and multilateral financial institutions to meet the goal of sustainable development;
- g) Environmental issues are best handled with the participation of all concerned citizens at the relevant level;
- h) The rights of all sectors of society shall be respected and protected;
- i) The precautionary principal shall be widely applied. Where there are threats of serious irreversible damage and insufficient scientific knowledge projects should not be implemented so as to prevent environmental damage;

- j) Activities within Uganda and DRC should not cause damage by pollution to each other and to other states and their environment;
- k) The interrelationship between conservation and socio-economic development implies that conservation is necessary to ensure sustainability of development, and that socio-economic development is necessary for the achievement of conservation on a lasting basis.

The proposed Lake Edward Basin Management Plan (ILMP-E) will address not only fisheries and water problems but also catchment based management issues which are of general nature but specific and unique to the Lake Edward Basin as these have impacts on the fisheries, water quantity and quality. A synthesis of the issues unique to the Lake Edward Basin which were described in the Diagnostic and Feasibility Reports and repeated elsewhere in this report include:

- a) Poor policies and laws;
- b) Inadequate implementation and enforcement of policies and laws;
- c) Declining biodiversity and dwindling fish stocks due to over fishing;
- d) Pollution due to eutrophication from the Mweya Peninsula and the Mweya Hotel;
- e) Pollution through agricultural activity in the farms around Mt Rwenzori which emit fertilizers and pesticides;
- f) Deteriorating water quality in the inflowing rivers as well as in the lake itself;
- g) Eutrophication due to wild life particularly hippopotami;
- h) Eutrophication due to over grazing by cattle within the Queen Elizabeth National Park (QENP);
- i) Chemical pollution due to the copper mine and the cobalt mine;
- j) De-forestation due to fish smoking activities of fishermen;
- k) Increasing environmental deterioration due to tourism activity in the QENP;
- l) Potential tourism related pollution and environmental damage in both QENP and the Virunga National Park;
- m) Poor sanitation in the fish landings;
- n) Poor fish handling and processing facilities;
- o) Security related problems

The following strategic actions are, therefore, proposed to be implemented within the over all Lake Edward Integrated Lake Management Plan.

- i. Improve policies and the legal framework through revision and harmonization,
- ii. Improve implementation and enforcement systems through improvement of the MCS system,
- iii. Conservation of biodiversity through better control and creation of “Conservation areas”,
- iv. Improve fisheries management through revision and harmonization of the policy and regulatory framework,
- v. Controlling pollution from industries,
- vi. Controlling pollution from agriculture,
- vii. Conservation of the environment through controlling de-forestation,

- viii. Managing wildlife,
- ix. Managing livestock,
- x. Improving fish landing sanitation,
- xi. Managing solid and liquid wastes in riparian towns and rural growth centers,
- xii. Managing tourism development,
- xiii. Improvement of the socio-economy of the local communities and
- xiv. Managing insecurity.

## 5.2 Specific strategic instruments and activities to address each of the above issues

### a) Establish a regional transboundary institutional mechanism for the sustainable management and development of the Lake Edward Basin

It is proposed to establish a regional institution for the sustainable management and development of the Lake Edward Basin and this institution will be called the **Lake Edward Basin Management Authority (LEBAMA)**. The successful establishment and operationalization of LEBAMA will require an operating environment with the following instruments and actions.

- i. Have political recognition and support and should be given a high level of autonomy from the political leaders/Ministers to allow for day-to-day decision-making by experts from both countries based on efficient and cost-effective management and flexible enough to cater for a strong partnership approach between the different key stakeholders.
- ii. Have well defined linkages to different national and international agencies concerned with management of trans-boundary natural resources.
- iii. Have clearly defined institutional and operational roles.
- iv. Implement common management guidelines for the shared resource to ensure coordination, effectiveness, and harmonization at levels.
- v. Allow for innovative revenue generation mechanisms and appropriate incentives including common investment guidelines, fiscal systems, and access rights frameworks for national and shared resources where revenues can be derived from levies and thus improve efficiencies and service delivery through self financing.
- vi. Undertake capacity building of both DRC and Ugandan personnel in order enhance their skills, knowledge and technical capacity to undertake joint institutional planning and management of trans-boundary natural resources.
- vii. Adopt harmonized standards on both lakes for quality assurance, control, and certification systems including; inspection, monitoring, communication, surveillance, construction of landing sites and enforcement of legislation.
- viii. Involve the local communities by equipping them with resources and information packages as well as skills to foster their participation in decision making and the sustainable management of the natural resources.
- ix. Have a Strategic Plan and a Business Plan that can be used by both countries to evaluate performance and attract donor funding for joint investment projects.

**b) Adopt Harmonized Legislation and Enforcement Mechanisms**

The strategic Integrated Lake Management Plan for Lake Edward (ILMP-E) should harmonize legislation and enforcement mechanisms as follows:

- i. Development of a common legal framework and restrictions.
- ii. Development of legally recognized co-management frameworks for integrated management of the two lakes (public-private partnerships) which should allow for participation of civil society and, where relevant, private industry to develop, implement and monitor the performance and impacts of integrated lake management plans.
- iii. Harmonization of standards for monitoring, control and surveillance systems of the national and shared natural resources.
- iv. Addressing issues relating to national privatisation and investment priorities of the two countries in the code of conduct regulating the harmonized fisheries management on Lakes Edward and Albert.
- v. Strengthening Operational Patrol on Lakes Edward and Albert by procuring monitoring, communication, and surveillance equipment to optimize operations and harmonize enforcement measures.

**c) Conservation of the environment**

The strategic Integrated Lake Management Plan for Lake Edward (ILMP-E) should improve general environmental management through the following:

- i. All approved ILMP activities must be implemented at national level;
- ii. Harmonized national environmental policies and laws;
- iii. Environmental management must be incorporated into economic development plans at regional, national, and local level;
- iv. Environmental assessment and management systems to prevent water quality
- v. deterioration, destructive fisheries, land degradation, flood and soil erosion, deforestation, and environmental pollution must be put in place as tools for sustainable development and management;
- vi. Integrated environmental management programs including training, sensitization, and legislation should be implemented by local authorities in the Lake Edward catchment;
- vii. Cooperation between communities for addressing trans-boundary environmental problems across national boundaries should be activated;
- viii. The major international environmental instruments must be ratified and implemented by both countries.

**d) Harmonize Water Quality and Catchments Environment Standards**

The strategic Integrated Lake Management Plan for Lake Edward (ILMP-E) should adopt and implement the following for the improvement of water quality in the catchment

- i. Formulate and institute realistic
- ii. Raise awareness of the importance of water quality and pollution control among policy makers and the general public;

- iii. Apply pollution control at all levels including the lowest appropriate level in order to ensure that decisions or actions concerning water quality standards and pollution control are taken as close as possible to those affected;
- iv. Prevent the production of wastes that cannot be recycled or treated;
- v. Minimize pollution from non-point sources through fostering “best environmental practices” in agriculture, soil and water conservation, forest management, population control, wildlife management;
- vi. Apply the “polluter-pays” principle where the cost of pollution prevention, control, and reduction measures are born by the polluter;
- vii. Use the “precautionary principle” to prevent the release of hazardous substances into the lake and general catchment;
- viii. Encourage the establishment of cross-sector mechanisms for the co-ordination of water quality standards and pollution control efforts within water related sectors;
- ix. Promote international co-operation on trans-boundary water management.

**e) Improve Water Resources Management**

The following interventions are being recommended for adoption and implementation in the ILMP-E programs:

- i. Develop physical facilities and infrastructure for transboundary water resources monitoring and management;
- ii. Develop a joint databases on water quantity that should be shared;
- iii. Develop common groundwater management strategies for policies, laws and guidelines for monitoring and assessment of groundwater sources;
- iv. Develop a program to rehabilitate and upgrade the Hydro-meteorological and water quality monitoring network to support management of the water resources; and
- v. Develop a program to improve the management of water resources with a joint management framework supported by an aggressive capacity building strategy tailored to suit the needs of each country.

**f) Improve Biodiversity and Fisheries Management**

The following interventions are recommended for implementation within the ILMP-E in order to improve biodiversity and the management of the fisheries:

- i. The Haplochromine species populations in Lake Edward are key strata in the food chain and trophic relations in the two lakes. This group is the main target of all the piscivorous species which themselves are the basis of the commercial fishery in the lake. Therefore, small meshes sizes of gill-nets (1 to 3 inch) should be prohibited;
- ii. Illegal fishing practices using beach seines, beating water, poison fishing and dynamiting should be strictly prohibited;
- iii. Very large mesh size gill-nets and long lines should be encouraged in fisheries;
- iv. The small 4 inch mesh size gillnets should be experimented with on a pilot scale for at least 6 months and the catch structure analyzed before deciding whether they could be permitted;

- v. BMUs units should be established all around the lake in both Uganda and the DRC. These units should be trained and empowered to carry out some fishery biological work including monitoring, qualitative and quantitative measurements and record keeping;
- vi. Lake Edward ecosystems are not well known and it is recommended that a fully fledged fisheries research center with adequate laboratories, equipment, transport, library and documentation facilities and communications be established with field stations on both lakes in the two riparian countries to carry out research on fisheries biology, limnology, water quality, ecosystem functions and socio-economic relationships on a continuous basis;
- vii. Training of scientific and other staff to conduct research in the two lakes should be mounted with full cooperation of near by universities of the two countries;
- viii. Published and unpublished documents and literature on Lakes Edward should be gathered as a lot of this information is scattered around the world and is not available to national scientists within the region;
- ix. It is recommended that Protected Areas “Pas” be set up, surveyed and monitored to enable fish to breed successfully;
- x. Commercial fishing should be limited to seasons when the fish are not breeding;
- xi. Stakeholders should be periodically and continuously sensitized on environmental management and scientific conservation measures with emphasis on what role they should play;
- xii. Curricula should be developed for schools on environmental management and biodiversity conservation;
- xiii. Multi-disciplinary research capacity should be strengthened at national institutions and that appropriate research should be conducted on the ecology, biology, Fish stock assessment, taxonomic, Limnology and water quality, pollution, atmospheric deposition, Post-harvest losses, fish preservation, packaging and transportation techniques, parasites and aquaculture.

**g) Improve the Socio-Economics and Livelihoods of the Communities**

The following interventions are recommended for implementation within the ILMP-E in order to improve the Socio-Economics and Livelihoods of the Communities.

- i. Provide alternative employment opportunities.
- ii. Improve agro and fish marketing systems;
- iii. Empower co-operatives and rural based enterprises;
- iv. Provide access to affordable long term financing;
- v. Strengthen extension services;
- vi. Promote production of high value crops;
- vii. Increase on- farm production and marketing of farm products;
- viii. Invest in value addition to boost sustainable production and incomes of the rural poor in the Lakes Edward and Albert Basin;
- ix. Investments should support the increasing involvement of small scale, community based businesses and associations;
- x. Invest in the promotion of the agro-based and fisheries sectors and products at all levels;

- xi. Invest in marketing strategy using on-line market information;
- xii. Encourage the principle of public–private sector partnerships;
- xiii. Develop micro credit schemes for community groups and disadvantaged groups to benefit from investment opportunities.

**h) Improve Fisheries Infrastructure**

The following interventions are recommended for implementation within the ILMP-E in order to improve fisheries infrastructure along the beaches.

- i) Upgrading and rehabilitation of damaged fish landing infrastructures and facilities including concrete surface slabs, shelters for protection of fish, provision of clean and portable water for cleaning fish, control of waste water to prevent lake water contamination, improvement of fish storage facilities, provision of public toilets facilities;
- ii) Improvement of for fish processing facilities including kilns for smoking fish, concrete slabs for fish sun-drying, ice facilities for chilling fish and storage facility for finished products and utensils;
- iii) Provision of technical training in elements of quality control, sanitation, hygiene and safety
- iv) Provision of electricity supply at the landings and within the fishing villages; and
- v) Improvement of access roads and road networks in order to reduce post-harvest losses.

**i) Improve Fisheries Statistics through the following**

**Frame Surveys**

Frame surveys to be conducted by carrying out a complete enumeration of each lake, collecting information on existing landing sites and their location and characteristics (Fish species, facilities, etc) and number of fishing units and information on their components, such as fishermen, fishing boats, fishing gear per landing site.

**Catch and Effort Surveys**

Carrying out Catch/Effort surveys to collect current information on total catch and fishing effort.

**Data Processing, Analysis, and Archiving**

Statistical data from Catch/Effort studies should be processed in the following manner:

- (i) the local fisheries officer will compute the Catch per unit of Effort for the sampled day, and raise it to the total catch for the sampled day;
- (ii) at the end of the month, the officer will compute the monthly catch for the site. The daily catch forms and the monthly catch estimates will then be submitted to the District (Territoire) Fisheries Office;
- (iii) The District Fisheries Office will weight the sentinel site catches to obtain a District total for monitoring the District fisheries production;



- (iv) The daily catch forms will be submitted to the Regional (Provincial) Fisheries where they will be entered into the Fisheries Database, hereafter referred to as the Fisheries Information Management System (FIMS), using a suitable data entry system;
- (v) checking the data for errors of transfer and gross recording errors will be done by appropriate automatic checking routines built into the data entry system
- (vi) weighting up samples to total landings by day, site, month and region as needed and preparation of summaries of data will then be carried out by FIMS;
- (vii) *ad hoc* analysis of the data will be carried out using a suitable statistical package e.g STATA;
- (viii) the data will then be archived so as to be easily retrievable and updated as new information becomes available. The data will be in the form of a simple database with a record for each landing site, and a record for each site visit.

**j) Institute Revenue Generation Mechanisms within the lake basin**

It is recommended to explore means of revenue collection from the following sources:

- i. Establish a “cess”, levy or retention fund mechanism to access funds from users of catchment based natural resources like fish, water, forests, land, minerals, wildlife and hotels by charging a percentage of their earnings as retention fee for management purposes;
- ii. A deduction fee should be charged against traders and markets dealing in natural resources (fish, timber and wood products, sand, clay, stone materials, minerals and wild life products) and this money should be deposited into an environmental account for the management of these resources;
- iii. A percentage should be charged on all tourists entering the QENP and the Virunga National Park and this money be deposited into an environmental account for the management of these resources;
- iv. A percentage should be charged on all research projects and scientists entering the QENP and the Virunga National Park for research purposes and this money should be deposited into an environmental account for the management of these resources;
- v. A percentage should be charged on all users of roads and water ways within Lake Edward and within the QENP and the Virunga National Park;
- vi. Funds should be sourced from donors, foundations and local business entrepreneurs;
- vii. Funds should be sourced from local governments and local authorities; and
- viii. Funds should be sourced from the central governments of the two riparian states.

It is recommended to explore means of revenue collection through introduction of fiscal systems that will be able to increase the funds to local government, increase charges to resource uses, and leave a substantial amount for resources management and development. The system should simplify the existing complex local taxation systems and take into account its differential impacts on different stakeholder groups with regard to poverty reduction.

**k) Establish Conflict Resolution Mechanisms**

There is need to establish formal mechanisms for conflict and dispute resolution between the DRC and Uganda and between fishing communities. This should involve instituting regular cross border meetings. Law enforcement should be separated from extension services with well defined guidelines and adequate facilitation

**l) Control access to resources**

It is recommended to control access to the fisheries of Lake Edward by various restrictive measures which may include licensing, limiting the size of fish harvested, limiting the minimum mesh size of gill net to be used on the lakes, use of closed seasons and closed area restrictions, prohibiting a number of fishing gears and methods, and limiting the vessel size and propulsion power of fishing boats since the size and power determine how far the vessel can go and hence reduce the threat of illegal cross-border fishing and trade.

**m) Property Rights**

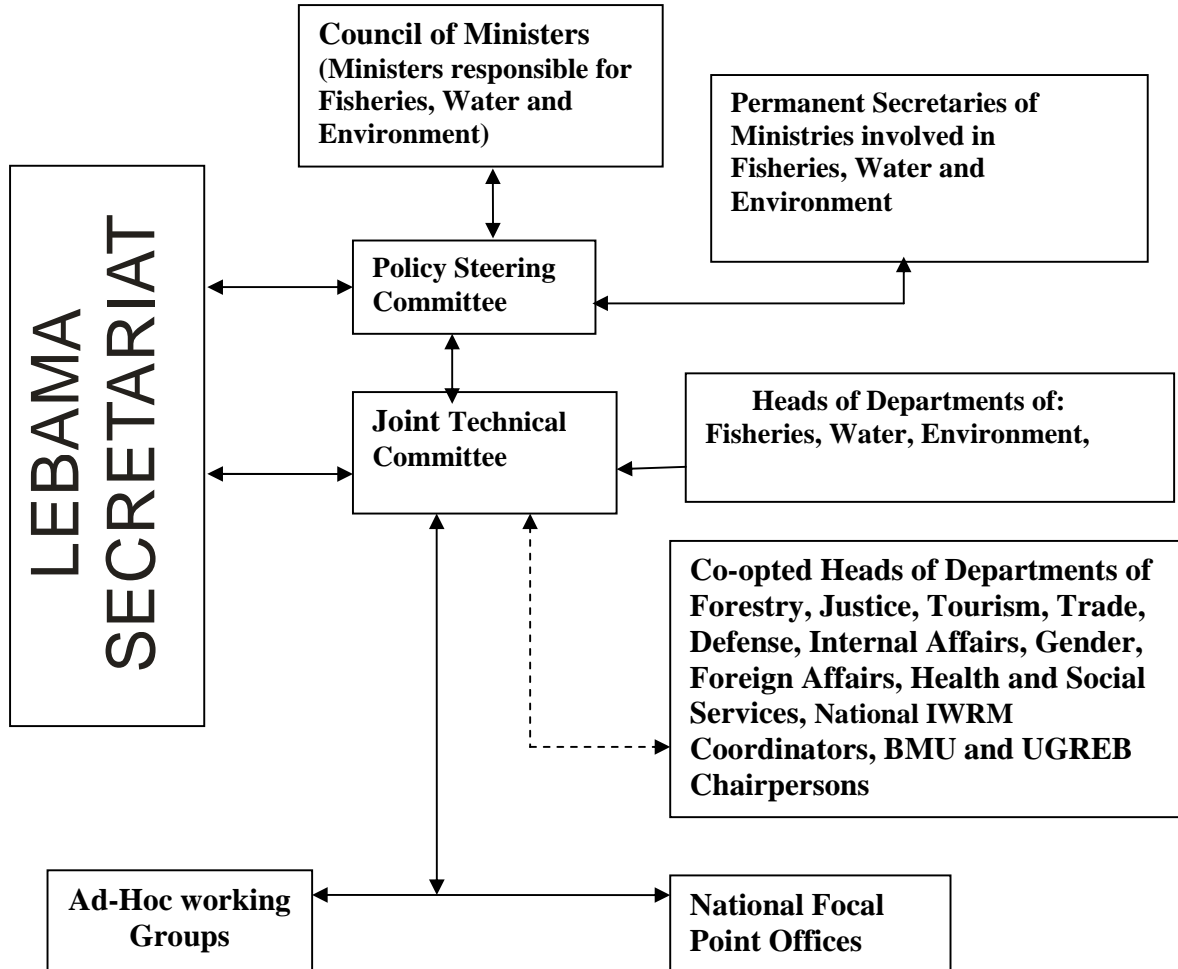
The issue of land ownership should be addressed in light of existing legislation on land ownership in each country. A permanent strip should be maintained of at least 100-200m from the lake shores to enable fishermen conduct their fishing activities without harassment from the land owners or wildlife protection authorities where the landing sites fall within protected areas.

**5.3 The Proposed Institutional Framework for the Management of Lake Edward Basin**

**a) The Lake Edward Basin Management Authority (LEBAMA).**

It is proposed to establish a transboundary institution for the sustainable management and development of the Lake Edward Basin and this institution will be called the **Lake Edward Basin Management Authority (LEBAMA)**. The structure and linkages of LEBAMA are illustrated in **Fig. 12** below.

**LAKE EDWARD BASIN MANAGEMENT AUTHORITY (LEBAMA)**



**Fig. 12: The structure and linkages of the Lake Edward Basin Management Authority (LEBAMA)**

Studies of successful aquatic environmental management systems world wide have revealed that the major factors that underlie successful fisheries management include sufficient institutional capacity (including policy and legislation), appropriate incentives including fiscal systems and use-rights frameworks; and cooperation and communication between all stakeholders. A key factor that determines success in resources management is the nature of the governance arrangements i.e. the institutional framework which defines the relationship between the different stakeholders, e.g., in the fisheries, and which ensures that all stakeholders can participate in management decisions (at different levels) and can share in the benefits derived from the resources. It was found during the study that the existing institutional arrangements frameworks of the two countries are deficient and the main deficiencies common to both countries were the following: inadequate budgetary allocation; inadequate funding for research; lack of human resources and equipment; poor to non-existent enforcement of regulations and

insufficient linkage between central administration and field agents at local level. It was further noted that a wide range of Government institutions in both countries have overlapping mandates or are engaged in activities that impact directly or indirectly on the management fisheries and other resources of Lake Edward. Examples of these agencies include those responsible for wildlife protection, security and defense, judiciary, tourism, trade and investment, environment, water resources, energy and mineral development and research and training. This raises the need to bring all key institutions in the two countries under a regional transboundary arrangement that can address the cross border concerns in a coordinated and efficient manner for the sustainable management of the environmental resources of both lakes.

The implementation of the ILMP for Lake Edward will involve the creation of an institutional structure for the management of the proposed plan. The proposed institution is therefore the Lake Edward Basin Management Authority (LEBAMA). It is recommended that the institutional structures for the management of LEBAMA should not be complex but should be simple in order to avoid bureaucracy, “red tape” and time wasting processes and procedures. These structures should focus and make use of existing national government institutions within the basin. The following structure is therefore proposed for LEBAMA.

#### **a) The Structure of LEBAMA**

##### **The Council of Ministers**

##### **Composition**

The structure of **LEBAMA** is shown diagrammatically in **Fig. 12** above. The Council of Ministers will be the supreme body responsible for oversight, supervision of the Authority which provides direction on all policy matters. The Authority will be composed of the Ministers responsible for the Ministries of Fisheries, Water and Environment from each of the riparian countries. Attention was paid to avoid overloading LEBAMA with too many ministers who would make its work clumsy and wieldy. The Regional Secretariat of LEBAMA will be headed by a Regional Executive Secretary who will provide technical and administrative services to the Council, to the Policy Steering Committee, and to the JTC.

The Chief Executive of the LEBAMA Secretariat and his staff shall attend Ministerial Council Meetings in their capacity as ex-officio members.

##### **Roles and mandates**

The Council of Ministers of LEBAMA shall be the supreme organ of the Authority responsible for overall supervision and oversight of the functions of the Authority. It shall have powers to formulate and amend policies and to approve laws and regulations for the Authority.

### **Functions of the Ministerial Council**

The Ministerial Council shall have the following functions:

- Approve policies and regulations of the Authority;
- Approve work plans, budgets and audited accounts of all the programs and projects of the Authority and its Joint Technical Committee;
- Approve Financial Regulations of the Authority;
- Review reports and recommendations;
- Approve Rules governing the appointment of the staff of the Authority;
- Set up such committees or other subsidiary bodies as it may deem appropriate for the performance of the functions of the Authority;
- Approve management and conservation measures to ensure sustained conservation and management of the fisheries, water quality and quantity and other natural resources of Lake Edward.

The Council of Ministers shall meet quarterly and alternately in each of the riparian countries. The Minister responsible for Fisheries will be the chairperson. The chair will rotate between the DRC and Uganda. All meetings shall have bi-lingual translation facilities. The Council of Ministers may hold special sessions if it so decides or at the request of any one of the riparian countries. The Council of Ministers shall adopt its own Rules of Procedure. Decisions of the Council of Ministers will be taken by consensus.

### **The Policy and Steering Committee**

The Policy and Steering Committee shall be responsible for servicing the Council of Ministers. The Policy Steering Committee shall be responsible for implementation of the policies, laws, regulations and decisions of the Council of Ministers. It reports to the Council of Ministers and is serviced by the Joint Technical Committee of Heads of Departments. The Policy and Steering Committee will relate to the private sector, donors and NGOs. The Policy and Steering Committee will also link and coordinate with the Secretariat of LEBAMA as well as other lakes management organizations such as those operating on Lakes Albert, George, Kyoga, Vitoria and Tanganyika.

### **Composition of the Policy Steering Committee**

The Policy Steering Committee shall consist of Permanent Secretaries of the Ministries responsible for ministries responsible for Fisheries, Water and Environment in each of the riparian countries. The Permanent Secretaries may be represented during meetings by competent representatives and advisors. The Chief Executive of the Secretariat of the Authority and his staff shall attend Policy Committee Meetings in their capacity as ex-officio members. The composition of the Policy Steering Committee and its communication channels are shown in **Fig. 12**.

### **Meetings of the Policy Steering Committee**

The Policy Steering Committee shall hold regular meetings quarterly but can hold other meetings as it may see fit on written request by any one of the riparian states. It shall hold its meetings alternately in each of the riparian countries. The Chief Executive of the Secretariat of the Authority shall inform the members of the Policy Committee of the date and place of each meeting. The Policy Steering Committee shall elect a chairman, whose term of office shall be one year. The chairmanship of the Policy Steering Committee shall rotate every year among the members of the Committee. The Policy Steering Committee shall adopt its own Rules of Procedure. As far as possible, decisions of the Committee will be taken by consensus. The Rules of Procedure of the Policy Steering Committee shall provide for consultation by correspondence or any rapid means of written communication, if a matter of exceptional urgency requiring action by the Committee arises between two of its sessions.

### **Functions of the Policy Steering Committee**

The Policy Steering Committee shall perform the following functions:

- Prepare submissions and reports for meetings of the Council of Ministers;
- Review the activities of the Authority and its Joint Technical Committee and report to the Council of Ministers on the work of the Secretariat;
- Submit reports and recommendations to the Council of Ministers concerning the state of the basin of Lake Edward;
- Review reports and recommendations submitted to it by the Joint Technical Committee including recommendations on standards and guidelines;
- Review reports and recommendations on management and conservation measures for LEBAMA for adoption by the Council of Ministers;
- Establish posts for the Secretariat, adopt or amend the Staff Regulations of the Authority and determine the conditions of service for the staff of the Authority;
- Provide advice and guidance to the Chief Executive of the Secretariat on the implementation of policy and decisions taken by the Council of Ministers;
- Process Agreements and Memoranda of Understanding with other organizations for adoption by the Council of Ministers; and
- Conduct any other business as shall be directed by the Council of Ministers from time to time.

### **The Joint Technical Committee**

The composition of the Joint Technical Committee (JTC) is shown in **Fig.12**. It shall be composed principally of the heads of the Departments of Fisheries, Water (particularly the Directorate of Water Resources Management) and Environment. For better coordination, the JTC may at a later stage wish to co-opt heads of other relevant departments such as Forestry, Justice, Tourism, Trade, Defense, Internal Affairs, Foreign Affairs, Internal Security Organizations and External Security Organizations. The Chairmanship of the Joint Technical Committee will rotate among the heads of the Fisheries Departments of the DRC and Uganda and the Private Sector. The JTC links up with the Lake Edward integrated lake management organizations in the DRC and in Uganda at the national and district level.

### **Meetings of the Joint Technical Committee**

The JTC shall meet at least quarterly but the Chairperson shall call a meeting of the JTC when called upon by any one member of the Committee from any one of the riparian states. The JTC shall have its own Rules of Procedure which shall be adopted by the Committee. Decisions of the JTC shall be taken by consensus. The JTC shall submit Reports to the Policy Steering Committee regularly.

### **The Functions of the Joint Technical Committee (JTC)**

The Joint Technical Committee shall service the Policy Steering Committee, link up and network with the Lake Albert Basin Management Authority (LABAMA) and other lake basin management agencies. The Joint Technical Committee shall perform the following functions:

- Consider and adopt appropriate measures for the management of the Lake Edward;
- Review for approval by the Policy Steering Committee and the Council of Ministers, all management and scientific programs and projects of LEBAMA;
- Monitor the implementation of all programs and projects of LEBAMA at regional and national levels;
- Make regular reports to the Policy Steering Committee;
- Make recommendations to the Policy Steering Committee on any matter relevant to the functions of LEBAMA;
- Establish sub-committees or working groups as necessary;
- Review for approval by the Policy Steering Committee and the Council of Ministers all recommendations for harmonization and standardization of policies, laws and regulations for the efficient management of the Lake Edward Basin;
- Coordinate with the Lake Edward integrated lake management organizations in the DRC and in Uganda at the national and district levels; and
- Carry out any other functions entrusted to it by the Policy Steering Committee;

### **Working Groups (WG)**

Working Groups may be constituted by the Policy Steering Committee or the JTC to undertake any tasks commensurate with the roles and responsibilities of LEBAMA on Fisheries, IWRM, Environment, Research, Forestry, Agriculture, Mining, Petroleum, Security, National Parks and Wildlife, Transport and Communications, Trade and Social Services. The functions of the WGs will include amongst others the following:

- Enforcement and implementing fishing regulations,
- Controlling illegal fishing practices,
- Collection of taxes and levies,
- Data collection,
- Assisting in research,
- Assisting in security matters,
- Community education,

- Conflict resolution,
- Formulating and or reviewing for approval of the JTC, reports on the management, research, financing of the activities of LEBAMA,
- Carrying out fund raising for LEBAMA,
- Developing Regional Standard Operating Procedures (SOPs),
- Synthesize and harmonize regional and national work plans and budgets,
- Reviewing regional technical reports and advise on issues related to the thematic areas,
- Carrying out implementation of specific LEBAMA projects, and
- Carrying out any other duties specific to any areas of interest to the work of LEBAMA as will be provided by the JTC.

Working Groups may be constituted on ad-hoc basis but some areas may need to have permanent WG and the decisions to form them will be decided by the PSC on the advice of the JTC with due regard to financial expediency.

### **Composition of the Working Groups**

As the WG will be constituted by the PSC on the advice of JTC, the chairperson of the WGs will be one of the members of the JTC. However, its composition will of necessity come from government officials from the Lake Edward Basin such as district heads of departments, Water Management Zone Coordinators for Lake Edward (Uganda) IWRM Water Management Zone Coordinators for Lake Edward (DRC), BMU Chairperson for Lake Edward (Uganda) and UGREB Chairperson for Lake Edward (DRC) and the Private Sector.

Current strategies for the management of natural resources are closely linked to communities who are the immediate beneficiaries of these resources. Stakeholder's organizations in form of associations or other appropriate groups could therefore be proposed to be established at national, district and community level in both the DRC and Uganda to participate in the management of the resources of Lakes Edward. These could be a peoples' own organizations which could participate in ensuring implementation of uniform provisions and uniform code of conduct regulating the fishing practices including rules for fishing gear and equipment, fishing methods and fishing time. This arrangement although ideal, is fraught with numerous management and financial constraints as experienced by earlier organizations like the Lake George Basin Integrated Management Organization (LAGBIMO) and the Lake Kyoga Integrated Management Organization (LAKIMO). It is also feared that such arrangement would bring confusion and duplication of duties in the management of the lake basins of Lakes Edward and Albert.

### **b) Key Attributes of LEBAMA**

**LEBAMA** as an institutional and management structure should have the following key attributes:

- **LEBAMA** should have political recognition and support by a Joint Permanent Commission and be established as an institution under the revised 1990 Protocol for Fisheries and to include other environmental resources. However, there should also be a high level of autonomy from the political leaders to allow for day-to-day



- decision-making by experts from both countries based on efficient and cost-effective management and flexible enough to cater for a strong partnership approach between the different key stakeholders.
- **LEBAMA** should have well defined linkages to other agencies. The proposed institutional structure will need to have close linkages and working relationships with different national and international agencies concerned with management of trans-boundary natural resources. This linkage could possibly be under a natural resources sector committee that meets regularly to determine and review policy issues and progress of implementation of bilateral decisions between the two countries.
  - **LEBAMA** should define the roles and functions of the national fisheries and other management bodies at national district and community level.
  - **LEBAMA** should implement common fisheries management guidelines for both lakes. This should be under jointly implemented Lake and Fisheries Management Plans to ensure that fisheries management institutions at all levels are operating in an effective, coordinated, and harmonized manner.
  - **LEBAMA** should allow for innovative revenue generation mechanisms and appropriate incentives including common investment guidelines, fiscal systems, and access rights frameworks for both lakes. This could be implemented through a Retention Scheme that derives revenue from levies on exploitation of environmental resources including fisheries, and thus improve efficiencies and service delivery through self financing.
  - **LEBAMA** should undertake capacity building of both DRC and Ugandan personnel in order to enhance their skills, knowledge, and technical capacity to undertake joint institutional planning and management of trans-boundary resources.
  - **LEBAMA** should adopt harmonized standards on both lakes for quality assurance and certification systems including; inspection, monitoring, communication, surveillance, construction of landing sites, and enforcement of legislation.
  - **LEBAMA** should involve the local communities by equipping them with resources and information packages as well as skills to foster their participation in decision making and the sustainable management of the resources of Lakes Edward and Albert basins.
  - **LEBAMA** should develop a Strategic Plan and a Business Plan that can be used by both countries to evaluate performance and attract donor funding for joint investment projects.

In developing the ILMP for Lake Edward and its instructional structure, due reference has been made to four existing examples of Inland Fisheries Management Initiatives namely:

- The Integrated Lake Management Project (ILM) on Lakes George and Kyoga in Uganda that ran from 2000 to 2004 and established Lake George Basin Integrated Management Organization (LAGBIMO) and Lake Kyoga Integrated Management Organization (LAKIMO).
- The Lake Victoria Fisheries Organisation (LVFO) a regional organization under the East African Community responsible for coordinating and managing fisheries resources of Lake Victoria. The organization was formed through a Convention in

- 1994 by the three East African Community (EAC) Partner States of Kenya, Uganda, and Tanzania sharing Lake Victoria. The LVFO is currently implementing an Integrated Fisheries Management Plan project (IFMP).
- The Fisheries Framework Management Plan (FFMP) for Lake Tanganyika developed under the Lake Tanganyika Research (LTR) Project. The FFMP is based on the principles laid out in the FAO Code of Conduct for Responsible Fisheries of 1995.
  - The Lake Malawi Participatory Fisheries Management Programme that was implemented by the Ministry of Forestry, Fisheries, and Natural Resources from 1998 to 2002.

An analysis of the above Fisheries Management Programmes reveals that there is a strong case for replication of the co-management/participatory management systems that are similar to the ones being implemented for Lake Malawi and Lake Victoria. In terms of the institutional structure, the one adopted by LVFO is recommended although it would need to be simplified since the LVFO has a complex structure, designed to connect into the EAC structures and ensure regional equity and harmonization. It is noted that the activities of the LVFO are implemented through five programs and the different functions under each program are implemented by Regional and National Working Groups while the programs of the LVFO are implemented through projects designed to address one or more thematic areas of the programs. The process for the development of the Integrated Lakes Management Plan should follow the FAO model process as depicted in **Fig.14**.

It should be noted that there are four assumptions that underlie the proposed design and implementation of the above institutional and management framework. **(a) Enactment of legislative and policy changes:** it is assumed that both countries will expedite any required changes to their natural resources policy/legislation and have them reflected in their National Natural Resources Sector Strategic Plans as soon as possible; **(b) Political support:** it is assumed that any political constraints between the two countries will quickly be worked through under the Joint Permanent Commission; **(c) Stakeholder cooperation:** it is assumed that all sector stakeholders will support the proposed institutional and management framework for Lake Edward; and **(d) Donor support:** it is assumed that donor support (in various forms) will be available to fund the proposed investment projects, the operational costs of the secretariat and joint operations until it becomes self financing.

#### **d) Linkages between the Lake Edward Basin Management Authority (LEBAMA) and other organizations**

It is recognized that LEBAMA's primary responsibility is to implement the ILMP for Lake Edward in a manner that is sustainable, judicious, equitable for the benefit of the riparian states of the RDC and Uganda. This is a cross sectoral activity implying collaboration and interaction with many sectors with an interest in the Lake Edward basin such as fisheries, water, environment, forestry, agriculture and livestock, lands, energy, minerals, transport and communications, tourism, trade and industry. It is also noted that activities in all these sectors impacts positively and negatively on the lake and its ecosystem. Therefore, there is need for close collaboration between LEBAMA and all

these sectors. Hence, this calls for cross sectoral collaboration at international, regional level, at national level, at district level and at community level. The following therefore high lights the kind of linkages LEBAM will have at the various functional levels.

#### **Linkage and collaboration at international and regional level**

This will involve collaboration with international agencies of the United Nations (UNDP, UNEP, GEF, UNESCO, FAO, WHO); collaboration with international funding agencies (World Bank, ADB, EU, USAID, GTZ); collaboration with regional organizations (NBI, EAC, LVEMP) collaboration with other basin organizations (LABAMA, KBO, Lake Victoria Basin Organization, LVFO, Lake Tanganyika Basin Authority). This collaboration will entail funding mechanisms, joint research activities, training and capacity building, information and data exchange, visits, library and IT.

#### **Linkage and collaboration at national level**

This will involve collaboration with national bodies and organizations which will include central government ministries, departments and agencies (particularly those dealing with fisheries, water and environment); foundations, private sector and NGOs. LEBAMA will also coordinate with the regional organization (the Lakes Edward and Albert Integrated Basin Management Organization-LEABIMO) and the national Lake Edward Basin Integrated Management Organization (LEBIMO) when these bodies are formed). This collaboration will involve capacity building and training, implementation of projects, MCS activities, research and data collection and attending joint meetings.

#### **Linkage and collaboration at district and community level**

This will involve collaboration with district authorities, NGOs, CBOs, National IWRM Coordinators in the catchment, BMU and UGREB Chairpersons and their organizations. This collaboration will involve capacity building and training, implementation of projects, MCS activities, and research and data collection.

### **5.4 The expected outcomes from implementation of the Lake Edward Integrated Management Plan**

Expected outcomes from implementation of the ILMP for Lake Edward will include the following:

- a) Attitude change among stakeholders, including policy makers, public officials, private sector, and civil society towards the need for sustainable development and management;
- b) An educated and environmentally conscious people collaborating to conserve the environment resources of Lakes Edward and Albert Basin;
- c) Communities and other stakeholders highly involved and participating in programs to conserve the environmental resources of the two lakes and their basin;
- d) Private sector investing in environmental programs and in the fisheries;

- e) More communities able to achieve sustainable development goals in their areas;
- f) Scientific advice available at regional, national, and local levels of Governments and communities;
- g) Improved public health levels;
- h) Communities pursuing sustainable livelihoods;
- i) Communities better prepared and able to cope with natural disasters and climatic events;
- j) Environmental management fully integrated into community growth area development;
- k) Major degradation of habitats arrested and restoration undertaken;
- l) Endangered fish and other aquatic species and biodiversity effectively protected;
- m) Protected areas on land and in water established and well managed;
- n) Natural and cultural heritage areas protected;
- o) Fish stocks equitably and sustainably utilized;
- p) Improved fish quality that is safe for human consumption;
- q) Pollution from all sources managed;
- r) Systems for preventing pollution damages and for restoration of damages established;
- s) Rivers and the lakes safe for public recreation;
- t) Recovery of water quality in polluted areas;
- u) Latrines and other sewerage treatment facilities installed and operational in major industries, towns, and villages;
- v) Waste treatment plants established by industries generating wastes;
- w) Systematic and safe management and disposal of toxic and hazardous wastes;
- x) Fish Landing Sites equipped with waste reception facilities; and
- y) Fishing canoes and transport boats implementing safety and environmental audits.

## **6. THE PROPOSED INTEGRATED LAKE MANAGEMENT PLAN FOR LAKE ALBERT BASIN (ILMP-A)**

### **6.1 Rationale for developing a separate ILMP for Lake Albert**

The need to develop two separate ILMPs each for Lake Edward and another for Lake Albert has been described earlier on the sections of this report covering Lake Edward. The rationale for this is that Lakes Edward and Albert are distinct entities found in two geological formations separated by the Rwenzori Mountains in the Albertine Rift. Lake Edward has a mean lake level of 920 meters (m) whose western border is the Mitumba - Kyavirimu mountain range. The Ruwenzori Mountains lie 20 km north of the lake. The lake is 90 km long and 40 km wide. Lake Albert on the other hand lies at an altitude of 620 m above sea level. It is 160 km long and 35 km wide. It is relatively shallow with an average depth of 25 m and a maximum of 58 m towards the Congolese border. The lake receives water from Lake Edward through the Semliki River in the south, from the Nile River in the north, which ultimately comes from Lake Victoria to the southeast and from other rivers. Its outlet, at the northernmost tip of the lake, is the Albert Nile. The eastern part of Lake Albert on the Ugandan side is surrounded partly by the Murchson Falls National Park, the Bugungu Game Reserve and the Kaiso Tonya Game Reserve. Hence the two lakes have characteristically different fauna and flora in their biodiversity as a consequence of the interaction between their hydrology and ecology. The evolutionary adaptations of both lakes are different as evidenced by *Hydrocynus*, *Lates niloticus*, *Barbus bynni* and some haplochromine species which are present in Lake Albert but absent in Lake Edward. Lake Albert contains 32 variety of fish species but the commercial catch is dominated by *Alestes baremose*, *Hydrocynus forsdkahlii*, *Lates niloticus*, *Bagrus docmac*, *Oreochromis niloticus* and some Haplochromine species. The Lake is rich in plankton. Blue-green algae (*Anabaena*) cause anoxic conditions some times resulting in massive deaths of the Nile perch in the lake.

Oil exploration is new major activity on the eastern shores of Lake Albert as well as on the lake itself. Several companies have been authorized to explore for oil on the Ugandan size and it expected that commercial production could become possible in the 2009. This has greatly increased the potential for polluting the lake and its environs. Although Uganda has provided measures to reduce oil pollution from the current operations on Lake Albert (Hardman Resources 1998 and Hardman Petroleum Africa Limited 2006) oil extraction activity needs to be closely watched. Hence, stringent measures need to be adhered to so as to prevent environmental degradation and water pollution that can result during exploration, drilling, extraction, transportation, distribution, and usage. Common oil pollutants like alkanes, gases, gasoline, naphtha, kerosene, residual oils, cycloalkanes, solvents and aromatics can escape into the ecosystem. Further, oil pollution could arise through tanker accidents, during transportation and operations. Furthermore, oil seepage can occur from the lake bottom and from ships leading to pollution and contamination of the environment. Hence, Lake Albert has unique geology and geographical features. It has developed unique aquatic biota and although the lake is threatened by soil erosion

and other pollution threats, the lake is more endangered by oil pollution. These issues therefore require special attention to be addressed within a lake management plan which is being developed.

## **6.2 General principles for the management of Lake Albert**

The general principles for the development of the Lake Management Plan for both Lakes Edward and Albert were described in Chapters 3, 4 and 5 of this report apply equally to the Lake Albert situation. However, the ILMP for Lake Albert (ILMP-A) will focus on addressing the issues raised in the Diagnostic and Feasibility Reports as well as in Chapters 2 of this report namely:

- the issue of protecting the ecosystem from oil pollution;
- the issue deforestation and consequent soil erosion from the steep hills on the western side of the lake;
- the issue mining on the DRC side of the catchment;
- the issue of eutrophication in the lake consequent mass fish kills;
- the issue of destructive fishing gears and over fishing all over the lake ;
- the issue of hygiene in fish landings;
- the issue of management of solid wastes, faecal material in the fish landings and rural growth centers along the lake basin;
- the issue of salting fish on boats on the lake;
- the issue of open access fishery, fishing rights and cross border conflicts on the lake;
- the issue of poor lake side infrastructure and high post harvest losses;
- the issue of inadequate capacity at all levels of the fishery and
- the issue of poor coordination and poor management of the fishery.

The action programs proposed in the ILMP will be those that respond to transboundary or regional problems and issues but with capacity for national implementation by all the different stakeholders working in partnership or in concert with each other. Implementers of these programs will include individual men and women, public and private sectors, civil societies, academic, research, and development institutions, local and national authorities, non-governmental organizations, the two riparian governments and their national agencies, development partners, the United Nations and international agencies. The ILMP programs will emphasize self-reliance and sustainability through building capacity in the two countries in order to promote regional self-reliance to manage the terrestrial and aquatic environment and their resources in order to achieve the shared vision.

The following general principles are, therefore, essential for the implementation of the ILMP activities and for achieving the expected outcomes.

- The ecosystem of Lake Albert and its environmental resources shall be managed to ensure preservation and conservation of the ecosystems and the quality of life of the people within the basin;

- The right to development must be fulfilled so as to equitably meet development and environmental needs on sustainable basis;
- Management of the environmental resources and the activities affecting them shall respect natural processes and systems;
- Beneficial uses of the environmental resources shall be encouraged and adverse uses avoided or minimized;
- Basic linkages between sustainable management of environmental resources, poverty alleviation, and protection of the aquatic and terrestrial environment shall be respected;
- Civil society and the private sector shall be recognized as a vital partner in joint efforts with Government, intergovernmental bodies, international agencies, and bilateral and multilateral financial institutions to meet the goal of sustainable development;
- Environmental issues are best handled with the participation of all concerned citizens at the relevant level;
- The rights of all sectors of society shall be respected and protected;
- The precautionary principal shall be widely applied. Where there are threats of serious irreversible damage and insufficient scientific knowledge projects should not be implemented so as to prevent environmental damage;
- Activities within Uganda and DRC should not cause damage by pollution to each other and to other states and their environment;
- The interrelationship between conservation and socio-economic development implies that conservation is necessary to ensure sustainability of development, and that socio-economic development is necessary for the achievement of conservation on a lasting basis.

The proposed Lake Albert Basin Management Plan (**ILMP-A**) will, therefore, address catchment based management issues of regional nature but with specific capacity to impact on the lake water resources and its fishery. A synthesis of the issues unique to the Lake Albert Basin which were described in the Diagnostic and Feasibility Reports and repeated elsewhere in this report includes:

- a) Poor policies and laws;
- b) Inadequate implementation and enforcement of policies and laws;
- c) Declining dwindling fish stocks due to over fishing;
- d) Pollution due to eutrophication from localized fish landings;
- e) Pollution through de-forestation on the lake basin and rampant soil erosion from the steep hillsides on the western coastline;
- f) Chemical pollution due to the mines on the DRC side;
- g) Poor sanitation in the fish landings;
- h) High post harvest losses;
- i) Poor fish handling and processing facilities;
- j) Invasion of livestock into the Kabalega Game Reserve;
- k) Security related problems

The management plan for Lake Albert will therefore address the above issues through implementing the following strategic actions.

- i. Improve policies and the legal framework,
- ii. Improve implementation and enforcement systems,
- iii. Conservation of biodiversity,
- iv. Improving fisheries management,
- v. Conservation of the environment through controlling de-forestation,
- vi. Managing livestock,
- vii. Improving fish landing sanitation,
- viii. Managing solid and liquid wastes from fish landings, riparian towns and rural growth centers,
- ix. Managing tourism development,
- x. Improvement of the socio-economy of the local communities and
- xi. Managing insecurity.

### **6.3 Specific strategic actions to address each of the above issues**

#### **a) Establish a regional institutional mechanism for the sustainable management and development of the Lake Albert Basin**

It is proposed to establish a regional institution for the sustainable management and development of the Lake Albert Basin and this institution will be called the **Lake Albert Basin Management Authority (LABAMA)**. The successful establishment and operationalization of LABAMA will require an operating environment with the following instruments and actions.

- i. Have political recognition and support and should be given a high level of autonomy from the political leaders/Ministers to allow for day-to-day decision-making by experts from both countries based on efficient and cost-effective management and flexible enough to cater for a strong partnership approach between the different key stakeholders.
- ii. Have well defined linkages to different national and international agencies concerned with management of trans-boundary natural resources.
- iii. Have clearly defined institutional and operational roles.
- iv. Implement common management guidelines for the shared resource to ensure coordination, effectiveness, and harmonization at levels.
- v. Allow for innovative revenue generation mechanisms and appropriate incentives including common investment guidelines, fiscal systems, and access rights frameworks for national and shared resources where revenues can be derived from levies and thus improve efficiencies and service delivery through self financing.
- vi. Undertake capacity building of both DRC and Ugandan personnel in order enhance their skills, knowledge and technical capacity to undertake joint institutional planning and management of trans-boundary natural resources.



- vii. Adopt harmonized standards on both lakes for quality assurance, control, and certification systems including; inspection, monitoring, communication, surveillance, construction of landing sites and enforcement of legislation.
- viii. Involve the local communities by equipping them with resources and information packages as well as skills to foster their participation in decision making and the sustainable management of the natural resources.
- ix. Have a Strategic Plan and a Business Plan that can be used by both countries to evaluate performance and attract donor funding for joint investment projects.

**b) Adopt Harmonized Legislation and Enforcement Mechanisms**

The strategic Integrated Lake Management Plan for Lake Albert (ILMP-A) should harmonize legislation and enforcement mechanisms as follows:

- i. Development of a common legal framework and restrictions.
- ii. Development of legally recognized co-management frameworks for integrated management of the lake (public-private partnerships) which should allow for participation of civil society and, where relevant, private industry to develop, implement and monitor the performance and impacts of integrated lake management plans.
- iii. Harmonization of standards for monitoring, control and surveillance systems of the national and shared natural resources. This is particularly necessary in the portfolio of oil prospecting and drilling as well as fish processing and salting on Lake Albert waters.
- iv. Addressing issues relating to national privatisation and investment priorities of the two countries in the code of conduct regulating the harmonized fisheries management on Lake Albert. This is particularly urgent regarding the management of the “Dagaa” fishery.
- v. Strengthening Operational Patrol on Lake Albert by procuring monitoring, communication, and surveillance equipment to optimize operations and harmonize enforcement measures.

**c) Conservation of the environment**

The strategic Integrated Lake Management Plan for Lake Albert (ILMP-A) should provide for general environmental management through the following:

- i. Implementing all approved ILMP activities at national level;
- ii. Harmonizing national environmental policies and laws;
- iii. Establishing acceptable standard operating procedures for oil prospecting and drilling;
- iv. Integrating and enforcing environmental management procedures into oil drilling activities;
- v. Establishing effective environmental auditing practices to ensure implementation of environmental laws and standards;

- vi. Incorporating environmental management into economic development plans at regional, national, and local level;
- vii. Establishing and enforcing environmental assessment and management systems to prevent water quality deterioration, destruction of fisheries, land degradation, flood and soil erosion, deforestation, and environmental pollution must be put in place as tools for
- viii. sustainable development and management;
- ix. Integrating environmental management programs including training, sensitization, and legislation should be implemented by local authorities in the Lake Edward catchment;
- x. Fostering cooperation between communities for addressing trans-boundary environmental problems across national boundaries should be activated;
- xi. Ratifying major international environmental instruments and their implementation by both countries.

**d) Harmonize Water Quality and Catchments Environment Standards**

The strategic Integrated Lake Management Plan for Lake Albert (ILMP-A) should adopt and implement the following for the improvement of water quality in the catchment

- i. Formulate and institute realistic regulations and standards;
- ii. Raise awareness of the importance of water quality and pollution control among policy makers and the general public;
- iii. Apply pollution control at all levels including the lowest appropriate level in order to ensure that decisions or actions concerning water quality standards and pollution control are taken as close as possible to those affected;
- iv. Prevent the production of wastes that cannot be recycled or treated;
- v. Minimize pollution from non-point sources through fostering “best environmental practices” in agriculture, soil and water conservation, forest management, population control, wildlife management;
- vi. Apply the “polluter-pays” principle where the cost of pollution prevention, control, and reduction measures are born by the polluter;
- vii. Use the “precautionary principle” to prevent the release of hazardous substances into the lake and general catchment;
- viii. Encourage the establishment of cross-sector mechanisms for the co-ordination of water quality standards and pollution control efforts within water related sectors;
- ix. Promote international co-operation on trans-boundary water management.

**e) Improve Water Resources Management**

The following interventions are being recommended for adoption and implementation in the ILMP-A programs:

- i. Develop physical facilities and infrastructure for trans boundary water resources monitoring and management;
- ii. Develop a joint databases on water quantity that should be shared;
- iii. Develop common groundwater management strategies for policies, laws and guidelines for monitoring and assessment of groundwater sources;
- iv. Develop a program to rehabilitate and upgrade the Hydro-meteorological and water quality monitoring network to support management of the water resources; and

- v. Develop a program to improve the management of water resources with a joint management framework supported by an aggressive capacity building strategy tailored to suit the needs of each country.

**f) Improve Biodiversity and Fisheries Management**

The following interventions are recommended for implementation within the ILMP-A in order to improve biodiversity and the management of the fisheries:

- i. Prohibited the use of small meshes sizes of gill-nets (1 to 3 inch);
- ii. Illegal fishing practices using beach seines, beating water, poison fishing and dynamiting should be strictly prohibited;
- iii. Very large mesh size gill-nets and long lines should be encouraged in fisheries;
- iv. The small 4 inch mesh size gillnets should be experimented with on a pilot scale for at least 6 months and the catch structure analyzed before deciding whether they could be permitted;
- v. BMUs units should be established all around the lake in both Uganda and the DRC. These units should be trained and empowered to carry out some fishery biological work including monitoring, qualitative and quantitative measurements and record keeping;
- vi. Lake Albert ecosystems are not well known and it is recommended that a fully fledged fisheries research center with adequate laboratories, equipment, transport, library and documentation facilities and communications be established with field stations on both lakes in the two riparian countries to carry out research on fisheries biology, limnology, water quality, ecosystem functions and socio-economic relationships on a continuous basis;
- vii. Training of scientific and other staff to conduct research in the two lakes should be mounted with full cooperation of near by universities of the two countries;
- viii. Published and unpublished documents and literature on Lakes Albert should be gathered as a lot of this information is scattered around the world admit is not available to national scientists within the region;
- ix. It is recommended that Protected Areas “Pas” be set up, surveyed and monitored to enable fish to breed successfully;
- x. Commercial fishing should be limited to seasons when the fish are not breeding;
- xi. Stakeholders should be periodically and continuously sensitized on environmental management and scientific conservation measures with emphasis on what role they should play;
- xii. Curricula should be developed for schools on environmental management and biodiversity conservation;
- xiii. Multi-disciplinary research capacity should be strengthened at national institutions and that appropriate research should be conducted on the ecology, biology, fish stock assessment, taxonomic, limnology and water quality, pollution, atmospheric deposition, Post-harvest losses, fish preservation, packaging and transportation techniques, parasites and aquaculture.

**g) Improve the Socio-Economics and Livelihoods of the Communities**

The following interventions are recommended for implementation within the ILMP-A in order to improve the Socio-Economics and Livelihoods of the Communities.

- i. Provide alternative employment opportunities.
- ii. Improve agro and fish marketing systems;
- iii. Empower co-operatives and rural based enterprises;
- iv. Provide access to affordable long term financing;

- v. Strengthen extension services;
- vi. Promote production of high value crops;
- vii. Increase on- farm production and marketing of farm products;
- viii. Invest in value addition to boost sustainable production and incomes of the rural poor in the Lake Albert Basin;
- ix. Investments should support the increasing involvement of small scale, community based businesses and associations;
- x. Invest in the promotion of the agro-based and fisheries sectors and products at all levels;
- xi. Invest in marketing strategy using on-line market information;
- xii. Encourage the principle of public-private sector partnerships;
- xiii. Develop micro credit schemes for community groups and disadvantaged groups to benefit from investment opportunities.

#### **h) Improve Fisheries Infrastructure**

The following interventions are recommended for implementation within the ILMP-A in order to improve fisheries infrastructure along the beaches.

- i. Upgrading and rehabilitation of damaged fish landing infrastructures and facilities including concrete surface slabs, shelters for protection of fish, provision of clean and portable water for cleaning fish, control of waste water to prevent lake water contamination, improvement of fish storage facilities, provision of public toilets facilities;
- ii. Improvement of for fish processing facilities including kilns for smoking fish, concrete slabs for fish sun-drying, ice facilities for chilling fish and storage facility for finished products and utensils;
- iii. Provision of technical training in elements of quality control, sanitation, hygiene and safety
- iv. Provision of electricity supply at the landings and within the fishing villages; and
- v. Improvement of access roads and road networks in order to reduce post-harvest losses.

#### **i) Improve Fisheries Statistics through the following**

##### **Frame Surveys**

Frame surveys to be conducted by carrying out a complete enumeration of each lake, collecting information on existing landing sites and their location and characteristics (Fish species, facilities, etc) and number of fishing units and information on their components, such as fishermen, fishing boats, fishing gear per landing site.

##### **Catch and Effort Surveys**

Carrying out Catch/Effort surveys to collect current information on total catch and fishing effort.

##### **Data Processing, Analysis, and Archiving**

Statistical data from Catch/Effort studies should be processed in the following manner:

- i. The local fisheries officer will compute the Catch per unit of Effort for the sampled day, and raise it to the total catch for the sampled day;
- ii. At the end of the month, the officer will compute the monthly catch for the site. The daily catch forms and the monthly catch estimates will then be submitted to the District (Territoire) Fisheries Office;
- iii. The District Fisheries Office will weight the sentinel site catches to obtain a District total for monitoring the District fisheries production;
- iv. The daily catch forms will be submitted to the Regional (Provincial) Fisheries where they will be entered into the Fisheries Database, hereafter referred to as the Fisheries Information Management System (FIMS), using a suitable data entry system;
- v. Checking the data for errors of transfer and gross recording errors will be done by appropriate automatic checking routines built into the data entry system
- vi. Weighting up samples to total landings by day, site, month and region as needed and preparation of summaries of data will then be carried out by FIMS;
- vii. *Ad hoc* analysis of the data will be carried out using a suitable statistical package e.g STATA;
- viii. The data will then be archived so as to be easily retrievable and updated as new information becomes available. The data will be in the form of a simple database with a record for each landing site, and a record for each site visit.

**j) Institute Revenue Generation Mechanisms within the lake basin**

It is recommended to explore means of revenue collection from the following sources:

- i. Establish a “cess”, levy or retention fund mechanism to access funds from users of catchment based natural resources like fish, water, forests, land, minerals, wildlife and hotels by charging a percentage of their earnings as retention fee for management purposes;
- ii. A deduction fee should be charged against traders and markets dealing in natural resources (fish, timber and wood products, sand, clay, stone materials, minerals and wild life products) and this money should be deposited into an environmental account for the management of these resources;
- iii. A percentage should be charged on all tourists entering the Murchison National Park, and the Kabalega Game Reserve and this money be deposited into an environmental account for the management of these resources;
- iv. A percentage should be charged on all research projects and scientists entering the Murchison National Park, and the Kabalega Game Reserve for research purposes and this money should be deposited into an environmental account for the management of these resources;
- v. A percentage should be charged on all users of roads and water ways within the Lake Albert basin;
- vi. Funds should be sourced from donors, foundations and local business entrepreneurs;
- vii. Funds should be sourced from local governments and local authorities; and
- viii. Funds should be sourced from the central governments of the two riparian states.

It is recommended to explore means of revenue collection through introduction of fiscal systems that will be able to increase the funds to local government, increase charges to resource uses, and leave a substantial amount for resources management and development. The system should simplify the existing complex local taxation systems and take into account its differential impacts on different stakeholder groups with regard to poverty reduction.

**l) Establish Conflict Resolution Mechanisms**

There is need to establish formal mechanisms for conflict and dispute resolution between the DRC and Uganda and between fishing communities. This should involve instituting regular cross border meetings. Law enforcement should be separated from extension services with well defined guidelines and adequate facilitation

**l) Control access to resources**

It is recommended to control access to the fisheries of Lake Albert by various restrictive measures which may include licensing, limiting the size of fish harvested, limiting the minimum mesh size of gill net to be used on the lakes, use of closed seasons and closed area restrictions, prohibiting a number of fishing gears and methods, and limiting the vessel size and propulsion power of fishing boats since the size and power determine how far the vessel can go and hence reduce the threat of illegal cross-border fishing and trade.

**m) Property Rights**

The issue of land ownership should be addressed in light of existing legislation on land ownership in each country. A permanent strip should be maintained of at least 100-200m from the lake shores to enable fishermen conduct their fishing activities without harassment from the land owners or wildlife protection authorities where the landing sites fall within protected areas.

**6.4 The Proposed Institutional Framework for the Lake Albert Basin Management Authority (LABAMA)**

It is proposed to establish a regional institution for the sustainable management and development of the Lake Edward Basin and this institution will be called the **Lake Albert Basin Management Authority (LABAMA)**. The structure and linkages of **LABAMA** are illustrated in **Fig. 13** below.

Studies of successful aquatic environmental management systems world wide have revealed that the major factors that underlie successful fisheries management include sufficient institutional capacity (including policy and legislation), appropriate incentives including fiscal systems and use-rights frameworks; and cooperation and communication between all stakeholders. A key factor that determines success in resources management is the nature of the governance arrangements i.e. the institutional framework which defines the relationship between the different stakeholders, e.g., in the fisheries, and which ensures that all stakeholders can participate in management decisions (at different levels) and can share in the benefits derived from the resources. It was found during the

study that the existing institutional arrangements frameworks of the two countries are deficient and the main deficiencies common to both countries were the following: inadequate budgetary allocation; inadequate funding for research; lack of human resources and equipment; poor to non-existent enforcement of regulations and insufficient linkage between central administration and field agents at local level. It was further noted that a wide range of Government institutions in both countries have overlapping mandates or are engaged in activities that impact directly or indirectly on fisheries resources management of Lake Albert. Examples of these agencies include those responsible for wildlife protection, security and defense, judiciary, tourism, trade and investment, environment management, water resources management and development, energy and mineral development and research and training. This raises the need to bring all key institutional stakeholders of the two countries under a regional stakeholders' forum that can address the cross linkages and different concerns in a coordinated and efficient manner for the sustainable management of the environmental resources of both lakes.

It is, therefore, proposed that the institutional structures for the management of the LABAMA should not be complex but should be simple in order to avoid bureaucracy, "red tape" and time wasting processes and procedures. These structures should focus and make use of the stakeholders within the basin. The following structures are therefore proposed.

#### **a) The Structure of LABAMA**

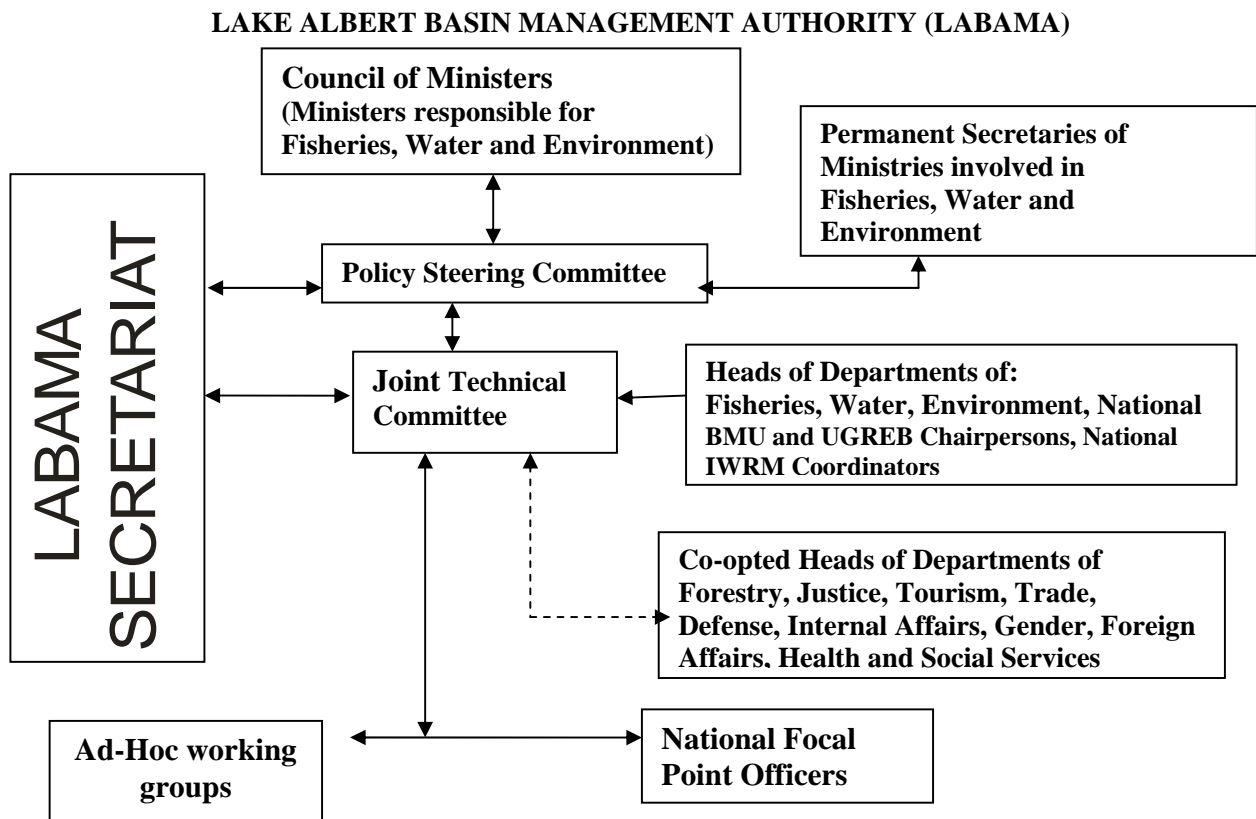
##### **The Council of Ministers**

###### **Composition**

The structure of **LABAMA** is shown diagrammatically in **Fig. 13**. The Council of Ministers will be the supreme body responsible for oversight, supervision of the Authority which provides direction on all policy matters. The Authority will be composed of the Ministers responsible for the Ministries of Fisheries, Water and Environment from each of the riparian countries. Attention was paid to avoid overloading LABAMA with too many ministers who would make its work clumsy and wieldy. The Regional Secretariat of LABAMA will be headed by a Regional Executive Secretary who will provide technical and administrative services to the Council, to the Policy Steering Committee, and to the JTC. The Chief Executive of the LABAMA Secretariat and his staff shall attend Ministerial Council Meetings in their capacity as ex-officio members.

###### **Roles and mandates**

The Council of Ministers of LABAMA shall be the supreme organ of the Authority responsible for oversight and supervision of the functions of the Authority. It shall have powers to formulate and amend policies and to approve laws and regulations for the Authority.



**Fig. 13: The structure and linkages of the proposed Lake Albert Basin Management Authority (LABAMA)**

### **Functions of the Ministerial Council**

The Ministerial Council shall have the following functions:

- Approve policies and regulations of the Authority;
- Approve work plans, budgets and audited accounts of all the programs and projects of the Authority and its Joint Technical Committee;
- Approve Financial Regulations of the Authority;
- Review reports and recommendations;
- Approve Rules governing the appointment of the staff of the Authority;
- Set up such committees or other subsidiary bodies as it may deem appropriate for the performance of the functions of the Authority;
- Approve management and conservation measures to ensure sustained conservation and management of the fisheries, water quality and quantity and other natural resources of Lake Albert.

The Council of Ministers shall meet quarterly and alternately in each of the riparian countries. The Minister responsible for Fisheries will be the chairperson. The chair will rotate between the DRC and Uganda. All meetings shall have bi-lingual translation



facilities. The Council of Ministers may hold special sessions if it so decides or at the request of any one of the riparian countries. The Council of Ministers shall adopt its own Rules of Procedure. Decisions of the Council of Ministers will be taken by consensus.

#### **b) The Policy and Steering Committee**

The Policy and Steering Committee shall be responsible for servicing the Council of Ministers. The Policy Steering Committee shall be responsible for implementation of the policies, laws, regulations and decisions of the Council of Ministers. It reports to the Council of Ministers and is serviced by the Joint Technical Committee of Heads of Departments. The Policy and Steering Committee will relate to the private sector, donors and NGOs. The Policy and Steering Committee will also link and coordinate with the Secretariat of LABAMA as well as other lakes management organizations such as those operating on Lakes Albert, George, Kyoga, Vitoria and Tanganyika.

#### **Composition of the Policy Steering Committee**

The Policy Steering Committee shall consist of Permanent Secretaries of the Ministries responsible for ministries responsible for Fisheries, Water and Environment in each of the riparian countries. The Permanent Secretaries may be represented during meetings by competent representatives and advisors. The Chief Executive of the Secretariat of the Authority and his staff shall attend Policy Committee Meetings in their capacity as ex-officio members. The composition of the Policy Steering Committee and its communication channels are shown in **Fig. 13**.

#### **Meetings of the Policy Steering Committee**

The Policy Steering Committee shall hold regular meetings quarterly but can hold other meetings as it may see fit on written request by any one of the riparian states. It shall hold its meetings alternately in each of the riparian countries. The Chief Executive of the Secretariat of the Authority shall inform the members of the Policy Committee of the date and place of each meeting. The Policy Steering Committee shall elect a chairman, whose term of office shall be one year. The chairmanship of the Policy Steering Committee shall rotate every year among the members of the Committee. The Policy Steering Committee shall adopt its own Rules of Procedure. As far as possible, decisions of the Committee will be taken by consensus. The Rules of Procedure of the Policy Steering Committee shall provide for consultation by correspondence or any rapid means of written communication, if a matter of exceptional urgency requiring action by the Committee arises between two of its sessions.

#### **Functions of the Policy Steering Committee**

The Policy Steering Committee shall perform the following functions:

- Prepare submissions and reports for meetings of the Council of Ministers;
- Review the activities of the Authority and its Joint Technical Committee and report to the Council of Ministers on the work of the Secretariat;

- Submit reports and recommendations to the Council of Ministers concerning the state of the basin of Lake Albert;
- Review reports and recommendations submitted to it by the Joint Technical Committee including recommendations on standards and guidelines;
- Review reports and recommendations on management and conservation measures for LABAMA for adoption by the Council of Ministers;
- Establish posts for the Secretariat, adopt or amend the Staff Regulations of the Authority and determine the conditions of service for the staff of the Authority;
- Provide advice and guidance to the Chief Executive of the Secretariat on the implementation of policy and decisions taken by the Council of Ministers;
- Process Agreements and Memoranda of Understanding with other organizations for adoption by the Council of Ministers; and
- Conduct any other business as shall be directed by the Council of Ministers from time to time.

### **c) The Joint Technical Committee**

The composition of the Joint Technical Committee (JTC) is shown in **Fig. 13**. It shall be composed principally of the heads of the Departments of Fisheries, Water (particularly the Directorate of Water Resources Management) and Environment. For better coordination, the JTC may at a later stage wish to co-opt heads of other relevant departments such as Forestry, Justice, Tourism, Trade, Defense, Internal Affairs, Foreign Affairs, Internal Security Organizations and External Security Organizations. The Chairmanship of the Joint Technical Committee will rotate among the heads of the Fisheries Departments of the DRC and Uganda and the Private Sector. The JTC links up with the Lake Albert integrated lake management organizations in the DRC and in Uganda at the national and district level.

### **Meetings of the Joint Technical Committee**

The JTC shall meet at least quarterly but the Chairperson shall call a meeting of the JTC when called upon by any one member of the Committee from any one of the riparian states. The JTC shall have its own Rules of Procedure which shall be adopted by the Committee. Decisions of the JTC shall be taken by consensus. The JTC shall submit Reports to the Policy Steering Committee regularly.

### **The Functions of the Joint Technical Committee (JTC)**

The Joint Technical Committee shall service the Policy Steering Committee, link up and network with the Lake Albert Basin Management Authority (LABAMA) and other lake basin management agencies. The Joint Technical Committee shall perform the following functions:

- Consider and adopt appropriate measures for the management of the Lake Edward;
- Review for approval by the Policy Steering Committee and the Council of Ministers, all management and scientific programs and projects of LABAMA;
- Monitor the implementation of all programs and projects of LABAMA at regional and national levels;

- Make regular reports to the Policy Steering Committee;
- Make recommendations to the Policy Steering Committee on any matter relevant to the functions of LABAMA;
- Establish sub-committees or working groups as necessary;
- Review for approval by the Policy Steering Committee and the Council of Ministers all recommendations for harmonization and standardization of policies, laws and regulations for the efficient management of the Lake Albert Basin;
- Coordinate with the Lake Albert integrated lake management organizations in the DRC and in Uganda at the national and district levels; and
- Carry out any other functions entrusted to it by the Policy Steering Committee;

#### **d) Working Groups (WG)**

Working Groups may be constituted by the Policy Steering Committee or the JTC to undertake any tasks commensurate with the roles and responsibilities of LABAMA on Fisheries, IWRM, Environment, Research, Forestry, Agriculture, Mining, Petroleum, Security, National Parks and Wildlife, Transport and Communications, Trade and Social Services. The functions of the WGs will include amongst others the following:

- Enforcement and implementing fishing regulations,
- Controlling illegal fishing practices,
- Collection of taxes and levies,
- Data collection,
- Assisting in research,
- Assisting in security matters,
- Community education,
- Conflict resolution,
- Formulating and or reviewing for approval of the JTC, reports on the management, research, financing of the activities of LABAMA,
- Carrying out fund raising for LABAMA,
- Developing Regional Standard Operating Procedures (SOPs),
- Synthesize and harmonize regional and national work plans and budgets,
- Reviewing regional technical reports and advise on issues related to the thematic areas,
- Carrying out implementation of specific LABAMA projects, and
- Carrying out any other duties specific to any areas of interest to the work of LABAMA as will be provided by the JTC.

Working Groups may be constituted on ad-hoc basis but some areas may need to have permanent WG and the decisions to form them will be decided by the PSC on the advice of the JTC with due regard to financial expediency.

#### **Composition of the Working Groups**

As the WG will be constituted by the PSC on the advice of JTC, the chairperson of the WGs will be one of the members of the JTC. However, its composition will of necessity come from government officials from the Lake Albert Basin such as district heads of departments, Water Management Zone Coordinators for Lake Albert (Uganda) IWRM

Water Management Zone Coordinators for Lake Albert (DRC), BMU Chairperson for Lake Albert (Uganda) and UGREB Chairperson for Lake Albert (DRC) and the Private Sector.

**e) Linkages between the Lake Albert Basin Management Authority (LABAMA) and other organizations**

It is recognized that LABAMA's primary responsibility is to implement the ILMP for Lake Edward in a manner that is sustainable, judicious, equitable for the benefit of the riparian states of the DRC and Uganda. This is a cross sectoral activity implying collaboration and interaction with many sectors with an interest in the Lake Albert basin such as fisheries, water, environment, forestry, agriculture and livestock, lands, energy, minerals, transport and communications, tourism, trade and industry. It is also noted that activities in all these sectors impacts positively and negatively on the lake and its ecosystem. Therefore, there is need for close collaboration between LABAMA and all these sectors. Hence, this calls for cross sectoral collaboration at international, regional level, at national level, at district level and at community level. The following therefore highlights the kind of linkages LABAMA will have at the various functional levels.

**Linkage and collaboration at international and regional level**

This will involve collaboration with international agencies of the United Nations (UNDP, UNEP, GEF, UNESCO, FAO, WHO); collaboration with international funding agencies (World Bank, ADB, EU, USAID, GTZ); collaboration with regional organizations (NBI, EAC, LVEMP) collaboration with other basin organizations (LEBAMA, KBO, Lake Victoria Basin Organization, LVFO, Lake Tanganyika Basin Authority). This collaboration will entail funding mechanisms, joint research activities, training and capacity building, information and data exchange, visits, library and IT.

**Linkage and collaboration at national level**

This will involve collaboration with national bodies and organizations which will include central government ministries, departments and agencies; foundations, private sector and NGOs. . LABAMA will also coordinate with the regional organization (the Lakes Edward and Albert Integrated Basin Management Organization-LEABIMO) and the national Lake Albert Basin Integrated Management Organization (LABIMO) when these bodies are formed). This collaboration will involve capacity building and training, implementation of projects, MCS activities, research and data collection as well as attending joint meetings.

**Linkage and collaboration at district and community level**

This will involve collaboration with district authorities, NGOs, CBOs, National IWRM Coordinators in the catchment, BMU and UGREB Chairpersons and their organizations.

This collaboration will involve capacity building and training, implementation of projects, MCS activities, research and data collection.

**f) Key Attributes of LABAMA**

**LABAMA** as an institutional and management body shall have the following key attributes:

- **LABAMA** should have political recognition and support by a Joint Permanent Commission and be established as an institution under the revised 1990 Protocol for Fisheries and to include other environmental resources. However, there should also be a high level of autonomy from the political leaders to allow for day-to-day decision-making by experts from both countries based on efficient and cost-effective management and flexible enough to cater for a strong partnership approach between the different key stakeholders.
- **LABAMA** should have well defined linkages to other agencies. The proposed institutional structure will need to have close linkages and working relationships with different national and international agencies concerned with management of trans-boundary natural resources. This linkage could possibly be under a natural resources sector committee that meets regularly to determine and review policy issues and progress of implementation of bilateral decisions between the two countries.
- **LABAMA** should define the roles and functions of the national fisheries and other management bodies at national district and community level.
- **LABAMA** should implement common fisheries management guidelines for both lakes. This should be under jointly implemented Lake and Fisheries Management Plans to ensure that fisheries management institutions at all levels are operating in an effective, coordinated, and harmonized manner.
- **LABAMA** should allow for innovative revenue generation mechanisms and appropriate incentives including common investment guidelines, fiscal systems, and access rights frameworks for both lakes. This could be implemented through a Retention Scheme that derives revenue from levies on exploitation of environmental resources including fisheries, and thus improve efficiencies and service delivery through self financing.
- **LABAMA** should undertake capacity building of both DRC and Ugandan personnel in order to enhance their skills, knowledge, and technical capacity to undertake joint institutional planning and management of trans-boundary resources.
- **LABAMA** should adopt harmonized standards on both lakes for quality assurance and certification systems including; inspection, monitoring, communication, surveillance, construction of landing sites, and enforcement of legislation.
- **LABAMA** should involve the local communities by equipping them with resources and information packages as well as skills to foster their participation in decision making and the sustainable management of the resources of Lakes Albert and Albert basins.
- **LABAMA** should develop a Strategic Plan and a Business Plan that can be used by both countries to evaluate performance and attract donor funding for joint investment projects.

In developing the ILMP for Lake Albert and its instructional structure, due reference has been made to four existing examples of Inland Fisheries Management Initiatives namely:

- The Integrated Lake Management Project (ILM) on Lakes George and Kyoga in Uganda that ran from 2000 to 2004 and established Lake George Basin Integrated Management Organization (LAGBIMO) and Lake Kyoga Integrated Management Organization (LAKIMO).
- The Lake Victoria Fisheries Organisation (LVFO) a regional organization under the East African Community responsible for coordinating and managing fisheries resources of Lake Victoria. The organization was formed through a Convention in 1994 by the three East African Community (EAC) Partner States of Kenya, Uganda, and Tanzania sharing Lake Victoria. The LVFO is currently implementing an Integrated Fisheries Management Plan project (IFMP).
- The Fisheries Framework Management Plan (FFMP) for Lake Tanganyika developed under the Lake Tanganyika Research (LTR) Project. The FFMP is based on the principles laid out in the FAO Code of Conduct for Responsible Fisheries of 1995.
- The Lake Malawi Participatory Fisheries Management Programme that was implemented by the Ministry of Forestry, Fisheries, and Natural Resources from 1998 to 2002.

An analysis of the above Fisheries Management Programmes reveals that there is a strong case for replication of the co-management/participatory management systems that are similar to the ones being implemented for Lake Malawi and Lake Victoria. In terms of the institutional structure, the one adopted by LVFO is recommended although it would need to be simplified since the LVFO has a complex structure, designed to connect into the EAC structures and ensure regional equity and harmonization. It is noted that the activities of the LVFO are implemented through five programs and the different functions under each program are implemented by Regional and National Working Groups while the programs of the LVFO are implemented through projects designed to address one or more thematic areas of the programs. The process for the development of the Integrated Lakes Management Plan should follow the FAO model process as depicted in **Fig. 14**.

It should be noted that there are four assumptions that underlie the proposed design and implementation of the above institutional and management framework. **(a) Enactment of legislative and policy changes:** it is assumed that both countries will expedite any required changes to their natural resources policy/legislation and have them reflected in their National Natural Resources Sector Strategic Plans as soon as possible; **(b) Political support:** it is assumed that any political constraints between the two countries will quickly be worked through under the Joint Permanent Commission; **(c) Stakeholder cooperation:** it is assumed that all sector stakeholders will support the proposed institutional and management framework for Lake Edward; and **(d) Donor support:** it is assumed that donor support (in various forms) will be available to fund the proposed investment projects, the operational costs of the secretariat and joint operations until it becomes self financing.

## **6.5 The expected outcomes from implementation of the Lake Albert Integrated Management Plan**

Expected outcomes from implementation of the ILMP for Lake Albert will include the following:

- i. Attitude change among stakeholders, including policy makers, public officials, private sector, and civil society towards the need for sustainable development and management;
- ii. An educated and environmentally conscious people collaborating to conserve the environment resources of Lakes Albert Basin;
- iii. Communities and other stakeholders highly involved and participating in programs to conserve the environmental resources of the two lakes and their basin;
- iv. Private sector investing in environmental programs and in the fisheries;
- v. More communities able to achieve sustainable development goals in their areas;
- vi. Scientific advice available at regional, national, and local levels of Governments and communities;
- vii. Improved public health levels;
- viii. Communities pursuing sustainable livelihoods;
- ix. Communities better prepared and able to cope with natural disasters and climatic events;
- x. Environmental management fully integrated into community growth area development;
- xi. Major degradation of habitats arrested and restoration undertaken;
- xii. Endangered fish and other aquatic species and biodiversity effectively protected;
- xiii. Protected areas on land and in water established and well managed;
- xiv. Natural and cultural heritage areas protected;
- xv. Fish stocks equitably and sustainably utilized;
- xvi. Improved fish quality that is safe for human consumption;
- xvii. Pollution from all sources managed;
- xviii. Systems for preventing pollution damages and for restoration of damages established;
- xix. Rivers and the lakes safe for public recreation;
- xx. Recovery of water quality in polluted areas;
- xxi. Latrines and other sewerage treatment facilities installed and operational in major industries, towns, and villages;
- xxii. Waste treatment plants established by industries generating wastes;
- xxiii. Systematic and safe management and disposal of toxic and hazardous wastes;
- xxiv. Fish Landing Sites equipped with waste reception facilities; and
- xxv. Fishing canoes and transport boats implementing safety and environmental audits.

## **7. NEW CONCEPT FOR THE MANAGEMENT OF LAKES**

### **7.1 The Beach Management Unit**

In Uganda, new concepts have emerged for the sustainable management of the natural resources. The first is the strategy to improve the management of fisheries resources through the Fish (Beach Management) Rules, No. 35 of 2003 which were formulated as a statutory instrument for empowering the fishing communities to participate in the management of the fisheries resources. This position has been affirmed through Fisheries Policy of 2004 and the Fish Bill of 2005 which under pinned the importance of co-management in fisheries management. The Department of Fisheries Resources (DFR) has, therefore, established Beach Management Units (BMUs) as an institution on the basis of the Constitution of Uganda and the Code of Conduct for Responsible Fisheries of the FAO. As a result of the enactment of the Fish (Beach Management) Rules, two legal structures were passed forming namely, the Lake George Basin Integrated Management Organization (LAGBIMO) in January 2003 and the Lake Kyoga Integrated Management Organization (LAKIMO) in September 2004 for the purpose of enhancing sustainable management of Lake George Basin resources and Lake Kyoga resources. LAGBIMO and LAKIMO are mandated to work with local fishing communities and the Local Government authorities of Lake George and Kyoga to reduce poverty, to improve the socio-economy and livelihoods of the communities, participate in research, data collection and collect revenues.

### **7.2 Decentralized Water Resources Management**

The second emerging strategy involves the principle of Decentralized Water Resources Management which is being spearheaded by the Directorate of Water Resources Management. The concept here is that water should be managed at the lowest level which in the case of water resources is the catchment (Water Resources Management Reform Strategy, August 2005). This strategy is well supported by the National Water Policy (1999) which permits decentralization of WRM functions to the district or community level. Further, the Local Government Act provides for creation of multi-district administrative instruments where clusters of districts may cooperate administratively for purposes of managing shared water resources. This concept is attractive although it is yet to be made legal through promulgation into policy. Its advantages are:

- It makes it possible for districts and communities to fully participate in the management of water resources through amalgamation of districts to facilitate devolution of some WRM functions;
- The Local Government Act mandates Local Governments to formulate by-laws, which could be relevant for Water Resources Management;
- In the context of regional cooperation, Local Governments will be in position to be guided in the management of water resources that transcend district boundaries;



- The Local Government Act further stipulates that the District Local Governments should formulate comprehensive development plans integrating priorities of lower District Local Governments;
- District Local Government involvement in WRM will enhance the integration of WRM issues with related sector planning responsibilities and plan for water supply and other natural resources interventions;
- It underpins the Principles for the Shared Trans-boundary Water Resources;
- It enhances the international cooperation and the principle of prior notification and information sharing where the potentially affected state has a right to demand notification in order to safeguard its interests;
- It fosters the principle of the prevention, minimization and control of pollution of watercourses which is meant to minimize adverse effects on freshwater resources and their ecosystems;
- It embodies the concept of viewing water as a social and economic good; It evokes the intergenerational principle that future generation should not be deprived from access to an adequate resource base;
- It carries on board the trans-boundary principle that upstream water users have a responsibility towards downstream water users and vice-versa which an extension of the equity and precautionary principles across national borders;

Implementation of the Principle of Decentralized Water Resources Management also embodies several pertinent environmental principles such as:

- The principle of environmental impact assessment of any planned activity;
- The principle of environmental audits of existing projects and economic activities in a given Basin;
- The precautionary principle about necessary measures to prevent environmental degradation from threats of serious or irreversible harm to the environment;
- The “polluter pays” principle where governments/institutions/individuals that inflict damage on the natural resources system should pay for the damage;
- The principle of pollution prevention at source;
- The principle of public participation, whereby decisions about a project or policy take into account the views of the stakeholders;
- The principle of sustainable development that takes into account satisfying the needs of this generation without denying the rights of future generations to use the same resources;
- The principle of permanent sovereignty over natural resources. Beyond the 1997 Convention, international law recognizes the principle of the permanent sovereignty of each people over his or her natural resources.

Uganda has eight major catchments which drain to major water receiving bodies within and outside the country. The catchment of Lake Edward and George fall within the **Albert Water Management Zone (4)** which includes catchments discharging into Lakes Edward and George as well as catchments flowing into Lake Edward but discharging into Lake Albert through the Semliki River **Albert Water Management Zone (5)**.

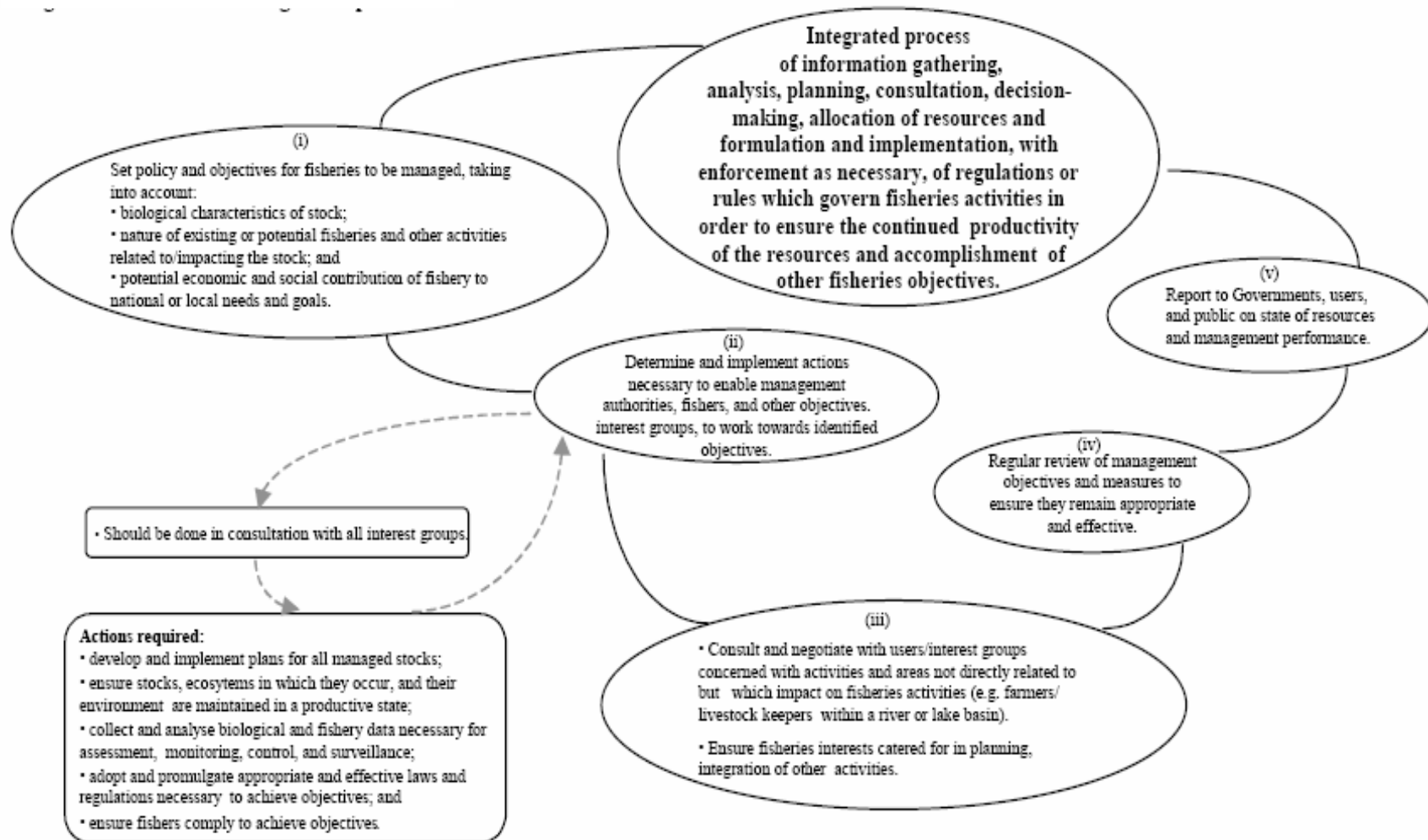
It is envisaged that the two strategies in Uganda i.e. the BMU strategy and the Principle of Decentralized Water Resources Management are ideal for replication in the DRC particularly for the management of the Lakes Edward and Albert Basin (LEAB). Indeed, the strategies and advantages identified in Uganda for the Implementation of the Principle of Decentralized Water Resources Management and the BMU would apply equally in the DRC. Hence, the implementation of the ILMP for LEAB would embrace the principles identified in both the BMU and Decentralized Water Resources Management. Although in the ILMP, the focus is Fisheries and integrated basin management, it is recommended that its implementation should invoke the application of the Principles of Decentralized Water Resources Management and the BMU at all levels of ILMP implementation in a collaborative manner with the WRM Directorate, the Fisheries Resources Department, the Local Governments, local communities, NGOs and CBOs. In the DRC, the same scenario should be replicated when the BMU and Decentralized Water Resources Management have been put in place.

### **7.3 Planning for Integrated Lake Management**

The international consensus on the need for integrated approaches for managing water resources has led to a development of integrated frameworks and strategies. The development of management plans for lakes and their drainage basins is part of the 'integrated management' agenda. Challenging questions, however, arise in regard to what integration actually means within the context of planning processes and systems, and for the management plans themselves. The limited literature on lake management planning emphasizes the need for a lead agency for planning and implementation. A relevant question is how to streamline lake management planning with the planning by local governments, national government departments and other stakeholder groups.

The integrated lake management efforts in Uganda have led to the development of lake management plans that build on, and complement, existing local government processes and plans. Lessons from early lake management experiences indicate that establishing clear linkages in the planning processes, and within the plans themselves between lake management structures and local government, is essential for sustainability, coordination and resource mobilization. The development of lake management plans also strengthens existing local government planning systems, by providing a forum for sharing information, ideas and lessons. The lake management planning also supports the introduction of local governments to participatory, community-based planning, as well as promoting intersect oral coordination.

**Fig.1.14: Overview of the Process for the Development of ILMP**



Source: FAO 1997

#### **7.4 Revenue Generation**

The economic benefit that exists within the fisheries and other environmental resources of both Lakes Edward and Albert is not properly extracted. Even the funds collected under the existing fiscal instruments of various fishing licenses and permits are hardly ever re-invested or ploughed back for the management and sustainability of fisheries. Current practice reveals that such funds are deposited with national and local treasuries or with private individuals to be used to finance other public goods such as roads and other social infrastructure. The national and local governments should revisit the budgetary allocations to the institutions managing the environmental resources generally and fisheries in particular and ensure that some of the taxes collected from the relevant sectors are re-invested in those sectors' management activities. In particular local governments should ensure that all landing sites are provided with sanitary facilities and hygienic fish handling infrastructure using these funds. There is need for both countries to explore avenues of introducing fiscal systems that will be able to increase the funds to local government, decrease the charges to resource uses, and leave a substantial amount for fisheries management and development. The system should simplify the existing complex local taxation systems and take into account its differential impacts on different stakeholder groups with regard to poverty reduction.

#### **7.5 Rights of Access to Environmental Resources / Property Rights**

A key mechanism for achieving sustainable management policies for fisheries and other environmental resources is the provision of secure and transferable access rights within statutory management plans that provide a stable legislative framework. The fisheries and other natural resources of Lakes Edward and Albert do not have uniform legal controls in place to prevent entry or harmful and illegal fishing practices. Both countries need to consider defining property ownership rights within the fisheries and the transferability of these property rights through the use of existing traditional institutional arrangements and the adoption of various restrictive measures to enhance control of access to fisheries and other environmental resources.

Regulation of access to fisheries and allocation of the fisheries to those who have been granted access remains a major challenge for Lakes Edward and Albert. This is more complicated since DRC regulates access mainly by quota systems based on closed seasons and fishing grounds while Uganda regulates through user rights/licensing. It is noted that allocation of quotas and seasons is normally practiced for fisheries resources where the Total Allowable Catch (TAC) has been determined and this is then allocated to different components of the fishery. This is however not possible in fisheries like those of Lakes Edward and Albert where information on TAC is not available. It has also been observed that the use of licenses has loopholes since in most cases the number of licenses issued is not controlled. To control access to the fisheries of Lakes Edward and Albert the use of various restrictive measures may be the most appropriate. These measures could include licensing, limiting the size of fish harvested, limiting the minimum mesh size of gill net to be used on the lakes, use of closed seasons and closed area restrictions, prohibiting a number of fishing gears and methods, and limiting the vessel size and

propulsion power of fishing boats since the size and power determine how far the vessel can go and hence reduce the threat of illegal cross-border fishing and trade. The issue of land ownership on the landing sites should also be addressed in light of existing legislation on land ownership in each country. A permanent strip should be maintained of at least 100-200m from the lake shores to enable fishermen conduct their fishing activities without harassment from the land owners or wildlife protection authorities where the landing sites fall within protected areas.

## **7.6 Conflict Resolution**

There is need to establish formal mechanisms for conflict/dispute resolution by instituting regular cross border meetings. To minimize conflicts between the enforcement personnel and the fishing or riparian communities, law enforcement should be separated from extension services with well defined guidelines and adequate facilitation. There is need for the Districts/ provinces that have fishing communities living in or near wild life protected areas to enter into Memoranda of Understanding with respective national institutions to ensure that potential causes of conflict are minimized. The proposed initiatives under the Joint Permanent Commission for the joint re-marking of the international boundary using pillars on land and using Buoys in the shared water bodies between the two countries based on the colonial agreement on geographical boundaries signed in 1915 by the Belgium and the United Kingdom and recognized by the OAU and AU should be expedited. Similarly, the proposals to smoothen the immigration procedures and identification of border communities through the provision of identity cards by the local community leaders to their members and the marking of fishing gears and equipment of Ugandan and Congolese fishermen with national colours and registration numbers for easy identification should also be expedited.

## **7.7 Monitoring and Evaluation**

In order to ensure successful implementation of the project, there will be need for a monitoring and Evaluation Plan with a detailed log frame. This should be prepared during implementation of the Investment Projects. The investment project will have a monitoring logframe, with Objectively Verifiable Indicators (OVIs). These OVIs will be designed to provide indications of the impacts of implementing the project. Most of the OVIs at Goal and Purpose Level will require information to be gathered through questionnaire surveys. In order to achieve this, a series of monitoring studies is proposed. In addition, there will be continuous monitoring by the project management. Further, there will be annual monitoring by an independent team. At the end of the project, there will be evaluation conducted by an independent team of experts. In addition, each year and each quarter, there will be annual and quarterly work plans and management will provide monthly, quarterly and annual progress reports on the various project components. At the beneficiary level, there will be regular project meetings at which the communities will discuss progress of their projects. Monitoring will enable managers and researchers to assess whether the Investment Projects are having positive impacts on the ecosystem of the Lake Basin and livelihoods of the fishing communities.

## 8. NATIONAL STAKEHOLDERS' MECHANISM FOR THE MANAGEMENT OF THE LAKES EDWARD AND ALBERT BASIN

Current strategies for the management of natural resources are closely linked to who are the immediate beneficiaries of these resources. Stakeholder's organizations in form of associations or other appropriate groups could therefore be proposed to be established at national, district and community level in both the DRC and Uganda to participate in the management of the resources of Lakes Edward. These could be peoples' own organizations which could participate in ensuring implementation of uniform provisions and uniform code of conduct regulating the fishing practices including rules for fishing gear and equipment, fishing methods and fishing time. This arrangement although ideal, is fraught with numerous management and financial constraints as experienced by earlier organizations like the Lake George Basin Integrated Management Organization (LAGBIMO) and the Lake Kyoga Integrated Management Organization (LAKIMO). However, it is feared that if this arrangement is implemented at the regional level, such arrangement could bring duplication of duties in the management of the lake basins of Lakes Edward and Albert. This arrangement is nevertheless deemed a suitable mechanism that could be implemented at national level in the DRC and in Uganda. Hence, the organization for this purpose could be called the **Lakes Edward and Albert Basin Integrated Management Organization (LEABIMO)**. A possible structure of this organization is depicted in **Fig.15**. **LEABIMO** would be a bottom-up organization, formed by a conglomeration of the following bodies, institutions, organizations and individuals. The organization proposed will be a grouping of stakeholders at various levels all of whom have deep interest in the lakes and their resources. The body will enable various stakeholder groups to meet and discuss problems and issues related to the utilization and management of the fisheries, water and other resources of the two lakes. At national level, the National Lake Edward and Albert Basins Management Organization (**LEABIMO**) will be the direct link to the JTC, while the lower bodies will hierarchically link to each other right from the BMU/UGREP. In particular, **LEABIMO** will facilitate the following:

- It will allow operational linkages with the Joint Technical Committee (JTC) of the two transboundary bodies namely, regional body; the **Lakes Edward Basin Management Authority (LEBAMA)** and the **Lake Albert Basin Management Authority (LABAMA)**.
- It will facilitate the coordination of national programs;
- It will permit through **LEBIMO**, the coordination of national programs on Lake Edward in each country;
- It will permit through **LABIMO**, the coordination of national programs on Lake Albert in each country;
- It will create District Fora for the coordination and implementation of District programs in each lake catchment in each country;
- It will create Sub-County or Territoire Fora for the coordination and implementation of Sub-County and Territoire programs in each lake basin within each country;

- It will create BMU/UGREP Fora for the coordination and implementation of programs in each lake basin within each country at local level.

This organization is described below starting from the lowest levels at the bottom of the organization.

#### **i) The BMU/UGREP FORUM**

This is the lowest grass root organization at BMU level (in Uganda) and UGREP (in the DRC). This will be composed of the following:

- Fisherfolk operating from the particular beach or fishing village,
- Boat owners of the BMU,
- Market Masters,
- Fishing Village administrators,
- LCs, Private Sector
- Fish Traders,
- NGOs and CBOs,
- Local Government Beach sectoral leaders for Fisheries, Water, Health, Education, Wildlife, National Parks, Forestry, Security, Traditional Leaders and Religious bodies.

The BMU/UGREP body will have its own FORUM. It could have its own Executive, 30 per cent of whom are recommended to be women. The Executive will have a Chairperson, Vice-Chairperson, Secretary, Vice-Secretary, Treasurer, Vice-Treasurer, The BMU/UGREP FORUM could create standing committees of Fisheries, Water, Security, Health, Education, Environment, Wildlife, Information, Roads, Welfare and Social Services to handle specific tasks as and when necessary. Each Committee will have its own Chairperson and Secretary. In the case of Uganda, the BMUs are empowered under the Fish (Beach Management) Rules 2003, Statutory Instrument No. 35, to undertake a range of functions and responsibilities. Hence the BMU/UGREP body (FORUM) will have the following functions:

- Enforcement and implementing fishing regulations,
- Controlling illegal fishing practices,
- Collection of taxes and levies,
- Data collection,
- Assisting in research,
- Assisting in security matters,
- Community education,
- Conflict resolution and
- Implementing programs and from Central and Local Governments,
- Developing and implementing local fisheries and holistic development and management plans covering catchment natural resources including water, land, forests, wildlife, national parks, and social amenities,

- Integrating of BMU plans into parish development plans, and
- Collaborating with other partners like local government, donors, NGOs and CBOs in the collection, use and dissemination of fisheries and environmental information for sustainable management of natural resources.

The BMU/UGREP FORUM could meet and adopt its own rules governed by statutory instruments determined the Central Government protocols. This body should meet at least quarterly. It could report to the **Sub-County (in Uganda) or Territoire (in the DRC) FORUM.**

**ii) The Sub-County (in Uganda) or Territoire (in the DRC) FORUM**

There will be a Sub-County FORUM (in Uganda) and Territoire FORUM (in the DRC) which will be composed of representatives from the following:

- Sub-County BMUs based on Catchment in Uganda,
- UGREP based on the Territoire in the DRC,
- LC111,
- Sub-County and Territoire Heads of Departments and Units including Fisheries, Water, Security, Health, Education, Environment, Wildlife, Information, Roads, Welfare and Social Services,
- Private Sector and
- NGOs.

The Sub-County (in Uganda) or Territoire (in the DRC) FORUM will oversee and monitor the BMUs/UGREP FORA on the implementation of the following programs and projects:

- The Enforcement and implementing fishing regulations,
- Controlling illegal fishing practices,
- Collection of taxes and levies,
- Data collection,
- Assisting in research,
- Assisting in security matters,
- Community education and
- Conflict resolution.

This is reminiscent of catchment based management of lake basins which incorporates government administrative boundaries at the level of Sub-Counties and Territoire. The Sub-County (in Uganda) or Territoire (in the DRC) FORUM will report to the



## **DISTRICT FORUM**

### **iii) The District Integrated Lake Management Forum**

The District Integrated Lake Management Forum will be formed by all the districts riparian to Lakes Edward and Albert in both the DRC and Uganda. Hence, for each lake, there will be a FORUM for all the districts which form the catchment of each particular lake. Like at the level of Sub-Counties and Territoire above, this also takes into account the concept of managing lake basins in LEAB on the basis of catchments at the district level which incorporates government administrative boundaries at the level of district in both the DRC and Uganda.

The District Integrated Lake Management Fora will be composed of the following:

- Local Council Five Chairperson in Uganda or his/her equivalent in the DRC,
- Chief Administrative Officer in Uganda or his/her equivalent in the DRC,
- BMU Chairpersons in Uganda,
- UGREP Chairpersons in the DRC,
- District IWRM Coordinators,
- District Technical Team including Fisheries, Water, Security, Health, Education, Environment, Wildlife, Information, Roads, Welfare and Social Services,
- Private Sector and
- NGOs.

The Local Council Five Chairperson in Uganda or his/her equivalent in the DRC will be the Chairperson of the District Integrated Lake Management Forum. The functions of the District Integrated Lake Management Form will be to implement the decisions, programs and projects as directed by the **NATIONAL Lake Edward Basin Integrated Management Organization (LEBIMO)** for the DRC and for Uganda;. and the **NATIONAL Lake Albert Basin Integrated Management Organization (LABIMO)** for the DRC and for Uganda.

### **iv) The National Lake Edward Basin Integrated Management Organization (LEBIMO) and the National Lake Albert Basin Integrated Management Organization (LABIMO)**

**LEBIMO** and the **LABIMO** are national organizations formed at the level of the two lakes basins for each or the riparian countries. This means that all the districts riparian to each of the two lakes get together to form the lake basin management organization. That means there will be a **LEBIMO** in the DRC and in Uganda; a **LABIMO** in the DRC and in Uganda composed of the riparian districts in each country. The functions of **LEBIMO and LABIMO** shall be as directed by the **Regional Integrated Lake Basin Management Organization** implementing programs and projects of the organization on:

- Enforcement and implementation of fishing regulations,

- Controlling illegal fishing practices,
- Collection of taxes and levies,
- Data collection,
- Assisting in research,
- Assisting in security matters,
- Community education and
- Conflict resolution.

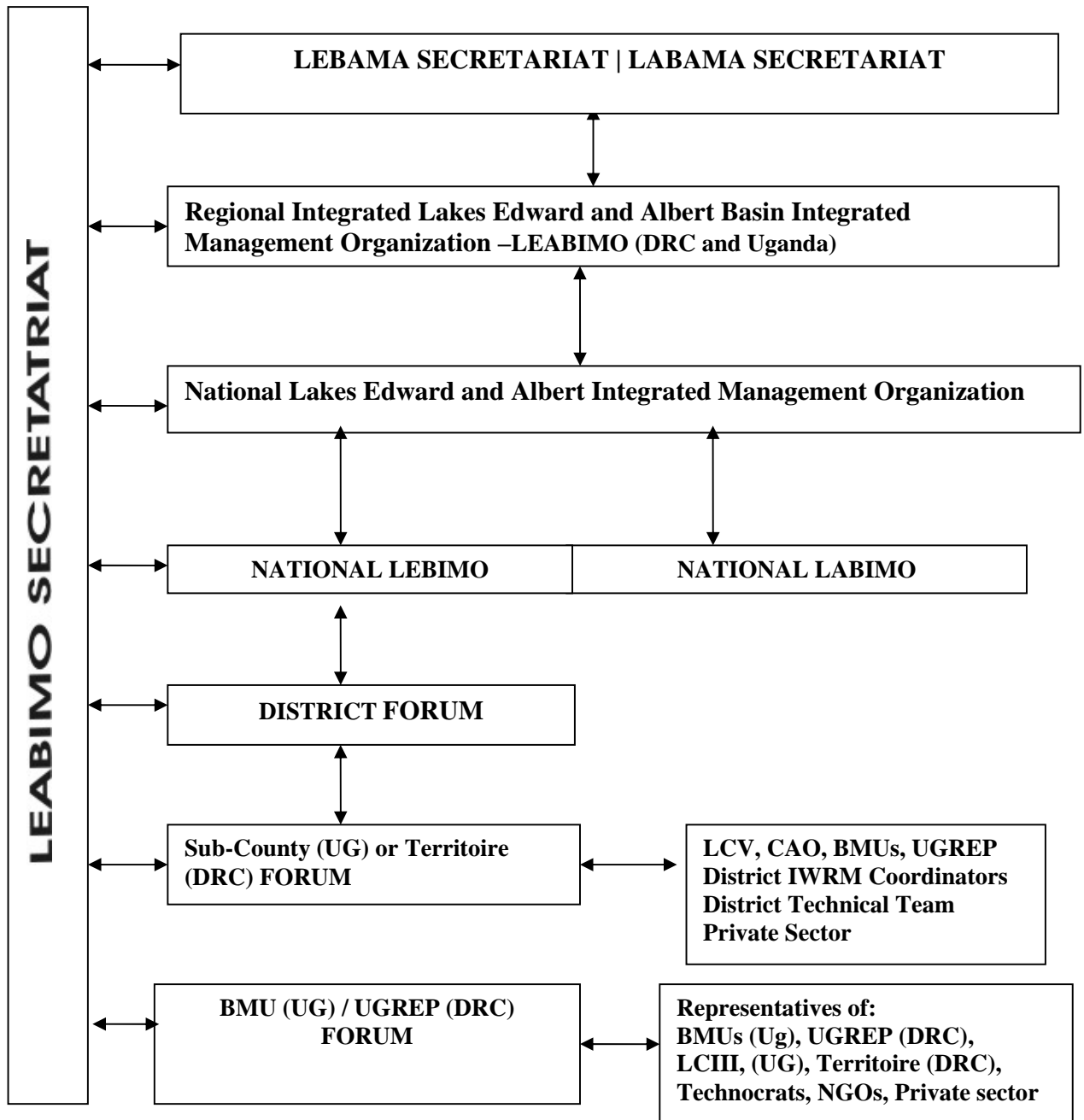
The National Lake Edward Basin Integrated Management Organization (LEBIMO) and the National Lake Albert Basin Integrated Management Organization (LABIMO) may associate to form one National Integrated Lake Basin Management Organization for each country.

**v) Regional Lakes Edward and Albert Basin Integrated Management Organization (LEABIMO)**

The Lakes Edward and Albert Basin Integrated Management Organization (LEABIMO) is the top organ of the organization. It is the basis of the framework for coordinated planning and implementation of programs and projects in the Lakes Edward and Albert Basin for sustainable management of the entire catchment. It will be a stakeholders body that will participate fully in the management of the fisheries and other activities in Lakes Edward and Albert basin. Integration of lake basin development and management will occur at five levels including at Regional level with the LEABIMO Organization; at national level with the LEBIMO and LABIMO in each riparian country; at the District level; at the Sub-County (in Uganda) and Territoire (in the DRC) level; and at the BMU/UGREP level of the communities. It will enhance the mechanism of co-management in the fishing communities of Lakes Edward and Albert and ensure ownership of common resources like fisheries of the two lakes. The proposed institutional structure of LEABIMO is shown in **Fig. 15**. LEABIMO will assist the Lakes Edward and Albert Basin Authorities to implement activities such as monitoring, and surveillance of fishing activities, collection of fees, taxes and levies as well as carrying out research and collection of scientific, commercial and management data and information. LEABIMO will be a bottom up organization with the BMUs and UGREP Cooperatives forming the baseline institutions at the first Level that have daily contact with the fisherfolk. The BMUs and UGREP cooperatives operate in fish landings and they will have their own Fora at the level of the sub-county and Territoire. LEABIMO and its agencies will collaborate with other partners like local governments, donors, NGOs and CBOs in the collection, use and dissemination of fisheries and environmental information for sustainable management of natural resources. LEABIMO may have its own Secretariat and Sub-committees whose role would include the following:

- providing support to other organs of the organization,
- documenting, recording, disseminating and ensuring safe custody of all information
- relating to the operations of the organization,
- providing technical guidance to the organization,
- carrying out planning and coordination as well as implementation of work plans,
- preparing annual work plans and budgets of the organization.

**LAKES EDWARD AND ALBERT BASIN INTEGRATED MANAGEMENT ORGANIZATION (LEABIMO)**



**Fig. 15: A diagrammatical representation of the proposed Integrated Lakes Edward and Albert Basin Integrated Management Organization (LEABIMO)**

## 9. CONCLUSIONS AND RECOMMENDATIONS

The problems, the threats, and the adverse impacts of the existing trends to sustainable environmental and socio-economic development in the study area together with their root and immediate causes were identified during data collection and situational analysis of fisheries biology, biodiversity, biostatistics, fisheries infrastructures, water quality and quantity, catchments environment, and the frameworks of policy, laws, and institutions. The details of the findings are in the Diagnostic Report. Possible mitigation measures and solutions to the threats inclusive of preliminary investment projects were proposed, details of which are in the Feasibility Report. The Final Report presented here makes proposals for two Integrated Lakes Management Plans one for Lake Edward and the other for Lake Albert in Volume I. Volume II presents the proposed Investment Projects which are intended to implement the ILMP. These are presented with their approximate cost estimates. It is recognized that at the time of implementation of the proposed Investment Projects, detailed feasibility studies will need to be mounted to determine accurate project costs and other project implementation details.

Besides the weaknesses and threats that were highlighted in Section 1 of this report, the SWOT analysis brought out the socio-economic and environmental strengths and opportunities that exist for the ecosystems of Lakes Edward and Albert. The situational analysis revealed that the status of the ecosystems of Lakes Edward and Albert is not yet alarming and can be easily rescued and conserved if the ameliorative measures recommended in this Report could be put into practice although amidst the existing poverty, poor socio-economic conditions, and weak institutional and operational status. Various management options were identified and assessed before recommending a combination of holistic, ecosystem, adaptive, precautionary, policing, proprietorship, and co-management/partnership management approach for adoption over time and space within the environment of Lakes Edward and Albert.

The proposed ILMP is, therefore, based on a new sense of direction referred to as 'integrated management frameworks' where there is adoption of a shared vision of the environmental resources, pursuance of a common integrated strategy to achieve the shared vision, taking of concrete steps to prevent and mitigate threats, sharing responsibility to address complex trans-boundary issues, and development of innovative new partnerships. It is on the basis of this understanding that the vision, mission, policy, and general principles, and operational, legal, and institutional frameworks were developed for implementation in the ILMP for Lake Edward and the ILMP for Lake Albert.

The main goal of the ILMPs is to promote integrated, sustainable, and balanced development, management, and utilization of environmental resources of the two lakes for the benefits of the present and future generations. The plans will promote local community participation at all stages of the project implementation. It will be implemented by the stakeholders in the two countries. Preference in the investment plans are being given to projects that will demonstrate positive impacts on biodiversity,

poverty, quality of life, and on the quality of the environment (water, land, and air), and those that will involve cross-border partners. The initial focus of the proposed projects is on harmonization of regulations, institutional establishment, biodiversity conservation, pollution control, environmental education, and promotion of regional cross-border cooperation.

Two Integrated Lake Management Plans are proposed for adoption by the two riparian states. One is for Lake Edward and the second is for Lake Albert. Two Transboundary Institutional Mechanisms are also proposed for the implementation of the two ILMPs. These are the **Lake Edward Basin Management Authority (LEBAMA)** and the **Lake Albert Basin Management Authority (LABAMA)**. The two authorities will implement the two ILMPs for the sustainable management and development of the Lake Edward and Lake Albert Basins. The successful establishment of two ILMPs will require an operating environment with the following operational instruments and mechanisms in place.

## 9.1 Appropriate policy and institutional framework

- i. Political recognition and support and should be given a high level of autonomy from the political leaders/Ministers to allow for day-to-day decision-making by experts from both countries based on efficient and cost-effective management and flexible enough to cater for a strong partnership approach between the different key stakeholders.
- ii. Have well defined linkages to different national and international agencies concerned with management of trans-boundary natural resources.
- iii. Have clearly defined institutional and operational roles.
- iv. Implement common management guidelines for the shared resource to ensure coordination, effectiveness, and harmonization at levels.
- v. Allow for innovative revenue generation mechanisms and appropriate incentives including common investment guidelines, fiscal systems, and access rights frameworks for national and shared resources where revenues can be derived from levies and thus improve efficiencies and service delivery through self financing.
- vi. Undertake capacity building of both DRC and Ugandan personnel in order to enhance their skills, knowledge and technical capacity to undertake joint institutional planning and management of trans-boundary natural resources.
- vii. Adopt harmonized standards on both lakes for quality assurance, control, and certification systems including; inspection, monitoring, communication, surveillance, construction of landing sites and enforcement of legislation.
- viii. Involve the local communities by equipping them with resources and information packages as well as skills to foster their participation in decision making and the sustainable management of the natural resources.
- ix. Have a Strategic Plan and a Business Plan that can be used by both countries to evaluate performance and attract donor funding for joint investment projects.

## **9.2 Adopt Harmonized Legislation and Enforcement Mechanisms that should include:**

- i. Development of a common legal framework and restrictions.
- ii. Development of legally recognized co-management frameworks for integrated management of the two lakes (public-private partnerships) which should allow for participation of civil society and, where relevant, private industry to develop, implement and monitor the performance and impacts of integrated lake management plans.
- iii. Harmonization of standards for monitoring, control and surveillance systems of the national and shared natural resources.
- iv. Addressing issues relating to national privatisation and investment priorities of the two countries in the code of conduct regulating the harmonized fisheries management on Lakes Edward and Albert.
- v. Strengthening Operational Patrol on Lakes Edward and Albert by procuring monitoring, communication, and surveillance equipment to optimize operations and harmonize enforcement measures.

## **9.3 Harmonize Water Quality and Catchments Environment Standards**

The existing policy guidelines, strategies, and action plans for water quality control under the National Environment Management Authority Statute of Uganda Number 4 of 1995 and under the framework of water resources management planning in Uganda (DWD, 2003) will be revised, harmonized, and adopted. The overall policy statements of NEMA and DWD in Uganda, relevant to water pollution control and water quality standards (2002) do define the Government of Uganda's concept of water resources as well as its long-term priorities for water resources exploitation which are based on the concept of Agenda 21 of UNCED (1992) that stated:

*“Freshwater should be seen as finite and vulnerable resource essential to sustaining life, development, and the environment” and “water should be considered as a social and economic good with a value reflecting its most vulnerable potential use”.*

Based on the guidelines of UNECE (1993) and making use of the mitigation measures suggested by the stakeholders, as well as the results of data analysis and assessment during the study, the water quality and catchments environment standards should be set with the following key attributes in order to provide suitable basis for sound management of the water quality and catchments environment of Lakes Edward and Albert:

- i. Formulate and institute realistic community/stakeholder owned water quality standards that are achievable and regulations that are enforceable so that they do not create an attitude of indifference towards rules and regulations in general, both among possible polluters and administrators.
- ii. Raise awareness of the importance of water quality and pollution control among policy makers and the general public; and ensure that the public is kept informed and is given the opportunity to express views, knowledge, and priorities and

should be apparent that the views have been taken into account, in addition to being provided with open access to all sources of information to help stimulate understanding, discussions, and suggestions for solutions to water quality problems.

- iii. Ensure that decisions are taken with full public participation and with the involvement of groups affected by the planning and implementation of water pollution control activities; public participation may take the form of interviews, public information sessions and hearings, expert panel hearings and site visits.
- iv. Apply the pollution control at the lowest appropriate level in order to ensure that decisions or actions concerning water quality standards and pollution control are taken as close as possible to those affected, and that higher administrative levels should enable lower levels to carry out decentralized management. The lowest level is defined as the level at which significant impacts are experienced.
- v. Prevent the production of wastes that cannot be recycled or treated. This is so because remedial actions to clean up polluted sites and water bodies are much more expensive than applying measures to prevent pollution from occurring.
- vi. Minimize contaminants from non-point pollution sources through “best environmental practice” of e.g. preventing bush fires, deforestation, bare soils, population control of wildlife, and applying agricultural practices that emphasizes soil and water conservation.
- vii. Apply the “polluter-pays” principle where the cost of pollution prevention, control, and reduction measures are born by the polluter in order to prevent the perception of water as a free commodity. The principle aims at changing behavior by encouraging and inducing behavior that puts less strain on the environment.
- viii. Use the “precautionary approach” to prevent the application and discharge of hazardous substances into the lakes even when such substances are only being suspected of having detrimental effects on water quality instead of waiting for scientific research to prove causal link between the substance and its hazardous environmental impacts.
- ix. Encourage the establishment of cross-sector mechanisms for the co-ordination of water quality standards and pollution control efforts within water related sectors, and as means for co-operation and information exchange.
- x. Promote international co-operation as trans-boundary water pollution problems require international co-operation and co-ordination of efforts in order to be effective in all ways. A permanent international body should be established with the objective of strengthening international co-operation on the pollution control of the shared resource of Lakes Edward and Albert.

#### **9.4 Improve Water Resources Management**

The following interventions are being recommended for adoption and implementation:

- i. Develop physical facilities and infrastructure for trans boundary water resources monitoring and management;

- ii. Develop a joint databases on water quantity that should be shared;
- iii. Develop common groundwater management strategies for policies, laws and guidelines for monitoring and assessment of groundwater sources;
- iv. Develop a program to rehabilitate and upgrade the Hydro-meteorological and water quality monitoring network to support management of the water resources;
- v. Develop a program to improve the management of water resources with a joint management framework supported by an aggressive capacity building strategy tailored to suit the needs of each country. It is proposed that these intervention measures be packaged and supported under a project for Integrated Water Resources Assessment for the Lake Albert, Edward and George Basin.

## 9.5 Improve Biodiversity and Fisheries Management

The following interventions have been recommended in order to improve biodiversity and the management of the fisheries:

- i. The Haplochromine species populations in Lake Edward and *Brycinus nurse* in Lake Albert are key strata in the food chain and trophic relations in the two lakes. This group is the main target of all the piscivorous species which themselves are the basis of the commercial fishery of the two lakes. Therefore, small meshes sizes of gill-nets (1 to 3 inch) should be prohibited around the two lakes;
- ii. Illegal fishing practices using beach seines, beating water, poison fishing and dynamiting should be strictly prohibited;
- iii. Very large mesh size gill-nets and long lines should be encouraged in fisheries;
- iv. The small 3.5 inch mesh size gillnets should be experimented with on a pilot scale in Lake Albert and the 4 inch mesh size gillnets in Lake Edward for at least 6 months and the catch structure analyzed, before concluding whether they could be widely authorized;
- v. BMUs units should be established all around the two lakes, in both Uganda and the DRC. These units should be trained and empowered to carry out some fishery biological work including monitoring, qualitative and quantitative measurements and record keeping;
- vi. Lakes Albert and Edward ecosystems are less known and understood that those of other East African lakes. It is recommended that a fully fledged fisheries research center with adequate laboratories, equipment, transport, library and documentation facilities and communications be established with field stations on both lakes in the two riparian countries to carry out research on fisheries biology, limnology, water quality, ecosystem functions and socio-economic relationships on a continuous basis;
- vii. Training of scientific and other staff to conduct research in the two lakes should be mounted with full cooperation of near by universities of the two countries;



- viii. Published and unpublished documents and literature on Lakes Edward and Albert should be gathered as a lot of this information is scattered around the world and is not available to national scientists within the region;
- ix. It is recommended that Protected Areas “Pas” be set up, surveilled, and monitored to enable fish to breed successfully;
- x. Commercial fishing be limited to seasons when the fish are not breeding;
- xi. Stakeholders be periodically and continuously sensitized on environmental management and scientific conservation measures with emphasis on what role they should play;
- xii. Curricula be developed for schools on environmental management and biodiversity conservation;
- xiii. Multi-disciplinary research capacity be strengthened at national institutions and that the following research topics should be pursued in the proposed research centre when established:
  - xiv. Fish stock assessment for all the fish species;
  - xv. Fisheries biology of the most important commercial species including breeding, feeding, growth and migrations;
  - xvi. Fish taxonomic studies particularly for the Nile Perch and the Haplochromine group;
  - xvii. Limnology and water quality of the main lakes and in flowing rivers;
- xviii. Point-sources and non-point sources of pollution within the catchment of the two lakes;
- xix. Atmospheric deposition of nutrients within the lake basin;
- xx. Post-harvest losses, fish preservation, packaging and transportation techniques;
- xxi. Fish and aquatic parasites and vectors; and
- xxii. Aquaculture techniques.

## **9.6 Improve the Socio-Economics and Livelihoods of the Communities**

The following interventions have been recommended for adoption by the two countries:

- i. Provide alternative employment opportunities.
- ii. Improve agro and fish marketing systems;
- iii. Empower co-operatives and rural based enterprises;
- iv. Provide access to affordable long term financing;
- v. Strengthen extension services;
- vi. Promote production of high value crops;
- vii. Increase on-farm production and marketing of farm products;
- viii. Invest in value addition to boost sustainable production and incomes of the rural poor in the Lakes Edward and Albert Basin;
- ix. Investments should support the increasing involvement of small scale, community based businesses and associations;
- x. Invest in the promotion of the agro-based and fisheries sectors and products at all levels;
- xi. Invest in marketing strategy using on-line market information;
- xii. Encourage the principle of public-private sector partnerships;

- xiii. Develop micro credit schemes for community groups and disadvantaged groups to benefit from investment opportunities.

## **9.7 The Special Case of Improving Livelihoods and Socio-Economy of the Fishing Communities**

Based on the findings of this, study the following additional recommendations were raised:

- i. Fishers should be supported through a package of technology and credit to target high value species and engage in value addition. They should also be provided with training, particularly in book-keeping and fish business management. The private sector should also be supported to improve supply of fishing inputs, through appropriate policies.
- ii. There is need to promote the establishment of community organizations for fisheries management in DRC and provide them with legal power.
- iii. Conflicts within the leadership of landing sites should be resolved through establishment of co-ordination mechanisms within the different agencies and definition of roles among them.
- iv. To mitigate the negative impacts of migration among fishers, alternative livelihood activities should be promoted, with which fishers could be gainfully occupied during seasons of low catch.
- v. There is need to lobby for educational, road, and public health programs for the fishing communities, involving sensitization and facilities.
- vi. Literacy should be promoted among fishers through appropriate programs and institutions.
- vii. By-laws governing fishing should be set, to avoid conflict and to promote dialogue among the different types of fishers under the BMU system.
- viii. There is need to lobby for women empowerment programs, aimed at providing skills, resources and sensitization to the fishing communities in order to improve equity in the share of benefits from fisheries.
- ix. Facilities for saving and credit should be established. There is also need to lobby for programs to improve food availability and diversity through food production and trade.
- x. Fishers should be sensitized on the need and how to use latrines, garbage pits and bath shelters.
- xi. There is need to demonstrate the incentives for compliance with fisheries regulations. Furthermore, dissemination of fisheries management information should be strengthened.
- xii. Institutions and mechanisms for co-ordination of cross-borer fisheries management and development should be established, details of which would be proposed by the legal and institutional consultant.

## 9.8 Improve Fisheries Infrastructure

The following recommendations were made:

- i. Upgrading and rehabilitation of damaged infrastructures and facilities and new construction of lacking basic infrastructure and facilities. These include the following basic landing infrastructures:
  - Concrete surface slab for hygienic fish handling
  - Shelter to protect fish from direct sunlight
  - Clean and portable water for cleaning fish and other uses
  - Appropriate ducting of waste water to prevent lake water contamination
  - Fish storage facilities to keep equipments and finished products
  - Public toilet facilities to improve sanitation system.
- ii. For fish processing the basic requirements include:
  - Kiln for smoking fish
  - Concrete slab for fish sun-drying
  - Ice facilities for chilling fish
  - Storage facility for finished products and utensils

The improvement of the current situation may be done at landings level by providing basic infrastructures and facilities to meet hygienic fish handling and at the community level by providing the sustainable infrastructures and facilities at one principal landing per lake and per country to be identified for development of an integrated management plan.

- iii. The field study identified the priority investments the following areas:
  - Fish landing infrastructure,
  - Health centre,
  - Improvement of road network,
  - Clean and safe water supply.
- iv. The following areas require technical training and are key elements for quality and safety of fish handling:
  - Fish processing science and technologies,
  - Hygiene and sanitation practices,
  - Quality control system and procedures for fish and fish products,
  - Personnel hygiene and public health checks,
  - Waste management procedures,
  - Dust proofs of environment.
- v. The preliminary findings show key issues in civil engineering and infrastructure that should be addressed for fisheries management plan and development of an integrated management plan:
  - Clean and portable water supply at landings, within the fishing communities and surrounding areas.

- Provide with basic landing infrastructures and facilities at landings to meet hygienic standards fish handling
- Provide sustainable infrastructures, facilities and equipments at the community level to be managed by NGO's, BMU's or a community association at identified principal landing sites.
- Improve the security on boats by providing safety equipments and put in place a control mechanism of the state of boats.
- Improvement of fish processing method by providing required equipments and facilities in smoking, sun-drying, freezing, icing and salting.
- Electricity supply at the landings and within the fishing village
- Increase public awareness on hygiene and sanitation system, dust proofs of environment.
- Improvement of access roads and road networks in order to reduce post-harvest losses by upgrading transportation system from landings to the markets.
- Construction of feeder roads within the fishing village where they are lacking.
- Put in place solid wastes and waste water management to prevent the pollution of environment
- Empowering the functioning of health centres by providing enough staffs and drugs.
- Increase the number of schools and rehabilitate the needed classrooms
- Some houses close to the landings may be moved to prevent water contamination
- Put chain link fence to separate fishing village and National Park particularly around the Lake Edward in order to reduce the threats of wild animals.
- Set up a ice plant to ensure the transport of fish in good conditions.
- Provide information on property rights and land titles to the fishing communities.

## **9.9 Improve Fisheries Statistics through the following**

### **Frame Surveys**

The starting point of any fisheries monitoring programme is a Frame Survey of the fisheries in the form of a map or chart, or a list of key features of the fishery. Such a frame is the first requirement for any proper sampling design, and guides all the subsequent data collection activities. Accordingly, the 'Authority', once established, will need to carry out a Frame Survey to establish such a sampling frame. Thereafter, regular frame surveys need to be carried out to update the inventory of existing fishing factors. It is recommended that a frame survey of the lakes be carried out every two years. For this plan, the Sampling Frame will consist of maps showing the fish landing sites for each of the two lakes; together with a list/table detailing the characteristics of each landing site; a list/table detailing individual boat particulars for all the fishing boats at each landing site.

The Frame will be constructed by carrying out a complete enumeration of each lake, collecting information on:

- a) Existing landing sites and their location and characteristics (Fish species, facilities, etc).
- b) Number of fishing units and information on their components, such as fishermen, fishing boats, fishing gear per landing site.

The recommended formats for collecting this information are Forms A1 and A2. The recommended approach to the Frame Surveys will be mainly by road and supplemented by water. Temporary data gatherers will need to be recruited and trained and used to carry out a landing site by landing site coverage of the shorelines of the two lakes while noting down such points on a topographical map while also filling in the recommended forms. Local Government (fisheries) officials and Beach management Units will be the respondents for completing the forms. Beach Management Units officials and local fisheries staff should be sensitized and trained to maintain a permanent register of the fishing fleet at the landing sites using Form A2. Future Frame Surveys would simply transcribe information from the BMU records.

### **Catch and Effort Surveys**

A Catch/Effort survey aiming at collecting current information on total catch and fishing effort needs to be periodically carried out. In this plan Catch will be defined in terms of weight of fish landed, categorized by species, while Fishing Effort will be measured in fishing boat-days. Catch Per Unit of Effort will then be computed as catch per fishing boat per day. A continuing decline in CPUE reflects over fishing, whereas increased CPUE generally reflects recovery of a fish stock or effective management of the fishery. Though a spatio-temporal probability sample is usually recommended for CES data collection, lack of capacity at local government levels may not permit strict random sampling methods to be properly applied. For the time being, the recommendation is that one sentinel site (perhaps the largest), should be selected for each of the lowest levels of government with a fisheries officer/agent (Sub-County in the Case of Uganda). The operational steps in the execution of the Catch/Effort Survey will involve the selection of the sentinel sites (in lieu of sampling in space) and the selection of the sample days (sampling in time). It is proposed that one day per week be selected for obtaining the required information from a sample of boat landings within the sentinel landing sites for the entire year. The recommended format for collecting Catch/Effort data is Form A3. For small landing sites, complete enumeration is recommended, while for large landing sites a sample of every  $i^{\text{th}}$  boat should be enumerated. Where sampling is done, the total catch for the sampled boats needs to be divided by the number of sampled boats and then raised by the total number of fishing boats landing that day to obtain the estimated total catch for the site.

At the end of the month, a time raising factor is to be applied to obtain an estimate for the whole month. Catch/Effort data can be collected by local fisheries staff, provided that they are adequately equipped. Ideally catch and effort data should be collected at landing sites, when fishermen land catches. The recommended method is to use suitable scales to weigh the total catch, by species, of each sampled boat. Where this is not possible, data can be collected through interviews with fishermen, after trips. Senior Fisheries Officers

should be required to periodically (e.g monthly) check on the junior officers to ensure there are no errors and biases due to either incomplete or inaccurate recording.

### **Data Processing, Analysis, and Archiving**

Statistical data from Catch/Effort studies will be processed in the following manner:

- i. the local fisheries officer will compute the Catch per unit of Effort for the sampled day, and raise it to the total catch for the sampled day;
- ii. at the end of the month, the officer will compute the monthly catch for the site. The daily catch forms and the monthly catch estimates will then be submitted to the District (Territoire) Fisheries Office;
- iii. The District Fisheries Office will weight the sentinel site catches to obtain a District total for monitoring the District fisheries production;
- iv. The daily catch forms will be submitted to the Regional (Provincial) Fisheries where they will be entered into the Fisheries Database, hereafter referred to as the Fisheries Information Management System (FIMS), using a suitable data entry system;
- v. checking the data for errors of transfer and gross recording errors will be done by appropriate automatic checking routines built into the data entry system
- vi. weighting up samples to total landings by day, site, month and region as needed and preparation of summaries of data will then be carried out by FIMS;
- vii. *ad hoc* analysis of the data will be carried out using a suitable statistical package e.g STATA;
- viii. the data will then be archived so as to be easily retrievable and updated as new information becomes available. The data will be in the form of a simple database with a record for each landing site, and a record for each site visit.

### **9.10 Institute Revenue Generation Mechanisms within the lake basin**

There is need for both countries to explore avenues of introducing fiscal systems that will be able to increase the funds to local government, decrease the charges to resource uses, and leave a substantial amount for resources management and development. The system should simplify the existing complex local taxation systems and take into account its differential impacts on different stakeholder groups with regard to poverty reduction.

### **9.11 Establish Conflict Resolution Mechanisms**

There is need to establish formal mechanisms for conflict/dispute resolution by instituting regular cross border meetings. To minimize conflicts between the enforcement personnel and the fishing communities, law enforcement should be separated from extension services with well defined guidelines and adequate facilitation.

There is need for the Districts/ provinces that have fishing communities living in or near wild life protected areas to enter into Memoranda of Understanding with respective national institutions to ensure that potential causes of conflict are minimized.

### **9.12 Emphasize Data Collection and Research**

There is need to generate data through research studies and to promote information gathering and exchange among the key stakeholders regarding interventions and measures to be undertaken. Such measures pertain to undertaking participatory research studies, sharing research findings, educating or even training these actors on the standards and codes concerning natural resources management. Since research facilitates resources development, management, and utilization, the linkage between the two should be strengthened and research findings should be made public. Data collection facilities should be made mandatory and enforced. There is also need to simplify data collection in a uniform format to capture basic data.

### **9.13 Ensure Access to Resources/Property Rights**

To control access to the fisheries of Lakes Edward and Albert the use of various restrictive measures may be the most appropriate. These measures could include licensing, limiting the size of fish harvested, limiting the minimum mesh size of gill net to be used on the lakes, use of closed seasons and closed area restrictions, prohibiting a number of fishing gears and methods, and limiting the vessel size and propulsion power of fishing boats since the size and power determine how far the vessel can go and hence reduce the threat of illegal cross-border fishing and trade.

The issue of land ownership should also be addressed in light of existing legislation on land ownership in each country. A permanent strip should be maintained of at least 100-200m from the lake shores to enable fishermen conduct their fishing activities without harassment from the land owners or wildlife protection authorities where the landing sites fall within protected areas.

## REFERENCES AND LITERATURE SITED

1. Chapman, D. (1996). ***Water quality Assessment. A guide to the of biota, sediments and water in environmental monitoring.*** Ed. Chapman and Hall, London.
2. Charles, A. T. (2002). Precautionary Approach and 'Burden of Proof' Challenges in Fisheries Management. *Bulletin of Marine Science* 70(2): 683-694.
3. Charles, A. T. (2001). *Sustainable Fishery Systems.* Blackwell Science. Oxford, U.K.
4. DWD. 1998. *Deterioration of Water Quality in Lake Albert.* Water Quality and Pollution Control Laboratory, Entebbe.
5. MAAIF. (2004). National Fisheries Policy. DFR, Ministry of Agriculture, Animal Industry and Fisheries, Entebbe. 52pp.
6. Matagi, S.V. (2002). The Biodiversity of the Flamingo Lake of Eastern Africa. *Biodiversity*, 5:31-45.
7. Miskell, J. (1989). Fuelwood Supply for Fishing Villages in the Queen Elizabeth National Park, Uganda. Agriconsulting, Rome. 51pp.
8. NEMA. 1998. Masindi District Environment Profile. NEMA/Environment Protection & Economic Development Project (EPED), Masindi.
9. Ssentongo, G. (1989). Technical Consultations on the Management of Lakes Edward and Mobutu. UNDP/FAO Regional Project for Inland Fisheries Planning. RAF/89/099-WP/02/08. 19pp.
10. Stankey, G.H., R.N. Clark, B.T. Bormann. (2005). Adaptive Management of Natural Resources: theory, concepts, and institutions. Gen. Tech. Rep. PNW-GTR-654, Portland, Oregon: US Dept. of Agric. 73pp.
11. Talling, J. F and Talling I. B (1965).The chemical composition of African lake waters. *Int. rev .ges. Hydrobiol.* 50:421-463
12. Wikipedia 2006 on Internet.
13. Water Resources Management Reform Strategy by Charles Wana-Etyem (Warner Consultants Ltd.) August 2005.



**Annex 1: Frame Survey Form A1 for Lakes Edward and Albert Fisheries**

**Summary of numbers of craft on beach and other facilities**

1. NAME OF RECORDER (AS IN ID) -----
2. STATUS/ RANK OF RESPONDENT -----
3. DATE -----
4. DISTRICT -----
5. SUB-COUNTY/ DIVISION -----
6. PARISH/LOCATION -----
7. NAME OF LANDING SITE -----

1	
2	
3	
4	
5	
6	
7	

**CRAFT SUMMARY**

8. DERELICT CRAFTS -----
9. FISH CARRIER -----
10. TRANSPORT CRAFTS (NON-FISHING) -----
11. FISHING CRAFTS WITH OUTBOARD ENGINE -----
12. FISHING CRAFTS WITH IN-BOARD ENGINE -----
13. FISHING CRAFTS USING PADDLES ONLY -----
14. FISHING CRAFTS USING SAILS -----

8	
9	
10	
11	
12	
13	
14	

**FACILITIES SUMMARY**

15. BANDA [1] YES [2] NO
16. COLD ROOM [1] WORKING [2] NOT-WORKING [3] NONE
17. PONTOON/JETTY [1] YES [2] NO
18. FISH STORE [1] YES [2] NO
19. ELECTRICITY SUPPLY [1] YES [2] NO
20. IF "NO" HOW FAR TO NEAREST SUPPLY (KM)?  
[1] <1 [2] 1-5 [3] 6 - 10 [4] > 10
21. TOILET FACILITY [1] YES [2] NO
22. POTABLE WATER [1] YES [2] NO
23. IS BEACH ACCESSIBLE BY ALL WEATHER ROAD? [1] YES [2] NO
24. IF "NO" HOW FAR TO NEAREST ALL WEATHER ROAD (KM)  
[1] <1 [2] 1-5 [3] 6 - 10 [4] > 10
25. DESIGNATED NET REPAIR FACILITY [1] YES [2] NO
26. DESIGNATED BOAT REPAIR FACILITY [1] YES [2] NO
27. IS FISHERIES STAFF RESIDENT? [1] YES [2] NO
28. IS THE **BMU** BASED AT THE LANDING BEACH? [1] YES [2] NO

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16	
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22	
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25	
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28	

**ADDITIONAL INFORMATION**

29 NAME THE NEAREST MARKET (WHERE MOST OF THE FISH IS FIRST SOLD)

29	
----	--

- 
- 30 DO FISHERMEN LAND AT THIS BEACH FOR MORE THAN 5 MONTHS IN A YEAR  
[1] YES, [2] NO

30	
----	--



Annex 2: Fisheries Statistic Form A2

Form No.		Sub-county	
Date		Parish	
District		Water body (Lake/River)	
Recorder(s) Name		Landing site Name	
		Boats landed today	

**Use separate rows for each gear type and species. Ensure that hours fished with each gear type is recorded**

VESSEL DETAILS								GEAR / EFFORT DETAILS				FISH CATCH DETAILS			
Serial Number	Day/Night fishing	Reg. No.	Vessel type code	Length (m)	Propulsion code	Number of Crew	Days the boat fished in the last one week	Gear type code	Number of units	Mode of operation Code	Hours fished	Species name or Code	No. of fish (large spp) No. basins /buckets (Dagaa/ Mukene and Nkejje/Furu)	Catch wt (kg) large spp Wt (kg) 1 basin/ bucket (Dagaa/Mukene & Nkejje/Furu)	Price (shs/kg) large spp. Price 1 basin/bucket Dagaa/Mukene & Nkejje/Furu

### Annex 3 (I): Database Table Definitions

#### 1. Boat Type

Field Name	Type	Length
CRAFT_TYPE_ID	N	2
CRAFT_TYPE	X	32

#### 2. Country

Field Name	Type	Length
COUNTRY_ID	N	2
COUNTRY	X	32

#### 3. Gear Type

Field Name	Type	Length
GEAR_TYPE_ID	N	2
GEAR_TYPE	X	32

#### 4. Lake

Field Name	Type	Length
LAKE_ID	N	2
LAKE	X	32

#### 5. Operation Mode

Field Name	Type	Length
MODE_ID	N	2
MODE	X	32

#### 6. Propulsion Type

Field Name	Type	Length
PROPULSION_ID	N	2
PROPULSION	X	32

#### 7. Species

Field Name	Type	Length
SPECIES_ID	N	2
SPECIES	X	32

#### 8. Landing Site

Field Name	Type	Length
SITE_ID	N	4
COUNTRY_ID	N	2
LAKE_ID	N	2
SITE	X	32
CONTACT	X	32
ADDR1	X	32
ADDR2	X	32
ADDR3	X	32
ADDR4	X	32
ADDR4	X	32
ADDR5	X	32
ADDR6	X	32
DERELICT	N	4

FISH_CARRIER	N	4
TRANSPORT	N	4
OUTBOARD	N	4
INBOARD	N	4
PADDLE	N	4
SAIL	N	4
PADDLE_SAIL	N	4
MO_PAD_SAIL	N	4
BANDA	N	1
COLD_ROOM	N	1
PONTOON	N	1
ELECTRICITY	N	1
ELEC_DIST	N	1
TOILET	N	1
POTABLE	N	1
ACCESSIBLE	N	1
ROAD_DIST	N	1
NETREPAIR	N	1
BOATREPAIR	N	1
STAFF	N	1
BMU	N	1
MARKET	X	32
ALLYEAR	N	1

#### 9. Fishing Boat

Field Name	Type	Length
SITE_ID	N	2
COUNTRY_ID	N	2
LAKE_ID	N	2
BOAT_ID	N	4
REG_NO	X	32
CRAFT_TYPE_ID	N	2
LENGTH	N	6.2
PROPULSION_ID	N	2
HORSE_POWER	N	6.2
TARGET_SPECIES_ID	N	2
CREW	N	4
MAINGEAR	N	2
CONMODE	N	2
OPMODE	N	2
BAITTYPE	N	2
GILLNET45	N	4
GILLNET4	N	4
SSEINE	N	4
HOOKS	N	4
SN	N	4
BS	N	4
CN	N	4
HL	N	4
TR	N	4
LN	N	4
OTHER	N	4

**10. Sampled Site**

Field Name	Type	Length
SITE_VISIT_ID	N	4
SITE_ID	N	2
COUNTRY_ID	N	2
LAKE_ID	N	2
DATE	D	
BOATS_LANDED	N	4
BOATS_SAMPLED	N	4

**11. Sampled Boat**

Field Name	Type	Length
SITE_VISIT_ID	N	2
SITE_ID	N	2
COUNTRY_ID	N	2
LAKE_ID	N	2
BOAT_ID	N	4
DAY_NIGHT	X	1
REG_NO	X	32
CRAFT_TYPE_ID	N	2
LENGTH	N	6.2
PROPULSION_ID	N	2
CREW	N	4
DAYS_FISHED	N	4

**12. Sample Gear**

Field Name	Type	Length
SITE_VISIT_ID	N	2
SITE_ID	N	2
COUNTRY_ID	N	2
LAKE_ID	N	2
BOAT_ID	N	4
GEAR_TYPE_ID	N	2
UNITS	N	4
MODE_ID	N	2
HOURS_FISHED	N	6.2

**13. Sample Catch**

Field Name	Type	Length
SITE_VISIT_ID	N	2
SITE_ID	N	2
COUNTRY_ID	N	2
LAKE_ID	N	2
BOAT_ID	N	4
GEAR_TYPE_ID	N	2
SPECIES_ID	N	2
CATCH_NUMBERS	N	4
CATCH_WEIGHT	N	12.2
PRICE		12.2

**Annex 3 (II): Data Entry Screens**

**1. Sample Parameter Entry Screen**

Species Code	Species Name
xx	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

(A similar design would be used for each of the following parameters: Boat Type, Country, Gear Type, Lake, Operation Mode, Propulsion Type).

**2. Landing Site Data Entry Screen**

Site Code	XXXX	Banda	
Country Code	XX	Cold Room	
Lake Code	XX	Pontoon/Jetty	
Site Name		Fish Store	
Contact		Electricity Supply	
Address 1		Distance to Elec.	
Address 2		Toilet Facility	
Address 3		Potable Water	
Address 4		All Weather Road	
Address 5		Distance to Road	
Address 6		Net Repair Facility	
Derelict Craft		Boat Repair Facility	
Fish Carriers		Res. Fisheries Staff	
Transport Craft		BMU	
Craft with Outboard Engine		Name of Nearest Market	
Craft with Inboard Engine		All Year Fishing	
Craft with Paddle			
Craft with Sails			

**3. Fishing Boat Data Entry Screen**

Site Code	XXXX	Operation Mode	
Country Code	XX	Bait Type	
Lake Code	XX	Gill Net 4.5	
Craft Code		Gill Net 4	
Reg. Number		Small Seine	
Craft Type Code		Hooks	
Length		Scoop Net	
Propulsion Code		Beach Seine	
Horse Power		Cast Net	
Target Species		Hook & Line	
Crew		Traps	
Main Gear		Lift Net	
Construction Mode		Other	

**4. Sampled Site Data Entry Screen**

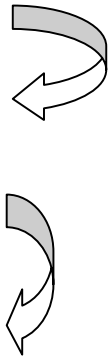
SITE ID	VISIT	SITE ID	COUNTRY ID	LAKE ID	DATE	BOATS LANDED	BOATS SAMPLED
					ddmmyy		

**5. Sampled Boat/Gear/Catch Data Entry Screen**

BOAT ID	DAY/NIGHT	REG NO	CRAFT TYPE ID	LENGTH	PROPULSION CODE	CREW	DAYS FISHED

GEAR TYPE CODE	UNITS	OPERATION MODE CODE	HOURS FISHED

SPECIES CODE	CATCH NUMBERS	CATCH WEIGHT	PRICE PER KG







7. **Sampled Boat/Gear/Catch Listing**

LAKE EDWARD AND ALBERT FISHERIES									
Sampled Boat/Gear/Catch Listing									
Country XXXXXXXXXXXXXXXX Lake XXXXXXXXXXXXXXXXXXXXXXXX From (Date) dd/mm/yyyy To (Date) dd/mm/yyyy									
Serial Number	District/Territoire	Site	Date	Boat Id	Gear Type	Species	Number	Weight	Price
9999	XXXXXXXXXX	XXXXXXXXXX	dd/mm/yy	99999	XXXXXXXXXX	XXXXXXXXXX	9999	99999	999999

8. **Catch per Unit of Effort**

LAKE EDWARD AND ALBERT FISHERIES		
Catch Per Boat-day		
Country XXXXXXXXXXXXXXXX Lake XXXXXXXXXXXXXXXX		
From (Date) dd/mm/yyyy To (Date) dd/mm/yyyy		
Date	Site	Kg per Boat -day
dd/mm/yy	XXXXXXXXXXXXXXXXXXXXXXXXXX	999.99
dd/mm/yy	XXXXXXXXXXXXXXXXXXXXXXXXXX	999.99
dd/mm/yy	XXXXXXXXXXXXXXXXXXXXXXXXXX	999.99

**Kg per Boat-day = (Total Catch)/(Boats sampled)**

9. **Catch Composition by Gear**

LAKE EDWARD AND ALBERT FISHERIES		
Catch Composition by Gear		
Country XXXXXXXXXXXXXXXX Lake XXXXXXXXXXXXXXXX		
From (Date) dd/mm/yyyy To (Date) dd/mm/yyyy		
Serial Number	Gear Type	Percentage of Catch
99	XXXXXXXXXXXXXXXXXXXXXXXXXX	999.99
99	XXXXXXXXXXXXXXXXXXXXXXXXXX	999.99
99	XXXXXXXXXXXXXXXXXXXXXXXXXX	999.99

**Percentage of Catch = (Catch by Gear Type)x100/(Total Catch)**

10. **Catch Composition by Species**

LAKE EDWARD AND ALBERT FISHERIES		
Catch Composition by Species		
Country XXXXXXXXXXXXXXXX Lake XXXXXXXXXXXXXXXX		
From (Date) dd/mm/yyyy To (Date) dd/mm/yyyy		
Serial Number	Species	Percentage of Catch
99	XXXXXXXXXXXXXXXXXXXXXXXXXX	999.99
99	XXXXXXXXXXXXXXXXXXXXXXXXXX	999.99
99	XXXXXXXXXXXXXXXXXXXXXXXXXX	999.99

**Percentage of Catch = (Catch of Species)x100/(Total Catch)**