Pollution Control and Other Measures to Protect Biodiversity in Lake Tanganyika

Strategic Action Plan

Lake Tanganyika
The Preliminary Transboundary Diagnostic Analysis

---

10 February 1999

Preliminary TDA Report Word 97.doc

Document History

First Draft	3 December 98	Based on TDA Workshop Conclusions Lusaka 23 -26November 1998. Nick Hodgson and Jean Paul Ledant
Comments	15 December 98	Andy Menz
Comments	28 January 99	Graeme Patterson
Comments	9 February 99	Vicki Cowan, Eddie Allison
Comments	10 February 99	Kelly West
Second Draft	10 February	Nick Hodgson

CONTENTS

Participants at the TDA Workshop Lusaka 23-26 November 1998

	Burundi	
1	Jean Berchmans Manirakiza	National Coordinator & Directeur Général INECN
2	Salvator Ruzima	Directeur Général de Développement Communal
3	Gaspard Ntakimazi	Professeur à l'Université du Burundi
4	Didace Nimpagaritse	Professeur à l'Université du Burundi.
5	François Nkurunziza	Professuer à l'Université du Burundi.
	Congo	
6	Mady Amule	National Co-ordinator, Min. de l'Environnement et Conservation de la Nature.
7	Nshombo Mudherwa	Director General, CRH - Uvira
8	Takoy Lomema	Professeur, Universite de Kinshasa
9	Palata Kabudi	Professeur-Expert, Universite de Kinshasa
10	Baluku Bajope	Scientific Director, Research Center for Natural Sciences of Lwiro, Bukavu
	Tanzania	
11	R.P Yonazi	National Coordinator, LTBP
12	Dr Francis Chale	LTBP Research Consultant Pollution Special Studies
13	W.Y. Haule	Senior Fisheries Officer, Ministry of Natural Resources and Tourism
14	Ms. Hidaya M.M Faraji	Senior Research Officer, Central Water Laboratory, Ministry of Water
15	Dr. H.H. Nkotagu	Senior Lecturer, Hydro-geology, University of Dar-Es-Salaam
	Zambia	
16	James Phiri	National Coordinator, Director, Environmental Council of Zambia
17	Leonard Mwape	Fisheries Department, Mpulungu
18	Henry Sichingabula	University of Zambia
19	G Chilukusha	Min for Environment and Natural Resources
20	R Sinyinza	Fisheries Department Mpulungu
21	Shadreck Nsongela	Environmental Council of Zambia
	PCU	
22	Andrew Menz	Project Coordinator
23	Kelly West	Scientific Liaison Officer
	Resource persons	
24	John Dorr	Fishing Practices, SS
25	Nick Hodgson	SAP Workshop Facilitator
26	Jean-Paul Ledant	SAP Workshop Facilitator
27	Graeme Patterson	Sediment and Pollution SS
28	Eddie Allison	Biodiversity SS
	Observers	
29	Gerard Cougny	GEF, Project Evaluation Mission
30	Niels Henrik Ipsen	GEF, Project Evaluation Mission

1 Preface

1.1 Why Lake Tanganyika?

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

Lake Tanganyika is the richest freshwater ecosystem in the world, with more than 1,300 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.

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.

1.3 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 aims 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.

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

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 Socioeconomics, 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.

1.3.1 The Strategic Action Plan

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 Plan - 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[1]."

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 initial interventions based on present knowledge.

The responsibility for formulating the SAP and implementing the steps leading to the development of the document is 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.

1.3.2 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.[2]"

1.3.3 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[3] it was agreed that this legal framework would be formulated as a ***Convention***, in line with recognised legal international principles.

[1] Operational Strategy of the GEF; GEF 1996

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

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

The overall aim of developing the Convention is to establish a legal and institutional framework to support the strategic action plan (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.

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.

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 likely to be controlled management rather than exclusion[4].

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 Plan. 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 Plan 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).

[4] "…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.

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

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

This document is the first iteration of the TDA and forms the basis for the preparation of the draft SAP, ensuring that the SAP has the scope to incorporate present and expected management requirements. In addition, this preliminary TDA guides the special studies towards answering specific priority management concerns through their research and monitoring programmes.

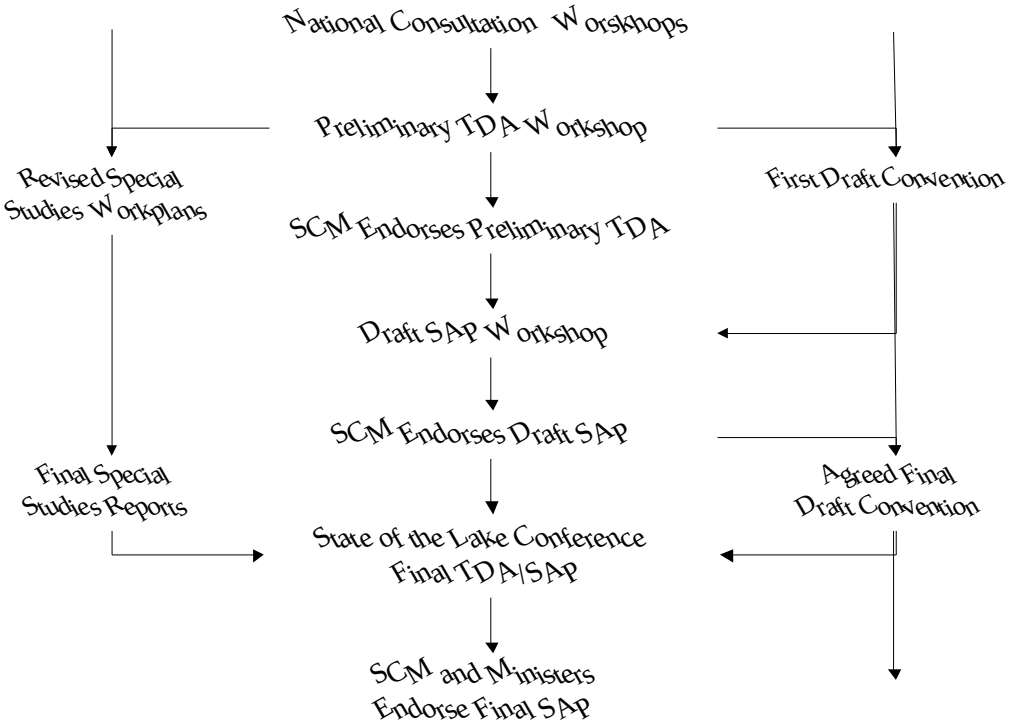
In a similar way, the preliminary TDA also feeds into the development of the Convention that is being developed in parallel with the SAP, ensuring that the Convention will have the scope to support the management concerns of the SAP.

The second stage is the preparation of the final TDA and final project SAP. This will take place after the special studies have been completed, incorporating their results and conclusions in the analysis to identify priorities[5]. It will also incorporate and be harmonised with the final agreed draft Convention.

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 programmes that stem from the SAP, and promoting national programmes within the framework of the regional plan. The Lake Management Body will also be responsible for developing future iterations of the SAP in response to improved information and changing threats and opportunities.

[5] The special studies still being undertaken by the project with local partner institutions are due to be completed by November 1999, their conclusions are to be presented at a regional workshop.

Figure 1 Seven Steps in the Development of the SAP



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[6]. 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:

[6] 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.

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 TAC 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 TAC SAP Planning Group met in Lusaka in November 1998, and with the support of the project research team leaders, drew up the matrix that forms the body of this document prioritised the sub-components dealing with specific problems.

Table 1 Technical Composition of the TAC 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

1.5.2 The Next Step – The Draft SAP

The TAC will take the prioritised set of specific problems, and on the basis of these will draw up a draft Strategic Action Plan.

This document is expected to be presented in three volumes:

Volume 1 - will define the goal of the Lake Tanganyika SAP and the long term objectives, the scope of the agreement, the principles guiding the future management of the lake environment and development of the lake resources, forming the basis on which the four countries will work together;

Volume 2 – will describe the State of the Lake; and

Volume 3 – will contain the prioritised programme of activities that the four countries would like to undertake within this regional framework. Volume 3 becomes the working document of the SAP, and as such will be amended from time to time in response to new information, and new threats and opportunities.

The first iteration of the SAP, the Draft SAP will include outline recommendations for establishing a formal Lake Management Body, and arrangements for future cooperation. It will define the process and timing for the review and update of the SAP.

The Draft SAP will be endorsed by the Project Steering Committee.

Following this, the TAC SAP Planning Team will prepare a second iteration of the SAP, revising the TDA and completing the final project SAP, incorporating the final conclusions of the Special Studies.

It is expected that these will be presented and discussed at the "State of the lake Workshop" scheduled for the year 2000, following which the TAC SAP Planning Team will finalise the TDA and SAP documents for endorsement by the Project Steering Committee and Ministerial Representation.

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 Plan. 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.

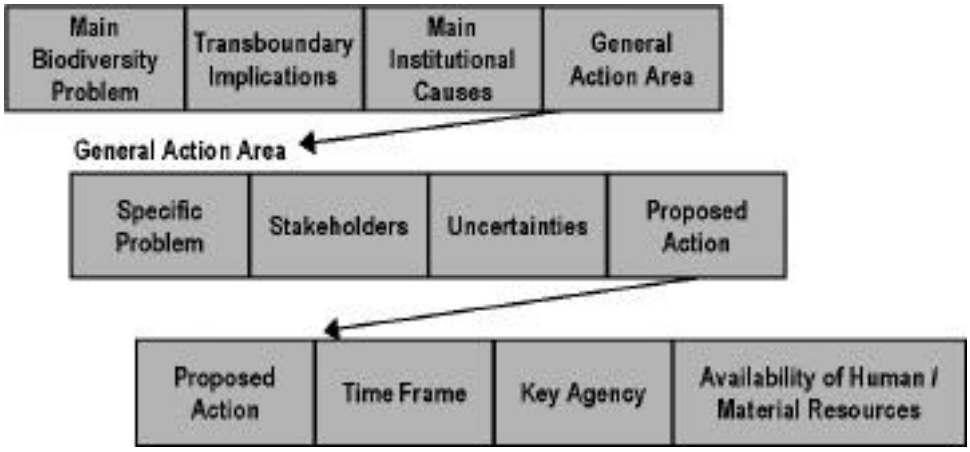
2.1 Analytical Problem Matrix

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[7].

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***[8]. 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, 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.

[7] 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.

[8] 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	Transboundary Implications	Main Institutional Problems	General Action Areas
Unsustainable Fisheries	Global Loss of Biodiversity	Lack of Resources	A. Reduce Impact of Fishing
Increasing Pollution	Loss of Shared Fisheries Resource	Poor Enforcement of Existing Regulations	B. Control Pollution
Excessive Sedimentation	Decline in Water Quality	Lack of Appropriate Regulations for Lake Tanganyika	C. Control Sedimentation
Habitat Destruction		Lack of Institutional Coordination	D. 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 ***Proposed 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 Proposed 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, to 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

2.2.1 The Need to Prioritise

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.

2.3 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[9]. 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, in which 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 local management solutions[10].

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 officers represented in the NWGs (officers for fisheries, erosion control, harbour management, towns…).

[9] "*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.

[10] 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.

2.3.1 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.

Although there are many possible criticisms of this method of criteria aggregation, it has at least the advantage of being 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 - Prioritised Interventions

1.1 Outputs

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), final classification in three categories A, B, C and the prioritisation for A category problems.

Table 3 Prioritisation of Problems - Reduction of Fishing Pressure

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

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

Table 4 Prioritisation of Problems - Control of Pollution

Specific Problem	S	F	B	T	C	P
Industrial pollution	3	2	3	8	A	1
Pollution from urban waste	3	2	3	8	A	2
Harbour pollution	3	2	3	8	A	3
Pollution from future mining activities or oil exploitation	3	2	3	8	A	4
Risks of major marine accidents	3	2	3	8	A	5
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, P: priority

Table 5 Prioritisation of Problems - Control of Sedimentation

Specific Problem	S	F	B	T	C	P
Erosion from inappropriate farming practices	3	2	3	8	A	1
Deforestation	3	1+	3	7+	A	2
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	1+	2	5+	C	
Potential mines and quarries	2	1	2	5	C	

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

Table 6 Prioritisation of Problems - Habitat Conservation

Specific Problem	S	F	B	T	C	P
Degradation of sensitive areas in littoral zone	3	1+	3	7+	A	1

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

3.2 Justification for Prioritisation

3.2.1 Fishing Problems

High Priority Fishing Problems (Class A)

All the problems are considered as being important for the lake biodiversity, of

possible solutions although difficult, and having additional benefits (mainly sustainable fishing, for the benefit of fishermen and consumers)[11].

1. Excessive fishing effort in littoral area

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 the richest in biodiversity.

Feasibility of solutions: the problem is not easy to solve, insecurity restricts the areas in which fisheries officers can operate and their capacity is further constrained by lack of equipment, but some solutions are identified.

Additional benefits: as with most other fishing problems, the solution would contribute to more sustainable fishing.

Comment on the general diagnosis and rank. A high priority level is given because of presumed impact on biodiversity.

2. Use of beach seines

Severity of problem: beach seines are widespread, although currently banned by law in both Tanzania and Zambia, and used in the coastal strip, rich in biodiversity. The method is not very selective, and is known to cause additional benthic damage, and hence be prejudicial to a large number of species.

Feasibility of solutions: solutions are envisaged, but need to be developed and tested.

Additional benefits: again benefits could be high because the solution would make fishing more sustainable: beach seines are considered prejudicial to fisheries because of their impact on fry and immature fish.

Comment on general diagnosis and rank: although the problem is clearly defined in terms of the possible impact on biodiversity and particularly on vulnerable endemic species and overall fisheries, the scale of the impact has yet to be determined.

3. Fishing in sensitive areas

Severity of the problem: sensitive areas include spawning grounds (usually seasonal) and key areas for biodiversity, these two categories overlapping in a large part. The problem is believed to be serious as in addition to inflicting high mortality on immature fish, it disturbs habitats that are often limited in extent and distribution, and with sensitive biodiversity.

Feasibility of solutions: the problem is not easy to solve, but solutions are identified and facilitated by the fact that they are relatively concentrated in space.

[11] During the workshop, the general point was raised that the existing regulations governing the management of the lake and catchment resources were inadequate or inappropriate, and that the capacity to enforce regulations was strictly limited. Although raised originally as a separate point, the regulatory and capacity building considerations are incorporated into the interventions proposed to counteract specific problems.

Additional benefits: as with most other fishing problems, the solution would make fishing more sustainable, thanks to the protection of spawning grounds, which generally correspond to sensitive areas.

4. Excessive or uncontrolled extraction of ornamental fish

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

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.

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

Comment on general diagnosis and rank: the practice focuses on vulnerable species, which justifies a high priority level, but at present this is limited by the modest scale of uncontrolled extraction.

Medium Priority Fishing Problems (B)

Two problems in this category (Use of inappropriate mesh sizes, Lack of economic alternatives for fishermen) are believed to be important for the lake biodiversity and their solution would bring or would have favourable effects on other points of view (sustainable fishing, socio–economic development).

The main reason for the lower priority is the intractability of the problem to management solutions. As a result these problems are given a medium priority.

A third problem, excessive fishing pressure in the pelagic zone seems above all to be a problem for the fishing economy, but not for the biodiversity because few species are targeted and these species, although in reduced stocks, are not threatened with extinction. However, the secondary impact on other species has not been evaluated.

Low Priority Fishing Problems (C)

These are generally problems which have low impact on biodiversity (insecurity 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 commercial demand, which results in the high fishing pressure (a problem addressed elsewhere), is considered as an 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).

3.2.2 Pollution Problems

High Priority Pollution Problems (A)

1. Industrial pollution

Severity of problem: the problem is considered to be serious in most of the countries. Despite the low development of industrialisation, limited to Tanesco in Kigoma, Kiliba and Kabimba in Congo and the industrial base in Burundi, the fact that the lake is effectively a closed system, the emission of non biodegradable pollutants will result in an accumulation process which could threaten the lake.

Feasibility of solutions: solutions are identified and facilitated by the concentration of pollution sources.

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.

2. Pollution from urban waste

Severity of problem: the problem is considered as relatively serious. Despite recent efforts in Bujumbura, domestic waste is a major and increasing source of organic and chemical pollution

Feasibility of solutions: the problem is not easy to solve, but solutions are identified and interventions are facilitated by the concentration of those sources of pollution. They also receive political support as a result of their social and health benefits. Some sources, such as the Kigoma institutions, are very localised and hence easy to control.

Additional benefits: controlling the problem would improve water quality for the benefit of many direct users. The main impacts would be on public health, and since the most polluted areas are also those where the users are more numerous; in Bujumbura, benefits could be localised and immediate.

3. Harbour pollution

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).

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.

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

4. Pollution from future mining activities or oil exploitation

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, pollution from other heavy metal contained in ores, eutrophication from phosphates, pollution from hydrocarbons).

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

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.

5. Major risks of marine accident

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 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.

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

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.

Medium Priority Problems (B)

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 or 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 they 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, require monitoring, but do 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.

Low Priority Pollution Problems (C)

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).

3.2.3 Sedimentation Problems

High Priority Sedimentation Problems (A)

High priority problems are widespread and require sustained effort. From the point of view of lake biodiversity, information is still limited on whether there are critical source areas.

1. Erosion from inappropriate farming practices

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.

Feasibility of solutions: the problem is not easy to solve, because of its scale, the large number of concerned farmers and the constraints they are confronted with. However technical solutions are well known and efforts are underway and intervention strategies are improving on the basis of previous experiences. Despite the scale of the problem, interventions can be concentrated according to the two criteria of agriculture viability and lake protection.

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

2. Deforestation

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. The problem covers agricultural clearing, woodland destruction through burning, wood exploitation (particularly for charcoal and, in Tanzania, for tobacco curing).

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.

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).

Medium Priority 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 designing or construction.

Those problems include locally important erosion sources, which lead to localised, but in some cases serious sediment discharge in sensitive habitats. Overgrazing in plains is perhaps an exception because sediments are carried towards deltas (ecosystems which are not threatened by sedimentation), but it is locally important (Rusizi, Malagarazi).

It is mainly because they seem to be less serious and because remedial actions bring less additional benefits that those problems were prioritised in the second position rather than the first one. However, it is likely that actions on those problems could turn out to be more effective and efficient for lake protection than some actions to control agricultural and forestry problems classified as a higher priority. The analysis will need to be refined or reviewed at a later stage, particularly regarding problems of human settlements, roads and communication routes, extraction of materials in rivers, all of which had received a relatively high priority in national workshops.

Low Priority Problems (C)

These are problems considered to be less harmful and difficult to control: despite the fact that they are causes of erosion, bush fires 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. 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 reduced.

3.2.4 Habitat Problems

These problems are posed as if they were only one. However they include both the degradation of the supra littoral area (semi-flooded band of the lake) in Burundi, and risks threatening coastal wetlands including the large deltas (Ruzizi, Malagarazi) or the outlet (Lukuga). These play a role in the lake hydrology and the water quality and are also critical habitats for important elements of biodiversity. Taken together, the problem seems to be fairly difficult to solve, but actions are possible at the level of fragile zones correctly identified.