

UNITED NATIONS DEVELOPMENT PROGRAMME  
Global Environment Facility  
PROJECT DOCUMENT

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| COUNTRIES:               | Burundi, Tanzania, Zaire and Zambia   |
| PROJECT TITLE:           | Pollution Control and Other Measures to Protect Biodiversity of Lake Tanganyika |
| PROJECT REFERENCE:       | RAF/192/G32   |
| DURATION:                | Five years  |
| ACC/UNDP SECTOR:         | Environment   |
| SUBSECTOR:               | Biodiversity/International Waters   |
| ESTIMATED STARTING DATE: | 1 January 1994  |
| EXECUTING AGENCY:        | OPS   |
| UNDP/GEF INPUT:          | GEF funds US\$ 10 million   |

#### Brief Description

Lake Tanganyika is one of the worlds great lakes and it has an important role in the economies of Burundi, Tanzania, Zaire and Zambia. It possesses perhaps the highest biodiversity of any lake on earth. The lake is very vulnerable to pollution because of its natural characteristics, and there are presently few efforts to conserve its biodiversity. The most immediate threats to the lake environment and biota a are 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 cause concern. Immediate attention is required to assess and control pollution and protect biodiversity.

The 5-year project aims to improve understanding of the ecosystem function and effect of stresses on the lake system; to take action on all other measures necessary to maintain the health and biodiversity of the ecosystem; and to co-ordinate the efforts of the four countries to control pollution and to prevent the loss of the exceptional diversity of Lake Tanganyika.

This will be done by establishing a regional framework for co-operation, including endeavours to harmonise legislation; investigating pollution including sources, effects and control; and investigating biodiversity and conservation measures leading to the setting up of protected areas as underwater parks. Activities will closely involve government environmental ministries and agencies, and sectoral departments; a major objective is to strengthen national capabilities and community participation. The project will be supported by international and local staff and contractors. NGOs will be involved particularly through community education and conservation, and the private sector through promotion of tourism and the control of industrial pollution. Provision will be made to continue the work of the project after its life by a regionally co-operating organisation.

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## A. CONTEXT -

### A.1 Description of Sector

Lake Tanganyika is one of the Great Lakes of the world, and the largest water reservoir in Africa (18,800 km<sup>3</sup>). The lake is shared by four countries, Zaire (45%), Tanzania (41%), Burundi (8%) and Zambia (6%). It is a vital water resource and plays a pivotal role in the economic activity of the region. Fish from the lake (85,000 tons/year) is a primary protein source, and there is a valuable ornamental fish export industry. The lake provides a transportation link for the countries around it which will be increasingly vitally important in their development.

Biodiversity in Lake Tanganyika is truly remarkable, and may be greater than in any other lake on earth. Over 1,300 species of fish, invertebrates and plants have been recorded, some 500 of which do not occur anywhere else. Many of these have no close relatives outside the lake basin, and are the result of a very long evolutionary history. The rich diversity of this ecosystem is of world-wide interest and importance.

Serious environmental threats currently face the lake. The most immediate problems concern pollution from excessive amounts of suspended sediment entering the lake as a result of deforestation and agricultural practices. Furthermore, chemical pollution is occurring increasingly from urban and industrial sources. Both of these general kinds of pollution also alter the nutrient balance in the lake causing eutrophication. Intensive oil exploration in the past decade is believed to have indicated petroleum resources in the basin and the lake sediment. This raises the possibility of oil spills in the future, and leaks and losses of oil incidental to lake transportation have already occurred. Another serious problem is the long-term decline in the fish catch in areas where improved mechanised methods of fishing have been developed. The diversity of these fishery stocks has already diminished. Inshore, the uniquely diverse assemblages of cichlid fishes are being affected by destructive fishing practices.

Unfortunately, the lake is singularly vulnerable to pollution. It is virtually a closed basin with only one small river outlet, and almost all water loss is by evaporation. As a result, its flushing time, which is related to the renewal of water in the lake, is extremely long (as much as 7,000 years). This flushing time is longer than in any other great lake. Moreover, most of the deep water is already naturally permanently deoxygenated, in a proportion greater than in any other great lake. As this proportion is further decreased by changes that may arise from exploitation and pollution, so the health of the ecosystem and its ability to sustain human populations and maintain its biodiversity will become imperilled. A very serious aspect is that these effects would be long-term ones; in effect, pollution would be permanent in relation to human life times.

These threats are potentially grave because of the areas dependence of people in the basin on the lake (some 7 to 10 million, including the L. Kivu catchment). There is a growing awareness in the region of these problems, as well as a growing appreciation of the value of the lake and its resources. Since it is clear that these resources and the environmental threats are to a large extent shared because of their interactions within a single ecosystem, the need is widely recognised for an integrated regional approach to the conservation and management of the lake environment.

There are large gaps in our knowledge about the lake resources and environmental dangers, and strategies for pollution control and biodiversity conservation have yet to be worked out. Enough is known, however, to identify key questions where research and enquiry are necessary. This will have to be done in a context where communication between the lake countries in technical and logistic matters is poor. /moreover, there is a shortage of skilled person power in fields related to conservation management and pollution control, and there is need for greater community awareness and education about environment problems and solutions.

On the positive side, enough is known to identify key environmental problems and work out approaches to their solution. There is evidence of a strong desire in the region to undertake this work, and it will be facilitated by the recent wide-reaching restructuring of legislation

and institutional responsibilities for environmental matters which has occurred within the countries. This project presents an opportunity both to investigate urgent problems, and also to initiate regional co-operation in establishing a facility for the control of pollution and the good management of an exceptional natural environment.

## A.2 Sectoral Strategies

There is as yet no legal framework among the four countries for the joint management of the lake. The countries participate in the FAO Committee for the Inland Fisheries of Africa (CIFA) which meets every year and shares experiences specifically on fisheries matters. Burundi, Tanzania and Zambia are members of the Preferential Trade Area for Eastern and Southern Africa (PTA), and Zaire has applied to join, while Burundi and Zaire are also members of the Economic Commission for the Great Lakes (CEPGL). PTA is an organisation with a very broad range of interests, and CEPGL does not include Tanzania and Zambia. Under these circumstances, the sectoral policies of the four countries have been primarily concerned with national interests.

Chief of these has been the development of fisheries. There are about 36,000 fishermen on the lake, operating some 10,000 coastal canoe fishing units and 2,000 improved artisanal units. Industrial (purse seine) units number about 60 and have operated from the main ports, Bujumbura, Kigoma, Kalemie and Mpulungu. The export of ornamental fish to destinations around the world is an increasing business.

The entire lakeshore population depends on the lake water for drinking and other domestic purposes. In urban areas, notably the city of Bujumbura, water supply arrangements with treatment on municipal scales exist. Plans exist in these places to develop lake water resources, which for the future must be of huge potential value in view of the size and location of this reservoir in a generally arid part of the continent with growing populations.

A shipping transport system exists linking the main ports. This has long been established, but there are strong indications, notably at the north and south ends, that lake transportation is growing, and will become an important part of a transportation network linking countries of East, Central and Southern Africa. Oil is already transported (oil imports to Burundi are routed by the lake), and this will increasingly be the case especially if oil is produced in the basin.

At present, the countries have no formal policies to conserve biodiversity in the lake. No areas of the lake are set aside for conservation as parks or reserves, other than the nearshore waters of four land parks. Tourism is not developed, though huge potential for this exists.

Lake Tanganyika has received considerable attention from the international scientific community for many years, first for its highly diverse endemic biota and more recently in regard to its geology and sedimentology. There is no doubt that the riches of the lake and basin represent large potential natural resources for each country.

The project will take account of the various sectoral strategies and reflect a multisectoral approach, in which certain technical programmes will differ between the four countries but will complement each other to achieve the required regional objectives.

## A.3 Prior and Ongoing Assistance in the Sector

There has been relatively important support for the fisheries of the lake. Three FAO projects, each about 5 years duration, were partly (Zambia) or entirely (Burundi, Tanzania) concerned with Lake Tanganyika, and a regional FAO fisheries planning project which included L. Tanganyika has just been completed. Most recently (1992) a regional FAO/FINNIDA fisheries research project commenced, which will investigate the biological basis of fish production. Though these projects have concerned lake biota, none have covered the conservation of biodiversity in general; it is important that Biodiversity Conservation now be addressed since fish catches in the lake have been declining and an effect of the fishery itself has been to reduce biodiversity,

Other projects concerned with the lake or watershed, either underway or in an advanced stage of preparation that will have bearing on this project are given below. [In the list, each project title is followed by the donor agency, the implementing agency, the country or countries involved, and the areas of co-operation with this project which can be foreseen.] Contacts will be initiated by the Project Co-ordinator with all these projects with a view to the exchange of information and co-operation where appropriate. Moreover, where project relating to the environment are operating on the neighbouring Lakes Malawi and Victoria, cognisance will be taken of progress and results that may be of use to this project.

Role of Ecotones in Lake Tanganyika DANIDA/UNESCO, Burundi; lake margin wetland research (Ruzizi delta), development of Lake Tanganyika museum.

Bujumbura Municipal Water Quality GTZ (Germany) BWW, Burundi; pollution monitoring in Bujumbura area.

Biodiversity Support Project (INECN) USAID/Peace Corps Burundi; on land conservation.

Ntihanowa River Basic Project FAO (France)/ISABU; Burundi; natural forest & park protection, environmental education.

Project Memwere & Muhuta Swiss Aid/Travaux Publiques, Burundi; watershed management.

Projet d'Aménagement d'Haute Terre Italian Foreign Aid/ISABU, Burundi; watershed management.

Sewage Treatment Facility for Bujumbura KFW (Germany)/SETEMU, Burundi; pollution control for Bujumbura area.

Administrative Management Design (ADMADÉ) project for national parks and wildlife services, WWF & USAID/Zambia Govt;

community involvement in reserve design and management.

Zambian Environment Educational Programme (ZEEP), WWF/Zambia Govt; community, primary and secondary education.

Fisheries Loan & Capital Equipment, IBR/Zambia Govt; improvements in fishing gear, strengthening of institutions (project in suspension).

Lake Tanganyika(Tanzania) Fisheries Project Netherlands/Tanzania Govt; fisheries.

Ornamental Fish Export Production CBI-Netherlands/Tanzania; sustainability of ornamental fish exploitation.

Land Degradation in Western Tanzania DANIDA/Tanzania Govt; remote sensing of land degradation.

Integrated Regional Development NORAD/Tanzania Govt, Tanzania; - afforestation, water supply.

Hydrothermal Activity in Lake Tanganyika (TANHYDRO) French and Germ. an National Science Foundations, Zaire, Burundi, Tanzania; - limnology.

Creation and Management of a Research Centre in Ichthyology and F hydro-biology AGCI (Belgium)/CEPGL-IRAZ, Burundi, Rwanda, Zaire; - pollution monitoring in northern bay of the lake limnology, training.

Fish and limnological investigations Kyoto University (Japan)/National Governments, Zaire, Tanzania Zambia; behavioural ecology, fish biology, limnology.

Regional Fisheries Project for Lake Tanganyika FINNIDA/FAO, Burundi, Tanzania, Zaire, Zambia; improved fishing practices, limnology, training.

International Decade of East African Lakes (IDEAL), (regional project with 15 participating countries NSF (USA) and others to be identified; limnology. Development phase to be or going over 12 to 15 years, (other projects are in preparation between various of the lakeshore countries and the University of Arizona (USA), the Royal Museum of Natural Sciences, Belgium, and the University of East Brittany France.)

Ongoing community development, land management and fisheries project conducted by CADIC and HAAC at Uvira (Zaire).

Most of these projects are quite small and narrowly focused, and deal with specific problems. Most involve only one lake country. While there are areas of complementarity, there is little if any overlap with this project none of them serve the need for biodiversity conservation and pollution control in the lake as a whole which to be effective must be approached on a regional basis.

#### A.4 Institutional Framework for the Sub-sectors

In the absence of a formal regional institutional framework for co-ordinated management of the lake resources, interchange between the four countries has been taking place primarily through ad hoc inter-country, consultations. Fortunately, similar institutions exist for the management of natural resources at the national level, and lead agencies for environmental matters have been designated. In Burundi, there is a Ministry of Land Management, Tourism and Environment which includes a National Institute for Environment and Conservation of Nature (INECN). In Zambia, a National Environment Council (NEC) has been set up with Natural Resources Inspectorate responsible for the management of natural resources; at a ministry level there is the Ministry of Environment and Natural Resources. In Tanzania, a Ministry of Tourism, Natural Resource and Environment exists to complement the National Environment Management Council (NEMC). In Zaire, there is a Ministry of Environment, Conservation of Nature and Tourism.

All these environmental agencies are relatively new and have inadequate staff, with little resources and finance. While their responsibilities are broad their operational capacities have yet to be well established.

There are also national universities which are responding to the research needs of their societies. The University of Burundi has now developed some research capacity on ecological and pollution aspects of the lake. The Biology Department of the University of Zambia is also interested in working on the lake at some point. The staff of the Department of Biology at the University of Dar-es-Salaam in Tanzania has done research on lake fisheries. In addition, several non-governmental organisations in the countries exist which; re-oriented towards providing direct support to communities in the field of environmental awareness.

More detail is given in Annex VII about these various national bodies which provide the institutional framework in which the project must function. The project therefore has the challenging task of establishing working relationships with them all, and increasing their respective capacities to help manage the lake environment. All must be involved in a concerted effort to ensure that the hydrological, soil and biotic regimes of the lake basin can be sustained and deleterious activities controlled.

## B. PROJECT JUSTIFICATION -

### B.1 Present Situation, and Problems to be Addressed

#### a. Present Situation

Burundi: The entire coastline of Burundi is inhabited, most of it densely. Nearly complete deforestation has occurred in the Burundi watershed, with protected areas restricted to three

places (Rusizi Delta, Rumong Forest and Kibwesa Forest) none of which is large enough to avoid significant impacts from the outside. Soil erosion consequent on deforestation and intensive agriculture is considered by most authorities to be a critical environmental problem facing Burundi. The effect on the lake is excess sediment pollution and severe siltation. Recently it has been observed (1992) that great quantities of anoxic muds are accumulating in places as shallow as 70 metres depth (above the usual maximum depth of oxygenation there), apparently as a result of rapid accumulation of organic matter. Although it is known that this problem is potentially occurring elsewhere in the lake as a result of deforestation, it is undoubtedly most acute here.

Rock and sand coastlines are the richest aquatic habitats in L. Tanganyika in terms of species diversity. In northern Burundi such habitats are already severely degraded resulting in reduced biodiversity. The very steep slopes of the lake bottom imply that siltation affects the entire nearshore biota of the lake in Burundi. Another aspect of sediment pollution is its potential but as yet unknown impact on the traditional and commercial fisheries as all the important fishery species have a juvenile phase of life inshore.

The offshore and inshore fisheries in Burundi are, or were, the most intensive in the lake. A former, prosperous commercial fishery, supported by a large local market and good road communications, is now in severe decline. This has serious economic and nutritional implications. The causes of the evident depletion of fish stocks are not well understood.

Industrialisation and population numbers in Bujumbura are believed likely to expand rapidly, possibly doubling in the next decade or so. At present, numerous industries discharge their wastes with little or no treatment into canals which enter the lake. Currently there is no sewage treatment in Bujumbura. The water supply for the city comes from the lake, and it is quite possible that intake water quality will be threatened if the pollution discharge continues to increase. Chemical pollution, if uncontrolled, is likely to become a serious problem in the northern bay of the lake.

Zambia: Environmental conditions in the Zambia sector are mostly very good. About one third of the coastline receives considerable protection within the Nsumbu National Park boundaries which extend a mile offshore. Another third of the coast is very lightly inhabited. These areas support extremely rich species diversities, especially nearshore (0 - 40m depth), but there is also a remarkable deep water fauna offshore down to 200m, which is more abundant in the Zambian part than elsewhere.

The remaining third of the coast, around the south-east arm, contains areas heavily influenced by human settlements, such as the environs of Mpulungu where there is a harbour, several industrial fisheries installations and a large population in satellite villages. Mpulungu is growing very quickly. Beach seining is commonly practised around most of this area, and this fishing method is known to be destructive to nearshore biota, especially those with low reproductive rates and limited distribution, as is the case in many of the cichlid fish species. Also, large changes in the pelagic and bottom fish stocks have occurred following sustained purse seining and gill-netting. While these trends have been documented, the magnitude of the total impact of human activities in the area, including chemical enrichment around the harbour, has not been estimated.

Tourism facilities are more developed in Zambia than elsewhere, and there is considerable potential for the establishment of underwater parks. These would help preserve biodiversity and augment tourism, and would also assist the commercial fishery outside the park by protecting inshore nursery grounds of fish. Other commercial enterprises present are ornamental fish exportation and crocodile farming.

Tanzania: The Tanzanian sector includes most of the eastern coast, and is one of the remotest and least developed parts of that country. Few roads reach the lake, and none run parallel to the lakeshore (see map in Annex). However, there is a considerable population of fishermen-farmers in villages along the coast, and there are fairly large population centres around the port and railhead of Kigoma, and at Kipili. Increasing deforestation and erosion are occurring, in particular along the northern Tanzanian coast seine nets are wider, used but their effects are not quantified. Industrial vessels fish sporadically from Kigoma, with apparent impacts on local fish stocks. Some chemical pollution has been noted at Kigoma, and as the port and shore installations grow, precautions against pollution in the area are required.

There are two land parks adjoining the lake, the small Gombe Reserve known internationally for its chimpanzees, and the mountainous Mahali Reserve. The former is under considerable pressure from adjacent highly populated areas. Extension of these parks to include sectors of the lake, as envisaged in the project, should considerably enhance the value of these parks, from both ecological and tour) m viewpoints. The Tanzanian coast in general is highly variable in habitat types and appears to contain a very rich aquatic fauna.

Zaire: A similar description applies to the Zairian part of the lake, which comprises virtually all the west coast. There is one main railhead port, Kalemie, from which lake transport ships and industrial fishing boats operate. Villages are scattered along the lakeshore with poor communications to the interior. There is evidence from satellite photographs that significant deforestation is occurring along certain steep escarpments near the lake. The northern 75 km of the coast is densely populated with a large local fishery. Catches there have diminished drastically in the past decade, apparently due to intense fishing. Considerable aquatic biodiversity exists, as indicated by a long series of underwater studies based at Uvira. The need is great to establish reserves in parts of the Zairian coast to help in the conservation of the watershed and lake. None have yet been proposed.

In short, there are clearly considerable disparities between the four countries in resource exploitation and environmental problems, actual and potential. Corresponding differences exist in the ways that special problems and their priorities of importance are perceived. The project must reflect these differences, and will do so through locating and emphasising particular project activities in the different countries. Despite the different situations, however, the control of pollution and protection of biodiversity are closely related to environmental issues that are common throughout the basin. Certain problems of common interest stand out clearly. They are as follows:

#### b. Problems to be Addressed

In general, poor management of resources at a time of rapid demographic expansion has characterised activities in the region. Inappropriate land use and deforestation are increasing the load of sediments and nutrients flowing into the lake, and threats of industrial pollution are increasing. There is inadequate capacity within the countries to stem these processes and to integrate conservation measures with development efforts. Moreover, there is a need for a concerted regional approach to manage the ecosystem<sup>1</sup>. Specifically, the project will assist the four countries to address these problems in the following ways:

##### (i) Ensuring a regional focus within the basin

The project will help develop a co-ordinated administrative mechanism for the environmental management of the lake and its basin. It will co-operate with national sectoral departments and institutes and with other international and bilateral projects operating in the region in related fields. It will foster public awareness, education and community involvement on lake environment matters, and support for environmental policy.

##### (ii) Obtaining vital data on the lake and watershed

A major strategy of the project is to obtain better understanding of particular aspects of the lake system, and of changes which are occurring that threaten it. To do this an intensive programme will be implemented to collect essential data and assess them. For example, it will investigate biodiversity in the lake and measures to conserve it, and also identify and try to quantify pollution and recommend measures to control it.

##### (iii) Formulating a co-operative mechanism for environmental management

A co-operative permanent mechanism is needed to adequately control pollution and conserve biodiversity, and the project aims to establish a system for co-ordinated management of the lake environment. This approach must include provision for well-articulated, basin-wide monitoring and follow-up action based on the project findings. It



must also take account of the Desire for sustainable rational development of lake resources, and of the different national priorities of the lakeshore countries.

#### (iv) Strengthening national capabilities

Since trained personnel in the various fields of expertise involved in the project is largely inadequate in all four countries, the project will develop and strengthen national capability in research, monitoring and management of biodiversity and pollution control.

### B 2. Situation Expected at End of Project

A regional framework for the co-ordination of activities for the management of biodiversity and pollution problems in the lake watershed will have been well established. Communication and co-operation would be much improved between the lake countries in environmental matters of common concern. Numbers of skilled and experienced scientific, management and technical staff will be increased, and government agencies would have stronger capability to deal with biodiversity and conservation issues.

The scale of the negative impacts from sediment loads and urban or agricultural pollution at present and in future will have been limited, and a harmonised system of pollution control regulations will have been adapted by the four partner countries. The actual damage caused by fishing upon the natural communities will have been documented and improved fishing practices encouraged by government department, and NGOs. Existing environmental laws will have been reviewed, with recommendations for co-ordination of laws and standards of allowable limits for pollutants. A pollution monitoring programme by the partner state will be in operation. The lake will have been zoned for conservation and utilisation with appropriate management regimes outlined. Specific reserves or national parks will have been designated.

A regional environmental management plan, the Lake Tanganyika Strategic Plan with a time horizon of at least 10 years will have been adapted and be in operation. This will have integrated a consideration of all positive and negative impacts within the catchment area into a management framework for the lake basin. It will represent the objectives of the four partner countries. The economic benefits at national and local level will have been assessed along with the most probable distribution of those benefits.

Awareness of lake/catchment area environmental problems will be increased at local community level, whilst their perceptions and expectations will have been addressed in the plan. Participation in the Planning and Conservation procedures will have taken place. Measures will have been taken to create local income generation in lake shore communities with activities which promote rather than inhibit environmental protection.

The most suitable form of permanent organisation for lakewide co-operation in pollution control, conservation and lake bank management (e.g. a lake basin commission) will be agreed upon and the appropriate preparations made. This organisation should be ready to take over and be operational by the end of the present project. A mechanism for the sustainability of the structure will be established.

Much more essential knowledge about lake biodiversity and pollution will be available. Existing practices causing deterioration in the lake environment will be identified, their effects demonstrated, and recommendations and plans for remedial follow-up action made. Existing environmental laws will have been reviewed, with recommendations for harmonisation of laws, and standards for mitigation of international pollution problems in the lake agreed upon, including pollution monitoring and plans for emergency situations (e.g. oil spills). The impacts of certain fishing methods will be ascertained. Four under water reserves with trained management will be established, and other potential reserve areas located.

### B.3 Target Beneficiaries

The direct beneficiaries will be:

(i) The lakeshore communities, especially those in the larger population centres, which will benefit by the steps taken to avoid pollution of the lake on which all depend (drinking water and domestic purposes. Development of new sustainable methods of income generation and local resource management should replace environmentally destructive ones currently in use and will benefit many rural communities.

(ii) People depending on fisheries, agriculture, forestry and other natural resource uses, will benefit from

better resource management and also from increases in local income generation from tourism.

(iii) Government agencies responsible for national development at planning and implementation levels will benefit by increased capability to develop, monitor and manage the lake and catchment resource towards sustainable goals. More indirectly, the world-wide community will benefit by the conservation of one of the most valuable lake faunas on earth, comparable to others which have been internationally recognised as heritages of mankind

#### B.4 Project Strategy and Implementation Arrangements

The general strategy is to move towards broader understanding of the lake and its net rural resources whilst putting their use and protection into a firm long-term planning framework. The strategy addresses all aspect of biodiversity and its protection from the increasing effects of waste disposal and agricultural management practices within the basin as a whole. It is particularly important that a broadly-based and co-operative lake management mechanism be put into place which can continue to influence and extend the Strategic Plan beyond the life-time of the present project. A phased sequence of activities required to pursue this strategy is shown in the accompanying bar chart.

At present there are broad perceptions as to the types of processes which might threaten the existence and biodiversity of natural communities in the lake. These include increased domestic and industrial waste discharge, increased fishing pressure and greater sediment inflows resulting from deteriorating agricultural and forestry management within the basin. Each of these, however, is symptomatic of the general increase in pressure on resources caused by increasing population pressure around the lake. However, having identified some of the qualitative threats to biodiversity in the lake, the first points to be addressed must be:

- the relative scale of these processes;
- where might they be having their effects; and
- how much worse they might become over a specified time.

There is, therefore, an initial need for quantification of the processes involved, combined with a comparison with plans in other sectors such as industry, agriculture, fisheries and forestry to gain an indication of both the magnitude and time scale of any deleterious effects in the Lake. Only at this point can specific points of intervention be identified to augment the broad management measures, such as, for example sewage treatment, which might be sought right from the start.

The first step, therefore, is to assemble all existing quantitative data on pollution and other processes through a series of cross sectoral reviews. Any projections of future developments from plans in other sectors will need to be taken into account. These reviews can provide the first tier of information in a lake-wide database compilation. Gaps in information can provide guidance for specific studies related to the direction and magnitude of potentially deleterious processes. In addition, since international collaboration is a crucial element in the strategy, the review should also include the relevant legislation and regulations of all four counties with a view to eventually developing a coherent legal framework for the integrated management of the Lake.

There is no doubt, from the information collected already on the number and nature of the species existing in Lake Tanganyika, that it is a site of primary international significance and a spectacular evolutionary laboratory. However, while the conservation of biodiversity is a pre-eminent objective of the present project, it cannot be seen in isolation. National interests and economies will expect to gain from the natural resources just as local communities will not readily forgo their traditional activities and sources of income. As pressure on resources increases, sustainable conservation can only operate through consensus which can usually only be achieved where there is no conflict of interest or where there are incentives for people to restrict their activities in some way. Around Lake Tanganyika communications are poor, and so central influence and control of lakeside communities is difficult. It is all the more important, therefore, that these lakeside communities are included in the consensus since their attitudes may play a major part in the success or failure of the project.

It is likely, therefore, that Lake Tanganyika will be used to an increasing degree for a number of different purposes in the foreseeable future. However, just as the number of uses are varied so the conservation requirements within the Lake may not be uniform. In terms of habitat, the Lake is rather heterogeneous. A review of the biological information available will be used to identify centres of biodiversity and to identify zones which should be kept pristine, those of national or local significance, areas of potential for tourism and education through their accessibility, those in need of rehabilitation, or those where exploitation can be carried out with perhaps intermediate buffer zones in sensitive cases.

The preliminary zoning, or classification of the Lake from the physical and biological reviews, which can be combined with management outlines for each category, will lead into the drafting of a preliminary Strategic Plan. This should also take into account what has been deduced about the severity of the trends with time, and contain some initial impression of the opinion of local communities of the Lake and its problems. In effect the first six months will be a major planning exercise where all existing data is brought together and the major strands of project driven research, institutional development and education are finalised. This data will be organised into a database which will be copied to all national centres. The major information -taps in the quantification of potential negative trends, such as sediment transport and water quality will require specific surveys and research. Ultimately, if properly designed, such surveys could provide the basis of a long-term monitoring of the Lake.

The primary objective of the project research, however, is to determine exactly what is going into the Lake, what and how much is coming out of the Lake, and the extent to which these inputs and outputs are likely to change with time.

With regard to fisheries, fish catches over time are known to some degree. Nominally on y six out of 300 + fish species are involved, but the extent to which some techniques, such as beach seines, and gill nets, damage wider sections of the fish community is unknown. In addition, there is no indication of the potential knock-on effect through the food chain of destabilising influences brought about by over exploitation of the six species principally involved. The position of the ornamental fish trade is also unclear. Although the numbers involved are relatively low and while it may also be a potential income generator for national interests and lakeside communities, the nature of the trade often puts a premium on rarity. Rarer species may, therefore require specific protection and the trade may require some regulation. An understanding of its present operation, scale and outlets, as well as potential, will therefore be needed.

The Strategic Plan should also include surveys which will establish the baseline condition of the Lake and its normal processes. Target areas for more complete biological inventories will be identified from the gaps evident in the reviews and the assessment of need for conservation areas. Relatively little is currently known about the hydrology of the Lake and it is important to know where sediment inflows and chemical inputs are likely to end up. Studies required to complete a basic understanding of the hydrodynamics and mixing processes in the Lake will lead to the formation of a simple model which would indicate the most likely fate for increased inputs. In a similar way there are simple community models (e.g. ECOPATH) which take fisheries and fish community data and can predict the knock-on effects of changing exploitation through the fish community as a whole. This has in fact, already been applied in a some portion of Lake Tanganyika and Lake Victoria.

For a wider view of the baseline conditions over the basin as a whole, GIS surveys will be employed. This will enable the tracking of progress on such features as erosion and deforestation to be followed on land as well as the extent of sediment plumes and phytoplankton productivity in the water.

Ultimately no conservation plan will succeed without the co-operation of the people. The Strategic Plan will therefore develop studies to ascertain the expectations of local people from the development of the Lake identifying areas of conflict between these expectations and needs for conservation will entail small representative socio-economic studies around the Lake, looking at the significance of watershed use, fish patterns of fishing and fishing activity in those communities, with a view to seeing if any changes in activities are necessary and, if so, that they are acceptable to the people. In tandem with this, additional ways of generating income should be explored. For example tourism is a potential means of income generation, and a survey of existing and future needs for organisation and infrastructure in each of the four countries is required. However, it must be clear that the local people should share in the benefits of tourism and not just bear its impact and the assessment of tourism potential will consider the distribution of existing benefits. Other alternative sources of income or revenue, which essentially may be needed to sustain conservation planning in the future, would also need to be investigated, such as differential licence fees for commercial fisheries, or tourism transport taxation.

To liaise with local communities it will be essential to work through the local power groups and councils. Further study within the Strategic Plan will be to ascertain the most appropriate channels of information through local government and community organisation. Both for enquiries into conditions and attitudes and for dissemination of information the use of local forums will be of paramount importance.

For the future the most influential target group will be the teachers and their schools. For this reason the rapid production of information materials on the Lake and the project within the four countries will be essential. Just as appropriate NGOs may act for liaison with local communities, they may also help in organising teacher groups during the early phase of the action plan. In addition, when Protected Areas or reserves become designated, classrooms and dormitory blocks for the use of schools should be included in any infrastructure.

These special studies, identified within the Lake Tanganyika Strategic Plan, following the initial Reviews and Inception Report, will proceed over a 2 year period. They will operate from four national centres, Uvira (Zaire), Bujumbura (Burundi), Kigoma (Tanzania) and Nsumbu (Zambia). To carry out the studies and subsequent implementation and management of the Strategic Plan will make demands upon the personnel and institutional resources of all four countries. Therefore the review phase will include a review of national staffing levels and institutional facilities. From this the immediate ability to contribute to the project will be factored into the plan while future training needs and training programmes will be characterised.

As the project studies near completion a second planning phase will begin. At this point the magnitude and direction of the major threats will be known. Based upon the knowledge gained from research, measures of intervention or mitigation will be recommended for incorporation into the final version of the Strategic Management Plan, whilst taking into account the most likely prognoses from other sectoral management plans. The various categories of conservation zones will be drawn up and their selection finalised. For each of the identified zones a management option will be determined and specific long-term objectives will be defined. The formulation of such a well-documented plan for ministerial approval, will not only provide a unifying influence for multilateral co-operation over lake management, but will provide a clear pattern of objectives, and ways and means thereby giving the Environmental Sector a voice in discussions with other sectors principally industry, agriculture, fisheries and forestry in the integrated management of the whole lake basin. It will be a recognisable planning element at Ministry level.

Once the Strategic Plan is finalised, the legal framework within each country will need to be scrutinised and changes suggested if necessary. Information on allowable limits for pollutants will also be available to assist in refining the newly framed pollution regulations in each country. Management regulations governing conservation zones and other areas of the Lake can also be formulated at this point.

Consultation at community level is an integral part of the project process. Therefore at the finalisation of the planning stage all elements of the plan and its management components will have been discussed with local groups so that the workable options can be identified.

Further studies will have been identified as part of the final plan but some of the earlier studies will be used as the basis of an on-going monitoring programme incorporating physical, chemical and biological features which can be added to the project database and GIS system. An international manual for the monitoring programme could be produced.

One further element in the final Strategic Plan will be an economic appraisal at both macro and micro level. The overall conservation and management needs to be costed and the financial constraints on management options will be assessed. The amount of income which could potentially be generated by such activities as tourism, ornamental fish, licences and taxes, etc. should be set against the amount required to come from each of the national budgets on an annual basis over 10 years, or from outside sources. Any potential changes in local economies could also be investigated, and particularly the potential distribution of any benefits at community level, since these may be of the greatest incentive in obtaining the co-operation and participation of the people in management and conservation.

It is anticipated that organisational structure of the project outlined in Section B7 will foster multilateral co-operation in lake management, as well as a flow of information at all levels, and that this would provide the basis for future management of the programme.

An important aspect of implementing the technical and research programme is the use of a contractual approach. Specific tasks in different fields will be accomplished by sub-contractors rather than by engaging a number of resident, less specialist project staff. The experience of previous projects on the lake indicates that the contractual approach has produced better results and greater local benefits where it has been tried than the more traditional arrangement involving a group of resident experts. In any case, it would not be possible to assemble in a permanent staff the range of expertise and background required. Nor are the skills and experience needed likely to be found in any one body or institute elsewhere. Thus the project will proceed by engaging an implementing agency with the necessary world-wide contacts and professional organisation to employ suitable sub-contractors. Project staff will administer, work with, and provide necessary services and basic facilities needed by the sub-contractors, who will in fact be the principal technical implementing agents. Project staff will also be responsible for collating results of the research undertaken by the sub-contractors and providing a preliminary compilation of policy options emerging from this research. General direction and support of contractors will be maintained by project staff under the Project Co-ordinator, advised and monitored by a Technical Committee. Overall strategy will be directed by a project Steering Committee. (See section B.7 and Annex VII concerning these committees.)

It is expected that the efficiency of contractors directly responsible for the supply and execution of their own contracts will result in lower real costs for what they do and also in a reduction of the otherwise invisible costs that might be incurred through delays and other common administrative difficulties. A particular benefit of this approach is the educational and training advantage that should come from the involvement of a number of outside institutes and training centres. A significant criterion to be used in the selection of contractors will be the extent to which they will make use of local expertise and supplies, the amount of training they will offer in-country and abroad, and the improvements they will leave behind. Potential subcontractors will be evaluated in part on the basis of their proposals for training counterparts, and further use of those subcontractors will be decided on their performance in doing so.

The institutional framework for this international project is complex (see Annex VII) and the project management and implementation strategy must fit this setting. Within the context of building a partnership among the countries, the project proposes to operate from four national centres, one in each country, whose activities will of course extend to the other countries as well. These centres are proposed as follows:

Pollution Studies Centre, Bujumbura, Burundi

Efforts will concentrate on excess sediment pollution and chemical pollution. The most serious of these problems around the lake probably occur in Burundi. Land erosion projects are being mounted by other agencies in the same general area and should be complementary. As part of the same studies, observation will be made in nearby Zaire and Tanzania. Industrial and urban sources of pollution would be studied mainly near Bujumbura as well as at other ports and population centres. Project administration will also be located in Bujumbura for reasons of logistic advantages.

#### Limnological Centre, Kigoma, Tanzania

Tanzania has a cony coastline and, from consideration of probable circulation patterns, it is proposed to place two of the four lake stations for limnology in the Tanzanian sector. In addition to focusing the limnological investigations here, the study of the impacts of fishing methods on biodiversity would also be based in the centre. The project would co-ordinate its activities with the recently renovated laboratory in Kigoma.

#### Education and Training Centre, Uvira, Zaire

As one of the most densely populated parts of the lakeshore, it is proposed to make Uvira the centre for environmental education. Moreover, acute environmental problems related to population pressure (e.g. decline in fish catches, erosion) are occurring in this general northern area of the lake, and NGOs concerned with environmental education and extension are already in place in Uvira.

#### Biodiversity Studies Centre, Nsumbu, Zambia

The very rich variety of aquatic habitats in this part of the lake, including extensive deep areas of oxygenated bottom, make it a most suitable place to initiate the studies on biodiversity. The initial work to establish an underwater reserve will be carried out at Nsumbu, later extending to locations in the other countries.

Lastly, a major element of project strategy will concern co-operation with other projects hat are carrying out activities related to the lake environment, conservation or environmental education (see list in section A.3). Decisions as to the means and extent of co-operation with current projects will be made a t an early stage and periodically reviewed by the Steering and Technical Committees.

#### B.5 Reasons for Assistance from GEF

The terms of reference of the UNDP Global Environmental Facility stress the importance of biodiversity, which is often not of immediate economic consequence and which has not normally attracted significant international funds. Government resources are generally channelled towards development, improvement and alleviation goals which have precluded much investment in the environment. Many of the activities proposed for this project, while having great long-term environmental and resource significance, would nevertheless be difficult for individual governments to undertake on the basis of short-term economics. Therefore stimulating regional co-operation in solving common water resource management problems, and-protection of biodiversity on lakewide basis, are only likely to be achieved at the present time by the provision of significant technical and financial support.

Experience in large lakes elsewhere has shown that they are vulnerable to uncontrolled exploitation and pollution, particularly where they are shared by more than one country. Lake Tanganyika is especially vulnerable because of its slow renewal or flushing rate and its large proportion of already deoxygenated deep water. However, the pollution problems in Tanganyika have not yet reached the point where they would draw sustained government attention, particularly not on a regionally co-operative basis. GEF can help to prevent a critical and perhaps irreversible situation from arising, by addressing the lakes environmental problems before more costly intervention is necessary; and by promoting

regional co-operation to ensure the long-term viability of the lake as a biotic and economic resource.

## B.6 Special Considerations

Two outstanding special considerations are the related problems of communication within the lake basin and co-ordination of lake management. Travel between localities around the lake is difficult and slow. This is largely due to the fact that the sides of the basin are steep with rugged shorelines, and most roads and the two rail links lead directly to or from it. There are few places where land transport along the lakeshore is possible. The capital cities of the four countries are, with the exception of Bujumbura, remote from the lake. There are numerous linguistic barriers. There are no long standing traditions of co-operation or mobility around the lake, and in fact the lake has served more as a barrier in the past than a means of communication. Physical scale must also be borne in mind: not only is the lake 650 km long, but its shore-line is over 1500 km.

Passenger and freight transportation services are provided by several ships, which ply regularly between the major lake communities. Local transportation is by various kinds of small wooden boats. These services, however, are of a limited and basic nature in relation to the size of the basin populations and their dependence in some way or other on lake resources, and transported materials.

Against this background, an absolutely essential element for the implementation of the project will be an efficient communications system. For project operations, good radio links between the project centres and with project vessels will be a minimal requirement, with possibly telephone-satellite link for voice and data transmission to be established wherever feasible. However, satellite link systems are expensive to use and, therefore will be impossible to sustain after the project. Good, high frequency (HF) radio equipment which can operate between land stations on ship-to-shore, may be preferable. In addition, project vessels (main vessel, four utility boats, and minor craft) will be in constant use in the work programme and will ensure the mobility of staff. Committee meetings, workshops, training activities and newsletter, will all serve and be used deliberately to increase communication.

As regards co-ordination of project activities, which are intended to lead to a regionally organised structure for the environmental management of the lake, the following arrangements will be put in place.

## B.7 Co-ordination Arrangements

At regional level:

A Lake Tanganyika Conservation Steering Committee will be set up, consisting of senior civil servants representing the four governments. Membership will also include project National Co-ordinators, and representatives of the GEF, the UNDP and the Executing Agency. (See Annex VII for terms of reference of the Committee.) The overall management and organisation structure and lines of communication are shown in the accompanying organogram.

A project Co-ordination Unit will be set up consisting of a contracted Project Co-ordinator a Scientific Liaison Officer and a Training Officer, together with their Administrative support personnel. Their responsibility will be for the overall management and implementation of the project. Since training and education will play a major role in the institutional development within the project, the Training Officer should lead a Training and Education Committee to decide upon education and training needs following the review phase and to be responsible for arranging and implementing the program. One further important aspect is procurement of equipment and materials, which is also a specialised task for new institutions. A procurement cell, headed by the Project Co-ordinator with representatives of some or all of the participating institutions and including a Technical Officer experienced in procurement, should be instigated during the first eighteen months of the program when procurement will be a major activity. This may need to be reconvened when new infrastructure is proposed later in the project.

At national level:

Each participating country will designate a National Co-ordinator, who will facilitate effective co-ordination of project activities with that country. The National Co-ordinator will effectively make available the information and experience gained by the project to relevant national institutions and departments through National Working Groups. These will be formed early in the project. They will contain representatives of participating institutions and NGOs. They will be led by the National Co-ordinators.

Regular contact needs to be made with local communities. This could be the responsibility of some of the government officers who are part of the National Working Group. It might, however, be more appropriate for this liaison to be through NGOs. They could assist in forming consultative groups at District or Village level, through existing community structures. Ultimately these consultative groups could form the nuclei of local management groups.

Overall Co-ordination:

The Project Co-ordinator will be the executive secretary for the Steering Committee and will report annually to the Committee. He will chair the Technical Committee, and will maintain co-ordination between the various project activities in each country, regularly visiting each project centre. He will also keep in close touch with other projects working on the lake, sharing progress reports and arranging for them to contribute to project conferences and committees as appropriate. Other international project staff will each have a co-ordinating role for their respective activities; for example, the scientific liaison officer will monitor and facilitate the work of the technical sub-contractors, providing basic logistic support and ensuring that in the field their work not only conforms to technical requirements but is integrated with the national centres.

A Conservation Technical Committee will have oversight of the Project Technical Program, monitoring and reviewing the progress of its activities. Membership will include national and international technical experts involved with or experienced in Lake Tanganyika. (See Annex for Terms of Reference.)

To co-ordinate and monitor the overall management and progress of the project a six-monthly supervision mission should be convened by the GEF. This can run in tandem with the Conservation Technical Committee but should be equally concerned with management as well as technical issues. It should consist of the Task Manager of the GEF or its executing agency, plus the team leader of the Technical Committee and one other co-opted member who should have considerable project management as well as technical experience. It should not, however, include the Project Co-ordinator. The Technical Committee will operate concurrently with the supervision mission on a 6 monthly basis. It will interpret technical progress for the supervision mission but the supervision mission will prepare the final Aide Memoir on overall management and technical progress for the donor agencies and the Steering Committee. During their 6 monthly meetings the GEF Supervision Mission and the Technical Committee should have contact with each level of project organisation as indicated in the accompanying organogram. These contacts should be made on a regular basis by the Project Co-ordination Unit and be the subject of a report to the two reviewing bodies.

Operation and Management:

The activities required to manage and co-ordinate the project are summarised in the accompanying bar chart. The staff for this Project Co-ordination Unit should be recruited for the start of the project and the National Co-ordinators should be appointed immediately afterwards. There may be a start of project meeting between a GEF Supervision Mission, the Project Co-ordination Unit and the National Co-ordinators to plan the initial program and the review phase. The review phase can be conducted by contractors who will go in to conduct the special studies required by the Strategic Plan. The Technical Committee should be recruited as soon as possible. The Technical Committee and the GEF supervision mission will convene in month 4 after the review are complete. In addition to contributing to the formulation of the initial Strategic Plan, they will agree upon criteria to incorporate into a logical framework or sequence of milestones against which future missions will assess progress. The GEF Supervision Mission and the Technical Committee will meet with the



Steering Committee at the end of year one after having reviewed and evaluated the first years progress. Further detail on monitoring and evaluation procedures are given in Section H. These tripartite meetings should continue on an annual basis.

The first meeting at the end of the review phase should also provide manpower and training requirements as well as the objectives for community information and education. The Training and Education Committee can also, therefore, establish their program at this point.

At some point in the first year, preferably shortly after the Lake Tanganyika Strategic Plan has been put together, a ministerial meeting of all four countries should be convened to establish a collective political commitment to the project and to generally facilitate international co-operation.

A major meeting of the GEF Supervision Mission, the Technical Committee and the Steering Committee should take place at the finalisation of the Strategic Plan, following the results of the special studies.

## B.8 Counterpart Support

The availability of adequate numbers of counterpart staff and certain contributions in kind are essential both to initiate the project and continue its work. Training and education are large components of this project in order to strengthen national capacities. Sites for the project centres and various facilities there (which will be improved to the extent necessary for operations), are also basic requirements. National inputs are described in Section E.

## C. DEVELOPMENT OBJECTIVE

The ultimate objective of the project 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. The means by which the project proposes to achieve this development objective are set out in this document.

## D. IMMEDIATE OBJECTIVES, OUTPUTS AND ACTIVITIES

### IMMEDIATE OBJECTIVE 1

Establish a regional long-term management program for pollution control, conservation and maintenance of biodiversity in Lake Tanganyika.

#### OUTPUT 1.1

Review all existing relevant data on Lake Tanganyika and its basin to provide platform for initial formulation of the Strategic Plan for the management of Lake Tanganyika.

Activity 1.1.1 Review biological, hydrological and water quality information to establish known patterns of biodiversity in the lake and to determine the extent of degradation in the lake at present.

Activity 1.1.2 Review demographic trends from census data and examine all sectoral plans in agriculture, forestry, industry, urbanisation and fisheries, past and present. Ascertain the current status of each sector, in as much as they impinge on the lake, and the likely extent and timing of future developments;

Activity 1.1.3 Review present capability of host country institutions to identify gaps in equipment and facilities which need to be filled during the project. Similarly assess present staffing strengths of these institutions, as well as non-government institutions, in order to compare with probable staffing requirements. This will lay the basis of the training program. The plans of

other related development projects will also be scrutinised so that the prospects for shared facilities can be taken into account.

Activity 1.1.4 Review all legislative aspects including present environmental policies in the four host countries, and any existing or prospective regulations on pollution control and allowable limits. This review will contribute to the eventual drawing up of the legislative framework needed in all four countries to underpin the proper implementation of the program and its conservation areas, as outlined in Objective 2 below.

Activity 1.5 Establish early contact with representative lakeside communities as part of a continuing process of dialogue and consultation. This could mean early involvement of NGOs, as initial attitudes of the communities to the present state of activities on the lake and their perceptions of the future must be solicited by interview.

## OUTPUT 1.2

Inception Report based on all review data will provide bench-line data for the planning of the management program.

Activity 1.2.1 From all the data assembled all the negative trends amongst processes influencing the lake will be characterised and identified.

Activity 1.2.2 From all the data assembled all the major gaps in information will be identified. This will see the formulation of special studies which can be directed to filling these gaps (see Immediate Objective 5). Once these studies have been carried out for a sufficient time, the Lake Tanganyika strategic Plan can be finalised on a firmer planning basis (see Output 1.1).

Activity 1.2.3 Compile review data in Inception Report into a computerised database which can be shared between project centres and updated as new information becomes available. The Inception report should be available 3 to 5 months after the start of the project.

Activity 1.2.4 The database will be continually updated by results from the special studies and will be made the basis of a GIS system for Lake Tanganyika.

## OUTPUT 1.3

A preliminary Lake Basin Strategic Plan will be drawn up from information compiled in reviews and combined into the Inception Report. This plan will be used to lay down the basic elements of the management program and the activities needed to finalise and implement it. This preliminary plan should be complete within 5 months of the start of the project.

Activity 1.3.1 The lake will be divided into zones based on use or known conservation value, taking into account the multiple uses of the lake and its pattern of biodiversity. Some initial prioritisation of conservation areas will be attempted, based on known biodiversity, habitat distinctiveness and accessibility.

Activity 1.3.2 Finalise work programs for special studies which will contribute to a long-term understanding of the functioning of the lake (see Immediate Objective 5) and help fill n gaps identified in reviews.

Activity 1.3.3 Prepare and initiate four project centres, one each from the host countries around the lake, where various elements of the program will be carried out. Once the direct study requirements have been identified" these can be shared amongst the centres and a work program for each drawn up.

Activity 1.3.4 Finalise a list of equipment and services for procurement. This will be acted on over the next eighteen months by the procurement cell (see Section B7).

Activity 1.3.5 The future staff needs, in terms of number, discipline and level for trained personnel will be itemised from the institutional and manpower review. A training programme to address these needs will be drawn up by the training officer and the necessary arrangements and progress review will be carried out by the training committee (see Section B7).

Activity 1.3.6 Community consultations to determine their reactions and suggestions to the proposed plan will be carried out by NGOs.

#### OUTPUT 1.4

Finalisation of the long-term Lake Tanganyika Strategic Plan will take place when all the requisite information has been collected. Finalisation will therefore take place after Year 2 when sufficient data should have become available from the special studies (see Output 5).

Activity 1.4.1 From the biological, tourism and education data, conservation areas will be selected to be given National Park or other status as conservation areas, to add to the previously identified areas at Nsumbu and Mahali. The criteria for determining such areas and their potential status will be established, e.g. degree of biodiversity, accessibility, educational value.

Activity 1.4.2 Instigate specific remedial actions to combat pollution problems and identify those particularly requiring international co-operation.

Activity 1.4.3 Harmonisation of measures to mitigate pollution and of pollution regulation including the convening of a workshop to recommend environmental standards for the lake.

Activity 1.4.4 Draw up management measures for zones identified on lake.

Activity 1.4.5 A legislative framework enabling these to be implemented in the four countries will be drawn up (see Objective 2), once regulations and the various zones, including national parks, within the lake have been finalised.

Activity 1.4.6 The tourism and pollution control considerations may propose new infrastructure requirements. These will be itemised and costed.

Activity 1.4.7 The major long-term impacts on the lake and the most likely points at which those impacts will have their effects, will be identified and quantified from the reviews and special studies

Activity 1.4.8 As proposals for final elements in the plan become available these will be discussed with local communities to assess which are acceptable, meaningful and practical in the local context.

Activity 1.4.9 Economic evaluation of costs and benefits of all potential elements of the plan with indications of annual budgetary requirements from government and non-government sources will be conducted, and plans refined accordingly.

Activity 1.4.10 Produce the final document of the Lake Tanganyika Strategic Plan for environmental management, following approval by the Steering Committee and appropriate ministries.

#### IMMEDIATE OBJECTIVE 2

Formulation of a regional legal framework for co-operative management of the lake environment.

#### I OUTPUT 2.1

Analysis of existing laws and recommendations for new legislation placed in an international legislative framework.

Activity 2.1.1. Existing laws for the protection of the lake environment in the four countries will be reviewed .

Activity 2.1.2 Shortcomings in the implementation and enforcement of existing legislation will be identified .

Activity 2.1.3 A comparative analysis for discussion between the four countries with the view of defining compatible legislation will be prepared.

Activity 2.1.4. A basic framework of lake environment legislation for consideration by the four countries will be recommended.

#### IMMEDIATE OBJECTIVE 3

Establish a programme of environmental education and training for Lake Tanganyika and its basin.

#### OUTPUT 3.1

Increased environmental awareness and sensitivity among lakeside communities concerning the fragility of Lake Tanganyika, the international nature of its problems and the interdependence of people with the lake.

Activity 3.1.1 The regular contacts between the National Working Groups, intermediary NGOs and lakeside communities (see Section B7) will provide regular channels for two-way dissemination of information. In addition to explanatory meetings, these regular contacts can be augmented with extension-style techniques, e.g. simple posters, radio broadcasts and possibly mobile videos.

Activity 3.1.2 The National Working Groups and NGOs will organise teachers groups amongst local schools where appropriate ideas and material can be disseminated.

Activity 3.1.3 Specific printed materials for use in communities and schools will be produced early on in the project and refined as the planning process proceeds.

#### OUTPUT 3.2

A cadre of trained environmental scientists and technicians to provide a core of expert staff for managing the biodiversity of the lake and protecting its watershed in the future will be produced.

Activity 3.2.1 Establish an in-service training programme for technical staff to learn skills relating to lake environmental management .

Activity 3.2.2. Provide library and teaching support to the national universities to help them upgrade their programmes in aquatic conservation biology and limnology.

Activity 3.2.3 Provide fellowship support to post-graduate students working on projects relating to the Lake Tanganyika environment, and train African women scientists in aquatic sciences.

Activity 3.2.4 Provide on-the-job training for new parks managers to take over operation of the parks from project personnel.

#### IMMEDIATE OBJECTIVE 4

Establish tested mechanisms for regional co-ordination in conservation management of the Lake Tanganyika basin.

##### OUTPUT 4.1

Mechanisms for regional co-ordination will be introduced and developed.

Activity 4.1.1 Install an effective communication system, using radio and telephone /fax technology as appropriate, linking the four national project centres, national co-ordinators and project vessels.

Activity 4.1.2 Organise regular meetings of the international steering Committee and the project Technical Committee, and make them an integral part of the planning and management processes (see Section B7).

Activity 4.1.3 Prepare for approval by the steering Committee recommendations on steps to set up a system for co-ordinated management of the lake environment, and arrange that this system continues as an effective organisation after the project.

Activity 4.1.4 Prepare and distribute to all concerned a Newsletter in French, English, Kiswahili and any other appropriate local language.

Activity 4.1.5 Carry out such other tasks within the approved budget, time-frame and capacity of the project as may be authorised from time to time by the steering Committee.

#### IMMEDIATE OBJECTIVE 5

In order to produce a full Strategic Plan for long-term application, some specific studies need to be undertaken. These special studies will also add to the understanding of the lake as a whole and, in some cases, provide the baseline and framework for long-term research and monitoring programmes.

##### OUTPUT 5.1

Determination of the biological consequences of sediment discharge into Lake Tanganyika caused by watershed deforestation and erosion.

Activity 5.1.1 Regular determination of the quantities of sediment brought into the lake by the major rivers.

Activity 5.1.2 Satellite monitoring of lake-wide deforestation to establish the trends of deforestation and sediment discharge with time and the seasonal peaks in discharge into the lake.

Activity 5.1.3 Detailed analysis of the fate of transported sediment particles discharged into the lake.

Activity 5.1.4 Detailed analysis of the impact of suspended and deposited sediment in the lakes ecosystem.

Activity 5.1.5 Output to be added to Lake Tanganyika database/GIS system (see Activity 1.2.4).

## OUTPUT 5.2

Determination and the prediction of consequences of chemical pollution discharged from land or boats.

Activity 5.2.1 Identification and quantification of existing sources of pollutants.

Activity 5.2.2 Detailed analysis and modelling of lake circulation to determine the fate of pollutant and sediment discharges and the identification of high risk portions of the lake.

Activity 5.2.3 Output to be added to Lake Tanganyika database/GIS system (see Activity 1.2.4).

## OUTPUT 5.3

Determination of patterns and structure of biodiversity in Lake Tanganyika with emphasis on proposed national parks and other conservation areas.

Activity 5.3.1 Prepare inventories of species by geographic distribution and habitat and estimate their relative abundances.

Activity 5.3.2 Determine various criteria for assessing diversity in each study area and habitat.

Activity 5.3.3 Study the underlying causes of the extraordinary biodiversity in Lake Tanganyika and their implications for conservation of the fauna.

Activity 5.3.4 Output to be added to Lake Tanganyika database/GIS system where appropriate (see Activity 1.2.4).

## OUTPUT 5.4

The damaging effects of exploitation on the fish of Lake Tanganyika will be investigated and recommendations made for their mitigation.

Activity 5.4.1 Estimate actual and potential impacts of commercial (purse-seining!) and traditional (gill-netting and beach seining) fishing methods on the biodiversity and stability of fish stocks.

Activity 5.4.2 Examine the numbers and species of fish taken by the ornamental fish trade. Estimate the present and potential markets.

Activity 5.4.3 Evaluate the ecological impact on fishing, and other sources of exploitation, throughout the natural community using computer-based models.

Activity 5.4.4 Identify and make recommendations on alternative fishing methods and management strategies which would be less harmful to biodiversity than those presently used, and encourage their trial investigation by international projects, fisheries departments and directly by lakeside communities.

## OUTPUT 5.5

Developments in other sectors within the lake basin intimately affects what happens to the lake itself. A detailed examination of present and future plans in these other sectors needs to be carried out so that they can be taken into account in the Lake Tanganyika Strategic Plan.

Activity 5.5.1 Collect all available sectoral plans and contact all ministries concerned with agriculture, fisheries, forestry, urbanisation, industrialisation and planning in general in each of the four partner countries. Synthesise the present and future potential impacts on the lake from the various sectors.

## OUTPUT 5.6

The prospects for the future the lake management may depend upon additional benefits generated. The nature and direction of those benefits will be investigated and recommendations made for their distribution.

Activity 5.6.1 A study on existing tourism potential around the lake should be carried out looking at infrastructural and organisational requirements for the future in the context of existing tourism networks with in each country.

Activity 5.6.2 The precise economic role of fishing for men and women at village level will be examined along with the traditional patterns of these activities.

Activity 5.6.3 Enquiries should be made as to their awareness and expectations from the lake and from the project itself. The community power structure should also be described since any changes or exchange of in formation should be effected through existing systems.

Activity 5.6.4 The possibility of other income generating activities, whether from tourism, fishing skills, or other sources, should be examined.

## IMMEDIATE OBJECTIVE 6

The implementation and sustainability of the Lake Tanganyika Strategic Plan and incorporated environmental management proposals.

## OUTPUT 6.1

Creation of long-term research and monitoring programmes.

Activity 6.1.1 From the results of the special studies, identify those areas in need of further work to contribute to further understanding of the lake and its processes.

Activity 6.1.2 From the special studies and the final decisions on pollution regulations those elements which will give a continuing picture of the impact of pollution in the lake should be consolidated into an international monitoring program which is able to be operated by the four partner countries themselves.

## OUTPUT 6.2 I

Management plans will be drawn up for the development of four underwater reserves in Lake Tanganyika for the protection of biodiversity, the conservation of commercial fish nursery grounds and the enhancement of tourism.

Activity 6.2.1 Make ecological surveys of the proposed reserve areas.

Activity 6.2.2 Define and reconcile local socio-economic interests relating to the establishment of the reserves.

Activity 6.2.3 Prepare recommendations for specific reserve boundaries, access by user type and natural concessions.

Activity 6.2.4 Produce First Phase management plans for the underwater reserves.

## OUTPUT 6.3

Establish and manage new underwater reserves with trained management.

Activity 6.3.1 Put in an experienced manager to set up and manage new reserve at Nsumbu (Zambia) during project years to 3, together with trainee manager. 1

Activity 6.3.2 Put in experienced manager to set up and manage new reserve at Mail (Tanzania) during project years: to 4, together with trainee manager.

Activity 6.3.3 From the experience of Nsumbu and Mahali and the zoning the zoning arid conservation area recommendations of the Lake Tanganyika Strategic Plan, at least one further reserve will be selected, set up and managed within the project, during years 3 to 5.

Activity 6.3.4 Develop community participation programs to ensure local benefit from and encourage acceptance of reserves

Activity 6.3.5 Develop user facilities, such as underwater trails and interpretative displays.

Activity 6.3.6 Produce under water guidebooks for the reserves.

Activity 6.3.7 Convene a workshop to discuss the potential of Lake Tanganyika underwater reserves for stimulating eco-tourism in the area.

Activity 6.3.8 Prepare detailed recommendations with budgeting for sustainable operation of the underwater reserves.

Activity 6.3.9 Provide specialised advice and support for management of the reserves.

## OUTPUT 6.4

Mechanisms for ensuring the involvement and co-operation of local people.

Activity 6.4.1 Local consultative groups and teachers groups formed during the produce will be incorporate into local or national management groups for parks, conservation areas or other zones.

Activity 6.4.2 All support in terms of material, visits and time should be given to teachers and schools sine. the attitudes of the on-coming generations are the only true hope for a sustainable future.

Activity 6.4.3 An analysis of the scale and distribution of any benefits will be carried out to determine if the benefits are likely to reach the target group and to see if any trade-offs are possible.

## E. INPUTS

### E.1 Inputs provided by Beneficiary Government

Each of the participating countries will designate an official representative to the project Steering Committee who will be a senior official associated with environmental policy. National Co-ordinators for project activities will also be provided, who will also attend Steering Committee meetings. One graduate should be present as full-time counterpart research officer in the corresponding field in each country during the project, as well as six or more support staff. It is expected that at least three graduates and four technician will be provided by each country for in-service and/or academic training during the project period. Selection of trainees will be made in consultation with the implementation.

In addition, contributions in kind, will be made at the four proposed national lake centres, at Bujumbura, Uvira, Kigoma and Nsumbu, in the form of office/laboratory buildings,



workshops, stores and harbour facilities. Housing will be made available, where such exists, on a temporary basis for project staff and contractors.

## E.2 UNDP Inputs

### International staff:

Project Co-ordinator (60 months)  
Scientific Liaison Officer (60 months)  
Training Officer (60 months)

### Locally recruited staff:

Administrative Officer (60 months)  
Senior Technical Officer (60 months)  
Bilingual Secretary (60 months)  
Documents Editor (60 months)  
Underwater Reserve Manager (3 x 24 months each = 72 months)  
Reserve Manager trainees (3 x 36 months each = 108 months)  
Mechanic trainees (2 x 60 months each = 120 months)  
Boat trainees (2 x 60 months each = 120 months)  
Contractual services: (see Annex V b and Work Plan)  
Executing Agency (60 months)  
Lake Pollution Studies (42 months)  
Environmental Audit Biodiversity Studies (48 months) |  
Conservation Activities (54 months)  
Equipment: (see Annex V a)

### Meetings and Workshops:

Quadri-partite Ministerial meeting Regular meetings of Steering and Technical Committees  
International Workshop in State of the Lake" International Conferences in conservation and Biodiversity"

### Training Programmes:

Community Environmental Education In-service Training activities Assistance to national universities Post-graduate fellowships

### General Operating Costs:

Operation and maintenance  
Miscellaneous supplies

### Improvement of premises:

The four lakeshore national centres will be established to implement the project work programme and to provide a material basis for continuing activities.

## F. RISKS

This is an unusual project since it involves four countries and many traditional sectors working round a very large lake with difficult communications. These factors have been taken into account in the preparation of this project document.

Social instability or lack of security is the major risk to the success of the project. It is reasonable to hope that the security situation will improve all around the lake, but there is some risk that periods of insecurity will occur which will impede the implementation of

the project. Many of the activities have been designed to be implemented by nationals in their own country, but some activities go across boundaries or are lakewide. Insecurity in distant capitals may have only limited effect at the lake, but insecurity in project centres could have a major impact on the progress of the project.

The achievements of the project would be diminished if the legislatures of the Lake Tanganyika basin countries fail to move towards harmonising their natural resources legislations regarding the lake; or if they fail to continue co-operation on the lake after the project. The likelihood of these risks materialising will depend upon the extent to which the countries perceive the interdependency of their interests in the basin land and water resources. The vulnerability of the lake to pollution and the value of its highly diverse unique fauna has become much better known. The activities the project should make these factors even clearer, and increase the likelihood of harmonisation and continued co-operation.

An additional risk is the effect of the low priority that the project may have in individual national priorities at a time of budget restraint and cut-backs. This could affect counterpart funds and availability. Additional problems may be caused by changes in foreign exchange regimes and/or import restrictions. The need for special accounts has been foreseen but other changes may occur which could affect the speed of implementation. In order to assure high level commitment, it is recommended that the inaugural meeting of the Steering Committee should be attended by Ministry heads so as to consolidate the international consensus on this project. There will still be a risk, nevertheless, because this GEF project address issues that are not or are unlikely to be addressed through normal project prioritisation processes in each country.

A further risk is that pressure from donors for work in the field of environment is increasing to such an extent that governments may be tempted to undertake more in the way of commitments than they are likely to be able to maintain in the form of counterpart contributions of staff and facilities. An important criterion of the GEF is that there should be no duplication of effort with projects that are ongoing or can be otherwise funded. This also may lead to a lower priority being placed on the GEF activities, resulting in shortfalls of necessary contributions for this project.

## G. PRIOR OBLIGATIONS AND PREREQUISITES

No actions or inputs from governments or non-governmental organisations involved in this project are considered necessary as prerequisites. The signatures of the governments to this document indicate their agreement to provide the counterpart support (specified in Sections B and E above) required for project implementation.

## H. PROJECT REVIEWS, REPORTING AND EVALUATION

The project will be subject to periodic review in accordance with the policies and procedures established by UNDP for monitoring project implementation.

Every six months the project Technical Committee will review technical progress on the project with the National Working Group. At the same time a GEF/UNDP Supervision Mission will be mounted, led by the UNDP Project Officer or representative of the executing agency. They will review overall management progress and achievement of targets within the project. The Technical Committee will advise the Supervision Mission on progress on technical issues. The supervision Mission will prepare an Aide Memoir identifying new actions needed, actions pending and actions completed, on each occasion. During the first year the Technical Committee and the Supervision Mission should be convened three times, once at project inception, once to consider the preliminary Lake Tanganyika Strategic Plan at mid-year and once at the end of year one to report to the Steering Committee. The Mission and the Technical Committee should be convened

six-monthly thereafter. The two groups should also consult with NGOs and local consultative groups. The NGOs themselves should be represented in the Technical and Steering Committees. These structures are summarised in the management bar chart and organogram given in Section B.7.

There will be a major review of the project at least once every twelve months, in which the Supervision Mission and Technical Committee will report to the Steering Committee.

The project will prepare an Inception Report after three months, a draft preliminary Strategic Plan after six months, a finalised Strategic plan after 23/2 years and a Final Report at the end of 5 year g. These stages are summarised in the Activities bar chart shown in Section B4.

## I. LEGAL CONTEXT

This Project Document shall be the instrument referred to as such in Article 1 of the Standard Basic Assistance Agreement between the United Nations Development Programme and the Governments of the four countries:

- Burundi (20.1 . 1 975),
- Tanzania (30.5.1 978),
- Zaire (26.5.1976) and
- Zambia ( 14. 10.1 983).

## J. BUDGETS

The overall project budget covering the UNDP contribution is given below. It is not adjustable for inflation increases in fixed costs, and if there are such unavoidable increases in certain project components they v have to be offset through decreases in other components. The Steering Committee will provide guidance such changes.

The project will draw up administrative sub-budgets which will be maintained by the project Co-ordinator monitor activities and performance within sectors of the project. Sub-budgets will be maintained according to the UNDP accounting system.

## ANNEXES

### ANNEX 1: WORK PLAN

The major components of the work plan and preliminary estimates of staff, equipment and time scale are given below. Operation of the plan will be monitored by the Technical Committee, and any substantial changes that may become necessary authorised . at the discretion of the Steering Committee. The parts of the work plan that will be implemented in the field by consultants will be closely co-ordinated and integrated by the project Scientific Liaison Officer. The activities itemised in the Work Plan are summarised in the Activities Chart in Section B.

## I. REGIONAL STRATEGIC PLAN

### A Baseline Reviews

National Experts and/or Consultants will be appointed to compile and review all existing information on biological aspects , water quality, lake hydrology, sectoral plans, institutional capability and manpower availability over a three month inception period.

10 consultant months over the first 3 months of project.

## B Inception Report

1. All reviews will be compiled into a report by Project Co-ordination unit assisted by an environmental planner and environmental scientist.

2 Consultancy months during month 4.

2. All compiled information will be entered into a flexible database which can be extended with

time by data management specialist, and can be made the basis of a Lake Tanganyika GIS.

3 Consultancy months during first year.

## C Draft Preliminary Lake Tanganyika Strategic Plan

From the review data in the Inception Report the negative trends affecting the lake over time can be characterised and the condition of the lake assessed. The major qualitative and quantitative gaps in the understanding of the lake and the negative impacts can be identified and vectored into special studies. Major zones in the lake can be categorised and the staffing, training and procurement requirements for the future identified. The planning can be carried out by the Project Co-ordination unit and the National Co-ordinators with assistance from an Environmental Planning consultant and an environmental scientist.

3 Consultant months within months 4-6.

## 11 LEGAL FRAMEWORK

A consultant will be recruited to carry out the review of existing laws pertaining to the lake environment, and to make recommendations for a regional framework for consideration by the four countries in the Final Plan.

4 consultant months in Year 3 .

## iii SPECIAL STUDIES

These will be finalised when the preliminary Lake Tanganyika Strategic Plan for environmental management Plan is compiled by month. They will commence soon afterwards for up to 2 year, and the results will contribute to the Final Strategic Plan.

### A SEDIMENT DISCHARGE AND ITS CONSEQUENCES

#### (a) Sediment Discharge

1 Lakewide deforestation and sediment plume survey, using remote sensing (Satellite imagery GIS). Every effort will be made to involve institutes in Africa in this work. Historical analyst of deforestation to start near the beginning of project (1 to 2 years duration). 8 scientist months with continuation of work by a MSc student.

2 Quantification of volumes of sediment currently entering the lake through major inflows.

3 Detailed sedimentation and sediment impact studies. The main rationale for this study is the sediment pollution is diminishing biodiversity in faunal communities and may also be affecting fish important for food production.

4 Tracing fate of particles discharged into the lake (vertical and horizontal transport), using a case study discharges along the coast of Burundi. Lake monitoring sites measuring quantity of sediment discharged are to be established. Project will concentrate on sediment entering the water column around particular drainages, where several other, agronomy-oriented project (see Section \3) will supply useful complementary data. Several monitoring sites will also be located in rivers an river mouths. Additional study for comparative purposes will be mad at relatively undisturbed areas similar in geology and climate in northern parts of Tanzania an Zaire waters

18 scientist months plus 27 technician months.

(b) Effect of Sediment on Biota

Water Column impacts: (implications for commercial fishery)

Comparative; analyses of phytoplankton, zooplankton and of fish communities showing various degrees of impact a, different times of year; including effects of turbidity on phytoplankton an zooplankton community structure and feeding, effects of turbidity on zoo plankton-feeding fish and exclusion effects.

50 scientist months for plankton studies: 24 scientist months for fish studies.

(c) Benthos Impacts (implications for biodiversity)

Faunal census and inventory along transects at selected high and low impact areas. Shore cores to be taken from sediment polluted areas to establish historical timing, background fluctuation and rates of reductions in biodiversity.

25 scientist months plus 27 technician months.

Several MSc and PhD students may work with this project section. Dive equipment, elutriation tables, Van Veen dredge and cabling, gravity corer, Pb-210 dating. Main project vessel (5 months), and one utility boat, a plank boat and a lift-net unit for duration of work (shared between physical and biological study groups).

**B. POLLUTION OF INTERNATIONAL WATERS**

1. Identify existing and potential pollution sources, including sediments, and where possible quantify type, and levels of pollutant s. Lakewide investigation will include urban, industrial and shipping sources, as

well as an enquiry into the implications of exploration and exploitation of oil in the basin.

To start in first year of project (after other sediment pollution results completed): 43 scientist months  
Main project vessel (4 months) + 1.5 years utility boat time. Water and sediment analytical equipment.

2 Circulation of Lake Waters. Lakewide investigation to model transport and dispersal of pollutants, and identify areas of special risk. Creation of simple computer model. Thermistor monitoring chains and current meters at stations; supplementary limnological measurements on synoptic cruises, meteorological data at shore and on lake stations.  
Study to continue over 3-year period. 34 scientist/months (including calibration, operation and analysis time) + 28 technician /months. Main project vessel (8 Months) + 2.5 years utility boat time. major limnological equipment: - thermistor chains, currents meters and CTD probes.  
Data from programmes A and B will be utilised to review conclusions in terms of state of the lake, and to identify major existing and potential pollution processes requiring specific remedial and precautionary measures.

### **C. BIODIVERSITY STUDIES**

Because of the great size and complexity of the ecosystem it is not possible within the scope of this project to evaluate biodiversity over the entire lake. Therefore a number of representative study areas will be chosen. The criteria for these are accessibility, variety of habitats, and potential for continuing long-term observations so that the areas studied can be thoroughly understood. Reconnaissance inventories of the aquatic animals and plants will be made to provide information necessary for planning the management of identified reserves. In a second phase, after finalisation of the Strategic Plan, additional areas of exceptional biodiversity will be identified and studied.

#### **(a) Inventory of Species.**

Inventories will be made by geographic distribution and habitat type, monitoring changes in these over time. Procedures will include the following:

- Analysis of existing fisheries data from a biodiversity viewpoint:
- Diving (0 - 40 m) transect censusing:
- Remote sampling with nets, grabs and dredges over various bottom types (0 - 250m)
- Video records from submersible vessel (ROY) in same areas as nets etc.:
- Quantitative replicate sampling, for relative abundances by habitat:
- Long-term studies of movement and change in diversity patterns.

Exploratory investigations will continue at selected sites throughout the project.

#### **(b) Indicators of Diversity**

Various indicators will be determined, such as species richness, gradients in diversity, and diversity with habitat (ecological). Their significance will be explored and compared with other lakes. The study will be based on results from Section A.

For (a) and (b): 90 scientist months; main project vessel as available + 1 utility boat and 2 plank boats full time: supplies, computer, curation.

(c) Taxonomic Basis of Diversity

Co-ordinated morphometric, anatomical and molecular genetic studies of key hyper-variable taxa, to understand the extent of diversification for management decisions on conserving biodiversity. The investigation will include: analysis of phylogenetic relationships of endemic taxa, and mechanisms of speciation and evolution, and be partly based on samples and data from (a) and (b) Timing: 6 scientist months, years 2 to 5 of project.

**D FISHING PRACTICES AND BIODIVERSITY**

Certain modern fishing methods, notably purse-seining and gill-netting using powered vessels, have drastically altered the fish stocks in certain areas of the lake and reduced diversity. Some traditional methods such as beach seines, and the use of very small mesh nets for catching young sardines, are probably also destructive. The pelagic, benthic and littoral fish communities are closely linked ecologically, so bad fishing practices in one of these affect the others. The effects of the ornamental fish industry and sport fishing on the ecosystem are unknown.

(see Fishing Practices)  
Alternative fishing methods and management strategies which would be less harmful to biodiversity than those presently used, will be identified and recommended. The project will evaluate the impacts of these fishing methods on biodiversity and propose conservation strategies. Proving of alternative fishing methods involving experiment and training will not be addressed, but the findings and recommendations should guide and facilitate such work by fisheries projects.

The number of species valuable to each year should be determined.  
12 months fisheries biologist, + 24 months technician time (year 1 - 2 of project); main vessel (1 month), one utility vessel (6 months).

**(b) Ornamental Fish Trade**

The preferred target species and quantities of fish taken presently should be determined and the present and future market outlets examined. Potential threats to particular species should be identified for legislative action.

2 consultancy months In Year 1.

**(c) Community Modelling**

From the fisheries and community data available a simple community model can be set up using ECOPATH to assess the knock-on effects of fishing through the system.  
3 consultancy months in Year 1

**E SOCIO-ECONOMIC /WD SECTORAL STUDIES**

**(a) Tourism**

A survey of all existing tourism facilities and networks related to Lake Tanganyika in each country with recommendations on needs for infrastructure and organisation needed to encourage tourism in the area.

6 consultancy months in Year 1

**(b) Socio economic appraisals**

Socio-economic studies in representative lakeside communities to ascertain role of fishing in the local economy, the pattern of fishing and the organisation of lakeside communities and their decision making structures. Public awareness of the project will also be assessed.

4 consultancy months in Year 1-2.

**(c) Income generating studies**

Investigation of the possibility of other income generating activities along the lakeside.

2 consultancy months in Year 1-2.

**(d) Sectoral Appraisals**

Since much of what happens to the lake depends upon what happens in other sectors, a close study of all other sectors in each of the four countries needs to be made. This should ascertain the most likely developments in those sectors in respect of actions which will affect the lake. All development plans should be evaluated, planning ministries contacted and a liaison built up with sectoral ministries.

5 consultancy months in Years 1 and 2.

#### IV FINALISATION OF LAKE TANGANYIKA STRATEGIC PLAN

From the reviews and the special studies a definitive Strategic Plan for the integrated environmental management plan of the lake can be formulated in Project Year 3. The classification of conservation zones, pollution measures and regulations decided upon. Management regimes for the lake zone can be outlined and proposed for tourism. Those areas of research and monitoring which need to be continued can be identified.

A Draft of Plan: This part of the exercise will be conducted by the Project Co-ordination Unit with the National Co-ordinator, and the assistance of an environmental planner and an environmental scientist, plus any appropriate specialists required.  
10 consultancy months in project year 3.

B Economic appraisal of plan which costs out the various elements and translate them into annual bulletins requirements over a 10- year planning horizon. This will help to shape the final plan.  
2 consultancy month in project year 3.

#### V TRAINING AND EDUCATION PROGRAMME

Training and education are essential elements in the project. All technical programmes carried out through contractors should have a built-in training component. Community education will be undertaken to increase awareness of lake environmental problems and solutions. Small workshops will be held. The project Training Officer will supervise all aspects of this programme which will be carried out at four levels, as follows:



## A Environmental Education at Community Level

The NGOs should open up channels of communication with the local communities through their existing community structure. This should also act as a channel for educational communication via regular meetings and the dissemination of information through appropriate media. These channels may also be used for persuasion or extension if new practices are recommended. budgetary provision is required for all NGO liaison, education and extension activities. A particular target will be the schools and school teacher groups.

## B In-service Training

This will be effected primarily through the placement of employees of government departments and institutions in project related activities, where they will work closely with project staff and contractors. The aim will be to strengthen the capacity of these organisations. In addition, small workshops will be conducted primarily for such trainees for discussion and exchange of information, and to ensure their understanding of all aspects of the project.

## C Assistance to National Universities

This will be given according to the uniqueness of each university's needs. Assistance will take the form of library support (aquatic science books and journals), 1-year aquatic biology courses with emphasis on pollution and Conservation aspects (English and French), and short courses at the level of university staff and associated project scientists as required.

## D Fellowships for Post-graduate Trainees

Train 1-2 post-graduate students over the life of the project through a fellowship programme, giving some preference to prior in-service trainees and encouraging the training of women in aquatic sciences.

## IMPLEMENTATION AND SUSTAINABILITY OF THE PROJECT

### A Future Basin Organisation

In the final year of the project, arrangements will be put in place to continue its activities without break or delay. A permanent organisation to represent the four lake countries in all matters concerning pollution control and conservation of biodiversity will be planned. The Steering committee will have special responsibility for this planning, and will work out details and launch the necessary initiatives with the help of project staff. In addition, 7 months consultant time is dedicated to this.

### B Pollution Monitoring Programme

From the special studies and the decisions on pollution regulation the most appropriate monitoring programme will be given in the Strategic Plan. The implementation of this programme which follow on from the special studies can be initially assisted by GEF but ultimately transferred to the national institutions.

6 consultancy months in year 4.

### C Economic Appraisal

The economic implications of the project at both village and national level need to be ascertained., study in benefits, the sir distribution and beneficiaries will need to be conducted together with the overall economic implications of the plan. In particular the scale of benefits likely to reach those target groups which bear the main impact of the plan needs to be ascertained.

2 consultancy months in year 4.

#### D Ensuring Co-operation of Local Communities

The NGOs will have organised local consultative groups and also teachers groups and their schools These can be incorporated into local management groups related to their local conservation areas and management zones. These should have regular communication with the National Working Group an the National Co-ordinator.

#### E Creating a Cross-Sectoral Planning Forum

As the lake management will interact with several sectors in each of the four partner countries, a appropriate planning forum for the action of the Lake Tanganyika Strategic Plan for environmental management should be located or created where possible. Most probably access points are the planning ministries.

2 consultancy months in year 4.

#### F Conservation Activities

Nsumbu and Mahali have already been identified as good sites for new reserves , Other conservation areas will have been designated within the Strategic Plan. Reserves will eventually be necessary for adequate conservation of the life of the lake. Not all underwater reserves will be accessible to visitor because of safety (presence of crocodiles, hippopotamuses), water depth, and conservation of breeding and nursery grounds. Establishment of subsidiary lake and land use management areas bordering the reserves may be desirable from considerations such as ecotone interfaces (buffer zones), extension of carefully managed areas, and increase of tourist facilities. Recommendations will be made concerning these. In the reserves there must be integration of various user interests (e.g. traditional, commercial and sport fishing) along with conservation and the operation of adjacent land parks. Development of the underwater parks should involve the participation of local people for their benefit (income generating). The project will provide the main expertise and equipment, as well as training, while the riparian governments have counterpart obligations.

The objectives of the project are to help establish these underwater reserves, assist in their initial management including a training of personnel, and promote the establishment of further reserves by surveys and the biodiversity studies. Some informational material such as guidebooks can also be prepared.

(i) An experience d reserves manager to be installed for 2 years at Nsumbu in Year 1, to set up and manage reserve.

(ii) An experienced reserves manager to be installed for 2 years at Mahali in year 2 to set up and manage reserve along with trainee manager.

(iii) At least one further reserve to be established during the project from the analysis leading to the production of the Strategic Plan.

(iv) Preliminary ecological surveys of reserve areas. 9 Scientist months: diving equipment, small boats, necessary land transport. Co-operation of land park personnel will be required.

(v) Socio-economic studies to define and reconcile different interests, in consultation with local people. 3 months consultancy.

(vi) Management recommendations in a first phase management plan including proposals for reserve boundaries, access by user types and nature of concessions. 3 months consultancy: initiation of these reserves will involve completing this phase in years 3 to 5 of the project.

## ANNEX VI: JOB DESCRIPTIONS

### Project Co-ordinator

The Project Co-ordinator provides the leadership for the successful implementation and completion of the project, within the framework of the project document. He/she is responsible to the designated office at UNDP Headquarters, discharging his duties in accordance with UNDP regulations and procedures. Specifically he/she is responsible for:

- direction and supervision of the activities of project staff,
- supervision and facilitation of the activities of contractors,
- maintaining close working relationships between project staff,

contractors and national agencies,

- administration of the Project and its finances,
- appropriate use and safety of all project equipment,.
- organisation of conferences and meetings,
- preparation of such reports and accounts as may be required.

He/she is Secretary of the Steering committee, and Chairman of the Technical Committee. He/she will visit on a regular basis each of the project national centres to ensure satisfactory progress, and also travel extensively in the region as necessary.

Desirable qualifications: 15 to 20 years experience of project management, involving national officials and institutions, consultants and contractors, preferably in East Africa. Proven ability to work effectively with United Nations and other donor agencies, scientists, senior government officials and administrators in an international setting. Fluency in English and French required, and Kiswahili fluency desirable.

### Administrative Officer

The Administrative Officer is responsible to the Project Co-ordinator for administrative aspects of the project. Specifically he/she will:

- ensure the smooth operation of the project,
- handle all routine personnel matters, |
- assure the proper handling of accounting and finance,
- arrange and facilitate travel for staff and visitors,
- receive and dispatch supplies and equipment,

- maintain close contact with the project centres; establish and monitor project, administrative procedures at each centre,
- liaise closely with relevant UNDP offices in the region,
- prepare all necessary statements of account and administrative reports as required by the Project Co-ordinator,
- act as Secretary to the Technical Committee,
- carry out such other tasks as may properly be assigned by the Project Co-ordinator.

Desirable Qualifications: At least 10 years experience of complex project administration involving international and national agencies, officials and contractors. Accustomed to working with United Nations and other donor agencies, and with scientists, technicians, administrators and the public in an international setting. Fluency in English and French required, and in Kiswahili desirable, Required to travel as necessary. .

#### Scientific Liaison Officer

The Scientific Liaison Officer provides the operational link in the field with the various consultants serving the project. He/she will:

- support and facilitate the implementation of scientific work,
- ensure the smooth operation of scientific programmes at the four national centres, and elsewhere on the lake . ensure the satisfactory involvement of scientific counterpart staff with contracted activities,
- supervise the selection, care, maintenance and allocation of scientific equipment among project activities,
- carry out such other tasks as may be properly assigned by the Project Co-ordinator.

Desirable Qualifications: Graduate In natural or physical sciences with post graduate degree associated with limnology. At least 10 years experience of research, preferably on African waters. Accustomed to working with scientists, national officials and international agency personnel, and having proven ability to develop good personal relationships and work effectively with other scientists. Preference for field work, with strong practical capability. Fluency in English and French, with Kiswahili desirable. Required to travel frequently on the lake.

#### Training Officer

Responsible to the Project Co-ordinator for all aspects of the projects training and education activities. In particular, he/she will facilitate and supervise, directly or in co-operation with project and national scientific and technical officers and consultants, the following:

- environmental education at community level,
- in-service training of a all kinds,
- training workshops
- courses and material assistance at the national universities,
- support for post-graduate trainees through the fellowship programmer
- support for women's involvement in the project,
- preparation and distribution of Lake Tanganyika Newsletter,
- such other tasks as properly assigned by Project Co-ordinator.

Desirable Qualifications: Graduate in natural or physical sciences, with long-standing experience in communication skills and as a teacher specialising in environmental matters. Accustomed to working in Africa, with senior national officials, with teachers and academics and with United Nations Agencies, Fluency in English and French required, with Kiswahili desirable. Required to travel frequently.

#### Technical Officer

Responsible to the Project Co-ordinator for the proper maintenance and repair of all project equipment. He/she will:

support and backstop the technical aspects of project activities, ensure the smooth operation of technical and mechanical aspects of project activities at the four national centres

assist, monitor and support the technical counterpart staff,

provide all reasonable assistance in technical matters to facilitate the work of consultants and contractors,

carry out such other tasks as properly assigned by the Project Co-ordinator.

Desirable Qualifications: At least 10 years experience of responsibility for equipment functioning in a scientific project or equivalent in an international setting in Africa. Accustomed to working with United Nations officials, with national and international staff, and with on-the-job training of counterparts and students. Ability to converse in English, French and Kiswahili. Ability to operate under difficult field circumstances. Required to travel frequently.

### ANNEX VII: FRAMEWORK FOR EFFECTIVE PARTICIPATION OF NATIONAL AND INTERNATIONAL STAFF (National institutions and project)

#### A. Institutions

Each Government has agencies responsible for Fisheries which have local offices at or near the lake. The Burundi Ministry of Land Management, Tourism and Environment (INECN) has a Department of Fisheries which works closely with several international fisheries projects on the lake. The Zambian Ministry of Agriculture has a Department of Fisheries which maintains a Provincial Fisheries Officer at Mbala and offices at Mpulungu and Nsumbu. Tanzania's Ministry includes the Tanzania Fisheries Research Institute which maintains a regional office at Kigoma. The Government of Zaire has a Natural Sciences Research Centre (CRSN) at Uvira, not far from Bujumbura, where the Hydrology Department is also represented.

Responsibilities for Parks and Wildlife are fairly well established by the Governments, but some changes in environmental Ministries are being made at present. In Burundi, the INECN is responsible for Parks and also for "Nature Conservation". Parks are well staffed, and the Rusizi National Park is established at the lake, but there is no staff yet for nature conservation. In Zambia, there is a Department of National Parks and Wildlife which is now being put under the Ministry of Tourism. A park exists at Nsumbu. In Tanzania the National Parks Service is parastatal (TANAPA) which comes under the Ministry of Tourism, Natural Resources and Environment; based in Arusha, it is well established and already has two parks at Gombe and Mahali beside the lake.

Pollution control, on the other hand, tends to be a newly recognised responsibility of the governments. In Burundi, the INECN is responsible but has as yet no staff or regulations. In Zambia, the Environmental Council has recently established units for Water Pollution

Control; Solid Waste Management; Air Pollution and Noise Abatement; Pesticides and Toxic Substances; and Natural Resource Management. In Tanzania, the National Environmental Management Council has a division for Pollution Prevention and Control but they are still short-staffed.

The prevention of pollution through reduction of sedimentation from run-off and erosion of cleared or tilled lands is the indirect responsibility of several agricultural, land management and natural resources agencies. These have implicit responsibility to ensure sound agricultural and forestry practices to minimise run-off, erosion and soil loss. However, these agencies and activities tend to be dispersed through various ministries, departments and councils.

The co-ordination of all externally financed development projects is the responsibility of other Ministries, such as the Ministry of Planning in Burundi, the National Commission for Development Planning in Zambia, and the Ministry of Foreign Affairs in Tanzania. These are the lead contacts for each Government for all development projects.

A very positive factor at present is that the Governments are in the process of working out a new approach to management of their environments. Established Ministries are being changed and new ones created; legislation is being revised and new acts and regulations are being considered. Unfortunately the resources available for new initiatives are minimal and there is some uncertainty about how the new arrangements will evolve.

The legislative situation is complex. In each country there are numerous acts covering various activities that affect environment management. For example, in Zambia alone there are 22 acts dealing with the environment; among the more important for the lake are:

- The Tsetse Control Act (1941),
- Water Act (1949),
- National Parks and Wildlife Act (1968),
- Natural Resources Control Act (1970),
- Forests Act (1973),
- Fisheries Act (1974),
- Lands (Conversion of Titles) Act (1975), and
- The Environment Protection and Pollution Control Act (1990).

Other countries have a similar situation with many old acts, some dating from colonial times. All four countries have recently passed specific environmental legislation and are in the process of planning and preparing regulations dealing specifically with various aspects of environmental management and co-ordination. There is an opportunity to facilitate the harmonisation of objectives and standards for the lake basin, so that major inconsistencies can be avoided across borders.

The newly established environment agencies are typically understaffed and have much to do. The testing period for them to undertake an effective role is just beginning. Their responsibilities are broad, but their resources and operational capacities have yet to be built up.

From a policy point of view also, new strategies are only now being developed. Conservation has in the past been limited to certain agencies such as Parks, fighting a sometimes losing battle against production-orientated agencies such as agriculture, forestry and fisheries. Now a new realisation is taking root that maximum production may not be sustainable (fish catches at the lake are down, and soil in the basin is being lost at alarming rates). The concept of determining sustainable limits of resources and managing them accordingly is gaining ground. It is also being shown that conservation can bring concrete local benefits as well as meeting vaguer national conservation objectives. The new agencies are beginning to play lead roles in these changing perspectives.

Universities, laboratories and research institutes also have an important part to play in the project. The University of Burundi has been primarily a teaching university, but is now developing a research capability with particular interest in working on Lake Tanganyika. Other Burundi research agencies involved include the Department of Waters and Fish (fisheries and hydrobiology research); REGIDESO (potable water analysis), the Ministry of

Health (waste water analysis, sanitation and waste disposal), and the Institute of Scientific Agronomy (ISABU) (studies of erosion and mitigation strategies in the lake). Staff shortages and lack of adequate funding often make effective utilisation of the facilities of these agencies difficult.

In Zambia, the University has been focusing its research efforts on priority areas established by Government but is now entering a new phase under the "Third Republic" when it will be able to review its own research priorities. More attention may be paid to the lake by the Biology Department in this case and it may play a role in the project. The National Council for Scientific Research outside Lusaka may also have a role, and has certain laboratory facilities and a small staff.

In Tanzania, the University of Dar-es-Salaam has an active biology department with an interest in aquatic biology and experience on the lake in biology and pollution aspects. It is anticipated this capability can be utilised and strengthened through the project.

Other laboratory facilities and institutional capabilities of relevance to Lake Tanganyika will also be utilised and strengthened where feasible and appropriate, including those in Zaire at Uvira. Existing laboratory and office facilities in each of the proposed four national project centres will be upgraded to sustain additional operations. Training will be provided for local staff in operations and procurement.

There are a large number of local and international NGOs in the four countries, but not many are established at the lake shore. In Bujumbura there are a number of active NGOs, among which Catholic Relief Services are prominent. Some 70 NGOs are registered in Zambia, and in Tanzania a group of NGOs has been formed with 66 national and 6 international members. These are generally oriented towards direct support to people, but several are being established with environmental objectives, particularly in the field of education. Conservation of biodiversity is a fairly new concept, but a few NGOs are strong in this area, such as the East African Wildlife Association, the World Wide Fund for Nature (WWF), and the International Union for the Conservation of Nature (IUCN) with offices in Dar-es-Salaam and Lusaka.

NGOs offer an opportunity for reaching out to the poorest and most isolated people in ways that are difficult for Government agencies to achieve from often distant capitals at times of fiscal restraint. In particular, environmental education should be a fruitful area for the involvement of NGOs in the project. For example, a Zambian Environmental Education Programme (ZEEP) is just getting underway, and a similar programme is planned in Tanzania. Nearer the lake there is the community-based World Vision International which has an office in Mbala.

In summary, there are numerous ministries and agencies with responsibilities for the environment in the lake basin, many of them are being actively reviewed at present in the light of an increased interest in environmental management and pollution control, so the timing is good for supporting the process.

## B. Project Management

### Steering and Technical Committees:

Within this complex institutional framework, the project must incorporate the interests of the senior development co-ordinating ministries, the environment ministries and councils, the various natural resource sectoral agencies and the local interests of other agencies representing people in the basin. Thus to ensure compatibility of objectives and outputs, a project Steering Committee will be formed with the following terms of reference.

The Steering Committee will:

1. provide overall direction of the project;
2. review the progress of the project and the various national activities, ensuring a regionally integrated approach;
3. advise on policy matters, and monitor the utilisation and availability of

counterpart staff;

4. approve future planning, and make recommendations to UNDP and the executing agency as to changes in project timetables, inputs and budgets which may be necessary from time to time;

5. provide guidance and support to the Technical Committee and Project Co-ordinator.

The Steering Committee will consist of members appointed by each country, from the national Environmental Agency or ministry equivalent, preferably at Director General or Permanent Secretary level, as well as the designated National Co-ordinators from each country. Representatives of UNDP and of the executing agency will also be members. Arrangement for persons who can contribute special expertise to become member. will be made on an ad hoc basis. The Project Co-ordinator will serve as executive secretary to the Committee which will meet at least once a year.

The mandate of the Project Technical Committee will include;

1. general supervision of the implementation of the technical work program, with periodic review and revision within the terms of the project document and budget;

2. evaluating the technical work carried out by the project, drawing conclusions and recommendations for appropriate further action, and reporting as required to the Steering Committee;

3. providing technical support and advice to the project.

The Committee will consist of the technical experts from the agencies actively involved in the project; these are expected to be the Fisheries, Parks, Wildlife, Environment and Pollution Control Departments from each country. Project staff and representatives of contracting implementing agencies will be invited to meetings as appropriate to current activities. The Project Co-ordinator will chair the Committee, which will meet at least twice a year.