



A workshop on establishing a regional integrated environmental monitoring programme for Lake Tanganyika was organised on March 30th 2010 in Bujumbura, Burundi. The workshop was attended by a great number of participants from the riparian countries, as well as international monitoring partners, and was a great success.

Project executed by:



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ACRONYMS

| | |
|----------|--|
| AfDB/ADB | African Development Bank |
| COMESA | Common Market for Eastern and Southern Africa |
| CRH | Centre for Hydrobiological Research (Uvira) |
| DRC | Democratic Republic of Congo |
| DWA | Department of Water Affairs (Zambia) |
| EAC | East African Community |
| ECZ | Environmental Council of Zambia |
| ED | Executive Director |
| EU | European Union |
| FAO | Food and Agriculture Organization of the United Nations |
| FFMP | Fisheries Framework Management Plan |
| FINNIDA | Finnish International Development Agency |
| GEF | Global Environmental Facility |
| GTZ | German NGO for Technical Cooperation |
| ICCN | Congolese Institute for Conservation of Nature (DRC) |
| ICRAF | International Centre for Research in Agroforestry |
| ILTMA | Interim Lake Tanganyika Management Authority |
| INECN | National Institution for the Conservation of Natural Resources (Burundi) |
| INERA | Institute for National Agronomy Research (DRC) |
| IUCN | International Union for the Conservation of Nature |
| JGI | Jane Goodall Institute |
| LFA | Logical Framework Analysis |
| LTA | Lake Tanganyika Authority |
| LTBP | Lake Tanganyika Biodiversity Project |
| LTMC | Lake Tanganyika Management Committee |
| LTMS | Lake Tanganyika Management Secretariat |
| LTRIMDP | Lake Tanganyika Regional Integrated Management and Development Programme |
| LVEMP | Lake Victoria Environmental Management Project |
| MOU | Memorandum of understanding |
| M&E | Monitoring and Evaluation |
| MEWD | Ministry of Energy and Water Development (Zambia) |
| MTENR | Ministry of Tourism Environment and Natural Resources |
| NCU | National Coordination Unit |
| NDF | Nordic Development Fund |
| NGO | Non Governmental Organization |
| NIA | National Implementing Agency |
| NSC | National Steering Committee |
| PMU | Project Management Unit |
| PDF-B | Project Development Facility (Block B Grant) |
| PIR | Project Implementation Review |
| REGIDESO | Bujumbura Water and Electricity Organisation (Burundi) |
| RIEMP | Regional Integrated Environmental Monitoring Programme |
| SAP | Strategic Action Programme |
| SETEMU | Municipal Technical Services in Bujumbura (Burundi) |
| STAP | Scientific and Technical Advisory Panel (of the GEF) |
| TACARE | Tanganyika Catchment Reforestation and Education Programme |
| TAFIRI | Tanzania Fisheries Research Institute |
| TANAPA | Tanzania National Parks Authority |
| TDA | Transboundary Diagnostic Analysis |
| UNDP | United Nations Development Programme |
| UNOPS | United Nations Office for Project Services |
| VPO | Vice-President's Office (Tanzania) |
| ZAWA | Zambia Wildlife Authority |

SUMMARY

From February to March 2010, a consultancy was conducted in the framework of establishing a long-term environmental monitoring programme Lake Tanganyika and its catchment basin. The overall aim of the consultancy was to assess the current capacities and needs of local and regional institutions, and identify possibilities to enhance future harmonisation of environmental monitoring, data collection and information sharing activities.

The consultancy was commissioned and supported by the Regional Project Coordination Unit of the UNDP/GEF Project on Partnership Interventions for the Implementation of the Strategic Action Programme for Lake Tanganyika, in collaboration with the Lake Tanganyika Authority.

The Regional Environmental Monitoring Programme for Lake Tanganyika focuses on the following topics: water quality, fisheries, land use and erosion, biodiversity and climate change.

A range of institutes and resource persons in the lake basin was visited in order to obtain insights in their capacity and potential role as partners of the monitoring programme. Key issues that were assessed include mandate, manpower, field- and laboratory equipment, and other analytical facilities available to national institutions, as well as training needs of resource persons. In addition to field visits, a regional workshop was organised to enable stakeholders from the four riparian countries as well as several international partners to share knowledge, insights and ideas on establishing a monitoring programme for Lake Tanganyika¹.

Because of the interdisciplinary nature of the regional monitoring programme, multiple institutions should be involved with different specialisations in each country. Ideally, these institutions should collaborate by sharing laboratory facilities and by jointly implementing monitoring activities. In addition, relevant monitoring activities planned and implemented at the national level should be well coordinated at the regional level in order to benefit the overall Lake Tanganyika programme.

Recommendations on how to cost-effectively enhance capacities of monitoring partners include linking to national and international programmes, as well as training and investment in monitoring equipment. Up to date IT facilities including relevant software, sufficient data storing and processing capacity and Internet access are essential for all monitoring partners. Furthermore, recommendations were made according to the area of monitoring, including items such as sampling instruments,, chemicals and advanced laboratory equipment for monitoring of water quality and pollution, precise balances and microscopes for fisheries biology, and river sediment sampling materials for erosion studies. It was noted that transportation means for lacustrine sampling activities are lacking or inadequate in many cases. To enhance the quality of regional meteorological data, it is recommended to install small meteorological stations in various sites near the lake. Furthermore, it is advised to construct or improve simple jetties near partner institutions, to enhance boat access as well as for regular coastal water sampling.

All partners that were interviewed during the consultancy identified training as key to the enhancement of capacities. Specific short training initiatives (national or international) should focus on local needs, but training is also required for regional monitoring purposes. In addition, enhanced academic training (BSc, MSc, PhD) at the national as well as international level may enhance the capacities of national staff as well as the long-term quality of regional monitoring activities in the Lake Tanganyika basin.

¹ See: UNDP/GEF Project on Lake Tanganyika (2010). Towards a Regional Integrated Environmental Management Programme for Lake Tanganyika. Workshop Report, March 2010, 1-32.

To enable informed future management decisions at the regional level, a framework is needed to integrate data from all partners. A system is proposed that involves the Lake Tanganyika Authority as well as National Coordination Units and Project Management Units. To successfully implement such a system, well-defined roles, clear instructions, close follow up and feed back to all participating partners are critical. Data could be compiled and accessed by all partners using an online database.

The first steps of establishing a regional integrated environmental monitoring programme include the drafting of a framework, the identification of partners and signing memoranda of understanding. Next steps include the preparation and compilation of monitoring procedures, enhancement of capacities, and development of a regional database facility. After a period of pilot monitoring, thorough evaluation and adjustment should enable the establishment of a sustainable long-term operational monitoring programme.



Staff of some of the national institutions who were consulted for the monitoring programme.

1. Introduction

Lake Tanganyika and its catchment basin are characterised by unique aquatic and terrestrial ecosystems, which are of major economic and environmental importance to the riparian countries of Burundi, Democratic Republic of Congo, Tanzania and Zambia. The lake basin ecosystem and its biodiversity are threatened due to increased socio-economic and development activities, as well as the effects of global climate change. The riparian countries have recognized these threats, and the need to work together in order to ensure sustainable management of the natural resources of the lake and its basin for the benefit of present and future populations.

For this purpose, a Strategic Action Programme (SAP) was drafted with institutional support from the United Nations Development Programme (UNDP) and funding from the Global Environment Facility (GEF). Concurrently, a Convention on Sustainable Management of Lake Tanganyika was developed. The Convention provides a framework for the implementation of the SAP as well as for the establishment of the Lake Tanganyika Authority (LTA), which has the mandate to oversee and coordinate regional activities aimed at sustainable management of Lake Tanganyika and its catchment basin.

With support from the UNDP/GEF Project on Partnership Interventions for the Implementation of the SAP for Lake Tanganyika, the LTA is working towards a regionally harmonised monitoring process by adopting regionally agreed formats and parameters on which to collect environmental, biological, and socioeconomic data. As such, the monitoring framework is intended to facilitate joint management based on scientific data as stipulated in the Convention.

Each of the riparian countries has national regulatory organizations and research organizations mandated to collect information on the lake and its natural resources. So far, the capacities in most of these organisations have been limited and data collection has been according to national formats and criteria, with little regional collaboration. Future data collection needs to be regionally harmonised so that it can feed into planning and implementation processes of the regulatory and management agencies responsible for the resources of the lake.

To assess the present situation and identify possibilities to enhance future activities, an institutional needs assessment consultancy was commissioned, which took place from February 2nd to March 31st 2010 in the Lake Tanganyika riparian countries Burundi, DR Congo, Tanzania and Zambia². The LTA, UNDP/GEF Project and other partners will use the findings of this assessment as the basis for regional discussions on developing a harmonized monitoring and management program for Lake Tanganyika. The consultancy had the objective to collect information on the following topics:

- National and regional institutions that are/should be involved in the Regional Integrated Monitoring Programme as implementing partners.
- Current mandates of these institutions, and possibilities to expand their mandates if needed.
- Relevant monitoring activities done on the lake and in its basin by national institutions (including existing datasets).
- Resources (human and material), capacities, existing and potential funding mechanisms with relevance to the Lake Tanganyika monitoring programme.
- Possibilities for cost-effectively enhancing the capacities of the relevant institutions.

² See Appendix 1 for the TOR of the consultancy; Appendix 2 for the resource persons who were consulted. Furthermore, the questionnaires used for interviewing resource persons, as well as their answers are presented as appendices.

- Training needs of national institutions to conduct monitoring activities, as well as training opportunities (e.g. existing or potential workshops or courses, funding mechanisms, etc.).
- Possibilities to cost-effectively improve harmonization of monitoring activities (coordination, communication and cooperation among stakeholders) at the national and regional level.
- Possibilities and challenges for establishing data collection, data management and information sharing systems at the LTA level.
- Opportunities to integrate monitoring activities at the international level.

The results of the consultancy are presented in this report. The first part presents an overview of preceding projects and documents with special attention to the environmental monitoring aspects. The second part presents an overview of (potential) partners for monitoring activities in the Lake Tanganyika basin, as well as an assessment and recommendations on how to cost-effectively enhance their capacities. Thirdly, a framework is presented for establishing data management and information sharing systems and cost effective implementation of the regional monitoring. The consultancy also included a regional workshop (March 30th in Bujumbura) that gathered participants from 35 institutions in order to share ideas on how to establish regional integrated monitoring for Lake Tanganyika. The results of the regional workshop are integrated in this report³. The final chapter of the report includes recommendations for the way forward in establishing a sustainable, long-term regional integrated monitoring programme for the Lake Tanganyika basin.

2. Background of the Lake Tanganyika Monitoring Programme

2.1. Lake Tanganyika Facts

Lake Tanganyika is of great global, regional and local importance. The following facts emphasise the uniqueness and value of the lake in terms of economics and biodiversity:

- Lake Tanganyika contains 17% of the world's available surface freshwater resources. The lake is a major source of drinking water to the local communities as well as a route of primary importance allowing trade and access to villages and extended areas along its shore.
- The inland fishery production of Lake Tanganyika is Africa's second largest (after Lake Victoria). It is estimated that about one million people in the lake basin directly or indirectly depend on the fishing resources.
- Lake Tanganyika is characterised by an extreme level of biodiversity, harbouring over 2000 species of aquatic plants and animals. The lake is valuable not only for the presence of unique, endemic species, but also as a microcosm in which to study the processes of evolution. The value of the lake to Global Biodiversity is beyond measure (GEF, 2000 a).

The most comprehensive overview thus far of the history, fisheries and biodiversity of Lake Tanganyika is presented by Coulter (1991).

2.2. International Projects and Agreements

Lake Tanganyika knows a long history of explorations, scientific research, surveys and planning activities, many of which have contributed directly or indirectly to the present UNDP/GEF Project. The list included here provides an overview of the projects, documents and agreements preceding the effort to establish an integrated long-term regional environmental monitoring programme for the Lake Tanganyika basin.

³ Also see: UNDP/GEF Project on Lake Tanganyika (2010). Towards a Regional Intergrated Environmental Management Programme for Lake Tanganyika. Workshop Report, March 2010, 1-32.

1991: **First International Conference on the Conservation and Biodiversity of Lake Tanganyika.** The views of scientists from the four riparian states of Burundi, D.R. Congo, Tanzania and Zambia and their international colleagues were brought to the wider community at this conference held in Bujumbura in 1991. Concerns were expressed at the increasing threats to the lake's unique and, economically important resources, including pollution from excess loads of sediment and nutrients caused by erosion in the watershed, industrial and urban pollution, intensive fishing. These problems and their effects are increasing and others such as oil exploration and transportation on the lake, present potential future threats to the lake's ecosystem. It was recommended therefore that prompt attention be given to those threats. In doing so, the livelihoods of the lakeside communities should be safeguarded or used in a sustainable way. As four countries share the waters of Lake Tanganyika, any actions taken by one country can have impacts on these shared resources. Any approach to improving the understanding and subsequent management of the lake should have an international and regional perspective.

1992: The **Convention on Biological Diversity** opened for signature at the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in June 1992. The principal objectives of the Convention on Biological Diversity are the conservation and sustainable use of biological diversity, and the fair and equitable sharing of benefits arising from its utilisation. The Convention recognises that the key to maintaining biological diversity depends upon using it in a sustainable manner.

1992-2001: Project **Research for the Management of the Fisheries on Lake Tanganyika** (FAO/FINNIDA). Development of a Lake Tanganyika Framework Fisheries Management Plan (FFMP) (Reynolds, 1999).

1995-2000: **Project Pollution Control and Other Measures to Protect Biodiversity in Lake Tanganyika**, (UNDP/ GEF)⁴. Development of Transboundary Diagnostic Analysis (TDA) and a Strategic Action Programme (SAP).

The TDA (GEF, 2000) identified the major trans-boundary threats confronting the four countries in their efforts to manage the Lake and its Basin as: unsustainable fisheries, increasing pollution, excessive sedimentation and habitat destruction. The implications of these threats were the global loss of biodiversity, the loss of shared fisheries resources and the decline of water quality. The crosscutting barriers to addressing these threats are the lack of resources (including skills, infrastructure, institutions and funds), the lack of institutional coordination, poor enforcement of existing regulations, and few appropriate regulations for the management of the Lake.

The SAP (GEF, 2000) established an agreed planning and management process and prioritises an initial programme of interventions based on present needs and knowledge. SAP Priorities for GEF funding in DRC, Zambia and Tanzania included catchment management to reduce siltation which is adversely affecting lake processes, productivity and biodiversity. Priorities in Burundi, and in one site in Tanzania, included reducing wastewater effluents that cause significant pollution in the lake. Co-Finance supports improved sustainable fisheries, inputs to wastewater treatment and lake monitoring.

2002-2003: Elaboration of regional and national project proposals for the implementation of the SAP and finalization of the Convention under the Lake Tanganyika Management Planning Project funded by GEF (PDF B project ⁵).

⁴ First GEF funded project on Lake Tanganyika.

⁵ Second GEF funded project on Lake Tanganyika.

2003: Signing of the **Convention for the sustainable management of Lake Tanganyika** (12/6/2003) by the Ministers H.E. Barnabé Muteragirana (Burundi), H.E. Jules Yuma Moota (Democratic Republic of Congo), Hon. Arcadio Dennis Ntagazwa (United Republic of Tanzania) and Hon. Patrick Kalifungwa (Republic of Zambia).

The objective of the Convention is to ensure the protection and conservation of the biological diversity and the sustainable use of the natural resources of Lake Tanganyika and its Basin by the Contracting States on the basis of integrated and co-operative management.

The Convention includes an agreement on exchanging information. The Contracting States of the convention have agreed to co-operate in good faith in the management of Lake Tanganyika and its Basin. Such ***co-operation shall include exchanging information concerning the state of the Lake Basin, the results of the monitoring of activities in the Lake Basin*** that may affect its environment, and experience concerning the protection, sustainable use and management of Lake Tanganyika; (Article 4.2.D of the Convention).

In particular, article 20 of the Convention precises that the Contracting States shall exchange through the Secretariat data and information concerning the sustainable management of the Lake Basin and the implementation of the Convention, as is available including inter alia data and information on:

- a. The ***state of the Lake Basin and its biological diversity***, in particular ***monitoring data and information of a hydrological, hydro-geological, meteorological and ecological nature and related to water quality, as well as related forecasts***.
- b. The results of research relevant to the management of the Lake Basin.

2008. **Ratification of the Convention** for the sustainable management of Lake Tanganyika (11/2008).

2008: Installation of the **Lake Tanganyika Authority** in Bujumbura (19/12/2008).

2008: Start of the **GEF/UNDP Project⁶ Partnership Interventions for the Implementation of the Strategic Action Programme for Lake Tanganyika**, which is included under the umbrella of the overall Lake Tanganyika Regional Integrated Management and Development Programme (LTRIMDP). The LTRIMDP addresses the SAP as well as the FFMP. Interventions are outlined with an emphasis on the following areas:

- Institutional coordination for the sustainable management of the lake (including monitoring)
- Control of pollution
- Reduction of the impact of fishing
- Control of sedimentation
- Conservation of key habitats and biodiversity

In addition, climate change was listed as an area of concern in the 2008 UNDP/GEF Project document. The UNDP/GEF Project is implemented through two major approaches: national execution (NEX) in Tanzania and Zambia and Agency Execution via UNOPS for Burundi and DRC as well as the Regional Components.

2.3 Objectives of the UNDP/GEF Project on Lake Tanganyika

⁶ Third GEF sponsored project on Lake Tanganyika.

The long-term objective of the UNDP/GEF Project on Lake Tanganyika is “the improvement of the living conditions of the riparian populations through the implementation of the SAP, the FFMP and the Convention, together with the ongoing and future efforts of riparian countries, so as to bring about an integrated sustainable management and protection of the Lake Tanganyika”. The immediate objective of the project is “to implement prioritised activities of the Strategic Action Programme so as to achieve sustainable management of the environment and resources of Lake Tanganyika” (UNDP/GEF Project Document, 2008). One of the expected outcomes of the UNDP/GEF Project is the “Establishment of a Lake Monitoring and Management System”, of which this consultancy is part. A number of points have been identified in the UNDP/GEF Project documents that are considered key to successful establishment of a regional monitoring programme, as well as accompanying M&E indicators, assumptions and risks (Table 1). Several of these points will be addressed further in this report.

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| <p>OUTCOME 4:</p> <p>Regional monitoring decision-making support system to foster the lake’s management established</p> <p>Objectively Verifiable Indicators Monitoring and communication unit is equipped; Internal and external network for communication within the program is established; Standardization of methods, parameters and targets in environment monitoring; A web site is developed; Two reports are prepared each year to support decision-making at regional level.</p> <p>Sources of Verification APR-PIR documentation of the decision-making management support system; Documented reports on interactivity between workplan and LTA activities; Documented reports on increased country commitment and local benefits.</p> <p>Assumptions and Risks The LTAS will assist countries in recruiting Monitoring Committees; The LTAS will assist countries in assessing national monitoring processes; The LTAS will have the required technical expertise to develop monitoring capacity and to establish a decision-making management support system.</p> |
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Table 1: Summary of Outcome 4, M&E indicators, assumptions and risks as described in the Regional Component of the UNDP/GEF Project document (2008).

2.4 Previous Monitoring in Lake Tanganyika

Lake Tanganyika has been the subject of over a century of scientific research, which has lead to the documentation of an extensive amount of limnological, biodiversity and applied fisheries data. Information has been collected through investigations out of all four riparian countries, including the GEF funded TDA and SAP process, as well as the FAO-FINNIDA Fisheries Research Project. All four countries have national research institutes and regulatory organisations with a mandate to collect information on the lake and its natural resources. These include specialised fisheries, hydrobiology, water, agricultural and land use as well as health agencies.

Thus far, national capacities for extensive monitoring activities have been fairly limited. Monitoring activities have been ad-hoc and narrow in scope and coverage. This has lead to flawed data series, often showing extensive gaps during periods when no monitoring activities took place (Figure 1), which poses problems for statistics subsequent treatment and interpretation of the data.

Data collection has been to national formats and criteria, with little regional collaboration. Past monitoring and much of the scientific data collection has not fed into the planning and implementation processes of the regulatory and management agencies responsible for the resources of the lake (UNDP/GEF Project Document, 2008). In addition, poor enforcement of existing regulations, lack of appropriate regulations and absence of harmonization at the regional level pose serious challenges (GEF, 2000 a).

2.5. Objectives of the Lake Tanganyika Monitoring Programme

All parties have agreed that there is need for an integrated monitoring program for Lake Tanganyika. Integration should be cross-sectoral (fish, water, land use, climate) and include all four countries. It was also agreed that monitoring activities should be linked to the management of the lake and lake resources, should follow regionally agreed formats and protocols, and fall under the oversight of the Lake Tanganyika Authority and Secretariat.

The Lake Tanganyika Regional Integrated Environmental Monitoring Programme (RIEMP) is designed to be consistent with the SAP and the FFMP. It aims to provide tools and training in monitoring to national institutions, provide managers with relevant data and decision-support tools, and harmonize indicators and targets among the riparian nations. The objective is to establish a functional and sustainable environmental monitoring system, implemented in close collaboration with mandated national institutions, working towards regionally agreed standards. At the same time, the monitoring system should take into account international standards, and encourage linkages to global programs.

In order for regional monitoring activities to be sustained after donor funding concludes, they must provide data that is meaningful to at the national level, and be fully integrated into the annual work plans of the relevant institutions. These prerequisites, coupled with current institutional capacities and resources, argue for a simple, low-cost monitoring program using appropriate technologies. It is essential that planned activities fall within the (enhanced) capacity and resources of the institutions involved.

The long term monitoring programme aims to ensure that basic parameters are recorded continuously, and avoid leaving periods with data gaps (Figure 1).

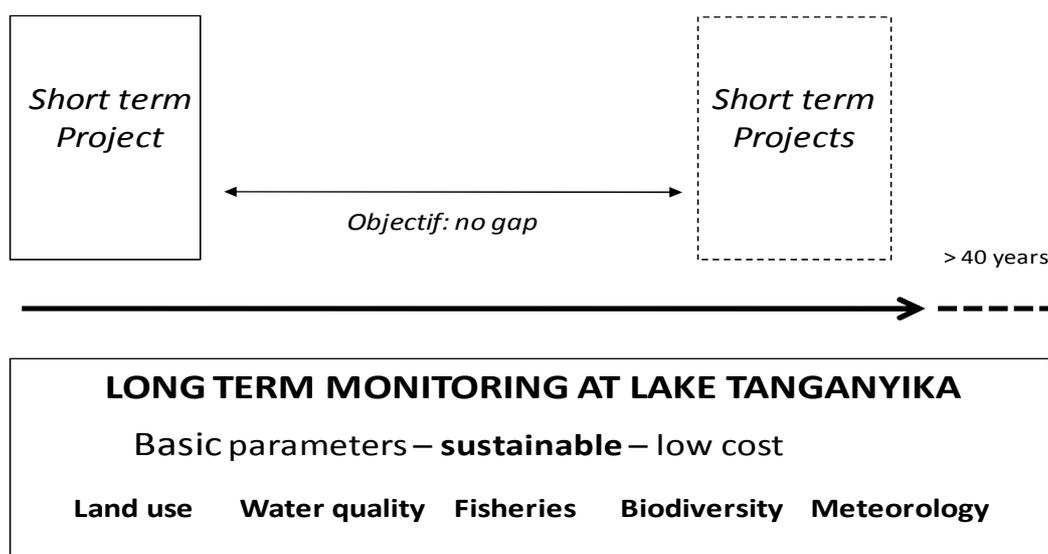


Figure 1: Long term monitoring should insure no gaps in series of basic data at Lake Tanganyika independently from short term projects.

2.6. Monitoring Topics

The monitoring programme aims to provide long-term information about the status of five focal topics that were identified through participatory processes⁷ as being relevant to the biodiversity and natural resources in the Lake Tanganyika basin. Combined, these monitoring topics should offer reasonable indicators of the overall health of the Lake Tanganyika ecosystem, and should provide sufficient knowledge to allow well-informed future management decisions at the regional level.

The following topics were prioritised for monitoring activities:

- A) Water Quality
- B) Fisheries
- C) Land Use
- D) Biodiversity
- E) Climate Change

Each of these monitoring topics and their associated parameters were discussed with the resource persons consulted during the institutional needs assessment, as well as during the subsequent regional workshop⁸. The summaries below provide an integrated overview of the outcomes of the consultancy discussions, as well as the results of the assessments conducted for the TDA (GEF, 2000 a), SAP (GEF, 2000 b) and UNDP/GEF Project (2008).

A) Water quality

Lake Tanganyika is at risk from pollution resulting from a rapidly increasing human population and urbanisation. The long residence time of Lake Tanganyika (440 years) makes it particularly fragile, and pollution not only poses threats to the lake's water quality, but also to fish stocks and overall biodiversity.

The city of Bujumbura (Burundi) was previously identified as the greatest pollution threat on the lakeshore, as it hosts a variety of industries and pollution sources close from the lakeshore. The rapidly growing town of Kigoma (Tanzania) was also identified as a potential pollution threat. In addition, cities and towns such as Mpulungu (Zambia), Kalemie and Uvira (DRC) pose current and future pollution hazards. Pollution from mining activities is also threatening. Waste from industries and domestic use are poorly treated or not treated at all. There is evidence in Lake Tanganyika of pollution by pesticides, heavy metals, sulphur dioxide, fuel, and oil (Patterson et al. 1998). Sediment pollution is another form of pollution that affects Lake Tanganyika, which is caused by increased deforestation followed by erosion in the catchment. This causes an increase in the suspended sediment loads entering the lake through the rivers, which can have a dramatically detrimental effect on lacustrine habitats and biodiversity (also see monitoring topic Land Use).

The levels of pollution already identified, as well as the continuously increasing human population and urbanisation of the lakeshore emphasises the need to establish a long-term monitoring program of water quality, so that managers can take adequate decision for the sustainable use of the water in the basin. Water quality monitoring should target: (A) chemical pollution; (B) pollution by sediments; (C) microbiological parameters. Furthermore, it is important to relate monitoring data to aquatic

⁷ See TDA (GEF, 2000 a), SAP (GEF, 2000 b), UNDP/GEF Project Document (2008).

⁸ See: UNDP/GEF Project on Lake Tanganyika (2010). Towards a Regional Integrated Environmental Management Programme for Lake Tanganyika. Workshop Report, March 2010, 1-32. Also see Appendix 48 and 49.

habitats, to obtain insight in questions of how changes in water quality can affect fish stocks and overall biodiversity.

Ideally, water quality monitoring should cover the entire pathway from the upper catchment to the lake. To accomplish insights in how urbanisation, pollution and deforestation in the catchment affects the lake, the following range of sites should be included in monitoring activities: Rivers in the country side; rivers crossing urbanised areas (cities, large towns); waste water systems in urbanised areas; shoreline areas; pelagic area.

Several institutions in the Lake Tanganyika riparian countries have a mandate dealing with water (environment, drinking water, sediment, fish habitat, health). Some institutions have well equipped laboratories while others are in the process of having their laboratories renewed (e.g. instruments, infrastructure)⁹. Several national institutions would need improved capacities to be able to participate to the regional monitoring (instruments, training)¹⁰.

Institutions situated near the lake in Uvira, Bujumbura, Kigoma and Mpulungu could be involved in frequent sampling activities. For other sites, a minimum sampling of once a week along the coast is suggested. Pelagic sampling (i.e. one sample every 20 meters from 0 to 100 m) is proposed in each main station (Uvira, Bujumbura, Kigoma and Mpulungu) every week or every two weeks. It is important to monitor the oxygenated layers of the lake, as these are the habitat of pelagic fish. Lower monitoring frequencies were proposed for nutrients (every month), heavy metals and pesticides (every year).

In addition, as water level fluctuations can have a significant effect on life in and around the lake, this is certainly a topic that should be included in monitoring activities. It is further discussed under the monitoring topic Climate Change.

B) Fisheries

The main fishery in Lake Tanganyika is pelagic. Six pelagic fish species are found in Lake Tanganyika: two species of sardines (clupeids) fishes (*Stolothrissa tanganyicae* and *Limnothrissa miodon*) and four species of *Lates* spp (*Lates stappersii*, *Lates angustifrons*, *Lates microlepis* and *Lates mariae*). Among those, the two sardine species and *Lates stappersii* are economically the most important.

Previous projects indicated that local overfishing exists in the northern and southern part of the lake although this remains to be confirmed with more data analyses. Although further exploitation of fisheries resources could be possible in some areas of the lake, a precautionary approach is highly advisable in the light of increasing human populations and anticipated climate change effects.

A regional lake wide frame survey is a priority, while a national stratified sampling program should be adopted to estimate catches and fishing efforts. If sufficient funding is available, biological sampling should be implemented (particularly gonad development and length frequency analysis of commercially important species to monitor growth). Additional studies could include other biological aspects (stomach analysis, fecundity, condition factor, parasites, etc.) as well as gear selectivity.

⁹ See overview presented in UNDP/GEF Project on Lake Tanganyika (2010). Towards a Regional Integrated Environmental Management Programme for Lake Tanganyika. Workshop Report, March 2010, 1-32.

¹⁰ UNEP-ROA through a partnership with the Nanjing Institute of Geography and Limnology, Chinese Academy of Sciences pledged to support the rehabilitation of two laboratories (INECN in Burundi and TAFIRI in Tanzania), see Appendix 51.

Fisheries independent assessments such as lake wide hydro-acoustic surveys are also advised. A research vessel will be constructed for Tanzania. Such a vessel could be used for regional research activities, with regional scientists on board (Tanzanian crew, insurance, registration, etc.). During the surveys not only fish abundance should be measured but also limnological parameters required for stock assessments. Data analysis and presentation should be done using Geographic Information Systems. The movements of processed fish across the lake to certain markets could be monitored to estimate the total quantity processed for consumption outside the basin.

To insure sustainable longterm data collection after the termination of the projects, fishing communities could be involved for parameters such as fishing effort and target species production.

Under the guidance and responsibility of the LTA Director of Fisheries in close collaboration with the Fisheries Experts in the National Coordination Units as well as national Fisheries Departments and Research Institutions, appropriate sampling and monitoring programs will be established for data collection and research activities. The LTA is planning to establish Beach Management Units, which could also provide a useful system for local data collection.

C) Land Use

In the Lake Tanganyika basin, sedimentation resulting from deforestation, inappropriate land use practices and climate change (stronger intensity of rainfalls) has been identified as a major threat to biodiversity.

Key Issues of land use monitoring are vegetative and agricultural crop cover and sediment loads in the rivers. Two scales need to be considered when monitoring land use: i) country to basin, which may be monitored using remote sensing; and ii) landscape and demonstration sites, which may be monitored using participatory methodologies. The two main parameters for monitoring land use are: i) land cover and agroforestry interventions; and ii) erosion and sedimentation¹¹.

A problem with sedimentation monitoring is that measurements of erosion at site level often lead to an overestimation of the levels of erosion when scaled up to the landscape scale. This is related to the fact that soil loss formulae do not account for deposition in other areas.

The UNDP/GEF Project partnership with ICRAF plans to use sophisticated remote sensing techniques combined with a bottom-up participatory approach in collaboration with local communities at project demonstration sites. Large scale monitoring by remote sensing can provide useful information on changes in land cover and sediment deposition in Lake Tanganyika. Ground truthing of land cover changes using participatory methods with local communities can validate findings from remote sensing. The data collected by ICRAF will be useful for establishing models to identify the most suitable sites, plant/tree species and agroforestry interventions to reduce erosion in the Lake Tanganyika basin.

D) Biodiversity

The Lake Tanganyika Convention emphasizes that the riparian states are responsible for conserving their biological diversity and for using their biological resources in a sustainable manner. Lake Tanganyika harbours a tremendous diversity of species, many of which have adapted to a wide diversity of ecological niches. Different ecological food webs in Lake Tanganyika are intricately intertwined with each other, and its species plays its own specialized role. Without a wide range of species to maintain these intricate links, food webs in Lake Tanganyika would be at risk of collapsing.

¹¹ Also see Appendix 45 for an overview of landuse and erosion parameters.

This would have direct effects on the availability of fish for human consumption. As such, monitoring of biological diversity can provide a mean to measure overall aquatic ecosystem health¹².

Site selection should be based on a pragmatic approach, taking into account the fact that various substrates need to be covered as well as factors of accessibility. Monitoring should focus on taxa that play a key role in the aquatic ecosystem. Taxa should be easily identifiable by para-taxonomists and easily sampled, for instance using dip nets, snorkeling, or fishing gear. Reference collections (taxonomic guidelines, and preserved example specimens of key taxa) will need to be established in strategic locations within each country. Collaborative networks with national, regional and international experts as well as ongoing training of selected para-taxonomists should ensure sustainability of a biodiversity monitoring programme in Lake Tanganyika. Short-term lake-wide biodiversity surveys of wide range of taxa could take place periodically by teams of international experts. Long-term site-specific monitoring of limited key taxa could be done by national survey teams.

The UNDP/GEF Project has established a partnership with IUCN to support the monitoring and management of invasive species in the Lake Tanganyika basin. Invasive species can have tremendous impacts of local and regional biodiversity, as well as on agricultural or fisheries productivity. Ideally, invasive species monitoring should go hand-in-hand with overall biodiversity monitoring activities.

Over the past years, IUCN has implemented several surveys in the lake basin, covering the northern lake basin and eastern shore to the delta of the Malagarasi River. These surveys have revealed the presence of a number of invasive plants in the lake as well as in the catchment, several of which can have harmful effects on biodiversity and agriculture. Monitoring and regional awareness raising is urgently needed to identify expansion of existing invasions and the arrival of new (potentially) invasive species in the basin, as well as to implement management and control interventions.

E) Climate Change

Adaptation to climate change issues and responses is an important global issue that also affects the Lake Tanganyika basin. Terrestrial ecosystems that are already affected by high rates of deforestation, and unsustainable agriculture are particularly susceptible to the anticipated effects of climate changes. Lake Tanganyika itself is extremely sensitive to changes in climate, since temperature drives the stratification of the lake (including the thermocline, nutricline and oxycline). Changes in upwelling and internal waves caused by temperature variations affect the hydrodynamics and the mixing of nutrient rich hypolimnion water and ultimately the primary and secondary productivity of the lake. This can subsequently have an effect on fisheries and aquatic biodiversity.

Changes in the climate should primarily be investigated through long term monitoring of meteorological parameters (historical data as well as actual data). The main meteorological parameters to monitor around the lake include air temperature (max and min), rainfall, rain intensity, wind speed and direction, humidity, solar radiation and atmospheric pressure. In addition, an important parameter to measure in relation to climate change is the lake level.

The spatial coverage of meteorological synoptic station around Lake Tanganyika is not uniform. A rather good meteorological coverage exist in the North East of the lake (Bujumbura, Kigoma) while meteorological station are situated too far from the lake in Zambia (40 km from the lake and 700 m higher in altitude) and are probably not operational actually in the DRC. This means that presently a great part of the lake is not sufficiently covered by an observation network of meteorological parameters.

¹² See Appendix 45 for an overview of biodiversity parameters discussed during the workshop.

The long term monitoring of Lake Tanganyika needs to address this issue. Ideally, national meteorological institutions should install stations near Lake Tanganyika (Mpulungu, Kalemie and Uvira are priorities) with standard meteorological monitoring equipment. Lakeside institutions such as the Department of Fisheries in Zambia, CRH in Uvira, Fisheries Department in Kalemie, TAFIRI in Tanzania could support the meteorological monitoring activities after an ad hoc training and with a close supervision of the Meteorological agencies or departments in each country.

3. Framework for Cost-effective Monitoring

Monitoring should be possible on the long-term, continuing during periods when no partner funding is available. National support at the government level is key to ensuring sustainability, and the LTA Secretariat as well as the NCU teams should ensure that monitoring activities are integrated in national policies¹³. Memoranda of Understanding with national institutions and international partners could contribute to enhancing the appreciation of mutual expectations. Partner institutes should ensure that monitoring activities are included in their annual budgets. They should also ensure that funding gaps are identified and that these are communicated to the LTA as well as to potential donors.

During periods when sufficient funding from international donors is available, enhancement of capacities should take place, with focus on key needs. Enhancement should relate directly to the activities of the monitoring, and to improving data processing capacities.

Design of a Sustainable Monitoring Programme

An appropriate balance needs to be found between the costs and the value of the data obtained through monitoring activities (Figure 2). This will depend of a wise choice of partners, parameters, sites and frequency of measurement.

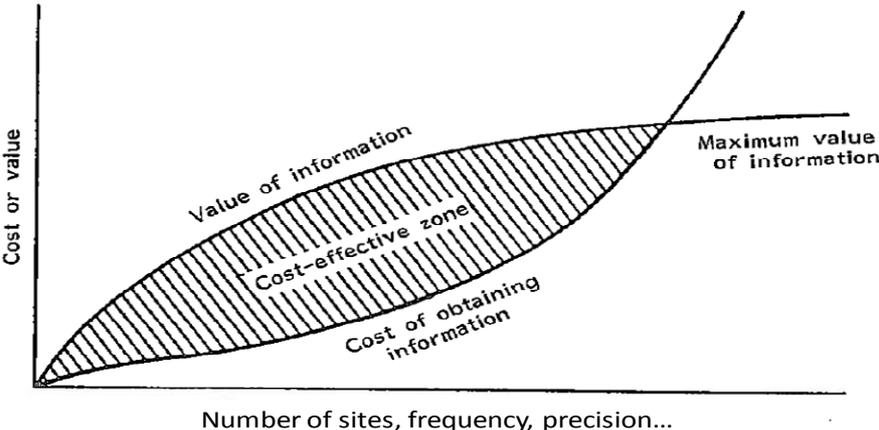


Figure 2: Cost effectiveness of monitoring (after Biswas, 1988)

The location of the monitoring institutions is important, and ideally staff should be posted as close as possible to the monitoring sites to avoid expensive transport costs. Monitoring sites should be easily accessible to insure low cost and sustainability. Monitoring parameters should be informative and useful. The frequency of monitoring should be sufficient to obtain the necessary data, while keeping in mind cost-efficiency. The number of monitoring partners should not be too large, but should focus

¹³ The UNDP/GEF Project has included several activities in its workplan that are pertinent to this topic.

on the relevance of the (expected) inputs of each partner. Collaboration among selected partners should be encouraged as much as possible. This can be practical collaboration (joint sampling expeditions, sharing laboratory facilities), as well as sharing of data and knowledge. Sufficient training opportunities should be available, to ensure that partners are capable of delivering quality data. A clear organogram clarifying the various roles of each partner is a requirement for a successful long term monitoring.

Communication and adequate dissemination of information will be key to the success of the monitoring programme. Feedback should be given to support the efforts of partners in collecting data (advise on methods, database, providing additional information etc.). Communication is also important for harmonization of monitoring and partnership, as well as public, political and donor support. Communication could take place in various ways: i) Meetings and workshops; ii) email; iii) LTA website; iii) newsletters; iv) presentations; v) publications; vi) short films; vii) summaries for decision makers.

In total, the building of sufficient capacity and initial establishment of the monitoring programme may take up to 2-3 years. About 1 year after the programme is up and running (taking into account seasonal monitoring activities), evaluation and adjustment of the monitoring programme could take place (see Figure 3). Throughout the entire period of establishing and testing, the LTA Secretariat should ensure to solicit the opinions and suggestions of partners in order to continuously strengthen the programme.

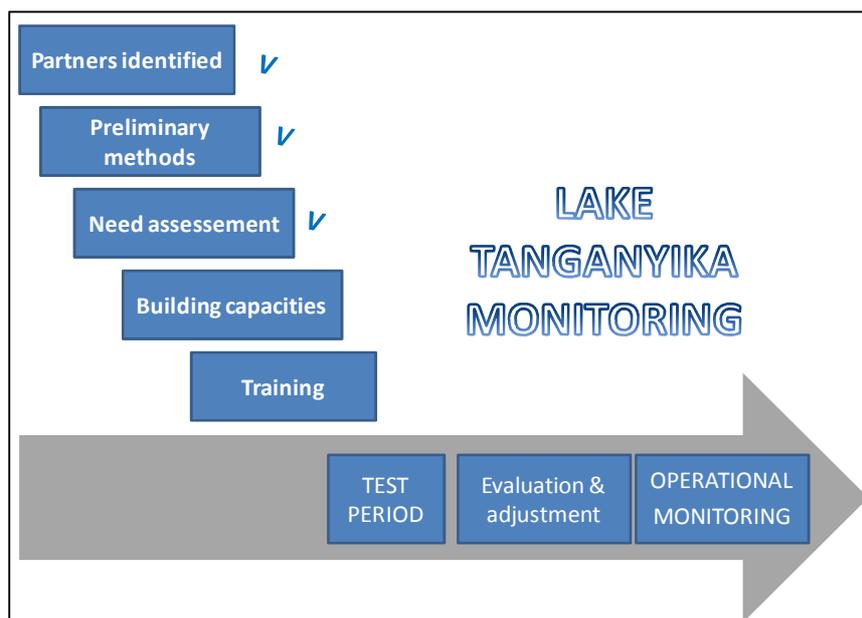


Figure 3: Steps toward a long term environmental regional integrated monitoring of Lake Tanganyika and its basin. Initial steps in advance stages or realisation are indicated. The necessary period to launch the operational monitoring could take 2-3 years.

4 Potential Monitoring Partners and Capacity Building Recommendations

The Lake Tanganyika riparian countries host a diversity of institutes that could be potential partners for the regional monitoring programme (see Table 2). Also see Appendix 2, which lists key resource persons within the possible partner institutions.

| BURUNDI | | | | | | TANZANIA | | | | | |
|--|---------------|-----------|--------------|----------|----------------|--|---------------|-----------|--------------|----------|----------------|
| | Water quality | Fisheries | Biodiversity | Land Use | Climate change | | Water quality | Fisheries | Biodiversity | Land Use | Climate change |
| REGIDESO | x | | | | | Lake Tanganyika Bassin Water Office (LTBWO) | x | | | x | x |
| Institut National pour l'Environnement et la Conservation de la Nature (INECN) | x | | x | | | Tanzania Fisheries Research Institute (TAFIRI) | x | x | x | | x |
| Service Technique Municipal (SETEMU) | x | | | | | Fisheries Development Division | | x | | | |
| Direction des Eaux Pêches et Pisciculture | x | x | x | | | Ministry of agriculture/land use | | | | x | |
| Institut Géographique du Burundi (IGEBU) | | | | x | x | Tanzanian Meteorological Agency (TMA) | | | | | x |
| Ministry of Environment Progr.National de Lutte Anti-Erosive (PNLAE). | | | | x | | Ministry of Natural Ressources/forestry | | | | x | |
| Université du Burundi | x | x | x | x | x | Ministry of Natural Ressources/wildlife | | | x | | |
| <i>Coordination</i> | | | | | | TACARE | | | | x | |
| NCU | | x | | | | University of Dar es Salaam | x | x | x | x | x |
| PMU | x | | x | x | x | <i>Coordination</i> | | | | | |
| | | | | | | NCU | | x | | | |
| | | | | | | PMU | x | | x | x | x |
| D.R.CONGO | | | | | | ZAMBIA | | | | | |
| | Water quality | Fisheries | Biodiversity | Land Use | Climate change | | Water quality | Fisheries | Biodiversity | Land Use | Climate change |
| Ministère de l' Agriculture/ Direction Nationale des Pêches | x | x | | | | Department of Fisheries (DOF) | x | x | x | | x |
| Ministère de l' Environnement/ Direction des Ressources en Eau | x | | | | | Ministry of energy and water development / Dept of Water affairs (DWA) | x | | | x | |
| Centre de Recherches Hydrobiologiques (CRH) | x | x | x | x | x | Environmental Council of Zambia (ECZ) | x | | | | |
| Ministère de l'Agriculture pêche et élevage/Bureau de pédologie | | | | x | | Ministry of Health / Dept of Public Health | x | | | | |
| REGIDESO | x | | | | | Zambia Meteorological Department (ZMD) | | | | | x |
| Société National de l' Hydraulique Rurale (SNHR) | x | | | | | Ministry of Agriculture and Cooperatives/Land Husbandry | | | | x | |
| Régie des voies fluviales (RVF) | | | | x | | Ministry of Tourism and Environment/Forestry Dept. | | | | x | |
| METTELSAT | | | | | x | Ministry of Tourism and Environment/Zambian Wildlife Authorities | | | x | x | |
| Institut Congolais pour la Conservation de la Nature ICCN | | | x | | | University of Zambia (UNZA) | x | x | x | x | x |
| Université - Kinshasa | x | x | x | x | x | Copperbelt University (CBU) | x | x | x | x | x |
| Université Lubumbashi | x | x | x | x | x | <i>Coordination</i> | | | | | |
| <i>Coordination</i> | | | | | | NCU | | x | | | |
| NCU | | x | | | | PMU | x | | x | x | x |
| PMU | x | | x | x | x | | | | | | |

Table 2. Potential partners for the Lake Tanganyika Regional Integrated Environmental Monitoring Programme. Bold crosses denote that the institute has a mandate to monitor a specific topic.

For each monitoring topic, there are several aspects to consider. For instance, water quality can be seen in relation to anthropogenic pollution and/or sediment pollution, as well as in relation to fish habitats. Monitoring needs to take into account different sites, such as coastal, pelagic, riverine, or very specific point pollution sites. Therefore, it is preferable that multiple institutions are involved in

each country to take advantage of their specific expertise and/or location. This will also help to insure the cost effectiveness of the monitoring.

The best ways to cost-effectively enhance capacities of partner institutions depends on a range of factors, including present capacity (e.g. human, infrastructure, equipment). Capacity building should initially focus on infrastructure, instruments, functioning and training. On the longer-term, the sustainability of the monitoring programme will depend upon institutional mandates as well as commitment and collaboration of partners (agreements among partners should be detailed in MoU's).

The extent to which capacities can be enhanced will also depend on the amount of funding and support available. The main donors of the LTRIMDP (ADB, GEF, and NDF) provide some funding for capacity building, but this will not be sufficient given the current needs. Co-funding and capacity building support have been pledged by the UNEP ROA/China partnership (water quality monitoring activities) and indirectly exists through collaborations with third parties such as GTZ and Pays de la Loire (Burundi), and USAID (Tanzania). It should be encouraged for the LTA, UNDP/GEF Project, NCU and PMU national teams, as well as the partner institutions to actively seek additional funding and support opportunities.

The overview below lists the institutions in the riparian countries that could be useful partners for the Lake Tanganyika Regional Integrated Environmental Monitoring Programme, their possible roles and recommendations on how to enhance capacities on a case-to-case basis.

4.1. Overview of Potential Partners and Capacities

The organs of the LTA, including the NCU and PMU teams that are implementing the LTRIMDP should play key roles in coordination, compilation and translation of the data collected through the Regional Integrated Environmental Monitoring Programme.

- **LTA Monitoring Coordination Unit (LTA MCU)**

The LTA Secretariat is intended as a long-term structure, which has an important responsibility in the coordination and harmonisation of regional activities in the Lake Tanganyika basin. The Secretariat should also play an important role in identifying training opportunities and ensuring that their national partners can benefit from capacity building activities. The LTA Secretariat currently lacks the capacity to adequately check quality, compile, and translate regional monitoring data. An online database and clearing house mechanism should be set up, preferably integrated in the LTA website. It would be advisable for the LTA to establish a Monitoring Coordination Unit including a Scientific Advisor, Database Clerk, and Technical Experts with extensive knowledge on each of the monitoring components.

- **National Coordination Unit (NCU)**

NCUs are intended to be long-term structures, which are directly linked to their governments as well as to the LTA. For regional monitoring, during the short-term period, NCUs could be involved with the following fisheries related aspects: data collection coordination, quality check, data transmission, processing and reporting at the national and regional level. Some specific fisheries related studies could also take place to establish baseline data during the short-term period. For long-term regional monitoring, the NCU could coordinate all fisheries aspects as well as environmental aspects (coordination, quality check, processing and reporting). Data should be shared with partners to allow multidisciplinary analysis, and provide LTA with information on trends and possible causes.

- **Project Management Unit (PMU)**

PMUs will only exist for the duration of the UNDP/GEF Project. For short-term (UNDP/GEF Project duration) regional monitoring, PMUs could coordinate water quality (related to anthropic and sediment pollution), biodiversity, land use and climate change data. This would include data collection coordination, quality check, data transmission, processing and reporting at the national and regional level (through the PCU). PMUs should provide data to both the NCUs and LTA. Specific environmental studies should take place to establish baseline data during the short-term project period.

4.2 Burundi

- **REGIDESO**

Regie de Distribution d'Eau (Water Distribution Management) has the mandate to provide safe drinking water in Burundi. In Bujumbura, 94 % of the drinking water comes from the lake. REGIDESO has an operational water laboratory. They are able to measure a range of parameters including As, Ba, Cd, Zn, CN, F, Ni, NO₃⁻, NO₂⁻, Pb, Na⁺, Al, Cl⁻, Fe, Mn, DO, pH, SO₄⁻, H₂S, T°, alkalinity, hardness, turbidity, , global radioactivity (a and b), total germs, faecal coliforms, and *E. coli*.

Every day, REGIDESO measures T°, pH, turbidity, conductivity, coliforms and *E. coli* from pelagic water pumped at a depth of 25m. Twice a year, REGIDESO samples the pelagic area of the lake at a depth of 50 m and do a complete water analysis. In addition, the Ntahangwa River in Bujumbura is sampled every day while the water of four rivers in the North of the lake is analyzed on a yearly basis. A mobile laboratory allows water analysis of many water sources and wells in Burundi. To enhance the results for the regional monitoring framework, a weekly or biweekly vertical sampling is advised at 100 m depth. This depth allows monitoring of oxygenated layer, an important parameter for fish population studies. Also see Appendix 7 and 8.

If no additional measurements involving chemical analysis are necessary, capacity building for REGIDESO could be mainly with improving the computers equipment and connection to Internet. In case of regular pelagic sampling by REGIDESO, it would be useful to enhance their capacities in some aspects of limnology. There is capacity for phytoplankton monitoring at REGIDESO (trained personal and microscope) however some presently missing microscope accessories should be provided to allow this implementation. The determination of algae species during blooms of algae could be useful, as it is known that some algae may produce toxins. Relationships with fish mortality or changing fish abundance could also be investigated.

- **INECN**

The Institut National pour l' Environnement et la Conservation de la Nature (National Institute for the Environment and Protection of Nature) manages several natural reserves in Burundi and has a mandate for environmental monitoring. INECN has staff posted permanently near the Rusizi River, which is one of the main inflowing rivers in Lake Tanganyika. This team could be involved in regular water sampling of the Rusizi (temperature, transparency, turbidity, pH, conductivity, suspended sediments) and sampling for other parameters on a lower frequency (e.g. heavy metals, pesticides). For this purpose, the Rusizi station would need to be equipped with basic instruments (T°, DO, pH, conductivity, turbidity and transparency). The parameters could be daily sampled concerning the water habitat and less frequently for other parameters related to pollution. Hydrological parameters (level, river flow) could also be measured in collaboration with IGEBU.

INECN has a small laboratory in Bujumbura, which has almost no instruments. A water distiller needs to be fixed. A precision balance is present as well as a stove and some glassware. A large motorised pirogue was recently obtained through donations of an international NGO. In the next months, new instrument should be provided to the INECN laboratory in the framework of the UNEP ROA/China

partnership, which should enhance its capacity for water monitoring. An improved laboratory in Bujumbura, including a field spectrophotometer (at least Hach type) and chemicals, filtration kits and filters would allow monitoring of water quality at a range of different sites on a regular basis. A partnership with INSP and the LACA laboratory in Bujumbura could be beneficial. INECN could be also involved in biodiversity monitoring in collaboration with other partners such as the University of Burundi. Also see Appendix 4, 5, 45 and 46.

- **SETEMU**

The Centre Technique Municipal (Technical Centre for the Municipality) operates a water treatment station in Bujumbura. The number of staff is 35 persons. The monitoring capacity of SETEMU is currently very limited. Donations obtained through GTZ will enable SETEMU to install new instruments in their laboratory for the analysis water before and after processing at the wastewater treatment station (DBO, DCO, coliform bacteria, conductivity, pH, suspended matter, etc.). Capacity building activities should include training, as well as enhancing IT facilities. Also see Appendix 10.

- **Direction Peches, Eaux et Pisciculture**

The Department of Fisheries, Water, and Aquaculture has staff in 12 sites along the coast of Burundi where fish statistics are collected. The former LTR (FAO/FINNIDA) project laboratory is part of this institution as well as a library related to Lake Tanganyika.

A main activity of DEPP for the monitoring is the follow up of fish statistics. For this purpose, balances of various sizes are required: a few precision balances for fish biology at the laboratory and enough spring balances (of 1, 5, 10, 25 and 50 kg in duplicate) for field staff. Main balances (100 kg) are also necessary for each beach where fish statistics data are collected.

The monitoring of water quality linked to fish habitat is a task traditionally of DEPP. Equipment provided to DEPP from previous projects needs to be checked. A probable enhancement of this equipment will be necessary. It is recommended that the DEPP would be equipped for sampling, T°, DO, pH, conductivity, turbidity and transparency every day along the coast which is close from DEPP headquarters. A small jetty on this coastal site would allow the required quality for this frequent sampling.

Pelagic limnological sampling (every week or every 2 weeks) would require that DEPP be equipped with a suitable boat (at least 8 m long) and engine or collaboration with a partner that may provide the regular use of a boat (e.g. REGIDESO, INECN) for the monitoring. A cost efficient way would be to provide a boat for DEPP (since they are based near the lake) that could be used also by other partners in the frame of the Lake Tanganyika monitoring. At least, a similar fiberglass type of boat, as those provided during the LTBP project to some partners is advised.

An experimental fishing unit (catamaran) provided to DEPP would be advisable (with lights, nets, fish boxes, etc.). This would allow them to carry specific studies related to fishing efforts (different nets, different light powers, etc.), which would allow a better interpretation and use of historical fisheries data that lack this type of information presently. Also see Appendix 8, 9 and 37.

- **IGEBU**

The Institut Geographique du Burundi (Geographical Institute) operates a total of 19 main meteorological stations, 24 thermopluviometric stations and 153 rainfall stations in the country. IGEBU stopped participating in the World Meteorological Organization due to a lack of government funding since 1993, and therefore has not been able to benefit from WMO advantages such as equipment maintenance.

The flow of several main rivers is monitored along the coast of Burundi (in addition to temperature, pH and suspended sediments are measured there). During the LTBP project many smaller rivers were

also monitored, but the level gages are no longer functional. It is advisable to re-install gages in the rivers, for the benefit of the monitoring programme. For maintenance reasons, it would be better to systematically monitor a smaller number of rivers than a large number. Discussion on river choice should take place in collaboration with other monitoring partners (e.g. INECN, ICRAF, LTA, etc).

Internet capacity enhancement would be required, as well as training to increase the number of specialists in remote sensing data processing.

IGEBU has knowledge in GIS and remote sensing analysis although an update of their software is needed. Some spot image (5th generation) will be provided soon by a EU funded project (PPCDR) but a regular provision of images would be required for monitoring. IGEBU has potential to develop remote sensing and GIS in relation with land use and erosion. Better computer and software capacities as well as satellite image resources would be needed, as well as additional training. Collaboration between a regional remote sensing partner providing information for the whole Lake Tanganyika Basin and IGEBU focusing on the north of the lake (Burundi as well as for the Uvira area in collaboration with DRC partners) would be ideal. Also see Appendix 13 to 16, 51 and 52.

- **Ministry of Environment/ Programme National de Lutte Anti-Erosive (PNLAE)**

The PNLAE is active in fighting erosion in several areas of the Tanganyika Basin. PNLAE technicians are present in each commune of Bujumbura Rural and Bururi Provinces. They are interested in linking to measurements that some institutions do on rivers flows, suspended sediments etc., to help identification of best methods to fight erosion. PNLAE has data on reforested and land surface areas, slope, and length of contour lines. This could be used as indicators of erosion levels and compared to observed sediment in the rivers.

- **The University of Burundi**

The University of Burundi is situated nearby the lake and their staff includes specialists on topics such as fish biodiversity, chemistry, botany and remote sensing, their involvement in the monitoring activities would be advisable. Special studies by the Universities and partners could usefully enhance knowledge's on the environment of Lake Tanganyika. The University could also be involved in data analysis and reporting related to the regional monitoring programme. The scientific interest is a strong driving force to support the sustainable effort in monitoring environmental variables. Scientific publications using monitoring data should be possible providing that primary producers of data have publication rights during a period such as 2 years after collection.

It is advised that research instruments necessary for the activities of the University in the monitoring could be provided (ex: material related to biodiversity and limnological studies). Also see Appendices 11 and 12.

- **Other Burundi Institutes**

The Institut National de la Santé Publique could be involved in microbiological monitoring of water quality. The Burundi Bureau of Normes (BBN), and the Laboratoire de Controle et d'Analyses Chimiques (LACA) might also be able to provide useful analyses.

4.3. DR Congo

- **Ministère de l'Agriculture/ Direction Nationale des Pêches (DNP)**

The Ministry of Agriculture/National Department of Fisheries is present in Uvira, Fizi, Kalemie and Moba. The Department should be involved in collecting fisheries statistics, but will need additional

training to enhance their capacities. Balances of various sizes will be necessary in each site where DNP staff is based.

Future Beach Management Units could also be involved in collecting fish statistics.

If the LTRIMDP could enable the establishment of four surveillance centers along the coast of Congo, these could be useful for limnological monitoring. For water quality monitoring purposes, DNP would need sufficient instruments for measurement of temperature, transparency, turbidity, pH, conductivity and dissolved oxygen. A sufficient number of boats will be needed. Small jetties on those coastal sites could allow easier boat loading and unloading as well as water sampling. IT facilities will need to be sufficient, including good Internet access. Small meteorological stations operated by those centres would also be highly advisable.

Also see Appendix 46 and 47.

- **Ministère de l' Environnement/Direction des Ressources en Eau**

The Ministry of Environment/Directorate of Water Resources is involved in control and monitoring of water (using OMS norms). They belong also to a network (SINIEAU) that exchanges information about specific water quality topics. The Ministry has a IT/GIS specialist who uses DSS (Decision Support System) for Nile Basin Initiative related activities. Enhancement of capacities of the Direction of Water Resources in the field of water quality could be advised as well for processing information.

- **Centre de Recherches Hydrobiologiques (CRH/Uvira)**

The Hydrobiological Research Centre has a mandate to do research on biology, ecology, biodiversity, water quality and pollution sources, as well as fisheries research including socio-economics. The CRH has about 70 staff and have sufficient human capacity to be involved in all five topics that are targeted by the monitoring programme.

However, CRH lacks functional equipment. To be able to monitor water quality for fish habitat, the CRH would need to be equipped with thermometers, pHmeters, conductivitymeters, turbiditymeters and oxymeters¹⁴. A level gage needs to be reinstalled and a small jetty refitting would allow suitable condition for daily limnological measurement along the coast and weekly or biweekly sampling in the pelagic area to a specific site, which should ideally reach at least 60m and ideally 100 m depth. GPS systems are also necessary, as well as a fridge for the laboratory. The monitoring program on water quality will need to be more defined to detail the necessary equipment. Chemicals should be available for nutrient measurements during short term project as this would not be sustainable at a low cost for the long term.

For the study of erosion, current meters, turbiditymeters, filters and balance for suspended sediment measurement are needed. It would also be advisable to install a small meteorological station near the coast at Uvira. The parameters to measure should include air T° (max and min), rainfall, wind speed (anemometer), humidity and air pressure. Fencing around the station is necessary also.

Fisheries research activities by the CRH require that this centre is equipped with a set of balances for weight measurements in a range from 0.1 mg (fish biology) to 100 kg (fish statistics). An experimental fishing unit would be also necessary for specific researches on fisheries.

CRH would need a vehicle for monitoring activities (such as a 4WD, pick up), particularly for land use and erosion monitoring. About 5 computers with Internet connection are required for CRH activities

¹⁴ For measurement in pelagic area (vertical profile from 0 to 100 m depth), long cables are advised for those instruments (about 105m). For dissolved oxygen, a steerer is also advised.

related to the monitoring. The absence of any Internet connection presently is a bottleneck for efficient regional networking.

Also see Appendix 16.

- **Institut National de la recherche Biomédicale (INRB)** National Institute of Biomedical Research.

This institute is situated in Kinshasa but may work with laboratories in Kalemie (REGIDESO) and Moba (Hospital Laboratory). Analyses may be done also at Goma. INRB could be involved in microbiological monitoring of lake water and possibly of fish products.

- **REGIDESO**

REGIDESO is a public enterprise that falls under the Département des Mines et de l'Énergie (Department of Mining and Energy). REGIDESO is in charge of the water distribution in the urban centers of DRC (> 5000 inhabitants). REGIDESO is also present in Kalemie. REGIDESO operates several water quality laboratories, but the one in Kalemie is apparently not functional (this needs to be verified).

- **SNHR**

The Service National d'Hydraulique Rurale (National Service for Rural Water) is responsible for water access in rural areas (<5000 inhabitants). Information on measuring water parameters in the Tanganyika basin was not available during the consultancy.

- **Ministère de l'Agriculture pêche et élevage/Bureau de pédologie**

The soil bureau of the Ministry of Agriculture, Fisheries, and Land Development is active in several areas concerning soils: improvement, cartography and fight against the erosion. They work in the whole country including the Lake Tanganyika basin. They have personnel on the field that may provide information on agricultural and forestry areas as well as for eroded urban areas. Some NGO are partners and may also contribute to provide information (FOLECO, grouping several NGOs such as COPEMECO Fondation, ATOIM, RAW AGRO, RAUKIN etc.)

- **RVF**

The Régie des Voies Fluviales (Management of River Transport) is in charge of hydrological studies and management of river systems and lakes in the DRC. Water levels are measured at various sites that should include the Lukuga River and Lake Tanganyika in Kalemie and possibly in other locations.

- **METTELSAT**

The National Agency of Meteorology and Satellite Remote Sensing monitors meteorological parameters it seems however that no meteorological station is presently operational on the Congolese side of the Tanganyika basin (but this needs confirmation).

- **ICCN**

The Institut Congolais pour la Protection de la Nature (Congolese Institute for the Protection of Nature) has the mandate to protect the fauna and the flora in specific site such as National Parks, Reserves and other protected areas. It promotes scientific research and tourism in agreement with fundamental principles of nature conservation. Capacity information could not be obtained during the consultancy, as a result of communication challenges.

- **The Universities of Kinshasa and Lubumbashi**

The Universities have specialists in several fields related to the regional monitoring and could be involved in data processing, reporting, or specific scientific studies useful to complete the monitoring in the Lake Tanganyika Basin.

4.4. Tanzania

- **Ministry of Water and Irrigation / Lake Tanganyika Basin Water Office (LTBWO)**

The LTBWO is mandated with water resources management in the Lake Tanganyika catchment. This includes, but is not limited to, water quality and quantity, sediment and rainfall monitoring. The LTBWO could be an important partner for the Lake Tanganyika monitoring programme.

The present laboratory in Kigoma is expected to improve through a World Bank funded project. In the frame of this restructuration, it is expected that water monitoring in the Tanganyika basin will be implemented in various stations including Lake Tanganyika. Monthly sampling during the dry season is foreseen and a sampling every two months during the dry season. LTBWO foresees that about 30 river stations will be monitored for hydrology in the basin. Installation of an automatic network for hydrology is planned in the following years in the Tanganyika catchment area.

The sampling in the pelagic area of Lake Tanganyika could be done in collaboration with TAFIRI (using the "Echo" boat) as well as making use of the TAFIRI laboratory if it is refitted before the one of LTBWO. It is suggested that a Niskin water sampling bottle would be made available to LTBWO as well as necessary chemicals (Hach type mainly) to allow a fast start of the monitoring program until the world bank funding is operational. For the pelagic, a weekly or biweekly sampling would be advisable for some of the parameters. Historical data (water quality, quantity and rainfalls) could be made available to LTA by the LTBWO. The LTBWO currently has Internet connection.

Also see Appendices 20 and 21.

- **Tanzania Fisheries Research Institute (TAFIRI)**

The objectives/mandates of TAFIRI include research on fisheries-related topics including fishing techniques, fish farming, fish products and diseases. TAFIRI could be involved in monitoring coastal water quality in relation to fish habitat and lake conditions (e.g. temperature, dissolved oxygen, transparency, pH, conductivity). Weekly or biweekly pelagic sampling including vertical profile of fish habitat related water parameters and, less frequently, additional water quality parameters related to pollution is advisable (in collaboration with LTBWO). Every week or every two weeks, vertical pelagic sampling should take place in the pelagic area¹⁵ from 0 to 100 m depth (every 20 m) measuring the same parameters as for the coastal sampling.

The TAFIRI office in Kigoma has a wet and a dry laboratory, including a significant amount of basic equipment that was donated during the LTBP and other projects. TAFIRI also has a boat (the ECHO) of about 11 m as well as a catamaran fishing unit. The laboratory and research boat are in need of repair and refurbishing, which is expected to be possible with the ADB/NDF as well as UNEP ROA/China funding. The installation of a jetty near the premise of TAFIRI could improve research activities (e.g. loading of boat, sampling of water). A level gauge could be installed along this jetty, as well as automatic recording instruments such as thermistors. Enhancement of the computer network and Internet connections would be useful.

¹⁵ The same pelagic sites at LTR (FAO/FINNIDA) are advised near Bujumbura, Kigoma and Mpulungu.

It is strongly advised to install a small meteorological station on the beach of TAFIRI¹⁶. This would allow the daily monitoring of min and max air T° (under a Stevenson screen), relative humidity, air pressure, solar radiation and particularly wind speed (anemometer) and direction. The TMA meteorological station is situated far from the lake shore (> 10 km). Traditional instruments are to be preferred to automatic stations that often are too fragile to be sustainable for a long term monitoring. During short term projects, an automatic weather station could be installed also to complete more intensive monitoring. The supervision by TMA is advised to insure that parameters are correctly measured and possibly incorporated to the official network of observations.

Also see Appendix 21 and 40.

- **Fisheries Development Division (FDD)**

The FDD of the Ministry of Livestock Development and Fisheries has staff all along the Tanzanian coast of Lake Tanganyika, and could be an important partner for the monitoring programme. FDD has an approximate number of nine administrative and two support staff located in Kigoma, plus 14 data collectors stationed at sampling sites in the Kigoma District. In the Kigoma District, FDD staff is assigned to one of three operative sections: legislation, licensing, and statistics. FDD is involved in training local communities and also in surveillance of fishing activities, including the collection of fish catches statistics.

The Frame survey (FS) conducted by FDD is the same survey that was conducted by the LTR project in Zambia and Burundi in 1995. FDD Kigoma did not conduct annual surveys prior to LTR. The focus of the survey was on the assessment of fishing gear, craft, and investment in ancillary fishing equipment. Data are recorded on standard forms. FDD has continued to conduct this survey once annually during 1996-98. The program and statistics recording by FDD have not been continuous. The Beach Landings Survey (CAS) program was initiated in 1965. Parameters assessed include: type and gear size, number of gear and fishermen, weight and value of catch by species, number of fishing units, and duration of fishing. FDD is expected to be involved in the development of beach management units in the framework of the LTRIMDP (e.g. provision of water, electricity, latrines, meeting space and other facilities).

As the FDD is mandated with Lake Tanganyika fisheries activities, including fisheries statistics along the coasts of Tanzania, their staff will need instruments such as spring balance of various weight ranges, ichtyometers, containers etc. In at least 4 centres along the Tanzania coast, it is advised that basic limnological monitoring would be carried on by staff of FDD for temperature and transparency (possibly also pH, conductivity, DO and turbidity). Small meteorological stations operated by those centres would be advisable in areas where meteorological parameters are not monitored presently.

- **Department of Land use Planning and Management (LUP)**

The LUP is a Department of the Ministry of Agriculture Food Security and Cooperatives. In the catchment area of Lake Tanganyika, the LUP has Zonal coordinators in Tabora and Mbeya. They are assisted by District Officers in Kigoma, Kasulu, Sumbawanga and Mbozi. LUP monitors land use practices including cultivated lands and soil erosion. The environmental parameters presently recorded are soil erosion, soil fertility and agricultural land use. The equipment used by LUP includes soil sampling equipment and field testing kits as well as land surveying equipments. Enhancing capacities of LUP should involve mainly training, and perhaps also monitoring equipment. Internet connections are present, but could be improved.

¹⁶ Surrounding with a fence around the station and on each side of the beach is necessary.

Also see Appendix 22.

- **Tanzanian Meteorological Agency (TMA)**

The mission of TMA is to provide quality, reliable and cost effective meteorological services to stakeholders, thereby contributing to the protection of life and property, environment and national poverty eradication goals. It also includes the cooperation with other institutions concerned with issues related to climate variability, climate change and environment. Meteorological stations in the Tanganyika basin are situated at Kigoma and Sumbawanga. The meteorological station at Kigoma is situated at about 10 km from the lake.

- **Ministry of Natural Resources & Tourism/ Forestry Division (FBD)**

The Forestry and Beekeeping Division (FBD) is part of the MNRT. Its aim is to manage all central government forest reserves and trees in community lands. More information related to monitoring in the Tanganyika basin is required, but could not be obtained during the consultancy.

- **Ministry of Natural Resources & Tourism /Wildlife.**

This Ministry is responsible for the management of natural and cultural resources. More information related to monitoring in the Tanganyika basin is required, but could not be obtained during the consultancy.

- **Tanganyika Catchment Reforestation and Education Programme (TACARE)**

TACARE is a programme from the Jane Goodall Institute, which focuses on the lake catchment in Tanzania. TACARE has significant human and resource capacity. Cars, boats, telephone, fax, Internet, mobile radio calls are available, as well as a GIS laboratory. More than 20 computers are connected through wireless connection. JGI monitors vegetation change in the Greater Gombe and Masito-Ugala ecosystems. They could possibly provide help to LTWBO for monitoring suspended sediment in several rivers.

Also see Appendix 23.

- **The University of Dar es Salaam**

UDSM has specialists in several fields related to the regional monitoring and could be involved in data processing, reporting, or specific scientific studies useful to complete the monitoring in the Lake Tanganyika Basin.

4.5. Zambia

- **Department of Fisheries (DoF)**

The Department of Fisheries has the mission to deal with all fisheries issues in the Zambian part of the Lake Tanganyika, including fisheries surveys, water quality related to fish habitat, biodiversity. They are also involved in meteorological monitoring (rainfall, wind speed, water temperature, relative humidity, air temperature, water level). The DoF could be an important partner for the monitoring programme. The department has a station near the lake at Mpulungu and a substation in Nsumbu. Meteorological monitoring has started in 1993 and has been continued every day since. A small meteorological station is operational but is missing some instruments. Frequent water sampling near the coast as well as regular pelagic sampling is advisable. Even though there is no extra financial support from ongoing projects, the DoF is committed to continuing sampling activities.

The DoF has a jetty that is in a very bad shape and needs to be fixed or replaced. Recently a small meteorological station was lost as it collapsed into the water. It would be advisable to improve the

new meteorological station, and provide a thermometer for minimum temperature measurement, a barometer, a humidity meter and a pyranometers for solar radiation, which are key instruments for long-term meteorological monitoring. A water level gage needs to be replaced and fixed adequately.

The present laboratory is very small (about 12 m²). There is a need for an improved water laboratory at Mpulungu for *in situ* analysis (water habitat, lake ecology, water pollution, microbiology). Sending lake samples to Lusaka as done by other Departments can affect the quality of the data and is expensive. Necessary equipment include at least a fridge, spare instruments for temperature, dissolved oxygen, pH, conductivity, turbidity and transparency, as well as weight balances in the range from 0.1 µg/l (fish biology) to 100 kg (including intermediary spring balance). Perhaps a new, possibly interdepartmental, laboratory could be established in Mpulungu and be used in a joined effort together with DoF, Water Affairs, Environmental Council of Zambia and the Ministry of Health. This would be cost effective in the monitoring.

A steel boat (Silver Shoal) and a fiberglass boat are available, but the fleet could be enhanced with small boats for sampling. One type could be a small boat that may be operated by one or two persons (when the lake is calm) for daily water sampling at a distance of less than 100 m from the station. The IT equipment of the DoF needs enhancement, including adequate Internet connections.

Also see Appendix 24.

- **Ministry of Energy and Water Development / Department of Water Affairs**

The Department of Water Affairs deals with water quality and hydrology in Zambia, and has at least nine water monitoring stations in the Lake Tanganyika Basin. Monitoring falls under responsibility of a Senior Hydrologist, Water Quality officer and District Water Officer (for Mbala) under the Provincial Water officer for Northern Province. The Department also works in collaboration with ECZ.

A laboratory is available in Lusaka. Several instruments would be needed at the field station to improve the capacities of DWA for the monitoring program (temperature, dissolved oxygen, turbidity, conductivity and pH probes, field spectrophotometer (Hach type¹⁷) and chemicals, filtration kits and filters). The use of an interdepartmental laboratory in Mpulungu in collaboration with DoF, DWA, ECZ and DOH would allow sharing of instruments and facilities (infrastructure, boat) near the lake. Some samples would still need to be processed in Lusaka (such as for heavy metals and pesticides analysis). There is no electricity and there are no Internet connections in the field stations.

Also see Appendix 25 and 42.

- **Environmental Council of Zambia (ECZ)**

The ECZ monitors discharges into rivers and other aquatic bodies. A partnership is advised through an Interdepartmental Laboratory in Mpulungu in collaboration with DOF, DWA, ECZ and DOH.

Also see Appendix 26.

- **Ministry of Health / Department of Public Health**

The Department of Public Health is present near Lake Tanganyika (Mpulungu District Medical Office). They sample water for microbiological measurement of water. Samples are sent to Lusaka for processing, and include those parameters: pH, total dissolved solids (mg/l), conductivity (µS/cm), turbidity (NTU), nitrite (mg/l), sodium (mg/l), potassium (mg/l), calcium (mg/l), magnesium (mg/l), iron (mg/l), lead (mg/l), arsenic (mg/l) and bacteriologic analysis of water and food. The sampling

¹⁷ It is noted that DWA in Lusaka does have a 2800 Hach spectrophotometer that seems to need only an electrical adaptor.

frequency of water in Lake Tanganyika is once per 3 months. The Mpulungu laboratory has no kit to monitor chemical and bacteriological analysis of water/food. The participation of DOH to an Interdepartmental laboratory in Mpulungu in collaboration with DOF, DWA and ECZ is suggested since DOH is mandated for microbiological analyses of water. The department has one Landcruiser and a speedboat. They have capacities for radio message, telephone and mobile Internet connection.

Also see Appendix 27 and 28.

- **Zambia Meteorological Department/ Kasama Meteorological Office (KMO)**

The ZMD/KMO operates five meteorological stations in the Lake Tanganyika Basin (Mbala, Kasama, Misamfu, Mpika and Isoka). Parameters measured include: temperatures, wind speeds and direction, rainfall, humidity, sunshine hours, soil and earth temperatures, cloud cover, visibility, solar radiation and evaporation. They are presently strengthening their network with more rainfall measurement stations. The data are collected and stored manually at the Province but digitally at Lusaka. Better Internet communication is required in field stations.

Also see Appendix 29.

- **Ministry of Agriculture and Cooperatives/ Department of Land husbandry**

The Department deals with land use, land degradation and rate of agriculture expansion. They also have the mandate to monitor agricultural land utilisation and management particularly in cultivated and grazing lands for controlling soil erosion and sedimentation as well as enhancement of soil productivity, however, this is not being done due to financial constraints. Environmental parameters are presently recorded include: area under cultivation, area covered of cultivated land under conservation agriculture and physical erosion control measures, rainfall.

Two staff are present at the district level and at Provincial level where they also have remote sensing and mapping capacities. Three field offices are situated in the Tanganyika Basin, with a total of about 40 staff. GPS and rain gauges are available. One field vehicle and motorbikes are available in some places. Telephone is available but no Internet connection.

Also see Appendix 30.

- **Ministry of Tourism and Environment/Forestry Department**

The mission of the Forestry Department is to ensure sustainable supply of wood and non-wood forest products and services, while at the same time ensuring the protection and maintenance of biodiversity. The Forestry Department has a District Officer present in Mpulungu, who is currently collaborating with the Zambia NCU.

Also see Appendices 31 and 32.

- **Ministry of Tourism and Environment/ Zambian Wildlife Authorities**

ZWA is responsible for all conservation, protection and management aspects of a 1.4 km wide of approximately 60 km long area along the Lake Tanganyika shore, which is part of Nsumbu National Park. There is a station of ZWA in Nsumbu near Lake Tanganyika. A motorboat and a vehicle are available. VHF Base Radio is used but there is no electricity (neither by the sector, neither by generator) and no tap water.

Also see Appendix 33.

- **University of Zambia (UNZA) and Copperbelt University**

UNZA and the Copperbelt University has specialists in several fields related to the regional monitoring and could be involved in data processing, reporting, or specific scientific studies useful to complete the monitoring in the Lake Tanganyika Basin.

Also see Appendix 35.

5. General Capacity Building Recommendations

One of the main challenges of many national institutes is the lack of maintenance capacity. Frequently, instruments and equipment are handled by people without sufficient training or responsibility, not sufficiently protected against dust and humidity, and not maintained adequately. Much of the equipment donated during previous projects has become damaged or useless. This includes essential monitoring equipment such as thermometers, DO/pH, conductivity/turbidity meter, weighing scales, etc., as well as IT equipment and boat engines. Therefore, capacity building should ideally also include a maintenance component (e.g. provision of sufficient spare parts and maintenance training).

It is advisable to have duplicates of important instruments as a reserve to insure a no break system. For instance, backup should be available for instruments to measure temperature, pH, conductivity, dissolved oxygen, turbidity and transparency. Breakdown hampers useful monitoring, and backups should not be considered a luxury. There should also be a system of responsibility for monitoring equipment, to ensure that the status of key instruments is known and maintenance as well as calibration can be done on time.

Reinforcing the capacities of partners to access relevant scientific publications and reference books would help enhance the implementation of monitoring (e.g. methodologies) as well as the interpretation of data (theory and analyses). Short training sessions on efficiently using online search engines such as Google Scholar would be beneficial. A library service for the whole network would be advisable¹⁸. Clear and concise field manuals should be available for the various aspects of the monitoring programme. Field manuals should identify procedures step by step with useful appendices when necessary (e.g. FAO/FINNIDA field manuals produced for LTR). They could also contain a summary of useful scientific references on relevant topics.

Capacity building should also include a communication component. The current levels of communication between the LTA Secretariat, NCU and PMU teams, as well as national institutions are insufficient. Enhancing communication capacities could include support to the LTA Secretariat for establishing a formal communication system among partners (including a communication organogram), enhancing email capacities (Internet access) and enhancing the LTA website.

IT capacity is insufficient for the majority of the identified partners. This includes sufficient quantity and quality of computers, voltage regulators, and UPS systems, as well as printers, and adequate Internet connections. General and recent software to process data is lacking in many cases (e.g. MS office including Access database, anti-virus, GIS software, specific software). In addition, handheld GPS systems are key instruments for accurate monitoring purposes, and often not available. Furthermore, the NCU teams should have access to a videoprojector with a white screen, and cable connection for PC to support training sessions, workshops and other meetings.

¹⁸ Note that an extensive amount of scientific literature can be accessed for free by registering with Online Access to Research in the Environment (OARE), an initiative that enables developing countries to gain access to one of the world's largest collections of environmental science research. See: www.oaresciences.org

A service by a regional or international partner in remote sensing could insure sustainable long-term land use information at the scale of the entire Lake Tanganyika Basin (e.g. see Appendix 49 and 52).

5.1 Training

Training is a very important aspect to insure a successful implementation of the regional environmental monitoring. Various types of training could be done, focusing on a range of different target groups, using a range of different approaches depending on the needs. Below are a few suggestions for various trainings that may be useful for the monitoring programme.

A) Field training

LENGTH: 1-2 weeks.

PARTICIPANTS: The choice should clearly target the staff that will really be involved with monitoring on the field. This is why it is advised to include at least 2 technicians and 1 or 2 researchers closely involved in supervising the sampling for each institution involved. A specialist of the NCU and PMU will also be required to participate, as their role will be to check the good implementation of the monitoring. It would be advisable also that someone involved at regional level participate at least to one of those training.

WHERE: On site training (Kigoma, Mpulungu, Kalemie or Uvira, Bujumbura) would help to decrease the costs of the training. The real conditions of work will also be possible to test by doing so.

CONTENT: For each component of the monitoring (water quality, fisheries, land use and erosion, biodiversity and invasive species, climate change (meteorology) training should target specific themes:

- (1) General theory and application to the Tanganyika basin
- (2) Sampling methods, sites, frequency
- (3) Analysis in the laboratory (e.g. parameters, quality control, instruments calibration) or on the field depending of each component
- (4) Reporting using word, excel or other specific software's
- (5) Data analysis for researchers or staff involved in data interpretation and reporting
- (6) Internet communication¹⁹; research tools and resources.
- (7) Equipment maintenance

B) Harmonisation sessions

LENGTH: generally 2-3 days

PARTICIPANTS: Technicians and staff of monitoring institutions from different countries together.

WHERE: Riparian institutions.

CONTENT: Participation to short sampling activities with partners that have similar mandates, in order to share methods, build partnerships and regional harmonization.

C) Regional short course

LENGTH: From one to several weeks

PARTICIPANTS: staff, researchers closely involved in the monitoring

¹⁹ A specific training dealing with internet use and IT communication could also be organised.

WHERE: Institute or university of the 4 riparian countries or another regional organisation installed near another lake of the region if lacustrine field work is necessary.

CONTENT: Database software use, GIS, satellite data processing, etc., in relation to technologies that will be used for monitoring. Resource persons (national or international) could provide field-training sessions. This approach would allow training of more people than sending staff abroad (providing that tools such as PC, software, images, etc. are available locally).

D) Short courses abroad

LENGTH: Variable (from weeks to months)

PARTICIPANTS: Selected staff closely linked to the monitoring

WHERE: Universities or research centres abroad

CONTENT: Same as for regional short course and other topics related to specific field of expertise such as taxonomy, database, GIS, etc... depending on training opportunities available in international institutes. Funding for this type of training could be solicited through international donors, cooperation agencies, or universities scholarships. Participants should be involved for a number of years following the training in the monitoring of Lake Tanganyika.

E) BSc, MSc, PhD Training

Partners could build a database on national and international academic training possibilities in their respective field. It would be advised also to identify fields where trained personal would be most useful such as fisheries, hydrology, limnology, chemistry, geochemistry, zooplankton, phytoplankton, microbiology, taxonomy, GIS, remote sensing, data bases, etc.

The proposed periods when training could take place and their frequency are presented in table 3.

| | Training types | Initial occurrence | Frequency |
|---|-------------------------|--------------------------------|----------------|
| 1 | <i>In situ</i> training | At the start of the monitoring | Every 10 years |
| 2 | Harmonisation sessions | After monitoring trial period | Every 5 years |
| 3 | Regional short course | Any time as needs arises | Continuous |
| 4 | Short course abroad | Any time as needs arises | Continuous |
| 5 | BSc, MSc, Ph.D... | Continuous | Continuous |

Table 3: Training type, time of initial implementation and frequency

5.2 Framework for Data Management and Information Sharing Systems

In order to integrate, interpret and use data for informed management decisions at a regional level, an integrated data management and information sharing system is crucial. Three levels of data management and information sharing may be foreseen for the Lake Tanganyika monitoring (1) national institutions and other partners collection field information; (2) National Coordination Units (in collaboration with Project Management Units) and; (3) LTA Secretariat Regional Coordination Unit (RCU). A simplified version of this system is shown in Figure 4.

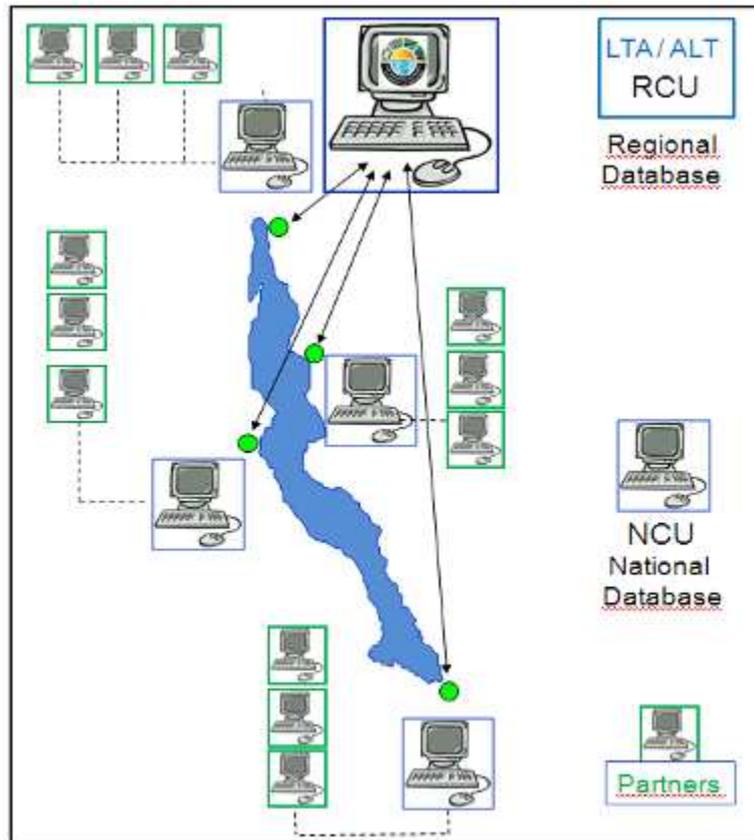


Figure 4: Data bases and data flow between national institutions and other partners collecting field data, the National Coordination Units (NCU) and the LTA Secretariat Regional Coordination Unit (RCU) in the frame of the Lake Tanganyika Regional Monitoring.

5.3 Field data collection

Data should be collected in a harmonised way, which should be similar for all partner institutions involved in the monitoring programme. The national institutions and other partners collecting primary information could use Excel spreadsheets for data recording. Spreadsheets should be well designed for use in the field as well as online. After an initial trial period, the data collection spreadsheet design should be re-evaluated and adjusted to match requirements for long-term use.

Some important points for data collection are indicated below:

Methods need to be harmonized as much as possible (units, accuracy, precision).

If different tools are used this should be clarified, so that data can be adequately manipulated afterwards.

Codes for naming files and parameters should be intuitive and clear to everyone.

Spreadsheets for data collection should have cell protection to avoid format changes.

Data collected in the field should be immediately digitized and checked by others for accuracy.

Metadata should be linked to primary data. This should include the name and contact details of the data collector, and information on sampling method and general conditions (also see point about logbook below).

Logbook with essential information about circumstances that can influence the data should be systematically completed. Important information that needs to be logged includes the date, time, and site of the observation (GPS coordinates), sampling method, weather conditions, observations on mass fish kills, plankton blooms, fishermen and fish movements, land slides, pollution events, flooding events, etc.

All partners should use the same referential geographic systems for GPS positioning (e.g. the World Geodetic System WGS84), and positions should be referred to using the same units (e.g. D. degrees, and DDD.DDDDD fraction of degrees)

5.4 Role of NCU and PMU in Data Collection

The first step in obtaining an overview that can be used at the regional level is collection and compilation of the data by the NCU teams. The NCU's should play a key role, as they are intended to be permanent structures of the LTRIMDP. In addition, the PMU's should play an important role for the duration of the UNDP/GEF Project, in closely collaborating and ensuring that all data collected as part of their project is processed and also disseminated to the NCU's.

All monitoring partners should report their data to the NCU on a regular basis. The NCU should check the data quality and compile all information into a main Excel spreadsheet or Access database²⁰. For the long term the NCU would be responsible for compiling all relevant national data for each of the monitoring components (water quality, fisheries, land use, biodiversity, climate change). Data should be analysed using a multidisciplinary approach to better understand the possible reason for changes in the environment. The NCU's should keep a checklist of data files on a monthly basis to identify possible gaps, missing data or any problems that need to be solved to insure the sustainability of the monitoring. Yearly reports will need to be produced by the NCU's (and PMU's during the project period) and sent to the LTA RCU as well as the partners. Reports should follow harmonized templates for each country.

NCU's should be assisted in this task by technical workgroups or scientific committees for each component of the monitoring programme²¹.

5.5 Role of LTA RCU

The LTA RCU should manage the regional database through their website. This database should be accessible by partners²² for input of data as well as for retrieving data after quality checks. The LTA Secretariat should ensure to have sufficient scientific and technical inhouse expertise, as well as to solicit inputs from external experts if needed (e.g. through technical working groups or scientific committees). Translation of data into knowledge and informed management decisions should also be the responsibility of the LTA Secretariat.

The LTA RCU should ensure annual dissemination of a report on the outcomes regional monitoring programme to all relevant partners, national authorities, and the general public.

5.6 Online Database

For developing the main database, there are several technical possibilities for integration in the LTA website. A "CMS" (Content Management System) such as DRUPAL could be used, which is an open-source software that can be run on an Apache server. It allows on line publication of pages using PHP and My SQL database. A complete website may be created with a graphic interface for its management. It allows password use identification²³. Software such as DRUPAL would probably be a

²⁰ The main LTA RCU database should be in accordance with those of national partners.

²¹ The example of the Lake Victoria Fisheries Organisation could be used as a model for Lake Tanganyika.

²² Password protection could be installed to ensure that third parties cannot access and manipulate the data without consent from the LTA.

²³ For example, DRUPAL is used for this website: <http://www.atbi.eu/summerschool/> by the EDIT Project, and http://edit.africamuseum.be/drupal_dev by the Royal Museum for Central Africa, which has been involved in websites/database establishment in DRC, Tanzania and Uganda (franck.theeten@africamuseum.be).

good choice for LTA. Its management is possible with a graphic interface for the administration of the Internet navigator. Other possibilities include software such as Joomla. Most of them are based on MySQL database and PHP. Adequate computer knowledge is required for initial installation of these types of software (including for Apache server). After installation and training, internal menus systems allow a non-computer specialist to use them.

It can be expected that Geospatial data and maps will be used and exchanged. The LTA RCU Database Clerk should be trained on the standards and tools used for Geospatial data and mapping on the Internet. The main database could include Web Map Service (“WMS”), Web Feature Service (“Web Feature service”) and Web Catalog Service (CS-W, a protocol for the registration and querying of metadata). These standards are Open-Source (defined by the OGC- open Geographic Consortium) and implemented by freely available applications. Examples are Geoserver (a web server for georeferenced data written in Java running on Tomcat) and PostGIS (a powerful Open source SQL database system able to handle georeferenced data and their reference system, which is following the standard notations defined by the OGC). These applications ease the publication and querying of geospatial data provided by Desktop GIS application (such as ArcInfo) or shapefiles made from worksheets on the Internet.

The Installation of an application such as a CMS (Content Management System) and the training of operators could take 2 to 3 months if a server is already installed, configured (IP address) and administrated by technical personnel in the institution.

The LTA website could also include other useful databases, such as:

- Online Library with references relevant to the sustainable management of the natural resources in the Lake Tanganyika basin (including downloadable PDF files if possible).
- Databases of resource experts and institutional partners, including short CV’s and contact details of national, regional and international experts in relevant areas (e.g. see Appendix 36).
- List of relevant research topics that could be studied in the framework of MSc or PhD to complement the monitoring programme, which could be circulated among partner universities.

6. Integrating Monitoring Activities at the International Level

Lake Tanganyika receives scientific interest from all over the world, because of its unique biodiversity, limnology, hydrodynamics, fisheries, and paleo-climatology, as well as its relevance as a source of freshwater and economic revenues. Short research projects on Lake Tanganyika continue to be developed by international universities and other research institutes. These projects are typically implemented in close collaboration with national institutions, such as the CRH (DRC), the University of Burundi and INECN (Burundi), TAFIRI (Tanzania), and the Department of Fisheries (Zambia). Research collaborations benefit each partners:

- **Local institutions**

- Knowledge exchange
- Publications in scientific journals
- Research collaboration
- Training opportunities
- Acquisition and maintenance of instruments

- **International researchers**

- Data
- Publications in scientific journals
- Research collaboration and permits

- Use of infrastructure and boats

An overview should be created of past, present, and (potential) future international research partners. An International Consortium for Lake Tanganyika Research could be established, in which partners could be involved for a certain number of years. Memoranda of Understanding could detail the type of scientific research, period of collaboration, necessary instruments and maintenance contributions, training possibilities, etc.). A board could be established that can propose new partnerships in collaboration with the LTA Secretariat. This could contribute to ensuring the sustainability of the overall monitoring programme.

Partnerships should be based on mutual scientific benefits. Collaboration and inputs from local staff can be seen as in-kind contributions to the regional monitoring programme. As long as the activities fall within the official mandate of the institution for long term monitoring of basic parameters, staff should not be expected to receive additional allowances. Short-term supplementary research activities as required by international partners, may require payment of allowances for national staff. However, expectations of continued payments for long-term monitoring would reduce the sustainability of international partnerships and particularly of the monitoring.

Collaboration at the international level will also enhance data interpretation, as this typically requires a number of national and international specialists in each field. Scientific publication of monitoring results should be encouraged. An important point to consider is the authorship, particularly as data will be exchanged between partners. Some rules should be developed with the partners of the Consortium on publications, to avoid that monitoring data is stored away for too long without dissemination to the wider scientific audience.

Some examples of possible international partners are listed in Appendices 48-53

7. Conclusions

Developing a sustainable, low-cost Regional Integrated Environmental Monitoring Programme for the Lake Tanganyika basin is an immense challenge. Fortunately, a number of relevant national institutions are present in the riparian countries, most of which have mandates that include activities relevant to the monitoring programme. By selecting key institutions, encouraging national and international collaborations, and developing capacity enhancement plans, regional monitoring should be possible on the long-term. The role of each partner should be clearly defined, including harmonised monitoring approaches. The establishment of Memoranda of Understanding between the LTA Secretariat and the monitoring partners is advisable.

The monitoring programme should focus on a limited number of parameters for each of the focal topics (water quality, fisheries, land use and erosion, biodiversity and climate change) to insure long term sustainability. Keeping in mind the restricted availability of national and international donor funding, it is important to keep the number of long-term monitoring parameters to a minimum, including only those that are absolutely relevant. The same counts for the choice of sampling sites, and the frequency of monitoring activities, which should be based on a combination of financial and environmental arguments. Regular short-term monitoring activities in collaboration with international research teams could focus on a larger set of parameters that could complement the programme. The establishment of a Lake Tanganyika Research Consortium is recommended, in order to benefit from international research programmes. Ultimately, the combined long- and short-term monitoring activities should provide sufficient insights in environmental trends.

A framework is proposed in which data generated by monitoring partners is compiled and assessed by national NCU teams (with support from the PMU teams), and integrated, disseminated, as well as translated into management actions by the LTA Secretariat.

Some of the most important points for capacity enhancement include transport and communication means (including IT facilities and adequate Internet access), basic as well as advanced monitoring equipment, and training. Training should be based on local needs, and should include topics focusing on monitoring methodologies, equipment use and maintenance as well as data processing, analyses and reporting. The capacity of the LTA Secretariat should be built in order to effectively coordinate the regional monitoring activities, ensure the establishment and functioning of an online database, and adequately disseminate the obtained knowledge back to partners, governments and the global community.

It is estimated that the successful establishment of the regional monitoring programme, including capacity building activities may take up to 2-3 years if all partners joint their efforts. Once the monitoring programme has been functional for about 1 year, re-assessment and adaptation should take place when needed, to ensure its sustainability. With the combined goodwill of all partners, sufficiently enhanced capacities, adequate regional coordination, and efficient communication the establishment of a long-term Regional Environmental Monitoring Programme should be possible, enabling informed future decision making for sustainable management of Lake Tanganyika

Acknowledgements

The help of Laurent Ntahuga from the Regional Project Coordination Unit of the UNDP/GEF project on Lake Tanganyika was greatly appreciated. The work could not have been possible without the support of the Lake Tanganyika Authority Directors Henry Mwima, Gabriel Hakizimana, Kaitira Katonda, Augustine Mutelekesha and Désiré Lompombi.

The assistance of Cynthia Barwendere, Désiré Hatungimana from the UNDP/GEF Project, as well as Alice Christelle Nijimbere, Liliane Debege and Pacifique Ndoricimpa from the LTA Secretariat during the preparation of the Regional Workshop was also much appreciated.

All the people from the visited institutions, universities, NGO's, and others who contributed their knowledge to this report are sincerely thanked.

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**UNDP/GEF Project on Partnership Interventions for the Implementation
of the Strategic Action Programme for Lake Tanganyika**

**LAKE TANGANYIKA REGIONAL INTEGRATED
ENVIRONMENTAL MONITORING PROGRAMME,
INSTITUTIONAL NEEDS ASSESSMENT**



APPENDICES

Appendix 1: Terms of Reference of the consultancy

TERMS OF REFERENCE

INSTITUTIONAL NEEDS ASSESSMENT

LAKE TANGANYIKA REGIONAL INTEGRATED MONITORING PROGRAMME

A. Consultancy Details

Job **Short term Consultancy**

Level International or Regional Consultant

Project title UNDP/GEF Project on Partnership Interventions for the Implementation of the Strategic Action Programme for Lake Tanganyika

Activity **Institutional Needs Assessment for Lake Tanganyika Regional Integrated Monitoring Programme**

Agency UNOPS

Duty Station Bujumbura, Burundi, with extensive travel to the Lake Tanganyika basin states

Closing Date 30 December 2009

Duration 10 weeks

B. Background

Lake Tanganyika is a globally significant hotspot of freshwater biodiversity, which contains almost 17% of the world's surface freshwater, and serves as an irreplaceable source of clean water, transportation and economic opportunities for an estimated 10 million people in its riparian countries. The Lake Tanganyika Regional Integrated Management and Development Programme (LTRIMDP) was developed by stakeholders from Burundi, DR Congo, Tanzania, and Zambia, UNDP/GEF, African Development Bank (ADB), Nordic Development Fund (NDF), International Union for the Conservation of Nature (IUCN) and other organizations in order to sustainably manage and protect the natural resources and biodiversity in the lake basin.

The LTRIMDP is implemented through two projects: (i) the UNDP/GEF Project on Partnership Interventions for the Implementation of the Strategic Action Programme for Lake Tanganyika (hereafter referred to as UNDP/GEF Project), and (ii) the ADB funded Project to Support the Lake Tanganyika Integrated Regional Development Programme (PRODAP).

To address major trans-boundary issues for sustainable management of the resources of Lake Tanganyika and its basin, the following interventions were developed:

- Support to the Lake Tanganyika Authority (LTA) and its Secretariat, launched in December 2008 to coordinate and monitor sustainable management of the lake.
- Pollution control through wastewater management in Bujumbura (Burundi) and Kigoma (Tanzania).
- Sedimentation control through catchment management interventions in the regions of Uvira (DRC), Kigoma and Rukwa (Tanzania), and Mpulungu and Kaputa (Zambia).
- Introduction of sustainable and responsible fishery co-management regimes.
- Institutional support to policy process, implementation of the Convention on Sustainable Management of Lake Tanganyika, and the establishment and implementation of environmental monitoring programmes.

The Convention on Sustainable Management of Lake Tanganyika stipulates that monitoring of the natural resources of the lake and its catchment basin must be harmonized among the riparian countries to facilitate joint management. The regional Project Coordination Unit (PCU) of the UNDP/GEF Project on Lake Tanganyika has developed a draft framework for a Regional Monitoring Programme that includes parameters relevant to water quality, land use, biodiversity, and fisheries. The monitoring programme is intended to inform the LTA about the status of the lake and its resources, thus enabling evidence-based decisions to achieve sustainable development of the Lake Tanganyika basin. The monitoring programme will be linked to the management of the lake and lake resources, and fall under the oversight of the Lake Tanganyika Authority Secretariat.

The programme will be implemented in collaboration with relevant governmental and non-governmental institutions in the riparian countries. Discussions on the implementation of the monitoring programme are underway among the cooperating partners and LTA. Current international partners cooperating with the LTA in the development of the monitoring programme include UNDP/GEF, AfDB, FAO, ICRAF, IUCN-ESARO, and UNEP-ROA. Additional partners may be identified to complement and strengthen the support framework for the monitoring programme.

For national monitoring programs to contribute effectively to a larger harmonized regional monitoring program, the national agencies in the four countries must use comparable data. Thus far, monitoring activities have been ad-hoc, and narrow in scope and coverage. Data collection has been to national formats and criteria, with little regional or international collaboration. Monitoring data has not sufficiently been fed into the planning and implementation processes of the regulatory and management agencies responsible for the resources of the lake. Furthermore, there is a lack of partnerships linking national agencies to global data sets, and opportunities to integrate activities at the international level are remaining to be explored.

In order for monitoring programs to be sustained after donor funding concludes, they must provide data that is meaningful to the national institutions, and be fully integrated into the institutions' annual work plans. These prerequisites, coupled with current institutional capacities and resources, argue for a simple, low-cost monitoring program using appropriate technologies, which dovetail with national priorities. To develop a Lake Tanganyika Regional Integrated Monitoring Programme that is sustainable on the long term, it is essential that planned activities fall within the (enhanced) capacity and resources of the institutions involved.

The outcomes of this consultancy are expected to include an overview of the current capacities and needs of the institutions identified to take part in the Lake Tanganyika monitoring programme, as well as a set of concrete recommendations for strengthening their capacities. The consultancy is expected to provide a realistic answer to the question how the riparian Lake Tanganyika countries can most cost-effectively harmonize monitoring practices with minimum adjustment. The consultancy is also expected to provide recommendations on additional partnerships as well as opportunities to link the monitoring program to international initiatives. As such, the consultancy will play an important role in preparing the foundations of the Lake Tanganyika Regional Integrated Monitoring Programme.

C. Objectives of the Assignment

The objectives of this assignment are to collect and compile information on:

National and regional institutions that are/should be involved in the Lake Tanganyika Regional Integrated Monitoring Programme as implementing partners.

Current mandates of these institutions, and possibilities to expand their mandates if needed.

Relevant monitoring activities done on the lake and in its basin by national institutions (including existing datasets).

Resources (human and material), capacity, existing and potential funding mechanisms with relevance to the Lake Tanganyika monitoring programme.

Training needs of national institutions to conduct monitoring activities, as well as training opportunities (e.g. existing or potential workshops or courses, funding mechanisms, etc.).

Possibilities to cost-effectively improve harmonization of monitoring activities (coordination, communication and cooperation among stakeholders) at the national and regional level.

Possibilities and challenges for establishing data collection, data management and information sharing systems at the LTA level.

Opportunities to integrate monitoring activities at the international level (e.g. linking research institutions, AGLONET, Large Lakes Observatory, UNESCO-IHE, etc.).

D. Scope of Work

Through a contract with UNOPS, the consultant will work closely together with the PCU as well as the LTA Secretariat – from the preparation phase to the reporting and disseminating of results and recommendations. The consultant will liaise with and visit relevant institutions in the four riparian countries for onsite assessments. Furthermore, the consultant will be the key resource person for a regional workshop that will be organized to bring together all relevant experts and partners to discuss the capacity needs for a harmonized regional Lake Tanganyika monitoring programme.

The consultancy work is expected to: i) generate a comprehensive assessment and recommendations following the objectives outlined herein, ii) contribute to enhancing the sustainability of the Regional Integrated Lake Tanganyika Monitoring Programme; and iii) contribute to the establishment of a system for data management and information sharing at the regional and international level.

E. Tasks

Working under the supervision and guidance of the PCU and LTA Secretariat, the consultant will be expected to:

Familiarize with relevant background documents.

Submit a preliminary review, workplan, draft outline for the assessment report and institutional assessment questionnaire to the PCU and LTA Secretariat for discussion and approval²⁴.

²⁴ All documents should be delivered in English. Translation to French will be the responsibility of the PCU.

Identify and liaise with relevant national and international institutions to solicit their input.
Conduct comprehensive needs assessments among relevant institutions in the Lake Tanganyika riparian countries, identifying challenges as well as possible solutions.
Prepare a framework for establishing data management and information sharing systems at the regional and international level, using appropriate communication techniques (e.g. e-mail lists, online clearing house mechanisms).
Contribute actively to organising a regional needs assessment workshop in close collaboration with the PCU and LTA, and act as a key resource person during this workshop.
Adequately and timely present the findings in a report for discussion and approval of the PCU and LTA Secretariat.

F. Timeframe and Deliverables

The consultancy will span ten weeks. It is planned to start on January 25th and should be finalized by April 4th 2010.

The following deliverables will be expected from the consultant:

Workplan, draft outline for the report and institutional assessment questionnaire, as well as proposed travel itinerary, submitted to the PCU in the first week of the assignment.

Contributions to organising a regional needs assessment workshop: i) list of recommended participants; ii) presentation of consultancy outcomes; iii) active member of the panel that will be assigned to lead discussions on the monitoring framework.

Comprehensive report in line with the objectives outlined above. The report should include:

- Overview of institutions in the Lake Tanganyika riparian countries that have the mandate to implement monitoring activities
- Review of the current capacities of these institutions
- Clear and realistic recommendations on how to cost-effectively enhance the capacities of these institutions
- Proceedings of the needs assessment workshop
- Framework for establishing data management and information sharing systems
- Recommendations for integrating monitoring activities at the international level

G. Consultant Qualifications

Education:

Advanced university degree in natural sciences.

Experience:

At least seven years of relevant working experience

Demonstrated experience in areas related to capacity development analyses of environmental management/research institutions.

Experience in working with/developing environmental monitoring procedures and large scale monitoring programmes.

Familiarity with environmental monitoring indicators for aquatic as well as terrestrial systems.

Experience working in developing countries.

Experience working with governmental institutions an asset.

Advanced information technology skills, including Internet-based communication systems.

Demonstrated skills in writing and revising report documents, and experience in presenting results to a specialized audience using advanced visual techniques.

Language Skills:

Oral and written fluency in English and working knowledge of French.

Appendix 2: Resource Persons Consulted

BURUNDI

| | | |
|------------------------|------------------------------------|------------------------------|
| Dr Henry Mwima | Executive Director | Lake Tanganyika Authority |
| Mr Kaitira Katonda | Director Fisheries | Lake Tanganyika Authority |
| Mr Gabriel Hakizimana | Director Environment | Lake Tanganyika Authority |
| Mr Désiré Ebaka | Director Administration & Finances | Lake Tanganyika Authority |
| Mr A. Mutelekesha | Director Monitoring & Evaluation | Lake Tanganyika Authority |
| Prof Laurent Ntahuga | Regional Project Coordinator | UNDP/GEF Project |
| Dr Saskia Marijnissen | Technical Advisor Environment | UNDP/GEF Project |
| Mr Charles Karakura | Coordinator | National Coord. Unit/Burundi |
| Mr Fidèle Gahungu | Environnement Expert | Ministry of Environment |
| Ir. Remy Barampama | Director General | SETEMU |
| Mr A. Ntungumburanye | Director | INECN |
| Mr Fidèle Bashirwa | Director | Fisheries Department |
| Ms Eugénie Nduwayo | Programme Director | PNLAE |
| Mr. Libérat Nsabimana | Chief water production | REGIDESO |
| Mr Prime Niyongabo | Chief of laboratory | REGIDESO |
| Mr Bigana Tharcisse | Chemist | REGIDESO |
| Mr Samuel Bigawa | Vice-Rector | University of Burundi |
| Dr Gaspard Ntakimazi | Professor | University of Burundi |
| Dr David Nahimana | Professor | University of Burundi |
| Mr Bonaventure Minani | Department Chief | SETEMU |
| Mrs B. Sindyirwanya | Director | LACA |
| Mrs D. Hakizimana | Director of Laboratories | INSP |
| Dr Pontien Ndabashinze | Research Director | INSP |
| Mr Geoffrey Citegetse | | ABO |
| Mr Alain Kakunze | Chief, Ruzizi Natural Reserve | INECN |
| Mr Antoine Kiyuku | Fisheries expert | National Coord. Unit/Burundi |
| Mme Marie F. Kamugisha | Responsible Water Service | Fisheries Department |
| Mrs Aline Irimbere | Responsible of Laboratory | INECN |
| Dr Deo-D. Niyonzimana | Dean | University of Burundi |
| Mrs R. Ndayishimiye | Director | IGEBU |
| Mr Maurice Shiramanga | Advisor | IGEBU |
| Mr Damien | Director | Burundi Bureau of Norms |
| Mr Pascal Ndayiragije | Director | ISABU |
| Mr Aloys Rurantije | Director Meteorology | IGEBU |
| Mr Protais Ntumigomba | Director Cartography | IGEBU |
| Mr Didace Rwabitega | Researcher | IGEBU |
| Mr Aloys Kazimwoto | Chief Diving Unit | REGIDESO |
| Mr Nestor Nikobagomba | Landuse- GIS | Ministry of Environment |

D.R. CONGO

| | | |
|-------------------------|-----------------------------|--------------------------------|
| Prof. Manara | Coordinator | National Coord. Unit/D.R.Congo |
| Mr Gayo Lemba | National Director | Fisheries Department |
| Mr Sedeke Crispin Okwul | Division Chief | Ministry of Environment |
| Dr Nshombo Mudherwa | General Director | CRH-Uvira |
| Mr René Shalukoma | Scientific Director | CRH - Uvira |
| Mr Muzumani Risasi | Researcher | CRH - Uvira |
| Mr K. Mukungilwa | Researcher | CRH - Uvira |
| Mr Beya Kadima Richard | Soil expert | Ministry of Agriculture |
| Dr Carlos de Wasseige | Regional Coordinator | FORAF Project |
| Mr Confiance Mfuka | GIS Officer | FORAF Project |
| Mr Bruno Perodeau | Principal Technical Officer | WWF |
| Mrs Francesca Lanata | DRC Program Coordinator | National Botanical Garden |
| Mr Gerard Kitungano | Fisheries Socio-economics | CRH-Uvira |
| Mr D. Mwenyemali | Researcher/Sedimentology | CRH-Uvira |
| Mr Wilfried Godderis | Seed Project | MINAGRI /BTC |
| Mr Emanuel Heuse | Forest Law Enforcement | BTC |

| | | |
|-------------------------|------------------------------------|-------------------------------------|
| Mr Frederic Nzale | IT/GIS specialist | Ministry of Environment/Water |
| Mrs Marie-R.Mukonkole | Chief Control Division | Ministry of Environment/Water |
| Mr Faustin Ngediko | Economist | Ministry of Environment/Water |
| Mr Fay Munimpabi | Director | Ministry of Public Works |
| Mr Guyguy Malengele | Jurist | Ministry of Environment/Water |
| TANZANIA | | |
| Dr Hudson Nkotagu | Coordinator | National Coord. Unit/Tanzania |
| Mr Vitalis Mnyanga | National Project Manager | Project Coord. Unit/Tanzania |
| Mr M. Muyungi | Environment Director | Vice-President Office/ Environment |
| Mr Stephen Nkondokaya | Principal Fisheries Officer | Vice President Office/Environment |
| Mr O.M.Kamukuru | Senior Environmental Engineer | Vice President Office/Environment |
| Mr W.Mutayoba | Director of water Ressources | Ministry of Water & Irrigation |
| Dr Yohana Budeba | Director General | TAFIRI |
| Mr Paulo Tarimo | Director | Land Use Planning |
| Mr Sospeter W Mtemu | Assistant Director | Land Use Planning |
| Dr Ben Ngatunga | Research Director | TAFIRI |
| Mr Amon Shoko | Director, Kigoma Station | TAFIRI |
| Mr Chris Lugiko | Head of MCS, Kigoma | Division of Fisheries |
| Mr Chobaliko Rubabwa | Director, Kigoma | Water Basin Office (WBO) |
| Mr P.Kiliho | Head of Laboratory, Kigoma | Ministry of Water & Irrigation |
| Mrs Beatrice Kunsindah | Head, chemical Section | Tanzania Bureau of Standards |
| Mr Huruma Mgana | Researcher, Kigoma Station | TAFIRI |
| Mr Zablon Masele | Director | Surveys and Mapping Division |
| Mr Rashid Mkezi | Director, Business Support Service | Tanzania Meteorological Agency |
| Mr Sylvester A. Matemu | Assistant Director Water Resource | Ministry of Water and Irrigation |
| Mrs Nahhifa Kemikimba | Ag. Dir. Water Quality Lab.Serv. | Ministry of Water and Irrigation |
| Mr John Mike | It Administrator | The Jane Goodall Institute Tanzania |
| Mr Emmanuel Mayage | Procurement Consultant | National Coord. Unit/Tanzania |
| Mr Emmanuel Mtiti | Program Director | The Jane Goodall Institute Tanzania |
| Mr Dikson Rutagemwa | Consultant | Project Coord. Unit/Tanzania |
| ZAMBIA | | |
| Mr Mutale Kangwa | Coordinator a.i. | National Coord. Unit/Zambia |
| Mr Simbotwe Mwiya | National Project Manager | Project Coord. Unit/Zambia |
| Mr Charles Maguswi | National Director | Department of Fisheries |
| Mr Patrick Ngalande | Deputy Director | Department of Fisheries |
| Dr Harris Phiri | Director of Fisheries | Department of Fisheries |
| Mr Willie Kalunga | Inspector | Environmental Council of Zambia |
| Mr Martin Sischekanu | Chief Agricultural Specialist | Land Husbandry |
| Mr Fred Tobolo | Provincial Meteorological Officer | Zambia Meteorological Dpt. |
| Mr Eduard Mwanza | Senior Hydrologist | Water Affairs |
| Mr Nicodemus Malisa | Laboratories Manager | Zambia Bureau of Standards |
| Dr. Martin Mbewe | Agricultural Officer | Project Coord. Unit/Zambia |
| Mr Boniface Mwalongo | District Agricultural Coordinator | Min.of Agriculture & Cooperatives |
| Mr Levy Museteka | Water quality Officer | Water Affairs |
| Mrs Carol Mwape-Zulu | Focal Point NCU & PMU | Ministry of Tourism & Environment |
| Mr Rabby Mulangala | Agrof. & Conservation Officer | Project Coord. Unit/Zambia |
| Mr Lemmy Situnyama | District Director of Health | Ministry of Health |
| Mr Banda Mackson | Clinical Care Officer | Ministry of Health |
| Mr Lawrence Makasa | Fisheries assistant | DOF |
| Mr Ruben Shapola | Fisheries assistant | DOF |
| INTERNATIONAL | | |
| Dr Martin Van der knaap | Consultant | FAO |
| Dr Adrien Radcliffe | Expert | ICRAF |
| Dr Emmanuel Mwendera | Regional Coord. Water& Wetland | IUCN ESARO |
| Ms Esther Abonyo | Expert | IUCN Invasive Species Initiative |
| Dr Steven Loiselle | Professor | AGLO/University of Sienna |
| Dr J.-C.Micha | Professor | FUNDP |

Appendix 3: Questionnaire Summary

- HQ1 What is the name of your institution? Please provide contact details (address, email address, phone number, web site...)
- HQ2 Is your institution governmental institution/university/NGO/otherwise (please define)? Would any documents presenting the institution status, goal, activities (recent annual reports) be available? A copy of these documents (either hard copy or electronic) would be greatly appreciated.
- HQ3 Does your institution have any field stations within the Tanganyika basin? If so, please provide name, address, mail and telephone or person(s) in charge.
- HQ4 Does your institution have an official mandate to implement monitoring activities relevant to sustainable management of Lake Tanganyika and its catchment basin (for instance, water quality, biodiversity, fisheries, meteorology, vegetation cover, sedimentation parameters...)? If so, please explain what the contents of this mandate are.
- HQ5 Would a change of mandate be needed in order for your institution to implement monitoring activities relevant to sustainable management of Lake Tanganyika and its catchment basin?
- HQ6 Would your institution be willing to be involved in the Lake Tanganyika monitoring activities and exchange of information with the LTA institution on a long term basis? (Please specify by wish, by national mandate or both).
- HQ7 Does your institution maintain active cooperation with other national, regional or international institutions or organisations? (If yes, please identify).
- HQ8 Does your institution receive any funding from the UN / AfDB or any other international funding body?
- HQ9 In your opinion, would the staff of your institution require any specific training in order to effectively participate in a harmonised regional monitoring programme for Lake Tanganyika?
- HQ10 Does your institution provides any specific training programs? If so, is there any support documentation? (Copies would be greatly appreciated).
- HQ11 Are training programs of your institution open to other participants? Which participants are eligible to take part?
- HQ12 Who is/are the main funding body /bodies for your institution?
- QH13 Does your institution do anything in terms of fundraising? E.g. do you write funding proposals to national or international donors, do you actively lobby among potential donors or among your government for funding,
- HQ14 Do you have any personal opinions or suggestions for successful long term monitoring in Lake Tanganyika and/or its catchment basin?
- F1 What is the name of your Field station and Institution? What is the name of the person in charge of the station, email, telephone?
- F2 Please provide the number of staff members and level of education (+ field of specialisation)? (or attach a list?)
- F3 Is your Station/organisation currently monitoring any environmental parameters relevant to sustainable management of Lake Tanganyika and its catchment basin? If yes, how long have you been actively monitoring these parameters?
- F4 What environmental parameters are presently recorded?
- F5 Which means of transport does your institution have in the field? For instance: car, boat, etc.?
- F6 Is your institution focusing on Lake Tanganyika itself / the lake catchment basin (e.g. sustainable agriculture, reforestation, riverine issues) / both?
- F7 Which means of communication does your institution have in the field? For instance: telephone, radio, Fax, Internet, etc.?
- F8 Do you have electricity from the network in your station? Estimate the percentage of time when electricity is available?
- F9 Do you have electrical generator(s)? If yes, what type (power, diesel) and working state?
- F10 Is tap water available in your laboratories? (Estimate the percentage of time when water is available during the week).
- F11 How operational is the Internet connection in the field station? For instance, how many computers are connected, what is the speed of the connection, how often do you experience problems with your Internet connection?
- F12 Do you have any personal opinions or suggestions for successful long term monitoring in Lake Tanganyika and/or its catchment basin?
- V1 In which area is your institution active (water, fisheries, biodiversity, land use, climate, other)?

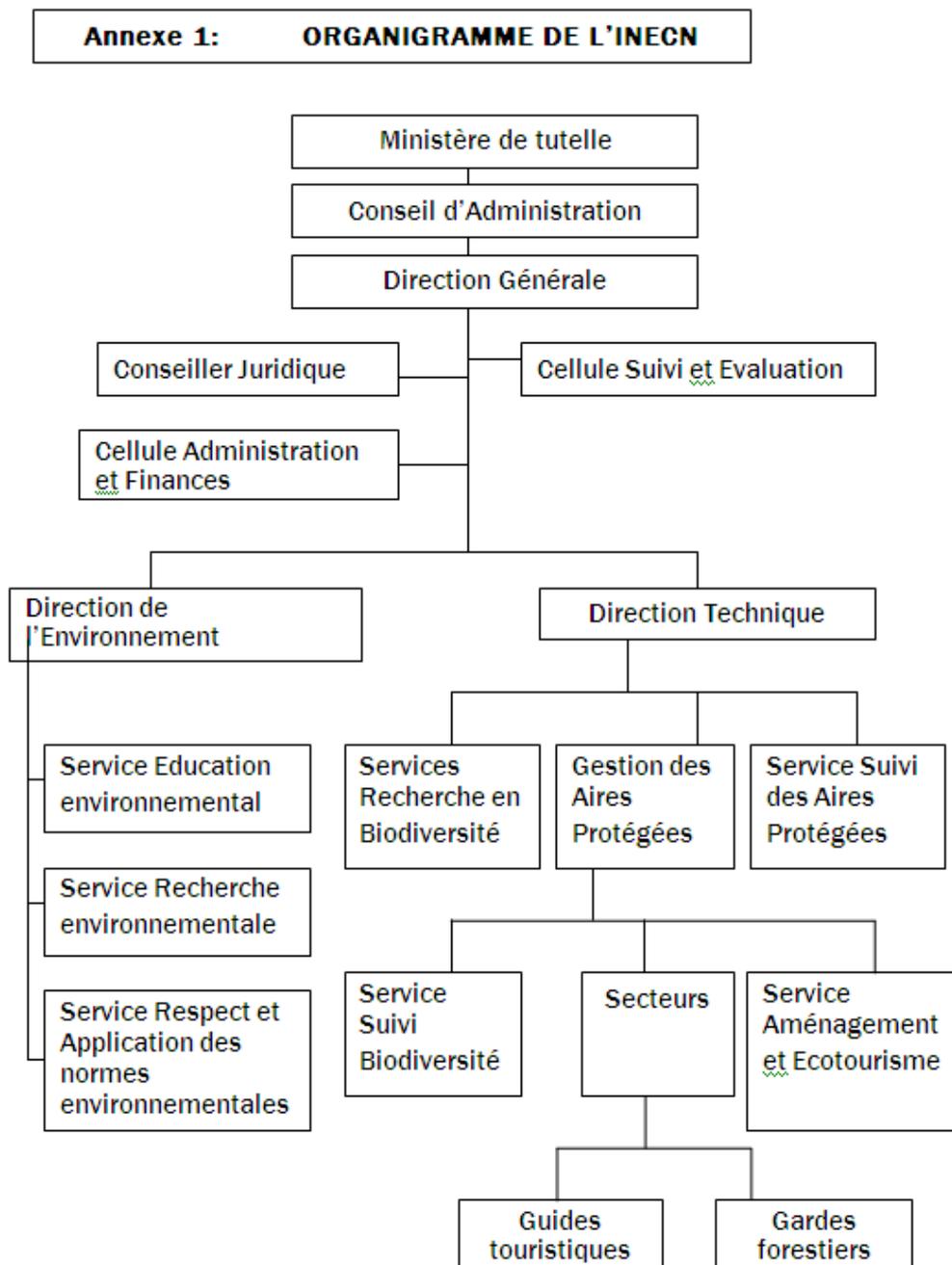
- V2 What equipment is available in your institute for monitoring (lab instruments, diving gears, and so on...)? The state of instrument is important to know. (An excel list could be attached).
- V3 Do you have any documents or a summary of the present monitoring taking place, indicators, methodology, units, etc.? Could you provide a copy (digital if possible)?
- V4 Is meteorological monitoring being implemented in the field station? (Please provide an overview of parameters measured.)
- V5 What is required to improve the monitoring?
- V6 Do you collect and organise your data manually or digitally?
- V7 What would be required for your institution to adapt its monitoring activities in order to reach regional harmonization?
- V8 Quality of the data? Any information or comments?
- V9 Do you use Internet? For what purposes do you use it? For instance: email, searching for scientific literature, using Google to find work-related information?
- V10 How the institutions obtain knowledge from the Internet?
- V11 Could you provide an organogram of your institution?
- V12 Has your institution contributed to any publications in scientific journals? Please list the specifics of these publications. (Copies would be greatly appreciated).
- V13 Would your institution be able to participate in long term monitoring partnerships and regional exchange of information, without any external financial assistance?
- V14 Could your institution make any databases / information /past observations relevant to the sustainable management of Lake Tanganyika and its catchment basin available to the LTA? If so, please specify the types of data, and their format (written/digital, etc.).
- V15 Are there some specialists in some environmental domaines in your institution (if yes, thanks to provide their CV).

Appendix 4: Questionnaire Answers from INECN

| BURUNDI - INECN (1/2) | |
|------------------------------|--|
| HQ1 | Contact address |
| | Institut National pour l'Environnement et la Conservation de la Nature (INECN), BP 56 Gitega/ Burundi ; Tél : +257 22403031 ; inecndg@yahoo.fr; www.biodiv.bi; http://bi.chm-cbd.net |
| HQ2 | Type of institution ? |
| | Governmental; Presidential decree for its establishment. More information are available in the "Plan d'action biennal 2009-2010" and yearly reports. |
| HQ3 | Is a station of your institution situated near lake Tanganyika ? |
| | Yes; the natural reserve of Ruzizi; Responsible: KAKUNZE Alain Charles, akakunze@yahoo.fr; tél : +257 79 97 32 89 |
| HQ4 | Do you have an official mandate related to monitoring of L. Tanganyika? |
| | Yes; the natural reserve of Ruzizi; Responsible: KAKUNZE Alain Charles, akakunze@yahoo.fr; tél : +257 79 97 32 89 |
| HQ5 | Would a change of mandate be necessary to implement this monitoring ? |
| | No |
| HQ6 | Would you agree to participate to a long term monitoring & information exchange ? (by wish/by mandate or both?) |
| | Of course. Lake Tanganyika is a national, regional and international treasure on several aspects including conservation of the biodiversity and sustainable ecological equilibrium |
| HQ7 | Cooperation with other institutions ? |
| | Yes, ISABU, université du Burundi, ISA ; IRAZ ; IGEBU |
| HQ8 | Does your institution get financing from UN/AFDB or other international organisation ? |
| | Yes: GEF UICN, GTZ (before the war) ; WCS |
| HQ9 | Does your staff needs specific training ? |
| | Yes. Planing, evaluation, GIS, biodiversity, environnemental monitoring, eco-touristic management, touristic guiding, paramilitary |
| HQ10 | Does you institution provide specific training ? |
| | The program is presently under preparation |
| HQ11 | Are training programs of your institution open to other participants? |
| | As soon as adopted, they will be open to others |
| HQ12 | Who mainly finance your institution ? |
| | The Burundeese state |
| QH13 | Do you write projects proposals for financing ? |
| | Yes |
| HQ14 | Do you have suggestions for the long term monitoring ? |
| | Yes. It is necessary to establish a system of follow-up/evaluation in a participative way that includes from the start all stackholders. INECN is ready to help. |
| F1 | Field station: name and contact adress. |
| | Ruzizi Natural Reserve, INECN, KAKUNZE Alain Charles, akakunze@yahoo.fr, +257 79 973 289 |
| F2 | Number of persons working in the field station (by education level) ? |
| | At Ruzizi: 2 Bsc in biology including one specialize in managing protected areas, 2 agronomist technician, 14 rangers of 6th level primary school. |
| F3 | Do you presently monitor environmental parameters in relation with LT ? |
| | Biodiversity monitoring since 1989. |
| F4 | What parameters do you actually monitor ? |
| | Water level and impact on the biodiversity |
| F5 | What means of transport does have your station ? |
| | Motorcyle in a poor state; 10 bicycles for the 14 rangers, dugout canoe with an outboard engine |
| F6 | Is your institution dealing with the lake, the watershed or both ? |
| | It deals with the biodiversity of the lake and its watershed. |

| BURUNDI - INECN (2/2) | |
|------------------------------|---|
| F7 | Means of communication ? |
| | Personnal telephones (non operationnal radio, no service phone) |
| F8 | Availability of electricity in the station ? |
| | none |
| F9 | Availability of electric generator in the station ? |
| | none |
| F10 | Availability of water in the station ? |
| | Yes (100%) |
| F11 | How many internet connection are operationnal in your station ? |
| | no computer and no internet connection |
| F12 | Do you have suggestions for the long term monitoring ? (field) |
| | managing the basin to decrease it's pollution |
| | associate the population in its protection |
| V1 | In which field is your institution active ? |
| | biodiversity, water, fishing, pollution, environmental education |
| V2 | What equipment is available in your institute for the monitoring ? |
| | Computers, biodiversity laboratory, librairy, GPS, Water laboratory is not presently operationnal because of lack of instruments, boat |
| V3 | Are documents available to explain the methodology for your monitoring? |
| | yes: on paper forms only |
| V4 | Is a meteorological monitoring implemented in your station ? |
| | today: no |
| V5 | What is required to improve the present environnement monitoring ? |
| | Laboratory equipment for the water quality control |
| | training of laboratory personal and other staff of environnemental research |
| | GIS |
| | Reinstallation of meteorological equipment in the protected area |
| | Training for setting up and implementation of research program |
| | Developping a database for the environnemental reserarch service |
| | Enhancing the librairy |
| V6 | Do you organise your data manually (hard copy) or digitaly ? |
| | Only biodiversity data are digitaly processed |
| V7 | What is required to harmonise a regional monitoring ? |
| | Training with other staff from the region for setting a similar level |
| | Equip the institution in the same way as others |
| | Organise external visit to share experience |
| | harmonize the databases |
| V8 | Quality of previous data : any comments ? |
| | They are good concerning the biodiversity. For the laboratory of pollution control, it should be reequipped and managers trained |
| V9 | Do you use internet ? |
| | Yes: google research, research and information recording on the web site of the Biodiversity Center of Information Exchange (BCH) in the frame of the Convention on Biological Diversity, e-mail... |
| V10 | How did your staff aquire internet knowledge ? |
| | Selftraining in Cyber cafés but also while being trained during studies and for some: workshop organised by the focal point of CHM pr BCH |
| V11 | Is an organogram of your institution available ? |
| | An organogram is attached |
| V12 | Did your institution contribute to scientific publications ? |
| | See this web site: http://www.biodiv.be/burundi/ |
| V13 | Would your institution be able to participate to a long term monitoring without external support ? |
| | No |
| V14 | Could your institution share past or present informations with the LTA ? |
| | Yes, written or digital if they exist digitaly |
| V15 | Does your institution have ressources persons in the field of environment ? |
| | INECN has specialist in several areas= biologists, agronomy engineers, chemists, industrial engineers.. Most of those staff are specialised in various areas of the environnement. |

Appendix 5: INECN Organogram



Appendix 6: Questionnaire Answers from REGIDESO

| BURUNDI - REGIDESO (1/2) | |
|--------------------------|--|
| HQ1 | Contact address |
| | REGIDESO degregie@cbinf.com tel: 22 22 34 12 |
| HQ2 | Type of institution ? |
| | Governmental |
| HQ3 | Is a station of your institution situated near lake Tanganyika ? |
| | Yes: water processing station "l'Usine lac". |
| HQ4 | Do you have an official mandate related to monitoring of L. Tanganyika ? |
| | water quality of the lake |
| HQ5 | Would a change of mandate be necessary to implement this monitoring ? |
| | A change of mandate would be necessary to monitor Lake Tanganyika that provide more than 80% or Bujumbura water |
| HQ6 | Would you agree to participate to a long term monitoring & information exchange ? (by wish/by mandate or both?) |
| | Yes; both |
| HQ7 | Cooperation with other institutions ? |
| | Yes, Ministry of Health, SETEMU,NBZ |
| HQ8 | Does your institution get financing from UN/AFDB or other international organisation ? |
| | Yes: AFDB, World Bank, GTZ |
| HQ9 | Does your staff needs specific training ? |
| | Yes |
| HQ10 | Does you institution provide specific training ? |
| | Yes, we do have a training center |
| HQ11 | Are training programs of your institution open to other participants? |
| | Yes with costs |
| HQ12 | Who mainly finance your institution ? |
| | World Bank |
| QH13 | Do you write projects proposals for financing ? |
| | Yes, Our institution is active to look for financing |
| HQ14 | Do you have suggestions for the long term monitoring ? |
| | A follow up of the lake water in several site along along the lake is necessary to follo the various of its composition. Financing would be necessary. |
| F1 | Field station: name and contact adress. |
| | Pumping station (SP1) Ir Nsabimana Liberat |
| F2 | Number of persons working in the field station (by education level) ? |
| | Laboratory : 2 chemists, 1 technician level A1, 1 technician level A2 |
| F3 | Do you presently monitor environmental parameters in relation with LT ? |
| | Yes: pH, turbidity, conductivity, temperature,... |
| F4 | What parameters do you actually monitor ? |
| | pH, turbidity, conductivity, temperature E.coli, fecal coliforms... |
| F5 | What means of transport does have your station ? |
| | Mobile laboratory, van, boats.. |
| F6 | Is your institution dealing with the lake, the watershed or both ? |
| | On the lake but also on rivers reaching it. |

| BURUNDI - REGIDESO (2/2) | |
|---------------------------------|--|
| F7 | Means of communication ? |
| | telephone, radio, internet |
| F8 | Availability of electricity in the station ? |
| | 100% |
| F9 | Availability of electric generator in the station ? |
| | yes |
| F10 | Availability of water in the station ? |
| | 100% |
| F11 | How many internet connection are operationnal in your station ? |
| | Before 5 computers were connected via satellite but now we think about connecting 2 computers via telephone line |
| F12 | Do you have suggestions for the long term monitoring ? (field) |
| | If financing allow it, we could do analyses in several sampling sites |
| V1 | In which field is your institution active ? |
| | water |
| V2 | What equipment is available in your institute for the monitoring ? |
| | computer, laboratory, diving gears |
| V3 | Are documents available to explain the methodology for your monitoring? |
| | Yes, we have documents : follow up of water quality of the lake |
| V4 | Is a meteorological monitoring implemented in your station ? |
| | N/A |
| V5 | What is required to improve the present environnement monitoring ? |
| | We need to increase the size of the laboratory to split the physico chemistry and the microbiological laboratory. |
| V6 | Do you organise your data manualy (hard copy) or digitaly ? |
| | Data ar organised bot hmanualy and digitally. |
| V7 | What is required to harmonise a regional monitoring ? |
| | We communicate with member countries of the NBI to harmonize the water quality monitoring in our countries |
| V8 | Quality of previous data : any comments ? |
| | Data that we acquire for water quality are really very trusty |
| V9 | Do you use internet ? |
| | Yes for documentation and to find information in relation with the work |
| V10 | How did your staff aquire internet knowledge ? |
| | From training organised inside our Department of from other places |
| V11 | Is an organogram of your institution available ? |
| | |
| V12 | Did your institution contribute to scientific publications ? |
| | Civil engeenering, water network of Bujumbura, water processing |
| V13 | Would your institution be able to participate to a long term monitoring without external support ? |
| | yes for the long term |
| V14 | Could your institution share past or present informations with the LTA ? |
| | yes |
| V15 | Does your institution have ressources persons in the field of environment ? |
| | Yes, Mr Dr Ndayegamy Joseph, Mr Prime Niyongabo, Chief of Laboratory, Mr Ir Nsabimana Liberat, Chief of Water Production Service |

Appendix 7: REGIDESO Water Parameters

Decadal average 1994-2004 for surface and 25 m depth of Lake tanganyika and Ntakangwa River.

MOYENNES DECENALES (1994 - 2004) CONCERNANT LA QUALITE DES EAUX BRUTES DES SOURCES QUI ALIMENTENT LA VILLE DE BUJUMBURA EN EAU POTABLE

| Pos. | Paramètre | | Eau du Lac à la Surface | Eau du Lac à 25 m | NTAHANGWA | MISUMBA | GATUNGURU | Méthode d'analyse |
|--------------------------|-------------------------------|-----------------------------------|-------------------------|-------------------|-----------|---------|-----------|-------------------------------|
| Physico-chimiques | | | | | | | | |
| 1 | Temperature | °C | 27,6 | 26,4 | | | | Instrumentale |
| 2 | pH | | 9,2 | 8,95 | 7,6 | | | Electrochimique/instrumentale |
| 3 | Oxygène dissout | mg O ₂ /l | 6,7 | 6,45 | 7,3 | | | Electrochimique/instrumentale |
| 4 | Turbidité | TE/F | | 1 | | | | Photométrique/instrumentale |
| 5 | Conductivité | µS/cm | 642,6 | 651 | 80 | | | Electrochimique/instrumentale |
| 6 | CO ₂ | mg CO ₂ /l | 0 | 0 | | | | Titrimétrique/Volumétrique |
| 7 | CO ₂ équilibrant | mg CO ₂ /l | | 0,9 | | | | Titrimétrique/Volumétrique |
| 8 | CO ₂ combiné | mg CO ₂ /l | | 146,6 | | | | Titrimétrique/Volumétrique |
| 9 | HCO ₃ ⁻ | mg/l | | 327 | 36,24 | | | Titrimétrique/Volumétrique |
| 10 | Alcalinité totale | mg CaCO ₃ /l | 312,8 | 322,7 | 33,57 | | | Titrimétrique/Volumétrique |
| 11 | Durété totale | mg CaCO ₃ /l | 192 | 192,75 | 32,3 | | | Titrimétrique/Volumétrique |
| 12 | Chlorures | mg Cl/l | 29 | 28,9 | 5,3 | | | Spectrophotométrique |
| 13 | Fer total | mg Fe ^{2/3+} /l | 0,05 | 0,03 | 2,05 | | | Spectrophotométrique |
| 14 | Manganèse | mg Mn ²⁺ /l | 0,04 | 0,4 | 0,12 | | | Spectrophotométrique |
| 15 | Nitrate | mgNO ₃ ⁻ /l | 0,009 | 0,006 | 0,35 | | | Spectrophotométrique |
| 16 | Nitrite | mgNO ₂ /l | 0,003 | 0,002 | 0,12 | | | Spectrophotométrique |
| 17 | Azote ammoniacal | mgNH ₄ ⁺ | 0,03 | 0,03 | 0,45 | | | Spectrophotométrique |
| 18 | Phosphore total | PO ₄ ³⁻ /l | | 0,18 | 0,93 | | | Spectrophotométrique |
| 19 | Orthophosphate | PO ₄ ³⁻ /l | 0,1 | 0,08 | 1,21 | | | Spectrophotométrique |
| 20 | DCO | mg/l | 5,5 | 5 | 16,7 | | | Spectrophotométrique |
| 21 | Na ⁺ | mg/l | 62,1 | 61,6 | 4,7 | | | Spectrophotométrique |
| 22 | K ⁺ | mg/l | 33,25 | 32,9 | 4 | | | Spectrophotométrique |
| 23 | Ca ²⁺ | mg/l | 11,3 | 11,2 | 7,5 | | | Spectrophotométrique |
| 24 | Mg ²⁺ | mg/l | 38,95 | 39,65 | | | | Spectrophotométrique |
| Bactériologiques | | | | | | | | |
| | Germes Totaux | Colonies/ml | | | | | | Membrane filtrante |
| | Coliformes Totaux | Col./100ml | | | | | | Membrane filtrante |
| | Escherchia Coli | Col./100ml | | | | | | Membrane filtrante |

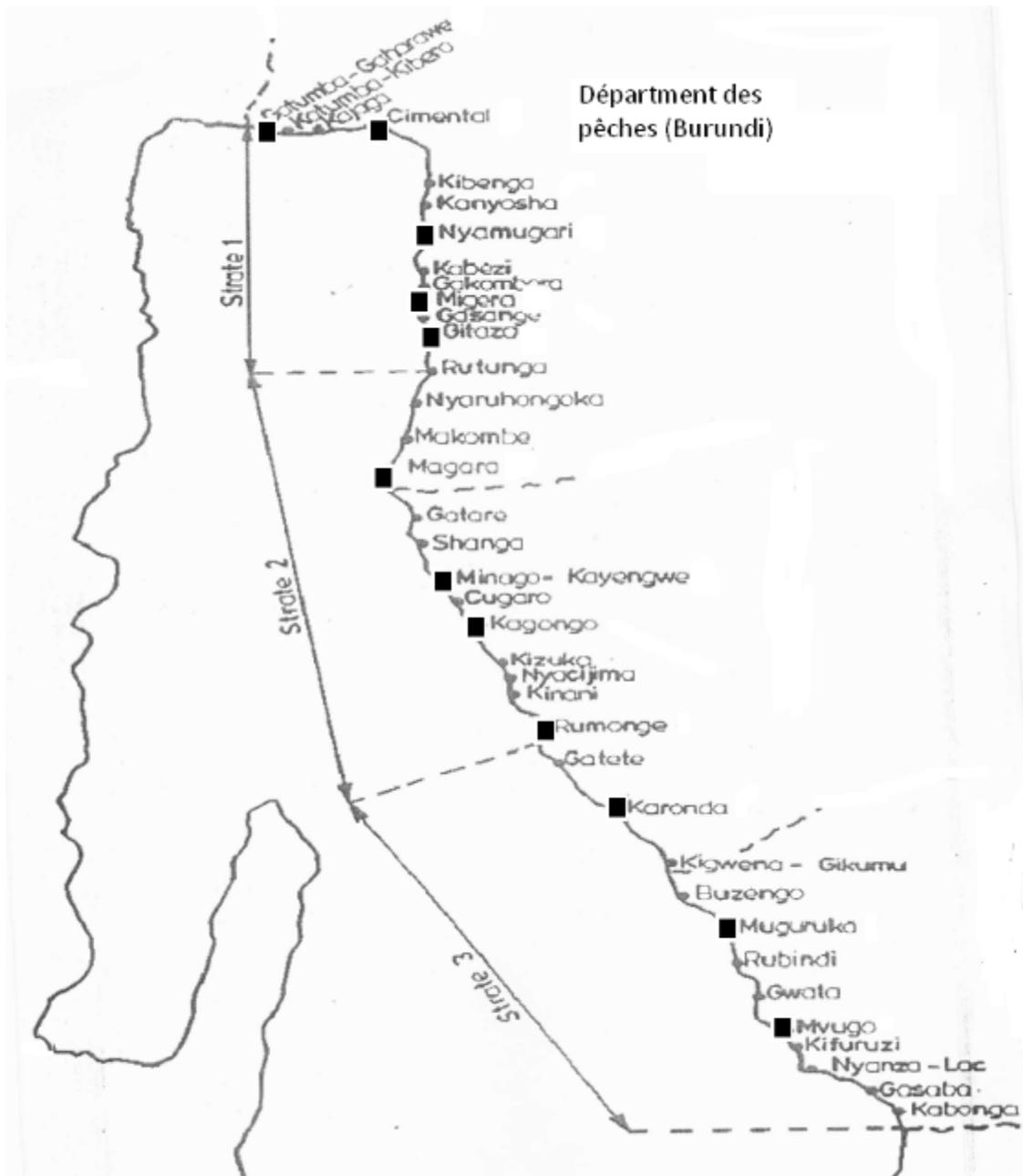
Appendix 8: Questionnaire Answers from Direction des Eaux, Pêches, et Pisciculture

| BURUNDI - Direction Eaux, Pêches et Pisciculture DEPP (1/2) | |
|---|--|
| HQ1 | Contact address |
| | Direction des Eaux, Pêches et Pisciculture (DEPP), BP1850 Bujumbura, Burundi Tel(257)22212820 |
| HQ2 | Type of institution ? |
| | Governmental |
| HQ3 | Is there a station of your institution situated near lake Tanganyika ? |
| | |
| HQ4 | Do you have an official mandate related to monitoring of L. Tanganyika? |
| | The mandate is detailed in the 28/11/2005 Decree dealing with organisation of the Ministère de l' Agriculture et de l' Elevage (Ministry of Agriculture and Livestock). Among the activities are to promote and frame the national policy dealing with fishery |
| HQ5 | Would a change of mandate be necessary to implement this monitoring ? |
| | No |
| HQ6 | Would you agree to participate to a long term monitoring & information exchange ? (by wish/by mandate or both?) |
| | Both |
| HQ7 | Cooperation with other institution ? |
| | we wish to collaborate with IGEBU |
| HQ8 | Does your institution get financing from UN/AFDB or other international organisation ? |
| | Financing by AFDB, FAO, in fisheries management, fisheries statistics, training of associations, processing of fish (1998-99, 2001 et 2007). Presently, there is no external financing beside Belgian financing for the River Fish Museum. |
| HQ9 | Does you staff need specific training ? |
| | Training is necessary |
| HQ10 | Does you institution provide specific training ? |
| | No |
| HQ11 | Are training program of your institution open to other participants? |
| | No |
| HQ12 | Who mainly finance your institution ? |
| | The Government and sometimes donors |
| HQ13 | Do you write projects proposals for financing ? |
| | yes |
| HQ14 | Do you have suggestions to the long term monitoring ? |
| | Financing of activities related to the monitoring, enhancement of material and equipment. |
| F1 | Field station: name and contact adress. |
| | Station de terrain, Lac TANGANYIKA DIRECTION DES EAUX ,PECHES ET PISCICULTURE - KAMUGISHA MARIE France 22212820 Responsable service Eau |
| F2 | Number of persons working in the field station (by education level) ? |
| | One agronomy engeneer (water serice) and 6 persons trained on the job |
| F3 | Do you presently monitor environmental parameters in relation with LT ? |
| | N/A |
| F4 | What parameters do you actually monitor ? |
| | none |
| F5 | What means of transport does have your station ? |
| | sometimes car, boat |
| F6 | Is your institution dealing with the lake, the watershed or both ? |
| | with the lake |

| BURUNDI - Direction Eaux, Pêches et Pisciculture DEPP (2/2) | |
|--|--|
| F7 | Means of communication ? |
| | telephone, internet (5) through telephone line |
| F8 | Availability of electricity in the station ? |
| | normaly electricity is avaiable during the week beside break downs. |
| F9 | Availability of electric generator in the station ? |
| | Yes: 15 KVA, diesel (since around 2001) |
| F10 | Availability of water in the station ? |
| | 24h/24h |
| F11 | How many internet connection are operationnal in your station ? |
| | Five but connection are slow |
| F12 | Do you have suggestions to the long term monitoring ? (field) |
| | Enhancement of equipment and training to all levels |
| V1 | In which field is your institution active ? |
| | Fishing, water, biodiversity and climate |
| V2 | What equipment is available in your institute for the monitoring ? |
| | computer, laboratory |
| V3 | Are documents available to explain the methodology for your monitoring? |
| | N/A |
| V4 | Is a meteorological monitoring implemented in your station ? |
| | We were monitoring meteorology before equipment got stolen |
| V5 | What is required to improve the present environnement monitoring ? |
| | Equipment, material |
| V6 | Do you organise your data manualy (hard copy) or digitaly ? |
| | Data are collected manual then entered into excel |
| V7 | What is required to harmonise a regional monitoring ? |
| | Standard form for data recording and monitoring |
| V8 | Quality of previous data : any comments ? |
| | Training to the use of data/ checking with fishermen committee (present on each beach) |
| V9 | Do you use internet ? |
| | yes: google to find information, scientific information search |
| V10 | How did your staff aquire internet knowledge ? |
| | through training |
| V11 | Is an organigram of your institution available ? |
| | We have 4 services (Fishing (sub services: statistics and management of infrastructures), fishculture, water and administration & finances |
| V12 | Did your institution contribute to scientific publications ? |
| | we publish the field results dealing with fishing and water |
| V13 | Would your institution be able to participate to a long term monitoring without external support ? |
| | An external financial input is necessary for this activity to be sustainable |
| V14 | Could your institution share past or present informations with the LTA ? |
| | Yes, writen and digital data (CPUE, SE survey, Frame survey, fish biology) |
| V15 | Does your institution have ressources persons in environnement ? |
| | Yes (identification of fish species) |

Appendix 9: DEPP staff along the Burundi coast

Boxes indicate staff location



Appendix 10: Questionnaire Answers from SETEMU

| BURUNDI - SETEMU (1/2) | |
|------------------------|--|
| HQ1 | Contact address |
| | Services Techniques Municipaux (SETEMU) BP 2845 Bujumbura – tel (257) 223901 setemu_bu@yahoo.fr |
| HQ2 | Type of institution ? |
| | governmental |
| HQ3 | Is there a station of your institution situated near lake Tanganyika ? |
| | Treatment station for waste water of the city of Bujumbura |
| HQ4 | Do you have an official mandate related to monitoring of L. Tanganyika? |
| | Treatment of waste water, rainfall waters and solid urban wastes. |
| HQ5 | Would a change of mandate be necessary to implement this monitoring ? |
| | Yes, a precise national mandate |
| HQ6 | Would you agree to participate to a long term monitoring & information exchange ? (by wish/by mandate or both?) |
| | By national mandate |
| HQ7 | Cooperation with other institution ? |
| | |
| HQ8 | Does your institution get financing from UN/AFDB or other international organisation ? |
| | Yes, Lake Victoria Basin, German Cooperation |
| HQ9 | Does you staff need specific training ? |
| | German Cooperation (K.F.W) |
| HQ10 | Does you institution provide specific training ? |
| | Yes |
| HQ11 | Are training program of your institution open to other participants? |
| | No |
| HQ12 | Who mainly finance your institution ? |
| | NA |
| QH13 | Do you write projects proposals for financing ? |
| | Auto financing, the Government, K.F.W |
| HQ14 | Do you have suggestions to the long term monitoring ? |
| | Coordination of the different stakeholders in the watershed, to precise who regulates, who are the actors, who controls... |

| BURUNDI - SETEMU (2/2) | |
|-------------------------------|--|
| F1 | Field station: name and contact adress. |
| | Station d'épuration des eaux usées de la Ville de Bujumbura |
| F2 | Number of persons working in the station (by education level) ? |
| | 35 persons |
| F3 | Do you presently monitor environmental parameters in relation with LT ? |
| | This is being installed for the measurement of : |
| F4 | What parameters do you actually monitor ? |
| | Settleable matter, DCO, BDO5, phosphates, total nitrogen, pH, T°, conductivity, dissolved oxygen |
| F5 | What means of transport does have your station ? |
| | Car and motorcyle |
| F6 | Is your institution dealing with the lake, the watershed or both ? |
| | no |
| F7 | Means of communication ? |
| | telephone |
| F8 | Availability of electricity in the station ? |
| | Yes permanently (beside cuts in July-August) |
| F9 | Availability of electric generator in the station ? |
| | Yes, 225 KVA diesel in good fonctionning state |
| F10 | Availability of water in the station ? |
| | Yes, permanently |
| F11 | How many internet connection are operationnal in your station ? |
| | 1 computer |
| F12 | Do you have suggestions to the long term monitoring ? (field) |
| | |

Appendix 11: Questionnaire Answers from University of Burundi, Department Biology

| BURUNDI - University of Burundi (UB)/Biology (1/2) | |
|---|--|
| HQ1 | Contact address |
| | University of Burundi / Faculty of Sciences / Department of Biology |
| HQ2 | Type of institution ? |
| | Government institution |
| HQ3 | Is there a station of your institution situated near lake Tanganyika ? |
| | No fixed station, but occasional fish sampling in the northern end of the lake |
| HQ4 | Do you have an official mandate related to monitoring of L. Tanganyika? |
| | No explicit mandate but, as one of the traditional duties of a University is to doing research, Lake Tanganyika is a good field to do so |
| HQ5 | Would a change of mandate be necessary to implement this monitoring ? |
| | No special mandate is necessary. The Department of Biology is willing to be involved in monitoring biodiversity |
| HQ6 | Would you agree to participate to a long term monitoring & information exchange ? (by wish/by mandate or both?) |
| HQ7 | Cooperation with other institution ? |
| | Researchers in our Department work traditionally with colleagues in DR Congo (Uvira) and Tanzania (Kigoma). |
| HQ8 | Does your institution get financing from UN/AFDB or other international organisation ? |
| | Not for the moment |
| HQ9 | Does you staff need specific training ? |
| | Young researchers need training to replace senior ones and have them harmonized at regional level |
| HQ10 | Does you institution provide specific training ? |
| | We organize a master in environment management, with a specialization in aquatic ecosystems |
| HQ11 | Are training program of your institution open to other participants? |
| | Our master is open to all young scientists, Burundians or not, with a good background in biology, agriculture, chemistry, geography, but, as places are limited, the best academic profiles are selected. |
| HQ12 | Who mainly finance your institution ? |
| | Government of Burundi, Bilateral cooperation (i.e. Belgium, France) |
| QH13 | Do you write projects proposals for financing ? |
| | We try every year, but few results |
| HQ14 | Do you have suggestions to the long term monitoring ? |
| | Long term monitoring and quality data are better produced by researchers who need them for personal promotion (publications, curricula's, etc.); a university department is a good structure to organize this work, as it has the necessary scientific workers |
| F1 | Field station: name and contact adress. |
| | No fixed station, but occasional sampling off Rusizi river delta and in the bay of Bujumbura |
| F2 | Number of persons working in the station (by education level) ? |
| | Two professors, one technician, and yearly about 4 undergraduate and 4 master students doing their research before graduation |
| F3 | Do you presently monitor environmental parameters in relation with LT ? |
| | Since 1993 |
| F4 | What parameters do you actually monitor ? |
| | Fish biodiversity |
| F5 | What means of transport does have your station ? |
| | None |
| F6 | Is your institution dealing with the lake, the watershed or both ? |
| | Lake itself for the moment, as the resources are limited |

| BURUNDI - University of Burundi (UB)/Biology (2/2) | |
|---|--|
| F7 | Means of communication ? |
| | None |
| F8 | Availability of electricity in the station ? |
| | Our network is very slow (1 to 10 KB/s), when it works. |
| F9 | Availability of electric generator in the station ? |
| | A funding for basic material acquisition and a small budget for regional harmonization between national monitoring centers (within existing institutions) will be necessary. |
| F10 | Availability of water in the station ? |
| | |
| F11 | How many internet connection are operational in your station ? |
| | |
| F12 | Do you have suggestions to the long term monitoring ? (field) |
| V1 | In which field is your institution active ? |
| | Fisheries and Plankton biodiversity, environment issues |
| V2 | What equipment is available in your institute for the monitoring ? |
| | - Diving gears (not in use since 10 years : need a check up control before use); - Experimental fishing nets; - Plankton nets |
| V3 | Are documents available to explain the methodology for your monitoring? |
| | Monitoring of fish and plankton biodiversity in littoral zone off Bujumbura and off Rusizi river has been conducted |
| V4 | Is a meteorological monitoring implemented in your station ? |
| | No |
| V5 | What is required to improve the present environment monitoring ? |
| | Possibility to organize fish sampling at night time |
| V6 | Do you organise your data manually (hard copy) or digitaly ? |
| | manually |
| V7 | What is required to harmonise a regional monitoring ? |
| | - meet with colleagues in DR Congo (Uvira), Tanzania (Kigoma), and Zambia to harmonize methodology, sampling time, material, and species determination |
| V8 | Quality of previous data : any comments ? |
| | The data on biodiversity is reliable as the methodology to collect it consistent since years |
| V9 | Do you use internet ? |
| | All uses |
| V10 | How did your staff aquire internet knowledge ? |
| | A network connected to V Sat is installed at University |
| V11 | Is an organigram of your institution available ? |
| | Don't have it at hand |
| V12 | Did your institution contribute to scientific publications ? |
| | Don't have them at hand |
| V13 | Would your institution be able to participate to a long term monitoring without external support ? |
| | Yes, in working locally |
| V14 | Could your institution share past or present informations with the LTA ? |
| | Fish and Plankton (Phyto and Zoo) biodiversity |
| V15 | Does your institution have ressources persons in environnement ? |
| | Yes |

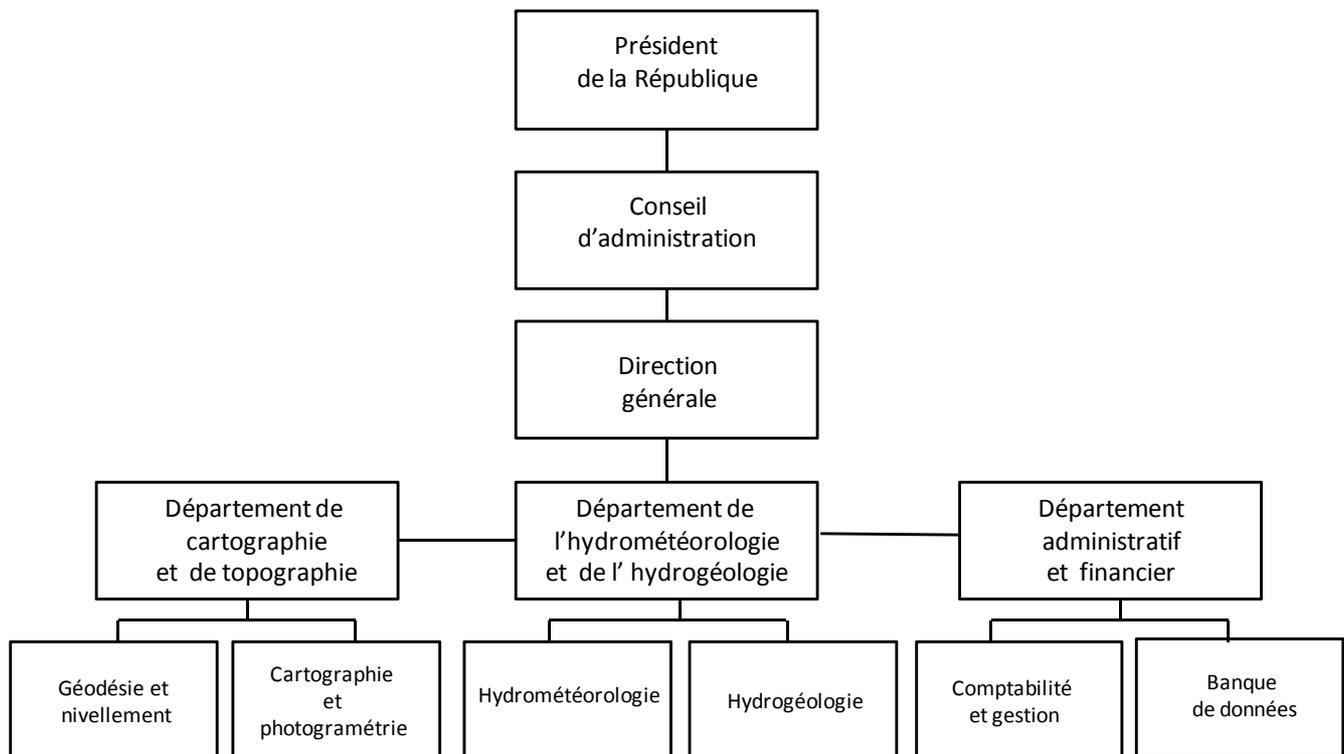
Appendix 12: Questionnaire Answers from University of Burundi, Department Chemistry

| BURUNDI - University of Burundi (UB)/Chemistry (1/2) | |
|---|---|
| HQ1 | Contact address |
| | UNIVERSITE DU BURUNDI, B.P. 1550 BUJUMBURA, Tel : 25722222059 Site Web : www.ub.edu.bi |
| HQ2 | Type of institution ? |
| | Public University |
| HQ3 | Is there a station of your institution situated near lake Tanganyika ? |
| | no |
| HQ4 | Do you have an official mandate related to monitoring of L. Tanganyika? |
| | The Univeristy has a research mandate that implies also the management of Lake Tanganyika and its basin in its various scintific aspects |
| HQ5 | Would a change of mandate be necessary to implement this monitoring ? |
| | It is not possible that the University changes this double mission (training and research) |
| HQ6 | Would you agree to participate to a long term monitoring & information exchange ? (by wish/by mandate or both?) |
| | Probably yes: both by mandate and by wish. Previous projects had associated the University |
| HQ7 | Cooperation with other institution ? |
| | As one of the few research institutions of the country, the UB maintains active cooperation with other institution (national, regional and international) with similar goals. (exemple: ISABU at the nationa level; Nile Basin Initiative at the Regional Level |
| HQ8 | Does your institution get financing from UN/AFDB or other international organisation ? |
| | Probably through the Government |
| HQ9 | Does you staff need specific training ? |
| | Yes, this is always necessary although basic notions are allready known |
| HQ10 | Does you institution provide specific training ? |
| | There is no specific training dealing with Lake Tanganyika and its basin |
| HQ11 | Are training program of your institution open to other participants? |
| | N/A |
| HQ12 | Who mainly finance your institution ? |
| | The Government of Burundi |
| QH13 | Do you write projects proposals for financing ? |
| | Individual initiative by some professors |
| HQ14 | Do you have suggestions to the long term monitoring ? |
| | The UB is well positionned to insure a long term follow up at Lake Tanganyika and its basin because of its research mission, the availability of qualified human ressorces and some basic equipment although that needs to be completed. |
| F1 | Field station: name and contact adress. |
| | There is none as such but sampling ahs been done at a precise point on the lake during 3 years for water quality. |
| F2 | Number of persons working in the station (by education level) ? |
| | For sampling on the lake, 3 persons were required: a scientist in charge, a technician and a boat skipper. |
| F3 | Do you presently monitor environmental parameters in relation with LT ? |
| | No |
| F4 | What parameters do you actually monitor ? |
| | N/A |
| F5 | What means of transport does have your station ? |
| | In case of field monitoring, one car and one boat is necessary |
| F6 | Is your institution dealing with the lake, the watershed or both ? |
| | No, but it is open to this aspect |

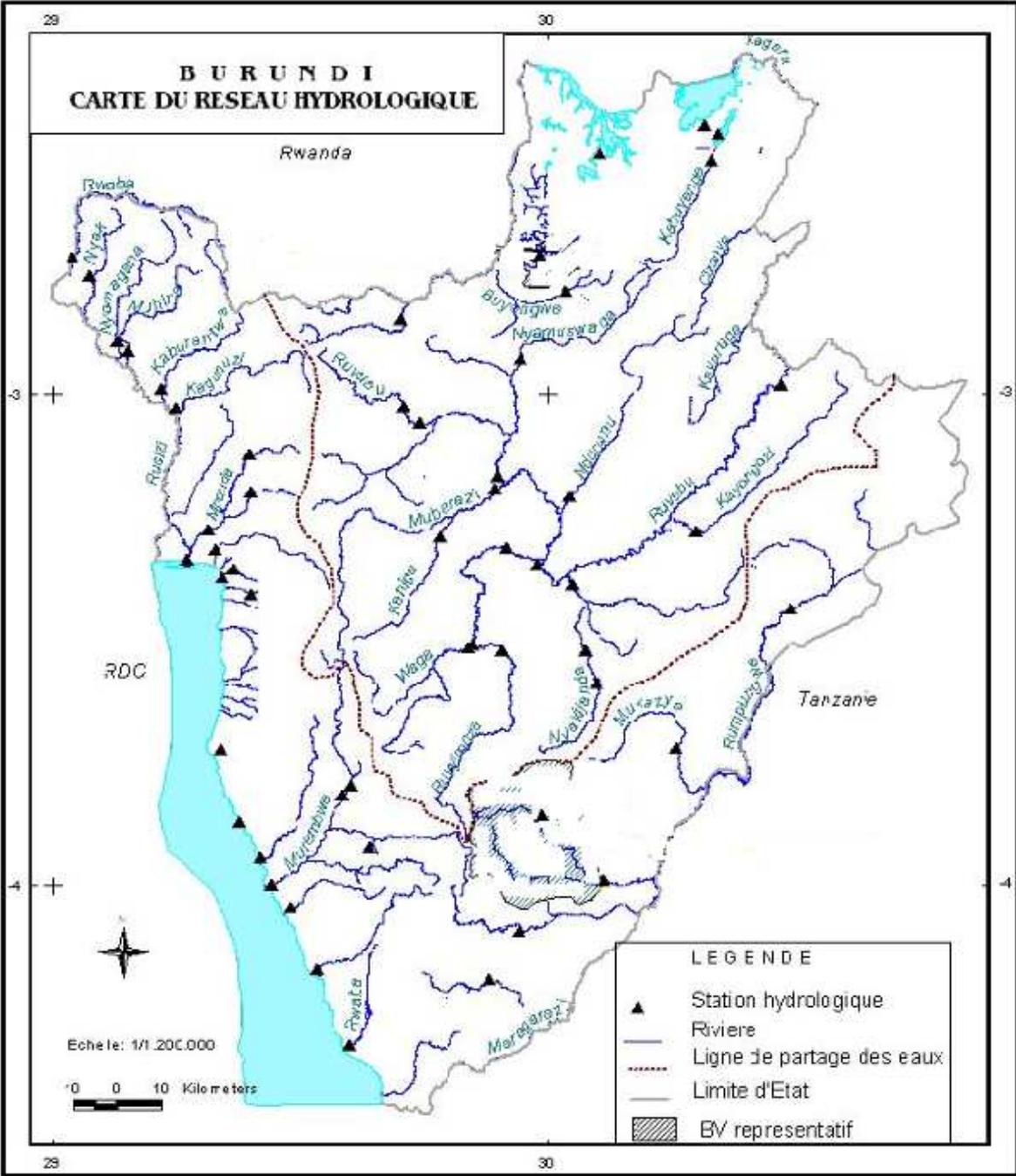
| BURUNDI - University of Burundi (UB)/Chemistry (2/2) | |
|---|---|
| F7 | Means of communication ? |
| | N/A |
| F8 | Availability of electricity in the station ? |
| | N/A at field station but the well at the University (100%) |
| F9 | Availability of electric generator in the station ? |
| | N/A |
| F10 | Availability of water in the station ? |
| | N/A at field station but the well at the University (100%) |
| F11 | How many internet connection are operationnal in your station ? |
| | The Univesity has a permanent Internet connection |
| F12 | Do you have suggestions to the long term monitoring ? (field) |
| | With a small support, the University is well positionned for a long term monitoring at Lake Tanganyika because of its research mission. |
| V1 | In which field is your institution active ? |
| | The University has ressources in all the topics of the montoring of Lake Tanganyika and its basin. Publications of UB show this. |
| V2 | What equipment is available in your institute for the monitoring ? |
| | We have laboratories and equipment that could be completed to allow a real monitoring at Lake Tanganyika and its basin. |
| V3 | Are documents available to explain the methodology for your monitoring? |
| | In our previous work, we sampled on average twice per month in the lake during two years. Parameters were T°,pH, conductivity, dissolved oxygen, nitrate, nitrite, amonium, silicaa, organic carbon, organic nitroge... Meteorological parameters monitored were: |
| V4 | Is a meteorological monitoring implemented in your station ? |
| | Meteorological parameters are those from IGEBU at the Airpot Station. |
| V5 | What is required to improve the present environnement monitoring ? |
| | Sampling material, consumable and and laboratory materail. Budget for fonctionning in relation to the monitoring. |
| V6 | Do you organise your data manually (hard copy) or digitaly ? |
| | Data are processed on computer. |
| | What is required to harmonise a regional monitoring ? |
| | Since this is a regional project, it is necessary to use the same analytical methods at the regional level implying harmonisation. |
| V8 | Quality of previous data : any comments ? |
| | Data may not be homogenous because of different methodologies which renders the comparision difficult. |
| V9 | Do you use internet ? |
| | Yes, as a communication tool and for research. |
| V10 | How did your staff aquire internet knowledge ? |
| | Often by self training or through specific training. |
| V11 | Is an organigram of your institution available ? |
| | Head: Rector of the University and vice-rector. There are then Directors including one for research. The Faculties include the chemistry. At the Department level, we have several laboratories including the one where water samples are analysed. |
| V12 | Did your institution contribute to scientific publications ? |
| | Yes. Some deal with Lake Tanganyika. (Gaspard Ntakimazi, Balthazar Mpawenayo, Louis Nahimana..) |
| V13 | Would your institution be able to participate to a long term monitoring without external support ? |
| | Yes but this is linked to the decision of the University responsible. The good will of researcher is howeve insured. |
| V14 | Could your institution share past or present informations with the LTA ? |
| | |
| | Yes. This is possible because of the scientifi spirit that must characterise the research institutions as the University. |
| V15 | Does your institution have ressources persons in environnement ? |
| | The University has many specialists and could provide CVS. |

Appendix 13: Organogram IGEBU

IGEBU, ORGANISATION ET STRUCTURE, 1980



Appendix 14: Hydrological Stations (IGEBU) Burundi



Appendix 15: Hydrological Stations (IGEBU) Burundi

| HFStationID | HFNationalID | HFName | Lon | Lat | HFBasePoint | HFStartDate | HFEndDate | HFBasin | HFRiver |
|-------------|--------------|----------------------------|-------|-------|-------------|-------------|------------|---------|---------------|
| 11001 | 11000 | RUSIZI (GATUMBA) | 29.27 | -3.34 | 774.00 | 20-févr-60 | | | RUSIZI |
| 11002 | 11010 | RUHWA (DOUANE) | 29.04 | -2.72 | 923.00 | 12-sept-79 | | | RUHWA |
| 11003 | 11020 | NYAKAGUNDA (MUSENYI) | 29.08 | -2.76 | 1000.00 | 12-sept-79 | | | NYAKAGUNDA |
| 11004 | 11030 | NYAMAGANA (MURAMBI) | 29.13 | -2.90 | 892.00 | 12-sept-79 | | | NYAMAGANA |
| 11005 | 11040 | MUHIRA (RUHAGARIKA) | 29.15 | -2.92 | 860.00 | 12-sept-79 | | | MUHIRA |
| 11006 | 11050 | KABURANTWA (MISSION) | 29.22 | -2.99 | 800.00 | 6-mars-79 | | | KUBURANTWA |
| 11007 | 11060 | KAGUNUZI (NDAVA) | 29.25 | -3.03 | 790.00 | 1-janv-73 | | | KAGUNUZI |
| 11008 | 11080 | MPANDA (AXE D) | 29.31 | -3.28 | 788.00 | 5-oct-79 | 30-sept-93 | | MPADA |
| 11009 | 11082 | MPANDA (GATURA) | 29.40 | -3.12 | 940.00 | 1-sept-79 | 31-déc-94 | | MPANDA |
| 11010 | 11083 | MUSENYI (MUSENYI) | 29.40 | -3.20 | 873.00 | 1-déc-79 | | | MUSENYI |
| 11011 | 12000 | TANGANIKI (PORT BUJA) | 29.34 | -3.38 | 776.00 | | | | LAC TANGANIKI |
| 11012 | 12001 | TANGANIKI (RESHA) | 29.38 | -3.87 | 776.00 | 18-juil-86 | | | LAC TANGANIKI |
| 11013 | 12010 | MUTIMBUZI (PONT AEROPORT) | 29.33 | -3.32 | 776.00 | 1-déc-88 | 31-mai-92 | | MUTIMBUZI |
| 11014 | 12020 | NTAHANGWA (BUYENZI) | 29.37 | -3.36 | 795.00 | 1-déc-79 | 30-oct-82 | | NTAHANGWA |
| 11015 | 12021 | NTAHANGWA (MUTANGA) | 29.40 | -3.41 | 900.00 | 12-janv-73 | 31-mai-74 | | NTHANGWA |
| 11016 | 12080 | RUZIBAZI (RUTUMO) | 29.34 | -3.73 | 790.00 | 18-nov-76 | 12-mars-96 | | RUZIBAZI |
| 11017 | 12140 | DAMA (MBUGA) | 29.42 | -3.95 | 780.00 | 18-nov-76 | | | DAMA |
| 11018 | 12150 | BASSE-MULEMBWE (MUTAMBARA) | 29.44 | -4.00 | 780.00 | 1-déc-74 | | | MULEMBWE |
| 11019 | 12152 | HAUTE-MULEMBWE (RUMEZA) | 29.59 | -3.82 | 1600.00 | 18-juil-74 | | | MULEMBWE |
| 11020 | 12153 | SIGUVYAYE (BURURI) | 29.61 | -3.80 | 1740.00 | 1-sept-74 | | | SIGUVYAYE |
| 11021 | 12154 | JJI (NDAGO) | 29.64 | -3.92 | 1840.00 | 18-juil-74 | | | JJI |
| 11022 | 12160 | BUZIMBA (GATETE) | 29.48 | -4.05 | 810.00 | 9-oct-79 | | | BUZIMBA |
| 11023 | 12200 | NYENGWE (RIMBO) | 29.54 | -4.17 | 798.00 | 9-oct-79 | | | NYENGWE |
| 11024 | 12220 | RWABA (NYANZA-LAC) | 29.60 | -4.33 | 780.00 | 9-oct-79 | | | RWABA |
| 11025 | 13010 | RUKOZIRI (MAKORONKWE) | 29.88 | -4.19 | 1478.00 | | | | RUKOZIRI |
| 11026 | 13031 | MUTSINDOZI (KAYOGORO) | 29.94 | -4.10 | 1164.00 | 1-sept-85 | | | MUTSINDOZI |
| 11027 | 13040 | MUYOVOZI (GIHOFI) | 30.11 | -3.99 | 1179.00 | 2-févr-70 | | | MUYOVOZI |
| 11028 | 13041 | MUSASA (BUGIGA) | 30.01 | -3.81 | 1248.00 | 1-sept-85 | | | MUSASA |
| 11029 | 13050 | MUKAZYE (NYANGE) | 30.26 | -3.72 | 1175.00 | 5-sept-85 | | | MUKAZYE |
| 11030 | 13060 | RUMPUNGWE (GISURU) | 30.49 | -3.44 | 1180.00 | 6-sept-85 | | | RUMPUNGWE |
| 11031 | 21000 | RUVUBU (MUYINGA) | 30.47 | -2.98 | 1350.00 | 9-juil-74 | | | RUVUBU |
| 11032 | 21030 | RUVUBU (KANABUSORO) | 29.71 | -3.03 | 1580.00 | 1-sept-79 | | | RUVUBU |
| 11033 | 21070 | RUVUBU (BURASIRA) | 29.74 | -3.08 | 1513.00 | 1-janv-82 | | | RUVUBU |
| 11034 | 21080 | NYAMUSWAGA (GISHA) | 29.95 | -2.93 | 1550.00 | 1-sept-89 | | | NYAMUSWAGA |
| 11035 | 21090 | MUBARAZI (MURONGWE) | 29.90 | -3.20 | 1486.00 | 1-sept-76 | | | MUBARAZI |
| 11036 | 21091 | KANIGA (DISPENSAIRE) | 29.78 | -3.29 | 1570.00 | 24-févr-75 | | | KANIGA |
| 11037 | 21100 | RUVUBU (GITONGO) | 29.90 | -3.17 | 1489.00 | 1-févr-75 | | | RUVUBU |
| 11038 | 21101 | RUVUBU (GITEGA) | 29.98 | -3.35 | 1402.00 | 20-juil-73 | | | RUVUBU |
| 11039 | 21110 | NDURUMU (SHOMBO) | 30.05 | -3.21 | 1448.00 | 3-mai-74 | | | NDURUMU |
| 11040 | 21120 | RUVYIRONZA (MUYANGE) | 29.85 | -3.51 | 1565.00 | 1-sept-85 | | | RUVYIRONZA |
| 11041 | 21121 | WAGA (MUYANGE) | 29.84 | -3.52 | 1575.00 | | | | WAGA |
| 11042 | 21122 | RUVYIRONZA (KIBAYA) | 29.92 | -3.32 | 1482.00 | 8-mai-74 | | | RUVYIRONZA |
| 11043 | 21123 | RUVYIRONZA (NYABIRABA) | 29.91 | -3.52 | 1578.00 | 22-oct-88 | | | RUVYIRONZA |
| 11044 | 21130 | NYABAHA (MUBUGA) | 30.05 | -3.39 | 1393.00 | 23-juil-73 | | | NYABAHA |
| 11045 | 21132 | NYAKIJANDA (BUHORO K10) | 30.08 | -3.52 | 1518.00 | 16-juil-73 | | | NYAKIJANDA |
| 11046 | 21133 | NYAKIJANDA (BUHORO K10) | 30.10 | -3.59 | 1556.00 | 6-juin-74 | | | NYAKIJANDA |
| 11047 | 21140 | KAYONGOZI (NYANKANDA) | 30.30 | -3.28 | 1458.00 | 7-mai-74 | | | KAYONGOZI |
| 11048 | 22010 | NDURUMU (MARANGARA) | 29.98 | -2.72 | 1455.00 | 1-sept-79 | | | NDURUMU |
| 11049 | 22020 | KAYAVE (MPARAMIRUNDI) | 29.70 | -2.85 | 1496.00 | 27-août-86 | | | KAYAVE |
| 11050 | 22030 | BUYONGWE (KIREMBA) | 30.04 | -2.79 | 1409.00 | 25-août-86 | | | BUYONGWE |
| 11051 | 22050 | COHOHA (KIGOZI) | 30.11 | -2.51 | 1350.00 | 22-août-86 | | | LAC COHOHA |
| 11052 | 22060 | RUNOMBE (KABANGA) | 30.33 | -2.53 | 1331.00 | 21-août-86 | | | RUNOMBE |
| 11053 | 22070 | RWERU (NYAGISOZI) | 30.32 | -2.46 | 1323.00 | 4-janv-60 | 25-sept-60 | | LAC RWERU |
| 11054 | 22071 | | 30.35 | -2.47 | 1323.00 | 10-août-91 | | | KANZIGIRI |

Appendix 16: Meteorological Stations (IGEBU) Burundi

| HMStationID | ID | HMName | Lon | Lat | HMAltitude | HMStationID | ID | HMName | Lon | Lat | HMAltitude |
|-------------|------|------------------------|-------|-------|------------|-------------|------|---------------------|-------|-------|------------|
| 10001 | 1580 | BITEZI (Gasibe) | 29.73 | -3.73 | 1870 | 10086 | 5500 | MARAGARAZI | 30.15 | -4.02 | 1250 |
| 10002 | 1600 | BUBANZA | 29.40 | -3.08 | 1102 | 10087 | 5550 | MARAMVYA | 29.32 | -3.27 | 785 |
| 10003 | 1650 | BUGARAMA (B.aeronaut) | 29.55 | -3.30 | 2240 | 10088 | 5555 | MASHITSI | 29.92 | -3.37 | 1650 |
| 10004 | 1700 | BUGARAMA (Commune) | 29.55 | -3.28 | 2203 | 10089 | 5600 | MATANA (Lycee) | 29.68 | -3.77 | 1934 |
| 10005 | 1720 | BUGENYUZI (Paroisse) | 30.05 | -3.08 | 1760 | 10090 | 5650 | MATONGO (Commune) | 29.62 | -3.05 | 1760 |
| 10006 | 1750 | BUGIGA | 30.05 | -4.00 | 1235 | 10091 | 5670 | MBIZI | 29.72 | -4.20 | 1820 |
| 10007 | 1800 | BUHIGA | 30.17 | -3.03 | 1649 | 10092 | 5700 | MINAGO | 29.35 | -3.80 | 784 |
| 10008 | 1900 | BUHONGA | 29.40 | -3.43 | 1350 | 10093 | 5750 | MONT MANGA | 29.52 | -3.45 | 2450 |
| 10009 | 1950 | BUHORO | 29.17 | -2.70 | 1307 | 10094 | 5800 | MPANDA | 29.40 | -3.17 | 890 |
| 10010 | 2000 | BUHINYUZA | 30.37 | -3.03 | 1553 | 10095 | 5850 | MPARAMBO | 29.08 | -2.83 | 887 |
| 10011 | 2051 | BUJUMBURA (Aeroport) | 29.32 | -3.32 | 783 | 10096 | 5900 | MPETE | 29.65 | -4.07 | 2138 |
| 10012 | 2100 | BUJUMBURA (Ex college) | 29.38 | -3.40 | 1100 | 10097 | 5950 | MPINGA | 30.17 | -3.73 | 1960 |
| 10013 | 2150 | BUJUMBURA (Jabe) | 29.37 | -3.37 | 812 | 10098 | 6000 | MPOTA (Tora) | 29.57 | -3.73 | 2160 |
| 10014 | 2200 | BUJUMBURA (Kamenge) | 29.40 | -3.35 | 890 | 10099 | 6050 | MUBIMBI | 29.48 | -3.30 | 1767 |
| 10015 | 2250 | BUJUMBURA (Port) | 29.35 | -3.38 | 780 | 10100 | 7000 | MUGEGE | 30.03 | -3.62 | 1624 |
| 10016 | 2300 | BUJUMBURA (Ville) | 29.35 | -3.40 | 785 | 10101 | 7020 | MUGERA (Cankuzo) | 30.65 | -3.05 | 1470 |
| 10017 | 2350 | BUKEYE (E.F.I) | 29.65 | -3.20 | 1849 | 10102 | 7050 | MUGERA (Paroisse) | 29.97 | -3.32 | 1757 |
| 10018 | 2400 | BUKWAVU | 29.63 | -3.43 | 2103 | 10103 | 7100 | MUGERA (Lycee) | 29.97 | -3.32 | 1702 |
| 10019 | 2450 | BURASIRA (Seminaire) | 29.92 | -3.07 | 1536 | 10104 | 7200 | MULEHE | 30.25 | -2.57 | 1564 |
| 10020 | 2500 | BURENZA | 30.02 | -3.52 | 1602 | 10105 | 7220 | MUKIKE | 29.52 | -3.53 | 2200 |
| 10021 | 2550 | BURURI | 29.62 | -3.95 | 1886 | 10106 | 7250 | MUNANIRA | 29.57 | -2.92 | 2120 |
| 10022 | 2600 | BUSIGA | 29.73 | -2.88 | 1795 | 10107 | 7300 | MUNGWA | 29.88 | -3.45 | 1649 |
| 10023 | 2650 | BUTA (Seminaire) | 29.63 | -3.97 | 1850 | 10108 | 7350 | MURAGO | 29.57 | -3.30 | 854 |
| 10024 | 2700 | BUTARA | 29.35 | -2.88 | 1563 | 10109 | 7380 | MURAMBA | 30.35 | -2.98 | 1567 |
| 10025 | 2750 | BUTEZI | 30.15 | -3.40 | 1680 | 10110 | 7400 | MURAMVYA | 29.62 | -3.27 | 1989 |
| 10026 | 2800 | BUTORA | 29.63 | -3.52 | 2044 | 10111 | 7450 | MUREHE (Mission) | 30.03 | -2.73 | 1539 |
| 10027 | 2850 | BUYE | 29.82 | -2.85 | 1760 | 10112 | 7500 | MURIZA | 30.08 | -3.53 | 1616 |
| 10028 | 2900 | BUZIRACAND | 29.73 | -3.38 | 1922 | 10113 | 7550 | MURONGWE | 29.90 | -3.20 | 1700 |
| 10029 | 2920 | BWAGIRIZA | 30.28 | -3.33 | 1571 | 10114 | 7600 | MURORE | 30.65 | -3.18 | 1930 |
| 10030 | 2950 | CANKUZO (Projet) | 30.38 | -3.28 | 1652 | 10115 | 7650 | MURUKARAMU | 29.32 | -3.30 | 785 |
| 10031 | 2980 | CIBITOKE (Agri) | 29.10 | -2.85 | 937 | 10116 | 7700 | MUSASA | 30.10 | -4.00 | 1260 |
| 10032 | 3000 | CIBITOKE (C.F.R) | 29.10 | -2.85 | 930 | 10117 | 7750 | MUSEMA | 29.67 | -3.08 | 1845 |
| 10033 | 3050 | FOTA | 29.72 | -3.42 | 1885 | 10118 | 7770 | MUSENYI (Bubanza) | 29.40 | -3.22 | 882 |
| 10034 | 3150 | GASENYI (Buganda) | 29.20 | -2.98 | 878 | 10119 | 7800 | MUSENYI (E.F.I) | 30.03 | -2.97 | 1684 |
| 10035 | 3200 | GAKARA (Rutongo) | 29.48 | -3.42 | 1959 | 10120 | 7850 | MUSENYI (Paroisse) | 30.03 | -2.97 | 1684 |
| 10036 | 3250 | GATARA | 29.65 | -2.98 | 1806 | 10121 | 7900 | MUSIGATI | 29.45 | -3.07 | 1473 |
| 10037 | 3280 | GIFURWE | 29.40 | -3.18 | 872 | 10122 | 7950 | MUSONGATI | 30.07 | -3.73 | 1770 |
| 10038 | 3350 | GIHANGA | 29.30 | -3.20 | 819 | 10123 | 8000 | MUTUMBA | 29.35 | -3.60 | 971 |
| 10039 | 3400 | GIHARO | 30.23 | -3.78 | 1250 | 10124 | 8050 | MUTUMBA (Nyabikere) | 30.22 | -3.20 | 1780 |
| 10040 | 3450 | GIHETA | 29.85 | -3.37 | 1624 | 10125 | 8100 | MUYAGA | 30.55 | -3.23 | 1750 |
| 10041 | 3550 | GIKWIYE | 30.03 | -3.53 | 1760 | 10126 | 8150 | MUYANGE (Kayanza) | 29.62 | -2.92 | 1930 |
| 10042 | 3600 | GISANZE | 30.18 | -2.78 | 1716 | 10127 | 8200 | MUYINGA | 30.35 | -2.85 | 1756 |
| 10043 | 3700 | GISHUBI | 29.78 | -3.62 | 1735 | 10128 | 8250 | MUZINDA (Nyagatobe) | 29.43 | -3.25 | 1140 |
| 10044 | 3750 | GISOZI | 29.68 | -3.57 | 2097 | 10129 | 8300 | MWARO | 29.70 | -3.52 | 1930 |
| 10045 | 3800 | GITANGA | 29.90 | -3.98 | 1475 | 10130 | 8350 | MWEYA | 29.92 | -3.48 | 1735 |
| 10046 | 3850 | GITEGA (Aerodrome) | 29.92 | -3.42 | 1645 | 10131 | 8400 | MWISALE | 29.48 | -3.38 | 1600 |
| 10047 | 3900 | GITEGA (Agri) | 29.93 | -3.42 | 1721 | 10132 | 8450 | NDAVA (Cogerco) | 29.25 | -3.03 | 840 |
| 10048 | 3950 | GITEGA (Ndebe) | 29.92 | -3.40 | 1663 | 10133 | 8500 | NDORA | 29.40 | -2.92 | 2120 |
| 10049 | 4000 | GITEGA (Zege) | 29.92 | -3.40 | 1663 | 10134 | 8510 | NGOMA | 30.02 | -3.78 | 1700 |
| 10050 | 4050 | GITONGO | 29.87 | -3.18 | 1603 | 10135 | 8520 | NGOZI (Caprin) | 29.82 | -2.88 | 1650 |
| 10051 | 4100 | GITWENGE | 30.67 | -3.18 | 1650 | 10136 | 8550 | NGOZI (College) | 29.83 | -2.90 | 1808 |
| 10052 | 4150 | IMBO (Sems) | 29.35 | -3.18 | 820 | 10137 | 8570 | NGOZI (Kagoma) | 29.88 | -2.97 | 1540 |
| 10053 | 4200 | IJENDA (Mission) | 29.57 | -3.48 | 2191 | 10138 | 8600 | NGOZI (OCIBU) | 29.83 | -2.90 | 1831 |
| 10054 | 4220 | IJENDA (The villag) | 29.55 | -3.47 | 2191 | 10139 | 8620 | NYABIGOZI | 30.47 | -3.42 | 1400 |
| 10055 | 4250 | KABEZI | 29.35 | -3.53 | 867 | 10140 | 8650 | NYAKAGUNDA | 29.07 | -2.80 | 954 |
| 10056 | 4280 | KABUYENGE | 30.35 | -2.53 | 1380 | 10141 | 8700 | NYAKARARO | 29.60 | -3.52 | 2228 |
| 10057 | 4300 | KAJONDI | 29.77 | -3.88 | 2020 | 10142 | 8750 | NYAMUSWAGA | 30.03 | -2.88 | 1720 |
| 10058 | 4320 | KINANIRA (Imbo) | 29.38 | -3.42 | 876 | 10143 | 8820 | NYANZA LAC (IRAT) | 29.62 | -4.32 | 820 |
| 10059 | 4350 | KANYINYA (E.F.I) | 30.08 | -2.58 | 1501 | 10144 | 8850 | (Mugerana) | 29.60 | -4.30 | 773 |
| 10060 | 4400 | KANYINYA (Paroisse) | 30.08 | -2.58 | 1450 | 10145 | 8900 | NYANZA LAC (Projet) | 29.60 | -4.35 | 792 |
| 10061 | 4450 | KARUZI | 30.17 | -3.10 | 1600 | 10146 | 8950 | RANDA | 29.37 | -3.15 | 860 |
| 10062 | 4500 | KAYERO | 30.13 | -3.82 | 1854 | 10147 | 9000 | REMERA | 29.55 | -2.88 | 2140 |
| 10063 | 4520 | KAYOGORO (Bukemba) | 30.07 | -4.00 | 1235 | 10148 | 9050 | RUGARI (E.F.I) | 30.40 | -2.73 | 1650 |
| 10064 | 4550 | KAYOGORO (Makamba) | 29.93 | -4.08 | 1550 | 10149 | 9100 | RUGARI (Paroisse) | 30.40 | -2.73 | 1650 |
| 10065 | 4650 | KAYONGOZI | 30.33 | -3.25 | 1500 | 10150 | 9150 | RUGAZI | 29.33 | -3.23 | 1590 |
| 10066 | 4700 | KAZBA | 29.55 | -3.47 | 2286 | 10151 | 9200 | RUKOKO | 29.22 | -3.25 | 790 |
| 10067 | 4750 | KIBIMBA | 29.80 | -3.30 | 1726 | 10152 | 9251 | RUMONGE | 29.43 | -3.98 | 785 |
| 10068 | 4800 | KIBUMBU | 29.75 | -3.37 | 1814 | 10153 | 9270 | RUSAKA | 29.62 | -3.45 | 2159 |
| 10069 | 4850 | KIGAMBA | 29.52 | -3.05 | 1607 | 10154 | 9300 | RUSENGO (E.F.I) | 30.35 | -3.40 | 1660 |
| 10070 | 4880 | KIGANDA (E.F.I) | 29.68 | -3.35 | 1930 | 10155 | 9350 | RUSHUBI (Bona) | 29.50 | -3.37 | 1680 |
| 10071 | 4900 | KIGANDA (Paroisse) | 29.68 | -3.35 | 1930 | 10156 | 9380 | RUSHUBI (Village) | 29.48 | -3.35 | 1670 |
| 10072 | 4920 | KIGARKA (Mosso) | 30.28 | -3.47 | 1589 | 10157 | 9400 | RUTANA | 30.00 | -3.93 | 1778 |
| 10073 | 4950 | KINAZI | 30.42 | -2.70 | 1553 | 10158 | 9450 | RUTEGAMA | 29.75 | -3.30 | 1760 |
| 10074 | 5000 | KIGWENA (Mission) | 29.55 | -4.17 | 914 | 10159 | 9500 | RUTONGANIK | 30.20 | -3.47 | 1601 |
| 10075 | 5100 | KINYINYA | 30.33 | -3.65 | 1308 | 10160 | 9600 | RUTOVU | 29.85 | -3.88 | 2013 |
| 10076 | 5120 | KIRAMBI | 30.47 | -3.32 | 1575 | 10161 | 9650 | RUVYIRONZA | 29.77 | -3.82 | 1822 |
| 10077 | 5150 | KIREMBA | 29.67 | -3.95 | 1870 | 10162 | 9700 | RUVYIRONZA | 30.25 | -3.48 | 1610 |
| 10078 | 5200 | KIRUNDO (Agri) | 30.12 | -2.58 | 1420 | 10163 | 9750 | RUYIGI (Mission) | 30.25 | -3.47 | 1602 |
| 10079 | 5250 | KIRUNDO (Projet) | 30.12 | -2.58 | 1449 | 10164 | 9800 | RWEGURA | 29.52 | -2.92 | 2302 |
| 10080 | 5300 | KIVOGA | 29.42 | -3.28 | 877 | 10165 | 9820 | RWEZA (Nyangwa) | 29.77 | -3.63 | 1845 |
| 10081 | 5320 | MABANDA | 29.78 | -4.27 | 1530 | 10166 | 9850 | RWEZA (Vyanda) | 29.60 | -4.10 | 1851 |
| 10082 | 5350 | MABAYI | 29.23 | -2.72 | 1509 | 10167 | 9900 | TEZA (Nyabigondo) | 29.57 | -3.18 | 2166 |
| 10083 | 5400 | MAKAMBA | 29.82 | -4.13 | 1450 | 10168 | 9950 | VUGIZO (Martyazo) | 29.70 | -4.18 | 1550 |
| 10084 | 5420 | MAHANDE | 29.23 | -2.87 | 1540 | 10169 | 9970 | SOSUMO (MOSO) | 30.07 | -3.15 | 1170 |
| 10085 | 5450 | MAKEBUKO | 30.00 | -3.60 | 1770 | 10170 | 9971 | RUYIGI | | | |

Appendix 17: Questionnaire Answers CRH

| D.R. CONGO - CRH (Uvira) (1/2) | |
|--------------------------------|---|
| HQ1 | Contact address |
| | Centre de Recherche en Hydrobiologie/C.R.H.-Uvira, Quartier Kimanga ,Av.des Pionniers ,Uvira,Province du Sud-Kivu (Rd Congo) Via B.P.254 Bujumbura/Burundi. www.CRH |
| HQ2 | Type of institution ? |
| | Governmental.It is under the Ministry of Scientific Research. CRH-Uvira has been created by Ministerial Decree of January 6th 1994 (cfr yearly report 2006-2007). |
| HQ3 | Is there a station of your institution situated near lake Tanganyika ? |
| | CRH is situated near the lake. There is no other field station since we do not have functioning budget but we hope to create two other stations in the future (including one in Kalemie). |
| HQ4 | Do you have an official mandate related to monitoring of L. Tanganyika? |
| | Yes, the CRH has this mandate not only for Lake Tanganyika but also for all other aquatic environment of D.R.Congo. It has three main departments of research : biology and ecology (animals, aquatic plants, biodiversity...), water quality and pollution sour |
| HQ5 | Would a change of mandate be necessary to implement this monitoring ? |
| | No |
| HQ6 | Would you agree to participate to a long term monitoring & information exchange ? (by wish/by mandate or both?) |
| | Both. CRH is one of the institution that has contributed to the strategic action program. It thus has a mandate from D.R.Congo. |
| HQ7 | Cooperation with other institution ? |
| | Yes, of course. We cooperate with the official University of Bukavu (UOB) that sends 1st and 2 nd licence students at CRH for short cursus in the field of hydrobiology. We also had collaboration with the Museum of Chicago and CRSN Lwiro at Bukavu in the fr |
| HQ8 | Does your institution get financing from UN/AFDB or other international organisation ? |
| | No |
| HQ9 | Does you staff need specific training ? |
| | The scientific staff is trained but it needs to harmonize with scientist of riparine countries. He needs more explanation on the impact of climate change on Lake Tanganyika in general and on the parameters to monitor. |
| HQ10 | Does you institution provide specific training ? |
| | We train students of the hydrobiology department of the Official University of Bukavu in the field of ichtyology (ecology, taxonomy of fishes, fishing techniques, diving : handouts do exist) |
| HQ11 | Are training program of your institution open to other participants? |
| | There are conditions : Candidates need to be biologists that have reached the 1st or 2 nd licence year of Biology |
| HQ12 | Who mainly finance your institution ? |
| | The Governement of DRC only finances the personnel but we do not have a budget for the functioning. |
| QH13 | Do you write projects proposals for financing ? |
| | Yes, sometimes The Belgian Technical Cooperation (BTC) ask us project proposals in the field of fisheries and development. |
| | Do you have suggestions to the long term monitoring ? |
| | Yes. It would be necessary to equip all centres or stations in the same way and train the scientific and technical personal in each center to harmonize the methodology. It is important to foreseen a small allowance to encourage the CRH because of the pro |
| F1 | Field station: name and contact adress. |
| | We do not have other station at Lake Tanganyika since CRD is close from the lake |
| F2 | Number of persons working in the field station (by education level) ? |
| | none |
| F3 | Do you presently monitor environmental parameters in relation with LT ? |
| | No, we take note of data on fish species caught, zooplankton, phytoplankton, number of boats, nets, fishermen in the North West of Lake Tanganyika,rainfalls, macro-invertebrates in the rivers, physico-chemistry etc.. |
| F4 | What parameters do you actually monitor ? |
| | we take note of data on fish species caught, zooplankton, phytoplankton, number of boats, nets, fishermen in the North West of Lake Tanganyika,rainfalls, macro-invertebrates in the rivers, physico-chemistry etc.. |
| F5 | What means of transport does have your station ? |
| | One zodiac boat. Three broken down vehicles |
| F6 | Is your institution dealing with the lake, the watershed or both ? |
| | Both |

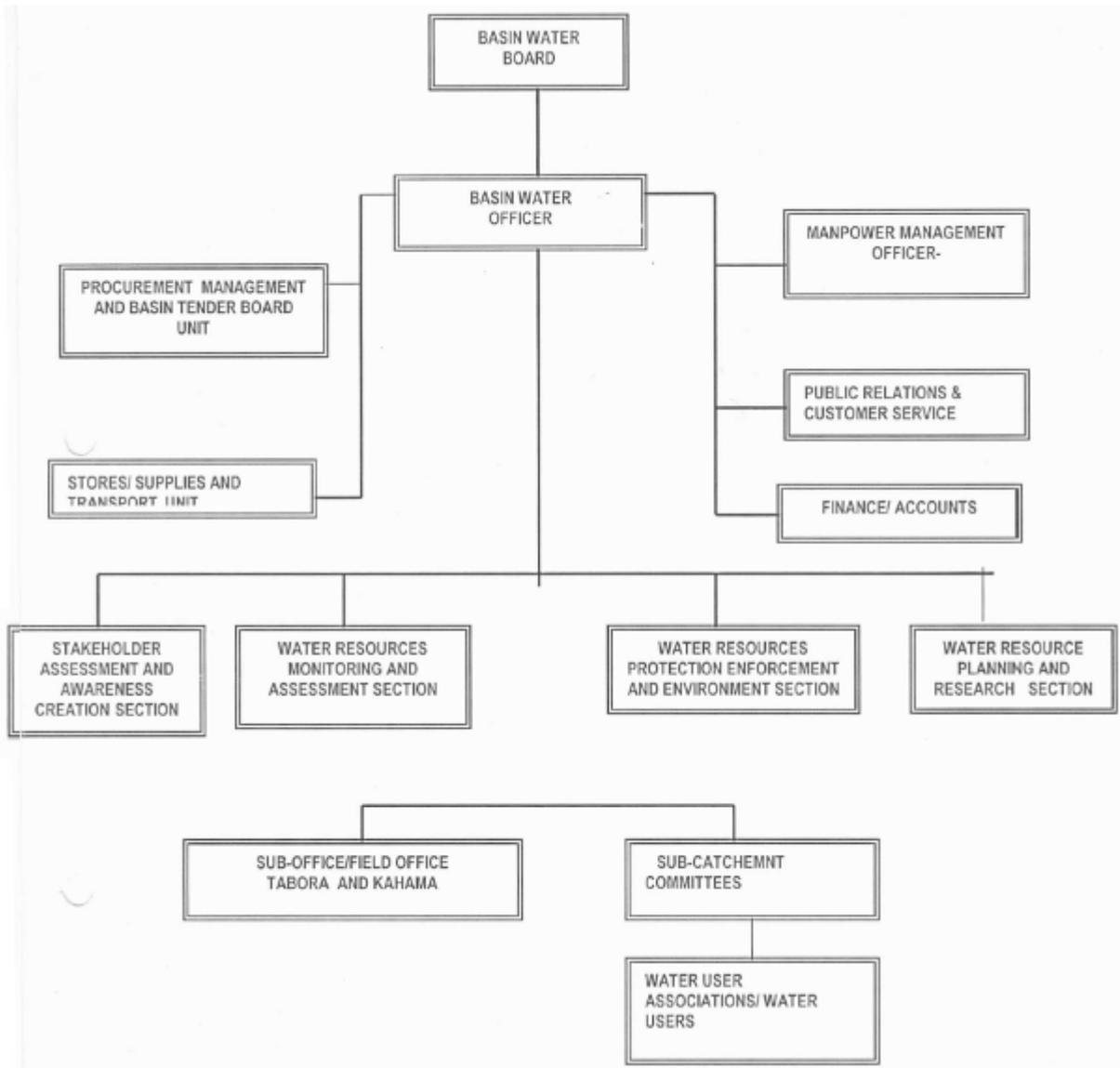
| D.R. CONGO - CRH (Uvira) (2/2) | |
|---------------------------------------|--|
| F7 | Means of communication ? |
| | Personnal phones |
| F8 | Availability of electricity in the station ? |
| | 2 or 3 hours per day only |
| F9 | Availability of electric generator in the station ? |
| | 2 generators= one of 10 KVA that needs to be fixed and one of 4 KVA |
| F10 | Availability of water in the station ? |
| | Yes. Water is sufficient |
| F11 | How many internet connection are operationnal in your station ? |
| | Any computer are working. We only use personnal computers (5 withouth internet connection). We have to go to a CYBER centre to communicate. |
| F12 | Do you have suggestions to the long term monitoring ? (field) |
| V1 | In which field is your institution active ? |
| | Water quality, fishing, biodiversity, ecology and taxonomy of fishes, phytosociology, socio-economy of fishing, erosion, climate, meteorology |
| V2 | What equipment is available in your institute for the monitoring ? |
| | A list is attached. |
| V3 | Are documents available to explain the methodology for your monitoring? |
| | cfr appendices |
| V4 | Is a meteorological monitoring implemented in your station ? |
| | rainfalls |
| V5 | What is required to improve the present environnement monitoring ? |
| | Instruments to measure water quality, scientific microscopes for phyto and zooplankton etc ; GPS, internet connection, a vehicle, a level gauge installed, a small fonctionning budget etc.. |
| V6 | Do you organise your data manually (hard copy) or digitaly ? |
| | Some are manuals, others are digital. |
| V7 | What is required to harmonise a regional monitoring ? |
| | Training ; computer equipment and internet connection, vehicle, autonomous boat with engine, budget. |
| V8 | Quality of previous data : any comments ? |
| | We have good data on rainfalls regime at Uvira and on fishing in the northern bay of Lake Tanganyika but for a good monitoring, it is necessary to have equipment and training. |
| V9 | Do you use internet ? |
| | non internet connection is avaiable in our center |
| V10 | How did your staff aquire internet knowledge ? |
| | Individually |
| V11 | Is an organigram of your institution available ? |
| | Yes |
| V12 | Did your institution contribute to scientific publications ? |
| | List of publication |
| V13 | Would your institution be able to participate to a long term monitoring without external support ? |
| | Yes but a small financial support would be necessary to measure the greatest number of parameters as possible. |
| V14 | Could your institution share past or present informations with the LTA ? |
| | Digitalis and particularly related to publications and others |
| V15 | Does your institution have ressources persons in environnement ? |
| | Several CV's are attached |

Appendix 18: Questionnaire Answers LTBWO

| TANZANIA- LTBWO (Kigoma) (1/2) | |
|--------------------------------|---|
| HQ1 | Contact address |
| | Lake Tanganyika Basin Water Office, P.O.Box 105, Kigoma - Tanzania, ltbwateroffice@yahoo.com, +255 28 280 2697/4901 |
| HQ2 | Type of institution ? |
| | It is a government institution |
| HQ3 | Is there a station of your institution situated near lake Tanganyika ? |
| | There is one sub-office based in Tabora Municipality; P.O.Box 307, Tabora, +255 26 260 44 03 |
| HQ4 | Do you have an official mandate related to monitoring of L. Tanganyika? |
| | As Basin Water Office, we are legally mandated with water resources management that includes but not limited to water quality and quantity ,sediments and rainfall monitoring. |
| HQ5 | Would a change of mandate be necessary to implement this monitoring ? |
| | No |
| HQ6 | Would you agree to participate to a long term monitoring & information exchange ? (by wish/by mandate or both?) |
| | This is mandatory if at all we want the project thereafter be sustainable. You can not talk of Lake Tanganyika catchment management without Lake Tanganyika basin water Office being involved. |
| HQ7 | Cooperation with other institution ? |
| | Yes, our Institution cooperates with LGAs i.e. Local Governement Authorities, Regional Secretariats, NGO's like USAID Forest Service, TACARE (Tanganyika Catchment reforestation and Education), just to mention a few. |
| HQ8 | Does your institution get financing from UN/AFDB or other international organisation ? |
| | Our Institution receives funding from World Bank through the Government system under the present Water Sector Development Programme (WSDP) |
| HQ9 | Does you staff need specific training ? |
| | Yes, we need specific training in various fields that fall within our roles and responsabiilities. |
| HQ10 | Does you institution provide specific training ? |
| | No |
| HQ11 | Are training program of your institution open to other participants? |
| | N/A |
| HQ12 | Who mainly finance your institution ? |
| | The Government of Tanzania and the World Bank |
| QH13 | Do you write projects proposals for financing ? |
| | No, the Institution only plans and budgets and then request funding from the government. |
| HQ14 | Do you have suggestions to the long term monitoring ? |
| | In order to have a successful long term monitoring in Lake Tanganyika there must be a clear organogram indicating who does what and to what extent ? Monitoring programme is an expensive task, therefore reliable funding is necessary. There must be a reliab |
| F1 | Field station: name and contact adress. |
| | Lake Tanganyika Basin Water Office, P.O.Box 105, Kigoma - Tanzania, ltbwateroffice@yahoo.com, +255 28 280 2697/4901 |
| F2 | Number of persons working in the station (by education level) ? |
| | 3 permanent staff, one hired. Two university graduated chemists and two FTC Water Quality Principal technician. |
| F3 | Do you presently monitor environmental parameters in relation with LT ? |
| | Our Institution has been monitoring rainfalls trends in Kigoma and Tabora for nearly 36 years. |
| F4 | What parameters do you actually monitor ? |
| | none |
| F5 | What means of transport does have your station ? |
| | two small old Nissan pick ups with capacity of carrying 4 people |
| F6 | Is your instution dealing with the lake, the watershed or both ? |
| | Water ressource management including water ressource protection |

| TANZANIA- LTBWO (Kigoma) (2/2) | |
|---------------------------------------|---|
| F7 | Means of communication ? |
| | Mobile phone/fax/telephone/internet/ television for educative programs |
| F8 | Availability of electricity in the station ? |
| | Intermittently |
| F9 | Availability of electric generator in the station ? |
| | There is an old generator which was installed by NORAD in 1978 and it is not working: it is diesel powered. |
| F10 | Availability of water in the station ? |
| | Yes, most of the time when all other inputs are steady (power, pumping units etc..) |
| F11 | How many internet connection are operational in your station ? |
| | No internet connection but mobile internet. Internet is expected in about one year from now (February 2010) |
| F12 | Do you have suggestions to the long term monitoring ? (field) |
| | (Same as in form 1) |
| V1 | In which field is your institution active ? |
| | Water resources management and climate |
| V2 | What equipment is available in your institute for the monitoring ? |
| | Most of bench equipment are defective and not in use but we do have working kits for field use. A list of world bank instrument to be installed will be sent. |
| V3 | Are documents available to explain the methodology for your monitoring? |
| | Rainfall and Lake Levels data |
| V4 | Is a meteorological monitoring implemented in your station ? |
| | parameters currently measured are rainfall data only |
| V5 | What is required to improve the present environment monitoring ? |
| | Construct and install new monitoring stations |
| V6 | Do you organise your data manually (hard copy) or digitaly ? |
| | Yes, both .Database used to be at Dar es Salaam. |
| V7 | What is required to harmonise a regional monitoring ? |
| | Same as in form 1 + "Our laboratory must be improved in terms of working space, equipment, chemicals/reagents and staff so as to meet the workload ahead. |
| V8 | Quality of previous data : any comments ? |
| | Partial quality data |
| V9 | Do you use internet ? |
| | Non internet at the institution but usually we access in town for communication, downloading work-related information from Google etc... |
| V10 | How did your staff aquire internet knowledge ? |
| | Browsing and downloading the relevant information and disseminate to others. |
| V11 | Is an organigram of your institution available ? |
| | An organogram is attached |
| V12 | Did your institution contribute to scientific publications ? |
| | No |
| V13 | Would your institution be able to participate to a long term monitoring without external support ? |
| | Yes after water sector development program is put in place sometimes this year |
| V14 | Could your institution share past or present informations with the LTA ? |
| | No? Focus has been only on water supply and sanitation so far. |
| V15 | Does your institution have ressources persons in environment ? |
| | No environmental specialist in Kigoma (but in the country all kinds are available: foresters, agriculture specialists, limnologist, chemists, microbiologists, environmental engineers, hydrobiologists, ecologists, conservationists, botanists etc... |
| | <i>Contacts: Mr Kiliho and Mr Rugwaba</i> |

Appendix 19: Organogram LTWBO Kigoma



Appendix 20: LTWBO Preliminary Parameter List

Preliminary list of water parameters that the Lake Tanganyika WBO in Tanzania might measure in their national program (a: ambient water quality, b: effluent water quality, c: groundwater quality).

Ambient Monitoring

| Name of source | Location | Date | Temp. °C | pH | EC μ S/cm | Turbidity NTU | Alkalinity mg CaCO ₃ /L | Hardness mg CaCO ₃ /L | Ca mg/l | Mg mg/l | Fe mg/l | Na mg/l | Cl mg/l | SO ₄ mg/l | F mg/l | NH ₃ mg/l | NO ₃ mg/l | NO ₂ mg/l | K mg/l | D.O. mg/l | TDS mg/l | FC CFU/100ml | Mn mg/l | |
|----------------|----------|------|----------|----|---------------|---------------|------------------------------------|----------------------------------|---------|---------|---------|---------|---------|----------------------|--------|----------------------|----------------------|----------------------|--------|-----------|----------|--------------|---------|--|
| | | | | | | | | | | | | | | | | | | | | | | | | |

*Parameters will depend on the activities within the Basin

Effluent Data- Pollution Control Table 2

| Name of source | Location | Date | Temp. °C | pH | EC μ S/cm | DO mg/l | Colour mg/pt/L | Turbidity NTU | PO ₄ mg/l | NO ₃ mg/l | NO ₂ mg/l | NH ₃ mg/l | Cl mg/l | BOD 30°C mg O ₂ /L | COD mg O ₂ /l | SO ₄ mg/l | TS mg/l | C mg/l | N mg/l | Hg μ g/l | Pb μ g/l | As μ g/l | Se μ g/l | Pest μ g/l | Cd μ g/l | Cr μ g/l | Cu μ g/l | Zn μ g/l | Al μ g/l | Ni μ g/l | |
|----------------|----------|------|----------|----|---------------|---------|----------------|---------------|----------------------|----------------------|----------------------|----------------------|---------|-------------------------------|--------------------------|----------------------|---------|--------|--------|--------------|--------------|--------------|--------------|----------------|--------------|--------------|--------------|--------------|--------------|--------------|--|
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

*Parameters will depend on the activities within the Basin

Groundwater quality data: Table 3

| Borehole No. | Location | Date | pH | EC μ S/cm | Na mg/l | Ca mg/l | Turbidity NTU | NO ₂ mg/l | NO ₃ mg/l | NH ₃ mg/l | Mn mg/l | Fe mg/l | Mg mg/l | Hardness mg/l | SO ₄ mg/l | Cl mg/l | Alkalinity mg/l | TS mg/l | F mg/l | As mg/l | Se mg/l | Pb mg/l | Zn mg/l | Aumg/l | Nimg/l | Agmg/l | |
|--------------|----------|------|----|---------------|---------|---------|---------------|----------------------|----------------------|----------------------|---------|---------|---------|---------------|----------------------|---------|-----------------|---------|--------|---------|---------|---------|---------|--------|--------|--------|--|
| | | | | | | | | | | | | | | | | | | | | | | | | | | | |

*Parameters will depend on the activities and Geology of the area.

Appendix 21: Questionnaire Answers TAFIRI

| TANZANIA- TAFIRI (Kigoma) (2/2) | |
|---------------------------------|---|
| F7 | Means of communication ? |
| | No radio, normally rely on personal mobile phones though network coverage is questionable. |
| F8 | Availability of electricity in the station ? |
| | YES, 50-75% coverage |
| F9 | Availability of electric generator in the station ? |
| | YES , Power diesel and in a running state though it needs minor repairs. |
| F10 | Availability of water in the station ? |
| | YES, 60-80% |
| F11 | How many internet connection are operational in your station ? |
| | We use broadband connection (520Kb/s) which is not very reliable and personal computers are the ones in use so far |
| F12 | Do you have suggestions to the long term monitoring ? (field) |
| | Efforts need to be put in place to make monitoring of Lake Tanganyika done on specific interval of time. The station need to be re-enforced monitoring equipments, internet and telephone services/connections, transport facilities both water and land for f |
| V1 | In which field is your institution active ? |
| | Water, fisheries, biodiversity, weather monitoring, water quality monitoring of both physical chemical and biological parameters, Aquaculture, Socio-economics |
| V2 | What equipment is available in your institute for the monitoring ? |
| | A list is attached |
| V3 | Are documents available to explain the methodology for your monitoring? |
| | NO |
| V4 | Is a meteorological monitoring implemented in your station ? |
| | Rain fall |
| V5 | What is required to improve the present environment monitoring ? |
| | Monitoring is done in collaboration with Meteorological department. A MoU could be put in place but the monitoring station need to be re-forced |
| V6 | Do you organise your data manually (hard copy) or digitaly ? |
| | Manually |
| V7 | What is required to harmonise a regional monitoring ? |
| | Harmonization of sampling methodologies and standards probably sampling to be conducted at the same time in the whole region. Harmonized Standard operating procedure (SOPs) such as those developed in Lake Victoria should be adopted. A region office should |
| V8 | Quality of previous data : any comments ? |
| | |
| V9 | Do you use internet ? |
| | Email but for literature search training (online) need to be conducted on appropriate/correct use of various search engines. |
| V10 | How did your staff aquire internet knowledge ? |
| | By search of relevant literatures |
| V11 | Is an organogram of your institution available ? |
| | To be provided from HQ |
| V12 | Did your institution contribute to scientific publications ? |
| | YES some more publications will be provided by HQ |
| V13 | Would your institution be able to participate to a long term monitoring without external support ? |
| | YES/NO YES once the laboratories are equipped with necessary Office, laboratory and filed infrastructure - NO if the above are not available then we may not be able to undertake consistency and timely monitoring and sharing of information |
| V14 | Could your institution share past or present informations with the LTA ? |
| | Relevant answers to be provided by HQ |
| V15 | Does your institution have ressources persons in environment ? |
| | Yes |

| TANZANIA- TAFIRI (Kigoma) (1/2) | |
|--|--|
| HQ1 | Contact address |
| | Tanzania Fisheries Research Institute, P.O. Box 78850, Dar es Salaam , Tel: +255-22-2650046, tafirihq@yahoo.com |
| HQ2 | Type of institution ? |
| | Governmental |
| HQ3 | Is there a station of your institution situated near lake Tanganyika ? |
| | Tanzania Fisheries Research Institute (TAFIRI), Kigoma Centre, Amon P. Shoko, E mail: amon_shoko@yahoo.co.uk, tafiri_kigoma@yahoo.com , Telephone: Office: +255282802068, Mobile: +255764192059, +255784318925 A station will also be established |
| HQ4 | Do you have an official mandate related to monitoring of L. Tanganyika? |
| | The objectives/mandates of the institute include, among others: To promote and conduct research in fisheries within and in relation to any part of the territorial waters or in relation to any part of the territory of the United Republic of Tanzania; To p |
| HQ5 | Would a change of mandate be necessary to implement this monitoring ? |
| | No |
| HQ6 | Would you agree to participate to a long term monitoring & information exchange ? (by wish/by mandate or both?) |
| | Both |
| HQ7 | Cooperation with other institution ? |
| | Yes. MOU are established with national institution/ collaboration with Ministry of Water on Lake Victoria for example.Cooperation with universities (Bergen in Norway, VUB and Leuven in Belgium, ...). |
| HQ8 | Does your institution get financing from UN/AFDB or other international organisation ? |
| | World bank funds through projects |
| HQ9 | Does you staff need specific training ? |
| | Training is required because new people have been hired |
| HQ10 | Does you institution provide specific training ? |
| | No but TAFIRI looks for funds by level (Ph.D. : each one looks for his funding, MSC and technical : TAFIRI pays the fee |
| HQ11 | Are training program of your institution open to other participants? |
| | There is no specific training program provided by TAFIRI beside internal training program in IT (database (UNICEF), bibliographic database with free software |
| HQ12 | Who mainly finance your institution ? |
| | The Government |
| QH13 | Do you write projects proposals for financing ? |
| | Yes |
| HQ14 | Do you have suggestions to the long term monitoring ? |
| F1 | Field station: name and contact adress. |
| | Tanzania Fisheries Research Institute (TAFIRI), Kigoma Centre, Amon P. Shoko, E mail: amon_shoko@yahoo.co.uk, tafiri_kigoma@yahoo.com , Telephone: Office: +255282802068, Mobile: +255764192059, +255784318925 |
| F2 | Number of persons working in the station (by education level) ? |
| | Total number staff is 41 see attached list in the end of this questionnaire for filed of specialization |
| F3 | Do you presently monitor environmental parameters in relation with LT ? |
| | NO |
| F4 | What parameters do you actually monitor ? |
| | NO |
| F5 | What means of transport does have your station ? |
| | An old Fiber boat (RV Echo), wooden boat & old pick up |
| F6 | Is your instution dealing with the lake, the watershed or both ? |
| | Lake Tanganyika, its catchment basin and riverine issues. |

Appendix 22: Questionnaire Answers LUP

| TANZANIA- Department of Land use Planning and Management (LUP) (1/2) | |
|---|--|
| HQ1 | Contact address |
| | Department of Land use Planning and Management. Ministry of Agriculture Food Security and Cooperatives . P.O.Box 9071, Dar es Salaam, Tanzania, East Africa. Tel Office +255 222 860 450 Fax: +255 222 860 444 |
| HQ2 | Type of institution ? |
| | Governmental department |
| HQ3 | Is there a station of your institution situated near lake Tanganyika ? |
| | YES, Tabora and Mbeya are the main centres covering Kigoma, Tabora, Rukwa and Mbeya regions. Two zonal coordinators for Land Use Planning and Management are stationed at Tabora (to cover Tabora and Kigoma regions) and Mbeya (to cover Mbeya, Rukwa and Iri |
| HQ4 | Do you have an official mandate related to monitoring of L. Tanganyika? |
| | YES, Monitor all activities carried out by land users on the terrestrial component of the Lake ecosystem, with more focus on land use practices on cultivated lands and soil erosion. |
| HQ5 | Would a change of mandate be necessary to implement this monitoring ? |
| | NO, no need for a change of mandate but improvement of coordination mechanism. |
| HQ6 | Would you agree to participate to a long term monitoring & information exchange ? (by wish/by mandate or both?) |
| | YES, by mandate we are dealing with land use; promoting sustainable land management technologies/practices which impact on the Lake. |
| HQ7 | Cooperation with other institution ? |
| | YES, e.g. Forestry & Beekeeping Division, VPO (division of Environment), NEMC, Institute of Resources Assessment, SUA, ICRAF, WOCAT, WWF, CARE, etc. |
| HQ8 | Does your institution get financing from UN/AFDB or other international organisation ? |
| | Not directly, mainly through the ASDP basket fund in which various development partners contribute. (ASDP means Agricultural Sector Development Programme) |
| HQ9 | Does you staff need specific training ? |
| | YES |
| HQ10 | Does you institution provide specific training ? |
| | YES, in collaboration with training institution e.g. SUA, MATI's. In-Service Training Curriculum is in place for natural resources management. |
| HQ11 | Are training program of your institution open to other participants? |
| | YES, any with relevance to natural resources management, it be water resources, forest resources, land, environment, ... |
| HQ12 | Who mainly finance your institution ? |
| | For now, the Government of Tanzania through the annual budgets |
| QH13 | Do you write projects proposals for financing ? |
| | YES, through existing government procedures, not necessarily that expectations are fulfilled |
| HQ14 | Do you have suggestions to the long term monitoring ? |
| | Integration of the activities within stakeholder's routine Workplans and budgets. |
| F1 | Field station: name and contact adress. |
| | Tabora zonal LUP[1] coordinator: Mr. Msillanga, MSc. LUP Tabora district LUP field officer: Mr. Francis Misana, Dipl. LUP Kigoma district LUP field officer: Visa Magige, Dipl. LUP Kasulu district LUP field officer: Mr. Mr. Rwezaula, Dipl. LUP Mbeya z |
| F2 | Number of persons working in the station (by education level) ? |
| | Refer to F1 above |
| F3 | Do you presently monitor environmental parameters in relation with LT ? |
| | Not as a routine activity but for certain purposes only |
| F4 | What parameters do you actually monitor ? |
| | Soil erosion, Soil fertility and Agricultural land use |
| F5 | What means of transport does have your station ? |
| | Currently none, one has to use public transport if field car is not available from headquarters |
| F6 | Is your instution dealing with the lake, the watershed or both ? |
| | YES, like any other strategic basins similar to that of Lake Tanganyika. |

| TANZANIA- Department of Land use Planning and Management (LUP) (2/2) | |
|---|---|
| F7 | Means of communication ? |
| | Mainly telephones (landline/mobile) |
| F8 | Availability of electricity in the station ? |
| | Yes, full time unless otherwise |
| F9 | Availability of electric generator in the station ? |
| | NO |
| F10 | Availability of water in the station ? |
| | There is water in all zones |
| F11 | How many internet connection are operational in your station ? |
| | NE The connection is at its juvenile stage. Efforts are being made by the Ministry to connect zonal research and training centres by intranet facility. |
| F12 | Do you have suggestions to the long term monitoring ? (field) |
| | Existing gaps must be dealt with, building the capacity as necessary in order to perform optimally. |
| V1 | In which field is your institution active ? |
| | Land use planning, and Land use management, soil and water conservation on cultivated lands. |
| V2 | What equipment is available in your institute for the monitoring ? |
| | Soil sampling equipment and field testing kits; as well as land surveying equipments |
| V3 | Are documents available to explain the methodology for your monitoring? |
| | YES, Through ASDP guidelines. |
| V4 | Is a meteorological monitoring implemented in your station ? |
| | NO, this is mandated to Tanzania Meteorological Agency. |
| V5 | What is required to improve the present environment monitoring ? |
| | Capacity building – technical & financial |
| V6 | Do you organise your data manually (hard copy) or digitaly ? |
| | The collection is done manually, and the manipulation is done digitaly. |
| V7 | What is required to harmonise a regional monitoring ? |
| | Capacity Building |
| V8 | Quality of previous data : any comments ? |
| | Improvement needed, especially updating existing data. |
| V9 | Do you use internet ? |
| | YES, for all purposes |
| V10 | How did your staff aquire internet knowledge ? |
| | |
| V11 | Is an organogram of your institution available ? |
| | Available if you like. |
| V12 | Did your institution contribute to scientific publications ? |
| | NO, but technical/study reports as well as training curriculum. |
| V13 | Would your institution be able to participate to a long term monitoring without external support ? |
| | YES |
| V14 | Could your institution share past or present informations with the LTA ? |
| | YES, pending further consultations. |
| V15 | Does your institution have ressources persons in environnement ? |
| | |

Appendix 23: Questionnaire Answers TACARE

| TANZANIA- TACARE (Kigoma) (1/2) | |
|---------------------------------|---|
| HQ1 | Contact address |
| | The Jane Goodall Institute, P. O. Box 70728, Kigoma: pngalason@janegoodall.or.tz (+255) 22 2775236 and Mob: 0767 666101 Website: www.janegoodall.org |
| HQ2 | Type of institution ? |
| | NGO. (See attached document) |
| HQ3 | Is there a station of your institution situated near lake Tanganyika ? |
| | YES : We have program office in Kigoma located next to UNHCR. Contact Person : Emmanuel Mtiti emtiti@janegoodall.or.tz P.O Box 1182, Kigoma Tel : (+255) 28 2804446/8 Mob : 0754 329920 and 0713 492172. |
| HQ4 | Do you have an official mandate related to monitoring of L. Tanganyika? |
| | NO we do not have official mandate for Monitoring. We only Monitor areas within our operating area. |
| HQ5 | Would a change of mandate be necessary to implement this monitoring ? |
| | NOT really change of mandate but notification of the local authorities. |
| HQ6 | Would you agree to participate to a long term monitoring & information exchange ? (by wish/by mandate or both?) |
| | YES |
| HQ7 | Cooperation with other institution ? |
| | YES : Institute of Resource Assessment (IRA) University of Dar, TANAPA, USAID, UNICEF, US Forest Services, The Nature Conservancy (TNC), IUCN, |
| HQ8 | Does your institution get financing from UN/AFDB or other international organisation ? |
| | We receive funds from USAID, UNICEF, |
| HQ9 | Does you staff need specific training ? |
| | YES : they need to be oriented to the changes |
| HQ10 | Does you institution provide specific training ? |
| | NO |
| HQ11 | Are training program of your institution open to other participants? |
| | N/A |
| HQ12 | Who mainly finance your institution ? |
| | USAID, UNICEF, JGI USA |
| QH13 | Do you write projects proposals for financing ? |
| | YES. We do fund raising. |
| HQ14 | Do you have suggestions to the long term monitoring ? |
| F1 | Field station: name and contact adress. |
| | Gombe Masito Ugalla program, The Jane Goodall Institute, Tanzania. Person incharge : Executive Director : Pancras Ngalason , pngalason@janegoodall.or.tz, (+255) 22 2775236. Mob : 0754 0767666101 Program Director : Emmanuel Mtiti, emtiti@janegoodall. |
| F2 | Number of persons working in the station (by education level) ? |
| | |
| F3 | Do you presently monitor environmental parameters in relation with LT ? |
| | YES : Since arround 2000 |
| F4 | What parameters do you actually monitor ? |
| | Vegetation change |
| F5 | What means of transport does have your station ? |
| | Cars and boats |
| F6 | Is your instution dealing with the lake, the watershed or both ? |
| | We focus on lake catchment |

| TANZANIA- TACARE (Kigoma) (2/2) | |
|--|---|
| F7 | Means of communication ? |
| | Telephone, fax, internet, mobile radio calls |
| F8 | Availability of electricity in the station ? |
| | YES we do have electricity for about 22 hours/day |
| F9 | Availability of electric generator in the station ? |
| | We have a diesel generator but aged |
| F10 | Availability of water in the station ? |
| | The office is well connected to urban water supply. |
| F11 | How many internet connection are operational in your station ? |
| | More than 20 computers are connected through wireless connection. Connection is fast. The problem is the connection is expensive to maintain. |
| F12 | Do you have suggestions to the long term monitoring ? (field) |
| | 1. Establishment of data base at country level (especially at lake area) then regional level will be very helpful |
| | 2. Support for data collection in terms of resources and technical knowledge will improve data management |
| V1 | In which field is your institution active ? |
| | BIODIVERSITY CONSERVATION |
| V2 | What equipment is available in your institute for the monitoring ? |
| | GPS – Ranging from small to big GPS. All in good condition. |
| V3 | Are documents available to explain the methodology for your monitoring? |
| | YES : We monitor conservation initiatives including vegetation change. See attached PMP. |
| V4 | Is a meteorological monitoring implemented in your station ? |
| | NO. |
| V5 | What is required to improve the present environment monitoring ? |
| | Establishing baselines |
| V6 | Do you organise your data manually (hard copy) or digitaly ? |
| | Both Manually and digitaly |
| V7 | What is required to harmonise a regional monitoring ? |
| | 1. Information sharing |
| | 2. Extended satellite images that cover a bigger area |
| V8 | Quality of previous data : any comments ? |
| | Quality is Good. Verification done regulary |
| V9 | Do you use internet ? |
| | YES : We use internet for email, searching for information and we have agreement with Google for some services |
| V10 | How did your staff aquire internet knowledge ? |
| | 1. Browsing through important sites. |
| | 2. Exchange of information from collaborators and partners |
| V11 | Is an organogram of your institution available ? |
| | YES : See attachment. |
| V12 | Did your institution contribute to scientific publications ? |
| | YES : Mainly on the chimpanzee reasearch. Visit our website : www.janegoodall.org |
| V13 | Would your institution be able to participate to a long term monitoring without external support ? |
| | NO. We can not participate regionally without external funding since we are donor funded and so limited by the area of coverage. |
| V14 | Could your institution share past or present informations with the LTA ? |
| | YES : We believe in sharing. In some cases we may need an MOU signed. |
| V15 | Does your institution have ressources persons in environnement ? |
| | 1. Anthropologists and Conservation biologists. |
| | 2. GIS specialist |
| | 3. M&E specialist |

Appendix 24: Questionnaire Answers Department of Fisheries

| ZAMBIA- Department of Fisheries (DOF) (1/2) | |
|---|--|
| HQ1 | Contact address |
| | Department of Fisheries P.O. Box 350100, Chilanga, ZAMBIA Phone : 260 211 278418, FAX : 260 211 278618 Email : piscator@zamnet.zm |
| HQ2 | Type of institution ? |
| | Department of Fisheries is a governmental institution established by a parliamentary act and two national policies (Fisheries Act, national agriculture policy - attached) |
| HQ3 | Is there a station of your institution situated near lake Tanganyika ? |
| | There are Two stations on the shores of Lake Tanganyika 1. Mpulungu : OIC – Danny Sinyinza/Justina Kasabila (Research) Lloyd Hambiya (Extension). 2. Nsumbu. OIC – Freddie Zulu |
| HQ4 | Do you have an official mandate related to monitoring of L. Tanganyika? |
| | Yes, the department is mandated with the management of the fisheries resources in Lake Tanganyika. The DoF also conducts research activities which include monitoring the fish stocks, zoo/phytoplankton, and recently, general environmental and meteorologic |
| HQ5 | Would a change of mandate be necessary to implement this monitoring ? |
| | No |
| HQ6 | Would you agree to participate to a long term monitoring & information exchange ? (by wish/by mandate or both?) |
| | Yes |
| HQ7 | Cooperation with other institution ? |
| | Yes, Kyoto University, Gratz University, Bern University, University of Zambia, SADC, African Wildlife Fund, FAO,UNDP, etc |
| HQ8 | Does your institution get financing from UN/AFDB or other international organisation ? |
| | Yes |
| HQ9 | Does you staff need specific training ? |
| | Yes, they will need training in data collection, management and analysis, Taxonomy of the different flora and fauna, water quality assessment, meteorological data interpretation with respect to climate change. |
| HQ10 | Does you institution provide specific training ? |
| | |
| HQ11 | Are training program of your institution open to other participants? |
| | Farmers, fishermen, school leavers |
| HQ12 | Who mainly finance your institution ? |
| | Zambian Government (GRZ) |
| QH13 | Do you write projects proposals for financing ? |
| | Yes |
| HQ14 | Do you have suggestions to the long term monitoring ? |
| | |
| F1 | Field station: name and contact adress. |
| | Justina kasabila zimba, fisheries research officer,justina.zimba@yahoo co.uk+260977308986 |
| F2 | Number of persons working in the station (by education level) ? |
| | as per attached |
| F3 | Do you presently monitor environmental parameters in relation with LT ? |
| | Since 1993 |
| F4 | What parameters do you actually monitor ? |
| | Rainfall,wind direction,wind speed,water temperature,air temperature,water level,humidity |
| F5 | What means of transport does have your station ? |
| | boat |
| F6 | Is your instution dealing with the lake, the watershed or both ? |
| | Lake tanganyika itself |

| ZAMBIA- Department of Fisheries (DOF) (2/2) | |
|--|---|
| F7 | Means of communication ? |
| | telephone |
| F8 | Availability of electricity in the station ? |
| | Electricity is available 80% |
| F9 | Availability of electric generator in the station ? |
| | Yes,petrol,working |
| F10 | Availability of water in the station ? |
| | Water available more than 60% |
| F11 | How many internet connection are operationnal in your station ? |
| | No internet facility |
| F12 | Do you have suggestions to the long term monitoring ? (field) |
| V1 | In which field is your institution active ? |
| | fisheries |
| V2 | What equipment is available in your institute for the monitoring ? |
| | An inventory is attached |
| V3 | Are documents available to explain the methodology for your monitoring? |
| | Not available |
| V4 | Is a meteorological monitoring implemented in your station ? |
| | Rainfall,wind direction,wind speed,humidity,water temperature,air temperature,water level |
| V5 | What is required to improve the present environnement monitoring ? |
| | |
| V6 | Do you organise your data manualy (hard copy) or digitaly ? |
| | digital |
| V7 | What is required to harmonise a regional monitoring ? |
| | |
| V8 | Quality of previous data : any comments ? |
| | |
| V9 | Do you use internet ? |
| | no |
| V10 | How did your staff aquire internet knowledge ? |
| | |
| V11 | Is an organogram of your institution available ? |
| | There are 3 sections i.e research,extension and training |
| V12 | Did your institution contribute to scientific publications ? |
| | Yes,list not available |
| V13 | Would your institution be able to participate to a long term monitoring without external support ? |
| | yes |
| V14 | Could your institution share past or present informations with the LTA ? |
| | Yes,digital |
| V15 | Does your institution have ressources persons in environnement ? |
| | no |

Appendix 25: Questionnaire Answers DWA

| ZAMBIA- Department of water affairs (DWA) (1/2) | |
|--|---|
| HQ1 | Contact address |
| | Ministry of Energy and water development (Department of Water Affairs) P.O. Box 30530,Lusaka, Zambia, www.mewd.gov.zm |
| HQ2 | Type of institution ? |
| | Government institution. Ministry of Energy and Water Development Strategic plan(soft copy) and integrated Water Ressources and Water Efficiency Implementation Plan (Hard Copy) |
| HQ3 | Is there a station of your institution situated near lake Tanganyika ? |
| | There are at least nine water monitoring stations in the Lake Tanganyika Basin. These are monitored by Senior Hydrologist , Water Quality officer and District Water Officer(for Mbala) under the Provincial Water officer for Northern Province |
| HQ4 | Do you have an official mandate related to monitoring of L. Tanganyika? |
| | The mandate of the Ministry is Water Resources Management and Development. In MEWD strategic Plan objective 6: To establish a network for continuous monitoring and assessment of water resources availability. Under Water Resources Management , some of the |
| HQ5 | Would a change of mandate be necessary to implement this monitoring ? |
| | No change of mandate is required. The department has relevant Units for monitoring activities : Such as Water quality Unit (for water quality), Water Resources Unit(Water resources assessment) and (Hydrological unit-for flow monitoring) and has office |
| HQ6 | Would you agree to participate to a long term monitoring & information exchange ? (by wish/by mandate or both?) |
| | Yes : By virtue of our Mandate, we are involved in the monitoring of water resouces in the country(Surface and Groundwater) |
| HQ7 | Cooperation with other institution ? |
| | At national level : with institutions such as Zambia Meteorological Department on Data Sharing and with office of the vice President on Disaster Preparedness. International Organisations such as WWF on management of wetlands. At regional level : with SAD |
| HQ8 | Does your institution get financing from UN/AFDB or other international organisation ? |
| | Yes. Whenever they support water resources development programmes. Presently the EU is supporting a range of activities in the water sector through WRAP(Water Resources Action Programme) |
| HQ9 | Does you staff need specific training ? |
| | Yes. In sediment load sampling and use of equipment |
| HQ10 | Does you institution provide specific training ? |
| | Yes. Through the Support of Danish International Development Agency (DANIDA) and Intergrated Water Resources Management (IWRM) center at University of Zambia |
| HQ11 | Are training program of your institution open to other participants? |
| | No. |
| HQ12 | Who mainly finance your institution ? |
| | Government |
| QH13 | Do you write projects proposals for financing ? |
| | Yes.This year the Department has written proposal for funding to the World Bank, European Union , African Development Bank and the Chinese Government |
| HQ14 | Do you have suggestions to the long term monitoring ? |
| | Yes. Training of local people capturing collecting information for the established stations is required |
| F1 | Field station: name and contact adress. |
| | Department of Water Affairs, Adam Hussien : ahussien@mewd.gov.zm |
| F2 | Number of persons working in the station (by education level) ? |
| | See attachment |
| F3 | Do you presently monitor environmental parameters in relation with LT ? |
| | Yes. |
| F4 | What parameters do you actually monitor ? |
| | Water samples are normally analysed using field water quality tests Hach field kits. The kits are used to test for pH, electric conductivity (EC), dissolved oxygen (DO), redox potential (Eh) and water temperature (WT), Iron (Fe) and Manganese (Mn). The co |
| F5 | What means of transport does have your station ? |
| | Car and Boat |
| F6 | Is your instnution dealing with the lake, the watershed or both ? |
| | Monitoring of water quality and river flows into Lake Tanganyika |

| ZAMBIA- Department of water affairs (DWA) (2/2) | |
|--|---|
| F7 | Means of communication ? |
| | Individual mobile phones of officers. Data collection staff have none |
| F8 | Availability of electricity in the station ? |
| | There is no electricity in field stations |
| F9 | Availability of electric generator in the station ? |
| | No |
| F10 | Availability of water in the station ? |
| | Yes. 75% |
| F11 | How many internet connection are operational in your station ? |
| | Field stations have no internet connections |
| F12 | Do you have suggestions to the long term monitoring ? (field) |
| | Include a programme of sensitisation of the local communities on the need to have monitoring equipment.This will minimise vandalism of installed monitoring equipment |
| V1 | In which field is your institution active ? |
| | Water |
| V2 | What equipment is available in your institute for the monitoring ? |
| | See attachment |
| V3 | Are documents available to explain the methodology for your monitoring? |
| | Yes |
| V4 | Is a meteorological monitoring implemented in your station ? |
| | No |
| V5 | What is required to improve the present environment monitoring ? |
| | Training of field staff in operational Hydrology and procurement of field water quality test kits. |
| V6 | Do you organise your data manually (hard copy) or digitaly ? |
| | The collection of data from gauging (field) stations is done manually. The storage is digital. There is an initiative through SADC in which the riparian states of the Zambezi Basin have set up a common software for data storage and information exchange. |
| V7 | What is required to harmonise a regional monitoring ? |
| | |
| V8 | Quality of previous data : any comments ? |
| | The quality of data from field stations is satisfactory |
| V9 | Do you use internet ? |
| | Yes. The ministry has website. www.mewd.gov.zm. Each member of staff has a web address |
| V10 | How did your staff acquire internet knowledge ? |
| | By searching for relevant literature |
| V11 | Is an organogram of your institution available ? |
| | See attachment |
| V12 | Did your institution contribute to scientific publications ? |
| | |
| V13 | Would your institution be able to participate to a long term monitoring without external support ? |
| | Yes. Water Resources Monitoring is part of institutional |
| V14 | Could your institution share past or present informations with the LTA ? |
| | The institution currently has (water level) data base for some stations dating as far back as 1950s country wide |
| V15 | Does your institution have resources persons in environment ? |
| | Yes |

Appendix 26: Questionnaire Answers ECZ

| ZAMBIA- Environmental council of Zambia (ECZ) | |
|--|--|
| HQ1 | Contact address |
| | Environmental Council of Zambia |
| HQ2 | Type of institution ? |
| | Statutory Body, Grant Aided. |
| HQ3 | Is there a station of your institution situated near lake Tanganyika ? |
| | No |
| HQ4 | Do you have an official mandate related to monitoring of L. Tanganyika? |
| | Yes, we monitor discharges into rivers and other aquatic bodies. We monitor the Kafue River annually. |
| HQ5 | Would a change of mandate be necessary to implement this monitoring ? |
| | No |
| HQ6 | Would you agree to participate to a long term monitoring & information exchange ? (by wish/by mandate or both?) |
| | YES |
| HQ7 | Cooperation with other institution ? |
| | YES, NWASO, ZCCM-IH, Water Board, Research Institutions etc |
| HQ8 | Does your institution get financing from UN/AFDB or other international organisation ? |
| | YES |
| HQ9 | Does you staff need specific training ? |
| | YES |
| HQ10 | Does you institution provide specific training ? |
| | NO |
| HQ11 | Are training program of your institution open to other participants? |
| | N/A |
| HQ12 | Who mainly finance your institution ? |
| | License fees, Govt grant, Cooperating partners. |
| QH13 | Do you write projects proposals for financing ? |
| | Writing of funding proposals |
| HQ14 | Do you have suggestions to the long term monitoring ? |
| | No |

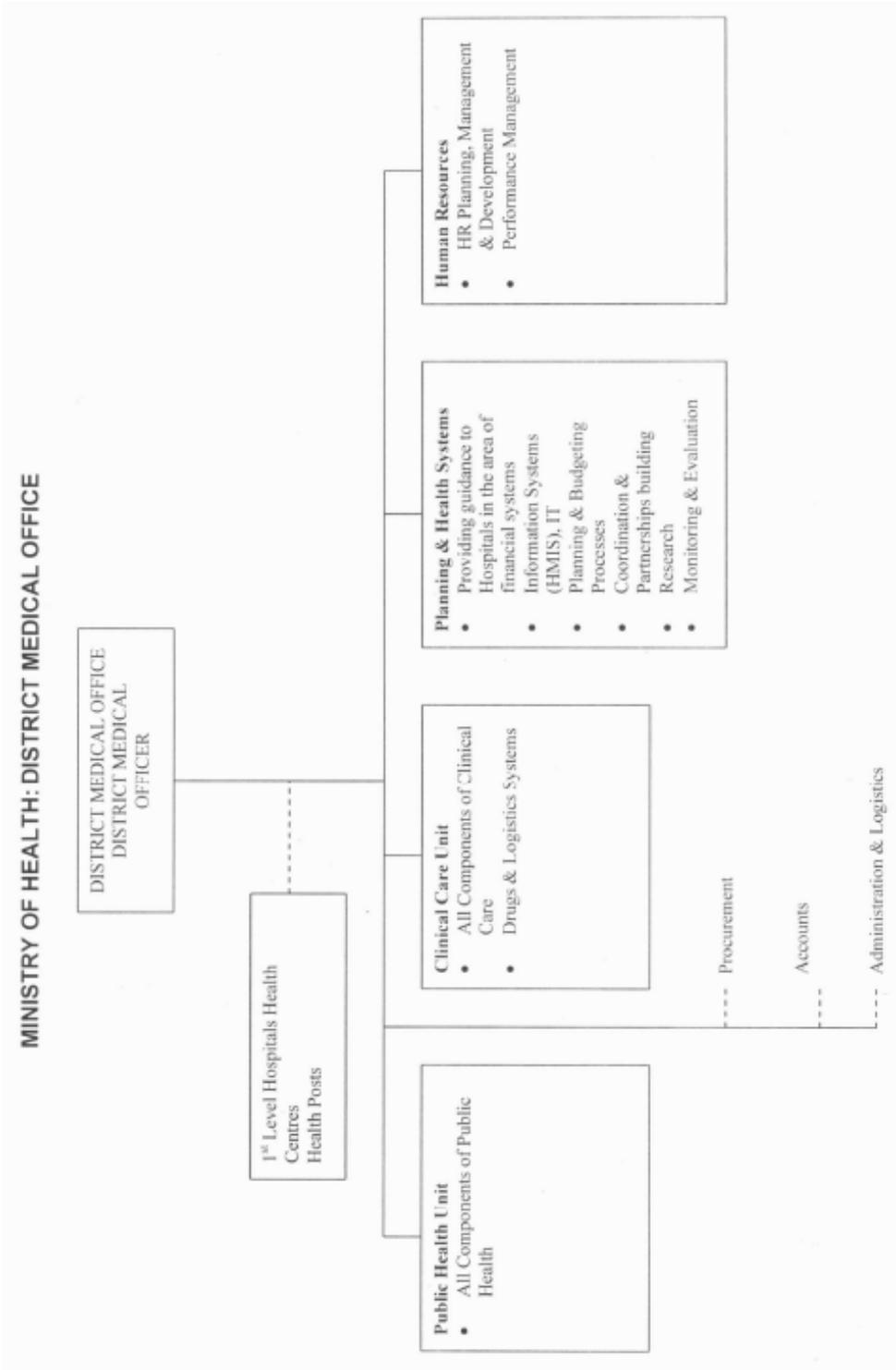
Appendix 27: Questionnaire Answers MOH

| ZAMBIA- Ministry of Health / Dept of Public Health (MOH) (1/2) | |
|---|---|
| HQ1 | Contact address |
| | MPULUNGU DHO MINISTRY OF HEALTH BOX 113 telephone no.02455104 mann lupili@yahoo.com |
| HQ2 | Type of institution ? |
| | GOVERNMENTAL INSTITUTIONAL-ACTION PLAN |
| HQ3 | Is there a station of your institution situated near lake Tanganyika ? |
| | MPULUNGU URBAN CENTRE,IYENDWE AND ISOKO RURAL HEALTH CENTRES,BOX 113 |
| HQ4 | Do you have an official mandate related to monitoring of L. Tanganyika? |
| | WATER SAMPLING(IN GENERAL COMMUNITY MEDICINE) |
| HQ5 | Would a change of mandate be necessary to implement this monitoring ? |
| | POLICY IS MADE AT CABINATE LEVEL |
| HQ6 | Would you agree to participate to a long term monitoring & information exchange ? (by wish/by mandate or both?) |
| | YES-BOTH |
| HQ7 | Cooperation with other institution ? |
| | REGIONAL EPIDEMIC NOTIFICATION(TANZANIAN HEALTH AUTHORITY),HABOUR MANAGEMENT LIMITED,DEPARTMENT OF COUNCIL,EDUCATION,FISHERIES,AGRICULTURE,ZAMBIA REVENUE AUTHOLITY,IMMIGRATION,SOCIAL &COMMUNITY DEVELOPMENT,FORESTRY |
| HQ8 | Does your institution get financing from UN/AFDB or other international organisation ? |
| | NO |
| HQ9 | Does you staff need specific training ? |
| | YES |
| HQ10 | Does you institution provide specific training ? |
| | NO |
| HQ11 | Are training program of your institution open to other participants? |
| | N/A |
| HQ12 | Who mainly finance your institution ? |
| | GOVERNMENT |
| QH13 | Do you write projects proposals for financing ? |
| | YES |
| HQ14 | Do you have suggestions to the long term monitoring ? |
| | EQUIP LOCAL LABORATORY WITH CHEMICAL AND BACTERIOLOGICAL ANALYSIS FOR WATER/FOOD,TRANSPORT FOR BOTH WATER AND LAND,TRAININGS,PERMANENT INTERNET CONNECTION,GENERATOR,BOLE HOLE FOR CONSTANT WATER SUPPLY TO THE LABORATORY |
| F1 | Field station: name and contact adress. |
| | MPULUNGU DISTRICT MEDICAL OFFICE MR LEMMY SITUNYAMA CELL.0978-067435 |
| F2 | Number of persons working in the station (by education level) ? |
| | SEE F2 LIST ATTACHED |
| F3 | Do you presently monitor environmental parameters in relation with LT ? |
| | YES |
| F4 | What parameters do you actually monitor ? |
| | pH,total dissolved solids (mg/L),conductivity (us/cm),turbidity (NTU),nitrite (mg/L),sodium (mg/L),potassium (mg/L),calcium (mg/L),magnesium (mg/L), iron (mg/L), lead (mg/L), arsenic (mg/L) and bacteriologic analysis of water/food. |
| F5 | What means of transport does have your station ? |
| | One land cruiser and one speed boat |
| F6 | Is your instution dealing with the lake, the watershed or both ? |
| | BOTH |

| ZAMBIA- Ministry of Health / Dept of Public Health (MOH) (2/2) | |
|---|---|
| F7 | Means of communication ? |
| | RADIO MESSAGE,TELEPHONE AND INTERNET |
| F8 | Availability of electricity in the station ? |
| | 95% |
| F9 | Availability of electric generator in the station ? |
| | NO |
| F10 | Availability of water in the station ? |
| | YES 30% |
| F11 | How many internet connection are operational in your station ? |
| | MOBILE INTERNET CONNECTION |
| F12 | Do you have suggestions to the long term monitoring ? (field) |
| | YES |
| V1 | In which field is your institution active ? |
| | WATER |
| V2 | What equipment is available in your institute for the monitoring ? |
| | OUR LABORATORY HAVE NO KIT TO MONITOR CHEMICAL AND BACTERIOLOGICAL ANALYSIS OF WATER/FOOD. WE SEND SAMPLES TO LUSAKA FOR ANALYSIS |
| V3 | Are documents available to explain the methodology for your monitoring? |
| | WE HAVE PAST COPIES AND STILL A WAITING FOR RESULTS FOR SAMPLES SUBMITTED ON FEBRUARY 2010. |
| V4 | Is a meteorological monitoring implemented in your station ? |
| | N/A |
| V5 | What is required to improve the present environment monitoring ? |
| | AVAILABILITY OF EQUIPMENT SUCH AS WATER SAMPLING KIT FOR CHEMICAL ANALYSIS OF WATER,DIGITAL CAMERA FOR EFFECTIVE REPORTING, |
| V6 | Do you organise your data manually (hard copy) or digitaly ? |
| | BOTH |
| V7 | What is required to harmonise a regional monitoring ? |
| | EQUIP LABORATORY,PROVISION LAND AND WATER TRANSPORT,TRAINING OF OFFICERS |
| V8 | Quality of previous data : any comments ? |
| | QUALITY IS OBSERVED/MAINTAINED THROUGH CONSISTENCE,COMPLETENESS AND ACCURACY OF DATA WITH USE OF THE HEALTH MANAGEMENT SYSTEM |
| V9 | Do you use internet ? |
| | YES.FOR COMMUNICATION PURPOSES TO THE PROVINCIAL HEALTH OFFICE AND HEADQUARTERS.ALSO FOR SEARCHING WORK RELATED AND SCIENTIFIC LITERATURE |
| V10 | How did your staff aquire internet knowledge ? |
| | BY DOWNLOADING USEFUL AND LATEST KNOWLEDGE AND PRESENT IT IN MEETINGS AND SYMPOSIUMS. |
| V11 | Is an organogram of your institution available ? |
| | SEE ATTACHED COPY |
| V12 | Did your institution contribute to scientific publications ? |
| | NO |
| V13 | Would your institution be able to participate to a long term monitoring without external support ? |
| | YES |
| V14 | Could your institution share past or present informations with the LTA ? |
| | DATA ON DISEASE TRENDS(WATER BORNE DISEASES) WRITTEN |
| V15 | Does your institution have ressources persons in environment ? |
| | YES,QUALIFICATIONS MENTIONED ON F2 LIST |

Appendix 28: Organogram of the Department of Health

Zambia, Mpulungu District



Appendix 29: Questionnaire Answers ZMD

| ZAMBIA- Zambia Meteorological Department (ZMD) (1/2) | |
|---|---|
| F1 | Field station: name and contact adress. |
| | Kasama Meteorological Office Toboolo K. Fred, toboolofk@yahoo.com; 260 977 867607 Meteorological station in the province (with WMO number): 1. Mbala (67413) 2. Kasama (67475) 3. Misamfu (67476) 4. Mpika (67477) 5. Isoka (67483) |
| F2 | Number of persons working in the station (by education level) ? |
| | 12 - Grade 12 Certificate in Basic Meteorology, Diploma in Meteorology, Diploma Remote Sensing Diploma Practical Theology |
| F3 | Do you presently monitor environmental parameters in relation with LT ? |
| | Yes ; Since 1995 |
| F4 | What parameters do you actually monitor ? |
| | Temperatures, Wind Speeds and Direction, Rainfall, Humidity Sunshine hours, Soil and Earth Temps, Cloud cover, Visibility, Solar Radiation and Evaporation. |
| F5 | What means of transport does have your station ? |
| | Car |
| F6 | Is your instution dealing with the lake, the watershed or both ? |
| | Both – Sustainable Agriculture and Riverine Issues |
| F7 | Means of communication ? |
| | Mobile Phones |
| F8 | Availability of electricity in the station ? |
| | 100% |
| F9 | Availability of electric generator in the station ? |
| | No |
| F10 | Availability of water in the station lab ? |
| | No Lab as yet |
| F11 | How many internet connection are operationnal in your station ? |
| | Only available at main office |
| F12 | Do you have suggestions to the long term monitoring ? (field) |
| | Establish automated buoy weather stations along the lake |
| V1 | In which field is your institution active ? |
| | WEATHER AND CLIMATE |
| V2 | What equipment is available in your institute for the monitoring ? |
| | ALL BASIC WEATHER MONITORING EQUIPMENT |
| V3 | Are documents available to explain the methodology for your monitoring? |

| ZAMBIA- Zambia Meteorological Department (ZMD) (2/2) | |
|---|---|
| V4 | Is a meteorological monitoring implemented in your station ? |
| | YES – WIND SPEED AND DIRECTION, AIR TEMPS, RAINFALL,HUMIDITY, RADIATION, SUNSHINE... |
| V5 | What is required to improve the present environment monitoring ? |
| | MORE WEATHER STATIONS AND AUTOMATED INSTRUMENTS |
| V6 | Do you organise your data manually (hard copy) or digitaly ? |
| | MANUALLY at the Province, digitaly at the HQ |
| V7 | What is required to harmonise a regional monitoring ? |
| | INTERNET FOR COMMUNICATIONS |
| V8 | Quality of previous data : any comments ? |
| | MAYBE COMPROMISED BY HUMAN ERROR – NEED FOR AUTOMATED EQUIPMENT TO COUNTER CHECK |
| V9 | Do you use internet ? |
| | YES |
| V10 | How did your staff aquire internet knowledge ? |
| | USE OF SEARCH ENGINES LIKE GOOGLE ACCORDING TO SUBJECT OF INTEREST |
| V11 | Is an organogram of your institution available ? |
| | YES |
| V12 | Did your institution contribute to scientific publications ? |
| | YES |
| V13 | Would your institution be able to participate to a long term monitoring without external support ? |
| | YES |
| V14 | Could your institution share past or present informations with the LTA ? |
| | ALL ARE WRITTEN MANUALLY & DIGITALLY AT HQ |
| V15 | Does your institution have ressources persons in environment ? |
| | YES |

Appendix 30: Questionnaire Answers Land Husbandry Department

| ZAMBIA-Ministry of Agriculture and Cooperatives/Land Husbandry (1/2) | |
|--|--|
| HQ1 | Contact address |
| | Ministry of Agriculture and Cooperatives, Department of Agriculture, Technical Services Branch, Land Husbandry Section, P.O. BOX 50291, Lusaka, ZAMBIA. Agric@maff.gov.zm/mnsishekanu@maff.gov.zm, +260255346, www.maco |
| HQ2 | Type of institution ? |
| | Government; see the roles of the Section attached. |
| HQ3 | Is there a station of your institution situated near lake Tanganyika ? |
| | Yes we have stations i.e. Kaputa District (Mr. Ronald Chewe +260979445586); Mpulungu District (Mr. Patrick Katongo +260978288038) The basin is also supported by a Senior Land Husbandry Officer (Mr. Innocent B. Mulauzi) at the Provincial Headquarters, P.O. Box 410018, Kasama, 2010. Cell No. +2609777801614 |
| HQ4 | Do you have an official mandate related to monitoring of L. Tanganyika? |
| | Yes, our office is part of the Integrated Land-use Assessment programme that monitors land-use changes in three areas of the Basin. We also have the mandate to monitor agricultural land utilisation and management particularly in cultivated and grazing lands for controlling soil erosion and sedimentation as well as enhancement of soil productivity. This is not being done due to resource constraint. |
| HQ5 | Would a change of mandate be necessary to implement this monitoring ? |
| | Yes it would! See HQ4 above particularly for enforcement of proper land use and management. |
| HQ6 | Would you agree to participate to a long term monitoring & information exchange ? (by wish/by mandate or both?) |
| | Yes! By both wish and national mandate. |
| HQ7 | Cooperation with other institution ? |
| | Yes! Food and Agricultural Organisation; UNDP; ADB; World Bank; COMESA Secretariat, SADC; CARE; AFRICARE, Programme Against Malnutrition; World Vision International ect. Ect. |
| HQ8 | Does your institution get financing from UN/AFDB or other international organisation ? |
| | Previously yes and a programme may start receiving funds soon under UNDP/GEF |
| HQ9 | Does your staff need specific training ? |
| | Yes! Particularly in Participatory Agricultural Land-use planning and management and its monitoring. |
| HQ10 | Does your institution provide specific training ? |
| | Yes, we support training. |
| HQ11 | Are training program of your institution open to other participants? |
| | Yes they are open as long depending on the availability of funds. |
| HQ12 | Who mainly finance your institution ? |
| | Government, The Royal Norwegian Government, FAO, EU. |
| QH13 | Do you write projects proposals for financing ? |
| | Yes! |
| HQ14 | Do you have suggestions to the long term monitoring ? |
| | We may have something to contribute upon having known more of the implementation components of the project. |
| F1 | Field station: name and contact adress. |
| | Kaputa District, Department of Agriculture, Land Husbandry (Mr. Ronald Chewe +260979445586); Mpulungu District, Department of Agriculture, Land Husbandry (Mr. Patrick Katongo +260978288038). The basin is also supported by a Senior Land Husbandry Officer (Mr. Innocent B. Mulauzi) at the Provincial Headquarters, P.O. Box 410018, Kasama, 2010. Cell No. +2609777801614 |
| F2 | Number of persons working in the station (by education level) ? |
| | Kaputa District: Ronald Chewe -Junior Technical Officer (Certificate in General Agriculture) and works with 12 field staff at field level who are at Certificate level. At District level he is supervised by one Agricultural Degree level officer and a Diploma level Officer.. Mpulungu District: Patrick Katongo is a Junior Technical Officer, with a General Certificate in Agriculture who is working with Mr. Kangungu Junior Technical Officer at District level working with 16 field staff at field level who are at Certificate level. At District level he is supervised by two Agricultural Degree level officers. |
| F3 | Do you presently monitor environmental parameters in relation with LT ? |
| | Yes. |
| F4 | What parameters do you actually monitor ? |
| | Land use parameters i.e. area under cultivation, area covered of cultivated land under conservation agriculture and physical erosion control measures. |
| F5 | What means of transport does have your station ? |
| | One field vehicle and motorbikes in some places. |
| F6 | Is your instution dealing with the lake, the watershed or both ? |
| | Yes but in a very limited matter. |

| ZAMBIA-Ministry of Agriculture and Cooperatives/Land Husbandry (2/2) | |
|---|---|
| F7 | Means of communication ? |
| | Telephone |
| F8 | Availability of electricity in the station ? |
| | ? |
| F9 | Availability of electric generator in the station ? |
| | ? |
| F10 | Availability of water in the station ? |
| | N/A |
| F11 | How many internet connection are operationnal in your station ? |
| | Nil |
| F12 | Do you have suggestions to the long term monitoring ? (field) |
| | There is need to inject and strengthen the locally available Institutions |
| V1 | In which field is your institution active ? |
| | land use and climate |
| V2 | What equipment is available in your institute for the monitoring ? |
| | Chain and Compass GPS, Rain Gauges. |
| V3 | Are documents available to explain the methodology for your monitoring? |
| | No |
| V4 | Is a meteorological monitoring implemented in your station ? |
| | Rainfall |
| V5 | What is required to improve the present environnement monitoring ? |
| | Replacing the manual with automatic raingauges. |
| V6 | Do you organise your data manualy (hard copy) or digitaly ? |
| | Manually |
| V7 | What is required to harmonise a regional monitoring ? |
| | ? |
| V8 | Quality of previous data : any comments ? |
| | Nil |
| V9 | Do you use internet ? |
| | Yes! For communication, searching for scientific scientific literature, using Google to find work-related information . |
| V10 | How did your staff aquire internet knowledge ? |
| | We have linked ourselves to many Net-working that distribution latest developmental issues and reports. |
| V11 | Is an organogram of your institution available ? |
| | |
| V12 | Did your institution contribute to scientific publications ? |
| | |
| V13 | Would your institution be able to participate to a long term monitoring without external support ? |
| | Yes but in a limited capacity. |
| V14 | Could your institution share past or present informations with the LTA ? |
| | To be followed with District and province later. |
| V15 | Does your institution have ressources persons in environnement ? |
| | Yes! To be send later. |

Appendix 31: Questionnaire Answers Forestry Department

| | |
|-------------|---|
| | ZAMBIA- FORESTRY DEPARTMENT |
| HQ1 | Contact address |
| | FORESTRY DEPARTMENT, P. O. BOX 50042, 2ND FLOOR, KWACHA HOUSE ANNEX, CAIRO ROAD, LUSAKA, ZAMBIA. Email : annamasinja@yahoo.com, dkashole@mtetr.gov.zm, Phone : +260 211 226 131 |
| HQ2 | Type of institution ? |
| | GOVERNMENT- FORESTRY DEPARTMENT - see attached description |
| HQ3 | Is there a station of your institution situated near lake Tanganyika ? |
| | DISTRICT FORESTRY OFFICER, MPULUNGU DISTRICT |
| HQ4 | Do you have an official mandate related to monitoring of L. Tanganyika? |
| | The mission statement of the Forestry Department is to ensure sustainable flow of wood and non-wood forest products and services while at the same time ensuring protection and maintenance of biodiversity for the benefit of the present and future generations through the active participation of all stake holders. The overall objective of the forestry sector is to enhance the quantitative and qualitative contributions of the sector towards the nation's socio-economic development in a sustainable manner. |
| HQ5 | Would a change of mandate be necessary to implement this monitoring ? |
| | Changes to the mandate are inevitable and this has been considered in the revised Forestry Policy of 2009 which has been submitted to the Zambia Government Cabinet office for approval. |
| HQ6 | Would you agree to participate to a long term monitoring & information exchange ? (by wish/by mandate or both?) |
| | Yes by wish and national mandate |
| HQ7 | Cooperation with other institution ? |
| | Active cooperation exists with SADC and COMESA in the region. The Department is actively involved in the development of the SADC strategy on Forestry, SADC REDD+ Programme. At international level, it has been collaborating with UN Agencies such as FAO, UNEP, IFAD and UNOPS and UNDP. The Forestry Department has been leading the process of developing a UNREDD+ Programme for Zambia that has just been approved by the UNREDD Policy Board for possible Funding. FAO is also supporting Forestry Department with Integrated Land Use Assessment (ILUA) Programme and National Forest Programme Facility (NFPF) |
| HQ8 | Does your institution get financing from UN/AFDB or other international organisation ? |
| | Yes, from UNDP and FAO |
| HQ9 | Does you staff need specific training ? |
| | SPECIFIC TRAININGS : ENVIRONMENTAL IMPACT ASSESSMENTS, DYNAMICS OF RURAL LIVELIHOODS, MODERN TOOLS FOR IMPROVED FOREST RESOURCE ASSESSMENTS (SPATIAL TOOLS), ENVIRONMENTAL EDUCATION, AREAS REQUIRING SUPPORT:Update information on forest resources, socio-economy, and land-use for planning and sustainable management of the forest resources/ Development of criteria and indicators for sustainable forest management in Zambia/ Developing a tracking system for forest produce to ensure appropriate control and management of forests/ Developing appropriate research strategies focusing on applied research aimed at improving silvicultural methods of managing indigenous forests./ Need for Capacity development in new and emerging areas of forest management like climate change./ Developing a forest information management system that responds to current challenges |
| HQ10 | Does you institution provide specific training ? |
| | NO |
| HQ11 | Are training program of your institution open to other participants? |
| | N/A |
| HQ12 | Who mainly finance your institution ? |
| | GOVERNMENT THROUGH THE CENTRAL TREASURY |
| HQ13 | Do you write projects proposals for financing ? |
| | YES |
| HQ14 | Do you have suggestions to the long term monitoring ? |
| | |

Appendix 32: Additional Description Forestry Department (CFR HQ2)

GOVERNMENT- FORESTRY DEPARTMENT

The portfolio functions of the Forestry Department are legally supported by the Forests Act No; 39 Cap 199 of 1973. The Department uses general development principals that are contained in the National Forestry Policy (NFP) of 1998 and government directives issued from time to time. Broadly, forestry sector development is guided by the Policy (NFP).

The management of forests in Zambia is the responsibility of the Forestry Department which ensures that it reports to Government and other stakeholders on: extent of forest resources, biological diversity, forest health and vitality, productive functions of forest resources; protective functions of forest resources, socio-economic functions, legal, policy and institutional framework.

CURRENT GOVERNMENT INITIATIVES IN THE FORESTRY SECTOR

The Government prepared a 20 year forestry action plan (1997 – 2017) called the Zambia Forestry Action Plan (ZFAP), which covers the period 1998 to 2018. The Plan recognized that the vast forestry resources were under considerable strain and proposed policy and programme actions to ensure sustainable protection, management, production and utilization of the country's forest resources. The plan offers opportunities in the forestry sector to different stakeholders in collaborative management and private sector investment.

Participatory Forest Management

Joint Forest Management (JFM) is aimed at promoting collaborative management of forests between government and local communities and the private sector. This is aimed at enhancing sustainable forest management. The initiative provides an opportunity for increased user rights and benefit sharing mechanisms that would help in developing stewardship principles in stakeholders.

UN-REDD programme

The UN-REDD is a collaborative programme supported by three United Nations Agencies namely UNDP, FAO and UNEP aimed at preparing Zambia for the post 2012 Kyoto Protocol climate change regime. It is expected that a National Strategy to reducing emissions from deforestation and forest degradation will be developed. The programme offers opportunities for integrated approach to forest and land resource including public, private partnerships.

Integrated Landuse Assessment (ILUA) Project

The programme aims at strengthening the capacity in planning and implementation of Sustainable Forest Management and REDD through better information, capacity building dissemination of information, and improved multi-sectoral dialogue. The programme will generate data and information which would help decision makers make informed decisions.

National Forestry Programme Facility (NFPP)

National Forest Programmes Facility (NFPP) provides an appropriate platform for multi-stakeholder dialogue and agreed action towards sustainable forest management as described in national forest programmes. The stakeholders play an essential role in addressing critical forest sector issues, to analyze the current situation, to elaborate adequate policies and strategies and to define measures for implementation, monitoring, coordination and cooperation.

Appendix 33: Questionnaire Answers ZWA

| ZAMBIA- Zambia Wildlife Authority (ZWA) (1/2) | |
|--|--|
| HQ1 | Contact address |
| | Zambia Wildlife Authority Private Bag 1 Chilanga ZAMBIA Telephone : +260211278513 Email : info@zawa.org.zm www.zawa.org.zm |
| HQ2 | Type of institution ? |
| | Governemental ; Statutory body established by Act of Parliament the Zambia Wildlife Act No. 12 of 1998 for the conservation and management of wildlife resources. |
| HQ3 | Is there a station of your institution situated near lake Tanganyika ? |
| | Yes, Nsumbu Sector, station at Nsumbu. |
| HQ4 | Do you have an official mandate related to monitoring of L. Tanganyika? |
| | Yes, 1.4km wide of approximately 60km Lake Tanganyika shore is part of Nsumbu National Park under our management. We are responsible for all conservation, protection and management aspects in this area. |
| HQ5 | Would a change of mandate be necessary to implement this monitoring ? |
| | No |
| HQ6 | Would you agree to participate to a long term monitoring & information exchange ? (by wish/by mandate or both?) |
| | Yes. |
| HQ7 | Cooperation with other institution ? |
| | Yes ; WWF, UNDP, LTA, Govt. Ministries and Departments etc |
| HQ8 | Does your institution get financing from UN/AFDB or other international organisation ? |
| | UNDP provided funding in the Lake Tanganyika area. |
| HQ9 | Does you staff need specific training ? |
| | Yes, more capacity building will be required for them to effectively participate in the programme |
| HQ10 | Does you institution provide specific training ? |
| | |
| HQ11 | Are training program of your institution open to other participants? |
| | Yes ; cooperating partners especially from the local community |
| HQ12 | Who mainly finance your institution ? |
| | Self and cooperating partners |
| QH13 | Do you write projects proposals for financing ? |
| | Yes. |
| HQ14 | Do you have suggestions to the long term monitoring ? |
| | No. |
| F1 | Field station: name and contact address. |
| | Nsumbu Sector, Zambia Wildlife Authority. Park Ranger ; Mr. Kasempa |
| F2 | Number of persons working in the station (by education level) ? |
| | Not readily available |
| F3 | Do you presently monitor environmental parameters in relation with LT ? |
| | Yes ; monitoring of theTanganyika fishery along 60Km Nsumbu National Park boundary. Human settlement offshore (encroachments into the National Park) |
| F4 | What parameters do you actually monitor ? |
| | 1. Verbal agreements with the local community on volumes of fishermen at every given fishing time. 2. Random patrols for law enforcement |
| F5 | What means of transport does have your station ? |
| | 1. Motor Boat 2. Motor Vehicle |
| F6 | Is your instution dealing with the lake, the watershed or both ? |
| | Both |

| ZAMBIA- Zambia Wildlife Authority (ZWA) (2/2) | |
|--|---|
| F7 | Means of communication ? |
| | VHF Base Radio |
| F8 | Availability of electricity in the station ? |
| | No |
| F9 | Availability of electric generator in the station ? |
| | No |
| F10 | Availability of water in the station ? |
| | No |
| F11 | How many internet connection are operational in your station ? |
| | No Internet connection a tour office but the Tourism Operator in the area has internet. |
| F12 | Do you have suggestions to the long term monitoring ? (field) |
| | No. |
| V1 | In which field is your institution active ? |
| | Biodiversity |
| V2 | What equipment is available in your institute for the monitoring ? |
| | None |
| V3 | Are documents available to explain the methodology for your monitoring? |
| | No. |
| V4 | Is a meteorological monitoring implemented in your station ? |
| | No. |
| V5 | What is required to improve the present environment monitoring ? |
| | Capacity building in terms of equipment and human resource. |
| V6 | Do you organise your data manually (hard copy) or digitaly ? |
| | manual |
| V7 | What is required to harmonise a regional monitoring ? |
| | Capacity building in terms of equipment and human resource. |
| V8 | Quality of previous data : any comments ? |
| | No. |
| V9 | Do you use internet ? |
| | No. |
| V10 | How did your staff aquire internet knowledge ? |
| | No. |
| V11 | Is an organogram of your institution available ? |
| | |
| V12 | Did your institution contribute to scientific publications ? |
| | Yes ; List not readily available. |
| V13 | Would your institution be able to participate to a long term monitoring without external support ? |
| | Yes. |
| V14 | Could your institution share past or present informations with the LTA ? |
| | Yes |
| V15 | Does your institution have ressources persons in environment ? |
| | Yes ; CVs not readily available |

Appendix 34: Questionnaire Answers University of Zambia

| ZAMBIA- University of Zambia (UNZA) | |
|--|---|
| HQ1 | Contact address |
| | The Public Relations Officer The University of Zambia P.O. Box 32379 Great East Road Lusaka, Zambia www.unza.zm |
| HQ2 | Type of institution ? |
| | Documents will be available through the Public Relations Office of the University |
| HQ3 | Is there a station of your institution situated near lake Tanganyika ? |
| | No |
| HQ4 | Do you have an official mandate related to monitoring of L. Tanganyika? |
| | No |
| HQ5 | Would a change of mandate be necessary to implement this monitoring ? |
| | Yes |
| HQ6 | Would you agree to participate to a long term monitoring & information exchange ? (by wish/by mandate or both?) |
| | Yes |
| HQ7 | Cooperation with other institution ? |
| | Yes : Contact Public Relations Office for details |
| HQ8 | Does your institution get financing from UN/AFDB or other international organisation ? |
| | Contact Public Relations Office |
| HQ9 | Does you staff need specific training ? |
| | Yes |
| HQ10 | Does you institution provide specific training ? |
| | Yes, the details are on the University Website : www.cbu.edu.zm |
| HQ11 | Are training program of your institution open to other participants? |
| | Yes, it is an international university with training programmes which are open to any interested individuals or institutions |
| HQ12 | Who mainly finance your institution ? |
| | The Government of the Republic of Zambia |
| QH13 | Do you write projects proposals for financing ? |
| | Yes |
| HQ14 | Do you have suggestions to the long term monitoring ? |
| | This could be enhanced by engaging the University of Zambia researchers and students who should have a research station on the lake . |

Appendix 35: Questionnaire Answers Copperbelt University

| ZAMBIA- The Copperbelt University (CBU) | |
|--|--|
| HQ1 | Contact address |
| | The Public Relations Officer The Copperbelt University P.O. Box 21692 Jambo Drive, Riverside Kitwe, Zambia www.cbu.edu.zm |
| HQ2 | Type of institution ? |
| | Documents will be available through the Public Relations Office of the University |
| HQ3 | Is there a station of your institution situated near lake Tanganyika ? |
| | No |
| HQ4 | Do you have an official mandate related to monitoring of L. Tanganyika? |
| | No |
| HQ5 | Would a change of mandate be necessary to implement this monitoring ? |
| | Yes |
| HQ6 | Would you agree to participate to a long term monitoring & information exchange ? (by wish/by mandate or both?) |
| | Yes |
| HQ7 | Cooperation with other institution ? |
| | Yes : Contact Public Relations Office for details |
| HQ8 | Does your institution get financing from UN/AFDB or other international organisation ? |
| | Contact Public Relations Office |
| HQ9 | Does you staff need specific training ? |
| | Yes |
| HQ10 | Does you institution provide specific training ? |
| | Yes, the details are on the University Website : www.cbu.edu.zm |
| HQ11 | Are training program of your institution open to other participants? |
| | Yes, it is an international university with training programmes which are open to any interested individuals or institutions |
| HQ12 | Who mainly finance your institution ? |
| | The Government of the Republic of Zambia |
| HQ13 | Do you write projects proposals for financing ? |
| | Yes |
| HQ14 | Do you have suggestions to the long term monitoring ? |
| | This could be enhanced by engaging the Copperbelt University researchers and students who should have a research station on the lake . |

Appendix 36: Resources Persons Within Possible Partner Institutes

| BURUNDI | |
|--|---|
| INECN | <i>Among the resource persons</i> |
| Biologists, Agronomy Ingeneers, Chemists, Industrial Ingeneers... Most are specialised in various environmental fields. | Benoît Nzigidahera Alphonse Fofo (CV1) François Ndabahagamyé & others |
| Direction des Eaux Pêches et Pisciculture | |
| Specialists in fish identification | |
| NCU – Burundi | |
| Environment | Felix Nicayenzi (CV) |
| Fisheries | Antoine Kiyuku (CV) |
| University of Burundi | |
| Many specialists including in the field of Fish, plankton (phyto and zoo), biodiversity and chemistry. | Gaspard Ntakimazi David Nahimana (CV) & others |
| IGEBU | |
| Meteorology, Hydrology, cartography.. | |
| REGIDESO | |
| Water chemistry specialist Divers | Joseph Ndayegamyé Prime Niyongabo Ir Liberat Nsabimana |
| D.R.CONGO | |
| CRH-Uvira | |
| Various specialists (water quality, phytoplankton, fisheries, fish taxonomy, socio-economist...) | Dr Muderhwa Nshombo (CV) N ' Sibula Mulimbwa (CV) Mayembe Milenge (CV) Gérard Kitungano (CV) Amundala Shekani (CV) Bashonga Bishobibiri (CV) & others |
| Ministry of Environment | |
| Chemist GIS specialist | |
| TANZANIA | |
| TACARE | |
| Anthropologists and Conservation biologists. GIS specialist M&E specialist | |
| TAFIRI | |
| Various specialists in fish biology, fisheries or aquaculture | Msafiri, Mathias (CV) Huruma F. Mgana (CV) Ismael Aaron Kimirei (CV) Amon Paul Shoko (CV) Julius Assam (CV) Julietha Bazil (CV) & others with TAFIRI HQ |

1 (CV means that a curriculum vitae was made available. It will be transferred to the LTA database)

| ZAMBIA | |
|---|---|
| Copperbelt University (CBU) | |
| Biology, Phylogeography, Taxonomy... Environmental Ecology, Environmental Chemistry, Waste Management, Fisheries.. Aquaculture | Cyprian Katongo (CV) Misery Mulele Nabuyanda (CV) Simuchimba Grant (CV) |
| Department of Health | |
| Clinical medicine, environmental health studies, pharmacy technology, diploma in biomedical sciences, medical laboratory | Lemmy Situnyama Mackson Banda Amon b. Phiri Benjamin Nsenje Evans Kangwa (& 10 others) |
| Department of Fisheries | |
| Ecology, fisheries, aquaculture | Danny Sinyinza Lusebo Nalishuwa Anamunda Loyd Hambiya & others with DOF HQ |
| NCU – Zambia | |
| Environment | Chintu Richard |
| PMU-Zambia | |
| Land Ecology Agriculture Conservation Biology Agro-Forestry | Simbotwe Mwiya Martin Mbewe Rabby Mulangala |

Appendix 37: Inventory Departement des Pêches, Bujumbura

| N° | Items | Nbre | State | OBSERVATION |
|----|-------------------------------|------|-------|-----------------|
| 1 | aquarium | 15 | 2 | without pump |
| 2 | compressor | 1 | 1 | |
| 3 | computer | 1 | 1 | |
| 4 | conductimetre | 3 | 2 | to recalibrate |
| 5 | cooler box | 1 | 3 | |
| 6 | counting chamber (Lund) | 1 | 1 | |
| 7 | deep freezer | 1 | 1 | |
| 8 | depth gauge | 1 | 1 | |
| 9 | electronic balance | 1 | 1 | |
| 10 | fridge | 1 | 2 | |
| 11 | GPS | 1 | 1 | |
| 12 | ichthyometer | 2 | 1 | |
| 13 | life jacket | 3 | 1 | |
| 14 | messenger | 1 | 1 | |
| 15 | oxymetre | 1 | 1 | probe and cable |
| 16 | pH metre | 1 | 2 | to recalibrate |
| 17 | phytoplankton net (20µm size) | 5 | 1 | |
| 18 | printer | 1 | 1 | |
| 19 | projection screen | 1 | 1 | |
| 20 | sampling rope | 1 | 1 | |
| 21 | scientific microscope | 1 | 1 | no accessories |
| 22 | Spectrophotomètre | 2 | 1 | |
| 23 | steam oven | 1 | 2 | to complete |
| 24 | surge regulator | 1 | 1 | |
| 25 | water distillator | 1 | 1 | |
| 26 | weight balance 5 kg | 1 | 3 | |

STATE 1 = good 2 = to be fixed 3 = poor state; may not be fixed

Appendix 38: Inventory CRH

| N° | Items | Nb | Type | State |
|----|---|----|-----------------------|-------|
| 1 | Caliper | 1 | | 1 |
| 2 | Centrifugator | 1 | Vortex genie | 1 |
| 3 | Centrifugator | 1 | Centurion 1000 series | 1 |
| 4 | Conductimeter | 1 | HANNA CH | 3 |
| 5 | Currentmeter | 1 | | 3 |
| 6 | Deep freezer | 1 | Sanyo | 3 |
| 7 | Deep freezer | 1 | Lec | 1 |
| 8 | Dissecting Trays | 3 | | 1 |
| 9 | Dissection tools | 1 | | 1 |
| 10 | Distillator | 2 | Distinction | 1 |
| 11 | diving gear | 3 | | 3 |
| 12 | Electronic weight balance | 1 | ADN Elecric balance | 3 |
| 13 | External lamp for stereo microscope | 1 | KL1500 Electronic | 1 |
| 14 | Fish lenght measuring scale | 1 | | 1 |
| 15 | Fridge | 1 | Lec | 1 |
| 16 | Graduated cylinder | 3 | | 1 |
| 17 | Ichtyo mètre | 2 | | 1 |
| 18 | Manual centrifugator | 1 | | 1 |
| 19 | Measuring scale (plastic) | 1 | | 1 |
| 20 | Oxymetre | 1 | HANNA | 3 |
| 21 | pHmeter, conductimeter | 1 | HANNA Combo | 2 |
| 22 | Porcelain crucible | 3 | | 1 |
| 23 | Portable weight balance (sedimentation) | 1 | AND EK 200g | 1 |
| 24 | Precision balance | 1 | Philip Hovis | 1 |
| 25 | Pressure cooker | 1 | Tradition | 1 |
| 26 | Pressure cooker | 1 | | 1 |
| 27 | scientific microscope | 1 | Olympus CH3 | 1 |
| 28 | Secchi disk | 1 | | 1 |
| 29 | Silicate gel desiccator | 1 | | 1 |
| 30 | Spectrophotometre | 1 | HACH DR2000 | 1 |
| 31 | Spring balance of 23 kg | 3 | RAPALAX SALTER | 1 |
| 32 | Steaming machine | 1 | DN-42 | 1 |
| 33 | Stereo microscope | 1 | Olympus | 1 |
| 34 | Stereo microscope | 1 | Nikon | 1 |
| 35 | Vacuum pump | 1 | | 3 |
| 36 | Weight balance 0.5 kg | 1 | FUN | 1 |
| 37 | Weght balance 2 kg | 1 | Harvard | 1 |

STATE 1 = good 2 = to be fixed 3 = poor state; may not be fixed

Appendix 39: Inventory TAFIRI Kigoma

| N° | Items | Nb | Brand/Type | State | Remarks |
|----|--|----|-------------------------|-------|------------|
| 1 | Box for carrying fishes | 6 | | 2 | |
| 2 | Cooler boxes | 1 | | 1 | |
| 3 | Counting chamber (lund) | 1 | | | |
| 4 | Electronic balances | 2 | | 3 | |
| 5 | Freezers | 2 | Whirlpool, west frost | 2 | |
| 6 | Graduated cylinder | 5 | | 1 | |
| 7 | Lab coats | 5 | | 3 | |
| 8 | Manual centrifugation unit | 1 | | 1 | |
| 9 | Mask | 3 | | | |
| 10 | Measuring boards | 1 | | 3 | |
| 11 | Messenger (for closing limno bottle) | 3 | | 3 | |
| 12 | Oven | 1 | Raven oven | 2 | |
| 13 | Paddles | 2 | | 1 | |
| 14 | Phytoplankton net (meshsize, | 1 | | 3 | |
| 15 | Plastic sample bottles (25ml) | 5 | | | |
| 16 | Refrigerators | 1 | WestPoint | 2 | old |
| 17 | Sampling ropes | 1 | | 3 | |
| 18 | Secchi Disc | 1 | | | |
| 19 | Tension regulator | 1 | APC | 3 | |
| 20 | Thermometer (0 to 100oc) | 3 | | 1 | |
| 21 | Vacuum pump | 1 | KnF Neuberger | 2 | |
| 22 | Zooplankton net (mesh size, | 1 | | 3 | |
| 23 | Zooplankton counting chambers | 1 | | 3 | |
| 24 | Diving suit | 1 | | | |
| 25 | Regulator | 1 | | | |
| 26 | Diving jackets(BCD) | 1 | | | |
| 27 | Research boat(hard) | 1 | ECHO RV250HP VOLVO | 2 | Fiber boat |
| 28 | Electrical winch 300m on board research | 1 | | | |
| 29 | Manual winch (300m) on board research | 1 | | | |
| 30 | Radar on research boat | 1 | | | |
| 31 | Fishing lights | 9 | | 2 | |
| 32 | Outboard engine | 2 | MARINA 25HP, MARINA15HP | 2 | |
| 33 | Lift net size of mesh(size of mesh, total | 1 | 10mm,45/65m | 1 | |
| | | | | | |
| | STATE 1 = good 2 = reparable 3 = not reparable | | | | |

Appendix 40: Needs as Identified by TAFIRI Kigoma

Laboratory building:

Windows

22 aluminium windows need to be fitted in the lab building, 8 of them should behind the labs should be increased their sizes.

22 bugler proof need to be fitted

Wall

Outside the building- Water paints, fixing cracks and worn out cemented parts

Inside the building – Silk paint

Extension of the partitioning walls so that each room becomes safe and independent security wise.

Floor

Fitting of the floor tiles in the whole building

fixing cracks and worn out cemented parts

Air condition

Fitting the two offices with air condition

Research Vessel (Rv) Echo

Rehabilitation of RV Echo will involve hiring a consultant who will assist in identification of specific activities to be done. The consultant will normally work in close collaboration with TAFIRI. However the following list of equipments may give guidance to what should be done with the boat.

New engine 250/300 horse power

Navigation equipments

Radar (Furuno) 32 Km range

Radio call

Echo sounder

GPS

Survival equipments

Life jackets 20

Life rings

Fire extinguisher

Small generator (1) AC/DC capacity

Batteries N150*2/ N200*2

1 propeller shaft

1 propeller

Oil filters 24

Diesel filters 48

Impeller 10

Marine paints

Fibber material and resin gums

Fence pipes

Anchor 1

Overhaul of sleeping bed

2 new wipers

Gauges

acceleration

Fuel

Oil

Charging system

RPM

Timer/clock

Maintenance of

Door

Side windows

2 wind mirrors

Maintenance of captain chair

Navigation lights

Search lights

Tanzania flag

Overhaul of the electric system

Massive cleanliness of the fuel tanks and fitting them with cleaning system

Appendix 41: Inventory Department of Fisheries Mpulungu

| N° | Items | Nb | Brand/type | State | Remarks |
|----|--|----|---------------|-------|---|
| 1 | boat for experimental fishing | 1 | VIKING | 1 | |
| 2 | computer | 2 | | 1 | |
| 3 | conductivitimeter | 1 | | 2 | |
| 4 | depth meeter | 1 | | 3 | |
| 5 | dissecting Kit | 1 | | 3 | |
| 6 | distiller | 1 | | 1 | |
| 7 | diving jacket (BCD) | 2 | | 3 | |
| 8 | electrical centrifugation unit | 1 | | 1 | |
| 9 | electrical winch on board research boat | 1 | | 2 | with cable |
| 10 | external lamp for stéréo microscop | 1 | | 2 | |
| 11 | freezer | 2 | | 2 | |
| 12 | gilnet | 12 | MULTIFILAMENT | 2 | (mesh size 25,37,50,63,76,89,102,114,127,140,152,165 &178mm). 45m all nets. |
| 13 | GPS | 1 | | 2 | |
| 14 | life jackets | 9 | | 2 | |
| 15 | measuring fish meter | 2 | | 2 | |
| 16 | messenger | 2 | | 2 | |
| 17 | meteorological station | 1 | | 2 | |
| 18 | non closing zooplankton net | 1 | | 3 | |
| 19 | oven | 1 | | 2 | |
| 20 | oxymetre | 1 | | | 80M Cable length |
| 21 | paddles | 2 | WOODEN | 2 | |
| 22 | ph meter | 1 | | 2 | |
| 23 | precision balance | 1 | | 2 | |
| 24 | printer | 2 | | 2 | |
| 25 | regulator | 2 | | 3 | |
| 26 | research boat (hard) | 1 | METAL | 1 | Silver shoal |
| 27 | sampling ropes | 1 | | 2 | |
| 28 | secchi disk | 1 | | 2 | |
| 29 | spectrophotometer | 1 | | 2 | |
| 30 | tent | 1 | | 3 | |
| 31 | thermometre (0 to 100°C) | 1 | | 1 | |
| 32 | vacuum Pump | 2 | | 1 | |
| 33 | weight balance 0.1 kg | 1 | | 2 | |
| | | | | | |
| | STATE 1 = good 2 = reparable 3 = not reparable | | | | |

Appendix 42: Inventory Department of Water Affairs

| DWA-Headquarters | |
|---|----|
| Equipment Available at DWA headquarter | |
| | Nb |
| Inflatable boat | 1 |
| Dumpy Level | 1 |
| Current maters (Price, Ott, Nikasa, etc) | 1 |
| Pygmy Current Meter | 1 |
| Sinker Weight (7 kgs) | 1 |
| Wading Boots/(Chest Waders) | 0 |
| Equipment Available at DWA Northern Province-Lake Tanganyika | |
| | Nb |
| Motor vehicles | 1 |
| Motor cycle (Off the road) | 1 |
| (a)Meters for the following parameters: | |
| -Manganese | 1 |
| -Iron | 1 |
| -EC | 1 |
| (b) Distillation Unit (Kasama) | 1 |
| (c)Millipore Environmental Potable Duo (or multi) chamber | 1 |
| (d)Sampling bottles | 15 |
| (e)Re-usable petri dishes | 10 |
| (f)Chemical, media and reagents for Faecal and Total Coliforms. | |
| | - |

Appendix 43: Water Analyses Zambian Bureau of Standard

WATER

| Bottled Drinking Water [ZS 388:2000] | | |
|--|--------------------------|--------------|
| Parameter [Physical + Chemical] | Test Method | Cost [ZMK] |
| Conductivity | APHA 2120 B, ZS ISO 7888 | 45,000.00 |
| pH | APHA 4500 H | 45,000.00 |
| Total Dissolved Solids (TDS) | APHA 2540 C | 45,000.00 |
| Total Suspended Solids (TSS) | APHA 2540 D | 45,000.00 |
| Turbidity | APHA 2130, ZS ISO 7027 | 45,000.00 |
| Total Alkalinity | | 45,000.00 |
| Biological Oxygen Demand (BOD) | | 45,000.00 |
| Calcium Hardness | | 45,000.00 |
| Chemical Oxygen Demand (COD) | | 45,000.00 |
| Chloride content | APHA 4500 | 45,000.00 |
| Iron | APHA 3500 | 45,000.00 |
| Magnesium | APHA 3500 | 45,000.00 |
| Nitrates | APHA 4500 | 45,000.00 |
| Nitrites | APHA 4500 | 45,000.00 |
| Potassium | APHA 3500 | 45,000.00 |
| Sodium | APHA 3500 | 45,000.00 |
| Sulphates | APHA 4500, AOAC 973.57 A | 45,000.00 |
| Sulphides | | 45,000.00 |
| Phosphates | APHA 4500 | 45,000.00 |
| Full Analysis [Physical + chemical Parameters] | | 700,000.00 |
| Full Microbiological Analysis | | 300,000.00 |
| Full determination of metals | AAS | 550,000.00 |
| Total cost per sample | | 1,550,000.00 |

| Metals in Foods, Drinks and Water | | |
|---|------------------|----------------|
| Parameter | Test Method | Cost [ZMK] |
| Sample preparation | | 25,000.00 |
| Aluminium, Arsenic, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Nickel, potassium, Selenium, Sodium, Strontium, Zinc | AAS | 60,000.00 each |
| Full determination of above metals / sample | AAS | 550,000.00 |
| Lithium, Sodium, Potassium | Flame photometry | 60,000.00 each |

| Microbiological Analysis of Foods, Drinks and Water | | |
|---|----------------------------|------------|
| Parameter | Test Method | Cost [ZMK] |
| Sample preparation | | 25,000.00 |
| Aerobic plate count at 35°C for 24 hours | Plate count technique | 60,000.00 |
| E. Coli | Conventional method | 55,000.00 |
| Faecal coliforms | MPN / Membrane filtration | 60,000.00 |
| Salmonella spp | Conventional method | 60,000.00 |
| Staphylococcus aureus | Conventional method | 60,000.00 |
| Total coliforms | MPN | 60,000.00 |
| Total Viable Count | Plate count technique | 60,000.00 |
| Yeast and moulds | Dilution plating technique | 60,000.00 |
| Full Microbiological Analysis | | 300,000.00 |

Appendix 44: Agenda Monitoring Framework Workshop

Also see : UNDP/GEF Project on Lake Tanganyika (2010). Towards a Regional Intergrated Environmental Management Programme for Lake Tanganyika. Workshop Report, March 2010, 1-32.

| MONITORING FRAMEWORK WORKSHOP | | March 30, 2010 Bujumbura |
|--------------------------------------|--|----------------------------------|
| Time | Activity | Chairperson / Facilitator |
| 08:00 | Registration | |
| 08:30 | Welcoming Speeches Statement by UNDP Burundi Country Representative, Ms. Aissata De Statement by Dr. Henry Mwima, Executive Director LTA | Ir. Gabriel Hakizimana |
| 08:50 | Official Opening by the Minister of Water, Land Environment and Urban Planning, Hon. D. Nduwimana | |
| 09:00 | Statements by Heads of Delegations of the Lake Tanganyika riparian countries | Maguswi Charles (ZAM) |
| 09:40 | Introduction to the Workshop Prof. Laurent Ntahuga, Regional Coordinator UNDP/GEF Project | |
| 09:55 | Group Photo | |
| 10:00 | Coffee/Tea break | |
| 10:20 | Towards a Regional Integrated Environmental Monitoring Programme for Lake Tanganyika by Dr Pierre-Denis Plisnier, Consultant UNDP/GEF Project and Climate Change in Burundi by Mr. Didace Rwabitega from IGEBU | |
| 11:00 | Proposed methodologies for short and long term monitoring - Land-use and Erosion: Dr. Adrien Radcliffe (ICRAF) - Water Quality: Dr Pierre-Denis Plisnier (Consultant, UNDP/GEF Project) - Fisheries: Dr Martin van der Knaap (Consultant, FAO) - Aquatic Biodiversity: Dr Saskia Marijnissen (UNDP/GEF Project) - Invasive Species: Mrs Esther Abonyo (IUCN) | |
| 11:50 | Questions/answers on proposed monitoring methodologies | |
| 12:20 | Monitoring from an Ecosystem Perspective: Dr. Emmanuel Mwendera (IUCN) | |
| 12:30 | Linking Lake Tanganyika Monitoring to the African Great Lakes Observatory by Dr. Steven Loiselle (AGLONET) | |
| 12:40 | Lunch break | |
| 14:10 | Working group discussions - Land use and erosion - Water quality - Fisheries - Biodiversity and Invasive Species | Sedeke Crispin (DRC) |
| 15:40 | Coffee/Tea break | |
| 16:00 | Summary of the results of the working group discussions by the facilitators of each group, followed by discussion | |
| 17:00 | Recommended roles, monitoring feasibility and next step for the monitoring programme Facilitator: Dr. Pierre-Denis Plisnier | |
| 17:30 | Press Conference | |
| 18:00 | Closing ceremonies and cocktail | |

Appendix 45: Parameters, Site and Frequency Discussed During Workshop

| WORKGROUP ON LAND USE & EROSION | | WORKGROUP ON FISHERIES | |
|--|---|-------------------------------|---|
| PARAMETERS | | PARAMETERS | |
| In the field | | Frame survey (FS) | |
| | Surface used for agriculture, forest, pasture,... | | adopt and ajust Lake Victoria method |
| | Surface used on exposed soil (categor. slopes) | | to be conducted at the same time by all |
| | Population and distribution | | every 2 years |
| | River flow measurements | Catch assessment survey (CAS) | |
| | Suspended sediments | | to be harmonised by regional working group |
| | Soil depth | | Method to be determined & conducted |
| | Meteorological data | | as soon as results of FS are available |
| By remote sensing | | Biological studies | |
| | Land cover | | Regionally harmonised |
| | Land use | | species to be determined |
| | Soil types | | update the FINNIDA tools |
| | Suspended sediments | Other | Morphological studies and gear selectivity |
| | Vegetation index | | may be conducted if time & ressources allow |
| | | | Biomass assessment with a regional vessel |
| Monitoring sites | | Monitoring sites | |
| | Global view | | Landing sites |
| | Specific areas | | Depend of FS results |
| Frequency | | Frequency | |
| | depending of parameters and equipment | | Depend of FS results |
| POTENTIAL PARTNERS | | POTENTIAL PARTNERS | |
| Burundi | IGEBU/technical equipment AMESD | Burundi | Direction des pêches |
| | PNLAE | | Beach Management units |
| Congo | Bureau de Pedologie (Land Use) | D.R.Congo | Direction des pêches |
| | INRA? | | CRH |
| Tanzania | Ministry of agriculture (LUP) | | Beach Management units |
| | LTBWO | Tanzania | Fisheries Development Division |
| | TMA | | TAFIRI |
| | IRA (UDSM) - remote service ? | | Beach Management units |
| | ARDHI University | Zambia | DOF |
| | National Land Use commission | | Beach Management units |
| Zambia | Ministry of agriculture (Land husbandry) | Other | Cooperatives |
| | Water Affairs | | |
| | Ministry of local developpement | | |

| WORKGROUP ON AQUATIC BIODIVERSITY | | WORKGROUP ON INVASIVE SPECIES | |
|---|--------------------------------------|---|--------------------------------------|
| PARAMETERS | | SURVEYS | |
| As for LTBP, fish species composition and richness could be used as indicators of aquatic ecosystem health | | The sampling strategy will be designed by IUCN Invasive Species Expert Team | |
| Total fish survey can be done at specific sites | | Baseline survey (begun in 2007/8) | |
| Zooplankton and phytoplankton could be included depending of available capacities | | to complete in lake waters & catchment to be collected also from litterature | |
| Habitats should be monitored for biodiversity status including aquatic and shoreline vegetation | | Changes from the baseline | |
| Monitoring sites | | Assessment of local capacity to prevent or eradicate introd. of new species likely to become invasive | |
| Previous monitoring sites (LTBP, IUCN survey,...) should be taken into account | | Monitoring sites | |
| Additional sites could be selected according to results of sedimentation and/or pollution impacts | | previous sites should be taken into account (LTBP, IUCN survey) | |
| Frequency | | Site could be flexible and spread out | |
| Habitat: possibly every 3 years | | Fundraising could open possibilities | |
| Fish, zooplankton, Phytoplankton: every 3 years during a annual cycle with sampling every 3 months for fish and every month for zooplankton and algae if funding is available | | Frequency | |
| | | Baseline: every 5 àr 10 years | |
| | | Changes in baseline: possibly annually | |
| | | | |
| POTENTIAL PARTNERS | | POTENTIAL PARTNERS | |
| Burundi | University | Burundi | University |
| | INECN | | INECN |
| | ISABU | | ISABU |
| | | | Fisheries Dept |
| D.R.Congo | CRH | D.R.Congo | CRH |
| | ICCN | | ICCN |
| | Universities | | Universities |
| Tanzania | TAFIRI | Tanzania | TAFIRI |
| | Wildlife | | Wildlife |
| | TACARE | | TACARE |
| | University | | University |
| Zambia | DOF | Zambia | DOF |
| | Wildlife | | Wildlife |
| | ZARI (Zamb. Agr. Res.Inst.) | | ZARI (Zamb. Agr. Res.Inst.) |
| | Forestry Dept. | | |
| | Universities | Other | Local or national NGOs |
| Other | Local or national NGOs | | Inv. species Manag. Group (ECZ) |
| | Inv. species Manag. Group (ECZ) | | if able to afford visits to the lake |
| | if able to afford visits to the lake | | |

Appendix 46: Parameters, Sites and Frequency for Water Quality Monitoring

| WORKGROUP ON WATER QUALITY | | | | | |
|--|---------------|----------------------------|-------------|---------------------|---------------|
| PARAMETERS | | Cfr list in attached table | | | |
| SITES & FREQUENCY | | Pollution | | Lake habitat | Health |
| | | Chemical | Sedimentary | | |
| River crossing a city | Min | 1/month | 1/month | | 1/month |
| | Max* | 1/week | 1/week | | 1/week |
| Rivers outside of cities | Min | 1/3 months | 1/3 months | | 1/3 months |
| | Max* | 2/month | 2/month | | 2/month |
| Lake costal area | Min | 2/year | 2/year | 1/week | 1/ months |
| | Max* | 1/month | 1/month | 1/day | 1/week |
| Lake pelagic area | Min | 1/year | 1/year | 1/2 weeks | 1/year |
| | Max* | 1/month | 1/month | 1/week | 1/month |
| <i>* Higer intensity may depend of capacities & special cases (pollution from industries, mines..)</i> | | | | | |
| POTENTIAL PARTNERS | | | | | |
| Burundi | REGIDESO | | | | |
| | INECN | | | | |
| | IGEBU | | | | |
| | Dept Pêches | | | | |
| | UB | | | | |
| | INSP | | | | |
| D.R.Congo | CRH | | | | |
| | Dept Pêches | | | | |
| | REGIDESO | | | | |
| | Min Santé | | | | |
| Tanzania | Unif Kinshasa | | | | |
| | LTBWO | | | | |
| Zambia | TAFIRI | | | | |
| | DWA | | | | |
| | ECZ | | | | |
| | DOF | | | | |
| | DOH | | | | |
| Suggested partners by topic | | | | | |
| Burundi | REGIDESO | INECN | INECN | Dept Pêches | INSP |
| | INECN | IGEBU | IGEBU | UB | |
| D.R.Congo | CRH | CRH | CRH | CRH | Min Santé |
| | REGIDESO | | | Dept Pêches | REGIDESO |
| Tanzania | LTBWO | LTBWO | LTBWO | TAFIRI | LTBWO |
| Zambia | DWA | DWA | DWA | DOF | DOH |
| | ECZ | ECZ | ECZ | | |

Appendix 47: Parameters According to Water Quality Topic

1. Basic: frequent sampling; 2. Basic: infrequent sampling; 3. Important but not essential; 4. Less important

| Parameters | Units | Chem. Pollution | Sed. Pollution | Lake Habitat | Health |
|--|-------------------------------------|-----------------|----------------|--------------|--------|
| Water temperature | °C | 1 | 1 | 1 | 4 |
| Dissolved oxygen | mg/l | 1 | 1 | 1 | |
| pH | | 1 | 1 | 1 | 1-2 |
| Electrical conductivity | µS/cm | 1 | 1 | 1 | 1-2 |
| turbidity | NTU | 1 | 1 | 1 | 1-2 |
| transparency | cm | 1 | 1 | 1 | 1-2 |
| chlorophyll a | µg/l | | | 2-3 | |
| primary production | g C m ⁻² y ⁻¹ | | | 3 | |
| TN, TP | mg/l | | | 3 | |
| SiO ₂ | mg/l | | | 3 | |
| NO ₃ ⁻ , NO ₂ ⁻ , NH ₄ ⁺ | mg/l | 1-2 | 1-2 | 3 | 2 |
| PO ₄ ⁻⁻⁻ | mg/l | 1-2 | 1-2 | 3 | 2 |
| TDS, TSS | mg/l | 1-2 | 1-2 | | 1-2 |
| Alcalinity | mg/l (CaCO ₃) | 2-3 | 2-3 | | 2 |
| Total hardness | mg/l (CaCO ₃) | 3 | 3 | | 2 |
| coliform E.coli | N/100ml | | | | 1-2 |
| BOD, COD | mg/l | 1-2 | 2-3 | | 3 |
| TDM | mg/l | 2-3 | 3 | | 3 |
| Ca ⁺⁺ | mg/l | 3-4 | 4 | | 2 |
| Mg ⁺⁺ | mg/l | 3-4 | 4 | | 2 |
| Na ⁺ | mg/l | 3-4 | 4 | | 2 |
| K ⁺ | mg/l | 3-4 | 4 | | 2 |
| Cl ⁻ | mg/l | 3-4 | 4 | | 3 |
| F ⁻ | mg/l | 3-4 | 4 | | 4 |
| SO ₄ ⁻⁻ | mg/l | 3-4 | 4 | | 3 |
| As, Ni, Pb, Cd, CN, Hg, Mn | mg/l | 2 | 2 | | 2 |
| Cr | mg/l | 4 | 4 | | 3 |
| Co | mg/l | 4 | 4 | | 3 |
| Sn | mg/l | 4 | 4 | | 3 |
| Ag | mg/l | 4 | 4 | | 4 |
| Be | mg/l | 4 | 4 | | 4 |
| Se | mg/l | 4 | 4 | | 4 |
| Cu | mg/l | 4 | 4 | | 3 |
| Zn | mg/l | 4 | 4 | | 3 |
| Ra | mg/l | 4 | 4 | | 3 |
| U | mg/l | 4 | 4 | | 3 |
| Al | mg/l | 4 | 4 | | 3 |
| Fe | mg/l | 4 | 4 | | 2 |
| Ba | mg/l | 4 | 4 | | 4 |
| Sr, S, V, Au | mg/l | 4 | 4 | | 4 |
| H ₂ S | mg/l | 4 | 4 | | 3 |
| Pesticides | µg/l | 2-3 | 2-3 | | 2 |

Appendix 48: Possibilities for International Collaborations - LVFO

The Lake Victoria Fisheries Organisation (LVFO) has 16 years of experience in developing collaboration with partners in three countries around Lake Victoria. The LVO has developed standard procedures for data collection (including Beach Management Units), quality control, processing and dissemination. Similar methodologies would be also useful in the framework of a future multilake approach. See: <http://www.lvfo.org>

Appendix 49: Possibilities for International Collaborations - ICRAF

| | |
|-------------------------|---|
| Project Title | Support for catchment management in the Lake Tanganyika Basin |
| Project Duration | 2009-2012 |
| Implementation | ICRAF under contract from UNOPS in collaboration with national teams from the countries comprising the Lake Tanganyika Basin. |

Project Objectives

To provide training and documentation on regional approaches to catchment management (including lessons learned from the Lake Victoria Basin) and the use of GIS software and datasets to identify degradation hotspots regionally and for each country.

To strengthen national and regional capacities in design and implementation of agroforestry interventions for catchment management and participatory monitoring of land degradation and sedimentation at three pilot demonstration sites.

To strengthen national and regional capacity in estimation of carbon stocks in soil and vegetation.

Project Activities

1. Supply GIS software for identification of land degradation hotspots with datasets (from early 1970's to present) customised for each of four countries (Tanzania, Zambia, DRC and Burundi), which can be linked to internet sources for subsequent monitoring.
2. A regional training workshop on transboundary approaches to catchment management and the use of GIS software to identify degradation hotspots regionally and for each country held in Burundi.
3. Three national training workshops in Tanzania, Zambia and DRC (with participants from Burundi attending the DRC workshop) on the use of GIS software and national datasets to identify degradation hotspots, priorities for intervention and the use of internet data sources for subsequent monitoring.
4. Three national training workshops, with supporting documentation on best practices, and tree germplasm where appropriate, for pilot catchment management demonstration sites in Tanzania, Zambia and DRC (with participation of personnel from Burundi at the DRC workshop) . These will cover methods for participatory monitoring of erosion and sedimentation; agroforestry interventions that enhance rural livelihoods and control water and sediment flows at landscape scales; together with design principles for choice of technology options and species for specific contexts.
5. A regional training workshop on estimating carbon stocks in vegetation and soils and the use of carbon accounting in policy and planning related to catchment management.
6. Institutional backstopping and partnership development, together with provision of documentation in English and French on methods and best practices in catchment management.

Appendix 50: Possibilities for International Collaborations – IUCN

Project Proposal Lake Tanganyika Monitoring Plan for Invasive Species

Objectives

The main objective is to build capacity to assess and respond to the threats of invasive species in Lake Tanganyika and its catchment through monitoring of invasive alien species – before, during and after their management. Sub-objectives are:

1. To finalise a monitoring plan for alien invasive species in Lake Tanganyika after a rapid assessment around the ecosystem
2. To initiate monitoring and management of existing biological invasions in LT
3. To prepare the LTA and riparian governments to address biological invasions in and around LT through a strategy and action plan (for five years)
4. To raise the level of awareness of the extent and threats of (actual and potential) biological invasions to the ecosystem functions and products of Lake Tanganyika
5. To establish the range and extent of potential invasive species in the LT ecosystem

Activities will include preparation, discussion and initiation of a monitoring plan; commence (or continue) efforts to manage or reduce existing biological invasions; build capacity in LTA and riparian government agencies to recognize and address invasive species invasions; develop and distribute awareness products.

Appendix 51: Possibilities for International Collaborations – UNEP ROA/NIGLAS

Short summary of objectives and key activities by the UNEP ROA/NIGLAS partnership.

Project Title ENHANCE THE CAPACITY FOR MONITORING SHARED WATER RESOURCES OF LAKE TANGANYIKA

Project Duration 2009-2011

Implementation Partners UNEP Regional Office for Africa

Nanjing Institute of Geography and Limnology, Chinese Academy of Sciences, Lake Tanganyika Authority (LTA), UNDP/GEF Project on Lake Tanganyika, National Teams from Riparian Countries

Project Objectives

1. To build and strengthen the technical capacity of the LTA and national teams in monitoring water quality of the Lake
2. To provide guidance on establishment of a long term water quality monitoring system for Lake Tanganyika

Project Activities

1. Capacity building activities
 - a) A technical training course in China for the LTA and national teams of the riparian countries on the theory and techniques for water quality monitoring and data management.
 - b) On-job training in Africa for technical staff on water sampling and analysis
2. A desk study on the water environmental issues and monitoring of Lake Tanganyika and to provide suggestions to establish a long-term water quality monitoring system.
3. Visiting scholar programme
 - Two African experts will be invited as visiting scholars to China to work on the desk study and related research programme
4. Upgrade of two existing labs for water quality analysis and monitoring.

Appendix 52: Possibilities for International Collaborations – RMCA

Geochemistry Division

The Geochemistry division of Royal Museum for Central Africa (RMCA) has a long-standing experience in the field of environmental analytical chemistry. The equipments available including clean laboratories and different mass spectrometers (Quad-ICP-MS, LA_ICP_MS, HR-ICP-MS and MC-ICP-MS) allow detailed characterization of the chemical composition (elemental and isotopic) of various environmental matrices. Current research on the earth climatic system is carried out using fossil and contemporaneous marine and lacustrine biogenic carbonates (CALMARSII project, Belspo SSD project) to retrieve paleoclimatic parameters like Sea Surface Temperature and Salinity (SST and SSS), phytoplankton dynamics, upwelling activity, etc., from some African lakes (Tanganyika) and various oceanic provinces (Caribbean, Mediterranean seas, Atlantic and North Sea).

Environmental biogeochemistry is an important topic of the division. It involved characterisation of biogeochemical cycles in present and past continental ecosystems, with emphasis on isotopes, trace (ppm, ppb), ultra-trace (ppt) and major elements analyses in waters, carbonates (bivalves, sclerosponges) and particles, with some specific knowledge in tracing the heavy metals pollutions.

The division is involved in a large number of national and international networks and has collaborative research programmes involving hundreds of research partners. Moreover, it has a thorough experience of field working in Central and East Africa, resulting in the existence of a large network of local contacts and strong familiarity with local working conditions.

Some of the recent research topics include:

- Si-Mg isotopes to trace present and past organic and inorganic processes in the aquatic systems.
- Carbonate skeletons as archives of (palaeo) environmental changes
- Soil-plant biogeochemical cycles
- Limnological prospects in Africa (Tanganyika, Uganda crater lakes, Congo River...)
- Analytical developments using EXcimer LA-ICP-MS instrument.
- The study of Early Archaean silicifications
- Soil and rock alteration research
- Pedological aspects of the cycle of heavy metals in the Katanga copperbelt.

In addition, the division provides scientific services through analytical expertises.

Geomorphology and Remote Sensing Division

The Geomorphology and Remote Sensing Division of RMCA aims to study geomorphic events of catastrophic dimensions like huge landslides, inundations, gully erosion, unforeseen oscillations of lake and water table levels, provoked by climate, soil use and seismics. The division aims also to promote local studies by local researchers in the field of hydrological risks and to increase the local research capacities by trainings, scientific publications in collaboration, co promoting Masters and PhD theses of African students in Belgium etc. The Division communicates with a hundred of Central African students along a network, called RéCO.

RéCO is network of researchers in DR Congo, Burundi and Rwanda developing collaboration with the “Geomorphology and Remote Sensing” division of the RMCA in the field of natural hazards:

- to study the geomorphologic events such as large landslides, inundations, gully erosions, unexpected oscillations of lake and water table levels, that are generated by climate, land use and earthquakes.
- to increase capacities for local research through training sessions, scientific publications with several contributions, co-promotion of dissertations and PhD thesis for scholarship holders in Belgium, etc.

ReCO also wants to meet the wish of most scientists from central Africa to gather in a working team in order to map and study natural hazards in their region. This project has been proposed by professors Louis Nahimana from Burundi University and Ilunga Lutumba from KIE-Kigali. To meet this purpose, the “Geomorphology and Remote Sensing” division of the RMCA tries to organize local training sessions.

The “Geomorphology and Remote Sensing” division of RMCA has also started two large projects:

(1) the building of a digital database of natural hazards and risks in DR Congo, Rwanda and Burundi since 1900 till present

(2) the organization a local group training on natural risks along the Tanganyika –Kivu rift. The course is mainly devoted to young researchers and university professors of Rwanda, Burundi and DR Congo (Kivu). The course includes 3 modules (5 days each):

(A) Theory on Geomorphological risks in Kivu, Rwanda and Burundi and basic knowledge on GIS (ArcGis 9). This module will be organized at the KIE Kigali.

(B) A field trip dealing with landslides, inundations, river floods and fluvial erosion, gullies, farm erosion, oscillations of the water table and lake levels (Bujumbura, Uvira, Bukavu, Lwiro, Kalehe, Goma, Gysenyi, Bigogwe, Butare). The University of Bujumbura will greatly contribute to the organization, with the aid of the CRSN at Lwiro and the KIE.

(C) Risk mapping for the detection and interpretation of the phenomena on remote sensing documents: stereo pairs of aerial photographs, satellite imagery. The use of GIS tools for the mapping and quantification of relevant topographic parameters that determine landslides and gullies. Notion of risk map. This module will be organized by the CGISNUR in Huye, Rwanda.

Mapping and Remote Sensing Division

The Mapping and Remote Sensing Division (MRSD) of the RMCA is focusing on remote sensing and GIS applications in Earth Sciences. However, in accordance with the mission of research and service of the Institution, the MRSD also contributes to the activities of the other departments of the RMCA.

Most of the research projects are in the field of natural resources mapping, or natural hazards studies and monitoring. Up to date optical and radar remote sensing techniques are in use at MRSD. As such, radar interferometry (InSAR) was developed as a prominent field of research applied to ground deformation monitoring notably in tectonic or volcano-tectonic contexts. Optic, radar, and InSAR are also used for more general mapping purposes.

Since more than a decade, the Division has contributed with international partners to the study and the assessment of the risk associated to seismogenic faults, or active volcanoes in Africa. In all research activities, data and result integration in Geographical Information Systems (GIS) is performed. On the one hand, spatial analysis of environmental parameters plays a major role in subsequent interpretations, whereas on the other hand data archiving and results dissemination is a constant concern of the MRSD.

Traditionally, the MRSD is maintaining a unique Map library dedicated to geological and topographical maps mainly of Africa. The library also contains a unique archive data set of aerial photographs from Democratic Republic of Congo. Maintaining the collections as well as facilitating its consultation is one of the major tasks of the MRSD. In parallel, generally associated to global or specific RMCA activities, an important effort concentrates on the collection and the update of general or thematic information out of which new maps can be produced.

Either for research or for service purposes, frequent field campaigns are organized in surveyed areas to collect new data, or to validate remote sensing observations. Field equipment includes handheld GPS, mapping GPS, Geodetic GPS, and a spectrometer. Field operations always associate local counterparts and are opportunities for knowledge transfer and capacity building.

Research projects are generally associated to a Ph.D. or a master thesis that are supervised at MRSD in collaboration with universities in Belgium or abroad. Training or capacity building sessions are also organized, either locally at RMCA or in Africa at the partner location.

The Mapping and Remote Sensing Division has been involved in many areas of the world though it concentrates today on sub-Saharan regions. Last decade activities were developed in Uganda, Tanzania, Rwanda, DRC, Cameroon, Sudan, but also Tunisia and Morocco. International collaborations involve universities and government research or service centres in Africa and universities in Europe and in the USA.

Ichthyology Unit

The Ichthyology Unit is part of the Department Biology, Section Vertebrates. It is currently the largest laboratory within the department.

The unit is specialized in research on the systematics (taxonomy, phylogeny and biogeography) and the ecology of African fresh and brackish water fishes. These studies also include aspects of biodiversity conservation and the sustainable use of fishes in aquaculture and fisheries. It harbours the largest collections worldwide of African freshwater fishes and includes a specialized library.

The systematic research is based on old and new collections (field work) using morphology, osteology and colour pattern analysis, complemented with molecular studies in close collaboration with the Joint Experimental Molecular Unit. The main outputs include descriptions of new species, revisions of species groups, genera and families, and editing of regional faunas.

Main objectives:

- the study of the biological diversity of African fresh- and brackish water fishes
- curating of the large and unique collections of these fishes
- maintaining a specialized library and databases on this fauna
- dissemination of knowledge to the scientific community and the general public
- provide short and long term training (M.Sc. & Ph.D.)
- provide scientific assistance by organizing study visits and loans of specimens

The study of African fishes has been an important task in the Royal Museum for Central Africa in Tervuren since its foundation. Currently Jos Snoeks and Emmanuel Vreven continue to build upon the ichthyological expertise gathered during more than a century with a team including three other ichthyologists, one collection manager and between five and eight associated Ph.D. students. In addition, there is a continuous in- and outflow of other students and trainees. Twenty-five to fifty national and international scientists visit the laboratory each year.

FishBase

The Royal Museum for Central Africa is one of the founding members of the FishBase Consortium. FishBase is the world's largest and most successful database on fishes (www.FishBase.org). All data is publicly available through the internet and on CD and DVD. Within the Consortium, the unit is responsible for the information on African fishes, fisheries and aquaculture. Every year five grants are awarded to African scientists for [training](#) in fish taxonomy and the use of FishBase, alternately in French and English.

Lake Tanganyika

The study of Tanganyika fishes has strong historical links with the RMCA as the majority of the fish species of the lake have been described by RMCA's scientists and the standard books on this fauna have been written by authors affiliated to the RMCA. As a result, the unit harbours the largest collection of Tanganyika fishes, including most of the type specimens that define the species. Current research on this fauna concentrates on the genus *Tropheus* and its parasites, on the fishes of the affluent rivers and on molecular bar-coding of the endemic cichlids.

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Appendix 53: Possibilities for International Collaborations - AGLONET

The African Great Lakes Observatory Network (AGLO) network brings together leading scientists in the study of large Lakes in Africa. The network was conceived as an instrument for support for researchers and policy makers to meet the challenges of current century. The network is working to develop a regionally coherent approach to the modelling, management and monitoring of these vital ecosystems. The central goal of the network is to facilitate the development of regionally based instruments for the sustainable management of large lake ecosystems in East Africa, while the specific scientific objectives are:

- To create regionally based protocols for the long term monitoring of resource quality and ecosystem functioning, combining in situ and earth observation technologies in a coherent and constructive manner
- To improve access to ecological and socio-economic data by regional scientists and policy makers to facilitate a comparative analysis, to identify common future scenarios (environmental drivers and ecosystem dynamics) for the African Lake region.

To begin to develop a comprehensive plan of action which takes advantage of expected changes in climate and regional socio-economic conditions, a shared information basis must be developed and linked to the latest developments in earth observation, in-situ monitoring, database management and climate/lake modelling. These scientific advances must be directed to support policies that recognise the dual importance of improving livelihoods and sustainably managing these complex ecosystems.

AGLO scientists have developed, individually and for specific lake ecosystems, monitoring (in-situ and earth observation), modelling (socio-economic, biogeochemical, hydrological) and management tools. It is time that these developments are utilised on a regional scale, to explore future scenarios (to 2050) where changes in regional climate and socio-economic conditions will occur. Integrated approaches are needed to examine the mutual feedbacks between socio-economic drivers, climate and regional environmental change (eg. trends in watershed and airshed conditions) and their impact on ecosystem services. Based on this new understanding of the resilience of these ecosystems, it will be possible for stakeholders to identify new opportunities to improve human well being which does not compromise the services provided by these ecosystems. The AGLO network is focusing on three priority areas:

1. Monitoring protocol and technology development,
2. Regional lake / climate / environmental database,
3. Ecosystem scenario simulation and analysis.

The network scientists are working to develop this collaboration through national, EU and international funding programmes. The activities of the network are directed at active exchange of fundamental and applied knowledge through International workshops, training schools, and web platforms (applications, courses) Focused scientific development through Short-term scientific exchanges between partner institutions, AGLO research support. Also see table 4 for an overview of AGLO Network associated scientists.

| | Keywords |
|--|-----------------|
| University of Nairobi (Kenya), Department of Zoology, Eric Odada, africanness@uonbi.ac.ke | LM, FI, MN |
| Univ. Siena (Italy) S. Loiselle, L. Bracchini (loiselle@unisi.it) | LM, EM, MN, RS |
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| TAFIRI (Tanzanian Fisheries Research Institute), Ismael Kimirei (kiakimirei@yahoo.com) | LM, FI, MN |
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| Univ. Liège (Belgium) Yves Cornet (ycornet@ulg.ac.be) | MN, RS |
| Institut National Polytechnique de Toulouse (France) Jacques Moreau (jmoreau@ensat.fr) | LM, FI, EM |
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| Bahir Dar University, Enyew Adgo (Ethiopia) enyewadgo@gmail.com | LM, MN |
| Finnish Environment Institute - SYKE (Finland) Timo Huttula, timo.huttula@ymparisto.fi | LM, FI, MN, RS |
| University of Bujumbura (Burundi) Gaspard Ntakimazi, David Nahimana | LM, FI, MN |
| Mekelle University, Kindeya Gebrehiwot (Ethiopia) kindeyagl@yahoo.com | LM, MN |
| Ghent University, (Belgium) Prof. Jan Nyssen (jan.nyssen@ugent.be) | LM, FI, EM, MN, |
| Department of Fisheries (Zambia) Charles Maguswi the Director of fisheries | LM, FI, |
| Maxillion Consultancy (NL) Martin van der Knaap, martin@maxillion.eu | FI, EM, MN, RS |
| University of Zambia, Department of Zoology, (Zambia) Dr Mudenda | LM, FI, EM, MN, |
| University of Leicester (UK) Dr. David Harper (Department of Biology; dmh@le.ac.uk), Dr Sean Avery (Department of Geography; bundufundi@gmail.com) | LM, EM, MN |
| World Agroforestry Center (KE) Thomas Gumbrecht, T.Gumbrecht@CGIAR.ORG | LM, EM, RS |

Table 4: Overview of AGLO Network associated scientists. LM = Lake management; FI = Fisheries, EM = Ecosystem modelling; MN = Monitoring (Biogeochemical monitoring in situ); RS = Lake remote sensing