THE UNITED REPUBLIC OF TANZANIA
VICE PRESIDENT'S OFFICE

LAKE VICTORIA ENVIRONMENTAL MANAGEMENT PROJECT

SUPPORT TO RIPARIAN UNIVERSITY COMPONENT

LESSONS LEARNT IN CAPACITY BUILDING

FINAL REPORT

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Executive Summary

Lake Victoria and the overall Lake Basin (LB) is an ecoregion of local, national, regional and global importance. It supports the livelihoods of one third of the populations of the riparian countries and it can be a significant moderating force to the status of a number of the Biosphere Reserves and Heritage Sites surrounding it, including the Serengeti Ecosystem.

There has been little awareness on the importance of the LB and little technical knowledge on its functioning. The LVEMP1 has done a commendable job of building capacity in awareness, research, monitoring and sustainable management of the LB. Local communities, administrators, managers and decision makers have had their horizons expanded and much interest and concern over the LB has been inculcated. A number of technicians, officers and researchers have been trained at the Masters and PhD levels.

The number trained varied between the eight main components of LVEMP1. It is expected that, a detailed training needs assessment that address the LB requirements first and which comes prior to allocation of training slots to individuals, institutes and components might end up building more relevant and targeted capacity even though room for basic research would still be important especially at the PhD level of training. Under LVEMP1, training was carried out without such a training needs assessment.

Training at the PhD and some Masters required conducting research at the LB. This is positive since it has increased knowledge of the LB and the respective trainees have acquired knowledge in a relevant local setting thus enhancing their capability to undertake future LB assignments. It is noted that there were some minor overlaps in research topics. It is also noted that there was no clear separation between a study worth a Masters and one worth a PhD. Again, an analysis of training needs prior to undertaking the research activities would have been useful in sorting out such albeit minor anomalies.

A number of local and overseas institutions were used for training. While training overseas might be more efficient, it often is more expensive and it also reduces the chance for CB of local institutions especially the universities. As much as possible a project of LVEMP1 magnitude could seriously consider giving priority to local training institutions for then the equipment and tools used for the training and the experience gained through the training are left behind as potential capacity for future. Two of the ongoing PhD candidates are locally registered at Makerere and UDSM; the latter is exemplary in that he will complete both the Masters and PhD with the support of LVEMP1. They both started late (2003) into project life.

All who registered for Masters with UDSM completed the training in two to three year periods, and all had a research component in their training. Still the riparian universities need to address the question of efficiency and time budget. Theses and dissertations are required to be read by external examiners. Some external examiners have taken over three months to give feedbacks and it is questionable whether all the feedback given has had significant and positive impact in improving the training.

In addition to formal training, there has been tremendous increase in knowledge on LB through involvement in research, conferences, seminars, meetings, field visits and local and overseas study tours that have involved all cadres from top level decision makers to data collectors at the local communities. The bulk of this capacity has a good to fair chance of involvement in future LB initiatives because the individuals involved are mostly either government employees or local residents who have now created much interest in the well being of the lake. Without these LVEMP1 inputs, such capacity would not have been realized.

The LVEMP1 improved infrastructure and working gear, thus enabling the conduct of research and the other conservation activities. Offices and laboratories were built and/or renovated at both the base and field stations. Land and water travel was much facilitated through provision of cars and water vessels. Laboratory equipment and chemicals were bought and used. Prior to the LVEMP1 inputs, research and monitoring were largely

stagnant and lake management highly handicapped. An exit plan could be developed that will ensure continued use and maintenance of these facilities.

Several other projects and programmes have addressed the Lake region. It is noted that LVEMP1 has had the biggest impact of them all, especially in building capacity of the local people. The LVEMP1 led into a sharp increase in the number of publications by the local individuals and institutions. It enabled marked cross-sector interaction and collaboration. Without the LVEMP1 initiative, the knowledge base, to-date, would have been much less and would have continued to be dominated by overseas ad hoc efforts.

A number of initiatives have taken place that impact on LB conservation but appear to have been unnoticed by the different actors. The notable example is the conservation efforts in Western Serengeti (which is actually Eastern LB) that are undertaken by the Wildlife Sector. Those involved on this seem to be unaware of the importance of the LB and the initiatives taking place at the LB. Likewise, the LB initiatives, including LVEMP1, seem to be unaware of the importance of activities taking place at the protected areas within the catchment. This gap could be bridged and the capacity on infrastructure, working gear, human resources, literature and overall work experience shared to the common good.

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Acronyms/Abbreviations

BMU: Beach Management Unit

CB: Capacity Building

CIFA: Committee for Inland Fisheries of Africa

CMUs: Conservation Management Units

DANIDA: Danish Development Agency

EA: East Africa

EU: European Union

FAO: Food and Agriculture Organisation

GEF: Global Environmental Facility

IDRC: International Development Research Centre

ILEC: International Lake Environment Committee

IPM: Integrated Pest Management

IUCN: World Conservation Union

K: Kenya

LANESCO: Lake Nyanza Environmental Sanitation

LB: Lake Basin

LLR: Lessons Learnt Report

LVEF: Lake Victoria Environmental Fund

LVEMP: Lake Victoria Environmental Management Project

LVFO: Lake Victoria Fisheries Organisation

NEMC: National Environmental Management Council

NORAD: Norwegian Development Agency

SADC: South African Development Community

SANAS: South African National Accreditation System

SIDA: Swedish International Development Agency

SRCS: Serengeti Regional Conservation Strategy

SUA: Sokoine University of Agriculture

TAFIRI: Tanzania Fisheries Research Institute

TANAPA: Tanzania National Parks

TAWIRI: Tanzania Wildlife Research Institute

TECCONILE: Technical Cooperation for the Promotion of Development and Environment Protection of the Nile Basin

TJS: Tanzania Journal of Science

TRC: Tanzania Railways Corporation

TZ: Tanzania

UDSM: University of Dar es Salaam

UG: Uganda

UK: United Kingdom

USA: United Republic of America

VICRES: Victoria Research

VPO: Vice President's Office

WD: Wildlife Division

WMO: World Meteorological Organisation

1. Introduction

1.1. General Introduction

Lake Victoria is important and crucial in many ways. It is the second largest in the world, it lies along the equator, it is in the interior of a most center continent of Africa, it stradles over three independent states, it has as its catchment the Serengeti ecosystem which is a most acclaimed piece of land globally, it is a main source of the longest river known, the Nile River that passes through the largest desert on earth, the Sahara Desert.

In recent years, there have arisen concerns on global warming for which the proportions of vegetated lands, forested lands, water bodies and bare lands are believed to be significant players in making warming adjustments. Conservation of main water bodies, including Lake Victoria, is therefore a main global concern.

There is a mutual positive relationship between Lake Victoria and the Serengeti Ecosystem. Much of the Serengeti Ecosystem has the high conservation status of National Park, the Serengeti National Park and surrounding Game Reserves, where much of the human activities are prohibited, including farming, settlement, clearing of vegetation and livestock grazing. The lake is therefore fed with water from this largely natural and protected environment, through the many seasonal and perennial rivers including Rivers Grumeti and Mara. While much of the other lands surrounding the lake are heavily populated and have the potential of increasing pollution to the lake, the Serengeti Ecosystem contributes positively as a catchment for fresh water into the lake.

In turn, the Serengeti Ecosystem might owe much of its status to Lake Victoria. The one thing that makes the Serengeti famous, attracting much tourism that has become a major source of income for Tanzania and Kenya, is the large herds of migratory ungulates there. These herds undertake round trip migrations North – West – South –East of the ecosystem, largely driven by annual precipitation that is lowest in the south-east and highest in the north-west. A look at the precipitation isoclines indicates that there could be significant influence from the lake (Fig. 1; Herlocker 1976, Campbell and Hoffer 1995, Yin *et al*. 2000, Phoon *et al*. 2004). By influencing spatial pattern of rainfall,

Lake Victoria indirectly influences the animal migrations and the subsequent tourism in the Serengeti

Lake Victoria influences the economy of many countries, riparian and beyond. Its influence on the precipitation of riparian lands has meant attraction and rapid increase of human populations and the accompanying activities interested in agriculture. The riparian communities have become main producers of some major crop products including cotton, tea and bananas. The area has also become a major source of cattle for neighbouring and distant cities. Over the years, the pressure on land has therefore been on the increase; population growth rate is among the highest in the world, and the area supports the economy of over two million people working in the fisheries industry and related activities (Anon 1996a).

Fisheries activities have attracted and created employment for many people from the Lake Region and all over the three countries. The annual fish catch can be as high as 500,000 metric tons, generating up to US$400 million and engaging an estimated two million people in direct fishing and related activities (Anon. 1996a). Fish from the lake is marketed and eaten within the Lake Region but a large proportion of it is increasingly being sold at the major cities in East Africa and neighbouring countries. Many tons are also exported overseas, thus earning riparian communities and countries the much needed foreign currency. Clearly it is of great importance that sustainability of the fisheries activities is addressed.

River Nile supports the livelihood and economy of an estimated 300 million people living within the 10 countries dependent on its water (Phoon *et al*. 2004). Some of these countries also happen to be traversed by the Sahara Desert, making water availability a very crucial issue there.

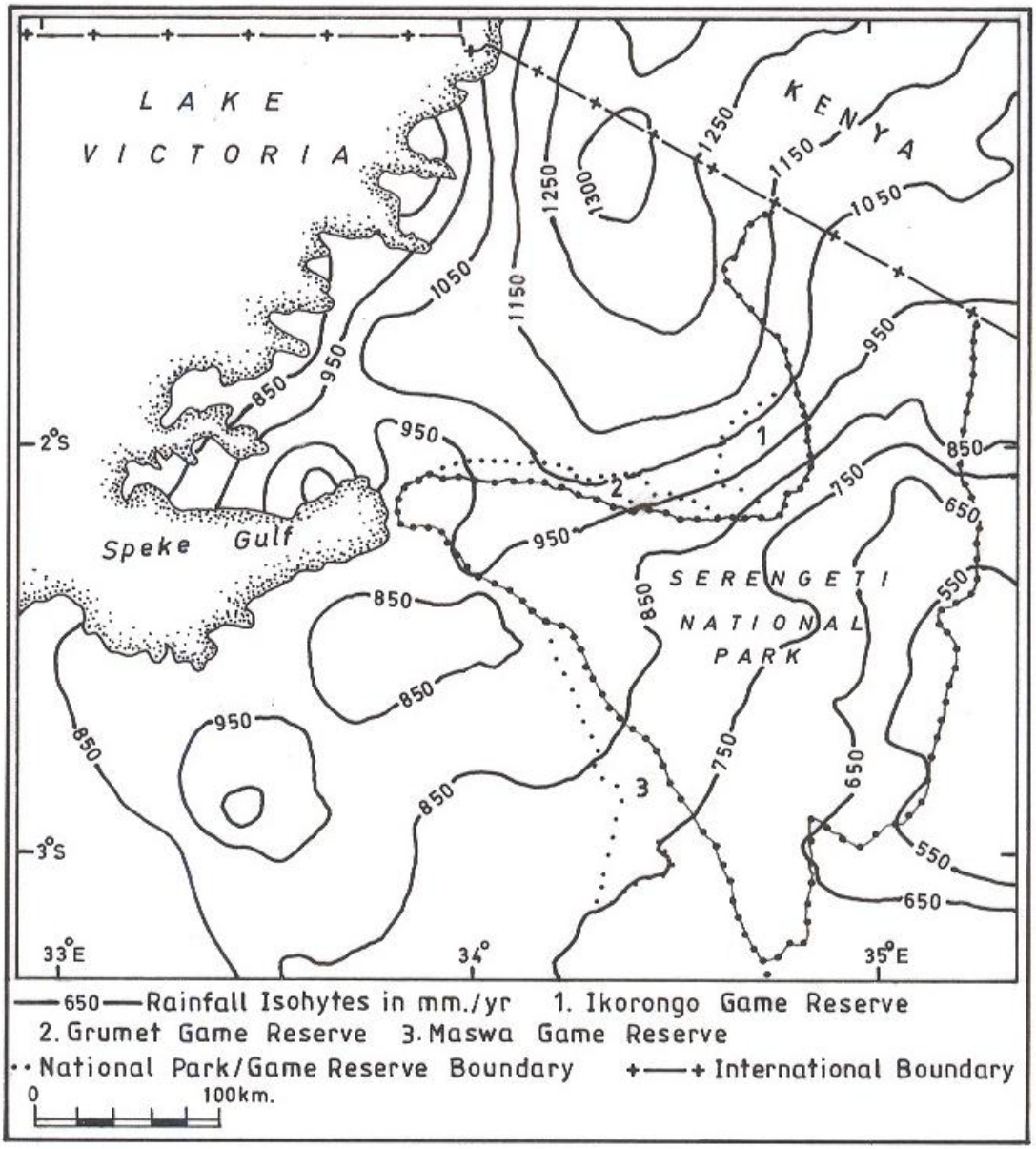

Figure 1: Map of rainfall isoclines between Lake Victoria and Serengeti National Park (modified from Herlocker 1977, Anon 1995).

Conservation of Lake Victoria therefore has many dimensions and calls for the interaction between riparian and other countries, multisectoral and multidiscipline involvement. It requires scientific, political and sociological considerations locally and globally. A very important undertaking towards achieving sustainable management of the Lake Region is training for awareness and understanding of the importance of the lake

and the delicate balance of forces operating there that need to be cautiously addressed in order to ensure its conservation, hereunder referred to as Capacity Building (CB). Without creating awareness and capability for concern, research and management, sustainability of the Lake Region cannot be expected. To this effect, a number of institutions and projects have undertaken training using Lake Victoria as a training ground. Currently, the Lake Victoria Environment Management Project (LVEMP) has eight years of operation there and has had CB as one of its major components.

The LVEMP is now ending its Phase I (LVEMP1) and it has been decided that a review on the way the project has handled the CB component be carried out with the objective of coming out with a Lessons Learnt Report (LLR) that would point out strong points, areas needing strengthening and suggestions for future action. The project has therefore sought a consultancy to prepare a LLR.

1.2. The Consultancy

The Support to Riparian Universities Component aimed at strengthening capacity in expertise and facilities for environmental analysis and graduate teaching; for Tanzania, the focal university is the University of Dar es Salaam (UDSM). In its eight years of existence, the project has implemented a number of activities in CB. Equipment has been bought, teaching has been conducted and research carried out facilitated by the project. Since the project is winding up its Phase I, it has been decided that a lessons learnt study be carried out to identify the achievements and failures of the project and suggest ways for remedy and alternative approaches that similar projects might take in order to minimize on the short falls. Vide a contract signed on 24th June 2005, the project engaged the present consultant to carry out the study and prepare and submit a LLR on CB. The present report covers CB across all the project components as explained in Section 1.3 below.

1.3 Terms of Reference

The Terms of Reference (ToR) provided in the contract for preparation and production of the LLR are as listed in Appendix 1. In discussions with the Project Secretariat and at the

inception workshop held in Mwanza (Tanzania), it was realized that CB under LVEMP1 did not just cover UDSM; rather, all the other components and various institutions underwent CB in the course of project implementation and that such CB should be covered by the present consultancy. The ToR were thus rephrased to read as listed hereunder.

1.3.1 To review the extent to which capacity building has been achieved through support by LVEMP1.

1.3.2 To review the approach that was used to achieve the above objectives.

1.3.3 To assess the impact of capacity building in relation to the Lake Basin environment, community livelihoods and stakeholder expectations.

1.3.4 To assess the sustainability of the support to components and institutions in terms of personnel, equipment, institutional set up and financial issues.

1.3.5 To assess the cost-benefit analysis of the support that has been extended per dollar invested.

1.3.6 To review problems encountered in the implementation of capacity building activities.

1.3.7 To list other capacity building programmes that addresses the Lake Basin.

1.3.8 To draw lessons of experience (both positive and negative) basing on the information given above.

1.3.9 To propose possible areas of emphasis that need to be continued/replicated or taken onboard in future capacity building initiatives.

1.4 Objectives

The support on CB had the following specific objectives:

1.4.1 To strengthen institutional capacity and thus enhance chances of continuity of the work of the project beyond project life.

1.4.2 To enable the university of Dar es Salaam and other implementing institutions to run upgrading and refresher courses.

1.4.3 To assist in solving local environmental problems in the Lake Basin (LB) through the theses research projects and other research projects.

1.4.4 To be able to train many staff at low cost through having the training done locally at the riparian universities instead of sending them overseas.

Since Phase I of the CB support is ending, LVEMP1 sought the present consultancy that would assist with the production of a LLR for CB across the project components. The project wished to review its approach in implementing CB activities, which review would provide background information that would guide the preparation of phase II project (LVEMP2).

2. Background to Capacity Building Component under LVEMP1

The Education system in Tanzania has a 7,4,2,3 (sometimes 4 or 5) structure. Nearly every Tanzanian attends the seven years of primary school. A few attend the four years of Ordinary Level secondary school and even fewer attend the two years of high school. Less than 1% chance to enroll at a university, where for most programmes the undergraduate training lasts three years. Most primary school graduates are expected to know Lake Victoria and its location. Geography is a compulsory subject at ordinary level secondary schools and graduates from this training are expected to know the location of Lake Victoria and some farming activities that take place there. The very few high school students who major in geography might be taught more on the activities inside and around the lake. For any one year, less than 50 university level students have majored in geography and environmental related subjects that might give them an even deeper understanding of the Lake Victoria and the Lake Basin (LB), mostly in the way of examples. A few ordinary level and high school graduates have also trained for certificate and diploma awards in fisheries at the two Mbegani and Nyegezi technical institutes. These conduct practical training in Lake Victoria.

Thus in all, it can be said that, for most Tanzanians, awareness and knowledge on the importance and delicate nature of Lake Victoria and its basin has not been sufficient as to guarantee the deserved level of concern for and/or sustainable management. Capacity Building at the levels of awareness, middle level training and management and research

are strongly called for. It is in this sense that LVEMP1 undertook CB at the various level of awareness, research, monitoring and management.

Prior to the LVEMP1 the main participants in research and management of Lake Victoria have been the Fisheries Division of the ministry responsible for natural resources and the Tanzania Fisheries Research Institute (TAFIRI), largely through its Mwanza Center. Other institutions and individuals have done research and other conservation activities that might enhance conservation of the Lake Victoria and the LB but largely on adhoc basis (see section 4.3 on list of the other programmes). The main constraints in carrying out research, management and other conservation activities have included shortage of manpower, equipment and infrastructure. The present review therefore looks at the achievements made at the various participating institutions and project components since the inception of the LVEMP1. Section 5 of this review points out the lessons that we might learn in implementing the project while section 6 provides some recommendations for future plans.

3. Approach and Methodology

3.1 General

In carrying out the study, the consultant conducted deskwork review of the existing information, conducted interviews and made field verification of the information acquired from the deskwork. The consultant participated in initial meetings that brought together the various players in the LVEMP1 and that provided inception information to the impending LLR exercise. An inception report was prepared followed by a draft report presented at the National Workshop on 11th – 12th August 2005 in Mwanza, Tanzania. Using the comments and suggestions made at the workshop and by component coordinators and other key personnel the draft report was reviewed and the present final report written.

3.2 Desk work

The consultant reviewed documents at the LVEMP Headquarters in Dar es Salaam, Department of Zoology and Marine Biology (UDSM) and Faculty of Aquatic Sciences and Technology (UDSM) that include research reports, theses, proceedings of workshops and other meetings and contracts signed between UDSM and LVEMP. Questionnaires targeting the various participations that relate to capacity building were developed.

3.3 Questionnaire administration

Structured questionnaires targeting component coordinators and students sponsored by LVEMP1 were administered. Discussions were held with individuals who participated in the project. Individuals interviewed come from the following institutions: UDSM (Faculty of Aquatic Sciences and Technology, Department of Zoology and Wildlife Conservation, Faculty of Mechanical and Chemical Engineering, Faculty of Civil Engineering and the Built Environment, Economic Resource Bureau, Tanzania Fisheries Research Institute (Dar es Salaam Head Office, Dar es Salaam and Mwanza Centres), Fisheries Division (Head Office and Nyegezi Fisheries Training Institute) and LVEMP1 (Secretariat and Components).

4. Findings

LVEMP set out to build capacity in the two broad areas of human resources and physical facilities including infrastructure, tools and equipment. Ten major components and sub components were covered (Table 1). The project registered varying achievements between components and through time as detailed below.

4.1 Human Resources

4.1.1 PhD Training

During the eight years seven professionals have been trained at the PhD level at various universities around the world. By year 2001, six were on this training (Nanai and Nyirabu 2001), and of these one dropped out one year into the training. The additional two suggests that LVEMP1 extension period (2003-2005) created the opportunity to train

even at the PhD level. In all cases, the research part of the training was conducted at the lake. Research and training areas reflected the component through which training was conducted (Table 2). The research topics for PhD theses or dissertations were of a rather general nature suggesting that baseline data was still a main requirement of LB even though substantial research had already been done as indicated below in section 4.1.8.

Table 1. Coding for the different LVEMP1 components and type of the implementing institutions.

Code	**Component**	**Type of lead implementing institution**
1	Fisheries Management	Ministry of Natural Resources and Tourism (Fisheries Division)
2	Fisheries Research	Tanzania Fisheries Research Institute
3	Water Quality and Ecosystem Management	Ministry of Water and Livestock
4	Wetland Management	NEMC
5	Catchment Afforestation	Ministry of Natural Resources and Tourism (Forestry and Beekeeping Division)
6	Soil and Water Conservation	Ministry of Agriculture
7	Water Hyacinth Control	Ministry of Agriculture
8	Support to Riparian University	University of Dar es Salaam
9	Community Participation	Secretariat, LVEMP1
10	Microprojects	National Secretariat, LVEMP1

At least one PhD candidate (component 8) absconded after being enrolled for about one year. He was to conduct research on a microbiology topic (*Biological treatment of waste water from industrial fish processing plants for nutrients removal*) that would have had direct relevance to the water and fisheries quality studies. The youngest was 35 years old and the oldest was 48 years old (refer Yhdego *et al*. 2001). This suggests potential for post training service of between five and 24 years assuming the retirement age of 60 years.

4.1.2 Masters Training

Over the eight years of LVEMP1, the project supported the training of 30 people through the various components (Table 3). By May 2001, 24 were undertaking Masters training (Nanai and Nyirabu 2001); the additional six, to-date, indicates that the extension period of LVEMP1 (2003-2005) created a window for more training. For the training programmes that had a research component, field studies were conducted at the Lake. Some training programmes had a research component while others did not; this appears to have depended on choice of component personnel.

4.1.3 Training for Diploma and short courses

This training was conducted at various places and durations; the number trained also varied between components (Table 4).

Table 2. Doctorate (PhD) research studies under LVEMP1 support.

Trainee (and Component*)	**Research Topic**	**Comment**
GC Mahika (2) M	Nutrition of tilapia *Oreochromis variabilis* (Boulenger, 1906) and the cat fish *Clarias gariepinus* (Butchell, 1915) juveniles using locally available feed ingredients.	A relevant applied study to the lake situation. Topic of rather general nature thus failing to address the *why* question. UK, COMPLETED
S Mwaiko (2) F	Origins of haplochromine cichlid superflock and monophyly of small lakes in Lake Victoria basin	UK, ONGOING. She has taken rather long to finish the studies. There is fear this might be another case of abscondment.
J Rwetabula(3) M	Modeling of pest sites in Simiyu Catchment	An applied study of much relevance to the lake catchment. BELGIUM, NEARING END.
F Katagira (6) F	Could not be obtained	UGANDA, ONGOING.
R Tamatamah (8) M	None point source loading of phosphorus to Lake Victoria from the atmosphere and rural catchment in Tanzania, East Africa.	A well done study, very applied and relevant to the lake. Topic rather general, thus the study fails to cover the *why* question. CANADA, COMPLETED
B Benno (8) M	Movement, fisheries and habitat use of *Labeo victorianus* in Lake Victoria, Tanzania.	An applied study of relevance to the fisheries and biodiversity of the lake. Topic rather broad and study fails to cover the *why* question. . CANADA, COMPLETED
C Mwita (8) M	Determinants of the parasite community structure of clariid fish species from Lake Victoria.	Depending on how the determinants part is researched, the study might turn out to produce empirical evidence for driving forces behind identified parasite community structure. TANZANIA, ONGOING. Candidate proceeded with the PhD upon finishing the MSc also under LVEMP1 sponsorship and in Tanzania.

* Refer Table 1. M = Male F = Female

Table 3. Masters training supported by LVEMP1.

Trainee (*component) and gender	**Area of specialization and/or Research topic**	**Comment**
M Kishe (2)F	Some aspects of heavy metal pollution in Mwanza gulf, Lake Victoria.	Relevant applied topic. Study well done. Title needed more forcusing to indicate the aspects. TANZANIA. COMPLETED.
A Shoko (2)M	Some aspects of nutrition and growth of *Oreochromis variabilis* (Boulenger, 1906) under aquaculture conditions.	Relevant applied study. Title needed tightening to indicate the aspects. Notice overlap with one PhD study above. TANZANIA. COMPLETED.
M Musiba (2)F	Studies on the life history of *Diplostonum (T) mashonense* Beverly Burton, 1963 (Trematoda: Diplostomatidae) in the Mwanza Gulf, Lake Victoria.	An applied study to the lake fisheries. Title needed tightening to indicate the studies. TANZANIA. COMPLETED.
B Msuku (2)M	Some aspects of the population ecology of *Oreochromis esculentus* (Graham, 1929) in Malimbe satellite lake, Lake Victoria basin.	A relevant study to the lake fisheries. Title needed tightening to indicate the aspects studied. UGANDA. COMPLETED.
E. Mutagwaba (1)M	Food Science	One year MSc training, no research. UK. COMPLETED.
E. Mosha (1)M	Food Science	One year MSc training, no research. UK. COMPLETED.
R. Mbilinyi (1)F	Fisheries Management	One year MSc training, no research. UK. COMPLETED
B. Mugulwi (1)M	Fisheries Policy and Planning	One year MSc training, no research.

		UK. COMPLETED.
E. Ngowi (1)	Environmental Policy and Management	One year MSc training, no research. UK. COMPLETED.
L. Mongo (1)M	Fisheries Management	One year MSc training, no research.
S. Lukanga (1)M	Food Science	UK. COMPLETED.
		One year MSc training, no research. UK. COMPLETED.
D. Kabingile (5)	Conservation and Natural Resources Management	Relevant training; dissertation topic not provided. TANZANIA. COMPLETED.
A Kiwale (5)	Analysis of social economic determinants of afforestation and its impact in semiarid areas: a case study of Magu District	Relevant training and area of research. TANZANIA. COMPLETED.
S. Matowo (3)M	Water quality Management	MSc by coursework; no research. UK. COMPLETED but quit working with LVEMP1.
M. Athumani (3)	Environmental Science and Technology	MSc by coursework; no research. UK. COMPLETED
O. Mnyanza (3)M	Water Resources Management	MSc by coursework; no research. UK. COMPLETED
P. Mawalla (3)M	Water Quality Management	MSc by coursework; no research. UK. COMPLETED
H Faraji (3)M	Water Resources Management	MSc by coursework; no research.

S Mwita (3)		UK. COMPLETED
P Buretta (3)	Water and Environmental Engineering	MSc by coursework; no research. UK. COMPLETED
D Rutagemwa (3)M	Engineering studies	MSc by coursework; no research. NETHERLANDS. COMPLETED
Zena (3)F	Laboratory Technology	MSc by coursework, no research. UK. COMPLETED but DID NOT REPORT BACK.
V Makota (4)M	GIS and Remote Sensing (1 year)	MSc by coursework, no research. Very applied study, useful in mapping of wetlands and other lake and catchment areas for all components. UK. COMPLETED.
J Kitandu (7)	Environmental Protection and Management.	COMPLETED.
J. Lugayila (7)	‘’	COMPLETED.
J. Kiboya (7)	“	COMPLETED.
M. Chacha (8)M	Abundance and diversity of parasite species in *Clarias gariepinus* from the Mwanza Gulf.	Relevant study. TANZANIA. COMPLETED.

* Refer to table 1. M = Male F = Female

Table 4. Size and places of the various types of training for the different LVEMP1 components.

Type of course	**Places of training**	**Number trained**	**Duration**	**Component* (and number)**
Diploma	UK	6	Not obtained	3(6)
Management	Europe, UK, TZ.	35	3 – 12 weeks	2(1),5(1), 1(32),4(1),
Taxonomy	TZ, UG	5	1-3 weeks	2(5),
Computer	TZ	79	1 – 8 weeks	1(39),2(10),5(9), 3(21),
Librarianship	TZ	2	1 year	2(2),
Fish Ecology (Survival strategies)	USA	1	8 weeks	2(1),
Statistics and Statistical Package (SAS)	TZ	6	2 weeks – 1 year	2(5),1(1).
Tropical Forestry	UK	1	9 weeks	5(1),
Wetland management and modeling	K, Europe	5+	6 weeks - 2 months	4(5),
**Study tours	TZ,K,UG,Senegal, USA, Canada, Philipines, West Somoa)	59+	1-6 weeks	2(2), 3(7), 1(52), 4(1)
Food quality and analysis	TZ	6	5 days – 6 weeks	1(6),
Fish quality	UK	2	12 weeks	1(2),
Aquaculture	TZ	21	4 weeks	1(21),
Pest control	UK, Australia	2	2 – 8 weeks	6(1),7(1),
Visual aids	TZ	4	4 weeks	1(4),
Public Prosecution	TZ (Mzumbe)	13	3 months	1(13),
Data collection (BMUs)	TZ	22	5 days	1(22),
Good Laboratory Practice	TZ	14	7 days	1(14),
Laboratory procedures, quality assurance and quality management	Europe	4	?(3)	3(4)
Workshops, Seminars, Conferences	TZ	Several	Few days	1,6 and 7(several each)

*Component/subcomponent coding as in Table 1. One participant died. **Other study tours took place than the present study could identify.

4.1.4 Potential for retention of capacity and future involvement with the research, monitoring and management activities of Lake Victoria.

The majority of LVEMP1 personnel will remain in their present parent institutions and thus constitute a reserve of capacity for future LB initiatives (Appendix 2).

4.1.5 Capacity on awareness and low level skills gained through working with LVEMP1

All individuals involved in the project have participated in one or all of the following: seminars, workshops, project meetings, study tours and field visits. In carrying out their daily activities, project personnel met several times, attended seminars and workshops and traveled much inside and around the lake. Each individual interviewed indicated tremendous increase in knowledge, interest, concern and overall internalization of Lake Victoria, its size and coverage, its importance and the dangers it faces. Participants have ranged from top level decision makers, researchers, secretaries, drivers to village level local data collectors and have come from all over Tanzania (Appendices 2 and 5).

4.1.6 Capacity building for take-over at the levels of extension and local communities

Present day conservation efforts recognize the importance of grassroots involvement for sustainability and minimisation of costs. Components of LVEMP1 involved extension personnel and local communities in various ways and to different extents dictated by the inherent requirements of each component as indicated below in Table 5.

4.1.7 Publications

Publications indicate human capacity at the highest technical and professional levels. A number of posters, brochures, research reports and theses/dissertations, seminar proceedings and even journal publications were realized through LVEMP1 and at different magnitudes and trends between the components through the age of the project as indicated below (Table 6). Technical and research reports and conference and workshop proceedings have dominated the list of publications.

Table 5. Involvement of district and extension workers and local communities in LVEMP1 activities.

Component/ Subcomponent	**Involvement at District, Extension and Local Communities**	**Comment**
Fisheries Management	Thirteen District Fisheries Officers have been trained for facilitating the preparation of relevant documents for fisheries cases and possible participation in the prosecution of fisheries cases in the court of law especially at the primary marts. Training was provided to fishers (especially at the BMUs) on beach hygiene and sanitation. Training was also provided to BMUs on collection of data such as weight and length. Basic aquaculture practices on fish farming were also taught to fish farmers. Many Fisher Communities have had awareness raised to the level of appreciating problems caused by illegal fishing and are participating in law enforcement.	Involvement has facilitated the formation of Beach Management Units (BMUs) at all landing sites (Hoza and Mahatane 2001; Anon 2005). It is important to identify those that are still active and revive the less active ones. Exit plans need to be strengthened and tested.
Fisheries Research	The component involved District Fisheries Officers and Extension Staff during planning and on aquaculture, socio-economics and formation of Conservation Management Units (CMUs) at the satellite Lakes. Local communities were trained in the raring of Nile Tilapia and on artificial spawning of *Clarias* species.	Although this is a strongly professional area, efforts to involve extension workers and the local people should be continued and strengthened.
Water Quality and ecosystem Management	Local primary and secondary schools have been involved and they have showed	This has been a strongly technical/professional area. Monitoring protocols need to be identified and for aspects where local people

	interest to participate in data collection. Involvement of local villagers has proved difficult owing the technical nature of equipment used.	and/or extension district level officers can be used they should be identified and their training conducted and exit plans be made.
Wetland Management	Training and use of data collectors on water birds has been an important undertaking.	Need to link up more with water quality component on role of wetlands in sequestration. Exit plans to be developed and tested.
Catchment afforestation	The component is working with District Forest Officers. Communities are involved in implementation of project activities, they are the ones conducting the day to day project activities. Much sensitization is needed to convince people especially because trees take long to grow to harvest time and therefore benefits of engagement are not quickly realized. An attempt to start commercial tree nurseries did not materialize because people were not much willing to spend their little earnings to purchase tree seedlings.	Consider conserving natural forests instead of planting new trees.
Soil and Water Conservation	Extension workers and representatives of local communities have participated in study visits, workshops, seminars and short courses on the various soil and water conservation areas. This has created much awareness, interest and commitment.	The component registered low interest and adherence to recommended practices as stated in Mahuha (2001). This need to be followed since agricultural activities have siltation impact into the lake (Lyaruu and Eliapenda 2001). The handy brochures thus far produced (section G below) is considered to constitute a good starting point.
Water Hyacinth Control	45 data collectors trained for two weeks. Weevils Raring Units Attendants trained and in place at 14 units	Data collectors trained for wetland birds seem to be interested and might be sustainable with minimum facilitation such as provision of motor bike or bicycle transport. Exit plan for one unit did not work well perhaps because the

		attendants felt being cheated as the project was still vividly present.
Support to Riparian University	As for Fisheries Research Component	Theses and research results could be written into smaller booklets and translated into Kiswahili to enable wider circulation and readership and posting into the LVEMP Website. The initiative taken by the Fisheries Research Component to summarize the information and publish same in the Nyanza Review Newsletter is a good start point.
Community Participation	Nanai and Nyirabu (2001) have summerised the involvement of the various LVEMP1 components in CB at the community level (Appendix 5).	As stated for the other components, exit plans need to be enhanced and tested perhaps using the proposed mechanism to facilitate community participation (Appendix 6).
Micro-projects	By 2001, some 54 projects were commissioned in 12 administrative districts benefiting about 300,000 people (Mbwana 2001). These have acted as a catalyst in appreciating the importance of LVEMP1 and environmental conservation. All the local people interviewed indicated that the microprojects created an interest to listen and participate in the other LVEMP1 activities.	The efforts to transfer management and administration of the microprojects to the local governments could be strengthened and exit plans developed and tested in impending LB initiatives. It is also important to inculcate the sense of ownership and self drive through encouragement for initiation of similar and/or different projects.

Table 6. The LVEMP1 Publications on Lake Victoria through time and across the different components*

Type of publication	**Year**									
	1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**Total**
a) Posters, Brochures, Leaflets, Directories, Articles in Newsletters and Documentaries	0	0	0	0	2(2)	0	0	0	0	8(2){6 undated}, 13(6) {undated}
b) Technical and Research Reports, Theses and Dissertations	2(1) 1(2)	7(1) 10(2) 3(3)	2(1) 4(2) 5(3)	3(1) 16(2) 5(3) 3(4)	5(2) 7(2) 12(3) 1(4)	1(1) 3(2) 3(3) 1(4)	6(1) 2(2) 1(3)	1(2)	0	26(1) 54(2) {10 undated} 29(3) 10(4) {5 undated}13 (4) {undated}
c) Workshop and Conference Proceedings	2(2)	1(1) 4(2)	1(2) 1(3)	1(1) 2(2) 1(3)	1(2) 3(3)	1(3)	2(1) 22(2)	0	33(2) {1undated}	65(2) 3(1) 6(3)
d) Journal publications	0	0	0	0	0	0	0	+16(2) +4(8)	1(8) 3++ (8)	16(2) 8(8)
Total	**5**	**25**	**13**	**31**	**31**	**9**	**33**	**21**	**37**	

* Refer to table 1. +Special issue on Lake Victoria. ++ Under Review in TJS

e) Books and booklets

Component	**Title**	**Comment**
Fisheries management	Anon. 2005a. Operational Mannual for Community Based Fisheries Collaborative Management (Co-Management) in Tanzania. LVEMP/VPO, Dar es Salaam. 28pp	A handy Operations Manual Giving origin and protocols for BMUs.
Fisheries Research	Bwathondi et al. 2001. The Status of Aquaculture Development in the Lake Victoria Catchment Area. Mahongo SB, Chande IA and Katunzi EFB (Eds) (undated). Biodiversity of Lake Victoria: its conservation and	Not made available.

	sustainable use. Mahongo SB, Chande AI and Katunzi EFB (eds) (*undated*). The Biology and ecology of Lake Victoria fishes: Their development and management.	The two draft books are being upgraded into regional books edited by PMB Kasoma and DAA Obudha respectively. They should be important reading material at the Universities and other academic training Institutes and for researchers as well.
Water quality and Ecosystem Management		
Wetland Management		
Catchment Afforestation	Uanzishwaji wa bustani miti na upandaji miti	A handy booklet in Kiswahili on tree nassaries and tree planting.
Soils and Water Conservation	Anon. 2004. Mbinu za kuzuia mmomonyoko wa udongo shambani kwa wakulima wadogo wadogo. LVEMP/VPO, Dar es Salaam. 23pp Anon. 2004. Matumizi Sahihi ya Madawa ya Kilimo. LVEMP/VPO, Dar es Salaam. 24pp Anon. Three undated booklets titled: Botanicals for tomatoes, Botanical for Cabbages, Botanicals for Onion	A handy operations manual on prevention of soil erosion in farming. A good guide booklet on use of agrochemicals to minimize spread to unintended places. Not made available
Support to Riparian University	None.	Theses could be compressed into booklets and also translated into Kiswahili for wider readership.
Secretariat/consultancies	Anon. Lake Victoria Environmental Management Project. 16pp	A handy booklets explaining the project and providing a reader friendly summary on Lake Victoria basic issues.

4.1.8 Capacity Building through other projects

Other programmes and agencies have conducted work on Lake Victoria and enabled the participation from Tanzania and East Africa to varying extents through time (Table 7 a-e). There has been a noticeable increase in the number of publications from East Africa when LVEMP1 support came in indicating that capacity for research has been enhanced.

Table 7 a – e. The amount of support from LVEMP1 and other sources and the resulting publications on Lake Victoria. (source:Anon 2005b and http://www.lvemp.org/L_Publications/tanzania/Bibliography__fishbiology.htm also _hydrology.htm, _aquaculture.htm, *env*pollution.htm, _limnology.htm)

a) Fish Biology and Biodiversity

Year	**LVEMP1support**	**Other support**	***Publications by Tanzanians**	***Publications by other East Africans**	***Publications by others**
Up to 1991	-	111+	11+	57+	44+
1991	-	26	3	14	9
1992	-	25	3	15	12
1993	-	12	3	2	7
1994	-	30	3	17	9
1995	-	40	5	10	27
1996	-	22	2	3	15
1997	-	26	0	3	23
1998	2	11	3	1	9
1999	2	7	5	1	3
2000	46	3	8	26	15
2001	15	0	10	4	1
2002	-	-	-	-	-
Up to '91	-	111+	11+	57+	44+
Total	65	313+	56+	153+	174+
91 – 01	65	202	45	96	130
97 – 01	65	47	26	35	51
00 – 01	61	3	18	30	16

+ counted to only about $^{1}/_{3}$ of the publications

b) Limnology, Ecology and Wetland Ecosystems

Year	**LVEMP1support**	**Other support**	***Publications by Tanzanians**	***Publications by other East Africans**	***Publications by others**
Up to 1991	-	4	1	1	2
1991	-	0	0	0	0
1992	-	2	0	1	1
1993	-	2	1	0	1
1994	-	1	0	0	1
1995	-	0	0	0	0
1996	-	2	0	1	1
1997	-	1	0	0	1
1998	0	0	0	0	0
1999	0	0	0	0	0
2000	9	0	2	5	2
2001	1	0	0	1	0
2002	-	-	-	-	-
Up to ‘91	-	4	1	1	2
Total	10	12	4	9	9
91 – 01	10	8	3	8	7
97 – 01	10	1	2	6	3
00 – 01	10	0	2	6	2

c) Environmental Pollution

Year	**LVEMP1 support**	**Other support**	***Publications by Tanzanians**	***Publications by other East Africans**	***Publications by others**
Up to 1991	-	24	1	10	13
1991	-	1	0	1	0
1992	-	3	0	1	2
1993	-	2	0	0	2
1994	-	7	4	0	3
1995	-	7	3	1	3
1996	-	7	2	2	3
1997	-	8	0	4	4
1998	0	3	1	0	2
1999	0	0	0	1	0
2000	18	2	1	12	7

2001	15	0	5	11	0
2002	-	-	-	-	-
Up to '91	-	24	1	10	13
Total	34	64	17	43	39
91 – 01	34	40	16	33	26
97 – 01	34	13	7	28	13
00 – 01	33	2	6	23	7

d) Aquaculture

Year	**LVEMP1 support**	**Other support**	***Publications by Tanzanians**	***Publications by other East Africans**	***Publications by others**
Up to 1991	-	11	1	3	7
1991	-	0	0	0	0
1992	-	0	0	0	0
1993	-	1	1	0	0
1994	-	1	0	1	0
1995	-	0	0	0	0
1996	-	0	0	0	0
1997	-	1	1	0	1
1998	0	1	1	0	0
1999	0	0	0	0	0
2000	5	0	1	3	1
2001	5	0	2	3	0
2002	-	-	-	-	-
Up to '91	-	11	1	3	7
Total	11	15	7	10	9
91 – 01	11	4	6	7	2
97 – 01	11	2	5	6	1
00 – 01	10	0	3	6	1

e) Hdrology, Geology and Climate

Year	LVEMP1 support	Other support	*Publications by Tanzanians	*Publications by other East Africans	*Publications by others
Up to 1991	-	18	0	5	13
1991	-	0	0	0	0
1992	-	1	0	1	0
1993	-	0	0	0	0
1994	-	3	1	1	1
1995	-	1	0	1	0
1996	-	3	0	1	2
1997	-	3	0	0	5
1998	0	0	0	0	0
1999	0	0	0	0	0
2000	4	0	0	1	3
2001	2	0	0	2	0
2002	-	-	-	-	-
Up to '91	-	18	0	5	13
Total	8	29	1	11	22
91 – 01	8	11	1	6	9
97 – 01	8	3	0	3	3
00 – 01	6	0	0	3	3

*As evidenced from senior authors and/or copyright and/or host institution. -Not applicable

4.2 Infrastructure, Equipment and Tools

The project supported construction and renovation of various buildings and structures including offices, research laboratories and field research plots. The project also provided various equipments as indicated below.

4.2.1 Infrastructure

Most components used existing buildings belonging to the ministries under which the various implementing institutions belonged. The bulk of LVEMP1 funding in this aspect went into renovation of the buildings and offices most of which were in bad state (Table 8).

4.2.2 Equipment and Tools

The LVEMP1 secured an assortment of equipment and tools that varied between components in numbers and type depending on specific component objectives as exemplified by the Fisheries Management and Catchment Afforestation components (Table 9). Component Coordinators and other project personnel interviewed indicated satisfaction on sufficiency of equipment and tools, serve for the isolated observations that some components were better facilitated than others. For example, the Fisheries Management Component had nine (9) cars while the Catchment Afforestation Component had only two (2) (Table 9). This difference might have depended on a number of factors including lack of a balanced detailed needs assessment at the project inception time and capacity to absorb certain working gear given the manpower and infrastructure on hand for the different components.

At the time of the present study, equipment was still being ordered. The Fisheries Management Component was expecting a Gas Liquid Chromatography for the laboratory at Mwanza, and the Water Quality Component had ordered an Atomic Absorption Spectrophotometer.

Table 8. Sample of the infrastructure constructed or renovated by LVEMP for use by its various components

Component	Renovations	Constructions	Comment
Fisheries Management	None	Four floating barges for fish handling.	Use of floating barges has improved speed for handling fish and impacted much on the overall hygiene in fish processing.
Fisheries Research	Offices renovated at the Mwanza Fisheries Research Centre.	1 Hatchery building, 10 fish ponds	Had requested to have Museum built but failed on account of procurement procedures, still needed. Only one fish pond is currently used. Ponds were also used for experiments by the PhD and MSc research students.
Water Quality and Ecosystem Management	Offices rehabilitated	Three laboratories built at Mwanza, Musoma and Bukoba. Constructed wetlands for research on water purification using macrophytes.	The Bukoba Laboratory was damaged by Elnino and needs reconstruction. Consider prioritization and possibility of having only one good laboratory.
Wetland Management	Offices renovated at Mwanza and Musoma	One hectare demonstration plot fenced and maintained	Consider prioritization; the office at Musoma was used for only a short period.
Catchment afforestation		1 office block, 6 surface-run-off monitoring plots; 3 in protected area and 3 in the open area. 60 permanent sample plots in the forest reserve and 65 in the open are for monitoring vegetation change.	Consider establishment of more research and monitoring facilities/plots in the other catchment areas around the lake. Harmonise requirements with soils and water conservation component.
Soil and water Conservation	Using building belonging to Ministry for Agriculture;	None	Consider harmonizing requirements with water quality and catchment afforestation components

	renovated offices.		
Water Hyacinth Control	Using building belonging to Ministry for Agriculture, renovated offices	14 units for raring water hyacinth weevils	
Support to Riparian University		Has requested for a research station in Mwanza.	The request for a research station in Mwanza to be carefully considered alongside existence of fish quality laboratory at Nyegezi and the request for a museum at to Mwanza TAFIRI centre
Community participation and Microprojects.		88 microprojects were completed and included schools, dispensaries, water and sanitation facilities and road construction.	Microprojects have stimulated and encouraged the local communities to participate in LB conservation activities.
Secretariat			

Table 9. List of equipment categories bought for the Fisheries Management and Catchment Afforestation components.

Type of Equipment	**Fisheries Management**	**Cost US$/TShs**	**Catchment Afforestation**	**Cost US$**
Motor Vehicles	9	US$147,921.18	2	30,166.14
Motorcyces	15	US$44,550.0.	5	14,850.00
Boats and dingies	9	US$40,661.13	Nil	Nil
Outboard engines	6	US$7,625.28	Nil	Nil
Computers	4	US$11,465.41	3	8,178.51
Printers	3	US$6,642.94	1	2,032.80
Scanners	2	US$8,888.53 and 28,793,050/=	Nil	Nil
Other computer accessories	11	US$4,761.12 and 735,000/=	7	1,351.16
Calculators	Nil	Nil	3	12.00
Laboratory and Field Equipment	27	355,945,238/=	221	1,508.70
Topographic Map sheets	Nil	Nil	45	180.00
Chemicals (batches)	4	14,685,557/=	Nil	Nil
Stationery (batches)	6	10,637,290/=	Nil	Nil
Furniture (butches)	1	3,755,200/=		
Telephone sets and Satellite Dish	2	3,699,406/=		
Other Office equipment			30	123.2
Others not priced (2 tents, 1 type writer, 1 fax machine, 1 photocopier, 1 village map,	nil	Nil	6	-
TOTAL		**US$272,515.59 and TShs 418,250,741.00**		**US$58,402.51**

4.3 Other Capacity Building Programmes that address the Lake Basin

Several programmes and/or organizations have addressed the LB by building capacity in areas of human, infrastructure, equipment and others. Below is a list of some of those programmes/organizations that have had such contribution in recent times. The list includes those that have worked in the LB and catchment but without necessarily having the Lake in mind and at times even at the detriment of the Lake, albeit unintentionally.

- International Development Research Centre (IDRC): *On small Scale Fishing and Fish Commodity Systems*
- Food and Agriculture Organisation (FAO) (of the United Nations):
- European Union (EU): *on Fishing Communities*
- Global Environmental Facility (GEF): *Which facilitated by providing seed money at the initial stages of preparing LVEMP1*
- Integrated Pest Management (IPM): *Which carries out pest control activities throughout the country, including the Lake Region*
- Lake Victoria Fisheries Organisation (LVFO): *an EA coordinating Body on Fisheries Acttivities; Largely taking over from CIFA (Committee for Inland Fisheries of Africa)*
- MacArthur Foundation: *on Economic Impacts of Changes in Lake Fisheries*
- Swedish International Development Agency (SIDA): *Which has funded the Lake Victoria Research Programme (VICRES)*
- University of Zurich (Switzerland): *on Management of Ecotones*
- Tanzania Fisheries Research Institute (TAFIRI): *the National Institute Responsible for Fisheries Research that has a Research Centre at Mwanza*
- Technical Cooperation for the Promotion of Development and Environment Protection of the Nile Basin (TECCONILE): *Which undertakes activities aimed at sustainable management of River Nile*
- World Meteorological Organisation (WMO): *contributed in developing the initial Lake Victoria Water Quality Model*
- World Conservation Union (IUCN): *has provided technical assistance to SRCS and other initiatives in the region*

- Serengeti Regional Conservation Strategy (SRCS): *on conservation issues of the Serengeti Region, covering eastern parts on LB*
- Tanzania Wildlife Research Institute (TAWIRI): *the National Institute responsible for wildlife research and has a Research Centre in Serengeti*
- Human- Wildlife Interface in Western Serengeti: *a NORAD funded project run jointly by UDSM and TAWIRI looking at interactions between humans and wildlife conservation in Western Serengeti including parts of the LB*
- Tanzania National Parks (TANAPA): *that manages Serengeti and Rubondo Island National Parks*
- Wildlife Division (WD): *that manages Ikorongo, Grumeti, Kijereshi and Maswa Game Reserves*
- Norwegian Development Agency? (NORAD): *that has funded the SRCS and Human-Wildlife Interface projects in western Serengeti*
- International Lake Environment Committee (ILEC): a*n international Body that has had World Lake Conferences, the 11th to be held in Nairobi at the end of 2005*
- Lake Nyanza Environmental Sanitation (LANESCO): *which is involved in the control of water hyacinth*

5. Lessons Learnt

5.1 Human Resources

5.1.1 Overall

Through LVEMP1, several people trained formally and informally and at various levels and areas of specialization. There was formal training for PhD, Masters, Diploma and undergraduate field attachments. There was on the job (project) learning through short courses, study tours, seminars, workshops, other meetings, field visits and various forms of discussions and interactions involving the whole hierarchy from top level project management personnel to drivers and office attendants. In all cases, appreciable experience, knowledge, interest and concern on Lake Victoria and its catchment was registered.

An important observation resulting from this sample study is that the bulk of Tanzanians have not had the chance to appreciate the important role that Lake Victoria plays. The people who have had the chance to work with LVEMP1 indicated a change in their knowledge of the Lake of over 80%. It is important that awareness is built through various ways including the media. It is suggested that a component on great lakes be included in the school curricula at all levels from primary schools, secondary schools, relevant certificate and diploma level programmes and university level programmes which address environmental and related studies.

Another important lesson is that an enabling environment had been lacking all along. The LVEMP1 has provided an enabling environment for work and capacity building for Lake Victoria. Although there was some manpower and infrastructure at the implementing institutions, such was heavily handicapped by lack of finances that would facilitate work, travel, acquisition of tools and equipment and rehabilitation of infrastructure. Prior to LVEMP1, the manpower can be said to have been largely stagnant and/or less aware of the lake issues.

It is suggested to identify the minimum enabling environment that will have the manpower and institutions, and especially the individuals and institutions that have been involved in LVEMP1 (work, research, monitoring and management issues of Lake Victoria). Such could be identified initially by the respective components before winding up LVEMP1 business. These might then be collated and synthesized by the secretariat, perhaps through a consultancy, and handed over to a lead institution identified by LVEMP1 as having the most interest and/or capability for continuing and improving the work of LVEMP1.

Only three components trained PhDs and only two of the seven PhD trainees came from an implementing institution other than the university or research institute. This is expected given research objectives and tasks of the different implementing institutions. However, this realization might have resulted without much justification as to why an implementing institution needed or did not need PhD training. It also might have depended on the aggressiveness of a particular component/implementing institution and

that would in turn depend on the officers manning the institution/component at the inception of the project. The suggestion is that training, other than workshops and seminars, could be implemented through one component which would synthesise and take into account the training needs of the different implementing and other relevant institutions, all the time having the LB as the main reference issue. Without a central, capable and answerable body, such as a component, an implementing institution might have been allocated fewer or more of the training slots than it deserved given the objectives on hand. In the end, it is also important to have one implementing institution which would serve as a central data base. The Support to Riparian University (Component 8) might be a suitable lead component in this.

There was much between components variation in the number trained; this might be the result of many factors including availability of staff for training, training needs as identified by the officers at the implementing institution and knowledge and capability of an implementing institution to identify possible training places as these were left for components and implementing institutions to decide (Anon 1996a, 1996b, Yhdego *et al*. 2001).

5.1.2 Doctorate (PhD) Training

The doctorate degree (PhD) remains the highest level of formal training in the world. It seeks to produce alumni who can design and conduct research independently. The research topics were all relevant to the lake situation and the ensuing studies revealed important findings. However, there was insufficient focus and detail as to produce empirical evidence on factors influencing the observed processes, as would be expected of a PhD study. Four of the trained PhD and one PhD candidate who dropped out came from the university and research institute; this allocation is clear since a PhD is almost a requirement for employment for the main business at such institutions.

It is noted that the PhD training for the university and research institute has been in order. Research and teaching capacity has been enhanced. There will be the spillover effect, especially at the university where the instructors involved were now providing more examples on Lake Victoria. Near future initiatives could take advantage of this LVEMP1

product and support more PhD (and Masters) training on Lake Victoria issues through the riparian universities and using the capacity already built.

It is not clear why two of the trainees came from the ministries. At least two LVEMP1 individuals indicated interest in training for PhD but could not be absorbed. The project document as well as the staff appraisal report (Anon 1996a, 1996b) identified modalities for allocating training slots to the implementing institutions. Item E 14 of Annex 3 in the staff appraisal report states "*The LVEMPS will coordinate the capacity building programs under the program and take overall responsibility for* ***Training****. Each implementing department and agency will prepare an annual training plan and submit it to the respective LVEMP National Secretariat. The training plan will identify the subjects and courses for training, their timing, duration, estimated costs, name and location of the training institutions, the names of the persons proposed, and the justification for their training. The training plans will be submitted to IDA for approval, the first within three months of Credit Effectiveness, and subsequent annuals plans by May 15 of each year*"

In the course of implementation, the project appeared to have found this mechanism to be needing improvement and thus engaged a consultancy to develop a training programme document (Yhdego *et al. 2001*).

The training programme document (Yhdego *et al*. 2001) was comprehensive in coverage. However, it could have been more detailed on needs for the conservation of Lake Victoria first and then secondarily bring in the needs of the implementing institutions. A training programme could have been best developed prior to the start of the project main activities. Its development could have involved a larger team comprising different specializations and specifically incorporating consultants conversant with environmental/ecological issues. This way the project, rather than the implementing institutions, would be the driving force in pointing out the training needs. The LVEMP1 has generated a lot of information useful in preparation of such a document in future Lake Victoria initiatives.

Yhdego *et a*l. (2001) noted the following: "*Unfortunately many of the expressed training needs lacked an objective focus on LVEMP-related duties, on which the training programme will focus. Clearly, most of the needs expressed by the employees in three components constituted parochial wishes for further education and skills training, taking opportunity of the offer of a training programme availed by the project. …. The Consultant had to remind the respondents repeatedly, that the needs and problems sought had to be those directly related to LVEMP's duties*"

Further, more time could have been allocated to the preparation of the training needs document, at least six months. This would allow for detailed studies that would carefully consider the LB processes. Like with many consultancies, insufficient time appear to have been allocated to the production of the LVEMP1 training programme.

Other than on matters of clarity and thoroughness, the research programmes for PhD and Masters training did not differ markedly. Future initiatives will have the advantage of the studies already conducted and specific problems identified so that PhD research studies will be sufficiently focused as to produce empirical evidence for mechanisms behind the processes such research will have identified.

5.1.3 Masters Training

Masters training is expected to produce a graduate who can design and conduct research under minimal supervision. Research topics are usually broader, than PhD study topics, and are targeted at studying processes that are taking place without necessarily producing empirical evidence on the forces behind the observed processes. The Masters research studies were adequate and those done through UDSM were all successful.

Interviews indicated that when the project came there was much vacuum in postgraduate training at many of the implementing institutions. So, to some extent, the project was viewed as just another opportunity for training for a higher qualification. Under the circumstance, any topic and/or area of study can be shown to be relevant to the project. However, it is the specific priority areas that would have ranked the various areas of training in an order of importance. A useful training strategy should therefore be in place

prior to the start of project activities, for it is this way that the priority human resources need areas can be agreed upon and addressed accordingly. A detailed training needs study was conducted and a final report submitted in April 2001 (Yhdego *et. al*. 2001). At least two issues emerge here. The study came late when project implementation was well underway and various training activities had already started. This might have necessitated the extrapolations backward into year 2000 for some of the training areas as indicated in Table 4.7.1 of that report (Appendix 3). Secondly, the emerging training programme appear to have been based more on what personnel were lacking than what the project might have needed. It would appear that more time allocated to developing the training needs report would have allowed for a detailed study of project's needs that would then largely dictate human resources needs.

There might have been reasons why some components preferred masters training by research while others opted for the course work alone. It would be nice if this was explained for the two routes of training differ much, the former is much stronger in training for research.

5.1.4 Places of Training

Training took place at different places, both local and overseas. Local training takes longer but leads to capacity building for the riparian institution and for the lake when research for PhD or Masters is conducted locally. Also the costs for overseas training tend to be much higher. Still the varied experience gained in LVEMP1 is important for future training arrangements as then it will be possible to compare costs against the type and depth of an intended training.

5.1.5 Potential for involvement in future LB activities

Individuals who have acquired experience on Lake Victoria through working, training or other involvement with LVEMP1 constitute an important *seed bank* for the conservation of Lake Victoria. Whether or not they will be available for future involvement will strongly be influenced by their future designation and work places. It is expected that those working with government institutions will be more available than those engaged by LVEMP1 on short term contracts as indicated in Appendix 2 and in the profile of

professional staff prepared by Yhdego *et al*. (2001). Also on pages 40 – 43 of the report by the recent WB mission (Appendix 4), two of the eight components are rated unsustainable and one is rated vulnerable for the same reason that such components depended much on consultancies and contracted research in the day to day LVEMP1 activities.

5.1.6 Awareness and overall skills

In all, it can be said that the project has been very successful in building capacity in awareness at different levels of specialization and that the personnel that have worked with the project form an important (reserve) cadre of individuals who for a long time will value and raise concern and even take action within their capability whenever an issue concerning the lake comes about.

Although a number were born in the lake region and/or had been there for various durations and in various capacities, most of them had considered the lake to be just another water body and had noted important events such as illegal fishing or water hyacinth intrusion, only in passing and without much internalization. The project period has meant tremendous increase in knowledge, interest, concern and overall internalization of the lake.

The dates at which different individuals were engaged into the project varied much (Appendix 4). One Task Leader was engaged in 2005 even though he did not have prior knowledge and experience of the project or project site. Such variation and very late incorporation could be minimized in future endevours as might affect overall project performance. A detailed appraisal on human resources needs and individual commitments, followed by engagement contractual agreements would minimize personnel turnover during a mere five year project life and increase the volume of knowledge project participants would have gathered in the end.

Placement of undergraduate students from institutions such as the Sokoine University of Agriculture (SUA) and the University of Dar es Salaam (UDSM) to the project, for field practical training, has also revealed an important area for consideration. The students

indicate clear interest and much gain in knowledge that would not be obtained from their other regular university training even though they were training in relevant courses such as environmental science and conservation of natural resources. Interviews with present and past students indicated that the great lakes, including Lake Victoria, are not given due weight and in most cases they are not much mentioned even as examples in the various ecological, socioeconomic and biological study topics. Perhaps lack of literature has important contribution to this situation. The present efforts to produce publications and especially the two books by largely the research component of LVEMP1 should prove an important start point and efforts could be made in this direction to make the books one of the reading material at the universities and institutes. Some project components have hosted up to 20 university students per year and this should be continued as it has spill over capacity building effects. The project has also received visits from secondary and primary schools, mostly from the lake region; this is also positive as an initiation in capacity building even though such students learn and internalize little given the short nature of such visits and their low level of training and specialisation. Journalists from various news media have also visited the different components, especially the component responsible for water hyacinth.

The project has also hosted demonstrations and discussions to top-level officials and decision makers including Senior Military Officers from the South African Development Community (SADC) countries, Members of Parliament of Africa, Members of Parliament from the three implementing nations of Kenya, Tanzania and Uganda, an official from the Department of Externally Funded Projects in the Ministry of Finance, the Vice President and the President of the United Republic of Tanzania.

Top level management undertook study tours to Germany, Asia and USA/CANADA and appreciated the much knowledge they gathered that relate to Lake Victoria especially in relation to management of River Mekong in Asia and Lake Superior which is shared between Canada and USA which also happens to be the largest in the world. River Mekong has a commission, Mekong River Commission, which is responsible for ensuring sustainable management of the river. The Mekong River Commission has membership from countries, such as Thailand, Cambodia and Vietnam, which can have

serious economic problems should the river dry out or become unusable because of pollution or other factors. The experience gathered there is relevant in future LB plans and in relation to the functioning of the Lake Victoria Fisheries Organization (LVFO) and the impending River Nile basin conservation initiatives.

Several seminars and workshops were held where there was much interaction between people of various cadres, specializations and outlooks. All project personnel interviewed indicated substantial increase in knowledge through the interactions in study tours, seminars, workshops and meetings. In August 2001, for example, a conference was held at the Mwanza project site which was attended by four non East Africans, 11 Ugandans, 12 Kenyans and 99 Tanzanians comprising mostly LVEMP1 personnel, government technical officials and journalists. Even very senior fisheries and other officers indicated substantial increase in knowledge breadth pointing out that for up to 20 years or so of their employment they were mostly concerned with sectoral issues. The LVEMP1 exposure has opened up a window for broader understanding of fresh water bodies and water catchment problems.

5.1.7 Involvement of extension workers and local communities

District, extension workers and local communities have had their skills and awareness increased and this has proved useful as it has created extensive participation in conservation issues including law enforcement. The BMUs were established in all landing sites of Lake Victoria between 1998 and 2000. However, there are active and none active BMUs which need to be strengthened. Initiatives are needed to translate research findings into the language and level where they are comprehendible to the wider audience, including extension workers and local communities. This would increase interest in sharing the benefits and costs of research and create a window for sustainability.

For example, fisheries staff who have attended short and long courses on fish quality and safety assurance have contributed in maintenance of fish quality standards through regular inspections at the places of fish processing and at exit points. Those who took

prosecution courses are now assisting in the preparation of fisheries cases and the prosecution of such cases is now done more efficiently than before LVEMP1.

Involvement of local communities is positive in that it is the way to ensure sustainability. As noted by the Fisheries Management Component, indigenous knowledge of fishermen can also be used in fishery resources development, management and environmental protection. Future LB initiatives could indicate the capacity built on indigenous knowledge. However, when the local people are involved in research and monitoring, it is important to note the need for constant supervision because some of the local people might not maintain long-term interest in data given their level of training and overall livelihood preoccupations (Nyundo *et al*. 2004). Capacity building at the level of awareness, need to be enhanced in order to reduce vandalism of data loggers as noted by the water quality component (Rutagemwa 2001).

Exit plans need to be carefully thought out and experimented considering the recent bad experience of HESAWA project (DANIDA funded) whereby facilities built for provision of safe water were left to deteriorate and even vandalized at some places shortly after end of the project. The proposal for establishment of Lake Victoria Environmental Fund (LVEF) that was proposed by Wilson *et al*. (2001) and reiterated by Nanai and Nyirabu (2001) could be pursued to the full since an internal system of generating funds is more likely to be sustainable than dependence on externally funded initiatives.

5.1.8 Publications

An important measure of CB is the number and quality of publications coming out of a project. Publications through LVEMP1 were mostly on technical and research reports and conference and workshop proceedings. This is to be expected of the LVEMP1; with passage of time it is expected that journal publications will accumulate and indicate a higher level of CB. For enhancement of sustainability, translation of the publications, especially brochures and booklets, into Kiswahili will prove to be a useful undertaking for it will enhance understanding by the local people and other middle level and extension workers as well as decision makers. The Fisheries Research Component has led in the production of publications. This is to be expected since the implementing

institution (TAFIRI) is the most research oriented having research as its main and perhaps only preoccupation. The two main books by the Fisheries Research Component were yet to be out; this is expected of books since they need to undergo thorough editing to ensure that they pass the test of time. It will be interesting to see how they compare with other conventional text books since as pointed out earlier, these could constitute a good beginning for reading material for environmental courses at universities and institutes that would give the Lake Victoria the deserved exposure in the education system. It will also serve a useful end if the PhD and Masters theses and dissertations were converted into booklets easier to read and distribute and if these were finally translated into Kiswahili. The initiative taken by the Fisheries Research Component to summarise the theses information and publish same in the *Nyanza Review Newsletter* is a good start point.

5.1.9 Capacity Building through other Projects.

Some amount of interest and concern on Lake Victoria has been there for a long time. Several initiatives have taken place there as indicated in the many publications dating back to the early twenties (Table 7 a – e). Several projects have addressed the lake and built capacity in many ways. In all, the LVEMP1 appear to have had the biggest impact on capacity building at the professional level as evidenced in the boost of support and publications resulting from participation of local researchers in Tanzania and East Africa (Table 7 a – e) especially in the year 2000 and 2001 when there were the two conferences held at Jinja (Uganda) and Mwanza (Tanzania) respectively.

5.2 Infrastructure and Equipment

In discussions with Component Coordinators and other LVEMP personnel, and from my personal field observations at project sites, the overall stand has been that LVEMP support in infrastructure, equipment and overall working gear has been largely sufficient. The isolated limitations might have emanated from other areas such as shortage of manpower, delays in disbursements and overall time constraints. Offices and laboratories have been renovated thus creating a good working environment that has been markedly better than it was prior to the project. Field stations were built and a research vessel

modified to suit current field laboratory demands. Required field tools and laboratory chemicals were provided. A major achievement has been contribution in the lifting of the European Union (EU) ban on fish export to Europe. The equipment acquired for microbiological and chemical analyses made it possible for the laboratories to be accredited by the South African National Accreditation System (SANAS), and this together with improved hygiene at the landing sites and creation of an internal monitoring mechanism are factors that made the EU to reconsider the ban.

Transport was made easy thus enabling field studies at nearly all intended areas; this constituted a major elevation in capacity. Some people who had worked at the lake for over 10 years as fisheries officers and/or trainers increased their knowledge on the different parts of the lake by as much as 90%.

It has been noted that some components differed markedly in capacity building for office and laboratory work for no clear reason. Capacity for office and laboratory work was markedly better built for the Water Quality Component than it was for the Fisheries Research Component. A plan for construction of a museum at the TAFIRI Research Centre at Mwanza was approved but could not be implemented while work to relocate the damaged water quality field station in Bukoba was underway at the time of the present study.

This might be calling for enhanced harmonization. The present study noted that the workings of the fish quality laboratory at the premises of Nyegezi Fisheries Training Institute, which is directly under the supervision of the Fisheries Management Component, the plan for a museum next door at the TAFIRI Mwanza Centre, the water hyacinth and soil conservation research activities, the water quality laboratory activities and the well justified request to have a UDSM research station at Mwanza (Machiwa *pers com*.), all need to be harmonized. These initiatives indicate that marked capacity has been built relating to Lake Victoria but in many fronts and harmonization is called for in order to avoid much divergence and scattering of efforts.

In future initiatives, it will be important to first conduct a needs assessment and thus streamline priorities across the components. It is equally important to facilitate the working of extension workers and local communities through provision of simple transport means such as bicycles. It is important to emphasise on sharing such as that undertaken by TAFIRI and the Water Quality Component in the use of the vessel TAFIRI II. Timetables for field and laboratory studies need to be harmonized to avoid conflicts such as one experienced in trying to share a hydrolab between the Fisheries Research and Water Quality Components.

Two of the major implementing institutions, TAFIRI and UDSM are based in Dar es Salaam and undertake research and training at the sea. Such training has a spill over effect of relevance to the LB and capacity built there will be of much use. The two might be considered for provision of a big research and training vessel noting that they are presently much handicapped on this.

There has been cooperation between components and between the project and other agencies. The Fisheries Research Component refurbished the vessel belonging to TAFIRI (TAFIRI II) and made modifications in the vessel that made it appropriate for the specific water quality analyses. Components 2 and 3 could therefore use the vessel simultaneously. In 2002, the Water Hyacinth Component borrowed and used Tanzania Railways Corporation (TRC) cargo vessel for mechanical removal of floating mats of weeds at the Bwiru Area, in Mwanza, using the other LVEMP resources including small boats and payment to the TRC divers and provision of fuel to the vessels and in collaboration with Bwiru Secondary School. This is important innovation on collaboration.

The LVEMP1 has been mainly a reconnaissance project that has generated much baseline information through sampling at different places and in different professional specializations. Future initiatives, such as the impending LVEMP2, that aim at undertaking LB-wide operations could build on the LVEMP1 sample results and will need much more infrastructure, equipment and tools. For example, although transport was made glaringly better by LVEMP1, an efficient LB-wide operation for the Fisheries

Management Component, alone, would need at least one vehicle for each district and a 10 m inboard patrol boat for each district. This way, the capability for extension staff to operate would be significantly enhanced.

5.3 Other Capacity Building Programmes

Lake Victoria has attracted many initiatives for its conservation on account of its local, national, regional and global importance (section 1.1). Mostly, these initiatives have been isolated and scattered efforts across time and disciplines. Local public and private institutions themselves have addressed research and management of the lake from their respective sector perspectives with little cooperation between different sectors even within the same ministry. The LVEMP1 has done a commendable job in bringing about appreciable cross-sector fertilization and this constitutes a major achievement in CB through the project.

Still a lot of ground remains to be covered. The LVEMP1 has stimulated awareness, interest and concern on the lake in addition to building up professional capacity for research and management. This is likely to bring about further initiatives that will need harmonization to avoid duplication of efforts and help minimize conflicts. The LVFO coordination centres more on the fisheries sector and might not have enough capability to coordinate a holistic approach for the conservation of the lake. The multinational Nile initiative is probably too wide in scope as to be able to sufficiently zero in on critical issues pertaining to sustainable management of the lake even though the lake happens to be the main source of River Nile. There is therefore a vacuum that will be left behind by LVEMP1 and the proposed LVEMP2 is much in order and timely. An important lesson that LVEMP2 might consider strongly is having a major component on **exit plan** that will address the way research, monitoring and management are to proceed after LVEMP2.

Another observation noted by the present study is the need for LVEMP2 to consider widening the scope and allow for participation of the different sectors. One important area that comes into mind is the wildlife sector especially the Wildlife Department, Tanzania National Parks, and Tanzania Wildlife Research Institute. These conduct ecological monitoring and are responsible for research and management of the National

Parks and Game Reserves in the Lake Region including Robondo Island National Park which is inside Lake Victoria, Serengeti National Park, Ikorongo, Grumeti, Kijereshi and Maswa Game Reserves that are on the eastern part of the lake's catchment area. These conservation areas constitute an important source of inflow water into Lake Victoria and the conservation efforts there are of importance to the LB since the areas constitute a catchment of relatively unpolluted water into the lake. The study by Tamatamah *et al*. (2005) showed significantly less phosphorus load inside the Serengeti National Park (at Seronera) than at areas outside the park. Yet, Serengeti National Park and the surrounding Game Reserves are faced with exploitative pressure especially at the western parts where the rate of human population increase is very steep.

A lot of conservation initiatives are taking place in the Serengeti that relate much to the LB initiatives. But there has been little or no effort for cross fertilization. Three publications that have come out during LVEMP1 period can serve as an illustration. Emerton and Mfunda (1999) analysed conservation issues in Western Serengeti (which is eastern LB) from the wildlife conservation perspective. The paper has the one passing mention of Lake Victoria: "*Average annual rainfall ranges between 500-1200 mm, declining towards the park boundary and increasing towards Lake Victoria (Campbell and Hoffer 1995)",* and indicates Lake Victoria on the map only as a *black box* to the west (Fig. 2). None of the quoted references in the paper has addressed Lake Victoria. Ntiba (2004) and Phoon *et al*. (2004) have addressed, in detail, environmental and capacity issues for Lake Victoria. None has mentioned the conservation areas and the activities therein; not even shown any on the map (Fig. 2).

It is important that there is exchange of knowledge and interaction between the two initiatives of Serengeti Region (and other wildlife conservation activities) and the Lake Region activities, especially east of the lake and west of the Serengeti, for the two address the same area, only that while one is concerned about the danger of human activities to the west the other is concerned about the same to the east (Fig. 2). Both the Lake and Serengeti Regions have been studied extensively (compared to almost any other area in Tanzania) and the capacity built over the years, in addressing the similar issues could be shared profitably.

The two ecoregions (Lake Region and Serengeti Region) both have tremendous importance to Tanzania. Serengeti is a major driving force behind tourism which has become a leading sector in the national economy. The one thing that boosts tourism in Tanzania and Kenya is the globally unique annual migrations of the big herds of large mammals in the Serengeti. These migrations are largely influenced by the rainfall pattern which is lowest to the southeast and highest to the north-west. A look at the precipitation pattern suggests that the lake has influence on the pattern (Herlocker 1977, Campbell and Hoffer 1995, Emerton and Mfunda 1999; Fig. 1). A significant change in the water regime at the Lake might therefore significantly impact on the wildlife migrations and the overall wildlife distribution in the Serengeti.

The Lake influences the economy of one third of human population in East Africa. The consensus opinion is that lake sustainability will be much more assured in the situation where it is surrounded by protected area. Yet without coordination one could end up in a position whereby the Serengeti initiatives are aimed at pushing human activities towards the west while the Lake initiatives would prefer that human population and activities build up more to the east beyond the catchment but obviously towards the protected areas. The impending LVEMP2 might take note of this situation and incorporate an interactive mechanism.

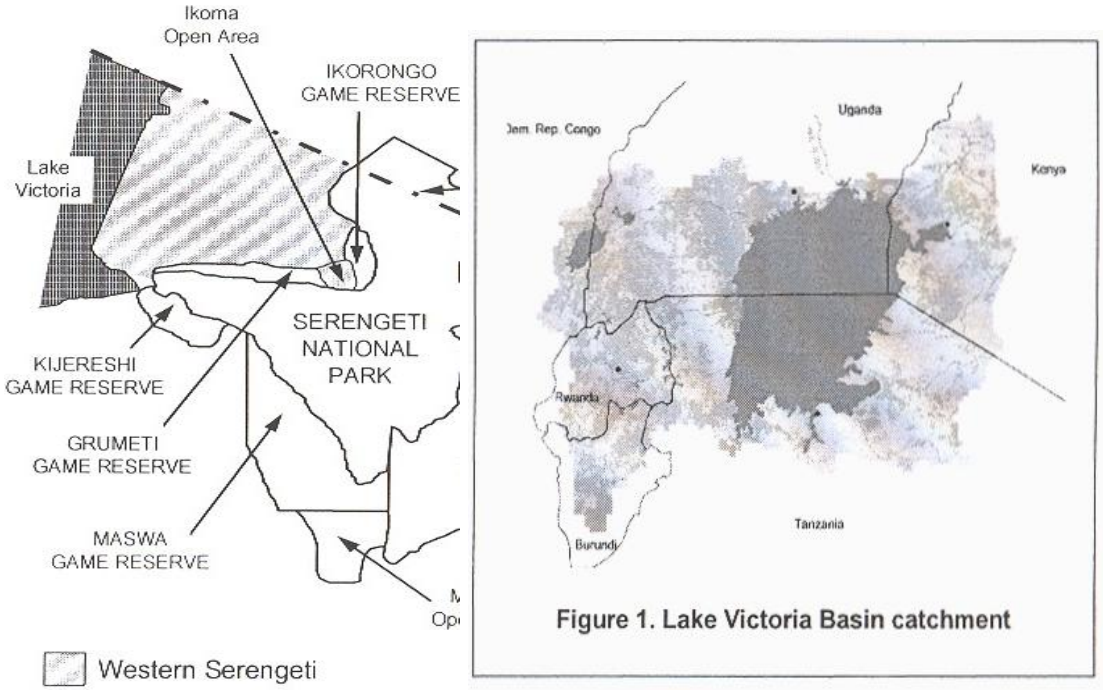

Figure 2. Western Serengeti (left) and Lake Victoria Basin (right) as depicted in Emerton and Mfunda (1999) and Phoon *et al*. (2004).

6. Conclusions

It is noted that LVEMP1 has had tremendous impact in creating awareness, interest and concern on Lake Victoria. Still, LVEMP1 has involved but a small fraction of the society including people who are dependent on the lake for their livelihood directly or indirectly and who might not even know that much of their well being has a connection to the lake. Awareness capacity through LVEMP1 has also touched only a small fraction of those who have and/or will have the power to influence human activities in the LB.

When the project started there was much demand for training at all levels including Masters and PhD training. Personnel at the implementing institutions had been wishing to undergo training but the opportunities were not there. A large number of first degree holders had accumulated and still is accumulating and future LB initiatives can take advantage of this whereby there is ample manpower that can be used to generate information through planned applied research for the higher qualifications.

It has been noted that training was conducted at many places locally and overseas largely depending on the suggestions of implementing institutions. Training also lasted for different durations and some Masters required research while others did not. A harmonized detailed training programme that is largely based on LB priority needs might have ironed out such differences and/or indicated why any differences were necessary.

The LVEMP1 built a lot of capacity in infrastructure, equipment and tools. Offices and laboratories were built and/or renovated creating a good working environment and improving efficiency. Land and water travel were made easy through provision of reliable vehicles and vessels, thus enabling visits to many parts of the LB to the extent hitherto unmatched. However, project components were facilitated to different extents not necessarily relating to their level of importance in LB conservation. This needs harmonization in future initiatives of such big magnitude as the LVEMP1.

For the PhD studies and for the Masters studies which had research conducted at the LB, important knowledge has been accumulated. The resulting theses and dissertations have but limited circulation and readership unless they can be converted into booklets and translated into Kiswahili so as to increase readership and enhance appreciation and use.

7. Recommendations

Although LVEMP1 has created much awareness and imparted a lot of skills, this has involved only a small fraction of the Nation and of the Lake Region people. It is suggested that awareness creation be continued and strengthened and to center around the importance and potential that Lake Victoria has. Various ways could be used including the use of popular media such as television, radio and newspapers. In addition to its importance in the agriculture and fisheries sectors, Lake Victoria has great potential for tourism; awareness similar to that created in the 1960's for the Serengeti could be deployed to the useful end.

The LVEMP1 has shown that there is much demand for training opportunities. The number of capable first degree holders wishing to pursue further studies is large and these

could be easily tapped for studies tied to the LB. This would be an easy way to build up a team of experts who are ready to take up research and conservation challenges and opportunities that will emerge in the Lake Region from time to time. Future LB initiatives might take note of this potential. For big projects, such as the LVEMP1, a training needs study should be conducted because such projects offer unique opportunity for multidisciplinary approach to solving the intricate ecoregion processes. Balancing is required so that the different processes are given due weight; this would in turn facilitate coming up with systems solutions that are not lopsided. It is also recommended that the resulting PhD and Masters theses or dissertations be converted into booklets and translated into Kiswahili to facilitate distribution and increase readership thus enhancing appreciation for the research and training and improve use of the resulting information.

It is suggested that, as much as possible, training should be conducted locally in order that capacity for training is also enhanced at the riparian institutions. In certain situations, some specific capability exists only in an institution overseas. In such cases, short visits of a semester or so could be arranged that would allow the local student and/or researcher acquire the specific techniques and skills. Continued over reliance for training overseas can only perpetuate the "we can not do it" dogma that appears to be very prevalent in East Africa.

It is further suggested that LVEMP1 proposes ways of use and care taking of the infrastructure and equipment before it winds up business. Without the project, a coordinating factor will be missing and the different implementing institutions might lack the forum for coordination of activities. One possibility is for LVEMP1 to suggest a coordinating committee that will take on board the different institutions and have it adopted by such institutions. If so, the financing and other mechanisms for the operation of the committee should also be identified.

It is recommended that future initiatives consider interaction with a wider array of sectors and especially the sector responsible for the protected area network. Sustainable management of the LB entails its conservation and the sector responsible for the protected areas has a long history and accumulation of knowledge and experience on the

various conservation approaches. There are a handful of protected areas in the LB catchment, including the Serengeti. While the protected areas have a positive influence on the health of the lake, the lake in turn influences the ecological processes in the protected areas. A collaborative approach would capture more and varied capacity and enhance sustainability.

8. Acknowledgement.

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Component Coordinators, Messrs Mahongo (Fisheries Research), Hoza (Fisheries Management), Chisara (Wetlands), Msongwe (Community Participation), Mbwana (Microprojects), and Ms Katagira (Water hyacinth and soil conservation) and Dr Mjengera (Water quality) provided valuable information through discussions and/or questionnaire and/or comments on the draft report. Task leaders Messrs Mjema (water hyacinth), Katunzi (Fisheries Research and Mwanza Centre Director), Rutagemwa (Water quality), Kimaro (Catchment Afforestation), Baruti (wetlands) and Ms Sekadende (Wetlands Biodiversity) availed similar information especially at the main project site in Mwanza. Other project personnel including scientists, Team Leaders, drivers and office personnel were very helpful in giving much guidance and I thank them all. Finally, I wish to register my thanks to participants at the National Workshop, including the Lead Consultant, Professor Owuor, for verbal and written comments on my draft report, which inputs have contributed in my making the present report.

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10. Appendices

Appendix 1. Terms of Reference

3. The Terms of Reference for the consultant

- To review the extent to which capacity building at the University of Dar es Salaam has been achieved through support by LVEMP
- To review the approach that was used to achieve the above objectives
- To assess the impact of capacity building at the University of Dar es Salaam by LVEMP in relation to the Lake Basin environment, community livelihoods and stakeholder expectations
- To assess the sustainability of the support to the University of Dar es Salaam in terms of
- personnel, equipment, institutional set up and financial issues
- To assess the cost-benefit analysis of the support that has been extended to University of Dar es Salaam per dollar invested
- To review problems encountered in the implementation of capacity building activities at the University of Dar es Salaam.
- To list other capacity building programmes at the University of Dares Salaam that addresses the Lake Basin
- To draw lessons of experience (both positive and negative) basing on the information given above
- To propose possible areas of emphasis that need to be continued/replicated or taken onboard in future capacity building initiatives

Appendix 2. Individuals interviewed on involvement with LVEMP and capacity gained.

Name/and place of birth/residence	**Designation (and *Component(s))**	**Date *engaged* in the project and potential for future involvement**	**Prior knowledge of the lake**	**Current knowledge of the lake**
Dr Ngatunga/ Songea	Director of Research, TAFIRI	2005 GOOD		
Dr Mahika	DSM Centre Director, TAFIRI (2), TL(2)	2002 GOOD	Very little	The lake, its importance, problems and much worry on its sustainability
Mr Hoza/ Lushoto	Fisheries Department CC(2,5)	1997 GOOD	Not much and sector oriented on fisheries	Wider knowledge on lake fisheries, ecological, management and social problems
Mr Makambi/ Musoma	Procurement Officer, Secretariat, DSM	December 2002 FARE		
Mr Katunzi/ Bukoba	Mwanza Centre Director, TAFIRI TL(2)	1997 GOOD	Day to day research activities on the lake since 1979	More details on lake biodiversity, knowledge on the small riparian lakes that were hitherto little known
Mr Mnyanga/ Coast Region	Sc(3)	FAIR		
Mr Mnyanza/ Same	Sc(3)	1998/July 2004 FAIR	Had very little knowledge of the Lake	Marked increase in overall knowledge of the lake including ecology, socioeconomics and threats facing the lake. Much interest and concern over the lake
Mr Rutagemwa/	TL(3)	FAIR		‘’

Bukoba				
Mr Chisara/ Nyasa	Research Officer, NEMC CC(4)	1998 GOOD	Had crossed the lake and visited it as fisheries officer. Limited knowledge from the fisheries sectoral perspective.	Much increase in knowledge on ecology, importance and threats.
Mr Baruti/ Lushoto	TL(4)	1999 for 1 year then February 2005 FAIR	Little beyond geographical location	Marked increase in knowledge including ecology, and importance.
Ms Sekadende /Kigoma	TL(4)	2000 as TAFIRI scientist at DSM, then January 2005 GOOD	Very little knowledge of the lake before 2000	Substantial knowledge on lake ecology, fisheries, wetlands and threats. Much interest and concern on the lake.
Mr D. Peter/ Arusha/Bukoba	Sc(6)	1999 FAIR	Very little knowledge beyond just crossing it and noticing fishing activities	Much knowledge on importance, for water supply, fisheries, contribution to national economy.
Ms Muchiri/ Mugumu	Secretary (6,7)	2003 FAIR	Little beyond just seeing it	Knowledge on importance. Developed much interest and attachment on the lake from typing reports and interaction with researchers.
Mr Magwaja/ Mwanza	Driver	1998 FAIR	Little	Wide knowledge on problems facing the lake including poison fishing, water hyacinth encroachment, farming; much attachment to the lake.
Prof Katima/ Bukoba	Contracted researcher (3)	2001 (briefly) FAIR	Farmiliar from crossing the lake several times	Basic water quality issues including pollution. Project did not much increase my knowledge of the lake.
Mr Makota/ Lindi (Phone	MSc student and GIS (4)	1999 as student /2001 GOOD	Very little knowledge beyond geographical	Much wider knowledge. Much interest and attachment.

discussion)			location	
Mr N. Kimaro/ Kilimanjaro	Forest Officer, Forest and Beekeeping division TL(5)	July 1997 GOOD	Just location on the map	Wide knowledge on ecology, importance and threats. Much attachment and interest.
Dr Benno/ Ukerewe	Instructor UDSM and PhD student (8)	1998 GOOD	Crossed the lake since early age. Conducted practical training at the lake during diploma studies on limnology and fish processing.	Did not travel widely and hence do not have wide knowledge on the field physical characteristics. Extensive knowledge through reading for PhD studies and interaction with different components. Marked increase in interest and attachment to the lake. Lots of examples I give in teaching now come from the lake.
Dr Tamatamah /Mtwara	Instructor UDSM and PhD student (8)	1997 GOOD	Exposed to Lake environment in 1979/80 while on certificate training at the Nyegezi Institute.	Marked increase on overall knowledge of the lake on Ecology, fisheries, socioeconomic importance. Marked increase in interest and attachment to lake.
Mr Rajabu/ Kilimanjaro	Three monthly contracts Sc(7)	2004 FAIR	Knew very little on the Lake	Substantial knowledge on the problems, socioeconomics, fisheries of the lake. Developed marked interest and attachment to the lake.
Mjema/Same	Research Officer, Ministry of Agriculture TL(7)	1997 GOOD	Little knowledge. Had been to Mwanza to train on pest control (insects and rodents) but did not much notice the lake.	Marked increase in knowledge on overall ecology, socioeconomics and threats facing the lake. Have traveled to nearly all parts of the lake. Built lots of interest, concern and attachment to the lake.
Ms Barongo/ Bukoba	Undergraduate	2004 and 2005 for 6 weeks of practical training	Traveled across the lake but took little interest.	Marked increase on knowledge of the lake especially on problems caused by water

	student studying Environmental Science with SUA on field training	FAIR	Lake not mentioned in undergraduate training.	hyacinth. Increased much interest, attachment and concern on the lake.
Ms Merchades/ Bukoba	Undergraduate student studying Environmental Science with SUA on field training	2004 and 2005 FAIR	Little knowledge from working temporarily with NIMRI, Mwanza noting also illegal fishing people. Not covered in undergraduate training.	Marked increase in knowledge of the lake, its fisheries, importance for water supply and ecology and control of the waer hyacinth. Substantial increase in interest and concern over the lake.
Ms Katagira/ Bukoba	Research Officer, Ministry of Agriculture CC and PhD student (6,7)	1999 GOOD	Little knowledge from crossing the lake; had noticed, in passing, the problems caused by water hyacinth on transport.	Marked increase in knowledge on overall ecology of the lake, its importance in transport and water supply, fisheries and socioeconimics, biodiversity, weeds and water quality. Marked increase in interest and attachment to the lake.
Dr Ndunguru/ Songea	Contracted Researcher Officer Sc(7)	2000 GOOD	Knew it, just as a lake, from traveling to Bukoba work station (at Maruku Agricultural Research Institute).	Much increase in knowledge and interest on the lake. Know its biodiversity, importance in socioeconomics and the impending threats. Increased concern over its sustainability.
Mr Mbwambo/ Same	Ministry of Agriculture Sc(7)	2003 GOOD	Knew it as a lake from crossing it enroute to work station at Ukerewe. As a crop officer at Ukerewe, used to fill LVEMP forms (questionnaires?) but did not take much interest beyond filling the forms.	Substantial increase in knowledge on importance of the lake in transport, socioeconomics. Much increase in interest and attachment to the lake.

Mr Msongwe/ Iringa	TL(9)	September 2005 FAIR	Crossed lake in 1985 and just knew it as any other lake.	Marked increase in knowledge of the lake especially its socioeconomics, and the threats it faces.
Ms Aaron/	Office attendant /Secretary(9)	1998 FAIR	Very little knowledge.	Substantial increase in knowledge from typing project works and interaction with project implementers.
Mr Mtallo/ Kilimanjaro	Senior Assisstant Fisheries Officer and Instructor at Nyegezi Training Institute	2000 GOOD	Knew few parts of the lake especially for training purposes. Noticed and got concerned over the marked increase in water hyacinth	Marked increase in knowledge of the lake especially through traveling to the many parts of it where I had not been able to reach before. Increase in knowledge on the socioeconomics, ecology and dangers facing the lake. Much increase in interest and attachment to the lake.
Prof Machiwa/ Mara Region	Associate Professor, UDSM	1997 GOOD	Used to play by the lake as a child. Conducted practical training there as a Fisheries Diploma student.	Extensive travel in the LB has markedly increased knowledge, interest, concern and internalization of the lake. Has almost shifted interest from working in marine biology to the lake.
Mr Lukanga/Tanga	Fisheries Officer, Fisheries Division Sc (1) and MSc student (1)	1999 GOOD	Conducted practical training at the lake as a diploma student in fisheries biology.	Marked increase in overall knowledge, interest, concern and internalization of the lake.
Mr Mwita/ Mara Region	MSc and PhD student (8)	2000 GOOD	Had crossed the lake while going to school in Bukoba. Did practical training at Bugando Hospital (Mwanza) as an undergraduate	Much increased knowledge on lake and inlet rivers where he was conducting parasitological studies. Know many now many fish species, their parasites and other invertebrates at the lake.

			microbiology student.	
Prof Mwanuzi/ Bukoba	Associate Professor UDSM Collaborator/ Consultant with LVEMP on several ocassions	2000 GOOD	Born near the lake and used to swim and play by the lake. Crossed the lake several times.	Marked interest in overall knowledge, interest, concern and internalization of the lake through extensive travel there and working with different project components.
Mr Mallya/ Kilimanjaro	Research Officer, Ministry of Agriculture, Senior Operations Officer, LVEMP	1997 GOOD	As pest control officer had traveled to Mwanza and crossed the lake. In 1995 he got involved in LVEMP1 project preparations and traveled extensively to many parts of the lake including all landing sites.	Has had appreciable increase in knowledge, interest and concern on the lake.
Ms Nhonoli/ Tabora	Management Information Systems Assisstant	2000 GOOD	Had not been to the lake and knew little about it.	Broad knowledge on the lake through participation in meetings, workshops and field trips.
Dr Kulindwa/ Mara Region	Senior Lecturer, UDSM. Consultant with LVEMP on socioeconomics.	2000 GOOD	As a child had played at the lake. Crossed the lake traveling to Bukoba several times.	Marked increase in knowledge of the lake through extensive travel there as a consultant. Was able to visit the village of origin of his clan for the first time. LVEMP consultancy has added to his CV there by being able to secure four more consultancies on LB.
Mr Mbwana/ Lushoto	Senior Forest Officer, Forestry and Beekeeping	1997 GOOD	Not much on the lake and not much on fisheries. Involved in the initial	Marked increase in knowledge, interest, concern and internalization of the lake. Marked increase in knowledge on local

	Division Senior Operations Officer LVEMP and CC(9)		preparations of LVEMP1.	peoples feelings and expectations.

CC = Component Coordinator Sc = Scientist
TL = Task Leader/Team Leader *Refer Table 1.

Appendix 3. Training timetable for LVEMP (Yhdego *et al*. 2001)

Table 4.7.1: LIST OF PROPOSED COURSE AND TIME

PROPOSED COURSES YEAR		2000						2001												2002										
MONTHS		J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N
1	Community part. & mobil & co. mgt																													
2	MS.C. Env. Science & Tech.																													
3	Public Administration																													
4	Data analysis/database managt.																													
5	Project Planning & Mgt. (Fisheries)																													
6	Fish quality & assurance centre																													
7	Advanced microb & Lab procedure																													
8	Statistics Collation																													
9	Public Persecution & Env. Gathering																													
10	PhD																													
11	Project Planning & Mgt. (General)																													
12	M.Sc.																													
13	Study tours-on job training																													
14	Conferences																													

15	Fish Taxonomy & Identification																														
16	Water Quality Modelling																														
17	Lab. Operators Mgt and Industries																														
18	Environment & Quality Mgt.																														
19	Water Shed Mgt.																														
20	Ecosystem Mgt.																														
21	Integrated Pest Mgt.																														
22	Integrated Soil Fertility Mgt.																														
23	GIS & Remote Sensing																														
24	Integrating Cons into farming syst.																														
25	Agroforestry																														
26	Methods in tropical forests																														

Appendix 4. Some of the observations by the World Bank Mission on LVEMP.

TANZANIA

- It is noted that all components in Tanzania have supporting staff (secretaries, drivers, watchmen, boatmen, etc.), and some scientists on contract.
- The phasing out of these during the BP must be done in a balanced way, blended with the reduction in the other activities.
- In general, the components working in the same area must coordinate the work as to limit transport costs.

Component	Focus during the Bridging Period (BP, up to 1 July 2007)
Fisheries, Management	• This component is assumed sustainable as all the scientists are government employees and will stay beyond LVEMP-1 • As there seems to be some ignorance as to the activities of the LVFO/IFMP, exchange of information between the two projects is required. • The management activities under the BP must continue to be coordinated with the activities under LVFO and the IFMP, and supplement these activities in a holistic manner benefiting the sector as a whole. The LVEMP plans for the BP must be discussed with the LVFO/IFM to clearly avoid overlap and secure synergy of the activities. • As IFMP has planned for major activities of establishing and strengthening the BMUS (around 1000 by end of 2006), this activity should not be continued under LVEMP during the BP to avoid duplication. • Activities should continue refining, compiling and analyzing the data collected under LVEMP-1, but limit the field travels.
Fisheries Research	• This component is assumed sustainable as all the scientists are government employees and will stay beyond LVEMP, continuing the key activities. • The research activities under the BP must in general be coordinated with the activities under LVFO/IFM, and supplement these activities in a holistic manner benefiting the total sector efforts. • The data collected and compiled under LVEMP must be generously shared with the LVFO and the IFMP, as they will build up a lake-wide database system. The SAMAKI database should be updated but not developed further. • The fisheries research findings under LVEMP could be disseminated to the villages/Bums by the IFMP staff where possible, who will maintain extensive contact with the Bums in the foreseeable future. • Key research gaps should be filled to the extent possible and as funds allow, but activities clearly have to be gradually reduced over the entire BP.
Water Hyacinth	• This component is assumed sustainable as the Component Leader

Control	and his assistant are government employees, thus the monitoring of the hyacinth development will be undertaken regardless of LVEMP funds. • The present (moderate) level of monitoring and surveillance should be continued throughout the BP, but must be gradually reduced to match the available funds (no. of field days, etc.) • Cost could be cut by reducing the salaries of the Rearing Unit Attendants.
Water Quality &Ecosystem Management	• This activity is most likely not sustainable beyond LVEMP-1, as the key staff are scientist on contract, who most likely will leave the area after completion (although they were initially coming from the host ministry). • Min. of Water and Livestock Development must ASAP provide at least a couple of counterparts that can understudy the LVEMP scientists so that the monitoring activities can be carried out beyond the BP. • Priority must thus be given to capacity building with counterpart staff. • The operation of the Water Quality Model is hinging on one (contract) person only, and is as such very vulnerable. Training of additional staff in the ministry, already having the basic computer knowledge, during the BP must be allowed for, if not fully completed under LVEMP-1. (Cost is around USD 6000 per person in Delft). • A clear plan for stepwise phasing out of the contract experts (3 Scientists, 3 Lab. Attendants, 1d Research Assistant) throughout the BP must be prepared. The downscaling must be blended with the scaling down of other activities. • Planning of construction activities of new wastewater treatment facilities should be put on ice until LVEMP-2.
Wetland Management	• This cross-cutting activity is clearly not sustainable beyond LVEMP-1, as it is run mostly by contract scientists, and there is at present no government institution to take over. • In October 2005, the new District Environment Officers (DEO) will be operational, and the priority during the BP should be to build capacity with these to gradually take over the wetland activities to their best ability and capacity. • Wetland activities inhabit several sectors and activities that are closely inter-linked. It is difficult to cut one without influencing the others. The activities in general should therefore continue, but be overall substantially scaled down. • The further development of new Wetland Management Plans (WMPs) should be halted, but one WMP could be developed as an exercise under which capacity of the DEOs could be built. • The community sensitization and minor low-cost add-on development activities (being part of the WMPs) should continue and blended with the other activities. This includes

	demonstration activities for utilisation of wetland products (assumed to tie well up with the LVEMP-2 activities on micro credits and economic in the area), and sustained contact with the Kenya wetland team. • One of the scientists on contract (that will most likely leave the project) has been trained in the Duflow model (purchased system at regional level in Mwanza (for example a water person that have computer skills and also can operate the Lake Model?) must be trained in the use of the model, otherwise the model will end up as a "white elephant". • A clear plan for stepwise phasing out of the contract experts (2 Scientists, 3 Research Assistants throughout the BP must be prepared. The downscaling must be blended with the scaling down of activities.
Catchment	• This component is assumed sustainable at a reduced level, as the Component Leader is a government employee and all activities are coordinated with an undertaken together with the DFOs in Musoma
Forestation (Sub-Component)	• The activities on conservation of natural forests by the communities should be continued as a priority (relatively cheap activity with relatively large impact. Mostly survey and map production assistance needed.) • The joint management (by government and the villages) of Forest Reserves should continue. • Village sensitization must be continued hand in hand with the two above-mentioned activities.
Capacity Building/Support to Riparian Universities (Univ. of Dar es Salaam)	• The university primarily runs courses and research activities for students (MSc and PhD), with a subsequent benefit to the agricultural sector overall. All the activities are related to the "normal" continuous operations which should be maintained by any university (in case they could afford these), comprising short "A-Z activities"/courses where the sustainability of the activities are not an issue at stake. A policy decision has to the made on whether, under the prevalent circumstances with very limited funds for the BP, this support should be terminated completely once LVEMP-1 is completed.
Micro Projects	• Follow up of the already completed projects, including sensitization of communities and capacity building, should be continued to the level affordable. (This is an important activity with direct impact on the ground, targeting the poor beneficiaries. Ownership most likely secured by 50% contribution from the community).
Community Participation	• The CPO is temporarily employed by the project, and might not remain in the area after completion. The activities are however believed sustainable through the District CDOs.

	• Activities of the CPO will largely follow the activities of the other components, and assist where needed. In addition come own activities that are cross-cutting (HIV/AIDS, gender and training). Scaling down will follow the other activities. The CPO is budgeted for under the secretariat. • Should concentrate activities around training-of –trainers in the BP, especially at district level (District CDO and his staff) • The CPO must be involved in the planning of the component activities during the BP, especially in Wetland, Forestry, Soil & Water Conservation and Water Hyacinth.

Appendix 5. Trained people through LVEMP as of 2001 (Nanai and Nyirabu 2001)

(Table 1. LVEMP's achievement through community participation)

Component	Achievements
Fisheries Management	• 511 Beach Management Units (BMUs). • Beach landing Sites. • 400 fish farmers trained on fishponds construction • 141 Closed Fishing Areas • 40 fish farmers trained on aquaculture practices • 72 fishermen trained on fish quality and safety assurance standards • 600 fisher folks trained on fish quality and safety assurance standards • 79 people from 8 landing beaches out of 53 selected landing beaches have been trained on data collection on length and weight of *Rastreneobola argents* (Dagaa) *Oreochromis niloticus* (sato), *Lates niloticus*
Fisheries Research	• 100 fish frmers in Mara kagera and Mwanza were provided with fingerlings.
Water Quality and Ecosystem Management	• 300 Shoreline settlements are involved in taking inventory of water quality and sanitary survey. • 12 institutions are involved in rain data collection.
Wetlands Management	• 1000 farmers in Kwibuse are involved in the integrated project on soil and water conservation. • Villagers around Simiyu and Rubana wetlands are discussing the wetland management plan.
Soil and Water Conservation	• 408 farmers are involved in integrated soil and water conservation.
Catchment Afforestation	• 372Ha and 626Ha of natural forests have been conserved in Sengerema and Tarime districts respectively. • Communities have prepared management plans for reserved forests. • 13 farmers have attended training on community involvement in natural forest conservation.

	• 350 contact farmers; 14primary schools; 3 church organizations; district councils of Musoma ®. Bunda, Mwanza, Misungwi and Sengerema are involved in tree planting activities. • 5 CBOs (3 in Musoma rural and 2 in Tarime districts) are involved in tree nursery establishment.
Water Hyacinth Control	• 500 villangers trained on massive rearing and release of water hyacinth weevils. • 280 Landing beaches have been kept weed free by communities. • 8 out of 11 water hyacinth weevil rearing centers are managed by village communities. • Lake Nyanza Environmental Sanitation (LANESO) is involved in water hyacinth control.
Support to Riparian University Micro Projects	• 14 District Steering Committees (DSC) have been established. • 12 micro-projects have been completed 22micr-projects are in progress.
Coordinating Secretariat	• 36 staff have attended long courses (MSc. To PhD level), 29 staff have attended short courses. • 70 primary schools are involved in awareness creation on LVMP.

Appendix 6. Proposed mechanism to facilitate community participation (Nanai and Nyirabu 2001)

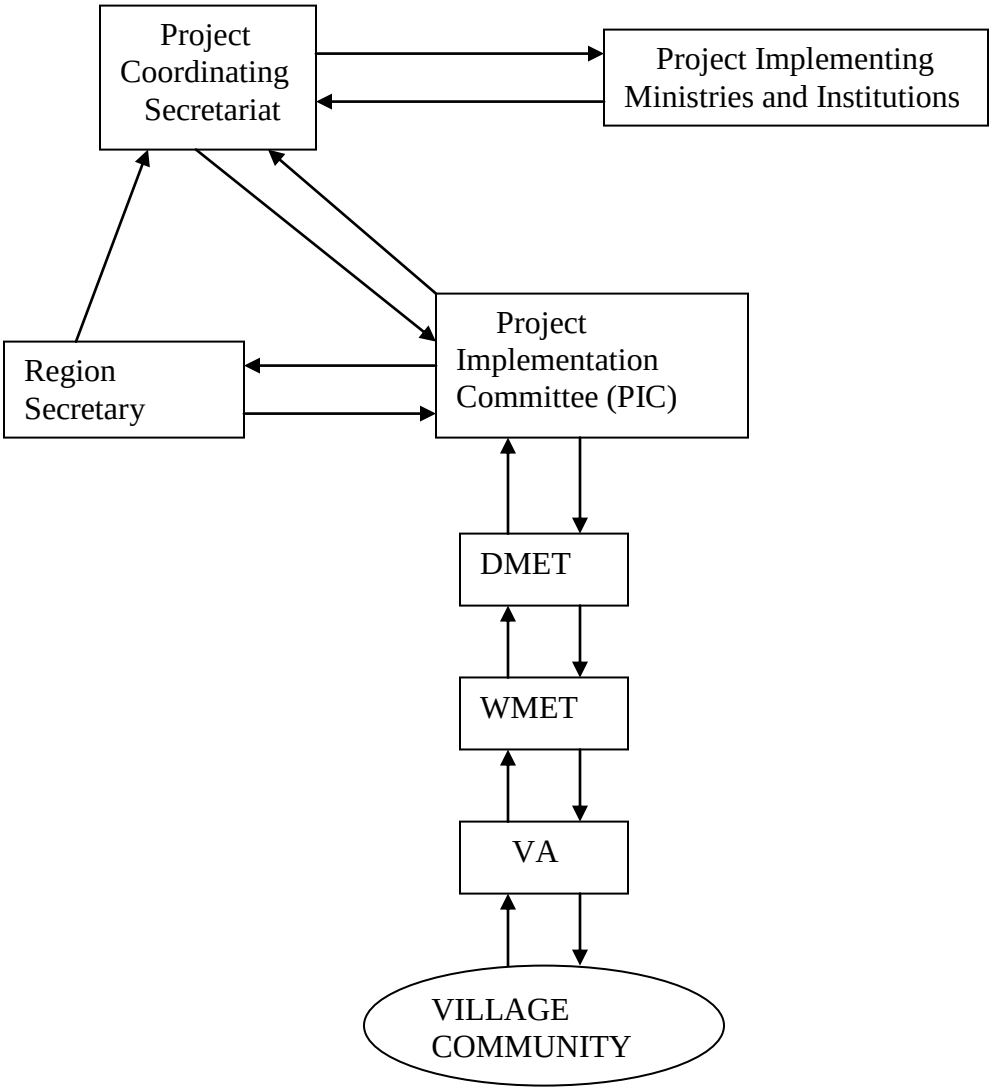

Figure 4. The proposed mechanism to facilitate community participation