Pollution Control and Other Measures to
Protect Biodiversity in Lake Tanganyika

# Lake Tanganyika
# The Transboundary Diagnostic Analysis

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## Abbreviations

**CIFA** Committee for Inland Fisheries of Africa

**CITES** Convention on International Trade in Endangered Species of Wild Fauna and Flora

**EIA** Environmental Impact Assessment

**FAO** Food and Agricultural Organisation of the UN

**FU** Fishing Unit

**GEF** Global Environmental Facility

**GIS** Geographical Information System - a data base system for managing spatial information, linking maps to physical and socio-economic data

**IAs** Implementing agencies of the GEF: UNDP, UNEP and the World Bank

**ILMC** Interim Lake Management Committee - of the ILTMB

**ILMS** Interim Lake Management Secretariat - of the ILTMB

**ILTMB** Interim Lake Tanganyika Management Body proposed in this SAP

**LTBP** Lake Tanganyika Biodiversity Project – full title "Pollution Control and Other Measures to Protect Biodiversity in Lake Tanganyika"

**LTFFMP** Lake Tanganyika Framework Fisheries Management Plan developed by LTR

**LTFMP** Lake Tanganyika Fisheries Monitoring Programme – part of the Lake Tanganyika Framework Fisheries Management Plan developed by LTR

**LTR** Lake Tanganyika Research Project **–** full title **"**Research for the Management of the Fisheries on Lake Tanganyika"

**NWG** National Working Groups of the LTBP

**SADCC** the Southern African Development Coordination Committee – now **SADC** the Southern African Development Community

**SAP** Strategic Action Programme

**STAP** Scientific and Technical Advisory Panel of the GEF

**TAC** Technical Advisory Committee of the LTBP

**TDA** Transboundary Diagnostic Analysis – a planning framework used in GEF international waters programmes

**UNDP** United Nations Development Programme

**UNEP** United Nations Environment Programme

# National Institution Abbreviations

## Burundi

**BBN** Bureau Burundais de Normalisation
**BRB** Banque de la République du Burundi
**CCI** Chambre du Commerce et de l'Industrie du Burundi
**DG ATE** Direction Générale de l'Aménagement du Territoire et de l'Environnement
**ETP** Ecole des Travaux Publics de Gitega
I**GEBU** Institut Géographique du Burundi
**INECN** Institut National pour l'Environnement et la Conservation de la Nature
**MAE** Ministère de l'Agriculture et de l'Elevage
**MCIT** Ministère du Commerce, de l'Industrie et du Tourisme
**MDC** Ministère du Développement Communal
**MEM** Ministère de l'Energie et des Mines
**MINATE** Ministère de l'Aménagement du Territoire et de l'Environnement
**MSP** Ministère de la Santé Publique
**MTPE** Ministère des Travaux Publics et de l'Equipement
**ODEB** Organisation pour la Défense de l'Environnement au Burundi
**ONAPHA** Office National Pharmaceutique
**Regideso** Régie de Distribution de l'Electricité et des Eaux
**SETEMU** Services Techniques Municipaux
**UB** Université du Burundi

## Congo

**AT** Admimistration Territoriale
**CADIC** Centre d'Actions et de Développement et d'Initiatives Communautaires
**CIC** Conseil Interministériel de Consultation
**CRH** Centre de Recherches en Hydrologie
**CRGM** Centre de Recherches Géologiques et Minières
**CRSN** Centre de Recherche en Sciences Naturelles
**ICCN** Instititut Congolais pour la Conservation de la Nature
**INERA** Institut National d'Etudes et de Recherches Agronomiques
**ISDR** Institut Supérieur de Développement Rural
**ISP** Institut Supérieur Pédagogique
**MINAGRI** Ministère de l'Agriculture
**NOPTA** Nouvelles Orientations de la Pêche au Lac Tanganyika
**SENADEP** Service National de Développement de la Pêche
**SNV** Service National de Vulgarisation

### Tanzania

**JGI** the Jane Goodall Institute
**NEMC** National Environmental Management Council
**NLUPC** National Land Use Planning Commission
**PMO** Prime Ministers Office
**TACARE** Tanganyika Catchment Reforestation
**TAFIRI** Tanzania Fisheries Research Institute
**TANAPA** Tanzania National Parks
**TANESCO** Tanzania Electrical Supply Company
**TRC** Tanzania Railways Corporation
**UWWS** & S Urban Water Supply and Sewerage
**WCST** Wildlife Conservation Society of Tanzania

### Zambia

**DOF** Department of Fisheries
**D-WASHE** District Water Supply and Sanitation Education
**ECZ** Environmental Council of Zambia
**MAFF** Ministry of Agriculture, Food and Fisheries
**ZAWA** Zambia Wildlife Authority
**ZRA** Zambia Revenue Authority

## Glossary of Terms

**Agenda 21** United Nations Conference on Environment and Development (Earth Summit) agreement on action to be taken to protect the environment. It proposes integrating environmental protection and economic development.

**Baseline Costs** the reference point for calculating incremental costs. The GEF funds the difference between the cost of a project undertaken with global environmental objectives in mind and the costs of the same project without global environmental concerns. The baseline is the latter project that yields only national benefits.

**Benthic** the environment where organisms are attached to, or rest on, the substrate.

**Biodiversity** defined in the Convention on Biological Diversity: "Biological diversity" means the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

**Co-funding or co-financing** Since the GEF funds the incremental costs of projects, with few exceptions (e.g. for enabling activities) GEF projects require additional funding from other sources to cover the national benefits costs. This additional funding component is referred to as co-funding. The incremental cost can be co-financed as well.

**Convention on Biological Diversity** was 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.

**Convention** The Convention for the Sustainable Management of Lake Tanganyika – a draft document prepared by LTBP.

**Dublin Principles** The Dublin Statement on Water and Sustainable Development, prepared at the International Conference on Water and the Environment (ICWE) in Dublin, Ireland, January 1992, calling for fundamental new approaches to the assessment, development and management of freshwater resources.

**Eutrophication** a process in which increasing nutrient load in rivers or lakes triggers algal blooms which in turn result in de-oxygenation and a change in species.

**Gazetted** (e.g. Gazetted Forest Reserve) a legally established protected area, with boundaries published in the Government Gazette or some other formal record of government procedures.

**Global environmental benefits** that accrue to the global community, as distinct from solely national benefits that accrue to the people of the country, in which a project is located.

**Hot spot** a local land area, stretch of surface water or specific aquifer which is subject to excessive pollution or other human induced pressure and which requires a specific action to prevent or reduce degradation.

**Incremental cost** the additional cost that the GEF funds between the cost of an alternative project that a country would have implemented in the absence of global environmental concerns and a project undertaken with global objectives in mind.

**International waters** One of the four focal areas that the GEF focuses on. Defined as the seas, shared river and lake basins and shared estuaries and wetlands and shared groundwater aquifers. The distinguishing feature is that more than one nation has access to or makes use of them.

**Investment project** A project where a significant part of the funding is used for the acquisition of capital equipment or the creation of infrastructural benefits.

**Leveraging** refers to the ability to secure, or "leverage" additional funds for GEF project implementation. GEF projects generally require such co-financing from host governments, the Implementing Agencies (UNDP, UNEP and the World Bank), multilateral development banks, bilateral agencies and/or other funding sources.

**Littoral** the near-shore environment (down to about 40m depth in Lake Tanganyika).

**Pelagic** the open water environment.

**Point source, Non-point source** a localised discharge of pollutants, (e.g. from an industrial plants; non-point source indicates diffuse pollution (e.g. agricultural run-off).

**Protected area** a geographical area or territory with legally defined boundaries, established to afford protection to certain natural characteristics of particular value or interest, in the case of Lake Tanganyika this is generally only used to refer to the formal network of National Parks or Natural Reserves.

**Public involvement** a basic operational principle for GEF project development and implementation is that the public be involved at all stages. Public involvement consists of information dissemination, consultation, and stakeholder participation. The GEF policy on public involvement is outlined in Public Involvement in GEF-Financed Projects, 1996.

**Ramsar** the Ramsar Convention – aims to protect wetlands sites of international importance.

**Stakeholder** the term applied to those potentially affected by a project, including recipient country governments, implementing agencies, project executing agencies, groups contracted to conduct project activities at various stages of the project , and other groups in the civil society which may have an interest in the project.s

# 1 Introduction

## 1.1 Lake Tanganyika

Lake Tanganyika was formed about 12 million years in ago, and as a result of this time-scale is ecologically very different from modern lakes formed by glaciers within the last 12,000 years. During this long period of isolation, the early colonisers of Lake Tanganyika have undergone some spectacular evolutionary productions.

Lake Tanganyika is the richest freshwater ecosystem in the world, with more than 1,500 species of plants and animals, of which at least 500 are found only in the Tanganyika basin.

Among these, the most notable are the cichlid fish species, crabs, sponges and snails.

Formal scientific interest in the lake dates back to the first sighting by Richard Burton and John Speke in 1858. Speke gathered shells from the beach at Ujiji, and sent these back to the British Museum, where they caught the attention of the scientific community. Unlike most freshwater shells, the Tanganyikan shells, with their heavy armour and sculpture, were nearly indistinguishable from the shells of marine species, leading to the hypothesis that, at one time, the lake had been connected to the sea.

However, it is now generally accepted that the main reason for this resemblance is the continual evolutionary development of species in response to an environment that equates to an inland sea, and has remained relatively stable over a vast period of time.

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.

But the lake is not just of interest to the global environmental community; the lake is a source of fish to local communities; it is their highway and their drinking water.

There are about one million people around the lake who depend on the fishing resources. Fish is also transported to distant urban centres where it is part of the preferred diet.

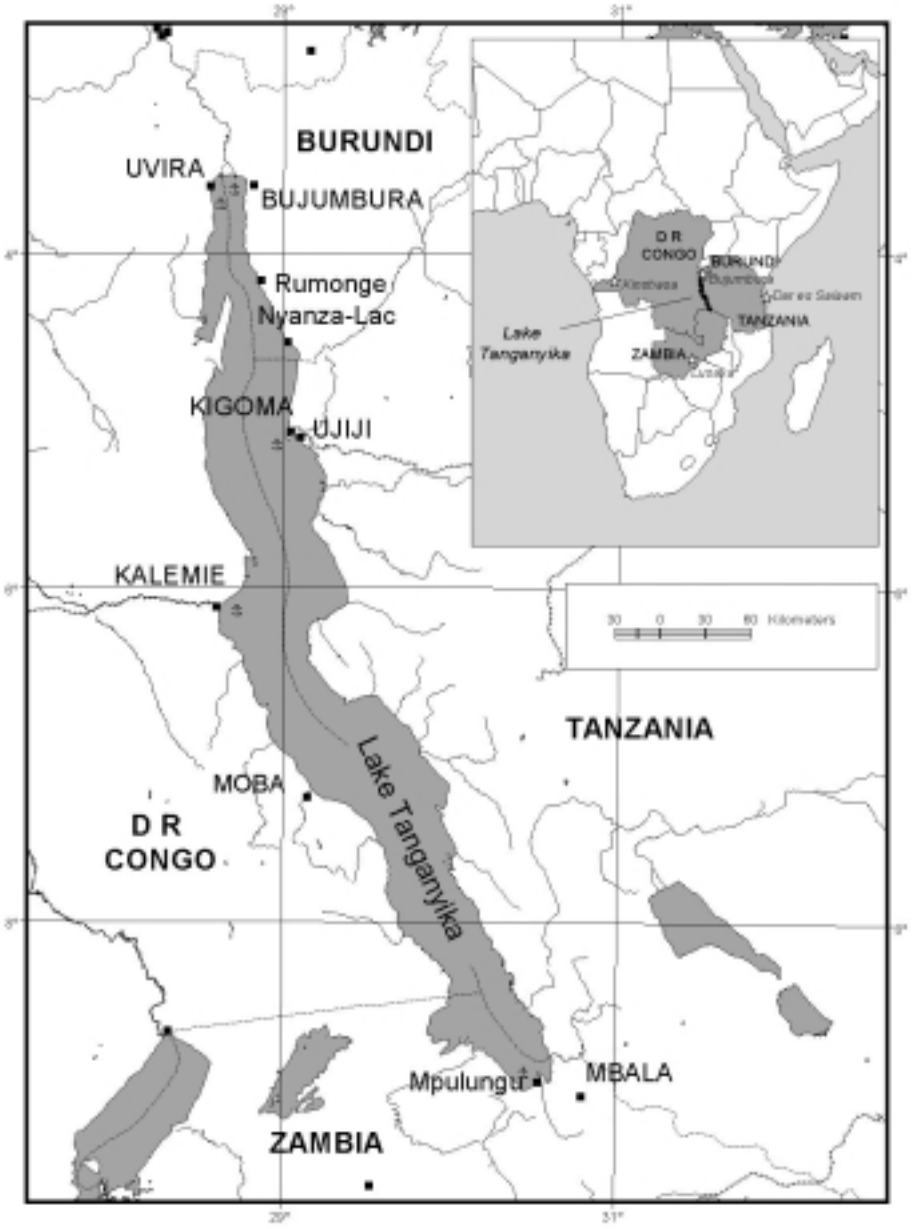
The future use of the lake by local communities relies on sound management of the environment of the lake and the catchment, sustaining the ecological balance and hence the resources on which local communities depend.

## 1.2 Concern for the Lake’s Future

Although the subject of much research, the views of the scientists were brought to the wider community at the First International Conference on the Conservation and Biodiversity of Lake Tanganyika held in Bujumbura in 1991.

At this meeting scientists from the four riparian states of Burundi, D.R. Congo, Tanzania and Zambia and their international colleagues expressed concern at the increasing threats to the lake's unique and, economically important resources.

**Map 1 Lake Tanganyika - National Boundaries, Main Towns and River Systems**




The lake is vulnerable to pollution because of its natural characteristics, and there are presently few efforts to conserve its biodiversity. The meeting concluded that the main threats to the lake environment and biota were pollution from excess loads of sediment and nutrients caused by erosion in the watershed, industrial and urban pollution including boat discharges and intensive fishing with inappropriate methods.

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 the assessment and control of pollution and protection of biodiversity. In doing so, the livelihoods of the

lakeside communities should be safeguarded, thus securing their future access to those resources on which they depend.

The waters of Lake Tanganyika are shared by the four countries; clearly any actions taken by one country can have impacts on these shared international resources. Any approach to improving the understanding and subsequent management of the lake must have an international and regional perspective.

Subsequently, steps were taken to attract the interest of international funding agencies in order to secure funding for a regional project to address the problems identified[1].

## 1.3 The Project

Funding was secured through the UNDP/ Global Environmental Facility (GEF) which at the 1992 Rio environmental summit meeting, was endorsed as a mechanism for financing activities which generate global environmental benefits. Originally conceived as primarily a biodiversity project, the project relates to GEF interests in both biodiversity and international waters, giving greater emphasis to management objectives for sustainable development.

The project became effective in 1995 following the signing of the Project Document by the four riparian countries, the funding agency UNDP/GEF and the executing agency United Nations Office for Project Services (UNOPS).

The ultimate objective of the project as stated in the Project Document is:

"…to demonstrate an effective regional approach to control pollution and to prevent the loss of the exceptional diversity of Lake Tanganyika's international waters. For this purpose, the development objective which has to be met is the creation of the capacity in the four participating countries to manage the lake on a regional basis as a sound and sustainable environment."

More specifically, the project aimed to:

"…establish a regional long term management programme for pollution control, conservation and maintenance of biodiversity in Lake Tanganyika."

To achieve these objectives the project included a number of research programmes aimed at addressing specific information gaps that were constraining improved management of the lake and catchment – the Special Studies.

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[1] However, this was not the first regional proposal related to the lake resources. The LTR project (Research for the Management of the Fisheries on Lake Tanganyika) which was focussed on the pelagic fisheries, was already under development. This followed recommendations adopted at the 1st Session of the Committee for Inland Fisheries of Africa (CIFA), Sub-Committee for Lake Tanganyika, convened in 1988. The project became operational in 1992.

While initially concentrating on establishing a lake-wide fisheries research programme, the project was also required to facilitate the development of a regional mechanism to coordinate the management and exploitation of the pelagic fishery resources of the whole lake. The project has prepared a proposal that is presently under review, "Regional Framework Planning for Lake Tanganyika Fisheries Management", which includes proposals for policy, planning and management, fisheries statistics, fisheries regulation and legislation, improved fishing practices and post harvest improvements.

The results of the special studies will feed into the Strategic Action Programme (SAP), of which this document is a component.

### 1.3.1 The Special Studies

Divided into five focal areas, these studies will collectively provide a multidisciplinary understanding of the complex scientific, technical and socio-economic issues related to conservation and sustainable use of the lake.

The Special Studies include: Biodiversity, developing appropriate field methods for assessment of impacts on biodiversity; Fishing Practices, identifying the impact of fishing on biodiversity and propose potential remedial actions; Pollution, identifying sources, evaluating consequences and finding preventative measures; Sedimentation, monitoring the movement and impact of soil entering the Lake; and Socio-economics, providing the human context within which the conclusions of the technical studies can be discussed, developed and implemented.

The legal and institutional component is primarily concerned with the development of an international agreement to support the ongoing development of the regional SAP. Underpinning all these activities are training and environmental education components, which aim to raise the capacity of regional institutions and communities to carry this work beyond the life of the project.

In association with these special studies, are studies on agricultural practices, merits of sites for underwater national parks, the relevance of the legal systems of land ownership, lake conservation and developmental needs considering all the problems associated with the huge distances and poor communications involved.

### 1.3.2 The Strategic Action Programme

Since the project document was prepared, the planning ideas incorporated in the first immediate objective have been encapsulated in the concept of a Strategic Action Programme – SAP. In 1996 the GEF published their Operational Strategy which describes the purpose of the SAP as follows:

> *"The SAP should establish clear priorities that are endorsed at the highest levels of government and widely disseminated. Priority transboundary concerns should be identified, as well as sectoral interventions (policy changes, program development, regulatory reform, capacity-building investments, and so on) needed to resolve the transboundary problems as well as regional and national institutional mechanisms for implementing elements of the SAP[2]."*

Fundamental to this is the recognition that management plans have to be revised in response to changing circumstances – there can be no final plan. The SAP therefore establishes an agreed planning and management process, and prioritises an initial programme of interventions based on present knowledge.

[2] Operational Strategy of the GEF; GEF 1996

The responsibility for formulating the SAP and implementing the steps leading to the development of the document are very clear:

> *"Formulation of SAPs is the responsibilities of the collaborating governments and national/regional stakeholders.…It is through SAP formulation that baseline and additional priority actions are identified."*

The role of the project is to facilitate the process, not to carry it out on behalf of collaborating governments.

The capacity to implement the programmes embodied in the SAP, and hence to make use of additional funding sources to support the programmes, is demonstrated by their capacity to develop the SAP.

### 1.3.3 The Transboundary Diagnostic Analysis

Following on from this, and as a response to the clear need for local and regional consultation the GEF recommends that participating countries adopt a process that includes a formal assessment of problems and priorities, described as a Transboundary Diagnostic Analysis – TDA.

> *"The centrepiece of the GEF strategy... is the concept of "strategic joint fact finding" as a means of arriving at a consensus on what actions are needed to address threats... collaborating states establish technical teams that work to establish a common baseline of facts and analysis of the problem in the form of a transboundary diagnostic analysis (TDA), which is then used to set (national) priorities for actions to address threats to international waters in the form of the SAP.*[3]*"*

### 1.3.4 The Convention

The project document also included the objective of "…a regional legal framework for cooperative management of the lake environment". As a result of preliminary consultation it was agreed that this legal framework would be formulated as a ***Convention***, in line with recognised legal international principles[4].

The overall aim of developing the Convention is to establish a legal and institutional framework to support the strategic action programme (SAP), specifically an agreement between the four countries, for the management of Lake Tanganyika. The Convention, based on international law, formalises national obligations, and allows international arbitration in case of dispute.

As the SAP provides flexible management guidance it will change as management priorities change however the Convention is unlikely to be regularly amended.

[3] Study of GEF's Overall Performance; GEF 1998

[4] Recommendations of the Legal and Institutional Workshop concerning the contents of the Draft Agreement - February 1998.

## 1.4 Biodiversity and Sustainable Development

Although in the project document the problems of managing the lake resources are phrased in terms of threats to biodiversity, in line with the lessons learned from other projects, the SAP addresses biodiversity conservation through promoting sustainable development[5].

The conservation of natural resources within and around the lake will have a positive effect on the sustainability of the fisheries, and the control of pollutants will have a positive impact on human health. Although the SAP will continue to support the appropriate development of protected areas (used in the sense of national parks and reserves), the main conservation approach is controlled management rather than exclusion[6].

Essentially the SAP is looking for win-win situations, where biodiversity considerations are taken into account in developing strategies for sustainable development.

## 1.5 The Development of the Lake Tanganyika SAP and TDA

The main threats to Lake Tanganyika's biodiversity were identified by the riparian representatives at the Project Inception Workshop in January 1996. The country representatives also ranked the perceived threats in order of national importance and the summation of these scores provided the initial prioritisation of threats for the region.

Building on this matrix, the project prepared a consultation document for the Preliminary Strategic Action Programme. The document was circulated and discussed at a regional meeting in December 1997.

At the January 1998 Project Regional Steering Committee (RSC) the four countries jointly committed themselves to formulating a regional Strategic Action Programme for Lake Tanganyika. The Steering Committee defined a process of consultation which would be led at the national level by the National Working Groups (NWG), and at the regional level by the Technical Advisory Committee (TAC).

The process was based on a two-stage development, leading to a final project SAP.

The first stage was the preparation of a preliminary TDA and a draft SAP.

The implementation of the preliminary TDA introduced the SAP Planning group to the analytical approach that would be followed and brought together national concerns into a regional framework. The preliminary TDA also guided the special studies towards answering specific priority management concerns through their research and monitoring programmes.

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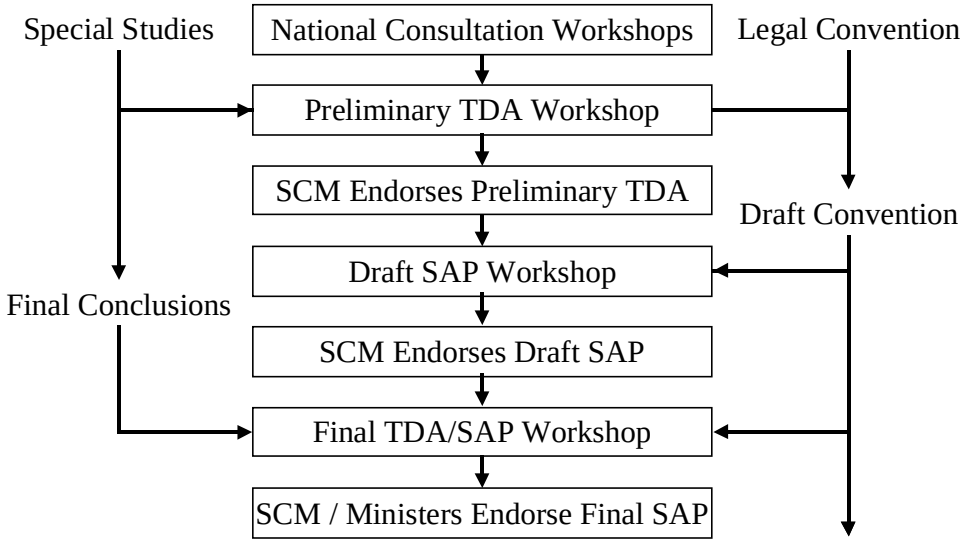
[5] *Biodiversity Conservation Projects in Africa: Lessona Learned from the First Generation* World Bank Environment Department Dissemination Notes Number 62 July 1998.

[6] "…free standing biodiversity operations - enclaves of conservation separated from the development mainstream – are unlikely to be financially sustainable" World Bank Environment Department Dissemination Notes July 1998.

In a similar way, the preliminary TDA also fed into the development of the Convention that was prepared in parallel with the SAP, ensuring that the Convention would have the scope to support the management concerns of the SAP.

The final project iteration of the TDA was undertaken following the completion of the special studies programmes and the preparation of reports directed at the specific information requirements of the TDA.

**Figure 1 Seven Steps in the Development of the SAP**




However, the SAP process does not stop with the production of the first plan. The SAP incorporates the formation of a Lake Management Body, responsible for supervising regional interventions that stem from the SAP, and promoting national interventions within the framework of the regional programme. The Lake Management Body will be responsible for developing future iterations of the SAP in response to improved information and changing threats and opportunities.

### 1.5.1 The Process of Consultation

**National Consultation**

Following the initial consultation process that led to and evolved from the inception workshop, and the regional agreement on a process to develop the SAP, each country then proceeded with their internal consultation process.

This was initiated with a planning meeting, at which the National Working Groups identified the need to expand the national consultation process to as wide a range of stakeholders as possible, including the private sector and NGOs.

Following this two workshops were held in each country: the National Sectoral Problem Review and the National Environmental Priorities and Strategies Review[7]. Participants were identified and background papers prepared in advance, to ensure a common national understanding of the problems facing the management of the lake.

These national workshops served two main purposes:

- The national consultation ensured that national representatives in the regional TDA and SAP process were in a position to reflect the concerns of their national constituents, following their national review of the priority biodiversity and management concerns and priorities for intervention.
- The four countries developed a common analytical framework, allowing their conclusions to be brought together into a regional framework. The national analytical framework effectively defined the framework for the TDA.

**Regional Consultation**

The TAC took on the role of supervising the development of the draft SAP, adapting their composition for this exercise to reflect the new terms of reference.

Each country was represented in the SAP Planning Group by a team led by the National Coordinator with four additional experts identified by the national working groups on the advice of the workshop participants. The team members were selected to provide a range of skills and knowledge of the lake and the lake management problems.

This expanded SAP Planning Group met in Lusaka in November 1998, and with the support of the project research team leaders, drew up the preliminary matrix that provided guidance as to areas of concern that should be addressed by the special studies.

The preliminary TDA was endorsed by the project Steering Committee in May 1999.

The next meeting of the SAP Planning Group was held in January 2000 in Arusha. The output of this second meeting was the draft SAP – "The First Strategic Action Programme for the Sustainable Management of Lake Tanganyika".

This first draft focused on the structure of the document, and proposed an interim Lake Management Body that would function until the introduction of the permanent regional body proposed in the Convention.

The second TDA workshop was held in Arusha in March 2000. The meeting was supported by the special studies facilitators who presented the conclusion of their research programmes of relevance to the management needs of the lake. It was at this workshop that the final matrix was drawn up indicating the priority actions for inclusion in the SAP.

[7] In the case of DR Congo, following the outbreak of fighting in August 1998, the two workshops were combined into a single meeting held in Arusha Tanzania, allowing representatives from both Kinshasa and the Lake area to participate.

This document records the conclusions of the TDA analysis and describes the process that was used to develop the TDA framework. Further supporting documents are listed at the end of the report.

**Table 1 Technical Composition of the SAP Planning Group**

| BURUNDI | DR CONGO | TANZANIA | ZAMBIA |
|---|---|---|---|
| National coordinator. | National coordinator. | National coordinator | National coordinator pollution / institutions |
| Socioeconomics and demography. | Hybrobiology | Fisheries | Fisheries |
| Biodiversity and fisheries | Environmentalist. | Pollution | Socioeconomics |
| Institutional framework | Fisheries expert. | Environment | Sediment |
| Catchment basin / sediment/ forestry and land use. | Institutional framework | Sediment) | Environment |

# 2 The Analysis

The purpose of the Preliminary TDA is to define immediate management objectives within the overall management goal of conserving the biodiversity of Lake Tanganyika, addressing global concerns and ensuring the sustainable use of these and other resources for local communities into the foreseeable future.

The Transboundary Analysis brought together technical teams from the participating countries to establish a common understanding of the threats and specific problems that the riparian countries are facing in managing the lake resource. With this information the teams together established priorities for possible interventions to address specific management problems.

This initial prioritisation, reflecting the management concerns of the four countries, sets the agenda for the remaining activities for the special studies being carried out by the project with local partner institutions. The TDA identifies some of the uncertainties, and effectively poses the question as to whether the identified problem is having a major impact on biodiversity and hence requires immediate attention, or may be a major problem in the future and hence requires monitoring. The special studies should also comment on the value of additional benefits to sustainable development that can be expected to accrue from counteracting the biodiversity problem.

The Preliminary TDA also acts as a guide to the development of the draft Convention, through indicating the expected scope of national and regional actions that will need to be covered in the legal framework.

The conclusions of the analysis are the basis for the recommendations for priority programmes of interventions that will be addressed in the draft Strategic Action Programme. However, the SAP will take into account additional aspects relating to economic and political needs and national responsibilities to regional and international agreements.

**From Threat to Management Intervention**

The analysis starts off by reviewing the major threats, defining the specific problems or sub-problems that together make up the threat and finally proposes a sequence of management interventions to counteract each specific problem.

The value of this approach is that what appears to be an excessively ambitious and daunting management objective such as the Control of Pollution, can be broken into a series of manageable objectives addressing specific problems, many of which can be done with available resources and initiated by local institutions.

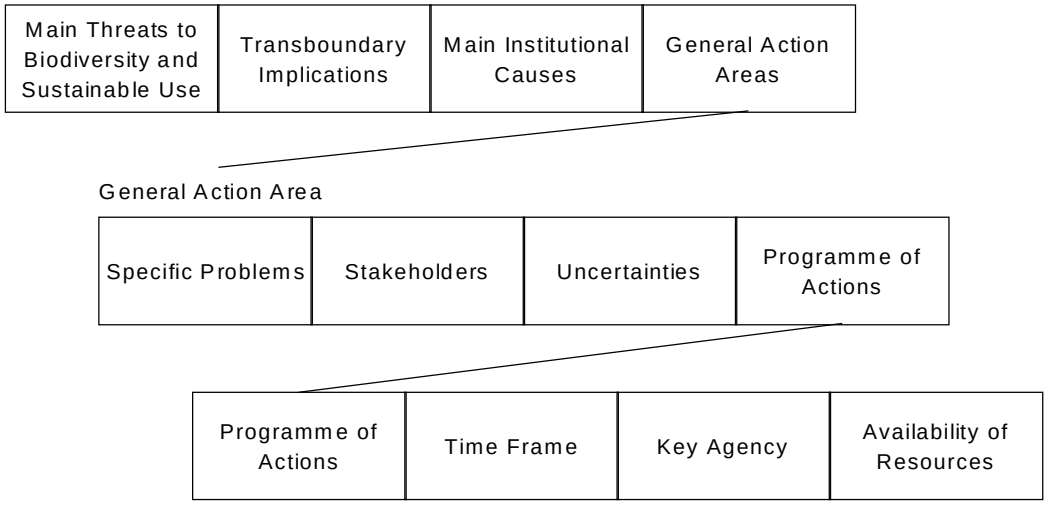
## 2.1 Analytical Problem Matrix

The Preliminary TDA brings together the four national review exercises and then adds the regional and transboundary perspective. The four countries adopted a formal

analytical matrix analysis that would form the basis of their workshops, and subsequently the regional TDA[8].

The matrix has three levels of analysis.

**Figure 2 The Analytical Matrix**




### 2.1.1 Level 1 Main Threats

The first matrix starts by reiterating the underlying objective of the project; the starting point is the list of the ***Main Threats to Biodiversity and Sustainable Use***[9]. The main threats are as follows:

- Unsustainable Fisheries;
- Increasing Pollution;
- Excessive Sedimentation; and
- Habitat Destruction

The second column, ***Transboundary Implications,*** highlights the rational for a regional programme, addressing global biodiversity and international waters issues. This column is effectively a justification for the need for international donor support for global biodiversity conservation, as well as the need for regional cooperation in addressing these threats.

The third column, ***Main Institutional Problems,*** describes the institutional constraints that are faced by the management institutions in addressing those threats. At this level the matrix is describing generic institutional problems that are common to many institutional management structures throughout the region.

[8] The adopted matrix framework is based closely on the analysis used in the "Black Sea Transboundary Diagnostic Analysis", a key in the GEF programmes concerned with the development of international waters SAPs.

[9] These threats are effectively still the same as those identified during the inception workshop, and built into the project design;

The final column, ***General Action Areas*** addresses the identified threats and provides a focus for linked programmes.

**Table 2 Analytical Problem Matrix Level 1**

| Main Threat to Biodiversity and Sustainable Use | Cross-Cutting Transboundary Implications | Cross-Cutting Institutional Problems | General Action Areas |
|---|---|---|---|
| Unsustainable Fisheries<br>Increasing Pollution<br>Excessive Sedimentation<br>Habitat Destruction | Global Loss of Biodiversity<br>Loss of Shared Fisheries Resource<br>Decline in Water Quality | Lack of Resources<br>Poor Enforcement of Existing Regulations<br>Lack of Appropriate Regulations for Lake Tanganyika<br>Lack of Institutional Coordination | Reduce Impact of Fishing<br>Control Pollution<br>Control Sedimentation<br>Habitat Conservation |

### 2.1.2 Level 2 Specific Problems

The Level 2 Matrix has four parts, one for each of the identified General Action Areas: Reduce Impact of Fishing; Control Pollution; Control Sedimentation and Habitat Conservation.

The starting point for the matrix is the column ***Specific Problem***; a listing of all the problems that together form the threat, which the general action area is addressing.

The second column lists the ***Stakeholders*** that that will need to be involved in resolving management issues for each Specific Problem identified within each General Action Areas.

***Uncertainties*** highlights those areas where further information is required to improve management or where the extent and nature of the problem is unknown. Effectively an uncertainty indicates a need for further research, often in advance of undertaking further actions.

The last column lists a set of ***Programme of Actions*** which address the Specific Problem, breaking down the interventions into steps. These proposed actions can include proposals for further research and/or monitoring activities and capacity building.

### 2.1.3 Level 3 Proposed Interventions

The third level takes each specific problem and in the first column lists each Programme of Action. The second column, ***Timing*** indicates whether an activity is "On going", whether it could start "Now" – assuming resources were made available, or whether a Proposed Action has to be preceded by a "Previous" action.

***Key Agency*** identifies the agency that would lead a particular Proposed Action, which would always be one of the Stakeholders from Level 2. Clearly this will not be the only agency involved, but it would be the one with the primary responsibility for coordination and the one that would be responsible for drawing together a detailed programme of activities for funding.

Finally the ***Availability of Human / Material Resources*** is an indication of whether the Key Agency and it's partner agencies could tackle the Proposed Activity with existing human and/or material resources. However this does not mean that these resources are already being directed to the action, merely that, given a priority by the agency, they could be made available now.

Lack of human resources includes lack of personnel and/or lack of training to be able to carry out the proposed activity. Lack of material resources includes both lack of physical equipment, ranging from laboratories to vehicles, and lack of funds to cover subsistence or other field expenses.

Clearly where a "No" exists, the implementation of the action will require additional institutional capacity building, either through reallocation of resources among the agencies, or through external donor support. In addition, if the rate of progress that can be achieved using only existing resources is considered unsatisfactory, then there is still a case for capacity building.

## 2.2 Prioritisation of Interventions

Throughout the region, government and private resources are stretched by existing demands for development. The resources that can be directed towards biodiversity conservation and sustainable development at the Lake, will always be limited by conflicting demands for national poverty alleviation, employment creation and food security. As a result it is necessary to establishing priorities to direct limited resources (financial, material or human), to address critical problems.

The concept can be presented quite simply: if you only have resources to address one problem, then based on some formal logical appraisal, the first priority is given to addressing that one rather than any others.

A problem is of second priority if, having resources to address a second problem, one would also decide to address that one.

Establishing priorities in this way will help the four countries to allocate their own resources. In the same way, donors are assured of the rational use of their financial support, and hence encouraged to contribute to the programme.

### 2.2.1 Prioritisation Criteria

The analysis used in the TDA exercise to establish priorities is based on three criteria. The first two are related directly to the objective of the lake biodiversity conservation. The third one is related to indirect benefits that can be associated with these actions.

The three criteria are:

1. **The severity of the problem threatening biodiversity;**
2. **The feasibility of the solution;**
3. **Additional benefits in terms of sustainable development.**

Identified problems and actions within each General Action Area were prioritised separately. There are therefore effectively four sets of priorities, dealing with fisheries, pollution, sediment control and habitat conservation.

### Severity of Problem

The first stage is to assess what benefits could be expected from addressing a particular problem, in terms of strengthening the conservation status of Lake Tanganyika biodiversity. This judgement is based as far as possible on a scientific diagnosis of the impact of the problem on the lake biodiversity.

However, many uncertainties inevitably remain – and it is then necessary to bring in the concept of the Precautionary Principle[10]. This can be summarised as follows:

> ***If an existing problem is considered to be a significant threat to the biodiversity of the lake, then steps should be taken to minimise this threat, even if it can not be conclusively shown on the basis of scientific evidence, that damage will be unacceptable.***

The assessment of the severity of a problem will result from the combination of a scientific diagnosis (where the information is available) and from more subjective and intuitive assessments, based on an empirical knowledge of the lake, where national consultation plays a crucial role.

### Feasibility of the Solution

The second consideration in setting priorities is the feasibility of the solution; there is little point in addressing management or research concerns to problems that have no real management solutions[11].

The assessment of the feasibility of the solution comes after the identification of actions needed to address the problem. In general, it comes from the acquired field experience of environment management in the region, particularly from the experience of different sectoral participants represented in the NWGs (fisheries, erosion control, harbour management, towns…).

[10] "Noting also that where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimize such a threat" Convention on Biological Diversity, 5 June 1992.

[11] Threats that are not susceptible to local management solutions such as global warming or volcanic movements, although with potential impacts on biodiversity, are therefore excluded from the analysis.

**Additional Benefits**

Although the primary objective of the project is defined as biodiversity conservation, this in itself is accepted as an integral component of sustainable development, within the framework of the Rio 1992 resolutions.

The conservation of lake biodiversity has benefits at both global and local levels, however the costs of biodiversity conservation, in terms of constraints on natural resource exploitation, are met by local communities. Identified actions should therefore strengthen sustainable development as a specific objective.

Here again, at the level of this assessment, additional stakeholders represented in NWGs have a central role to play. This is particularly important to ensure that proposed actions fit within the different national policies and strategies aimed at promoting sustainable development.

### 2.2.2 Prioritisation of Actions

The assessment of problems according to these three criteria resulted in three levels of classification:

**High (A), Medium (B) or Low (C) Priority**

To reach this classification, within each of the four general action areas, participants reviewed all identified problem areas against the three criteria described above: severity of problem; feasibility of solution and additional benefits. The participants then decided to give a score of 1, 2 or 3 to each of these criteria, with a high score allocated to addressing serious biodiversity problem, a high score to readily implemented management interventions, and a high score to high additional benefits to sustainable development.

The final prioritisation into High, Medium and Low priorities is based on a simple addition of the three scores, giving a maximum score of nine. High Priority (A) was given to those that scored eight or nine, Medium Priority (B) six or seven, while Low Priority (C) was given to those that scored five or less.

Although there are many possible criticisms of this method of criteria aggregation, it has at least the advantage of being a simple way of obtaining a consensus. The approach was not, however, rigid, as participants were able to react where they felt the conclusions were unsatisfactory. In the event, only minor readjustments were required, demonstrating the acceptability of the method.

**Specific Priorities within the High Priority Groups**

The result of the first level of prioritisation was to identify high, medium and low priorities within each of the four general action areas. The final stage of the prioritisation was to review the specific priority of each of those problems in the High (A) priority group.

The analysis was largely based on the appraisals carried out at the national level, again discussed before being given a regional priority. In most cases the specific problems

being addressed were not equally applicable throughout the four countries, and therefore not equally nationally significant, but identified as regionally significant.

As a result there will not be identical national interventions counteracting specific problem, or indeed actions by all four countries.

# 3 Conclusions of the TDA - Priority Interventions

While the problems are analysed as if they were sectoral issues, the interconnection between different sectors is recognised in the cross-sectoral proposed actions.

Fishing, along with farming, are the two main livelihood option for lakeside communities. The only major area of industrialisation is Bujumbura.

Fishing provides an important source of protein and cash for households in the region. It also provides a major export, Lake Tanganyika's sardines are highly valued and are transported to areas distant from the lake, such as the copper belt in Zambia and to the diamond areas in DR Congo. Annual commercial catch in 'recent years' has varied from 165,000 - 200,000 t, which translate into annual earnings of tens of millions of US dollars. Widening the perspective to include additional artisanal gears and the subsistence fishery it is clear that fishing makes a major contribution to the nutritional and financial well being of local and national economies.

The links between fishing and farming activities are important: many fishermen's households are also dependent on agriculture (a role largely taken by women). Demand for terrestrial resources (flat land for sun-drying and fuel wood for smoking) to support fishing also links the terrestrial and aquatic environment of the lake. The relative importance of fishing and farming to individual households changes according to factors such as the cycle of the moon, the season, short and long term returns from fishing or farming.

In many case agriculture in the coastal zone is constrained by the narrow flat shoreline and moves onto the steeper hillsides above the villages. The loss of forest cover and the limited use of soil conservation strategies results in a loss of soil and decrease in soil fertility. It is these steep coastal areas that provide the localised rocky habitats that support many of the species of major significance to biodiversity. Erosion from existing and newly opened farm land, while restricted to areas adjacent to coastal villages, threatens to swamp these rocky habitats with increased sediment load. Further away from the lake, the impact of farming practices in the medium sized basins has resulted in increased sediment load in the rivers flowing into the lake. The expanding deltas and coastal currents can result in the impact of the increased sediment load being felt up to ten kilometres away from the river mouth.

Poor farming practices and associated deforestation and land clearance threatens the long term viability of farming through loss of soils and soil fertility and threatens the lake biodiversity and fishing resources through increased sediment load.

The potential interaction between pollution and fisheries is also clear. Urban domestic waste and industrial pollution are of particular concern as the discharge is concentrated into a few areas and can build up to levels that can affect human health directly as well as through the fish and mollusc food chain.

While the focus of attention on biodiversity has been on the value of the littoral zone, the ecological and economic links between the pelagic fisheries, the littoral fisheries and coastal agriculture are clear. The concern is that if any one component of the system collapses, additional and unsustainable pressure will be put on the remaining

resources. If over-fishing damages the pelagic fisheries, then communities will be forced to transfer activities to the littoral fisheries and extend agriculture into ever more marginal areas, with the associated risks of increased land degradation and erosion, increasing the sediment load, in turn threatening biodiversity.

## 3.1 Priority Concerns

The following tables summarises the conclusions of the workshop, listing the specific problems, the score on each of the three criteria (severity, feasibility, additional benefits), and the final classification in three priority categories A, B, C.

**Table 3 Prioritisation of Problems - Reduction of Fishing Pressure**

| Specific Problem | S | F | B | T | C |
|---|---|---|---|---|---|
| Excessive fishing effort in the littoral zone | 3 | 2 | 3 | 8 | A |
| Excessive fishing effort in the pelagic zone | 3 | 2 | 3 | 7 | A |
| Excessive or uncontrolled extraction of ornamental fish | 3 | 2 | 3 | 8 | A |
| Use of beach seines | 3 | 1 | 3 | 7 | B |
| Use of inappropriate mesh sizes | 3 | 1 | 3 | 7 | B |
| Lack of economic alternatives for fishermen | 3 | 1 | 3 | 7 | B |
| Insecurity and piracy | 2 | 1 | 3 | 6 | B |
| Fishing in sensitive areas | 3 | 1 | 3 | 7 | B |
| Destructive methods (others than seines or mesh) | 1 | 1 | 3 | 5 | C |
| High demand for fish | 2 | 1 | 1 | 4 | C |
| Insufficient data in the southern part of lake in Congo | 1 | 1 | 2 | 4 | C |

S: severity, F: feasibility, B: additional benefits, T: total, C: classification

**Table 4 Prioritisation of Problems - Control of Pollution**

| **Specific Problem** | **S** | **F** | **B** | **T** | **C** |
|---|---|---|---|---|---|
| Urban and Industrial pollution | 3 | 2 | 3 | 8 | A |
| Harbour pollution | 3 | 2 | 3 | 8 | A |
| Pollution from future mining activities or oil exploitation | 3 | 2 | 3 | 8 | A |
| Risks of major marine accidents | 3 | 2 | 3 | 8 | A |
| Risk of water hyacinth expansion | 2 | 2 | 3 | 7 | B |
| Chronic pollution from boats | 2 | 2 | 2 | 6 | B |
| Introduction of exotic fish species | 2 | 2 | 2 | 6 | B |
| Pollution from farming in the catchment | 2 | 2 | 2 | 6 | B |
| Use of pesticides to control vectors of human diseases | 1 | 3 | 1 | 5 | C |
| Pollution by present mining activities | 1 | 1 | 2 | 4 | C |
| Atmospheric fallout from bush fires | 1 | 1 | 2 | 4 | C |

S: severity, F: feasibility, B: additional benefits, T: total, C: classification

**Table 5 Prioritisation of Problems - Control of Sedimentation**

| Specific Problem | S | F | B | T | C |
|---|---|---|---|---|---|
| Erosion from inappropriate farming practices | 3 | 2 | 3 | 8 | A |
| Deforestation | 3 | 2 | 3 | 8 | A |
| Human settlements badly designed or uncontrolled | 3 | 1 | 3 | 7 | B |
| Sand extraction and other activities in river banks | 2+ | 2 | 2 | 6+ | B |
| Overgrazing in plains | 2 | 2 | 2 | 6 | B |
| Bad installation or management of mines and quarries | 2 | 2 | 2 | 6 | B |
| Unsatisfactory designing or construction of roads | 2 | 2 | 2 | 6 | B |
| Erosion from uncontrolled bush fires | 2 | 2 | 2 | 6 | C |
| Potential mines and quarries | 2 | 1 | 2 | 5 | C |

S: severity, F: feasibility, B: additional benefits, T: total, C: classification

**Table 6 Prioritisation of Problems - Habitat Conservation**

| Specific Problem | S | F | B | T | C |
|---|---|---|---|---|---|
| Threats to Resources in National Parks | 3 | 1+ | 3 | 8+ | A |
| Degradation of Key Habitats | 3 | 3 | 2+ | 7+ | A |

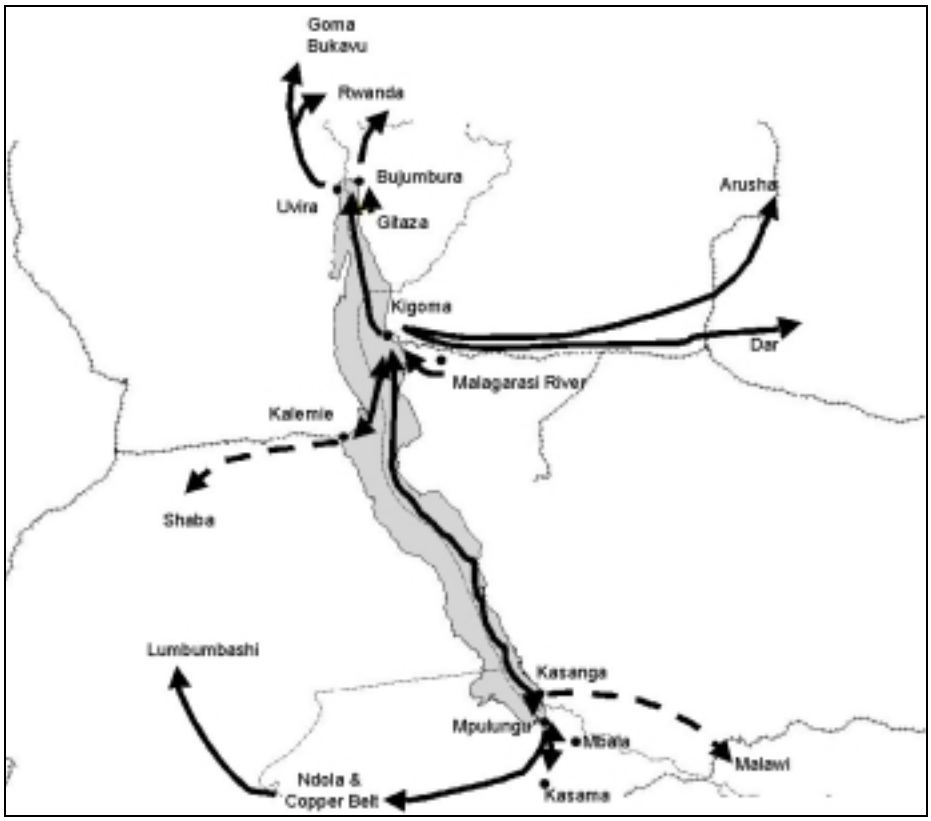
S: severity, F: feasibility, B: additional benefits, T: total, C: classification

## 3.2 Reduction of Fishing Pressure

There are two distinct but overlapping fisheries in the lake, the near-shore fisheries and the offshore fisheries – the littoral zone and the pelagic zone. The overlap is both ecological and economic, and both fisheries are linked to shore communities and interrelate with their other economic activities.

Within any lake shore community, there are likely to be groups who concentrate their fishing activities in the offshore zone, at the same time as other groups focus on the littoral zone for both subsistence and commercial activities. Meanwhile, other family members and the fisherman themselves are usually also engaged in farming. The balance between these activities depends on the season, the fluctuation in fish stocks, labour availability and changes in markets.

**Map 2 Main Fish Trade Routes**




The focus of the Lake Tanganyika Biodiversity Project (fishing practices and biodiversity special studies) has been predominantly on the littoral zone, the fishing grounds with the greatest biodiversity. The FAO/FINNIDA supported lake Tanganyika Research (LTR) Project, has been focused on the pelagic zone and the commercial fisheries. These two aspects must be related if an overall sustainable fisheries management programme is to be developed. If the pelagic fisheries collapse, then this will place additional pressure on the littoral fisheries.

Over 50 different fishing gears were recorded during surveys of the lake fisheries. Of these, twelve[12] are considered to be of key significance, and there is some overlap between the pelagic gear and the littoral gear. The problem is not one of fishing gear, but one of fishing pressure.

**Table 7 Key Fishing Gear Characteristics**

| **Gear** | Key Characteristics |
|---|---|
| **Industrial purse seine** | Used in the industrial fishery offshore Zambian DoF figures indicate that this fishery takes 4-5,000 tons/year, roughly 3% of the estimated 167,000 tons/year of the whole lake fishery |

[12] Industrial purse seine; beach seine; light assisted beach seine; ring net; bottom set gill net; encircling gill net; lift nets; simple lines; jigged lines; bottom set long lines; pole and line; and, non return traps.

| | |
|---|---|
| **Light assisted beach seine** | Targets sardines, attracted to kerosene pressure lights at night. Each beach seine can employ as many as 20 people, including light boat crews and net pullers. |
| **Beach seine** | Catches & targets littoral fishes. Usually has a larger mesh in the wings than in the bunt or bag. |
| **Ring net** | "Chiromila" seine as used in Zambia in Nsumbu region. Used offshore at night with lights. |
| **Bottom set gill net** | Set net, various mesh sizes and depths. Ubiquitous. Cheap. All countries have some mesh size restrictions. |
| **Encircling gill net** | M'timbo or splashing water or tam tam (not a ring net). Like a gill net but deeper and used in a circle with draw lines from a boat with a frightening device. |
| **Lift nets** | One, two or three boat. Each boat employs a crew of 6 and LTR estimated a minimum of 3,200 boats. A large percentage of the total lake catch is hauled by this gear. |
| **Jigged lines** | Mainly for Lates stappersii, 50 or more un-baited hooks. Used during the day in deep waters. High economic importance, found all round the lake. |
| **Simple lines** | Includes vertical hand lines. Used everywhere round the lake. Baited hooks, targeting fish on or near the bottom |
| **Pole and line** | Important in terms of contribution to protein in the household diet. This practice is carried out by children in every village round the lake, targeting juvenile littoral species. |
| **Non-return traps** | Used in swamps and reed beds. Very common in Rusizi. Made from bamboo, wooden slats and wire mesh. |
| **Bottom set long lines** | Lines with 40–400 baited hooks, which are laid along the bottom from a boat. Used everywhere where there is a snag free bottom. |

### 3.2.1 Excessive Fishing Effort in the Littoral Zone

**High Severity of Problem:** a major increase in the number of fishermen has been observed throughout large parts of the lake shore. Many people are now exploiting the coastal waters, which are richest in biodiversity. The higher the population density, the greater the problem.

**Medium Feasibility of Solutions:** the problem is not easy to solve, traditional approaches to enforcement have had little success, often constrained by very limited resources. However, there are possibilities to take a broader approach involving positive promotion of community solutions and promotion of alternatives.

**High Additional Benefits:** with few alternative livelihood options available for the majority of the riparian communities, the maintenance of sustainable fisheries is, at present, essential for the livelihoods of coastal populations.

The littoral fisheries are complex. They are multi-species, multi-gear, and involve both artisanal and subsistence fishermen whose pattern of effort is primarily dictated by the moon but with the rains also affecting fishing activity. Both artisanal (i.e. sell catch) and subsistence (i.e. eat catch and sell any occasional surplus) fishermen operate in the littoral zone.

Of the twelve significant practices the majority are deployed in the inshore area. These are light assisted and day beach seines, gill nets (bottom set and encircling), traps, and lines (simple, bottom set, pole).

Many of the inshore fishing grounds (0-50m depth) adjacent to areas of high population settlement are already under heavy pressure from a range of gears, and there are indications of reduced catch and changing catch composition and in some areas collapse.

Previous management interventions to try to control these fisheries have depended on state legislation limiting fishing effort through licensing or banning a particular gear. This approach has not been successful, partly as a result of lack of enforcement capacity[13] and partly as a result of the tendency by fishermen to switch gear without reducing effort.

An alternative approach, increasingly adopted in the management of fisheries world-wide is to look toward partnership arrangements amongst groups of people with a stake in the fishery (e.g. fisher communities, NGO's and governments). This is often called co-management, a broad term used to describe a range of partnerships from those which are primarily community-led through to those in which governments retain more responsibility in managing a fishery.

This approach does require a major change in perspective towards increasing participation of local stakeholders and a changing role for the institutions formally charged with fisheries management (usually focussing exclusively on enforcement).

One starting point might be the riparian communities in Zambia which have established village conservation and development committees, who have been working on training and environmental education component of the LTBP to improve their capacity to plan and manage projects.

### 3.2.2 Excessive Fishing Effort in the Pelagic Zone

**High Severity of Problem:** although the pelagic zone is less rich in biodiversity than the littoral zone, any collapse in the pelagic fisheries will have a dramatic knock-on effect on the littoral zone, both through increased fishing pressure and indirectly through intensified farming practices.

**Medium Feasibility of Solutions:** the improved management of the pelagic fisheries is essential for the economic well-being of the region. The LTR programme is in the

[13] The ban on beach seines is in Tanzania only (in Zambia they are banned everywhere except Lake Tanganyika, and they are not banned in Burundi and DRC). Tam Tam (encircling net with frightening device) is banned everywhere, but only in Zambia is it enforced (through local chiefs).

process of drawing up management plans through a process of negotiation, which has included coastal communities.

**High Additional Benefits:** with few alternative livelihood options available for the majority of the riparian communities, the maintenance of the pelagic fisheries is essential for the livelihoods of coastal populations, and for national economies.

As noted earlier, the study of fishing in the pelagic zone fell under the remit of the Lake Tanganyika Research project (LTR) that has initiated the development of a fisheries management plan covering the pelagic commercial species. The area of overlap between LTR's remit and LTBP's focus on biodiversity is however important for the SAP to consider.

In essence, the pelagic fishery supports large numbers of fishermen throughout the lake. The most 'visible' practices are the purse seine fleet, the light assisted beach seines and the lift net fleet which fall within LTR's plan. However, the pelagic species fishery is also an important livelihood option for many smaller scale artisanal fishermen who paddle some distance from the shore and use jigged lines to target Luciolates stappersi.

The effect of a failed pelagic fishery would be increasing pressure on the coastal zone through greater reliance on inshore fish resources and/or land for agriculture. This has serious implications for the sustainable management of the lake's ecosystem – the remit of the SAP.

Focussing the SAP's attention on the pelagic stocks and the livelihoods they support also recognises that, to many riparian communities, these species are the most valuable part of Lake Tanganyika's biodiversity. Sustainable use of the lates and clupeid stocks is a key contribution to the maintenance of the 'higher profile' part of the lake's biodiversity – the species of the littoral zone. Therefore, both local and regional aims can be achieved through implementing a sustainable management plan for the pelagic fishery.

It is important to note that fishing pressure is not the only factor influencing the status of the commercial stocks. Environmental changes such as temperature are thought to contribute to the relative abundance of clupeids and perch species. These environmental changes and their effect on the fish stocks are not fully understood. Thus management of the fishery has to be undertaken within some uncertainty and be guided by the precautionary principle.

The SAP should assess the status of the Fisheries Management Plan developed under LTR, reviewing it in light of the broader biodiversity objectives of the SAP. It is important for the sustainable management of the lake as a whole that any plan to manage the fisheries is brought into the SAP process. This ensures major resource plans will be considered alongside other regional priorities and provides a mechanism to proactively promote adoption of sustainable fisheries management in the lake.

### 3.2.3 Excessive or Uncontrolled Extraction of Ornamental Fish

**High Severity of Problem:** the problem is believed to be serious for biodiversity because the targeted species are endemic, rare, localised and hence vulnerable.

**Medium Feasibility of Solutions:** the problem is not very easy to solve, but exporters are specialised, few in number, identifiable; the problem can also be addressed through the end market.

**High Additional Benefits:** a reasonable management of this exportable resource could provide sustainable economic benefits.

These proposals are considered to have a high priority, as although they clearly affect a much smaller segment of the population in the region, they focus on vulnerable species, and there are already reports from traders of the disappearance of species from specific sites. The potential for improved management is quite high, and licensing for export could pay for the enforcement of legislation. Meanwhile the export of these species continues to draw attention to the lake biodiversity value, and can help direct donor attention to the lake management problems.

There is the potential for promoting community involvement in the industry and hence promoting livelihood alternatives. Environmental education and possibly the management of a few aquaria have been proposed as means of raising awareness.

### 3.2.4 Medium Priority Fishing Problems

There are five problems that have been given a medium priority rating. The impact on biodiversity is generally high and if they could be effectively managed the potential socials and economic benefits would also be high, but the potential management interventions are limited.

The specific issue of the use of beach seines and inappropriate mesh size highlights the concern of fisheries departments with the control of catch through targeting the use of gear. However, while the use of these gears clearly is a major contributory aspect to the problem of over-fishing in the littoral zone, it is not the key problem, which is too many people fishing and with little alternative options in terms of acceptable livelihoods.

This leads into the problem described generally as lack of economic alternatives for fishermen. Much of the lakeshore is remote with few options in terms of agricultural production or fisheries, while in the more densely populated areas there may be more options available related to urban markets, the number of people capable of taking up these options is limited. However, unless the issues of livelihoods and poverty are addressed, through the promotion of a broad range of socio-economic interventions, there can be no long term solution to the underlying problem of over dependence on a fisheries resource.

While insecurity and piracy clearly affect many fishing communities, the impact on biodiversity is localised. Fishing pressure is generally moved from one part of the pelagic zone to another, albeit one closer to the shore. In some cases where problems are really serious it can result in a switch from the pelagic zone to the littoral zone and increase damaging pressure on biodiversity. The social and economic pressures are also high, with fishermen loosing their craft and in some case their lives. However, given the continuing political disturbances in the region, there is little that can be done in the immediate future, apart from an overall political settlement.

The final issue – fishing in sensitive areas – is dealt with later in this chapter, under the topic Habitat Conservation. This issue impacts on both the littoral and pelagic fisheries, and has been largely overlooked in the LTR programme, however it does include the protection of critical spawning and nursery grounds.

### 3.2.5 Low Priority Fishing Problems

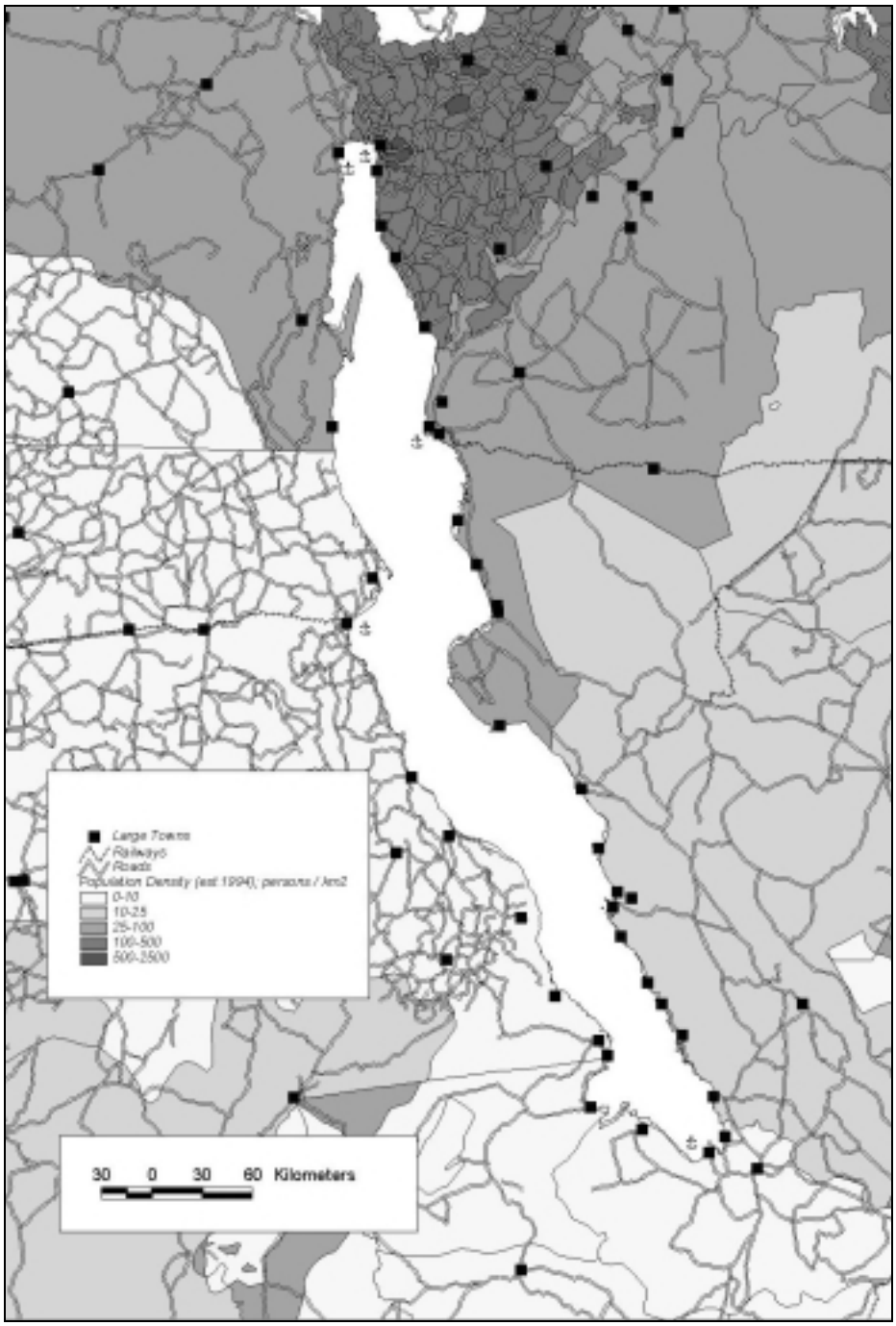
These are generally problems which are considered to have low impact on biodiversity or thought to be very limited in extent (destructive fishing methods such as dynamite and poison and lack of data in the southern part of the lake…) and are at the same time hard to solve (clandestine methods, insecurity, commercial demand). The high market demand, which results in the high fishing pressure (addressed as a specific problem above), is considered as a more important problem, but is particularly difficult to solve without harmful effects on the socio-economics of the area (decline of purchasing power) or environmental area (increasing grazing pressure).

## 3.3 Pollution Control

The potential impact of pollution on the lake is a major concern, and was given due weight in the full title of the LTBP – Pollution control and other measures to protect biodiversity in Lake Tanganyika.

Pollution is the result of human activities within the catchment, and is predominantly linked to settlements, ranging from villages to towns to capital cities. These settlements are scattered throughout the catchment and are centres for a variety of potentially polluting industries and activities. Possible sources of damaging pollution include: domestic waste; farming with fertilisers and pesticides; ports, harbors and marine traffic; industrial factories and small-scale registered and unregistered industries; petroleum products depots and power stations; commercial fishing industries and slaughterhouses; mines and quarries.

**Map 3 Main Urban Settlements and Population Density**




### 3.3.1 Urban and Industrial Pollution

**High Severity of Problem:** the problem is considered as serious in all urban centres around the lake. The major urban centre of Bujumbura has a growing industrialised base, and there are both registered and informal industries associated with all settlements round the lake. The fact that the lake is effectively a closed system means

that the emission of non biodegradable pollutants will result in an accumulation process which could threaten the lake.

**Medium Feasibility of Solutions:** the problem is technically easy to solve and localised, but requires the commitment of local government and the communities involved, as well as financing. However, interventions will also receive political support as a result of their social and health benefits.

**High Additional Benefits:** controlling the problem would allow for the preservation of water quality for domestic and industrial use, while also protecting the fishing industry. Particular benefits will go to the public health sector, while the recommended recycling of industrial waste provides also opportunity for economic savings.

Urban and industrial pollution is closely linked. Urban centres attract industries and form major market and transport hubs, which in turn attract more settlement. Urban population growth in all the riparian countries greatly exceeds rural population growth.

The largest city on the lake is Bujumbura with an urban and peri-urban population of around 600,000. With the other coastal towns in Burundi, and with Uvira in DR Congo, with a population of around 300,000, the northern part of the lake is the major concentration of urban settlement on the lakeshore. In Tanzania Kigoma, with a population of 135,000, is the major settlement and port facility, and to the south of the lake, Mpulungu in Zambia with a population of 70,000 is also a major port.

Bujumbura has two major industries that discharge significant quantities of waste water that passes untreated into the lake, brewing and textiles. There are in addition many other potentially polluting industries. These include the production of batteries, paints, soap, pharmaceuticals, slaughterhouse, oil depots and garages. In Uvira, the main concerns are petroleum products, cotton processing and sugar production.

In addition increasing volume of domestic waste and effluents linked to growing urban settlements is an issue in all countries round the lake. Even where the settlements were originally planned to incorporate sewage and solid waste management, their growth has outstripped the planned capacity of waste disposal systems.

In Kigoma bay, where water circulation is restricted, there are already signs of eutrophication. The water intake for the town is located very close to the discharge points for untreated sewage from a number of institutions and the waste entering the lake from the TANESCO power station.

While the problem is technically easy to solve and fairly localised, it requires the commitment of local government and the communities involved, as well as major financial investments. The benefits to public health are immediate and direct, with improved water quality benefiting many direct users. The long-term benefits to fisheries and biodiversity relate to a reduction in excess nutrient load, and the reduction in harmful leachates from poorly sited or managed solid waste disposal.

### 3.3.2 Harbour Pollution

**High Severity of Problem:** harbours are identified as an important source of pollution, sometimes deliberate as waste is dumped into the lake (Mpulungu); pollution is however estimated to be less than that of factories and towns; precautions have already been taken (Bujumbura) or are envisaged (Mpulungu).

**Medium Feasibility of Solutions:** actions are identified and will be facilitated by the concentration of those sources of pollution; some immediate actions are easy to undertake, although total eradication of the problem will be difficult as boat and harbour operators will not be willing to bear all additional costs.

**High Additional Benefits**: controlling the problem would allow for the preservation of water quality for its use (domestic or industrial) and for fishing.

Harbours are a significant source of pollution, both through accidental contamination from spillage during transfer of cargo, through waste dumped from boats, and in some cases, waste dumped from shoreline factories.

Harbour management systems are designed to avoid accidental pollution, but the majority of harbour facilities are designed for low volumes of marine traffic and become over-stretched by high traffic volumes. While dumping waste from boats may be acceptable at low levels, with increasing traffic pollution problems will occur.

The impact of political instability in the region has been to reduce the level of some marine traffic such as the transport of oil and agrochemicals, while increasing others such as bulk food transport. With increasing stability the volume of potentially hazardous goods and the potential for spillage in harbours will increase.

The benefits of addressing harbour pollution are again immediate, with direct public health impacts as well as more general benefits to fisheries and biodiversity.

### 3.3.3 Pollution from Future Mining Activities or Oil Exploitation

**High Severity of Problem:** very serious damage could result from those activities if no measure is taken (pollution from the mercury used by some gold washers[14], pollution from other heavy metal contained in ores, eutrophication from phosphates, pollution from hydrocarbons).

**Medium Feasibility of Solutions:** this potential problem is not easy to address, but preventive measures are identified (particularly by EIAs).

**High Additional Benefits:** controlling the problem would allow for the preservation of water quality for its direct use (domestic or industrial) and for fishing; controlling the usage of mercury by gold washers is a crucial issue in terms of public health.

At present there is relatively little mineral exploitation in the catchment. However, the mineral potential of the basin has not been fully explored, and there are indications that there may be economically viable oil fields as well as gold and other minerals.

[14] While mercury is now used for both small scale and industrial gold extraction, there are techniques that do not rely on these processes, these could be reviewed and promoted where relevant.

"Smallholder" gold mining is carried out in the upper catchment of the Malagarasi in Tanzania, and involves the use of mercury in processing, and there are companies that have looked into commercial operations in the same area.

There is also already a signed agreement for the exploitation of a nickel resource in the Burundi part of the Malagarasi basin. The processing factory will constitute a potential source of pollution for the lake.

The level of control on industrial mineral exploitation varies from country to country, although all have some legislation that could be used to support sound industrial development and to a lesser degree smallholder mining operations. In practice there is little control of smallholder systems and little experience of environmentally sound management of major industrial operations.

These limitations are recognised but if appropriate actions are taken now, there is the potential to implement preventive measures and avoid future problems associated with any significant expansion of mining or oil exploitation.

### 3.3.4 Risks of Major Marine Accidents

**High Severity of Problem:** the problem is considered as serious because of the potential danger of an accident causing oil slicks or spillage of dangerous products (pesticides or others). As the lake has numerous endemic species some limited to very confined habitats, there is a big risk that accidental pollution may cause irreversible extinction, even if the quality of water can restore itself. Although no major accident have yet occurred, the risk is ever present and increases with trade and development.

**Medium Feasibility of Solutions:** the risk cannot be eliminated, but progress is possible towards reducing of risks and planning better intervention in case of disaster.

**High Additional Benefits:** controlling the problem would allow for the preservation of water quality for its direct use (domestic or industrial) and for fishing; in addition, prevention of accidents favours directly transport activities and, indirectly, dependent economic sectors.

So far there have been no major environmentally damaging marine accidents recorded on the lake. However there are hazardous cargoes transported regularly across the lake with little control of storage or handling. The volume of traffic is variable and at present depressed as a result of the continued political disturbances. However, oil continues to be one of the main potentially hazardous cargoes and is transported in towed barges.

As the riparian countries continue to develop their industrial potential, the volume of traffic will increase as will the range of cargoes. Again there is existing legislation in all countries that deals both with design of vessels and cargo handling, but this needs to be reviewed in the light of increasing traffic and range of hazardous cargoes.

### 3.3.5 Medium Priority Pollution Problems

These are problems believed to be less important than the previous ones: two non-point sources of pollution (Chronic pollution from boats, Farming pollution in the

catchment) and two problems of introduction of biological pollution (risk of expansion of water hyacinth, introduction of exotic fish).

Pollution from boats remains limited and is going to be addressed in Burundi, but effective actions can however be envisaged at regional level. Farming pollution is modest and partially resorbed (pesticides in Rusizi). However it could be increased by changes in agricultural policy and import policy (agricultural development policies), but at the same time technical options exist allowing them to be controlled (options for integrated and organic agriculture).

Damage from biological pollution could turn out to be important, requires monitoring, but does not seem to constitute a direct threat. Problems are believed to be slight or easily controlled depending on whether the concerned species are already in the lake or not. Their impact will largely depend on additional changes in the lake ecology, the risk of expansion of water hyacinth is related to eutrophication trends and thus mainly to town pollution, considered above.

### 3.3.6 Low Priority Pollution Problems

These are minor problems (relatively harmless) with regard to the lake biodiversity and also largely uncontrollable (fallout of bush fires from very wide spaces; pollution from scattered and informal mining activities).

## 3.4 Control of Sedimentation

The impact of sedimentation on lake biodiversity has two components, the first relates to the physical changes to habitats through the deposition of a sediment blanket over other substrata, the second impact relates to the nutrient load associated with sediments.

It is clear that there have been major changes in sediment movement from the catchment to the lake over the last 50 years or so, with an increase in dissolved and suspended sediment load changing conditions in the littoral zone. However, so far the indications are that the major impacts are from siltation rather than nutrient load.

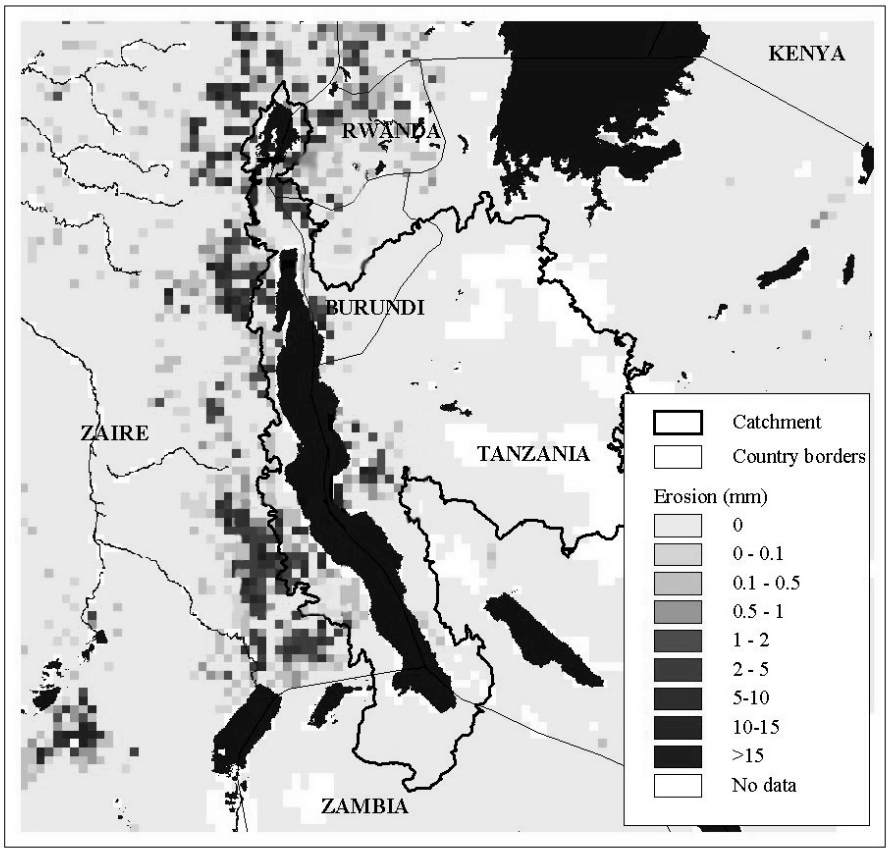
These changes in sediment load are directly related to changing land use patterns within the catchment. The expansion of agricultural land is both the cause of and follows deforestation. These two aspects can be considered separately as they often fall under different institutional mandates, but are generally linked.

The reduction of sediment load will only occur as a result of improved land management practices, however this is promoting a win-win situation as the reduction in sediment load will be reflected by the maintenance of soil structure and soil fertility in the agricultural and forestry production systems.

While both deforestation and inappropriate farming practices are significant local problems in the coastal zone, erosion in the hinterland is most critical in the medium size catchments where wetlands and deltas are unable to absorb or mitigate major increases in sediment load. The impact of sediment is not limited to the river outflow or the delta. Littoral sites within 10 km of the point of discharge of a catchment of the medium size range (50-4000 km²) are threatened by any changes in erosion rates

within that catchment. Larger catchments (>4000 km²) are unlikely to be as affected due to their history of input of suspended matter and the adaptation within adjacent habitats to this situation.

**Map 4 Erosion Hazard and Sediment Source Areas**




### 3.4.1 Erosion from Inappropriate Farming Practices

**High Severity of Problem:** the problem is believed to be serious because the cumulative impact of poor agricultural practices forms the major erosion source, including those which release sediments into the fragile lake ecosystems.

**Medium Feasibility of Solutions:** although the problems are understood and there are well-known technical solutions, there is little evidence of a major uptake of improved farming methods. However as the focus of activities is concentrated in key areas affecting the lake zone, efforts can be concentrated on solving local problems and adapting local solutions with communities.

**High Additional Benefits:** social and economic benefits from sustainable agricultural development, reduced loss of fertility and associated reduced need for fertilisers.

The goal of sustainable farming is a major objective in all of the riparian countries. Interventions in support of this goal include the promotion of physical conservation

structures and improved methods of maintaining soil fertility, in addition there is the potential for promoting alternative crops or adding value to production and hence intensifying the value of production, limiting the need for farming expansion.

Around much of the lakeshore flat land suitable for farming is limited, often to no more than a strip a few hundred metres wide at the base of the steep slopes of the rift valley escarpment. The principal crop is cassava, which is grown for subsistence, although a surplus may be sold. The primary cash crop, particularly in the north, is oil palm, although there is also some rice grown in river valleys. Other crops include maize, beans, and bananas. Where there is flat fertile land (e.g., in the Ruzizi floodplain, or at the mouth of the Lufubu) agriculture is much more diverse.

However, many lakeshore villages do not meet their non-fish food requirements, and depend on trade with inland villages. Subsistence farming is typically the mark of the poorest households. Most households depend on a diverse range of activities and income sources[15].

Where fishing has declined the importance of agriculture has increased. This, coupled with population growth, has resulted in land shortages in the immediate lakeshore area, with farmers clearing steep slopes to farm. In some areas fields are unusable after only two or three harvests, and new, even steeper slopes are cleared. In villages bordering National Parks, the land issue generates tension between villagers and park authorities. In many areas agriculture is still founded on extensive shifting cultivation. As populations grow and agriculture expands the natural miombo woodland is cleared, which results in increased erosion.

Farming is primarily undertaken by women, although patterns vary, and is more important to poorer families. A lack of hill farming traditions and a perception that farming is still not as important as fishing, particularly to the wealthier or more influential members of many communities has meant that there have been few efforts to improve it. Poor access to markets also limits people's attempts to increase or diversify production.

Nevertheless, in some areas the arrival of new practices and technologies such as the use of animal manure or ox-drawn ploughs has had some impact. Tree planting programmes are also a common response, providing additional benefits including sustainable wood supply (mainly for firewood and building materials), shade, fruit production and the use of leguminous tree species that can act as an alternative to fertilisers (which would ultimately add to the nutrient burden of the lake).

Tree planting programs could focus on shade and fruit trees in areas around houses with native trees planted on the more severe slopes[16].

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[15] Diversification occurs for many reasons including reducing risks/improving security, income instability due to seasonality, and the insufficiency of any one activity to support life of generate sufficient income, e.g., for school fees.

[16] The cycle of deforestation, land clearance and agricultural expansion followed by population growth often continues to the point of total loss of natural tree cover, at which point farmers will start on-farm planting. This cycle can be improved through the timely promotion of appropriate targeted .tree planting

In Kigoma Region the TACARE Project has promoted better hillside practices, agroforestry, and vegetable growing.

### 3.4.2 Deforestation

**High Severity of Problem:** deforestation, including diffuse deforestation, largely associated with agricultural expansion, is a primary cause of accelerated erosion. The problem is considered to be particularly serious in forest reserves gazetted as "protection forests", on the basis of their catchment protection value.

**Medium Feasibility of Solutions:** the problem is hard to solve, but multiple responses are known, and are locally implemented. A favourable social climate exists in at least in one part of the region and despite the scale of the problem, it is possible to focus efforts on the most critical areas.

**High Additional Benefits:** a control of deforestation and actions in favour of agroforestry would lead to obvious benefits in terms of production of wood and other products, land conservation, water control and conservation of forest biodiversity (including regional endemic species).

As a result of clearing woodland for agriculture and demands for fuelwood for domestic use, smoking fish, processing palm oil and producing traditional beer, there are fuelwood shortages in many lakeshore villages.

Trade in fuelwood and charcoal occurs both within lakeshore villages and between lakeshore and inland villages, and in some cases is a cross-lake trade carried from Tanzania to Zambia and then through Zambia down to the copper belt and urban centres.

In the wider catchment area in Tanzania there is further pressure on woodland resources for curing tobacco, as well as for charcoal production around urban areas, and timber extraction where suitable species exist.

The immediate response by many forestry authorities is to try to enforce control in gazetted areas, however the management of gazetted forests has broken down as a result of decreasing central government support and often in the face of political pressure to release land for settlement. The response adopted in parts of Tanzania is to pass the ownership of forests to communities, along with rights and responsibilities. While clearly there remains a need for managed forest areas, particularly those gazetted to protect critical catchments, the emphasis has to be on reducing pressure through the provision of alternatives and managed access, rather than exclusion.

Many of these interventions will be related and/or complimentary to farming and alternative livelihood interventions and should be geared towards improving the diets and/or income levels of the farming households involved. Farmers are more likely to invest in an activity because it will improve their own livelihoods than because it will reduce erosion for the benefit of fish productivity or the conservation of aquatic biodiversity.

### 3.4.3 Medium Priority Sedimentation Problems

These include: badly designed or uncontrolled human settlements, sand extraction and other activities in river banks, overgrazing in plains, bad establishment or management of mines and quarries, unsatisfactory road design or construction.

While not a general lake shore problem, these problems can lead to localised, but in some cases serious sediment discharge into sensitive habitats. Overgrazing in plains is perhaps an exception with sediments carried towards deltas (ecosystems which are not threatened by sedimentation), however when this has impacts on reed beds then this can effect fish spawning and nursery grounds (Rusizi, Malagarazi). The Rusizi has the additional specific problem of pressure on the National Park from cattle grazing.

Bush fires are also a known cause of erosion, however, unless followed by land clearance, they cause only temporary loss of vegetation cover. Attempts at control can have negative effects - a policy against burning can result in later burns and hence more harmful fires.

Despite their lower priority, some of these actions can be tackled locally, with local resources and activities addressing these problems could turn out to be more effective in the short term, than the wider actions to control agricultural and forestry problems classified as a higher priority.

### 3.4.4 Low Priority Sedimentation Problems

These are problems considered to be less harmful and difficult to control.

It is assumed that “potential mines and quarries” will have an impact limited by EIA guided preventive measures, but that this impact will not be able to be totally removed.

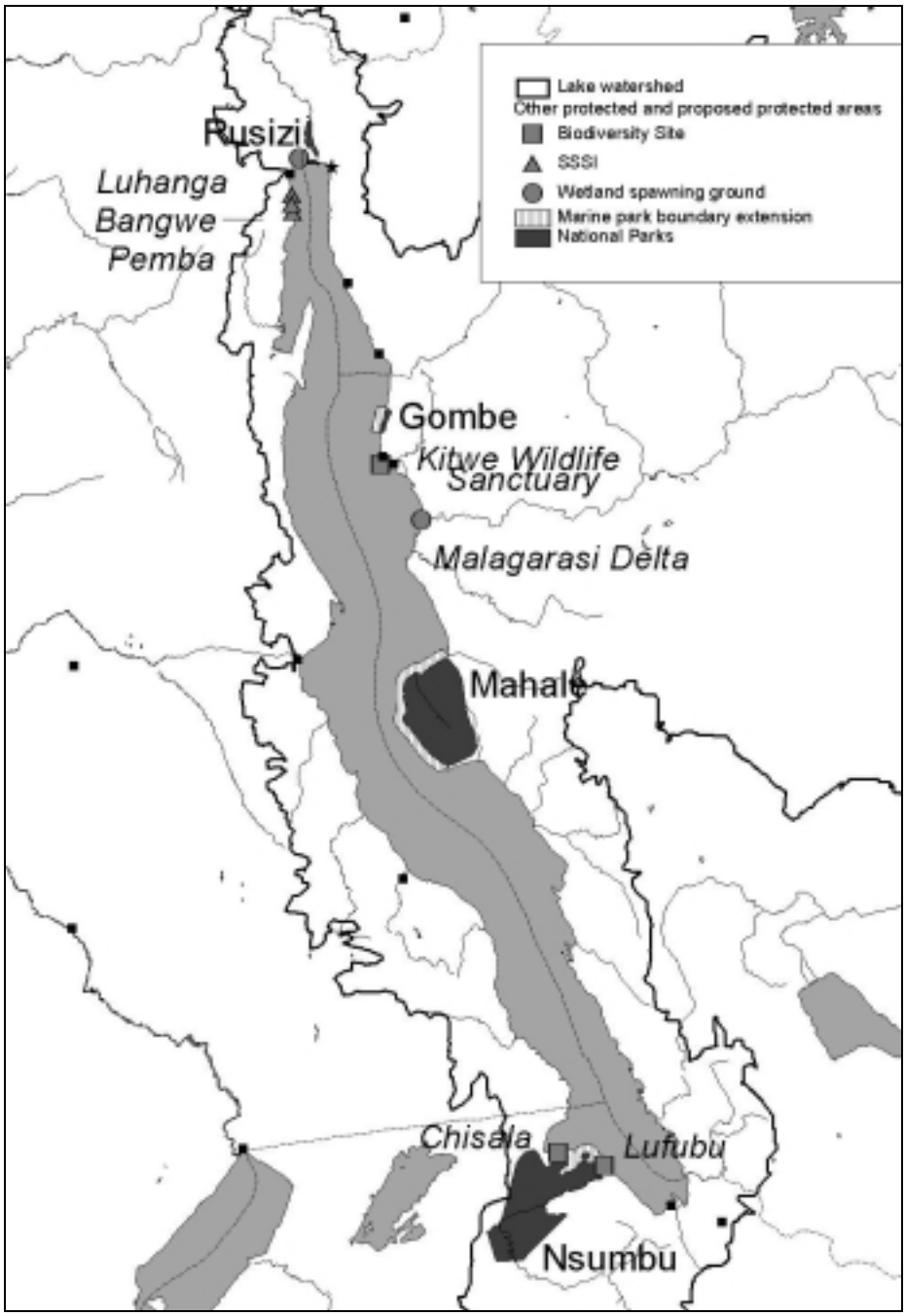
## 3.5 Habitat Conservation

While previous sections have dealt with threats to biodiversity and livelihoods and focused on the positive benefits to sustainable development from counteracting those threats, habitat conservation is a pro-active response to the need to protect biodiversity, and through this support sustainable development.

Management responses to protection range from the creation of national parks and reserves to more traditional community approaches of seasonal access restrictions to resource areas[17].

[17] While there are few examples of traditional community protected fisheries areas, there are many examples of traditional protection or reserve of grazing resources. This is particularly true in wetland areas, where grazing in seasonally flooded grasslands is reserved for the late dry season and livestock access is restricted.

**Map 5 National Parks and Sites of High Conservation Interest**




Although not yet generally applied to fisheries or wetlands, community ownership approaches are now being promoted for forestry management, and in parts of Tanzania government forests are being handed back to local communities to ensure their survival as protected areas.

The highest biodiversity, in terms of number of species, is situated in the sub-littoral zone (down to 40 m)[18]. Much of this biodiversity is found all around the lake, but there are limited number of taxa with spatially restricted distributions.

This littoral zone is most threatened by coastal development, particularly loss of terrestrial vegetation leading to increased siltation. At present, over much of the lakeshore, this effect is relatively localised around fishing villages and major towns. It is more widespread around the north basin and along the Tanzanian coast

There are four National Parks around the lake, Nsumbu in Zambia, Mahale and Gombe Stream in Tanzania and Rusizi in Burundi. These formal "protected areas" have provided a focus for conservation activities around the lake, and although 73% of known fish species have been found in waters in and around these park areas, they can not protect all species – or indeed protect all key habitats for the spawning and nursery grounds of the non-threatened economic species. There is therefore a need for a broader approach to protection ranging from parks to seasonally closed and restricted areas, where land and water based activities are limited to acceptable practices defined and agreed with the lake shore communities.

### 3.5.1 Threats to Resources of National Parks

**High Severity of Problem:** increasing land pressure adjacent to national parks and the lack of alternative livelihood options is resulting in resource conflicts between parks and neighbouring communities. The problem is compounded by a decline in the resources available to parks from central government as part of policies promoting decentralised management.

**High Feasibility of Solution:** however, parks management is already adapting to changes in social and economic pressures and negotiating access rights and compensatory mechanisms with local communities, and continue to be able to draw on non-governmental and international support.

**High Additional Benefits:** the objective of the proposed intervention is to reduce threats to parks resources by promoting benefits to communities. These benefits can range from agreed limited and/or seasonal access rights to adjacent communties, to compensatory investment in community development, such as health care or schools.

Simply maintaining or extending existing terrestrial parks can protect a representative sample of the majority of littoral habitats in the lake. Associating an aquatic zone with an existing terrestrial park is the most effective strategy as it minimises resources required for park management, reduces disruption to lake shore communities, and serves to ensure that the aquatic habitats are protected from developments in the adjacent coastal zone.

The waters adjacent to three of the existing terrestrial national parks (Mahale, Gombe, Nsumbu) include relatively unimpacted sandy, rocky and mixed sand/rock/ habitats.

[18] Sub-littoral is normally used to mean below low tide, however in the case of Lake Tanganyika this is considered to be down to 40m, where sufficient light reaches the benthic environment to allow primary production to occur.

The species assemblages associated with these habitats are representative, in terms of overall diversity and ecosystem structure, of communities in similar habitats elsewhere in the lake.

More specialised habitats, such as shell-beds, emergent macrophyte stands and stromatolite reefs are also represented in the areas adjacent to Lake-shore national parks. Shell beds are found in both Mahale (southern part) and Nsumbu (north-western part). Stromatolite reefs are also found in the northern part of Mahale NP. The species associated with these habitats, including unique assemblages of shell-dwelling cichlids therefore benefit from a measure of protection from land-based threats, and in the case of Nsumbu and Mahale, from aquatic protection.

Rusizi National Park provides an area adjacent to a major river delta, that includes emergent macrophyte stands, muddy substrates and the turbid, nutrient-rich waters associated with river-mouths. The major threats to its current diversity originate in the wider Rusizi basin, and are unlikely to be mitigated by protecting a small area of the delta, however the reed-bed areas provide important nursery grounds for fish of commercial importance, as well as trapping some sediment. Extending protection into the lake, to manage fishing and reed-cutting activities is therefore desirable.

### 3.5.2 Degradation of Sensitive Habitats

**High Severity of Problem:** by definition "key" habitats are critical for the protection of specific and often spatially limited ecological communities, and for the protection of the spawning and nursery grounds of economically valuable species.

**Low to Medium Feasibility of Solution:** these areas have not been "protected" under existing formal or informal agreements, and suffer from the same management constraints as other littoral areas. The degree of protection envisaged will generally be higher than required for the wider littoral zone.

**High Additional Benefits:** while some of these key habitats are selected for their biodiversity value, many of the wetland areas are spawning and nursery grounds supporting the littoral and pelagic fisheries. The protection of these areas is essential for the maintenance of sustainable fisheries.

Given that these areas do not have the formal protection status of national parks, management proposals will have to take direct account of community interests and will rely on a process of negotiation to reach agreements on limited access and possible mitigatory or compensatory mechanisms. Again co-management mechanisms should be explored.

Historical surveys indicate that the Congolese territory hosts very high aquatic biodiversity. Three sites have been identified as key habitats meriting some protection status, Pemba, Luhanga and Bangwe [19]. These locations are all high in species richness and are some of the few largely unimpacted sites within close proximity of Uvira, and as such provide a valuable research/study area for the Centre Dr Recherché En

[19] Pemba (3°.611S, 029°.150E), Luhanga (3°.522S, 029°.149 E) and Bangwe (3°.576S, 029° .149E).

Hydrobiologie. Currently, the major threat to their biodiversity is from sedimentation due to deforestation of the slopes above them.

Additional key protected habitats could include a number of rocky sites in the area of Gitaza in Burundi, the waters next to the Kitwe Wildlife Sanctuary and south of Kigoma in Tanzania.

From the perspective of fisheries protection, it is essential that some protection status be given to the coastal wetlands, the nursery and spawning grounds for economically important fish species. Key areas the Rusizi, the Malagarasi delta, the Lukuga effluent, or the Lufubu/Chisala river mouths.

A possible mechanism for managing these areas for sustainable use is provided by the Ramsar Convention, and indeed the Malagarasi has already been declared as a wetland of international importance. While focusing attention within the country, the real impact of this is to attract other donors that could provide co-financing in support of the wider activities envisaged in the TDA and the SAP.

# 4 The Transboundary Diagnostic Analysis Matrix

## 4.1 Level 1 Main Threats to Biodiversity

| Main Threat to Biodiversity and Sustainable Use | Cross–Cutting Transboundary Implications | Cross–Cutting Institutional Problems | General Action Areas |
|---|---|---|---|
| Unsustainable Fisheries<br>Increasing Pollution<br>Excessive Sedimentation<br>Habitat Destruction | Global Loss of Biodiversity<br>Loss of Shared Fisheries Resource<br>Decline in Water Quality | Lack of Resources<br>Poor Enforcement of Existing Regulations<br>Lack of Appropriate Regulations for Lake Tanganyika<br>Lack of Institutional Coordination | Reduce Impact of Fishing<br>Control Pollution<br>Control Sedimentation<br>Habitat Conservation |

## 4.2 Level 2 Action Areas and Specific Problems

### 4.2.1 Reduce Impact of Fishing – Excessive fishing pressure in the littoral zone

| Specific Problem | Stakeholders | Uncertainties | Proposed Actions |
|---|---|---|---|
| **Burundi** – Excessive fishing pressure | Fisheries administration (including MAE– Fisheries Dept and Territorial Admin.); Fishermen; Owners of fishing units; MINATE (INECN); NGOs; Local associations and communities; UB | Potential of resource | Ascertain potential, fishing standards and acceptable licensing quotas<br>Support other income generating activities or those that supply animal proteins<br>Strengthen capacities for Fisheries Dep. to control and supervise<br>Raise awareness and train (fishermen, boat owners, administration)<br>Update and issue draft law and by–laws, as well as ordinances<br>Translation in Kirundi and extension |
| **Congo** – Excessive fishing pressure in the northern part of the lake | Min Env; Fishermen and associations of fishermen; Local authorities; CRH; Fish sellers; NGOs and local communities; MINAGRI | Maximal exploitable production | Strengthen regulations : introduce licence system (according to type of FU) with recording of existing fishermen; regional harmonisation<br>Strengthen control<br>Improvement of statistics<br>Assessment of potential (maximal exploitable production) both in Northern and Southern zones<br>Feasibility study of tax raising system aiming to regulate fishing effort (feeding at the same time a lake management fund)<br>Identify reasons for catches increase in the South<br>(continued)<br>Identify actions to develop fish |

| | | | |
|---|---|---|---|
| | | | farming<br>Raise awareness – information<br>Research aiming at establishing how better fish conservation could decrease pressure on stock and favour transfer of demand towards bigger fish |
| **Tanzania** – Lack of quota on fishing licences | Fisheries; Communities; Local Authorities; TAFIRI | Optimal quota; available stock;<br>Impact on biodiversity | Review LTR conclusions<br>Assess relevance to fish biodiversity issues<br>Assess trend in expansion of licensing<br>Review licensing procedures |
| **Zambia** – Excessive coastal fishing | Artisanal Fishermen; Subsistence Fishermen; Dep. Fisheries; Local Leaders; Community Based Organisations | Optimal level of extraction<br>Impact of fishing gear on fisheries and biodiversity | Promotion of alternative livelihoods<br>Raise awareness<br>Strengthen Dep. of Fisheries<br>Negotiate co–management with identified communities in specific fishing zones<br>Assess impact of fishing gear |

### 4.2.2 Reduce Impact of Fishing – Excessive Fishing in the Pelagic Zone

| Specific Problem | Stakeholders | Uncertainties | Proposed Actions |
|---|---|---|---|
| **Burundi** – Excessive offshore fishing | Min. of Env; Fishermen; Local Authorities; Fish traders; Net manufacturers; CRH; NGOs; Local Communities | Acceptable catch | Establish standards and quotas for acceptable fishing practices<br>Put in place a sufficient capacity to control lake fisheries<br>Review national and regional components of the Framework Fisheries Management Plan within the context of the SAP<br>Incorporate additional activities into national programmes within the framework of the SAP |

| | | | |
|---|---|---|---|
| **Congo** – Uncontrolled offshore fisheries | Min. of Env; Fishermen; Local Authorities; Fish traders; Net manufacturers; CRH; NGOs; Local Communities | Optimal mesh size and net type<br>Impact on biodiversity | Research into best mesh sizes and fishing methods<br>Studies on secondary species<br>Legislation distinguishing between three levels of activity, banning excessively fine nets, limited permits for appropriate net types and banning destructive fishing practices<br>Support to control capacity<br>Education and awareness raising –<br>Review national and regional components of the Framework<br>Fisheries Management Plan within the context of the SAP<br>Incorporate additional activities into national programmes within the framework of the SAP |
| **Tanzania** – Inadequate Control of Offshore Fisheries | Fisheries Division; TAFIRI; Ministry of Regional Administration and Local Govt.; Fisheries investors; Communities; NGOs | Scale of problem | Build district statistics capacity<br>Establish the existing fishing pressure (vessels, gear, fishermen…), differentiate between industrial and artisanal<br>Establish optimal fishing pressure<br>Set up appropriate monitoring, control and surveillance<br>Implement education and awareness programmes for fishing communities<br>Enforce regulations<br>Review national and regional components of the Framework<br><br>(continued)<br>Fisheries Management Plan within the |

| | | | |
|---|---|---|---|
| | | | context of the SAP<br>Incorporate additional activities into national programmes within the framework of the SAP |
| **Zambia** – Excessive Industrial and Artisanal Fishing | Commercial Fisheries; Artisanal Fishermen; Local Authority; Dep. of Fisheries; Community Based Organisations; Local Leaders; Licensing Committee | Optimal fishing levels<br>Market Distribution | Raise national and Local Political Awareness<br>Negotiate interim acceptable fleet and means of reducing fleet<br>Establish optimal fleet composition<br>Review licensing procedures<br>Strengthen local capacity to monitor and enforce regulations<br>Review national and regional components of the Framework Fisheries Management Plan within the context of the SAP<br>Incorporate additional activities into national programmes within the framework of the SAP |

### 4.2.3 Reduce Impact of Fishing – Excessive or uncontrolled extraction of ornamental fish

| Specific Problem | Stakeholders | Uncertainties | Proposed Actions |
|---|---|---|---|
| **Burundi** – Excessive or uncontrolled extraction of ornamental fish | MINATE (INECN); MAE (Fisheries dep.); Exporters; Sellers; Customs; BRB; NGOs; Local associations and communities | Scale of problem and impact | Prepare list of threatened species and proposal of inclusion in CITES lists<br>Regulations, control, monitoring<br>Encourage fish farming of those species<br>Raise awareness<br>Set up protected areas (demarcation, eco – tourism development, management plans) |
| **Congo** – Excessive or uncontrolled extraction of ornamental fish | Local authorities; CRH; Customs; Exporters; Min Environ; ICCN | Vulnerability of all the species potential per species and per site | Improvement and strengthening of licence delivery (authorised species, |

| | | | |
|---|---|---|---|
| | | | quantities, extraction sites)<br>Strengthen extraction and exporting control<br>Establish natural reserves : Luhanga, Pemba, Kalamba, Kiriza(Ubwari) and Bangwe<br>Additional prospecting in order to expand the network of protected areas<br>Inscription of lake Cichlides on CITES list, except fish identified as capable to support extraction |
| **Tanzania** – Excessive or uncontrolled extraction of ornamental fish | Licensed Traders; Fisheries; TAFIRI; Foreign Affairs; Home Affairs; Customs | Endangered species<br>Extent of threat | Identify threatened species<br>Regional agreement on exportable species by country of origin<br>Monitor numbers and species exported<br>Raise senior level awareness of problems<br>Establish species quotas<br>Review number of licensees<br>Examine possibility of inclusion in CITES list |
| **Zambia** – Excessive or uncontrolled extraction of ornamental fish | Commercial Fishers; Local Authorities; Fisheries Dept; Parks; Museums; Communities and Local Leaders; Revenue Authority | Scale / Impact of Extraction | Ascertain Scale and Impact<br>Raise Public Awareness – Establish Aquarium<br>Define Levels of Extraction<br>Review License / Export Fees<br>Establish Local Regulations<br>Evaluate Potential for Captive Breeding<br>Review Inclusion of Species in CITES |

### 4.2.4 Level 2 Pollution Control – Urban and Industrial pollution

| Specific Problem | Stakeholders | Uncertainties | Proposed Actions |
|---|---|---|---|
| **Burundi** – Pollution from urban waste | MINATE (DG ATE ; INECN); Mayor | Nature and quantity of effluents | Expansion of treatment capacities |

| | | | |
|---|---|---|---|
| Particularly from Bujumbura and Rumonga | (SETEMU); MCIT; CCIB; Regideso; MTPE; MSP; BBN; NGOs; Local associations and communities | Impact of pollutants on biodiversity | Set up controlled site disposal and collect waste<br>Raise awareness and train<br>Regulations for marketing of dangerous products for environment<br>Develop standards for enforcement of legislation relating to waste<br>Implement land use plans in the framework of planning schemes<br>Strengthen capacities for INECN to monitor and control<br>Support development of secondary urban centres<br>Surveying pollution and impact levels, monitor and follow up |
| **Burundi** – Industrial Pollution from Bujumbura town (with particular concern to the paint industries, tanneries, soap industry, food industries, textiles and chemicals) | MINATE (DG ATE ; INECN); Mairie (SETEMU); MCIT; Industrial Enterprises – the paint industries, tanneries, soap industry, food industries, textiles and chemicals; CCIB; Regideso; MTPE; MSP; BBN; NGOs; Local associations and communities | Scale of pollution, pollutant discharges and impact on biodiversity<br>Acceptable standards | Pre–treatment of industrial sewage and put to work the water treatment plant<br>Expansion of the treatment capacities<br>Set up controlled site disposal and collect waste<br>Treatment, recycling and development of waste<br>Improve industrial procedures<br>Raise awareness and train<br>Regulations for facilities likely to pollute (Prior EIA technical specifications)<br>Regulations for marketing of dangerous products for environment (continued)<br>Develop standards for enforcement of legislation relating to waste<br>Implement land use plans in the framework of planning schemes<br>Strengthen capacities for INECN to |

| | | | |
|---|---|---|---|
| | | | monitor and control<br>Surveying pollution and impact levels, monitor and follow up.<br>EIA prior to Industrial Development |
| **Congo** – Pollution by domestic effluents and waste | Ministry of Environment; Local Authorities; Population; NGOs and Local communities; Urban services; INERA; Ministry of Energy | Nature and quantity of pollutants and impacts n the Lake biodiversity | Identification of pollutants, evaluation of impact.<br>Sanitation (construction of latrines, installation of controlled disposal sites and waste collecting, setting up waste and sewage network connected to a treatment plant) : Uvira, Mboko, Kalemie, Moba, Baraka<br>Health education<br>Research – focused on recycling through agricultural and energy<br>Develop appropriate legislation and support enforcement capacity |
| **Congo** – Industrial Pollution Kiliba Sugar Factory | Kiliba sugar factory; CRH; CRSN; INERA; ISDR; NGOs and Local Communities; Min. of Energy; Ministry of Environment | Impact of pesticides and lime on the lake biodiversity.<br>Alternatives | Recycling of by-products (bagasse, treacle, lime)<br>Assessment of the impact of herbicides on the Lake waters and the biodiversity.<br>Research for more appropriate fertilising modalities<br>Update legislation<br>Control |
| **Congo** – Pollution from Kabimba cement factory | Ciment-lac; CRH; CRSN; INERA; ISDR; NGOs and local Communities; (continued)<br>Ministry of Environment | Impact of ashes; dusts and smokes on lake biodiversity | Assessment of the impact and identification of the measures to be taken (continued)<br>Feasibility study of agricultural recovering of ashes<br>Implement recommendations<br>Update legislation<br>Control |
| **Tanzania** – Discharge of untreated | Local Council; Regional Authority; | Impact on biodiversity | Review existing town development |

| | | | |
|---|---|---|---|
| domestic waste, Kigoma Town | Min of Water; Min of Health; Min of Lands | Quantity and type of effluents | plans<br>Incorporate proposals for sewage, waste water and water supply;<br>Propose developments & promote awareness to counteract existing situation of open drains etc.<br>Monitor effluents |
| **Tanzania** – Discharge of untreated waste from institutions (Police, Prisons, Railway Station, Docks) Kigoma Town | Police; Prisons; TRC; Local Council; Min of Water; Min of Health; Min of Transport; Regional Authorities | Impact on biodiversity<br>Quantity and type of effluents | Enforce regulations;<br>Identify reasons for non–compliance<br>Promote Senior level awareness<br>Identify and propose practical treatment works and disposal sites<br>Implement proposals and regulations<br>Monitor effluents |
| **Tanzania** – Inappropriately sited solid waste dumps Kigoma Town | Local Council; Regional Authority; Min of Water; Min of Health; Min of Lands; Communities | Impact on biodiversity<br>Leaching and surface run–off | Identify appropriate sites;<br>Review present collection and disposal procedures<br>Check existing and introduce appropriate local regulations;<br>Develop appropriate landfills<br>Monitor quantity and quality of leachates |
| **Tanzania** – Industrial Pollution Kigoma TANESCO Power Station | TANESCO; Local Council; Min of Water; Min of Energy; NEMC | Extent of Pollution | Implement appropriate management practices and structures<br>Implement both short and long term remedial measures<br>Review TANESCO plans for rehabilitation, including funding |
| **Zambia** – Discharge of untreated domestic effluent, Mpulungu and Shoreline Settlements | Local Authority; Water Affairs; Fisheries Dept; Local Communities; District Health Management Team; D–WASHE; ECZ | Scale of problem and impact on biodiversity | Assess scale of problem and impact on biodiversity (note available data)<br>Review design of existing sewerage systems, assess potential for alternatives<br>Link with existing D–WASHE |

| | | | |
|---|---|---|---|
| | | | programme<br>Implement alternatives<br>Monitor effluent disposal<br>Raise awareness of issues |
| **Zambia** – Uncontrolled Waste Dumping in and around Mpulungu | Transporters; Fishing Companies; Local Authority; Water Affairs; **Zambia** Revenue Authority; Fisheries Dept; Local Communities; District Health Management Team; ECZ | Scale of problem and impact on biodiversity | Assess scale of problem and impact on biodiversity<br>Raise awareness of issues<br>Monitor disposal<br>Enforce regulations |
| **Zambia** – Transboundary movement of industrial pollution | Communities; Min of Energy & Water Depart.; Dept. of Fisheries; Local Authorities; Min of Environment; NISIR; ECZ; Maritime | Types of pollutants, distribution and buildup | Identify sites for monitoring<br>Establish a functioning monitoring programme<br>Training in monitoring lake pollution |

### 4.2.5 Level 2 Pollution Control – Pollution in harbours

| Specific Problem | Stakeholders | Uncertainties | Proposed Actions |
|---|---|---|---|
| **Burundi** – Pollution in harbours | MTPET (Lake transport), Ship owners, EPB, INECN – MINATE (INECN), MCIT, Lake Guard | Scale of threats | Promulgation of Lake Traffic Act, and extension<br>Control enforcement of Act, and continue technical checking of ships<br>Monitor and evaluate scale of the problem of lake pollution<br>Harmonise regulations and supervising activities and control with the other riparian states<br>Establish a shipyard for maintenance and repairing of ships |
| **Congo** – Harbour Pollution (Kalemie, Kabimba, Kalundu, Moba) | Ministry of Environment; Transport and Communication; CRH; Ship owners | Nature and quality of pollutants and impact on the Lake biodiversity | Raise awareness<br>Update regulations (eco tax combined system dissuading from legal pollution and penalising illicit pollution)<br>Strengthen control<br>Installation of controlled disposal sites on dry land |

| | | | |
|---|---|---|---|
| | | | Identification of pollutants and assessment of their impact on the lake biodiversity |
| **Tanzania** – Pollution in harbours (particular concern over storage and handling of oil) | TRC; Ship Owners / Operators; Local Council; Oil Companies; Shipping Department; NEMC; Min of Transport | No information on specific handling problems<br>Impact on biodiversity | Identify specific causes of leaks and spillage<br>Check and review regulations and recommended procedures<br>Review reasons for non–enforcement of regulations<br>Implement short term and long term remedial actions |
| **Zambia** – Pollution in harbours (particular concern over storage and handling of oil and other cargoes) | Mpulungu Population; Water Affairs; Maritime Department; Harbours Authority; Barge Owners; Fisheries Dept; Local Authorities; Police; Defence; ECZ; Disaster Management Unit | Impact on Biodiversity of Different Cargoes and Scenarios | Carry Out Risk Assessment<br>Review Potential Impact on Biodiversity<br>Mitigate impacts and put in place emergency response capacity |

### 4.2.6 Level 2 Pollution Control – Pollution from future mining and oil exploitation activities

| Specific Problem | Stakeholders | Uncertainties | Proposed Actions |
|---|---|---|---|
| **Burundi** – Pollution from future mining and oil exploitation activities | MEM (DMC); MINATE; mining companies; oil companies | Scale of pollution and effects on lake | EIA prior to start mining<br>Review Oil and Mines Act in order to take into account environmental impacts<br>(continued)<br>Negotiate agreements with other riparian countries<br>Support the existing chemical and biological laboratories |
| **Congo** – Pollution from future mining and oil exploitation activities | Min Environment; CRH; CRGM; Min. of Oil; Ministry of Energy | Probability and site of works | Studies of impact on the environment<br>Environment follow up of activities |
| **Tanzania** – Discharge of toxic substances from mine workings | "Smallholder miners"; Min of Energy and Mines; Min of Water; Regional / | Scale of problem | Quantify scale and processes used different mining areas |

| | | | |
|---|---|---|---|
| | Local Authorities; NLUPC; NEMC; Min of Health | | Promote appropriate technology<br>Enforce existing regulations<br>Review status of EIA legislation |

### 4.2.7 Level 2 Pollution Control – Pollution from major marine accidents

| Specific Problem | Stakeholders | Uncertainties | Proposed Actions |
|---|---|---|---|
| **Burundi** – Pollution from major marine accidents | MTPET (Lake transport), Ship owners, EPB; MINATE (INECN), MCIT, Lake Guard; MAE (Fisheries) | Scale of threats | Promulgation of Lake Traffic Act, and extension<br>Control enforcement of Act, and continue technical checking of ships<br>Monitor and evaluate scale of the problem of lake pollution<br>Harmonise regulations and supervising activities in riparian states |
| **Congo** – Pollution from major marine accident | Min. of Environment; Transport and Communication service; CRH; Ship owners; CRSN; External Commerce; **Congo**lese Office for Control | Nature and quantities of pollutants and impact on lake biodiversity | Raise awareness (ship operators and other stakeholders)<br>Review regulations (navigation rules; pollution and security standards, transport of hazardous cargo)<br>Strengthen control<br>Technical control of ships (with anti–pollution and security standards)<br>Pollution monitoring<br><br>(continued)<br>Evaluate impact (scale of problem, frequency of discharge, risks, harmfulness of pollutants) |
| **Tanzania** – Pollution from major marine accident | Ship Owners / Barge Operators; Regional Authorities; Shipping Department; NEMC; Min of Transport; Min of Water; NEMC; Insurance Companies; TAFIRI | Level of Risk | Risk analysis<br>Develop contingency plan |
| **Zambia** – Pollution from major marine | Large Transporters; Passengers; | Impact on Biodiversity of Different | Carry out risk assessment |

| | | | |
|---|---|---|---|
| accident | Maritime Department; Harbours Authority; Insurance Companies; Fisheries Dept; Local Authorities; ZRA; Police; Defence; Disaster Management Unit; Parks; ECZ | Cargoes and Scenarios | Review potential impacts on biodiversity<br>Put in place emergency response capacity<br>Review a need for a regional response and emergencies disaster management unit |

### 4.2.8 Level 2 Control Sedimentation – Erosion from agricultural practices

| Specific Problem | Stakeholders | Uncertainties | Proposed Actions |
|---|---|---|---|
| **Burundi** – Erosion from agricultural practices | MAE, MINATE, Territ. Admin., Farmers, Research Institutes, MTPE, NGOs, Local associations and communities | Impact on biodiversity, scale of sedimentation, relation between erosion and fragile areas receiving sediments at lake level | Evaluate impact of problem, study the extent of sedimentation in the lake and identify high risk erosion areas<br>Plan catchment (agro–forestry, anti–erosive practices), raise awareness and promote participative approach<br>Research – development and extension of suitable techniques<br>Planning focused on sediment deposits in the valleys, traps for sediments<br>Define special standards and prioritise interventions to identified areas |
| **Congo** – Inappropriate farming practices and extensive agriculture | Minagri (SNV); Ministry Environ; (continued)<br>INERA; NGOs and local communities; CRH; Local authorities; AT | Sensitive zones | Education and awareness (continued)<br>Identification of sensitive erosion zones<br>Regulation of soil use in these zones<br>Implementing demonstrations (anti erosive techniques, agrozootechnical, agroforestry integration)<br>Extension and support to enforcement capacity |
| **Tanzania** – Erosion from agricultural practices (particular concern on steep | Min of Agriculture; Communities; NLUPC; Local Authorities; | | Identify with communities sensitive areas |

| | | | |
|---|---|---|---|
| slopes and cultivating down the slope) | JGI/TACARE | | Demarcate hazardous areas and reforest<br>Raise awareness of critical issues<br>Promote soil conservation measures<br>Check/review local bye–laws<br>Assist villages in preparing land use plans |
| **Zambia** – Erosion from agricultural practices (particular concern slash and burn and stream bank cultivation) | Farming Communities; Forestry Department; Ministry of Agriculture; Water Affairs; Local Chiefs; Chongololo Club; Local Authorities; Churches | Scale of Problem and Trend; Cultural and Economic Viability of Alternative Farming Practices | Assess Scale, Impact and Risks<br>Evaluate impact on the lake<br>Review Alternative Practices including Irrigation<br>Review Relevance of Existing Regulations<br>Promote Appropriate Farming Practices<br>Identify Critical Erosion Sites and Remedial Measures<br>Monitor enforcement of regulations<br>Monitor current practices |

### 4.2.9 Level 2 Control Sedimentation – Deforestation

| Specific Problem | Stakeholders | Uncertainties | Proposed Actions |
|---|---|---|---|
| **Burundi** – Deforestation | MINATE, MAE; NGOs, Local associations and communities | Scale and distribution of clearings<br>State of resource | Inventory of forests and evaluate damage<br>Strengthen legal basis for Protected Areas<br>Expansion of network of Protected Areas to cover all natural forests<br>Demarcate PAs and national forests boundaries<br>Rehabilitation of destroyed parts of PAs and Forests<br>Environmental education<br>Prepare participative management plans for woods and PAs and identify alternative resources<br>Promote agroforestry and private woods<br>Compensate people expelled from PAs<br>Reinforce the capacity to supervise and control PAs and forests and INECN capacities |
| **Congo** – Deforestation | Ministry of Environment ; ICCN; Local authorities; NGOs (CADIC) and local communities; Population; Ministry of Energy; MINAGRI | Scale and distribution of clearing;<br>State of resource | Education and awareness (including authorities)<br>Promotion of private woods and agro forestry (extension, demonstration)<br>Protection and restoring of public forests along rivers<br>Identification of forestry areas to be protected<br>Establish protected forest areas (continued)<br>Update legislation |

| | | | |
|---|---|---|---|
| | | | Strengthen environmental services capacities<br>Creation of micro hydropower plants in order to supply substitution energy inciting to protect the catchment<br>Action towards improved stoves, improved process for smoking of fish and alternative energy (biogas, solar etc.) |
| **Tanzania** – Deforestation | Local / Regional Authorities; Communities; Forestry Department; NLUPC; Min of Lands: TACARE; Min of Local Gov't. | Current scale and rate of deforestation | Identify critical encroachment and critical threatened zones<br>Create political awareness of problems<br>Negotiate with communities to gazette sensitive areas<br>Negotiate means of resettlement from sensitive areas<br>Promote community forest management and access rights<br>Enforce bye–laws |
| **Zambia** – Deforestation | Local Communities; Forestry Department; Parks; Water Affairs; Local Chiefs; Chongololo Clubs; Politicians | Scale of Impact on Sediment Load | Assess Impact on Sediment Load<br>Negotiate Solution to Current Encroachment<br>Rehabilitate sensitive areas<br>Enable Enforcement of Current Regulations<br>Raise Awareness of Issues, particularly at the Political Level<br>Promote afforestation<br>Raise local awareness<br>Promote sustainable forest management, agroforestry and promote alternative energy |

### 4.2.10 Level 2 Habitat Conservation – Threats to Resources in National Parks

| Specific Problem | Stakeholders | Uncertainties | Proposed Actions |
|---|---|---|---|
| **Burundi** – Encroachment in the Rusizi Natural Reserve | MAE (incl. Fishing dep.); MINATE (INECN); Territ. Adm.; Farmers; NGOs; Local associations and communities | | Compensation for expulsion from sensitive zones<br>Extend the reserve into the littoral; zone to 1000 metres offshore of the 774-metre contour.<br>Plant hedges to demarcate the reserve in the delta |
| **Congo** – Lack of protection of the **Congo**lese side of the Ruzizi delta | ICCN; CRH; CRSN; NGOs, Local Communities | | Establish a "protected area" in the Ruzizi delta, adjacent to the Burundi Natural Reserve |
| **Tanzania** – Exploitation of Fisheries within the Parks | TANAPA; Fisheries Department; Local Communities | Compliance of local communities | Raise awareness of parks issues<br>Involve local communities |
| **Zambia** – Community Pressure on Nsumbu National Park | ZAWA; Lodge Operators; Local Communities; Fisheries | Support from Local Communities | Involvement of Communities in Parks Management<br>Training in Aquatic Parks Management<br>Define aquatic and aquatic mark parks boundary |

### 4.2.11 Level 2 Habitat Conservation – Degradation of sensitive habitats

| Specific Problem | Stakeholders | Uncertainties | Proposed Actions |
|---|---|---|---|
| **Burundi** – Degradation of sensitive coastal areas | MAE (incl. Fishing dep.); MINATE (INECN); Territ. Adm.; Farmers; NGOs; Local associations and communities | Extent of lake shore activities and impact on biodiversity | Mapping supra littoral area and cultivated area<br>Raise awareness<br>Participative management and non destructive recovering of natural resources<br>Declare sensitive areas as protected areas (Murembwe, Nyengwe, Rwaba) (continued)<br>Control lake shore vegetation |

| | | | |
|---|---|---|---|
| | | | exploitation<br>Protect the rocky coastline through tree planting between Gitara and Flugara |
| **Congo** – Risk of degradation of coastal zone; lack of protection of specific key zones (Rusizi, Lukuga, Luhanga, Pemba, Kalamba, Kiriza, Kazimia) | ICCN; CRH; CRSN; NGOs, Local Communities | | Establish a protected area – Lukuga<br>Establish a protected area – Ruzizi<br>Establish protection for sites of special scientific interest – Luhanga, Pemba, Kalamba, Kiriza, Kazimia<br>Participative preparation of a management plans<br>Hydrologic monitoring (rate of flow from lake) |
| **Tanzania** – Degradation of wetland areas – in particular the Malagarasi | Communities; Fisheries; TAFIRI; Local Government; Tourism | Impact on Biodiversity<br>Optimal size of protected areas<br>Community Compliance | Negotiate access with communities<br>Gazette areas<br>Raise Awareness<br>Ban destructive fishing practices<br>Evaluate stock<br>Conduct hydrological and limnological monitoring |
| **Zambia** – Damage to Sensitive Habitats Lufuba and Chituba Bay and Chisala River Mouth | Min. of Agriculture; Min. of Env.; Min of Tourism; Local Authorities; Local Communities; Traditional Leaders | Extent of degradation and impact on biodiversity | Evaluate destructive fishing practices<br>Ban specific destructive practices (poison, explosives…)<br>Negotiate designation of Chituba and Lufuba bays and Chisala river mouth as conservation areas<br>Negotiate with communities acceptable management practices<br>Develop procedures for capital empowerment of communities to alleviate impact of zone designation (continued)<br><br>Negotiate designation of Lufuba mouth as Ramsar site<br>Monitor stock levels |

## 4.3 Level 3 Specific Problems and Proposed Interventions

### 4.3.1 Level 3 Reduce Impact of Fishing – Excessive fishing pressure in the littoral zone

| Proposed Actions | Timing | Key Agency | Human Resources | Material Resources |
|---|---|---|---|---|
| **Burundi** – Excessive fishing pressure | | | | |
| Ascertain potential, fishing standards and acceptable licensing quotas | On Going | MAE | No | No |
| Support other income generating activities or those that supply animal proteins | On Going | MDC | No | No |
| Strengthen capacities for Fisheries Dep. to control and supervise | Now | MAE | No | No |
| Raise awareness and training (fishermen, boat owners, Administration) | Now | MAE | No | No |
| Update and issue draft law and by–laws, as well as ordinances | Now | MAE | No | No |
| Translation in Kirundi and extension | After previous | MAE | Yes | Yes |
| **Congo** – Excessive fishing pressure in the northern part of the lake | | | | |
| Strengthen regulations : introduce licence system (according to type of FU) with recording of existing fishermen; regional harmonisation | Now | Min of Env | Yes | No |
| Strengthen control | Now | Min of Env | No | No |
| Improvement of statistics | Now | CRH | Yes | No |
| Assessment of potential (maximal exploitable production) both in Northern and Southern zones | Now | CRH | Yes | No |
| Feasibility study of tax raising system aiming to regulate fishing effort (feeding at the same time a lake management fund) | Now | CRH | Yes | No |
| Identify reasons for catches increase in the South | Now | CRH | Yes | No |
| Identify actions to develop fish farming | Now | MINAGRI | Yes | No |
| Raise awareness – information | Suspended | Min of Env | Yes | Yes |
| Research aiming at establishing how better fish conservation could decrease | Now | CRH | Yes | No |

pressure on stock and favour transfer of demand towards bigger fish

| | | | | |
|---|---|---|---|---|
| **Tanzania – Lack of quota on fishing licences** | | | | |
| Review LTR conclusions | Now | TAFIRI | Yes | Yes |
| Assess relevance to fish biodiversity issues | After previous | TAFIRI | Yes | Yes |
| Assess trend in expansion of licensing | After previous | Fisheries Dept | Yes | Yes |
| Review licensing procedures | Now | Fisheries Dept | Yes | Yes |
| **Zambia** – Excessive coastal fishing | | | | |
| Promotion of alternative livelihoods | Now | Community Dev. | Yes | No |
| Raise awareness | On Going | DOF | Yes | Yes |
| Strengthen Dep. of Fisheries | Now | DOF | Yes | No |
| Negotiate co–management with identified communities in specific fishing zones | On Going | DOF | Yes | No |
| Assess impact of fishing gear | Now | DOF | Yes | No |

### 4.3.2 Level 3 Reduce Impact of Fishing – Excessive fishing pressure in the pelagic zone

| **Proposed Actions** | **Timing** | **Key Agency** | **Human Resources** | **Material Resources** |
|---|---|---|---|---|
| **Burundi – Excessive offshore fishing** | | | | |
| Establish standards and quotas for acceptable fishing practices | Now | MAE | Yes | No |
| Put in place a sufficient capacity to control lake fisheries | Now | MAE | Yes | No |
| Review national and regional components of the Framework Fisheries Management Plan within the context of the SAP | Now | MAE | Yes | Yes |
| Incorporate additional activities into national programmes within the framework of the SAP | Now | MAE | Yes | Yes |

| | | | | |
|---|---|---|---|---|
| **Congo** – Uncontrolled offshore fisheries | | | | |
| Research into best mesh sizes and fishing methods | On Going | CHR | Yes | No |
| Studies on secondary species | Now | CRH | Yes | No |
| Legislation distinguishing between three levels of activity, banning excessively fine nets, limited permits for appropriate net types and banning destructive fishing practices | After previous | Min of Env | Yes | Yes |
| Support to control capacity | Now | Min of Env | Yes | No |
| Education and awareness raising | Now | Min of Env | Yes | No |
| Review national and regional components of the Framework Fisheries Management Plan within the context of the SAP | Now | Min of Env | Yes | Yes |
| Incorporate additional activities into national programmes within the framework of the SAP | Now | Min of Env | Yes | Yes |
| **Tanzania** – Inadequate control of offshore fisheries | | | | |
| Build district statistics capacity | Now | Fisheries | No | No |
| Establish the existing fishing pressure (vessels, gear, fishermen…), differentiate between industrial and artisanal | Now | Fisheries | Yes | No |
| Establish optimal fishing pressure | Now | Fisheries | Yes | No |
| Set up appropriate monitoring, control and surveillance | Now | Fisheries | Yes | No |
| Enforce regulations | Now | Fisheries | Yes | No |
| Implement education and awareness programmes for fishing communities | Now | Fisheries | Yes | No |
| Review national and regional components of the Framework Fisheries Management Plan within the context of the SAP | Now | Fisheries | Yes | Yes |
| Incorporate additional activities into national programmes within the framework of the SAP | Now | Fisheries | Yes | Yes |
| **Zambia** – Excessive industrial and artisanal fishing | | | | |
| Raise national and local political awareness | On Going | Fisheries | Yes | Yes |
| Negotiate interim acceptable fleet and means of reducing fleet | Now | Fisheries | Yes | Yes |
| Establish optimal fleet composition | Now | Fisheries | Yes | No |
| Review licensing procedures | Now | Fisheries | Yes | Yes |
| Strengthen local capacity to monitor and enforce regulations | | | | |
| Review national and regional components of the Framework Fisheries Management Plan within the context of the SAP | Now | Fisheries | Yes | Yes |
| Incorporate additional activities into national programmes within the framework of the SAP | Now | Fisheries | Yes | Yes |

| | | | | |
|---|---|---|---|---|
| | After previous | Fisheries | Yes | No |

### 4.3.3 Level 3 Reduce Impact of Fishing – Excessive or uncontrolled extraction of ornamental fish

| Proposed Actions | Timing | Key Agency | Human Resources | Material Resources |
|---|---|---|---|---|
| **Burundi** – Excessive or uncontrolled extraction of ornamental fish | | | | |
| Prepare list of threatened species and proposal of inclusion in CITES lists | Now | MINATE | Yes | Yes |
| Regulations, control, monitoring | Now | MINATE | Yes | No |
| Encourage fish farming of those species | Now | MAE | Yes | No |
| Raise awareness | Now | MINATE | Yes | No |
| Set up protected areas (demarcation, eco – tourism development, management plans) | Now | MINATE | Yes | No |
| **Congo** – Excessive or uncontrolled extraction of ornamental fish | | | | |
| Improvement and strengthening of licence delivery (authorised species, quantities, extraction sites) | Now | Min of Env | Yes | Yes |
| Strengthen extraction and exporting control | Now | Min of Env | No | No |
| Establish natural reserves : Luhanga, Pemba, Kalamba, Kiriza(Ubwari) | Now | ICCN | Yes | No |
| Additional prospecting in order to expand the network of protected areas | Now | CRH | Yes | No |
| Inscription of lake Cichlides on CITES list, except fish identified as capable to support extraction | Now | Min of Env | Yes | Yes |
| **Tanzania** – Excessive or uncontrolled extraction of ornamental fish | | | | |
| Identify threatened species | Now | TAFIRI | No | No |
| Regional agreement on exportable species by country of origin | Now | Fisheries Dep | Yes | Yes |
| Monitor numbers and species exported | Now | Fisheries Dep/Customs | Yes | Yes |
| Raise senior level awareness of problem | Now | Local Govt. / Fisheries Dep | Yes | No |

| | | | | |
|---|---|---|---|---|
| Establish species quotas | Now | TAFIRI | Yes | Yes |
| Review number of licensees | Now | Fisheries Dep | Yes | Yes |
| Examine possibility of inclusion in CITES list | After previous | Fisheries Dep | Yes | Yes |
| **Zambia**– Excessive or uncontrolled extraction of ornamental fish | | | | |
| Ascertain Scale and Impact | On Going | Fisheries | Yes | Yes |
| Raise Public Awareness – Establish Aquarium | Now | Fisheries | Yes | Yes |
| Define Levels of Extraction | Now | Fisheries | Yes | Yes |
| Review License / Export Fees | Now | Fisheries | Yes | Yes |
| Establish Local Regulations | After previous | Fisheries | Yes | Yes |
| Evaluate Potential for Captive Breeding | Now | Fisheries | No | No |
| Review Inclusion of Species in CITES | After previous | Parks | Yes | Yes |

### 4.3.4 Level 3 Pollution Control – Urban and Industrial Pollution

| Proposed Actions | Timing | Key Agency | Human Resources | Material Resources |
|---|---|---|---|---|
| **Burundi** – Pollution from urban waste; particularly from Bujumbura and Rumonga | | | | |
| Expansion of treatment capacities | Now | Mairie / SETEMU | No | No |
| Set up controlled site disposal and collect waste | Now | SETEMU | No | No |
| Raise awareness and train | Now | MCIT | No | No |
| Regulations for marketing of dangerous products for environment | Now | MINATE (DG ATE) | Yes | Yes |
| Develop standards for enforcement of legislation relating to waste | Now | MINATE (DG ATE) | No | No |
| Implement land use plans in the framework of planning schemes | Now | MTPE | No | No |
| Strengthen capacities for INECN to monitor and control | Now | MINATE | No | No |

| | | | | |
|---|---|---|---|---|
| | | (INECN) | | |
| Support development of secondary urban centres | Now | MTPE | No | No |
| Surveying pollution and impact levels, monitor and follow up | Now | MINATE (INECN) | No | No |

**Burundi** – Industrial Pollution from Bujumbura town and other urban areas (especially in Rumonge)

| | | | | |
|---|---|---|---|---|
| Pre–treatment of industrial sewage and put to work the water treatment plant | Now | Mairie / SETEMU | No | No |
| Expansion of the treatment capacities | After previous | Mairie / SETEMU | No | No |
| Set up controlled site disposal and collect waste | Now | Mairie / SETEMU | No | No |
| Treatment, recycling and development of waste | Now | Mairie / SETEMU | No | No |
| Improve industrial procedures | Now | MCIT | No | No |
| Raise awareness and train | Now | MINATE (INECN) | No | No |
| Regulations for facilities likely to pollute (prior EIA technical specifications) | Now | MINATE (DG ATE) | No | No |
| Regulations for marketing of dangerous products for environment | Now | MINATE (DG ATE) | Yes | Yes |
| Develop standards for enforcement of legislation relating to waste | Now | MINATE (DG ATE) | No | No |
| Implement land use plans in the framework of planning schemes (including regulations for burial sites) | Now | MTPE | No | No |
| Strengthen capacities for INECN to monitor and control | Now | MINATE (INECN) | No | No |
| Surveying pollution and impact levels, monitor and follow-up | After previous | MINATE (INECN) | No | No |
| EIA prior to industrial development | Now | MINATE (INECN) | No | No |

**Congo** – Pollution by domestic effluents and waste

| | | | | |
|---|---|---|---|---|
| Identification of pollutants, evaluation of impact. | Now | CRH | Yes | No |
| Sanitation (construction of latrines, installation of controlled disposal sites and waste collecting, setting up waste and sewage network connected to a treatment plant) : Uvira, Mboko, Kalemie, Moba, Baraka | Now | Min of Env | No | No |
| Health education | Now | Health Services | Yes | No |
| Research – focused on recycling through agricultural and energy | Now | INERA | Yes | No |
| Develop appropriate legislation and support enforcement capacity | After previous | Min of Env | Yes | No |
| **Congo** – Industrial Pollution Kiliba Sugar Factory | | | | |
| Recycling of by-products (bagasse, treacle, lime) | Now | Min of Env | No | No |
| Assessment of the impact of herbicides on the Lake waters and the biodiversity. | Now | CRH | Yes | No |
| Research for more appropriate fertilising modalities | Now | INERA | Yes | No |
| Update legislation | On Going | Min of Env | Yea | Yes |
| Control | Now | Min of Env | No | No |
| **Congo** – Industrial Pollution Kabimba cement factory | | | | |
| Assessment of the impact and identification of the measures to be taken | Now | CRH | Yes | No |
| Feasibility study of agricultural recovering of ashes | Now | INERA | Yes | No |
| Implement recommendations | After previous | Min of Env | Yes | Yes |
| Update legislation | On Going | Min of Env | Yes | No |
| Control | Now | Min of Env | Yes | No |

| | | | | |
|---|---|---|---|---|
| **Tanzania** – Discharge of untreated domestic waste, Kigoma Town | | | | |
| Review existing town development plans | Now | Min of Lands | Yes | Yes |
| Incorporate proposals for sewage, waste water and water supply; | After previous | Min of Lands | Yes | Yes |
| Propose developments & promote awareness to counteract existing situation of open drains etc | After previous | Min of Lands | Yes | Yes |
| .Monitor effluents | Now | Min of Water | Yes | No |
| **Tanzania** – Discharge of untreated waste from institutions (Police, Prisons, Railway Station, Docks) Kigoma Town | | | | |
| Check and review regulations; | On Going | Min of Water | Yes | Yes |
| Identify reasons for non–compliance | Now | UWS&S dept | Yes | Yes |
| Promote Senior level awareness | After previous | Local authorities | Yes | No |
| Identify and propose practical treatment works and disposal sites | After previous | Min of Water | Yes | No |
| Implement proposals | After previous | Min of Water | Yes | No |
| Monitor effluents | Now | Min of Water | Yes | No |
| **Tanzania** – Inappropriately sited solid waste dumps Kigoma Town | | | | |
| Identify appropriate sites; | Now | Town Council | Yes | Yes |
| Review present collection and disposal procedures | Now | Town Council | Yes | Yes |
| Check existing and introduce appropriate local regulations; | After previous | Town Council | Yes | Yes |
| Develop appropriate landfills | After previous | Town Council | Yes | No |
| Monitor quantity and quality of leachates | Now | Min of Water | Yes | No |

| | | | | |
|---|---|---|---|---|
| **Tanzania** – Industrial Pollution Kigoma TANESCO Power Station | | | | |
| Identify appropriate management practices and structures | Now | Energy Department | Yes | No |
| Identify immediate remedial measures | Now | Energy Department | Yes | No |
| Review government plans for rehabilitation, including funding proposals | Now | Energy Department | Yes | Yes |
| Identify & implement appropriate long term solutions | After previous | Energy Department | Yes | No |
| **Zambia** – Discharge of untreated domestic waste, Mpulungu and Shoreline Settlements | | | | |
| Assess Scale of Problem and Impact on Biodiversity (note Available Data) | Now | ECZ | Yes | Yes |
| Review Design of Existing Systems, Potential for Alternatives | After previous | Local Council | Yes | No |
| Link with existing D–WASHE Programme | Now | Local Council | Yes | Yes |
| Raise Awareness of Issues | On Going | ECZ | Yes | No |
| **Zambia** – Uncontrolled Waste Dumping in and around Mpulungu | | | | |
| Assess Scale of Problem and Impact on Biodiversity | Now | ECZ | Yes | Yes |
| Raise awareness of Issues | Now | Local Councils | Yes | No |
| Monitor effluent disposal | Now | ECZ | Yes | No |
| Enforce regulations | Now | Local Councils | Yes | Yes |
| **Zambia** – Transboundary Movement of Industrial Pollution | | | | |
| Identify sites for monitoring | Now | ECZ | No | No |
| Establish a functioning monitoring programme | Now | ECZ | No | No |
| Training in monitoring lake pollution | Now | ECZ | No | No |

### 4.3.5 Level 3 Pollution Control –Pollution in harbours

| Proposed Actions | Timing | Key Agency | Human Resources | Material Resources |
|---|---|---|---|---|
| **Burundi** – Pollution in harbours | | | | |
| Promulgation of Lake Traffic Act, and extension | Now | MTPET | Yes | Yes |
| Control enforcement of Act, and continue technical checking of ships | After previous | MTPET | Yes | No |
| Monitor and evaluate scale of the problem of lake pollution | Now | MINATE (INECN) | No | No |
| Harmonise regulations and supervising activities in riparian states | Now | MTPET | No | No |
| Establish a shipyard for maintenance and repairing of ships | Now | MTPET | No | No |
| **Congo** – Harbour Pollution (Kalemie, Kabimba, Kalundu, Moba) | | | | |
| Raise awareness | Now | Min of Env | Yes | No |
| Update regulations (eco tax combined system dissuading from legal pollution and penalising illicit pollution) | On Going | Min of Env | Yes | Yes |
| Strengthen control | Now | Min of Env | No | No |
| Installation of controlled disposal sites on dry land | Now | Min of Env | No | No |
| Identification of pollutants and assessment of their impact on the lake biodiversity | Now | CRH | Yes | No |
| **Tanzania** – Pollution in harbours (particular concern over storage and handling of oil) | | | | |
| Identify specific causes of leaks and spillages | Now | Min of Water | Yes | No |
| Check and review regulations and recommended procedures | Now | Min of Water | Yes | Yes |
| Review reasons for non–enforcement of regulations | After previous | Min of Water | Yes | Yes |
| Implement short term and long term remedial actions | After previous | Min of Water | Yes | No |

| | | | | |
|---|---|---|---|---|
| **Zambia** – Pollution in harbours (particular concern over storage and handling of oil and other cargoes) | | | | |
| Carry Out Risk Assessment | Now | Maritime | Yes | Yes |
| Review Potential Impact on Biodiversity | After previous | Fisheries | Yes | Yes |
| Mitigate impacts and put in place emergency response capacity | After previous | Harbours Authorities | Yes | No |

### 4.3.6 Level 3 Pollution Control – Pollution from future mining and oil exploitation activities

| **Proposed Actions** | **Timing** | **Key Agency** | **Human Resources** | **Material Resources** |
|---|---|---|---|---|
| **Burundi** – Pollution from future mining and oil exploitation activities | | | | |
| EIA prior to start mining | Now | MINATE (INECN) | No | Yes |
| Review Oil and Mines Act in order to take into account environmental impacts | Now | MEM | Yes | Yes |
| Negotiate agreements with other riparian countries | Now | MEM | Yes | No |
| Support the existing chemical and biological laboratories | Now | MINATE (INECN) | Yes | No |
| **Congo** – Pollution from future mining and oil exploitation activities | | | | |
| Studies of impact on the environment | Now | CRH/Min of Env | Yes | No |
| Environment follow up of activities | After previous | Min of Env | Yes | No |
| **Tanzania** – Discharge of toxic substances from mine workings | | | | |
| Quantify scale and processes used different mining areas | Now | Energy and Minerals | Yes | No |
| Promote appropriate technology | Now | Energy and | Yes | Yes |

| | | | | |
|---|---|---|---|---|
| Enforce existing regulations | After Previous | Minerals Energy and Minerals | Yes | No |
| Review the status of EIA legislation | Now | Energy and Minerals | Yes | Yes |

### 4.3.7 Level 3 Pollution Control – Pollution from major marine accidents

| Proposed Actions | Timing | Key Agency | Human Resources | Material Resources |
|---|---|---|---|---|
| **Burundi** – Pollution from major marine accidents | | | | |
| Promulgation of Lake Traffic Act, and extension | Now | MTPET | Yes | Yes |
| Control enforcement of Act, and continue technical checking of ships | After previous | MTPET | Yes | No |
| Monitor and evaluate scale of the problem of lake pollution | Now | MINATE (INECN) | No | No |
| Harmonise regulations and supervising activities in riparian states | Now | MTPET | No | No |
| **Congo** – Pollution from major marine accidents | | | | |
| Raise awareness (ship operators and other stakeholders) | Now | Min of Env / Transp & Comm | Yes | No |
| Review regulations (navigation rules; pollution and security standards, transport of hazardous cargo) | On Going | Min of Env | Yes | Yes |
| Strengthen control | Now | Min of Env | No | No |
| Technical control of ships (with anti–pollution and security standards) | Now | Transp & Comm | Yes | No |
| Pollution monitoring | Now | CRSN | Yes | No |
| Evaluate impact (scale of problem, frequency of discharge, risks, harmfulness of pollutants) | Now | CRH | Yes | No |

| | | | | |
|---|---|---|---|---|
| **Tanzania** – Pollution from major marine accidents | | | | |
| Risk analysis | Now | NEMC | Yes | No |
| Develop contingency plans | Ongoing | NEMC | Yes | Yes |
| **Zambia** – Pollution from major marine accidents | | | | |
| Carry Out Risk Assessment | Now | Maritime | Yes | No |
| Review Potential Impacts on Biodiversity | On Going | Fisheries | Yes | Yes |
| Put in place emergency response capacity | After previous | Maritime | Yes | No |
| Review need for a regional response and emergencies disaster management unit | Now | ECZ | Yes | No |

### 4.3.8 Level 3 Control Sedimentation –Erosion from agricultural practices

| **Proposed Actions** | **Timing** | **Key Agency** | **Human Resources** | **Material Resources** |
|---|---|---|---|---|
| **Burundi** – Erosion from agricultural practices | | | | |
| Evaluate impact of problem, study the extent of sedimentation in the lake and identify high risk erosion areas | Now | MINATE (IGEBU) | Yes | No |
| Plan catchment (agro–forestry, anti–erosive practices), raise awareness and promote participative approach | On Going | MINATE (DG ATE) | No | No |
| Research – development and extension of suitable techniques | On Going | MAE | Yes | No |
| Planning focused on sediment deposits in the valleys, traps for sediments | Now | MINATE (DG ATE) | No | No |
| Define special standards and prioritise interventions to identified areas | After previous | MINATE (DG ATE) | Yes | No |

| | | | | |
|---|---|---|---|---|
| **Congo** – Inadequate farming practices and extensive agriculture | | | | |
| Education and awareness | Now | MINAGRI/SNV | Yes | No |
| Identification of sensitive erosion zones | Now | INERA | Yes | No |
| Regulation of soil use in these zones | After previous | Min of Env | Yes | Yes |
| Implementing demonstrations (anti erosive techniques, agrozootechnical, agroforestry integration) | After previous | INERA | Yes | Yes |
| Extension and support to enforcement capacity | After previous | MINAGRI/SNV | Yes | Yes |
| **Tanzania** – Erosion from agricultural practices (particular concern on steep slopes and cultivating down the slope) | | | | |
| Identify with communities, sensitive areas, demarcate hazardous areas | Now | NLUPC | Yes | No |
| Raise awareness of critical issues | Now | Min of Agriculture | Yes | No |
| Promote soil conservation measures | Now | Min of Agriculture | Yes | No |
| Check/review local bye–laws | Now | Local Authority | Yes | Yes |
| Assist villages in preparing land use plans | After previous | NLUPC | Yes | No |
| **Zambia** – Erosion from agricultural practices (particular concern slash and burn and stream bank cultivation) | | | | |
| Assess Scale, Impact and Risks | On Going | Water | Yes | Yes |
| Evaluate impact on the lake | Now | Water Affairs | Yes | No |
| Review Alternative Practices including Irrigation | Now | MAFF Research | Yes | Yes |
| Review Relevance of Existing Regulations | After previous | Water Affairs | Yes | Yes |
| Promote Appropriate Farming Practices | After previous | Field Services | No | No |
| Identify Critical Erosion Sites and Remedial Measures | After | Water Affairs | Yes | Yes |

| | | | | |
|---|---|---|---|---|
| | previous | | | |
| Monitor enforcement of regulations | After previous | Water Affairs | No | No |
| Monitor current practices | After previous | Water Affairs | No | No |

### 4.3.9 Level 3 Control Sedimentation – Deforestation

| **Proposed Actions** | **Timing** | **Key Agency** | **Human Resources** | **Material Resources** |
|---|---|---|---|---|
| **Burundi** – Deforestation | | | | |
| Inventory of forests and evaluate damage | Now | MINATE (DG ATE) | No | No |
| Strengthen legal basis for Protected Areas, Update Forestry and Land Act, harmonise with Environment Act | On Going | MINATE (INECN) | Yes | No |
| Expansion of network of Protected Areas to cover all natural forests | On Going | MINATE (INECN) | No | No |
| Demarcate PAs and national forests boundaries | After previous | MINATE (INECN) | No | No |
| Rehabilitation of destroyed parts of PAs and Forests | Now | MINATE (INECN) | No | No |
| Environmental education (at all levels) | On Going | MINATE (INECN) | No | No |
| Prepare participative management plans for woods and PAs and identify alternative resources | Now | MINATE | No | No |
| Promote agroforestry and private woods | On Going | MINATE (DG ATE) | No | No |
| Compensate people expelled from PAs | After previous | MINATE | No | No |
| Reinforce supervision of PAs and forests and INECN capacities | On Going | MINATE | No | No |

**Congo** – Deforestation

| | | | | |
|---|---|---|---|---|
| Education and awareness (including authorities) | Now | Min of Env | Yes | No |
| Promotion of private woods and agro forestry (extension, demonstration) | Now | Min of Env | Yes | No |
| Protection and restoring of public forests along rivers | Now | ICCN | Yes | No |
| Identification of forestry areas to be protected | After previous | ICCN | Yes | No |
| Establish protected forest areas | On Going | Min of Env | Yes | Yes |
| Update legislation | Now | Min of Env | Yes | Yes |
| Strengthen environmental services capacities | Now | Min of Env | Yes | No |
| Creation of micro hydropower plants in order to supply substitution energy to protect the catchment | Now | Min of Energy | Yes | No |
| Action towards improved stoves, improved process for smoking of fish and alternative energy (biogas, solar etc..) | Now | Min of Env | Yes | No |

**Tanzania** – Deforestation

| | | | | |
|---|---|---|---|---|
| Identify critical encroachment and critical threatened zones | Now | Forestry Department | Yes | No |
| Create political awareness of problems | Now | Local Government | Yes | Yes |
| Negotiate with communities to gazette sensitive areas | After previous | Local Authority | Yes | No |
| Negotiate means of resettlement from sensitive areas | After previous | Local Authority | Yes | No |
| Promote community forest management and access rights | After previous | Forestry Department | Yes | No |
| Enforce bye–laws | After previous | Local Authority | Yes | No |

**Zambia** – Deforestation (particular concern for protected areas, national parks and forest reserves)

| | | | | |
|---|---|---|---|---|
| Assess Impact on Sediment Load | On Going | Water | Yes | Yes |
| Negotiate Solution to Current Encroachment | Now | Forestry, Parks | Yes | No |
| Rehabilitate sensitive areas | After previous | Forestry, Parks | Yes | No |
| Enable Enforcement of Current Regulations | Now | Forestry, Parks | Yes | No |
| Raise Awareness of Issues, particularly at the Political Level | Now | ECZ | Yes | Yes |
| Promote afforestation | Now | MENR | Yea | No |
| Raise local awareness | Now | MENR | Yea | No |
| Promote alternative energy | Now | MENR | Yea | No |

### 4.3.10 Level 3 Habitat Conservation – Threats to Resources in National Parks

| **Proposed Actions** | **Timing** | **Key Agency** | **Human Resources** | **Material Resources** |
|---|---|---|---|---|
| **Burundi** – Encroachment in the Rusizi Natural Reserve | | | | |
| Compensation for expulsion from sensitive zones | Now | MINATE (INECN) | Yes | No |
| Extend the reserve into the littoral; zone to 1000 metres offshore of the 774-metre contour. | Now | MINATE (INECN) | Yes | No |
| Plant hedges to demarcate the reserve in the delta | After previous | MINATE (INECN) | Yes | No |
| **Congo** – Lack of Protection of the Congolese side of the Ruzizi delta | | | | |
| Establish a “protected area” in the Ruzizi delta, adjacent to the **Burundi** Natural Reserve | Now | ICCN | Yes | No |

| | | | | |
|---|---|---|---|---|
| **Tanzania** – Exploitation of Parks Fisheries | | | | |
| Raise awareness of parks issues | Now | TANAPA | Yes | No |
| Involve local communities | Now | TANAPA | Yes | No |
| **Zambia** – Community Pressure on Nsumbu National Park | | | | |
| Involvement of Communities in Parks Management | Now | ZAWA | Yes | No |
| Training in Aquatic Parks Management | Now | ZAWA | No | No |
| Define and mark aquatic parks boundary | Now | ZAWA | Yes | No |

### 4.3.11 Level 3 Habitat Conservation – Degradation of sensitive habitats

| Proposed Actions | Timing | Key Agency | Human Resources | Material Resources |
|---|---|---|---|---|
| **Burundi** – Degradation of sensitive coastal areas | | | | |
| Mapping supra littoral area and cultivated area | Now | MINATE (INECN) | Yes | No |
| Raise awareness | Now | MINATE (INECN) | Yes | No |
| Participative management and non destructive recovering of natural resources | Now | MINATE (INECN) | Yes | No |
| Declare sensitive areas as protected areas (Murembwe, Nyengwe, Rwaba) | Now | MINATE (INECN) | Yes | No |
| Control lake shore vegetation exploitation | Now | MINATE (INECN) | Yes | No |
| Protect the rocky coastline through tree planting between Gitara and Flugara | | MINATE (INECN) | Yes | No |

**Congo** –Risk of degradation of coastal zone; lack of protection of specific key zones (Rusizi, Lukuga, Luhanga, Pemba, Kalamba, Kiriza, Kazimia)

| | | | | |
|---|---|---|---|---|
| Establish a protected area – Lukuga | Now | ICCN | Yes | No |
| Establish a protected area – Ruzizi | Now | ICCN | Yes | No |
| Establish protection for sites of special scientific interest – Luhanga, Pemba, Kalamba, Kiriza, Kazimia | Now | ICCN | Yes | No |
| Participative preparation of a management plans | Now | ICCN | Yes | No |
| Hydrologic monitoring (rate of flow from lake) | Now | CRH | Yes | No |
| | | | | |
| **Tanzania** – Degradation of wetland areas – in particular the Malagarasi | | | | |
| Negotiate access with communities | Now | Min of Agric | Yes | No |
| Gazette areas | After previous | Min of Agric | Yes | No |
| Raise Awareness | Now | Fisheries | Yes | No |
| Ban destructive fishing practices | Now | Fisheries | Yes | No |
| Evaluate stock | Now | TAFIRI | Yes | No |
| Conduct hydrological and limnological monitoring | Now | TAFIRI | Yes | No |
| | | | | |
| **Zambia** – Damage to Sensitive Habitats Lufuba and Chituba Bay and Chisala River Mouth | | | | |
| Evaluate destructive fishing practices | On Going | Fisheries | Yes | Yes |
| Ban specific destructive practices (poison, explosives…) | Now | Fisheries | Yes | Yes |
| Negotiate designation of Chituba and Lufuba bays and Chisala river mouth as conservation areas | Now | Fisheries | Yes | No |
| Negotiate with communities acceptable management practices | Now | Community Dev | Yes | Yes |
| Develop procedures for capital empowerment of communities to alleviate impact of zone designation | Now | Community Dev | Yes | No |
| Negotiate designation of Lufuba mouth as Ramsar site | Now | ECZ | No | Yes |
| Monitor stock levels | On Going | Fisheries | Yes | No |

# Annex 1 Regional and National Workshop Participants

## Participants at the Final SAP Workshop

| | |
|---|---|
| BURUNDI | |
| Monsieur. Jerome Karimumuryango | Directeur General- INECN/ Coordinateur National |
| Monsieur Boniface Nyakageni | Conseiller au MINATE |
| Monsieur Gabriel Hakizimana | Coordonnateur du Volet Pollution |
| Dr. Gaspard Ntakimazi | Professeur, Universite du Burundi |
| DR Congo | |
| Monsieur Mady Amule | Directeur – Ministere de l'Environnement / Coordinateur National |
| Dr. Nshombo Mudherwa | Directeur General – CRH – UVIRA |
| Dr. Mulimbwa Nsibula | Directeur Scientifique – CRH – UVIRA |
| Prof. Takoy Lomema | Professeur, Universite de Kinshasa |
| Tanzania | |
| Mr. W.V. Haule | Assistant Director, Fisheries Division |
| Dr. Hudson Nkotagu | Lecturer / Geologist – University of Dar es Salaam |
| Mr. Faustin Masanja | Hydrologist, Water Resources Department |
| Zambia | |
| Mr. George M Chitalu | Assistant National Co-ordinator, Environmental Council of Zambia |
| Mr. Shadreck Nsongela | Senior Environment Impact Assessment Officer, Environmental Council of Zambia |
| Ms. Georgina Zulu | Senior Planning Officer – Ministry of Environment and Natural Resources |
| Mr. Leonard Mwape | Senior Fisheries Officer – Mpulungu |
| PCU | |
| Dr. Andrew Menz | Project Co-ordinator |
| Dr. Kelly West | Scientific Liaison Officer |
| Sap Coordinators | |
| Mr. Nicholas Hodgson | Anglophone |
| Mr. Jean – Paul Ledant | Francophone |

## Participants at the Final TDA Workshop

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| Monsieur Roger Kanyaru | Directeur, Departement d'Eaux, Peche et Pisciculture |
| Monsieur Antoine Kiyuku | Directeur des Affairs Juridique a.i |
| Dr. Gaspard Ntakimazi | Professeur, Universite du Burundi |
| DR Congo | |
| Monsieur Mady Amule | Directeur – Ministere de l'Environnement / Coordinateur National |
| Dr. Nshombo Mudherwa | Directeur General – CRH – UVIRA |
| Dr. Mulimbwa Nsibula | Directeur Scientifique – CRH – UVIRA |
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| Mr. Rawson Yonazi | Assistant Director – Division of Environment / National Coordinator |
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| Mr. Richard Paley | Biodiversity |
| Mr. Olivier Drieu | Sediment |
| Ms. Karen Zwick | Socio – Economics |
| Mr. Robert Lindley | Fishing Practices |
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| Mr. Nicholas Hodgson | Anglophone |
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## Participants at the First SAP Workshop

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| Mr. Benoit Bihamiriza | Director- Legal Affairs and Settlement of Disputes. |
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| Mr. Mady Amule | Director- Ministry of Environment/ Nat. Coord. |
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| Didace Nimpagaritse | Professeur à l'Université du Burundi. |
| François Nkurunziza | Professuer à l'Université du Burundi. |
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| Mady Amule | National Co-ordinator, Min. de l'Environnement et Conservation de la Nature. |
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| Palata Kabudi | Professeur-Expert, Universite de Kinshasa |
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| R.P Yonazi | National Coordinator, LTBP |
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| Jean-Paul Ledant | SAP Workshop Facilitator |
| Graeme Patterson | Sediment and Pollution SS |
| Eddie Allison | Biodiversity SS |
| Observers | |
| Gerard Cougny | GEF, Project Evaluation Mission |
| Niels Henrik Ipsen | GEF, Project Evaluation Mission |

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| Ms S Capper | AWF |
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| Bishop Dr G Mpango | Diocese of Western Tanganyika |
| Mr. M. M. Shirima | District Council |
| Mr. G. Makinda | |
| Mr. C. Swai | Division of Environment |
| Mr. R Yonazi | |
| Mr. S. Kisinto | |
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