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FINNISH INTERNATIONAL DEVELOPMENT AGENCY

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The conclusions and recommendations given in this and other reports in the Research for the Management of the Fisheries on the Lake Tanganyika Project series are those considered appropriate at the time of preparation. They may be modified in the light of further knowledge gained at subsequent stages of the Project. The designations employed and the presentation of material in this publication do not imply the expression of any opinion on the part of FAO or FINNIDA concerning the legal status of any country, territory, city or area, or concerning the determination of its frontiers or boundaries. <u>PREFACE</u>

The Research for the Management of the Fisheries on Lake Tanganyika project (LTR) became fully operational in January 1992. It is executed by the Food and Agriculture Organization of the United Nations (FAO) and funded by the Finnish International Development Agency (FINNIDA) and the Arab Gulf Program for the United Nations Development Organization (AGFUND).

LTR's objective is the determination of the biological basis for fish production on Lake Tanganyika, in order to permit the formulation of a coherent lake-wide fisheries management policy for the four riparian States (Burundi, Tanzania, Republique Démocratique du Congo, Zambia).

Particular attention is given to the reinforcement of the skills and physical facilities of the fisheries research units in all four beneficiary countries as well as to the build-up of effective coordination mechanisms to ensure full collaboration between the Governments concerned.

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# GCP/RAF/271/FIN PUBLICATIONS

Publications of the project are issued in two series:

\* a series of technical documents (GCP/RAP/271/FIN-TD)
related to meetings, missions and research organized by the
project;

\* a series of manuals and field guides
(GCP/RAF/271/FIN-FM) related to training and field work
activities conducted in the framework of the project.

For both series, reference is further made to the document number (01), and the language in which the document is issued: English (En) and/or French (Fr).

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#### I. SUMMARY OF MAIN FINDINGS AND RECOMMENDATIONS

The FAO/FINNIDA Lake Tanganyika Research Project aims at the determination, through implementation of a scientific research programme, of the biological basis for fish production in Lake Tanganyika. The scientific programme, divided into eight subcomponents, is expected to provide an adequate reference basis for the formulation of a lake-wide fisheries management policy, aiming at the maximum sustainable utilisation of the pelagic fish stocks. The project started with a preparatory phase of 1.5 years, followed by a phase of 3.5 years, during which intensive research is conducted for the preparation of a management plan and for the creation of an institutional capacity in the four riparian countries to continue routine monitoring of fish stocks and environment.

The joint FAO/FINNIDA mission evaluated the project in April/May 1995. Conclusions and recommendations are summarised here.

Lack of research on the pelagic fish stocks and the biological basis for fish production has been one of the major obstacles to meaningful fisheries planning, development and management in Lake Tanganyika. Although a substantial data base already exists, there is a clear need to formulate and assess the importance of core limnological and ecological processes that regulate fish stock dynamics.

It is felt that the scientific programme of the project as executed could ultimately provide the basis required for regional lake-wide management. It was noted with satisfaction that, in spite of difficulties encountered with the sociopolitical situation in some of the riparian countries, all scientific subcomponents were being finalised as specified in the Project Document. In addition, some new activities like the remote sensing and pilot studies in fish genetics were introduced.

Despite political difficulties in Burundi and Zaïre, the project has performed well. Project management has been very rigorous and effective. At the time of the mission, intensive data collection was still in progress.

Lakewide scientific cruises had just started at the time of the mission, because of difficulties encountered in acquiring a suitable vessel. The project's vital lakewide survey programme had yet to start and prove its applicability and effectiveness.

As the final results of the several subcomponent studies as well as results from the lake-wide cruise sampling by R/V Tanganyika Explorer were not yet available to the evaluation mission, it is somewhat difficult to state in detail the applicability of the results in formulating a more advanced lake management plan. As the current phase of the project specifically aims at providing a scientific basis for further management of the lake's resources, it is clear that a possible continuation phase should have a strong component in management development. Support to the (creation and initial) functioning of a supra-national management organisation for the lake is urgently needed. National institutions responsible for fisheries research and management are weak and require more systematic recognition.

The project's design, with activities in four riparian countries as well as in Finland has made it rely heavily on the backstopping of the Operations Service of FAO's Department of Fisheries. Further significant backstopping from the Organisation was required in relation to the construction according to specifications, subsequent lease and commissioning of the R/V Tanganyika Explorer, its fishing gears and the training of its crew.

National staff have participated in all activities of the project and should normally have the technical competence required to continue statistical data collection, routine monitoring and sampling duties.

Recommendations are formulated concerning the further organisation of work, given time and budget constraints. These recommendations are directed at the scientific coordination, the project co-ordinator, at FINNIDA and at the national Governments of the recipient countries.

After the end of the second sampling year (July 1995), the project should drastically reduce sampling and concentrate on lakewide resource surveys, general data analysis and synthesis work. The Scientific Sampling Programme (SSP) which ends a second sampling year by July 1995, should be revised in order to evaluate which components already have enough data to proceed with the data processing phase. Further sampling directly requirements are to be determined on the basis of (1) perceived additional data needs for the management plan and (2) on those data which show highest parameter concentrating variability. Gathering of socioeconomic data on the fisheries should also be considered as part of the SSP, particularly in the extension phase recommended.

The imminent start of a regional Global Environment Facility project aiming at the conservation and management of the lake's biodiversity will offer interesting possibilities for collaboration. This concerns common research interests as well as organisational opportunities for co-operation in a single organisational entity. The two projects will share equipment and vessel time, and hopefully work closely together.

Scientific coordination should prepare a technical document outlining the interlinkages of the various research subcomponents. During the remaining time of the current phase, special attention should be given to synthesis work related to hydroacoustics, linking zooplankton data with distribution patterns of the pelagic fish species, carbon energy budget and primary production.

Efforts should be made to collect basic phytoplankton data; organise more frequent interdisciplinary contacts and technical meetings within the project; integrate conclusions of various subcomponents and formulate working hypotheses which can subsequently be tested in the field; use such information for the formulation of a draft management plan that can be refined as and when more detailed data become available.

The project is advised to establish a research base in Kalemie, Zaïre, for intensive sampling on the Zaïrian side of the lake; to formulate minimum data requirements for national monitoring of fish stocks and environment, involving Universities of riparian countries. The mission recommends that the project should in addition provide initial support for establishing regional management consultations and train fisheries managers.

The project should further assist Governments in the formulation of requests for legal and institutional support to a single interdisciplinary lakewide management organisation, for safeguarding historical fisheries data, and project data banks. Use of modern electronic communications channels and CD-ROM technology is recommended.

As it would be unrealistic to expect that a synthesis fully interlinking the various findings of the research subcomponents and a good regional management plan can be achieved by mid-1996, the mission recommends a phase of additional support of two and a half years beyond the present term of the project, so that a stage of consolidation and organisational maturity can be reached.

This extension would concentrate on management support, refining of the management plan on the basis of limited data collection for testing working hypotheses and the continuation of lakewide research cruises, which the present project has been unable to perform in view of the late availability of the research vessel. It would also be able to fine tune its activities with the Global Environment Facility project addressing similar management issues in other disciplines. Precondition to such further support would, of course, be adequate financial commitments from the recipient countries for the regional management.

Governments of the riparian countries are requested to allocate such budgets for effective national and regional management and integrate the various regional projects on Lake Tanganyika in order to avoid duplication of effort, competition for counterpart staff and equipment.

# II. INTRODUCTION

Lake Tanganyika is shared by the four nations, Burundi, Tanzania, Zaïre and Zambia. It is a very ancient lake with a history of geographical isolation of some 20 million years. Fish species and fisheries resources therefore have unique characteristics not found elsewhere. Fisheries of Lake Tanganyika mostly target the abundant pelagic resources, composed of two freshwater sardines and their four endemic Nile perch-like predators.

This unique pelagic ecosystem with its characteristic fluctuations in fish catches and continuing changes in species

composition of the catch, defies standard fisheries planning, management and development practice. Development programmes and studies undertaken under FAO auspices in the 1960s and 1970s in each of the four countries had concluded that simultaneous lakewide research was needed to understand the observed phenomena. and the reason for the high fish production in the transparent, apparently nutrient-arm waters.

To this end, the four riparian countries requested FAO's Committee for Inland Fisheries of Africa (CIFA) in 1977 to create a Subcommittee for the Development and Management of the Fisheries of Lake Tanganyika. This body was specifically requested to formulate and subsequently find funding for a regional fisheries research project on the lake. The CIFA Subcommittee for Lake Tanganyika has to date met eight times. Its sessions typically unite Fisheries Directors and Technicians of the four countries, who share information on the fisheries and discuss issues of common interest.

FINNIDA eventually honoured the request for support of the four countries, and a FAO executed regional research project of 5 years' duration entitled "Research for the Management of the Fisheries on Lake Tanganyika" became operational in 1992. AGFUND financing could also be mobilised for part of the equipment component of the project.

The present report details the findings and recommendations of a joint FAO/FINNIDA mission, which evaluated the project in the period 25 April - 26 May 1995, both at FAO Headquarters in Rome and in the four recipient countries. Mission members were Mr. Frits Roest, Fisheries Research Expert on behalf of FAO (mission International leader, and senior fisheries adviser of the Agricultural Centre, Wageningen, The Netherlands) and Prof. Jukka Salo, Environmental/Biodiversity and Management Expert on behalf of FINNIDA. They were assisted in Burundi by Prof. Balthazar Mpawenayo, in Tanzania by Mr. Oman Karia, in Zaïre by Dr. Baluku Bajope, and in Zambia by Mr. H.G. Mudenda. The Terms of Reference for the Mission are given in Annex 1, the Mission's itinerary and list of key persons met in Annex 2 and the list of documentation consulted in Annex 3.

### III. BACKGROUND TO THE PROJECT

Lake Tanganyika, extending over  $32,000 \text{ km}^2$ , has valuable fisheries and pelagic fish stocks which are apparently not utilised to their full capacity. These pelagic fish stocks are subject to large seasonal and inter-annual fluctuations, but the biological basis of fish production is incompletely known. The lake has a 'poor' oligotrophic appearance and yet its assumed maximum fish production is high, having been evaluated at 90 kg/ha/yr, or some 295,000 t/yr for the whole lake. This figure, however, is a technical average as natural stock abundance's fluctuate widely.

For the management of the fish stocks, a proper understanding of the limnological and hydrological mechanisms present in the lake is essential; such mechanisms ultimately set the upper level for fish production, and determine also the catching methods allowable.

The lake's fish resources are shared by Zaïre (45%), Tanzania (41%), Burundi (8%) and Zambia (6%), and a close subregional cooperation is essential for the management and exploitation of these common resources. Previous national fisheries research and development projects had shown that independent uncoordinated research programmes could not be expected to provide the required knowledge and data. Also, pollution may pose an increasing threat to the fisheries and to the lake's various other uses. The need of pollution control, of uniform data system collection and legislative measures was stressed already in 1989 at the international symposium on "Resource Use and Conservation of African Great Lakes" held in Bujumbura by the African Great Lakes Group of the International Association of Theoretical and Applied Limnology (SIL).

Lake Tanganyika's environmental aspects and biodiversity are the concern of all those who collaborate in the effort of conserving the heritage of the Lake and its optimum use for the benefit of the riparian populations. The recommendations made by the "Conservation and Biodiversity conference on of Lake Tanganyika", hosted by the University of Burundi in 1991, lead to UNESCO's collaboration with the University to assess effects of run-off on biodiversity and fisheries. A collaborative study Belgium-Burundi is examining pesticides and other chemical pollutants entering the Lake. Pollution control and other measures to protect the Lake's biodiversity are the objects also of the UNDP-Global Environment Facility Project proposed to start in the course of the year.

Because of its special characteristics as a deep lake, Tanganyika's limnology and hydrology, in terms of biological and eventual fish production, possess features that can best be approached only on a lake-wide basis.

Based on the above considerations, and following the interest expressed by Finland in supporting a regional activity for the Lake as proposed by FAO, FINNIDA financed the preparatory assistance project GCP/RAF/229/FIN. A project identification mission was undertaken in early 1987, and a formulation mission undertook the preparation of a detailed project document and scientific work plan at the end of 1988.

The LTR project GCP/RAF/271/FIN was approved to start, with funding from FINNIDA, in January 1992 for a duration of five years. FINNIDA's contribution was at the time calculated at the equivalent of US\$ 5,835,425 for five years through end 1996, and is at present estimated in the range of US\$ 5,508,000. Simultaneously, FAO had negotiated with AGFUND a complementary project (GCP/RAF/221/AGF) for equipment and training inputs to the regional project up to a budget of US\$ 337,000.

#### IV. ASSESSMENT OF PROJECT OBJECTIVES AND DESIGN

# A. JUSTIFICATION

The highly migratory nature of the pelagic fish species, the enormous interannual variations in the catches and the seemingly unproductive, oligotrophic nature of the lake waters make that research was justifiably considered the main obstacle to development meaninqful planning, and management of the fisheries. As the resources are shared to an unknown degree by the four riparian countries of Lake Tanganyika, a concerted lake-wide effort is required to elucidate the most essential of the above issues. The Mission considers that the project thus correctly addresses the main and immediate problems.

The 5 year duration of the project was inspired by the wish to cover as much as possible of the observed longer-term abundance cycles of the fish, which appear to be of the order of seven years. An intensive phase of collaborative research undertaken by the project would provide insight into lakewide phenomena, which after the end of the project would be monitored by the four countries without major external assistance.

### **B. OBJECTIVES**

The overall development objective of the project is the provision of a rational basis for the maximum exploitation of the fishery resources of Lake Tanganyika, in order to increase the supply of high-protein food to the riparian States in line with national development goals.

The intermediate objectives are:

(a) the establishment of an agreed ongoing lake-wide modern scientific fisheries research programme with the continuing exchange and utilisation of the research results and experiences at Lake Tanganyika among all four participating States;

(b) the four national research centres each with the capacity (human and logistical) to continue, without duplication of effort, the agreed fisheries research programme independent of major external assistance inputs;

(c) the four national research centres able to provide their Governments with the scientific data and advice required for the further detailed planning of their national development programmes, aimed at the optimum exploitation of their fishery resources at Lake Tanganyika;

(d) the establishment and implementation by the Governments of the four riparian States of a mechanism to co-ordinate the management and exploitation of the pelagic fishery resources of the whole of Lake Tanganyika; (e) the national research centres each able to provide scientific data and advice to their Governments regarding the overall use of Lake Tanganyika's resources, including also the management of water supplies for the lakeside communities, the combat against pollution, the conservation of the biological and other lacustrine natural resources.

The immediate objectives are defined as follows:

(1) The establishment before the end of 1995 of an agreed longterm research programme for monitoring of the fish stocks and related environmental parameters, together with adequate basic infrastructure, logistics and trained national personnel to be able to continue this research programme after the conclusion of external assistance.

(2) The formulation within five years of a plan for the management on a subregional basis of the fisheries resources by all four riparian States, based on an adequate understanding of the mechanisms of the lake's limnological, hydrological and hydrographic processes which, through various biological interactions, influence and determine the patterns of fish production in different parts of the lake.

(3) The establishment of uniform methods throughout the lake for the subsequent longer-term collection, analysis and interpretation of new data by the four participating countries, following the compilation and analysis on a subregional basis before the end of 1996, of the already existing and available statistical data on fish yields and fisheries in general, as well as other environmental related data that are required for fish production estimates.

The development objective of the project as formulated is relatively clear and straightforward, but is restricted to "the provision of the basis for the maximum exploitation of the lake". This does not provide any guarantee for the effective application of the research results and of the management plan, in spite of the project document's recognition of present institutional weaknesses and the general precarious economic situation of the riparian countries.

The Mission considers that the project should have included, in addition to the research effort deployed, a parallel, simultaneous management exercise (e.g. in the form of a management-oriented subcomponent) which would have followed and guided some of the research components in order to develop a skeleton management plan, taking into consideration the often limited possibilities to develop such a plan in conditions where national institutions are relatively weak.

It considers in addition that the longer-term or intermediate objectives as formulated assume positive answers to the following questions:

• would it be realistic to expect the countries to continue the lake-wide modern scientific fisheries research after the end of the project (although they have not participated in the

financing of the ongoing project research?)

- (in the absence of any real tradition,) would it be realistic to expect that the Governments of the four riparian States would request their research institutes to provide data and advice for the management and exploitation of their lacustrine resources?
- would financing be available for the co-ordination of lakewide management of Lake Tanganyika?
- does the project sufficiently address the overall use of Lake Tanganyika's resources, including the management of water supplies, pollution monitoring and control, conservation of resources to be able to contribute scientific data and advice to Governments?

These four assumptions have direct implications for the activities of a project attempting to contribute to the improved management of the lake and its resources. Of crucial importance for the sustainability of the exercise will be the success of the project in creating awareness of the need for management, continued monitoring of the resources and in mobilising adequate national and supranational funds.

It should be noted that most of the other projects on Lake Tanganyika, which were either operational or being considered for funding when the Project Document was formulated, have ceased to exist or have faced indefinite delays in becoming operational. Only one of these is currently operational: the Belgian/CEPGL Centre Regional de Recherches en Hydrobiologie Appliqué (CRRHA), which provides faunal inventories and studies the effects of river pollution in the northern lake area. As these projects were conceived to be complementary to each other, the mission realises that, in a number of cases, their cancellation may have led to higher expectations from the LTR project.

A new project, to be financed by the Global Environment Facility (GEF), entitled "Pollution Control and Other Measures to protect Tanganyika" Biodiversity in Lake is expected to become operational in 1995. It will among other things execute pollution and hydrological modelling studies. FAO has been closely involved in the preparation of the GEF project and the mission assumes that close collaboration will be established to avoid overlap and enhance collaboration. The mission notes that the GEF project addresses more directly intermediate objective (e) of the FAO/FINNIDA project, to which the latter could realistically have only marginally contributed. Nevertheless, it is recommended that activities related to objective (e) are carefully concerted between the two projects, especially if the suggested continuation phase of LTR materialises.

A third project which is part-time active on the lake is the Belgian-funded "Speciation in Ancient Lakes" project linking biodiversity and evolutionary studies in East Africa, Siberia (Baikal) and Japan.

Lastly, UNESCO, as part of its project "Comprehensive and Comparative Study of Great Lakes", attempts to provide a basis for the shared use, development, planning and management of Lakes Victoria, Tanganyika and Malawi. This is done through the preparation of agreed detailed descriptions (monographs on the limnology and hydrology) of these lakes.

#### C. PROJECT DESIGN

The project has been designed, following detailed recommendations made by the CIFA Subcommittee for Lake Tanganyika, as a truly collaborative, single research programme between the four riparian countries Burundi, Tanzania, Zaïre and Zambia. In addition, a number of complex studies are contracted out to Finnish institutions.

Because of its ease of access and good communications, the availability of facilities to house the project and its staff, the project headquarters were installed at Bujumbura, Burundi. A number of project research stations and substations have been established (Burundi: Karonda; Tanzania: Kigoma, Kipili; Zaïre: Uvira, Kalemie, Moba; Zambia: Mpulungu). Each major substation is designed to be the lead station for a major research component of the project:

Bujumbura for fisheries statistics, Kigoma for fisheries biology and Mpulungu for limnology. Additional lakewide research requiring the use of the project's research vessel (primary production, hydrodynamics, linkage between zooplankton and fish production) is handled from Bujumbura. The overall co-ordination of the scientific work is provided by the University of Kuopio.

A permanent Project Co-ordination Committee represents the interests of the countries collaborating in the project. This is intended to inform and involve the participating heads and senior staff of the Fisheries Departments in the capitals, three of which (Dar es Salaam, Lusaka, and Kinshasa) are located at great distance (over 1,000 kin) from the project site. The mission considers a close involvement of the Fisheries Departments of vital importance because of the sustainability issue expressed above.

In addition, an International Scientific Committee has been foreseen, with the mandate to plan and evaluate scientific work to be undertaken by the project and related training requirements. Member of this Committee are the Scientific Coordinator, the Project Co-ordinator, one member of each of the beneficiary Governments, and one member of the donor Government.

The mission understands that, for practical reasons, the membership of such a Committee is necessarily limited, but regrets that senior project staff has not been systematically involved in this work. As no other, regular, scientific meetings were organised by the project, there has been too little attention for the need to generate an ongoing interdisciplinary discussion of results and develop working hypotheses required for the gradual formulation of a preliminary management plan. The project's principal objective is to gather and synthesise data on the main limnological, hydrological and ecological parameters, considered crucial to the further understanding of causal relationships between primary production and fish productivity of the lake. The scientific programme has been divided into several subcomponents, each of which was in the phase of data collection at the time of the mission. These subcomponents, which are combined into an initial Scientific Sampling Programme (SSP) are meant to provide sectoral outputs for the development of a lake-wide functional synthesis and finally to provide the basis for a sustainable fisheries management plan. The current SSP consists of the following subcomponents, most of which were already specified during the planning phase and were consequently incorporated into the Project Document:

Hydrodynamics Limnology Carbon energy budget Zooplankton biology Fish biology Remote sensing Fish genetics Fisheries statistics

It was felt that research along these subcomponents constitutes the broad type of ecosystem research required. It should be able to provide the necessary components for the preparation of a larger functional synthesis. The weighing between the subcomponents in the project design has been well-balanced.

In addition to the scientific programme prepared for the project, the mission feels that the removal of obstacles to the effective management of the lake's fisheries should have been another leading element in the project's design. This would have meant more implicit support to a management structure in addition to a scientific programme addressing the data needs. This would at the same time have provided a more transparent cohesion explanation of the the individual of research subcomponents than was available to the mission. As fisheries management involves primarily human activities, the mission is of the opinion that the project should also incorporate the collection of relevant socio-economic data.

The mission considers that the situation where the project's Scientific Co-ordinator is based in Finland, most of the ongoing field work is undertaken in Africa, and significant additional research is done through Finnish institutions, has made the project organisationally rely very heavily on the Operations Service of FAO's Department of Fisheries. The activities in scattered locations and consequent relative lack of contact between scientists participating in the various subcomponents of the project has not been conducive to the integration of preliminary results into overall working models.

#### V. ASSESSMENT OF IMPLEMENTATION

#### A. Project Budget and Expenditure

The LTR project GCP/RAF/271/FIN was approved to start, with funding from FINNIDA, in January 1992 for a duration of five years. Due to the devaluation of the Finnish Mark, the dollar equivalent of the funds earmarked has been lower than budgeted in the project document. Instead of the foreseen FINNIDA contribution of US\$ 5,835,425, at the end of March 1995, a total of US\$ 5,617,956 had been made available, as well as an additional US\$ 110,918 (interest earned from inception to 31/12/94). In addition, an AGFUND budget of US\$ 337,000 has been made fully available to the project. The utilisation of this AGFUND contribution to the project is detailed in Annex 4. Financial situation and expenditure as at March, 1995 are summarised Annex 5 ("Financial situation in of GCP/RAF/271/FIN"), and Annex 6 (Trust Fund Budget Revision 05/04/1995). It is generally felt that expenditure is in accordance with sound project management practice and that budget revisions were well-timed and fully justifiable.

International consultants involved in the scientific programme have been contracted mainly through the University of Kuopio. In order to simplify procedures and to avoid the difficulties involved in hiring the consultants individually through Reimbursable Loan Agreements, it was decided to conclude Contractual Service Agreements with the University of Kuopio. Five such Agreements had been signed at the time of the mission. on hydrodynamics These contracts include assignments and hydroacoustics, fish biology including fish genetics studies, limnology, remote sensing, completion of various reports and manuals as well as scientific coordination. The total sum involved has so far been US\$ 316,500. As full payment for these consultancies awaits the submission of the research results and reports, which generally are produced with some delay, actual spending at the time of the mission had been lower than anticipated.

Inputs by the four Governments are summarised in Annex 7. Although it was attempted to express these national contributions in monetary terms, it should be realised that, in accordance with the provisions in the Project Document, these have been limited to the availability of national staff, premises and equipment.

# B. Activities and Outputs

#### 1. Scientific Programme

A proper understanding of the limnological and hydrological mechanisms present in the lake is essential in order to develop a coherent management plan and procedures. Therefore a concentrated collaborative research programme is required to cover the whole lake on a subregional basis. Although a substantial body of data on limnology, fish biology and fisheries statistics already exists, there are obvious gaps in understanding the lake dynamics behind highly fluctuating fish yields. In particular, new insight is needed to assess the role of upwelling phenomena and the relations between different trophic levels (particularly primary production levels and the role of dissolved organic matter).

Activities in eight research disciplines ("subcomponents") were initiated to provide the basis for an improved understanding of the relation between lake dynamics and fish production. These eight subcomponents together constitute the project's Scientific Sampling Programme (SSP). In July 1993, the project started a rigorous and intensive SSP programme of field sampling in limnology, fish biology and fisheries statistics, of which the various components are led by field co-ordinators. All project stations take part in this exercise. The Bujumbura station is responsible for the statistical component, Kigoma for fish biology, Mpulungu for limnology. Results of the first year of sampling have been analysed and were presented at the meetings of the Third Co-ordination Committee/International Scientific Committee. The mission had the opportunity to visit all project locations and meet and discuss with all project staff. In addition, it noted the dedication of all professionals involved, the generally high standard of sampling and consequently the good quality of data generated.

#### 1. Hydrodynamics

The aim of hydrological and hydrodynamic studies on Lake Tanganyika is to provide a better understanding of the flow and temperature regime of the lake and the main factors influencing it. The hydrodynamics study aims to develop a numerical circulation model in order to quantify the impact of wind induced shear stress and surface heat flux, occurrence of upwelling and downwelling and patterns of lakewide circulation. Ultimate objective is to understand fish movements and biomass development in relation to nutrient flows.

The activities carried out so far include the establishment of four on-shore meteo and wind stations (Bujumbura, Kigoma, Kalemie and Mpulungu), two buoy meteo stations (off Mpulungu and off Kigoma) and two wind stations (Kipili, Mpulungu). At Kigoma, Mpulungu and Bujumbura, flow cylinders and water level stations were also established. Two thermistor chains have been installed, one off Kigoma and the other off Mpulungu. Four hydrophysical cruises have so far been carried out.

# 2. Carbon energy budget

The main purpose of this component is to relate primary production and dissolved organic matter to fish production.

A key finding has been the demonstration of the dependence of primary production on changing radiation conditions. Furthermore, it has been shown that measurements must reach as deep as 60 meters to fully cover water layers which show activity in primary production. These findings give new insight into the trophic dynamics of the lake and are of high significance for further considerations to formulate an integrated management system. The results obtained so far may provide helpful in explaining the well-known dilemma between high fish catches and presumably low primary production in the lake.

The role of dissolved organic matter, especially in relation to upwelling phenomena, is also surveyed in order to better understand carbon energy flows involving bacteria and protozoa.

The subcomponent is currently targeted on primary production, chlorophyll-a and light measurements which will be carried out both at fixed stations and during cruises.

It is regretted that due to budget constraints, no in-depth phytoplankton analyses are included in the working schedule of the project. This may substantially complicate efforts to understand the energy flow patterns within the lake.

#### 3. Limnology

The limnological subcomponent has been introduced to provide environmental data to monitor the nutrient dynamics and physical processes that relate to the abundance, distribution and production of fishes.

The sampling procedure includes three types of activities:

- regular sampling from 0 to 100 meters (2 to 4 per month).
- intensive sampling from 0 to 300 m during a 24 h cycle (every six weeks).
- seasonal sampling at the same site as intensive sampling (every three months).

During the weekly and intensive sampling the following parameters are measured:

transparency (Secchi), temperature, dissolved oxygen, pH, conductivity, total phosphorus, phosphate, ammonia, turbidity.

During seasonal sampling the following parameters are also included:

total hardness, calcium, alkalinity, chloride, sulphates, and silicates.

In addition to the analyses listed above, measurements of chlorophyll-a and water transparency changes are being carried out.

While a detailed analysis of the limnological SSP results is still going on, some results are already available, as listed in GCP/RAF/271/FIN-TD/27. In general the results confirm earlier observations of Coulter (1968) showing internal wave dynamics and upwelling sites during the dry seasons at the southern end of the lake. The mixing of deeper nutrient rich layers with the upper more oligotrophic layers due to these phenomena may prove to be an important factor behind the observed patchiness characterising many of the limnological and biotic parameters and may provide clues for a better understanding of fish movements and abundance timing.

# 4. Zooplankton

The aim of the zooplankton component is to relate seasonal and spatial variations in abundance and distribution of zooplankton to similar parameters in fish. Fixed sampling stations have been introduced and additional efforts made to link zooplankton dynamics with fish biology data. Zooplankton sampling will be an integral part of mid-water trawling and hydroacoustics cruises using R/V Tanganyika Explorer.

#### 5. Fish Biology

The fish biology component of the project studies the life history and demographic parameters of the pelagic species. Length-based methods have been used to make some preliminary estimates of growth and mortality for the three most important pelagic species.

The project has attempted to introduce otolith age reading to measure daily growth increments in *Limnothrissa miodon*, but at the time of the mission, only a very small number of samples had been analysed.

#### 6. Fisheries Statistics

Immediate objective of the fisheries statistics subcomponent is to improve, standardise and co-ordinate the existing fisheries statistics data collection systems of the four riparian countries. Furthermore, the aim is to co-ordinate and standardise the reporting of annual frame and catch assessment surveys results.

The project has provided assistance to ongoing surveys in the four riparian countries and organised extra activities to collect supplementary information not covered by the ongoing surveys. This particularly concerns the collection and collation of historical data from the four riparian countries.

A preliminary result of this subcomponent is the finding that catches are still increasing lake-wide due to the introduction of more efficient artisanal fishing units.

# 7. Fish Genetics

For the RAPD-DNA PCR population analyses, a total of 1176 individual samples of the two clupeid species and the four *Lates* species were collected. The aim of the study is to find indications of stock separation within species. The analyses carried out so far as documented in GCP/RAF/271/FIN-TD/27

indicate that *L. miodon* and *S. tanganicae* do indeed show some separation. However, the analysis is as yet based on inadequate sample sizes and future sequencing is definitely needed to confirm the preliminary results. The results analysing pelagic *Lates* species are not yet available.

This programme may provide vital information as to the identity of the fish stocks to be managed. Nevertheless, in view of the large numbers of samples required and the high cost of analysis, the project should carefully examine the feasibility to continue further such work applying DNA-sequencing techniques.

#### 8. Remote Sensing

Remote sensing is used in observing the expected upwelling events in the lake, largely by using temperature data provided by NOAA/AVHRR (source: Eurimage). The aim is to relate observed lake temperature patterns with the hydrodynamic model and subsequently with the primary production findings. Initially, also chlorophyll data analysis was planned. However, this has proven to be difficult due to high variation in lake water transparency and several conceptual difficulties involved in the methodology.

So far, mainly the technical specifications for processing NOAA AVHRR HRPT data in Kuopio have been established (Geometric correction, Normalised Difference Vegetation Index, Brightness Temperature, Temperature SST. The University of Kuopio has allocated an amount of US\$ 100,000 for image processing hardware and programmes.

The satellite imagery subcomponent is without doubt one of the key contributors to the further understanding of the dynamics of Lake Tanganyika. As the subcomponent mainly targets calibration procedures at present, results are not yet available to evaluate the output of this exercise.

A substantial obstacle in the remote sensing procedure is the time required to obtain images from Eurimage. Results of this method rely largely on the possibility to obtain simultaneous ground truth data (phytoplankton, temperature, limnology) *ex situ*. Every effort should be made to obtain real time image data directly through the South African receiver station in order to concert lake activities with the observed patterns. Furthermore, there is an evident lack of conceptual framework for the imagery exercise, especially with regard to the general approach to understand the dynamics of the lake. It would be helpful, if a more rigorous hypothesis-testing procedure is

developed in order to link other subcomponent results with the

## 9. Scientific Coordination

imagery work.

The University of Kuopio, Finland, is responsible for the scientific co-ordination of LTR. Prof. Ossi V. Lindqvist has served as chairman of the International Scientific Committee,

with Prof. Hannu Mölsä as a deputy. The scientific co-ordination activities during both the preparatory phase and the project operational phase have included, *inter alia*, the following tasks:

- Planning of the scientific programme for the LTR (6 subcomponents).
- Planning, co-ordination and support of the consultations of Finnish scientists.
- Maintenance and technical support of the LTR Home Office in Kuopio.
- Planning and monitoring of the training components of some subcomponents together with course or programme leaders.
- Involvement in the technical planning of the Project including and equipment, infrastructure research the stations, laboratories and field equipment, the research boats, and R/V Tanganyika Explorer. In addition, the scientific co-ordinators have been involved in the procurement and purchase of scientific equipment for the stations and the laboratories, the boats and the research vessel.
- The University of Kuopio, together with some other national organisations, has taken the financial responsibility of the remote sensing component, with investments and operations costs running up to 0.5 mill. FIM. so far.
- Scientific follow-up and editing of the project reports. Editing of final manuscripts intended for publication in scientific journals.
- Liaison with FAO/Rome.
- Collect pertinent scientific literature on Lake Tanganyika, tropical limnology and fisheries.
- Public relations and promotional activities both nationally and internationally.

The scientific co-ordination has adequately identified the key elements needed to accomplish this multi-sectoral research effort. The current scientific programme, if fully utilising the historical data available as well as research results from the other great lakes of Africa, is expected to result in novel findings concerning both the dynamics and perspectives for management of Lake Tanganyika.

# 2. Project Activities

Project activities have so far rigorously followed preestablished and published Work Plans. The following activities have been carried out so far:

1. Administrative headquarters in Bujumbura

Administrative headquarters in Bujumbura include the reception, laboratory, library/meeting room and 4 offices, a total of 360  $in^2$ . In addition, 56  $in^2$  storage/depot facilities were renovated and, a 10 car parking lot was constructed.

2. Sub-stations at Kigoma, Mpulungu and Kalemie

<u>Kigoma</u>: an extensive rehabilitation of Tanzania's Fisheries Research Institute (TAFIRI) facilities in Kigoma has been carried out. Large number of TAFIRI offices and laboratories, guest-house and one other house have been refurbished.

<u>Mpulungu</u>: The rehabilitation of Zambia's Department of Fisheries (DOF) facilities was completed on 26.06. 1993.

<u>Kalemie</u>: LTR Project Document calls for establishing of a substation in Kalemie by constructing of office, laboratory and guest-house and for modest renovation of CRH station in Uvira. Due to civil unrest and unstable political situation in Zaïre, alternative solutions have been sought. Basic office equipment was provided to CRH in Uvira and arrangements made in Kalemie in order to ensure the daily statistical coverage of the industrial fisheries fleet based there.

3. Establishing a Project Co-ordination Committee (PCC)

All permanent members of LTR's Co-ordination Committee were nominated by their respective Governments. The First Meeting of this Committee was held in Bujumbura from 20 to 22.05.1992. Subsequent meetings took place in Lusaka, Zambia, 14-15.10.1993 and in Kigoma, Tanzania, 28-30.11.1994.

4. Establishing an International Scientific Committee (ISC) All permanent members of the LTR's International Scientific Committee have also been named. So far, three meetings of the ISC have been held simultaneously with the PCC meetings.

5. Confirming arrangements by beneficiary Governments for the free movement of project personnel, equipment and information between the research substations.

All these arrangements have been confirmed by the four beneficiary Governments; thus LTR's personnel, equipment and information can in principle move freely around the lake. The continuing security problems in the area (e.g. in Zaïre) may, however, in practice restrict project activities.

#### 6. Securing a project-wide radio link

Radio equipment has been installed in the project headquarters, in Kigoma, Mpulungu, Kalemie as well as on the R/V Tanganyika Explorer. Similar equipment provided to TAFIRI Headquarters in Dar es Salaam, Tanzania, and to the Department of Fisheries in Chilanga, Zambia, proved to be of little use and has been recovered by the project. Regular radio contact is maintained between the substations. The Kalemie radio is used to communicate fisheries statistics to the project Headquarters at Bujumbura. 7. Providing facilities to other interested researchers

To date LTR has provided these facilities, support and advice to a large number of visiting researchers.

8. Organising in-project training of counterpart personnel and a continuous programme of meetings, seminars and workshops.

Five training courses have so far been organised:

- 1. <u>hydrodynamics</u>- held in Bujumbura from 22 to 27.02.1993. Course leader was Mr. Timo Huttula and a total of 12 persons took part;
- 2. <u>fish\_biology</u> held in Bujumbura from 29.03. to 09.04.1993. Course leader was Mr. Eero Aro and there were 8 participants;
- 3. <u>plankton biology</u> held in Bujumbura from 29.03. to 09.04.1993. Course leader was Dr. Ilppo Vuorinen and 10 persons took part;
- 4. <u>limnology</u> conducted by Dr. P.D. Plisnier in Bujumbura for Burundian and Zairian colleagues from 28 to 28.06.1993 and in Kigoma from 29.06. to 04.07.1993 for our colleagues from Tanzania;
- 5. <u>computer use</u> is a continuing process in all LTR stations; in addition, LTR headquarters staff was trained to use Excel (version 4.0).

A <u>Symposium on Biology. Stock</u> <u>Assessment and Exploitation of</u> <u>Small Pelagic species in the African Great Lakes Region</u> was coorganised and held in Bujumbura from 25 to 28.11.1992. It was attended by 36 participants and 18 observers from 9 countries out of the African region concerned, 2 European countries, Japan and FAO headquarters. 21 papers on the biology, stock assessment and exploitation of small pelagic fish species in Lakes Kivu, Kariba, Victoria, Tanganyika, Itezhi-tezhi, Mweru-Luapula and Malawi/Niassa were presented.

<u>Meeting of Project Managers of stock assessment projects of East</u> <u>African Lakes</u> - was also co-organised and held on 30.11.1993 in LTR headquarters. Six projects were represented: Zambia/Zimbabwe SADCC Fisheries Project, Mweru - Luapula Fisheries Research Programme, UK/SADCC Lake Malawi/Niassa Pelagic Fisheries Project, Belgium/CEPGL Applied Hydrobiology Project, IFIP and LTR.

First Workshop on the Co-ordination and Standardisation of Fisheries Statistics for Lake Tanganyika - this workshop was held in Bujumbura from 26 to 30.07.1993.

<u>Second Joint Meeting of the LTR Co-ordination and International</u> <u>Scientific Committees</u> was held in the Mulungushi International Conference Centre, Lusaka, Zambia from 14 to 15.10.1993.

<u>Sixth Session of the CIFA Sub-Committee</u> for Lake Tanganyika was held in the Mulungushi International Conference Centre, Lusaka, Zambia from 18 to 19.10.1993. 9. Providing a literature and information service to all research workers and participants in the project

LTR Documentation Centre has been established. To date more than 3,000 references have been entered in the Documentation Centre's computer.

### 10. Undertaking PR and information exercises

LTR logo was developed early and LTR stickers produced and distributed widely. LTR Newsletter has been developed and is now published regularly every 3 months. There is a very positive reaction to the LTR Newsletter. At the time of the mission, 12 Newsletters had been issued.

### 11. Establishing project data banks

Data banks were established for each of the LTR's eight research sub-components.

12. Collating and analysing available historical data

The collection, collation and analysis of historical data on Lake Tanganyika has continued after the preparatory phase. This work is co-ordinated by the LTR Biostatistician. Results have been published in the Technical Document series of the project.

13. Organising the procurement of equipment and of the fisheries research vessel and the rehabilitation of three auxiliary vessels.

Considerable delays were experienced in the acquisition of a suitable vessel for lakewide cruises. These are of vital importance for the project's work on lakewide limnological phenomena as well as for acoustic estimates of pelagic fish biomass. Such cruises were scheduled to have taken place from the beginning of the operational phase of the project. No suitable vessels could however be localised, and various other options were explored. The eventual solution of leasing the RIV Tanganyika Explorer (which was yet to be constructed at the beginning of the operational phase of the project) is considered by the mission to have been the only realistic alternative. FAO Headquarters staff (Mr. Turner FlIT, who executed four missions since January 1994) closely monitored the construction according to specifications of the vessel and took active part in its eventual commissioning. Further consultants were required in electronics, fishing gear and vessel construction. At the time of the mission, the project's first lakewide survey programme was underway. Fine tuning of equipment, training of a crew which is totally inexperienced in fishing, calibration of acoustic equipment, test fishing to demonstrate the vessel's ability to sample fish unselectively with its mid-water trawl therefore had yet to be undertaken.

A number of smaller vessels were refurbished (R/V Echo, R/V

Silver Shoal) for local sampling purposes.

In addition to the operations specified in the Project Document, the following activities were undertaken:

- Aerial frame surveys of the lake fisheries.
- Installation of hydrodynamics equipment around the lake
- Preparation of a base line document on ornamental fish trade (publication yet to follow)
- Compilation of Lake Tanganyika Fisheries Directory.

#### C. Government Support

As foreseen in the Project Document, participation of the four national Governments in the project has been limited to the provision of facilities, equipment and staff (for details, see Annex 7). No operational budgets have been made available.

#### D. Project Management

Project Document establishes the basis for the The T'LLK management *i.e.* the creation of two major committees (LTR Coordination Committee and the LTR International Scientific Committee). These Committees have so far met three times, always jointly, as follows: in Bujumbura, Burundi (20-22.5.1992), in Lusaka, Zambia (14-15.10.1993) and in Kigoma, Tanzania (28-30.11.1994).

Operationally, the responsibilities for the LTR management are the following:

# 1. Scientific Co-ordination

The responsibility rests with the University of Kuopio, Finland. Prof. O.V. Lindqvist serves as chairman of the LTR International Scientific Committee and Prof. H. Mölsä as his deputy.

To date the following activities have been undertaken:

- planning of the scientific programme for the LTR;
- planning, co-ordination and support of the Finnish inputs (consultants);
- technical support of the LTRIKuopio office;
- planning and monitoring of the training component with the Finnish subcomponent leaders i.e. for remote sensing, fish genetics, hydrodynamics,
- of zooplankton, energy biology carbon budget and. partially, for fish biology;involvement in equipment procurement for research stations
- and for research vessels;
- editing of reports prepared by Finnish scientists;
- co-ordination of Finnish inputs with FAO/Rome;
- public relations and promotional activities both nationally and internationally;
- and collaboration with other contacts international

organisations and projects;

- frequent meetings with FINNIDA/Helsinki and meetings concerning finances with FINNIDA and FAO/Rome; and
- University of Kuopio, together with some other national organisations, has taken the financial responsibility for the remote sensing subcomponent.

# 2. Field Co-ordination

LTR's Co-ordinator assumes the responsibility for the project's execution in the field. In the period May 1992 to May 1995 he was assisted by the LTR Biostatistician, who took over, in addition to his regular duties, responsibility for the day-to-day planning and monitoring of SSP activities.

General responsibilities of the Field Co-ordinator are listed in the LTR Project Document, under Annex IV (pages 33 and 34 refer).

Considerable efforts have been spent on administrative and financial matters as well as on overall management, training and supervision of both the numerous national counterparts, project staff and consultants.

The mission found the administrative and financial management of the LTR very efficient. With the support from FAO Headquarters, project administration has been largely computerised. Although LTR Headquarters in Bujumbura is overall responsible for reporting to FAO/Rome, both LTR substations of Kigoma and Mpulungu operate their own imprest accounts in local currencies. These are sent every month to LTRIHQ, for verification and onforwarding to FAO/Rome.

The mission expresses its appreciation for the excellent organising skills of the Project Coordinator, who, despite continuing security problems in both Burundi and Zaïre, manages to execute the project's activities as foreseen in the work plans. It should be realised that the project is virtually the only project, which continues to operate under alarm phase three conditions.

#### LTR STATIONS

LTR/Bujumbura: 5 internationals (2 experts + 3 APOs), 8 full time staff and 6 from Burundi and 6 from Uvira, Zaïre + 7 crew of R/V Tanganyika Explorer;

LTR/Kigoma:
3 internationals (1 expert, 1 APO and 1 SSA) and 26 nationals;

LTR/Mpulungu: 3 internationals (1 expert + 2 APOs) and 29 nationals.

LTR SUB-STATIONS LTR/Karonda: 1 national LTR/Kipili: 1 national

LTRINsumbu:	1	national
LTR/Moba:	1	national
LTR/Kalemie:	3	nationals
LTRIUvira:	6	nationals

### E. TECHNICAL AND OPERATIONAL BACKSTOPPING

The LTR operational backstopping is assured by FAO Fisheries Department Operations Service (formerly FIDO, now TCO4) and by the Management Support Unit (formerly FIDX, now FTCO4). Mr. Mike Doeff, Senior Project Operations Officer, was responsible for the entire preparation phase of LTR. For the last two years, this task is handled by Ms. Dora Blessich, Project Operations Officer. Both worked extremely hard and ensured efficient and expedient operational backstopping. Similarly, the LTR received very efficient assistance of Messrs. F. Mancini and L. Criscuolo, both of FIDX.

Three technical divisions of FAO Fisheries Department ensure the technical backstopping of the LTR, *i.e.* the Fishery Resources and Environment Division (FIR), the Fisheries Industries Division (FIR), and the Fishery Policy and Planning Division (FIP). The officers which ensured a timely and very effective technical backstopping are the following: Dr. J. Kapetsky, Senior Fishery Resources Officer, Mr. J. Turner, Senior Fishery Industry Officer (vessels) and Mr. G.V. Everett, Senior Fishery Planning Officer. In addition, the LTR received effective support and assistance from other officers of FAO Fisheries Department. These are:

Ms. J. Collins, Fisheries Branch Library (GI), Mr. J. Fitzpatrick, Director a.i. (FII), Mr. E.J. de Boer, Senior Fishery Industry Officer, Mr. A.R. Smith, Fishery Industry Officer, Dr. T. Petr, Senior Fishery Resources Officer, Mr. S.R. Coppola, Fishery Resources Officer, Mr. J.J. Kambona, Chief, International Institutions and Liaison Service and Mr. G. Ssentongo, Fishery Liaison Officer. Officers of the Marine Resources Service (FIRM) also provided advice.

The mission likes to stress that a number of these backstopping activities were financed from FAO Regular Programme funds. This concerned particularly the services of Mr. Turner in relation to the construction of the research vessel.

# VI. ASSESSMENT OF THE RESULTS

The mission had at its disposal, the various documents presented to the Third Co-ordination Committee Meeting at Kigoma in November 1994 as collected in LTR Technical Document 27. Further documentation consulted by the mission is listed in Annex 3.

The present project phase concentrates on intensive sampling (SSP), of which two annual cycles will have been completed in July 1995. Data collection is at present still in progress, although in some cases their analysis has already started. After this second year of sampling, the project is expected to reduce

its intensive sampling programme considerably and decide on further priorities for sampling. No attempt has as yet been made to integrate conclusions of the various research subcomponents into a preliminary model. This is a vital step which the project should now take. It is therefore definitely too early to expect that a better understanding of the biological basis for fish production would already have been achieved. Data collected has been very extensive, involving all project staff. Although the ultimate analysis may in some cases take ten years to achieve, the prospect for a better understanding of the lake at the end of the project appears to be certainly real, particularly when historical data are incorporated in the analysis with their long and short term trends in fish stock dynamics.

results of the research contracted out The to Finnish also form vital the institutions components for better understanding of the lake's biological production cycle. It is hoped that these reports will be presented, together with the results summarized by the LTR research teams on site, at the Fourth Session of the International Scientific Committee of the project.

Preliminary results appear to indicate that the project's expectations concerning the applicability of the results of the genetics work have been too highly strung. Considerably more funds would be required for this programme to yield acceptable results. However, these activities are suggested to be continued during the project's recommended extension phase.

Although possibly outside the scope of the present evaluation (as this is a voluntary contribution from Kuopio to the project), the mission notes that not much progress has been achieved with the remote sensing component of the project. While the usefulness of satellite data may be limited to temperature measurements, recent experience on Lake Malawi has shown that frequent series of images can successfully be used to provide a whole-lake processes. A synoptic view of fully automated satellite data reception and processing system installed at Lake Malawi provided a total of 76 acceptably cloud-free images of the whole lake from May 1993 to August 1994 (source: NRI 1995. "Real-time monitoring of African aquatic resources using remote sensing").

The mission regrets that no comprehensive document was available outlining research strategies, linkages of the various research subcomponents and listing working hypotheses. The latter could have had direct implications for refined or reduced sampling strategies, and thus have saved considerable time. The definition of such working hypotheses should guide the project in the further logical development of its activities.

It is suggested that a "shuttle paper", summarising current thoughts on lake processes and their interlinkages be made available to all scientific participants of the project. This working paper would provide a forum for the various counterparts to express their hypotheses and views about the trophic relations within the lake. National staff have participated in all activities of the project. Although some of the activities of the project involve high-tech methodologies, of which the continued use after the end of the project is highly unlikely, national staff should normally have the technical capacity to fulfil the continued routine monitoring and sampling duties expected from them.

The actual management of the lake's resources by the four countries, individually and collectively, now needs to be initiated. As there is no tradition in this respect, there is plenty of scope for further work through the project. National Government structures should on the one hand be better used fisheries managers should start asking (e.q. the proper questions to the scientists), and the process of supranational consultations for joint planning, and management of fisheries initiated. This requires training of managers at the national level as well as initial support for the organisation of a regional management body for the lake. The FAO CIFA Subcommittee for Lake Tanganyika has in the past played an important role in bringing the countries together to discuss matters of common interest, but the time has now come for the riparian countries to take their responsibilities and start a process of mutual information and consultation for the rational utilisation of the lake's resources. This should be initiated with the assistance of the project, and reach a stage of maturity where it would qualify for further or other donor support.

The mission considers the management workshop, which will be organised by the project in June 1995, a first important step in the support for the actual management of the lake. Further, more systematic support for this management component should be a major element of the remaining time of the project. This will involve support for additional data gathering in socio-economics as well as for the regional organisational aspects. It would be unrealistic to expect, however, that good regional management could be achieved by mid 1996. The mission recommends that additional support be provided beyond the present NTE date of the project, so that a stage of consolidation and organisational maturity can be reached. A precondition to this further assistance would, however, definitely be an adequate financial commitment from the participating States.

Conservation and biodiversity issues as such do not constitute the principal scope of the project. Reason for this is that a GEF project for Lake Tanganyika targeting environmental issues (specifically pollution prevention) was anticipated to start already in 1994. However, it has become clear that the exhaustive scientific programme is producing results with can be to environmental management of direct interest and the conservation of the biodiversity of the fish stocks. The activities which are directly linked with further environmental considerations are those related to the hydrodynamic modelling (pollutant mobility), fish stock assessment and the pattern of primary productivity (adverse effects of increased suspension sediments mobilised by denudation).

The mission feels that co-ordination of environmental issues, including biodiversity, should be subject of a joint meeting

between the four projects currently being implemented: LTR, the GEF/Tanganyilca, the Belgian CEPGL/CRRHA and the *Speciation in Ancient Lakes* programmes.

There is a clear need to integrate the results of the various environmental initiatives for Lake Tanganyika produced over the last six years. These should be incorporated in the management plan to be developed by LTR and the pollution control plan to be developed by GEF/Tanganyika. So far, these activities have been subject of two international meetings: Resource and Use of Conservation the African Great Lakes (Societas Internationalis Limnologiae, Bujumbura 1989) and Conservation and Biodiversity of Lake Tanganyika (University of Burundi, 1991).

### VII. FINDINGS AND RECOMMENDATIONS

#### A. Findings and Conclusions

Project Objectives and Design

The project aims to address the management of the fisheries of Lake Tanganyika through a research programme meant to elucidate the biological basis for fish production. The mission considers that the lack of research on the pelagic fish stocks and the biological basis for fish production has been correctly identified as one of the major obstacles to meaningful fisheries planning, development and management in Lake Tanganyika. There is a great need for lakewide standardised data gathering, which the project addresses. Support is provided to the four riparian countries in the establishment of national research capacities, but should also incorporate the establishment of an effective supranational management organisation. Immediate objectives of the project are the establishment of a long-term programme for monitoring fish stocks and environmental parameters; the formulation of a regional plan for the management of the fisheries resources and the standardised data collection, analysis and interpretation.

The Project Document provides no clues as to the link between data gathering and the actual application of the research results in effective collaborative management by the four countries, in spite of its recognition of present institutional weaknesses and the general precarious economic situation of the riparian countries. The Mission considers that the research effort deployed should have been matched much more explicitly by (creation and support to the initial) functioning of а supranational management organisation for the lake.

Although the Mission considers that there is nothing wrong with the provision of a solid scientific background to the overall management of Lake Tanganyika's resources, it considers essential (for the sake of sustainability of the project's results) that such information also be used. It is therefore of vital importance that - apart from the scientific capability awareness be created in the four riparian countries of the need for management, continued routine monitoring of the resources and for mobilising adequate national and supranational funds.

Project Implementation

In spite of the difficult political situation in Burundi and the civil unrest in Zaïre, the project has been able to perform most of the expected activities. Project management has been very rigorous and effective. Expertise present in the project is adequate and staff performance has been very good. In July 1995, the intensive period of sampling of the project will have completed its second annual cycle. Government participation in the project has been adequate, and the project has provided on-the-job training in all disciplines.

The mission considers that more frequent project management meetings would have allowed the four countries to participate more actively in the conceptual development of the research programme. The mission realises however that expectations concerning the capacity of the participating institutes may have been overly optimistic.

The mission feels that an additional effort is now required to effectively transfer some Zairian scientists from Uvira to Kalemie for sampling and additional data gathering in the so far unsampled western portion of the lake. Although this was originally foreseen, this did not materialise as their expectations concerning remuneration by the project were unrealistically high. Renewed negotiations should scale these expectations down to an acceptable level.

Considerable delays were experienced in the acquisition of a suitable vessel for lakewide scientific cruises. Of the various options explored, the eventual solution of leasing the RIV Tanganyika Explorer (which was constructed during the operational phase of the project) is considered by the mission to have been the only feasible alternative. At the time of the mission, the project's vital lakewide survey programme had yet to start and prove its applicability and effectiveness. A number of smaller vessels were refurbished (Echo, Silver Shoal) for local sampling.

Project reporting has been quite regular and of good quality. All project activities have been reported on, with most results published in LTR Technical Documents in both English and French. The quarterly project Newsletter is distributed widely and has contributed significantly to overcoming the project's relative geographical isolation.

The project's design, and particularly the external scientific co-ordination and involvement of Finnish institutions has made it rely heavily on the backstopping of the Operations Service of FAO's Department of Fisheries, performance of which has been excellent. Initial administrative problems were gradually overcome and attempts were made to simplify the procedures between FAO and the University of Kuopio. Five Contractual Services Arrangements were concluded with the University of Kuopio for the involvement of Finnish institutions. Delivery of results from some of these participating institutions has been occasionally slow, and the mission recommends a more rigorous follow-up from the side of the scientific co-ordination.

Further significant backstopping from FAO Headquarters was required in relation to the construction according to specifications, subsequent lease and commissioning of the R/V Tanganyika Explorer, its fishing gears and the training of its crew. Adequate backstopping was also provided by other technical divisions of FAO (FIRI, FIRM, FIIT, FIPP, FIPL) and the Fisheries Branch Library.

#### Results of the project

At the time of the mission, intensive data collection was still in progress, although in some cases their analysis had already started. After the end of the second sampling year, the project is expected to drastically reduce its sampling programme and concentrate on lakewide resource surveys and general data will Further sampling requirements have analysis. to be determined on the basis of perceived additional data needs for the management plan. It is hoped that all relevant results of studies contracted out to Finnish institutions will be presented to the Scientific Symposium on Lake Tanganyika in September 1995 or, at the latest, to the Fourth Session of the International Scientific Committee of the project.

National staff have participated in all activities of the project. Although some of the activities of the project involve high-tech methodologies, of which the continued use after the end of the project is unlikely, national staff should normally have the technical competence required to continue statistical data collection, routine monitoring and sampling duties expected from them.

The actual management of the lake's resources by the four countries, individually and collectively, now needs to be initiated. As there is no tradition in this respect, there is plenty of scope for further work through the project. National Government structures should on the one hand be better used fisheries managers should start asking the proper (e.q. questions to the scientists), and the process of supranational consultations for joint planning, and management of fisheries initiated. This requires training of managers at the national level as well as initial support for the organisation of a regional management body for the lake. The FAO CIFA Subcommittee for Lake Tanganyika has in the past played an important role in bringing the countries together to discuss matters of common interest, but the time has now come for the riparian countries to take their responsibilities and start a process of mutual information and consultation for the rational utilisation of the lake's resources. This should be initiated with the assistance of the project, and reach a stage of maturity where it would qualify for further or other donor support.

The mission considers the management workshop, which will be organised by the project in June 1995, a first important step in the support for the actual management of the lake. Further, more systematic support for this management component should be a major element of the remaining time of the project. This will involve support for additional data gathering in socio-economics as well as for the regional organisational aspects. It would be unrealistic to expect, however, that good regional management could be achieved by mid 1996. The mission recommends that additional support be provided beyond the present NTE date of the project, so that a stage of consolidation and organisational maturity can be reached. A precondition to this further assistance would, however, definitely be an adequate financial commitment from the participating States.

The imminent start of the Global Environment Facility project entitled "Pollution control and other measures to protect biodiversity in Lake Tanganyika" offers interesting possibilities for collaboration with LTR. This concerns common research interests like hydrodynamics, fish biodiversity and turbidity induced by suspended sediments. For these issues, the two projects could share the use of RIV Tanganyika Explorer. Further details are to be sorted out concern the use of equipment, premises, library facilities, staffing, etc.

6

#### B. Recommendations

To the Scientific Co-ordinator

• Shift project emphasis from data collection (in July 1995, two full years of data will be available) to analysis, lakewide resource surveys and support to national and regional management, including socio-economic data collection. Prepare a technical document outlining the interlinkages of the various research subcomponents, and make this available to the forthcoming Fourth Scientific Coordination Meeting.

In case that LTR project finishes in mid-1996, the following priority actions will be required:

Project scientific staff should concentrate on data interpretation and synthetic work interlinking the findings of various subcomponents.

Only those SSP variables showing high variability should be sampled after July 1995.

Priority areas are: hydroacoustics, linking zooplankton data with distribution ~tterns of the pelagic fish species, carbon energy budget and primary production.

Effort should be made that basic phytoplankton data is collected.

• Organise more frequent interdisciplinary contacts and technical meetings within the project. Integrate conclusions of various subcomponents and formulate working hypotheses to

be tested in the field as planned jointly by the scientifc coordinator and the field research coordinators. Use such information for the formulation of a draft management plan that can be refined as and when more detailed data become available.

- Through the project's Scientific Co-ordinator, encourage Finnish participating institutions to finalise their contributions/analyses. Where no complete analyses are as yet available, advance information should be provided which can be used for the formulation of above interdisciplinary working hypotheses.
- Concerning the project's publication and information policy:

Full scientific papers, published in peer-reviewed international journals should be favoured in the future. For some reason, not all the technical reports published through FAO have been listed in various international data bases listing subjects by title or key words. This slows down substantially the speed of LTR results being incorporated by the scientific community working outside FAO.

Local participation in publishing should be encouraged. This might be done by providing special training courses in the writing of scientific papers. The LTR Newsletters have provided invaluable help in informing various participants about the activities within the project. The distribution of the Newsletter should be further

widened to cover also various GEF projects globally, as they often struggle with implementation problems of similar kind encountered during the LTR.

Backup of all the LTR documentation centre material outside the participating countries is recommended.

Ornamental fish trade comprises an important sector of fishery. Currently, there are some ten exporters of ornamental fishes in the riparian countries. As many of these fishes are slow reproducers and have highly restricted distributions (e.g. most of the Tropheus species) there is a clear need for an assessment on the sustainability of fisheries related to this trade. If properly managed, the ornamental fish trade is a potential growth area and should be given extra attention during the suggested continuation phase.

To the project Co-ordinator

- Establish a research base in Kalemie, Zaïre, for intensive sampling, using CR11 scientists from Uvira.
- Formulate minimum data requirements for national monitoring of fish stocks and environment. Because of institutional wealcness for research in Fisheries Departments, and for the sake of sustainability, attempt to involve national

Universities of riparian countries in (part of the) research monitoring (e.g. in limnology).

- Provide initial management support to temporary body which should be able to qualify for further external support. This should include training of managers. Socio-economic data gathering.
- Assist in formulation of Governments' request for legal and organisational support to Lake Tanganyika (Fisheries) Organisation.
- Assist in formulation of Governments' request for safeguarding basic historical fisheries data, of which in many cases only a single hand-written table is available (e.g. in Burundi and Tanzania).
- Contribute to the integration of the various regional Lake Tanganyika projects into a single organisation (Lake Basin Authority, with reference centre, library, facilities for visiting scientists, etc.).
- The library and data bank should be safeguarded by establishing a duplicate collection outside the countries involved. A natural location for this backup collection would be the University of Kuopio. Electronic data storing should also be considered by scanning and subsequent installation of a CD-ROM base.
- To facilitate further co-operation and access to data among the scientists and institutions of the four riparian countries, Internet World Wide Web Home page for Lake Tanganyika research and management should be considered. This is suggested to take place jointly with the GEF-Tanganyika project.
- Because of the high cost involved in establishing a documentation centre on Lake Tanganyika issues in every riparian country, development of various CD-ROM products is advised. There is a clear need to place species identification data (especially fish species, zooplankton, phytoplankton) available in a more accessible form than the present cotlatiQw Qt 4oc~wtwev~t~. These i'Afte~ tt~a~ take `~u% fcwx~ 1~t tAxe ciQkw~ using the Linnaeus II procedure (University of Amsterdam) may well prove to be the most suitable. These activities should, again be concerted with the GEF-Tanganyika biodiversity activities.

# To FINNIDA

• There is an urgent need for the project to provide, in addition to the management plan (which is the immediate objective of the project) systematic support for the actual effective national and regional management of the lake. This will involve support for additional data gathering in socioeconomics as well as training of fisheries managers and support for the initial functioning of a regional management organisation. As it would be unrealistic to expect, however, that good regional management can be achieved by mid-1996, the mission recommends a phase of additional support for two and a half years beyond the present term of the project, so that a stage of consolidation and organisational maturity can be reached.

The continuation phase would need to redirect some of the elements of the current phase, which include: (i) special emphasis on management support; (ii) refining of the management plan on the basis of limited new data collection for testing working hypotheses; (iii) the continuation-of lakewide research cruises, which the present project has been unable to perform in view of the late availability of the research vessel. It would also be able to fine tune its activities with the Global Environment Facility project addressing similar management issues in other disciplines. Precondition to such further support would, of course, be adequate financial commitments from the recipient countries for the regional management.

It is of great importance that during the continuation phase, adequate financial support is provided for the finalisation of the scientific usb-programs, the Scientific Sampling Programme (SSP) and the synthesis scientific work as all of these compnents are needed to develop a meaningful management plan for the Lake.

To secure the sustainability of research and management efforts in the Lake Tanganyika region, it might prove necessary to organise training courses for the nationals of the riparian countries in ecology, limnology, fisheries science and conservation biology. The University of Kuopio has informally expressed an interest in organizing such training courses.

To the Governments of the riparian countries

• The allocation of adequate budgets for effective national and regional management of the lake's aquatic resources is a precondition to further exterior support. The mission recommends that such funds be made available, not as a counterpart contribution to a project, but for recurrent annual expenditure.

#### <u>Annex 1</u>

### TERMS OF REFERENCE

# JOINT FINNIDA/FAO EVALUATION MISSION of Research Project for the Management of the Fisheries on Lake Tanganyika (LTR) GCP/RAF/271/FIN

#### I. Background

Lake Tanganyika, extending over  $32,000 \text{ km}^2$ , has valuable fisheries and pelagic fish stocks which are apparently not utilised to their full capacity. These pelagic fish stocks are subject to large seasonal and inter-annual fluctuations, but the biological basis of fish production is incompletely known. The lake has a "poor" oligotrophic appearance and yet its assumed maximum fish production is high, having been evaluated at 90 Kg/ha/yr, or some 295,000 t/yr for the whole lake. This figure, however, is a technical average as natural stock abundances fluctuate widely.

For the management of the fish stocks, a proper understanding of the limnological and hydrological mechanisms present in the lake is essential; such mechanisms ultimately set the upper level for fish production, and determine also the catching methods allowable.

The lake's fish resources are shared by Zaïre (45%), Tanzania (41 %), Burundi (8%) and Zambia (6%), and a close subregional co-operation is essential for the management and exploitation of these common resources. Previous national fisheries research and development projects had shown that independent uncoordinated research programmes could not be expected to provide the required knowledge and data. Also, pollution may pose an increasing threat to the fisheries and to the lake's various other uses. Moreover, being a special type of deep lake, Tanganyika's' limnology and hydrology, in terms of biological and eventual fish production, possess features that can best be approached only on a lake-wide basis.

Based on the above considerations, and following the interest expressed by Finland in supporting a regional activity for the Lake as proposed by FAO, FINNIDA financed the preparatory assistance project GCP/RAF/229/FIN. A project identification mission was undertaken in early 1987, and a formulation mission undertook the preparation of a detailed project document and scientific work plan at the end of 1998.

The LTR project GCP/RAF/271/FIN was approved to start, with funding from FINNIDA, in January 1992 for a duration of five years. FINNIDA contributed the equivalent of US\$ 5,835,425 for five years through end 1995, and an additional amount equivalent to US\$ 357,143 for 1996.

Simultaneously, FAO had negotiated with AGFUND a complementary project (GCP/ RAF/221/AGF) for equipment and training inputs to the regional project up to a budget of US\$ 337,000.

The overall (development) objective of the project is the provision of a rational basis for the maximum exploitation of the fishery resources of Lake Tanganyika, in order to increase the supply of high-protein food to the riparian States, in line with national development goals.

The intermediate objectives are:

(a) the establishment of an agreed ongoing lake-wide modern scientific fisheries research programme with the continuing exchange and utilisation of the research results and experiences at Lake Tanganyika among all four participating States;

(b) the four national research centres each with the capacity (human and logistical) to continue, without duplication of effort, the agreed fisheries research programme independent of major external assistance inputs;

(c) the four national research centres able to provide their Governments with the scientific data and advice required for the further detailed planning of their national development programmes, aimed at the optimum exploitation of their fishery resources at Lake Tanganyika;

(d) the establishment and implementation by the Governments of the four riparian States of a mechanism to co-ordinate the management and exploitation of the pelagic fishery resources of the whole of Lake Tanganyika;

(e) the national research centres each able to provide scientific data and advice to their Governments regarding the overall use of Lake Tanganyika's resources, including also the management of water supplies for the lakeside communities, the combat against pollution, the conservation of the biological and other lacustrmne natural resources.

The immediate objectives are defined as follows:

(1) The establishment before the end of 1996 of an agreed longterm research programme for monitoring of the fish stocks and related environmental parameters, together with adequate basic infrastructure, logistics and trained national personnel to be able to continue this research programme after the conclusion of external assistance.

(2) The formulation within five years of a plan for the management on a subregional basis of the fisheries resources by all four riparian States, based on an adequate understanding of the mechanisms of the lake's limnological, hydrological and hydrographic processes which, through various biological interactions, influence and determine the patterns of fish production in different parts of the lake.

(3) The establishment of uniform methods throughout the lake for the subsequent longer-term collection, analysis and interpretation of new data by the four participating countries, following the compilation and analysis on a subregional basis before the end of 1995, of the already existing and available statistical data on fish yields and fisheries in general, as well as other environmentally related data that are required for fish production estimates.

The counterpart agencies are the Fisheries Directorates of the four riparian countries, who are responsible for the coordination of complementary inputs as necessary for the project's implementation from a variety of other national institutions in each country, including other ministries, universities, etc. Besides, each country collaborates to the project activities through a liaison officer.

The project reports to the Co-ordination Committee, consisting of representatives of participating countries, the donors, and the executing agency, and having an advisory and liaison function. In addition an International Scientific Committee assists in the planning and evaluation of the scientific programme.

The target beneficiaries will be the fisheries directorates of the four riparian countries who should have by the end of the project enhanced capacities to implement on a sustained and coordinated basis the necessary fisheries research and management programmes on the Lake.

The indirect beneficiaries will be the fishing communities and the ultimate beneficiaries will be the entire populations of the four countries in that management of the fish stocks should enable a sustainable fish production and secure supply of fish products.

The project document provided for execution in two phases: a preparation phase of 18 months (January 1992 - June 1993), mainly intended for the establishment of infrastructures and preparation of a detailed scientific research programme, followed by a second operational phase of 3.5 years duration. The first evaluation mission was due in June 1993, but the Second Joint Meeting of the LTR's Coordination and International Scientific Committees (Lu saka, October 1993) proposed that it be replaced by an internal project evaluation based on the LTR Co-ordinator's progress report and a report of the visit by the Project's Scientific Co-ordinator to all LTR main research stations.

The Third Meeting of the LTR's Co-ordination Committee (Kigoma, November 1994) recommended this mission to take place in June 1995, two years since the start of the implementation phase.

#### II. Purpose and Scope of the Evaluation

1. Purpose of the Evaluation

The evaluation will examine experience and results of the LTR

project to date. Its findings and recommendations should help parties concerned to have a better insight into the impact of results achieved as well as the technical aspects requiring improvement. The mission will particularly examine the potential for sustainability of achievements. In the light of findings, the mission will advise on the progress of activities towards the achievement of the project immediate objective and make recommendations as necessary.

### 2. Scope of the Evaluation

The primary scope of the evaluation is to:

- assess the effectiveness of the project in realising its immediate objectives and the extent to which they are likely to be setting the foundation for achieving the intermediate and long-term development objectives;
- assess how adequately the immediate objectives of the project are being attained and how effective they are likely to be in helping to achieve the relevant sectoral development objectives;
- review the efficiency and adequacy in implementation and management of the project;
- identify the factors which may have facilitated or deterred the achievement of the project's immediate and ultimate objectives;
- assess the likely relevance and application of the knowledge gained by participating governments and institutions through the project;
- determine the life span still necessary for the project to achieve its immediate objective and for the participating countries to attain self-sufficiency in planning, managing and monitoring development of the Lake's fish resources.

In carrying out the evaluation, the following points should be addressed with particular emphasis:

a) Clarity, continuing priority and realism of the project's development and immediate objectives, including specification of targets, identification of beneficiaries, linkages with other projects, and prospects of sustainability;

b) Quality, clarity and likely efficiency of design of the project including:

- Any major changes which might have a bearing on the continued relevance of the project;
- relevance of scientific programme to the project's objectives;
- clarity of specification of inputs, activities and outputs (quality, quantity and time frame);
- logical consistency between provision of inputs, execution of activities, production of outputs and progress towards achievement of objectives;
- the managerial and institutional framework for implementation of the work plan.

- c) Efficiency, problems and successes of the project implementation, including:
- quality and timeliness of input delivery;
- managerial and work efficiency;
- implementation difficulties;
- realisation of important prior obligations and assumptions;
- adequacy of monitoring and reporting;
- quality and quantity of administrative and technical support by FAO;
- degree of involvement, co-operation, support and commitment by the governments and integration with other related projects;
- extent and adequacy of FAO's support in terms of provision of all the requisite inputs.
- d) Results of the project, including:
- a full and systematic statement of outputs produced (quantity and quality) as compared with work plans, including appropriateness of the location of activities, relevance of technical choices, services provided by the project and output of trained manpower;
- progress towards achievement of development, intermediate and immediate objectives, including prospects for sustainability and the contribution to institution building in terms of technical and managerial capabilities of counterpart bodies;
- any unplanned effects;
- any significant lesson learned that can be applied in similar projects or programmes.

#### III. Composition, Timing, and Itinerary of the Mission

# 1. Composition of the mission

The mission will be composed of one representative of Finland, one representative of FAO, and one representative nominated by the participating countries. Each participant should have experience of fisheries management and/or fisheries research, preferably related to inland waters in developing countries.

The Government of each visited country is invited to associate itself with the mission's work.

#### 2. Timing and Itinerary of the Mission

The evaluation mission should take place in April 1995. The duration of the mission will be 27 days from 3 to 29.04. 1994.

Three days should be spent for a joint briefing at FAO Headquarters in Rome, followed by three days at the project Headquarters in Bujumbura.

The mission will visit participating countries, (the Project Management will prepare and communicate the exact travel

schedule) for visit of research stations, consultations with government representatives and project staff, FAO Representatives, Representatives of Finland, relevant bodies and institutions involved. They will thereafter spend five days at the project Headquarters for preparation of a complete draft report and two days in Rome for debriefing and presentation of their report.

Although the mission should feel free to discuss with the authorities concerned anything relevant to its assignment, it is not authorised to make any commitments on behalf of FAO and the donors.

# 3. Reporting

The mission leader will have the end responsibility for the final writing, editing and production of the report.

The report should follow the attached outline. The final version of the report should be delivered to FAO Headquarters within 10 days of debriefing in Rome, for onforwarding to the concerned parties. The FAO Representative in the mission will be responsible for submitting the evaluation summary sheet during debriefing in Rome.

# <u>Annex 2</u>

# ITINERARY OF THE MISSION AND KEY PERSONS MET

# Itinerary

25 April 26 April 26-28 April 29 April 29/30 April 02-03 April	Roest travels from Amsterdam to Rome (air) Salo travels from Helsinki to Rome (air) Briefing at FAO Headquarters. Rome - Brussels (air) Brussels - Bujumbura (air) Interviews at LTR project Headquarters, Bujumbura, in the presence of the Burundian mission member, Prof. Balthasar Mpawenavo
03 Max	Bujumbura - Kigoma (boat)
04-05 April	Interviews at LTP station Kigoma
04-05 April	Interviews at LIR Station Rigona Ingreation of D/M Tengenuike Euroleven in Vigeme
04 APIII	Devi
OF Annil	Bay Nigit to Katonga willage
05 April	Peperting
00 APILI 07 Max	Reporting Kigoma Maanda (gar)
07 May	Maanda Sumbawanga (gar)
00 May	Mpallua - Sullipawaliga (Car)
10 May	Interviewa at LTD station Moulungu inspection
IU May	of D/W Gilver Sheel
11 Mor.	Manulungu Lugaka (gam)
11 May	Mpulungu - Lusaka (Car) Migit to Chilongo intonuious with Dimostor of
IZ MAY	Fisheries; in Lusaka at Finnish Embassy and with
	FAO Representative to Zambia
13 May	Lusaka – Dar-es-Salaam (air)
14 May	Reporting, meeting with Tanzanian mission member Mr Oman Karma
15 May	Interviews with FAO Representative, Director of
	Fisheries, Ambassador of Finland to Tanzania,
	and TAFIRI Director General, Kunduchi
16 May	Dar-es-Salaam - Nairobi (air)
17 May	Nairobi - Bujumbura (air)
19 May	Visit to CR11 Headquarters at Uvira (Zaïre) and
	interviews with
	Zairian scientists involved in the project
21 May	Bujumbura - Brussels (air) Brussels - Rome (air)
22 May	At FAO Headquarters. Reporting
23 May	At FAO HQ. Reporting and Debriefing session
24 May	Salo returns to Helsinki, Roest continues
	reporting in Rome
26 May	Roest returns to the Netherlands (Rome -
	Amsterdam, air)

#### Persons met

#### FAO Headquarters, Rome

Ms Dora Blessich, Project Operations Officer (TCO4) Mr Mike Doeff, Senior Project Operations Officer (TCO4) Mr Michael I. Mann, Trust Fund Co-ordinator (TCO4) Mr Paulino Gonzalez-Alberdi, Chief, Fisheries Operations Service (TCO4) Dr Serge M. Garcia, Director, Fishery Resources Division (FIR) Dr James M. Kapetsky, Senior Fishery Resources Officer (FIRJ) Dr Robin L. Welcomme, Chief, Inland Water and Aquaculture Service (FIRI) Mr George V. Everett, Senior Fisheries Planning Officer, (FIPP) Mr Kees Leendertse, Fishery Economist (FIPP) Mr Jeremy M.M. Turner, Senior Fishery Industry Officer (FIIT) Mr Engel-Jan de Boer, Senior Fishery Industry Officer (FIIT) Mr Joel Prado, Fishery Industry Officer (FIH) Mr Frans Teutscher, Fishery Industry Officer (FIIU) Mr John Kambona, Chief, International Institutions and Liaison Service (FTPL) Mr Mike Ansa-Enimim, Fishery Liaison Officer (FIPL) Mr Costa Stamatopoulos, Senior Fishery Data Officer (FIDU) Ms Heda Klein, Personnel Clerk, Management Support Unit (FIDX) Mr David James, Senior Fishery Research Adviser (FID) Mr Robert Moore, Senior Evaluation Officer, FAO Evaluation Service Dr Heimo Milckola, FAO Representative to Malawi Mr Marc S. Bellemans, FAO Consultant Fisheries Bio-Statistician Ms Barbara Cooney, Programme Officer and Alternate GEF Focal Point, DDF Mr Siebren C. Venema, Project Manager GCP/INT/575/DEN.

#### Bujumbura, Burundi

Prof. Balthasar Mpawenayo, Université du Burundi Mr Roger Kanyaru, Director, Département des Eaux, Pêche et Pisciculture (DEPP) Dr Boniface Nyakageni, Technical Adviser, DEPP Mr Sylvestre Bambara, Technical Adviser, DEPP Mr Fidèle Bashirwa, Technical Adviser, DEPP Mr Edouard Nikomeze, Assistant Statistician, DEPP Mr Bernard Ndimunzigu, Assistant Statistician, DEPP Mr Jean Marie Tumba, Assistant Statistician, DEPP Mr Main Vandelanootte, Limnologist, Belgian CEPGL CRRHA Project Mr Mambona wa Bazolana, Fisheries Statistician, Centre de Recherche en Hydrobiologie (CRH), Uvira, Zaïre Mr Kimbadi Sona, Limnologist, CRH Mr Tshibangu Kalala, Hydrobiologist, CRH Mr Kakongozi Bombi, Technician, CRH Dr Luc de Vos, Ichthyologist, CRHHA Project Mr Elef Hadjiandreou, Director, Chantier Naval du Tanganyika Dr George Hanek, FAO Chief Technical Adviser, Lake Tanganyika Research Project (LTR) Mr Eric J. Coenen, FAO Fisheries Biostatistician (LTR) Ms Petra Paffen, FAO APO Fisheries Biologist (LTR) Mr Pekka Kotilainen, FAO APO Fisheries Biologist (LTR) Ms Spes Ndabigeze, Librarian (LTR) Mr Mamert Mamboneza, FAO Administrative Officer (LTR)

#### Kigoma, Tanzania

Mr Deonatus B.R. Chitamwebwa, Ag. Centre Director, TAFIRI Kigoma Mr M.B.S. Kissaka, Research Officer, TAFIRI

Mr A.N.M. Kalangali, Research Officer, TAFIRI Mr E.W. Lyoba, Principal Technician, TAFIRI Mr S.K. Muhoza, Senior Technician, TAFIRI Mr Kimoza Iddi Mohamed, Captain R/V Tanganyika Explorer Mr Nicholas A. Chale, Second Officer, TAFIRI, R/V Tanganyika Explorer Mr J.D. Vaitha, Director, Aqua Products Ltd., Kigoma Mr Piero Mannini, FAO Fisheries Biologist (LTR) Mr Piet Verburg, FAO APO Fisheries Biologist (LTR) Mr Victor Langenberg, FAO APO Fisheries Linmologist (LTR) Mr G. Pajot, FAO Consultant Gear Technologist (LTR) Dr Timo Huttula, LTR Consultant Hydrodynamics Mr Eero Sepp~1~, LTR Civil Engineer Mr Marko Turunen, LTR Consultant Carbon Energy Transfer

# Mpulungu, Zambia

Mr D. Kabakwe, Fisheries Development Officer, Officer-in-Charge, Department of Fisheries (DoF) Mr L. Mwape, Fisheries Research Officer, DoF Mr F. Ngandu, Assistant Training Officer, DoF Mr G. Miindi, Fisheries Officer, DoF Mr M. Banda, Fisheries Assistant, DoF Mr M. Syapila, Fisheries Assistant, DoF Mr R. Shapola, Fisheries Assistant, DoF Mr T. Zulu, Fisheries Assistant, DoF Mr Ch. Lukwesa, Fisheries Assistant, DoF Mr A.R. Banda, Fisheries Assistant, DoF Mr K. Kaoma, Fisheries Assistant, DoF Mr M. Mwenda, Fisheries Assistant, DoF Mr S. Sichivu, Fisheries Assistant, DoF Mr W. Chomba, Fisheries Assistant, DoF Dr Pierre-Denis Plisnier, FAO Fisheries Limnologist (LTR) Ms Els Bosma, FA) APO LTR Fisheries Biologist (LTR)

#### Lusaka, and Chilanga, Zambia

Mr H. Gordon Mudenda, Director, Department of Fisheries (DoF), Zambia Dr Raphael Mubamba, Assistant Director of Fisheries, DoF, Zambia Mr Seppo Kuusiniemi, Second Secretary, Embassy of Finland, Lusaka Mr George Mburathi, FAO Representative to Zambia Ms Norma Springer, FAO Programme Officer, Lusaka

# Dar es Salaam, Tanzania

Mr Thomas W. Maembe, Director of Fisheries, Fisheries Division Mr Harold Mongi, Deputy Director of Fisheries, Fisheries Division Prof. Philip O.J. Bwathondi, Director General, TAFIRI, Kunduchi Mr Oniari M. Karia, Fisheries Planning Officer, Fisheries Division Mr 11am Rantakari, Ambassador of Finland to Tanzania Mr E. Patrick Alleyne, FAO Representative to Tanzania Mr Shahid Najam, Deputy FAO Representative Mr Jim Yonazi, Programme Assistant, FAO Representation Ms Jean Backhouse, Administrative Officer, FAO Representation

# Bujumbura, Burundi

Prof. Gaspard Ntakimazi, Université du Burundi Mr Mulimbwa N'sibula, Fisheries Scientist, CRH Uvira, Zaïre

# Uvira, Zaïre

Dr Baluku Bajope, Director General Centre de Recherches Hydrobiologiques (CRH) Mr Muderhwa Nshombo, Fisheries Scientist, CRH

### <u>Annex 3</u>

### DOCUMENTATION AVAILABLE TO TELE MISSION

- LTR Newsletters 1 -12
- Project Document GCP/RAF/229/F1N
- Terms of Reference Joint FINNIDAIFAO Evaluation Mission GCP/RAF/271/FIN
- LTR Evaluation Mission (April May, 1995) Baseline Document
- Six monthly Progress Reports 1-6
- Budget Revisions F, G, H, I
- FAO Allotment Advice dated 06 January 1995
- List of Inventory Ledgers for Project
- AGFUND GCP/RAF/221/AGF Plan of Operation
- LTR Project's Technical Documents 1 -32 and Field Manuals
- LTR Station Report Fish Biology, 30.10.1994
- Lindqvist & Mikkola 1989. Lake Tanganyika: Review of Limnology, Stock Assessment, Biology of Fishes and Fisheries
- Mikkola and Lindqvist 1989. Report on a Project Mobilization Mission.
- Memorandum Lindqvist-Mölsä dated January 3rd 1995 on the Lake Tanganyika Research Project's Co-ordination Committees' Meeting: Proposal for the Project Continuation
- Contractual Services Agreements 1 5 between FAO and the University of Kuopio
- Memorandum Kato dated 28 March 1994 to Hanek concerning Lake Tanganyilca Fisheries Management Plan
- Statements by University of Kuopio dated 21 April 1995 on status of project scientific co-ordination, fish genetics and remote sensing.
- Rolling Plan and Forward Budget for Tanzania
- GEF Council Meeting: Scope and Preliminary Operational Strategy for International Waters (22-24 February 1994)
- CIFA:DM/LT/93/7. Present status of a Global Environment Facility Programme for Lake Tanganyika.
- Exchange of correspondence between FAO and UNDP concerning inter-agency co-operation for GEF project on Lake Tanganyika, in period December 1993 present
- · Research vessel Lake Tanganyika Explorer. Outline Specifications
- Proposal for 1995 cruise schedule for R/V Tanganyika Explorer
- Cruise plan for hydrodynamics (and limnology and zooplankton) on R/V Tanganyika Explorer in April-May 1995 (4. draft)
- G. Pajot's reports on consultancies to the project

# <u>Annex 4</u>

# CONTRIBUTION OF AGFUND COMPONENT TO THE PROJECT

(Source: Project Progress Reports)

Toyota Landcruiser \* Two computers 486 \* One Smart UPS 900 VA \* One stabilizer 500 VA \* 1 Windows 3.1 \* 1 Wordperfect 5.1 for Windows \* One portable computer 486 \* Two Data Storing Units (D5U)\* Koden 15 inch colour Sonar ESR~150\* Wind direction sensor\* Toyota Landcruiser \* Computer 386 SX 25 MHZ\* chemicals\* Limnos waters samples\* limnological equipment\* Toyota Hi-Lux \*

\* purchased from AGFUND component of project

# Annex 5

# FINANCIAL SITUATION OF GCP/RAF/271/FIN

OFFICE MEMORANDUM

ro: Mr. A. R. Bitar Coordinator, DDFR DATE: 28 March 1995

ECELLOTE Supervisor, Trust Fund Unit, AFFF

#### SUBJECT: Financial situation of GCP/RAF/271/FIN

We have now received the final payment from Finland for GCP/RAF/271/FIN and so I am able to give you a final US dollar position of the funds available to the project, which you may wish to use in order to fine-tune the budget.

Funds received from Finland:

	Date	<u>Finnish Marks</u>	<u>US\$</u>
	1991	7,750,000	1,772,644
	1992	900,000	199,071
	1992	5,100,000	1,075,269
	1992	900,000	182,463
	1994	5,250,000	949,384
	1995	4,750,000	1,089,125
	Total	24,650.000	5,267,956
Plus:	From General	Income Account	350.000
	Total funds m	<u>5,617,956</u>	
Interes	<u>st</u>		·

174,504
(61,586)
(2.000)
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# TRUST FUND BUDGET REVISION (5 APRIL 1995)

Annex 6

# Annex 7

# GOVERNMENT SUPPORT TO THE PROJECT

#### 1 BURUNDI

# 1.1 Personnel

#### In Bujumbura

07.93-09.94: 5 assistant biologists 10.94-06.95: 6 assistant biologists <u>sub-total</u>: 1,357 man/days

In Karonda <u>sub-total:</u> 96 man/days 09.93-06.95: 1 assistant biologist

TOTAL = 1,453 man/days @ 851 FBu/day = 1,236,503 FBu

1.2 R/V	Sangala	
208 days	@ 20,641 FBu/day =	4,293,328 FBU
TOTAL CO	ONTRIBUTION	5,529,831 FBU

US dollar equivalent @ 238 FBU

# 2 TANZANIA

#### 2.1 Personnel

#### In Kigoma

07.93-06.95: 6 researchers + 9 technicians <u>sub-total</u>: 3,120 man/days

\$ 23,234

#### In Kipili

07.93-06.95: 1 beach recorder sub-total: 206 man/days

# TOTAL = 3,326 man/days @ 1,454 Tshs/day = 4,836,004 Tshs

# 2.2 Infrastructure

1.	3 Offices	1	Library
2	Laboratories	1	Guest house
3	Store rooms	1	APO house
1	Meeting room		

Two years rental value of infrastructures estimated at 15,600,000 Tshs

# 2.3 R/V Echo

208 days @ 50,000 Tshs/day = 10,400,000 Tshs

# TOTAL CONTRIBUTION

30,836,004 Tshs US dollar equivalent @ 521 Tshs \$ 59,186

# **3 ZAIRE**

# 3.1 Personnel

In Bujumbura/Uvira
07.93-06.95: 5 CRH/Uvira researchers <u>sub-total:</u> 1,280 man/days
In Kalemie
09.93-06.95: 2 ECN'T staff <u>sub-total:</u> 428 man/days
In Moba
05.94-06.95: 2 ECNT staff <u>sub-total:</u> 164 man/days
TOTAL 1,872 man/days @ 1000 Z/day = 1,872,000 Z
US dollar equivalent @ 2310 Z = \$ 810

#### 4 ZAMBIA

### 4.1 Personnel

In Mpulungu

07.93-06.95: 3 researchers and 17 technicians <u>sub-total:</u> 8,320 man/days

In Nsumbu07.93-06.95: 1 beach recordersub-total: 208man/days

TOTAL = 8,528 man/days @ 2,727 K/day 23,258,182 K

# 4.2 Infrastructure

5 offices 1 guest house 2 laboratories 1 house for APO 1 meeting room

Two years rent of infrastructures estimated at 8,640,000 K

#### 4.3 R/V Silver Shoal

208 days @ 90,000 K/day 18,720,000 K TOTAL CONTRIBUTION 50,618,182 K US dollar equivalent @ 845 K \$ 59,903