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# REPORT OF THE SEVENTH MEETING OF THE LTR COORDINATION AND INTERNATIONAL SCIENTIFIC COMMITTEES

by

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FINNISH INTERNATIONAL DEVELOPMENT AGENCY

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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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, Democratic Republic of Congo, Tanzania, and 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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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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# TABLE OF CONTENTS

ACKNO	DWLEDGEMENTS	vi
1.Re Co Co	port of the Seventh Meeting of the LTR oordination and International Scientific ommmittees	1
LIST	OF APPENDICES:	
1.	Agenda	10
2.	List of Participants	11
3.	List of Documents	17
4.	LTR Coordinator's Report: Summary of LTR Activities	18
5.	Lake Tanganyika Framework Fisheries Management Plan	24
6.	Collaboration with Other Projects on Lake Tanganyika	37
7.	Strengthening the Future Role of the CIFA Sub-Committee	40
8.	Lake Tanganyika Fisheries Monitoring Programme: Progress Report	42
9.	Summary of the LTR Scientific Report	44

<u>Page</u>

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In addition, we wish to express our gratitude for the effective assistance of Dr. J.E. Reynolds, Dr. D. Gréboval and Mr. G. W. Ssentongo in drafting the adopted report and the effective assistance of Mr. Des Fortes, FAO Administrative Officer, and his staff for their assistance in organizing this meeting.

Further, we wish to record the effective and constructive participation of all members of the LTR Committees and, above all, the effective chairmanship of Mr. Charles Maguswi. Lastly and above all, we wish to record and deeply acknowledge the unprecedented efforts and generous hospitality made by the Government of Zambia.

## REPORT OF THE SEVENTH MEETING OF THE LTR COORDINATION AND INTERNATIONAL SCIENTIFIC COMMITTEES

#### Lusaka (Zambia), 18-21 May 1999

#### OPENING OF THE MEETING

The Seventh Meeting of the Lake Tanganyika Fisheries 1. Research Project (LTR) Coordination and International Scientific Committees and the Eighth Session of the Sub-Committee for Lake Tanganyika of the Committee for Inland Fisheries of Africa (CIFA) were held from 18 to 21 May 1999 in Lusaka, Zambia. The Meetings were attended by representatives from the four Member Countries of the LTR and the Sub-Committee, Burundi, Democratic Republic of Congo, Tanzania, and Zambia, as well as observers Finland, United Kingdom, United Nations from Development Programme (UNDP), African Development Bank, the Scientific, Technical and Research Commission of the Organization of African Unity (OAU/STRC) and the Common Market for Eastern and Southern Africa (COMESA). The list of participants is given in Appendix 2.

2. The Deputy Director of Fisheries of Zambia, Mr. C. Maguswi, welcomed the participants and requested members of each delegation to introduce themselves.

3. In his welcome address, Mr. T. W. Maembe, the Director of Fisheries of Tanzania and Chairman of the LTR Committees since June 1997, highlighted the importance of Lake Tanganyika to the populations of the riparian countries as a good source of protein and employment. Additionally, the Lake also provides for recreation and tourist activities as well as transport and water supply. He stressed the need for strong cooperation, financing mechanisms and legal institutions.

4. The FAO Representative in Zambia a.i., Mr. Andries Bosma, conveyed greetings from the Director-General of FAO, Mr. Jacques Diouf, and the Assistant Director-General of the FAO Fisheries Department for a fruitful meeting. While thanking Finland and the Arab Gulf Programme for the United Nations Development Organizations (AGFUND) for their support to fisheries activities on Lake Tanganyika, the FAO Representative a.i. encouraged them to provide further support and also urged other donors to provide assistance for these activities. He also noted with appreciation the support given to this Session by FAO/Norway Government Cooperative Programme through the FISHCODE Project and the FAO Sub-Regional Office for Southern and Eastern Africa. Representative a.i. expressed gratitude to The FAO the Government of Zambia for accepting to host the LTR Joint Meeting for the third time.

5. The Session was opened officially by Honourable Suresh Desai, Minister of Agriculture, Food and Fisheries. The Minister commended the assistance extended to countries sharing Lake Tanganyika by the Government of Finland through its agency, FINNIDA. He noted with appreciation the technical assistance provided by FAO to participating countries by the LTR as well as the assistance from the World Bank and other donors. The Minister underscored the need for regional collaboration, research and coordinated management measures.

## ELECTION OF CHAIRMAN AND VICE-CHAIRMAN

6. The Meeting unanimously elected Mr. Charles Maguswi, Deputy Director of Fisheries, Ministry of Agriculture, Food and Fisheries, Zambia as Chairman, with Mr. Roger Kanyaru, Director of Fisheries, Burundi as Vice-Chairman.

#### ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE MEETING

7. The agenda was adopted as given in Appendix 1. The documents placed before the Meeting are listed in Appendix 3.

# PROGRESS REPORT OF THE LAKE TANGANYIKA FISHERIES RESEARCH PROJECT

8. The Secretariat introduced the discussion on the basis of document CIFA: DM/LT/99/3.

9. The Committees considered the summary of results of the Scientific Sampling Programme, the *R/V Tanganyika Explorer*, socio-economic studies, Lake Tanganyika Fisheries Management Plan, the Lake Tanganyika Monitoring Programme, the framework for LTR extension under national execution, publications, and LTR Documentation Centre.

10. The Committees congratulated the LTR Coordinator and his staff for their achievements.

11. The Committees expressed concern about the sustainability of the activities begun under the project. It was noted that efforts should be undertaken to find additional sources of funding for the implementation the framework management plan developed by the project. Initial steps have been taken to involve the FISHCODE Project in the final stages of LTR activities, with part of the funding provided by FISHCODE being used for elaborating essential parts of the Framework and part for support of the participation of delegates from each country to the present meeting.

12. The Committees stressed the importance of the Documentation Centre and emphasized that this Documentation Centre should be strengthened for the use of the riparian countries.

13. The Committees renewed its observation that the absence of a research vessel will hinder smooth follow up actions on research lakewide. There is therefore a need for concerted efforts to raise funds for a research vessel that will be used on the lake in future.

The Committees expressed concern about the availability of 14. the project's data to support advanced degree training. The project's data had already been made available to each country on a tape streamer medium in 1996. The data are available for use by all nationals associated with the project for advanced Regarding the further use of the data and the results training. of the project's studies for advanced degree work, all of the publications are in the process of being made available on CD ROM disks as additional essential background. The project data also will be recorded on CD ROM and distributed to the countries. With respect to the participation of the nationals in the use of the data, the authorship of the publications of the project as well as those appearing in scientific journals is testimony to the important role played by the counterparts in the collection, analysis and reporting of the data. Appropriate steps should be taken to ensure security and access to the data as well as funding for further analysis of these data by national researchers.

#### LAKE TANGANYIKA FRAMEWORK FISHERIES MANAGEMENT PLAN

15. This agenda item was introduced by the Secretariat on the basis of document CIFA:DM/LT/99/4 and the following information documents: DM/LT/99/3 (LTR Progress Report), CIFA:DM/LT/99/6 (Strengthening the Future Role of the Sub-Committee), CIFA:DM/LT/99/Inf5 (Lake Tanqanyika Framework Fisheries Management Plan, CIFA:DM/LT/99/Inf6 (Review of Institutional and Legal Aspects Relating to the Management of Lake Tanganyika Fisheries), and CIFA:DM/LT/99/Inf7 (Review of a Monitoring, Control and Surveillance System for Lake Tanganyika Fisheries).

16. The Committees adopted the Framework Fisheries Management Plan (FFMP) as proposed in Part I of document CIFA:DM/LT/99/4. Additionally, the Committees adopted an outline programme for the implementation of the FFMP. The Committees encouraged the implementation of the proposals made for legal, institutional and Monitoring, Control and Surveillance (MCS) requirements to support the FFMP, as stated in Part II of document CIFA:DM/LT/99/4.

17. Subsequently, several interventions were made by members of the Committees and observers on the FFMP:

18. Regarding investment opportunities, it was emphasized that there is need for research opinion on the opportunities for investment in the fisheries of Lake Tanganyika based on scientific data available.

19. Concerning capacity building, it was agreed that priority be accorded to the following: training at all levels;

• creating an institutional mechanism to deal with management of the fisheries, with particular attention to enforcement of fisheries legislation; and

• authorship should be accorded to the local scientists who are the main data collectors.

20. The Committees noted that the main socio-economic issues which require intervention are:

- poverty and the lack of reliable source of income; and
- rapid increase in population around the lake which increases pressure on the fisheries resource.

21. With regard to fisheries legislation, it was noted that members of the Committees should focus attention on harmonized institutional mechanism to ensure that legislation is enforced at national level by all countries sharing Lake Tanganyika.

22. Regarding fisheries conflict, the Meeting agreed that member countries should resolve conflict between industrial and artisanal fisheries by providing acceptable management options.

23. The Committees agreed that research should provide the needed results/outputs to facilitate updating of the legislation or enacting of new regulations.

24. It was agreed that there is a need for a Ministerial Conference, and that the Committees should be assisted by FAO and the projects on Lake Tanganyika to organize this Conference which will deliberate on Lake Tanganyika fisheries.

25. The Committees requested FAO's assistance, more specifically asking the Secretariat of the LTR project to assist member countries in seeking funding from FAO or other sources in order to conduct the following activities:

- make a detailed feasibility study indicating activities and costs to implement the Fisheries Management Plan project for Lake Tanganyika; and
- develop guidelines for adapting the Code of Conduct for Responsible Fisheries applicable to Lake Tanganyika.

26. Concerning the reduction of fishing fleets and limiting catches around Lake Tanganyika, consideration was given to the possibility of preventing further expansion and in some case reducing fishing fleets around the Lake, using the following available scientific information:

- fish stocks are distributed randomly throughout the lake;
  there is upwelling throughout the lake; and
- fish production in 1995 show the following production figures by countries: Burundi (20,000), Democratic Republic of Congo (90,000), Tanzania (50,000) and Zambia (12,000) t.

It was recommended by the Committees that since the southern and northern areas are overfished,

fishing effort should not be allowed in these areas to exceed levels observed in the reference year 1995.

27. It was noted that considering that a fish does not have boundaries and the fishing fleets, both artisanal and industrial are mobile, the allocation of investment in the four riparian sectors of the Lake should be examined carefully.

28. During the ensuing discussions, the OAU delegate thanked the LTR project for inviting OAU to this meeting. He expressed his gratitude to the Government of Zambia for all the facilities made available to the delegates. He highlighted the following:

- training at all levels to provide the required manpower to take over and continue the work; and this issue has been raised at all meetings of the LTR project;
- implementing the FAO Code of Conduct for Responsible Fisheries and the accompanying appropriate guidelines for Lake Tanganyika; and
- involving stakeholders in the development of the guidelines.

29. The Representative of African Development Bank thanked the LTR project for inviting African Development Bank to participate in the meeting and appreciated the high quality of the documents presented. He stressed the need for member countries and the Secretariat to clarify and ascertain the following as soon as possible:

- updating of catch data;
- the factors determining fish productivity in the Lake;
- the status of exploitation of stocks including the demersal fishes; and
- the impact of all human activity in the entire lake basin, external factors impacting the lake and its sustainability.

The African Development Bank representative informed the Committees that the Bank proposes to participate in the financing of the management of fisheries of Lake Tanganyika as a multi-national regional programme. He further informed the meeting that after a general identification mission in Burundi in 1998 the AfDB included the management programme in the pipeline. The assessment of the programme is envisaged for the year 2000. Hence, some important issues need clarification, namely:

- a comprehensive feasibility study needs to be made;
- define an intergovernmental body or structure for the management of the programme;
- submit a funding request to the African Development Bank through the intergovernmental body or structure that is going to created or through individual requests by the four member countries; and
- identify other donors/partners for this programme.

30. The Committees made the following recommendations:

- The LTR Project should fully develop the FFMP Implementation Programme given in the Working Document CIFA:DM/LT/99/ Inf5, and should explore modalities for its execution in collaboration with the African Development Bank.
- The LTR Project should organize and carry out, with the

continuing support of the FISHCODE Programme supported by Norway, and with the support of other donors, a series of national seminars in all four lacustrine States for key officials of the respective national Ministries concerned with fisheries, environmental and other management issues on Lake Tanganyika through which the modalities of the FFMP Implementation Programme can be presented to a Ministerial Conference for endorsement as appropriate.

• A feasibility study should be carried out as soon as possible.

### COLLABORATION WITH OTHER PROJECTS ON LAKE TANGANYIKA

31. The Secretariat introduced agenda item 7 on the basis of document CIFA:DM/LT/99/5. The Committees were informed that the Lake Tanganyika Research Project (LTR) cooperates with three other major projects, which are active on Lake Tanganyika. These are the following: (a) the United Nations Development Programme (UNDP)/Global Environment Facility (GEF) project RAF/92/G32 'Pollution Control and other Measures to Protect Biodiversity in Lake Tanganyika (LTBP)'; (b) the Government of Burundi/African Development Bank project 'Développement de l'Aquaculture et de la Pêche Artisanale (DAPA)'; and (c) the U.S. National Science Foundation supported project 'International Decade for the East African Lakes (IDEAL)'.

32. Members of the Committees noted with appreciation the collaboration between LTR and the GEF programme; and the Inter-Agency Agreement between United Nations Office for Project Services (UNOPS) and FAO. The Committees were also informed about the sharing of resources by both projects and the direct cooperation of the personnel of both projects. The Committees stressed the need for sharing costs related to project equipment which is commonly used.

33. Concern was expressed about the utilization of exotic species in the aquaculture systems being developed by Burundi. It was clarified by the delegation of Burundi that the species to be used are the Nile tilapia (*O. niloticus*) and the trout (*Salmo* spp.). The Nile tilapia will be developed throughout Burundi while the trout will be introduced at high altitude sites in the catchment area of the Nile in northern Burundi. It was further stressed by Burundi that national measures are being taken to control the spread of water hyacinth into Lake Tanganyika and throughout Burundi.

34. The Committees noted with satisfaction the progress made by LTR in building collaborative relations with other programmes related to fisheries of Lake Tanganyika.

35. The Committees recommended that collaboration at national, regional and international levels be further enhanced around Lake Tanganyika.

## STRENGTHENING THE FUTURE ROLE OF THE SUB-COMMITTEE

36. This agenda item was introduced by the Secretariat on the basis of document CIFA:DM/LT/99/6 and also documents CIFA:DM/LT/99/2 and CIFA:DM/LT/99/4.

37. It was noted that the Seventh Session of the Sub-Committee had considered the following options for establishing the Lake Tanganyika Fisheries Organization or Commission:

(i) a regional Working Group under the CIFA Sub-Committee for Lake Tanganyika;

(ii) a Technical Committee with a Permanent Secretariat; and

(iii)an organization based on the model of the Lake Victoria Fisheries Organization.

38. The Committees discussed and adopted the new functions of the CIFA Sub-Committee for Lake Tanganyika to be as follows:

- facilitate discussions for all related fisheries matters, including coastal zone management, environment and water quality;
- promote the exchange and dissemination of fisheries information;
- develop and recommend conservation and management measures;
- facilitate periodic elaboration and implementation of a regional fisheries management plan and its components;
- harmonize national measures for the sustainable utilization of the living resources of Lake Tanganyika;
- advise on the direct or indirect effects of introduction of non-indigenous aquatic animals and plants into the waters of Lake Tanganyika and all the waters connected therewith consistent with the FAO Code of Conduct for Responsible Fisheries and the United Nations Convention on Biological Diversity and any other relevant international instruments;
- facilitate periodic elaboration and implementation of a regional monitoring programme and its components;
- facilitate the harmonization of fisheries regulations for Lake Tanganyika;
- establish ad hoc subsidiary committees to perform some of its functions and subject to such conditions, as the CIFA Sub-Committee for Lake Tanganyika may determine;
- continue to explore ways and means of establishing an autonomous intergovernmental organization or arrangement;
- seek international financial assistance to support fisheries development and management programmes;
- facilitate, recommend and coordinate training and extension activities in all aspects of fisheries;
- report to CIFA at each session on its activities during the preceding inter-sessional period.

39. It was recommended that the lacustrine countries of Lake Tanganyika and FAO take the necessary steps to strengthen the future role of the Sub-Committee in order to fulfill the functions adopted.

# LAKE TANGANYIKA FISHERIES MONITORING PROGRAMME (LTFMP): PROGRESS REPORT

40. The Regional (National) Co-ordinator presented his report which was adopted by the Committees.

41. The following items were discussed and the agreements reached are set out below:

### Regional Co-ordination

It was agreed that the Regional Co-ordinator should be held in a rotational manner. It started with Burundi and will move clockwise, i.e., Tanzania-Zambia-DRC. The following schedule was agreed: Burundi 1/5/1999 31/12/1999; Tanzania 1/1/2000 -31/8/2000; Zambia 1/9/2000 - 30/4/20101 and D.R.C. 1/5/2001 -31/12/2001.

This schedule should be strictly adhered to, and subsequently the LTR Project Co-ordinator should request the modification of the Allotment Advice already issued for the disposal for the Regional (National) Coordinator and modify the reporting schedules of LTFMP accordingly.

## Vehicles and Equipment

It was agreed that each country should get one new vehicle. If the funds are not sufficient, the LTR Project Coordinator should seek the required approvals in order to dispose of the existing "old" vehicles so as to allow for the purchase of the fourth one. It was also agreed that project equipment should remain in the Region. Consequently, the Project Co-ordinator was directed to undertake the required steps to that effect.

It was noted that every research station is ready to start the Monitoring Programme as the equipment required is already available. Further, it was stated that no funds for additional activities nor for additional equipment purchase or repair is presently available. Consequently, all efforts should be made to use local expertise for the repair of the equipment, if required. It was noted that the University of Kuopio has the capability to provide the upkeep of some equipment.

Lastly, it was strongly recommended that all efforts are made to share costs with other projects for commonly used equipment.

## SUMMARY OF THE LTR SCIENTIFIC REPORT

42. The Scientific Co-ordinator presented the summary of the LTR Scientific Report. His presentation highlighted results and conclusions of all major scientific components (SSP), i.e.,: hydrodynamics, limnology and primary production, phytoplankton, zooplankton, fish biology, fish stock assessment, and trophic structure and carbon flows. He concluded his presentation by

pointing out the implications of SSP results for management planning. The Committees recognized the good quality of the scientific work and adopted the report.

43. Observations by the delegates brought into light several concerns. These included the use of the scientific data to consider the appropriate means for regulating the fisheries that could include identification of the most suitable fishing methods and mesh sizes and the possibility of closed seasons and closed areas. In this connection, the Committees recommended the preparation of a report that would be useful to better assess fishery capacity and also would be a convenient source for gauging investment opportunities.

44. Regarding the kinds and locations of investments, it was noted that, biologically, it is almost impossible assess the maximum sustainable catch from the lake. This is due to environmental variability among seasons, years and climatic cycles that makes the availability of resources for fishing highly variable from time to time and from place to place.

# ANY OTHER MATTERS

45. All delegations and observers, *i.e.* Burundi, the Democratic Republic of Congo, Tanzania, Zambia, Finland, African Development Bank, COMESA, DAPA, OAU, LTBP/GEF, expressed their appreciation for the arrangements of the meeting and the fruitful discussions that were held. They all endorsed the development of the Lake Tanganyika Fisheries Research project.

#### ADOPTION OF THE REPORT

46. The report of the Seventh Joint Meeting of the LTR Coordination and International Scientific Committees was adopted on 21 May 1999.

#### APPENDIX 1

# SEVENTH MEETING OF THE LTR'S

COORDINATION AND INTERNATIONAL SCIENTTIFIC COMMITTEES

Lusaka (Zambia), 18-21 May 1999

### AGENDA

- Item 1: Opening ceremony and election of teh Chairman.
- Item 2: Adoption of the Agenda.
- Item 3: LTR Coordinator's Report: Progress Report.
- Item 4: Lake Tanganyika Framework Fisheries Managment Plan.
- Item 5: Collaboration with Other Projects on Lake Tanganyika.
- Item 6: Strengthening the future role of CIFA Sub-Committee.
- Item 8: Summary of the LTR Scientific Report.
- Item 9: Any other matters.
- Item 10: Adoption of the Report.

## List of Participants/Liste des participants

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#### APPENDIX 3

#### LIST OF DOCUMENTS

- 1. CIFA:DM/LT/99/3: Progress Report of the Lake Tanganyika Fisheries Research Project.
- 2. CIFA:DM/LT/99/4: Lake Tanganyika Framework Fisheries Management Plan.
- 3. CIFA:DM/LT/99/5: Collaboration with Other Projects on Lake Tanganyika.
- 4. CIFA:DM/LT/99/6: Strengthening the Future Role of the Sub-Committee.
- 5. LTR/99/7 : Lake Tanganyika Fisheries Monitoring Programme (LTFMP): Progress report.
- 6. LTR/99/8 : Summary of the LTR Sceintific Report.
- 7. CIFA:DM/LT/99/Inf5: Lake Tanganyika Framework Fisheries Management Plan.
- 8. CIFA:DM/LT/99/Inf6: Review of Institutional and Legal Aspects Relating to the Management of Lake Tanganyika Fisheries.
- 9. CIFA:DM/LT/99/Inf7: Review of a Monitoring, Control and Surveillance System for Lake Tanganyika Fisheries.

APPENDIX 4

# SEVENTH MEETING OF LTR COORINATION AND INTERNATIONAL SCIENTIFIC COMMITTEES Lusaka (Zambia), 18-21 May 1999

## PROGRESS REPORT OF THE LAKE TANGANYIKA FISHERIES RESEARCH PROJECT

#### INTRODUCTION

1. During this reporting period the LTR closely followed the recommendations of the seventh Session of CIFA Sub-Committee for Lake Tanganyika and took all necessary actions to meet them, as detailed hereunder.

# RESULTS

# Scientific Sampling Programme

As reported during the seventh Session, the field portion 2. of the Scientific Sampling Programme (=SSP), with the exception of the hydroacoustics studies, was completed on 2 July 1996. A further 2.5 years were required to complete the hydroacoustics studies and the time consuming data analyses of all the SSP Specifically, the hydroacoustics components. studies were completed by recovering the data from the first three acoustics cruises and by executing two additional cruises over the periods  $21^{st}$  of November to the  $10^{th}$  of December 1997 and  $4^{th}$  to  $20^{th}$ January1998 respectively. Data analysis for all SSP components was completed during 1998. A total of 32 Technical Documents have been produced which report on all aspects of SSP activities and findings. The demanding task of synthesising results from all SSP components was undertaken by LTR Scientific Coordinators. This resulted in the LTR Final Scientific Report, completed by late March 1999.

## <u>R/V\_Tanganyika\_Explorer</u>

3. The three year long charter of R/V Tanganyika Explorer came to the end on  $28^{th}$  of April 1998. Both parties signed the certificate of re-delivery 'without reserve' on the same day - a testament to both the quality of the vessel and the quality of the officers and crew who had handled and maintained her to the highest of standards. During the charter period, the vessel undertook 20 lake-wide research cruises and carried out 4 subcharters.

# LTR Socio-economic Studies

4. The first five years of LTR activities were devoted primarily to a programme of ecosystem and fisheries statistic-

related studies. Following the recommendation of the project mid-term evaluation and the decisions of the fifth Joint Meeting of LTR Committees, steps were taken in late 1996 to complement these studies with a series of investigations dealing more directly with local community circumstances and fisherfolk views and values. Beginning in the first half of 1997, the following activities were organised and implemented:

- two socio-economic research planning and training workshops for LTR national counterpart personnel;
- a lake-wide socio-economic survey covering a large sample of landing sites and individual fishers and fish processors and traders in all four countries;
- compilation and analysis of the survey data; and
- preparation and publication of a series of eight Technical Documents providing background on survey preparation and methodology as well as individual country studies and a lakewide synopsis of findings.

The timely and successful execution of all tasks under the project's socio-economic component represents one of the major accomplishments of LTR.

# Lake Tanganyika Fisheries Management Plan

5. On the basis of the SSP results and the socio-economic community studies, the LTR Management Working Group drafted a provisional 'Framework for Regional Fisheries Management'. This document, based on principles laid out in the FAO *Code of Conduct for Responsible Fisheries*, or CCRF, was presented at the sixth Meeting of the LTR Co-ordination Committee (Lusaka,  $22^{nd}$  to  $23^{rd}$  of June 1998). In addition to endorsing the Framework, meeting delegates agreed to series of supportive or accompanying measures in order to facilitate management planning co-ordination and implementation between the four lacustrine States.

6. One such measure proposed by the Working Group was the organisation of 'community referenda'. These were organised and conducted in all four lacustrine States during October 1998, with a view towards:

- informing lakeshore community residents on the outcomes of major LTR studies;
- demonstrating how these outcomes led to the formulation of the provisional regional management framework; and, simultaneously,
- in keeping with CCRF guidelines, obtaining feedback and inputs from local groups in order to strengthen the regional framework.

7. Although time and budgetary constraints limited the geographical scope of the referenda exercise, care was taken in the choice of meeting venues. Meetings in each littoral State were convened at places featuring high concentration of fisherfolk, and there is confidence that a representative cross-

section of local communities and interest groups was achieved. The six basic management propositions that comprise the core of LTR's draft Regional Framework Plan largely met with the local approval and may thus continue to be regarded as valid and legitimate reference points for elaborating management strategy and tactics on a lakewide basis.

8. In keeping with the need to facilitate regional management aims, as recognised by the delegates to the sixth Meeting of the LTR Co-ordination Committee, LTR in late 1988 submitted a request for funding support to the co-ordinators of 'FISHCODE' (GCP/INT/648/NOR), a new interregional project established at FAO headquarters (FISHCODE is an acronym for 'Assistance to Developing Countries for the Implementation of the Code of Conduct for Responsible Fisheries in Fisheries Monitoring, Control and Surveillance (MCS) and, in Improving the Provision of Scientific Advice for Fisheries Management'). This request was approved, and as a result LTR has been able to pursue a number of key initiatives during the first quarter of 1999. These included:

- detailed review and appraisal of existing fisheries legislation and monitoring, control and surveillance (MCS) capacities within the four lacustrine States, and verification of possible legal and institutional modalities in support of regional harmonisation of fishery resource management, leading to recommendations for actions to facilitate implementation of the proposed Regional Management Framework;
- revision and elaboration of the provisional Regional Management Framework into an advanced draft version, incorporating results of updated legal, institutional and monitoring capacity assessments as well as profiles of Accompanying Measures for regional management plan implementation, for presentation to and review by senior fishery officials of the concerned States;
- consultation meeting involving the LTR Management Working Group and FAO technical officers (Rome, 22-26 March1999), during which all the documentation for the eighth Session of CIFA Sub-Committee for Lake Tanganyika and the seventh Joint Meeting of the LTR Co-ordination and International Scientific Committees was reviewed and finalised;
- a series of national seminars in the four lacustrine States for key officials of the respective Ministries concerned with fisheries, environmental and other management issues on Lake Tanganyika, through which the principal elements of the LTR Regional Framework Fisheries Management Plan for Lake Tanganyika was presented and reviewed;
- meetings with major donor agency personnel in order to brief them on the progress of LTR management planning work and to present, for funding considerations, the project profiles for Framework Plan Accompanying Measures; and, lastly,
- arrangements to facilitate the participation of resource users of the four lacustrine States in deliberations of the eighth Session of CIFA Sub-Committee for Lake Tanganyika.

#### Lake Tanganyika Fisheries Monitoring Programme

9. The initial proposal for a Monitoring Programme for Lake Tanganyika was presented during the fifth Joint Meeting of the Co-ordination and International Scientific Committees (Rome, 25-26 November 1996). Subsequently, the LTR Working Group on Monitoring was established. It proposed to monitor a set of abiotic and biotic variables. Its proposal was presented during the 6<sup>th</sup> Meeting of the LTR Co-ordination Committee (Lusaka, 22-23 June 1998). Considering the fact that the Monitoring Programme will be an integral part of the Lake Tanganyika Fisheries Management Plan, executed exclusively by the nationals of the four participating lacustrine States, the Committee made a firm commitment to provide the field staff required for the execution the Monitoring Programme. It further requested that of а detailed programme is prepared including detailed budget, full list of equipment/materials, Terms of Reference for each post, and that the reporting schedules and administrative and financial procedures are fully developed. The project carried out these tasks, successfully, with the assistance of а consultant, towards the end of 1998.

10. It should be clear that the success of the Monitoring Programme will depend not so much on the degree of sophistication of the methods employed as its practicality in the sometimes very difficult working circumstances prevailing in the Lake Tanganyika region. The Programme has therefore been designed with an emphasis on feasibility and simplicity, and with confidence in the commitment and dedication of the national administrators and technical personnel who will assume responsibility for its operation.

# Framework for LTR Extension (1999-2001): National Execution

11. Delegates to the sixth Meeting of the LTR Co-ordination Committee agreed that the Monitoring Programme, under exclusive national execution, should start in early 1999. However, changes in the administrative/financial procedures of FINNIDA (LTR's main donor agency) that came into force in late September 198, have forced a postponement. LTR was requested to propose a new project document justifying its extension (1999-2001). Effective co-operation between the LTR Co-ordinators resulted in the almost immediate preparation of the new project document, in the form of a Framework for Project Extension (1999-2001) and a Project Budget Proposal. These were submitted in early December 1998. While approval 'in principle' was obtained almost immediately, administrative procedures were completed only towards the end of March 1999. As a consequence, the project has met with severe operational constrains which, *inter alia*, have delayed the start of the Monitoring Programme .

12. Despite the delay, LTR has take a number of actions to prepare for national execution of the Monitoring Programme. These were as follows:

- the methodology and procedures for the execution of the Programme have been fully elaborated (LTR Technical Document No. 90 refers). Administrative and financial arrangements follow specifications laid out in FAO Field Programme Circular No. 6/98 which details the UNDP procedures for National Execution (NEX);
- detailed Terms of References for the posts of the Regional (National) Co-ordinator and the Officers-in-Charge of different research stations have been drafted and the relevant authorities of all four lacustrine States requested to officially appoint staff to fill these positions. Mr. Roger Kanyaru was named to become the first Regional (National) Coordinator. The O-i-Cs were named as follows: Mr. D.B.R. Chitamwebwa for Kigoma, Mr. L. Mwape for Mpulungu, Mr. Mulimbwa N'Sibula for Uvira and Mr. S. Badende for Bujumbura;
- specifications and invoice pro-forma for all the equipment and materials required for the execution of the Monitoring Programme have been obtained; and
- all required steps were taken either to allow for the official transfer of LTR equipment to the Governments concerned, or to dispose, according to standard FAO procedures, of obsolete and/or surplus equipment.

## LTR Publications

13. A total of 94 Technical Documents have been produced under the project to date. In addition, a total of 20 LTR Field Guides and Manuals have been issued. Following the decision of the sixth Meeting of the LTR Co-ordination Committee, steps have already been taken to ensure all documents prepared by the LTR, including the LTR Regional Framework Fisheries Management Plan for Lake Tanganyika as well as the LTR Terminal Report, are produced in CD-ROM format. The completion of this task is planned for September 1999. Lastly, it should be noted that a total of 28 issues of the LTR Newsletter have been published. Two additional issues are scheduled, one for July 1999 and a final one for September 1999.

## LTR Documentation Centre

14. Thanks to the effective co-operation of FAO's Fisheries Department Library and many friends and supporters, LTR's Regional Documentation Centre continues to grow. It is extensively used by university students, researchers and consultants.

# <u>Co-operation with Other Projects</u>

15. The details on co-operation with the UNDP/GEF project RAF/92/G32 'Pollution Control and Other Measures to protect Biodiversity in Lake Tanganyika', the Government of Burundi/AfDB project 'Développement da l'Aquaculture et de la Pêche Artisanale (DAPA)' and project IDEAL are provided in document CIFA:DM/LT/99/5.

## LTR PERSONNEL

16. Several changes have occurred in the membership of the LTR Committees during this reporting period. Mr. H.G. Mudenda, the ex-Director of Fisheries of Zambia, was replaced by Mr. Charles Maguswi, the Acting Deputy Director of Fisheries, as a member of the LTR Co-ordination Committee. LTR extends deepest thanks to Mr. Mudenda for his important contribution, and at the same time extends a warm welcome to Mr. Maguswi. There were two changes in the membership of the LTR International S limitations, there was a significant reduction in administrative and support.

# SEVENTH MEETING OF THE LTR COORDINATION AND INTERNATIONAL SCIENTIFIC COMMITTEES Lusaka (Zambia), 18-21 May 1999

#### LAKE TANGANYIKA FRAMEWORK FISHERIES MANAGEMENT PLAN

### PART I. MANAGEMENT PLAN OVERVIEW

#### INTRODUCTION

1. Lake Tanganyika hosts one of the largest inland fisheries in Africa and is a significant source of food and livelihood to millions dwelling within and outside of its basin. The lake and its environs support a wide array of subsistence and commercial activity as well as a remarkable assemblage of tropical flora and fauna, including highly diverse populations of endemic fish, all within a setting of striking scenic appeal. The conservation value of the lake is thus also of prodigious importance.

2. Amidst growing concerns over the environmental status, endangered biodiversity, and possible over-fishing of this unique lake, efforts have been mounted since 1992 through the FAO-executed Lake Tanganyika Research (LTR) Project (GCP/RAF/271/FIN), to investigate Tanganyika's biological production and fisheries potential, and to devise modalities for the optimal management, on a regional scale, of its fisheries resources to serve present and future human welfare and biological conservation needs.

3. This document provides an overview of the draft Lake Tanganyika Framework Fisheries Management Plan (FFMP). Points summarised include:

- a) in Part I, i) use of the FAO Code of Conduct for Responsible Fisheries (CCRF) as a basic normative matrix, and ii) FFMP core elements;
- b) in Part II, institutional, legal and monitoring, control, and surveillance (MCS) aspects relating to the management of Lake Tanganyika fisheries; and
- c) in Table 1, a list of FFMP initial action recommendations.

1. This document should be reviewed in conjunction with related documents CIFA:DM/LT/99/3 (LTR Progress Report), CIFA:DM/LT/99/6 (Strengthening the Future Role of the Sub-Committee), CIFA:DM/LT/99/Inf.5 (Lake Tanganyika Framework Fisheries Management Plan, CIFA:DM/LT/99/Inf.6 (Review of Institutional and Legal Aspects Relating to the Management of Lake Tanganyika Fisheries), and CIFA:DM/LT/99/Inf.7 (Review of Monitoring, Control, and Surveillance for Lake Tanganyika Fisheries).

#### LAKE TANGANYIKA FFMP: POLICY CONSIDERATIONS

2. Assessment of the current state of Lake Tanganyika fisheries across its multiple dimensions -- ecological, socio-economic, legal, and institutional - indicates that management policy needs to be formulated to cope with broad problems inherent to conditions of lacustrine resource system uncertainty and complexity, plural stakeholder interests, and interactions between fishing and other sectors of the wider regional economy.

3. The CCRF provides a framework of basic policy orientation through which these requirements may be accommodated in an integrated fashion. Use of this policy framework requires simultaneous attention to what might be called the 'five principal Ps' of responsible fisheries -- namely:

- a) **Process** (understanding management as dynamic and adaptive in the face of complex and changing circumstances;
- b) Precaution (conservative, least-risk exploitation and development strategies in the face of system uncertainty);
- c) **Partnership** (reliance on co-management approaches involving shared management responsibilities between state fisheries authorities and local stakeholders);
- d) **Proprietorship** (recognition of limitations on rights of resource access and use); and
- e) **Policing** (monitoring, control, and surveillance and enforcement activities to secure the regulation of fishing mortality).

7. The management process is initialised through deliberations on fisheries policy and objectives within the context of existing biological and socio-economic circumstances, including the potentialities they offer and the constraints they impose. Whatever the specifics of the circumstances and the programme of actions elaborated to secure the identified objectives, management transactions must be based on the fundamental recognition that fishing mortality will have to be regulated in some fashion or another. It is a question of maintaining sustainability. As observed in the FAO Technical Guidelines for Responsible Fisheries, No. 4: Fisheries Management,

...the only mechanism available to maintain the biomass and productivity of a resource at a desirable level, at least in wild capture fisheries, is controlling fishing mortality by regulating the amount of fish caught, when they are caught and the size and age at which they are caught. In regulating fishing mortality there are a number of approaches which can be used, and each one will have different implications and different efficiencies for regulating fishing mortality, impact on fishers, feasibility of monitoring, control and surveillance and other facets of fisheries management [FAO 1997:45].

8. With these basic reference points in mind, the following directions for policy are recommended in order to build toward responsible fisheries management on Lake Tanganyika.

### LAKE TANGANYIKA FFMP: INITIAL MANAGEMENT ACTIONS

9. Although LTR studies over the past six years identify a large range of possible management actions for both the harvest and post-harvest sectors, the FFMP has not been formulated as an ambitious 'total package' approach that pretends to deal with all of them here and now. The intent is rather to develop a programme that is as minimal and straightforward as possible at this preliminary stage of regional agenda setting. Once a basic framework for responsible fisheries management is properly established, it would be elaborated, adjusted, and reviewed as part of an ongoing process.

 $10.\,{\tt FFMP}$  core elements relate to those policy initiatives and practical actions that:

- a) are needed to help set the overall management stage (prerequisites for other actions); or
- b) concern problems demanding immediate attention because of potentially serious sustainability impacts.

11. As described below and also further summarised in Table 1, such elements have been identified under six broad headings -- namely: overall policy matrix; partnership and resource access; institutional modalities; legal modalities; possible technical measures to regulate fishing; and possible input controls to regulate fishing.

# A. Adoption of CCRF Policy Matrix

12. First, in order to ensure that the four lacustrine States act with a common set of development objectives in mind, it is recommended that the CCRF be implemented by their respective competent authorities as the policy matrix for the shared fisheries of Lake Tanganyika.

13. It is further and more specifically recommended that the respective competent authorities of the four States, adopt and pursue management policy directions in support of:

- a) adaptive or interactive management practices that allow for adjustments in fishing pressure, and also allow for flexible application of management treatments appropriate to different circumstances encountered around the lakeshore;
- b) multi-disciplinary monitoring capability for measurement of continuity and change across a range of bio-physical and socio-economic parameters, as appropriate to the complexities of ecosystem - human system interactions;
- c) partnerships with local stakeholder groups in management decision-making and in fashioning modalities of enforcement and compliance;
- d) allocation of access and fishing rights at local community levels; and

e) use of integrated development strategies and coastal area management models at the local level, in order to accommodate complex interactions and possible conflicts between fishing and non-fishing activities, and, at national and regional 'macro-levels,' moves to foster economic diversification to reduce pressure on the fishery resource base.

# B. Partnership Arrangements and Local Control of Resource Access

14. Co-management (community-based management, participatory management, partnership management) structures and operational arrangements should be established around the lakeshore.

15. Because attitudes towards co-management appear to vary by country and even to some extent by fisherfolk sub-groupings, comanagement arrangements need to be encouraged in a somewhat flexible manner, depending on local pre-dispositions. Community outreach activities with a strong environmental education component will be crucial for building local awareness and acceptance of responsibility in fisheries regulation decisionmaking and compliance processes.

16.Local attitudes towards various forms of access limitation are not uniform. It is nevertheless the case that a 'free-for-all' or unlimited access regime will be impossible to sustain in the face of growing population pressures within the Lake Tanganyika region.

17. Licensing mechanisms in combination with allocation of use rights by zone or water territory between individual fishing communities would seem to be the most appropriate way of countering the 'race to fish.'

# C. Institutional Modalities

18. It is has been shown through LTR-associated studies and other appreciations of the situation that existing institutional arrangements and legislative frameworks of the four lacustrine States are deficient on a variety of counts and warrant significant review and revision.

19. The suggestions outlined in Part II of this document, for the comprehensive modification of existing fisheries institutional modalities, should be implemented.

# D. Legal Modalities

20. It has also been well demonstrated that existing legislative frameworks of the four lacustrine States as they pertain to Lake Tanganyika are incomplete and warrant significant revision.

21. The programme outlined in Part II of this document, for the comprehensive modification of existing and draft fisheries legislation, should be followed up.

#### E. Possible Technical Measures to Regulate Fishing

22. Approaches to the regulation of fishing mortality include technical measures that restrict gear use and gear specifications, and that impose various types of time-space restrictions on fishing operations.

23. Important examples of possible technical measures to apply in the Lake Tanganyika context are gear type restrictions and area restrictions pertaining to beach seining and industrial purse seining.

## Beach seine restrictions

24. Beach seining is a particularly destructive method of fishing wherever it is practised on the lake, both because it exploits inshore fish habitats and nursery and because it is highly unselective. The beach seine is an especially serious problem in the southern end of the lake, where it inflicts considerable harm on the juvenile stock of *Limnothrissa miodon* but is clearly the gear of choice amongst artisanal fishers.

25. Management measures should aim at the gradual but eventually total retirement/phasing out of beach seining on the lake. As a step towards this objective, 'beach seining prohibited' areas should be identified and established.

26. In Zambia as elsewhere on the lake, initiatives to restrict beach seining would require important complementary measures in the form of environmental education and the opening up of other gear and method options as viable alternatives to the practice.

## Purse seine restrictions

27. Progressive CPUE decline in the industrial fishery in southern waters indicates a decrease of the catchable stock and possible over-exploitation of *Lates stappersii* in southern waters, owing to uncontrolled growth of the industrial fishery. There are also indications of high exploitation pressure on *L. stappersii* within extreme northern waters, though in this case resulting from a concentration of artisanal liftnetting on top of a history of industrial purse seining.

 $28.\,{\rm For}$  this reason, 'off-limits' areas for industrial units should be considered for both the extreme north and extreme south sub-basins.

# F. Possible Input Controls to Regulate Fishing

29. Input control can be used to regulate fishing mortality through the imposition of limits on fishing capacity and effort. Typical mechanisms include licensing ceilings, individual effort quotas on fishing units, and the use of technical specifications to limit the harvesting power of vessels and/or their gear kits.

30. Principal examples of input controls relevant to the Lake Tanganyika situation are licensing ceilings for both the artisanal liftnet fishery and the industrial purse seine fishery.

# Imposition of effort control on liftnet and purse seine fisheries

31. Input or effort controls are indicated with respect to the industrial purse seine fisheries in the south of the lake (overexploitation risk to *L. stappersii*), and the liftnet fisheries throughout the northern end (overexploitation risk to *Stolothrissa tanganicae* on both west and east coasts north of Karonda).

32. It is thus recommended that licensing ceilings be established for both industrial units in the south and liftnet units in the north (waters north of Karonda). In the case of the purse seine fishery, effort should be reduced to levels that prevailed ten years ago. That is, licensing measures should aim at the gradual retirement or transfer to other fishing zones of units that entered the southern fishery within the last decade.

# PART II. INSTITUTIONAL, LEGAL AND MCS ASPECTS RELATING TO THE MANAGEMENT OF LAKE TANGANYIKA FISHERIES

# INSTITUTIONAL FRAMEWORK

# Existing institutional capacities within the four lacustrine States

33. Document CIFA: DM/LT/99/Inf.6 provides a description of the organisational structure of fisheries management institutions. This analysis underscores the limited capacity, both in terms of human and financial resources, of such institutions in all four lacustrine States and concludes that under current circumstances none of these institutions is in a position to effectively carry out the tasks entrusted to them by national legislation.

34. Principal deficiencies common to institutional frameworks were identified and can be summarised as follows:

- a) inadequate budgetary allocation to fisheries sectors by central governments.
- b) inadequate funding for research.
- c) lack of human resources and equipment.
- d) poor to non-existent enforcement of fisheries regulations.
- e) insufficient linkage between central administration and field agents at local level.

35. There is an obvious need for the respective central governments to increase their level of budget allocations to fisheries research and administrative agencies.

36. Increased involvement of local stakeholders in management decision-making and enforcement activities is also indicated as this would improve the overall level of compliance with regulatory measures and thus help to reduce the costs of fisheries administration.

# Regional institutional modalities: Modification of CIFA Sub-Committee Terms of Reference

37. In order for the CIFA Sub-Committee for Lake Tanganyika to function more effectively as a mechanism to facilitate coordination of regional fisheries-related matters, it is recommended that its Terms of Reference be adopted as proposed in document CIFA:DM/LT/99/6.

#### LEGAL FRAMEWORK

#### General

38. Basic fisheries legislation in all four lacustrine States generally provide sufficient legal basis for the implementation of most of the measures proposed in the FFMP, as they vest broad regulatory powers to competent authorities enabling them to regulate virtually all aspects of inland fisheries.

39. Actions that can be immediately undertaken in all four lacustrine States on the basis of existing legal framework to implement or facilitate the measures proposed in the FFMP include:

- a) implementation of the FAO Code of Conduct for Responsible
  Fisheries;
- b) use of existing traditional institutional arrangements and customary fishing rights, where appropriate, for enhancing local control of fisheries resource access;
- c) organisation and conduct of an awareness campaign designed to inform local fishers of FFMP objectives and enlist their support for its implementation.

# Zambia and Tanzania

40. In Zambia and Tanzania, where fishing operations in Lake Tanganyika remain virtually unregulated, it is recommended to draft a comprehensive set of regulations applicable to Lake Tanganyika fisheries, which should address the following tasks:

- a) devise various classes of fishing units or categories of fishing operations;
- b) determine which classes of fishing units are required to carry a fishing license;
- c) determine the number of fishing licenses that can be issued for industrial fishing units;
- d) determine prohibited or authorised methods of fishing and restrictions on certain methods of fishing (e.g. banning or gradual phasing out of beach seining);

- e) establish prohibited fishing areas (for all purposes/for the protection of spawning grounds/in respect of any fishing method or any species of fish);
- f) establish and demarcate prohibited industrial fishing areas and beach seining areas;
- g) establish closed times and/or closed seasons for fishing;
- h) set gear specifications (mesh sizes, height and length of nets and other fishing implements); and
- i) ban the introduction of non-native species of fish and aquatic plants.

## Democratic Republic of Congo and Burundi

40. In the Democratic Republic of Congo and Burundi, it was recommended to review fisheries regulations applicable to Lake Tanganyika in light of the findings and conclusions of the FFMP.

41. In the Democratic Republic of Congo, fisheries regulations applicable to Lake Tanganyika should include provisions for:

- a) banning the introduction of any non-native species of fish and aquatic plants;
- b) limiting the number of industrial fishing licenses that can be issued;
- c) banning beach seining throughout Lake Tanganyika waters falling under the Democratic Republic of Congo jurisdiction; and
- d) reviewing the classification of fishing units with a view to harmonising fisheries regulations.

42. In Burundi, fisheries regulations applicable to Lake Tanganyika should include the following provisions:

- a) banning beach seining throughout Lake Tanganyika waters placed under Burundi jurisdiction;
- b) modifying, if necessary, the limit imposed on the number of industrial fishing licenses that can be issued in the Burundi portion of Lake Tanganyika; and
- c) reviewing the classification of fishing units with a view to harmonising fisheries regulations.

# Harmonisation of fisheries regulations

43. It is reiterated that harmonisation of fisheries regulations is a key element of co-operation in the lake area that would greatly facilitate the implementation of a regional fisheries management plan. In particular, emphasis should be placed on three specific measures:

- a) elaboration of a common classification of fishing units or categorisation of fishing operations;
- b) development of mechanisms of management in partnership; and
- c) improvement of enforcement of fisheries legislation.

#### MONITORING CONTROL AND SURVEILLANCE (MCS)

44. The purpose of MCS is twofold:

- a) ensure compliance with fisheries management rules; and
- b) collect scientific and other information relating to fishing activities to form foundation for the devising of sound fisheries management measures.

44. It was recognised that the widespread failure of fisheries management is generally attributed to the inability of regional organisations, States or local authorities to enforce successfully or otherwise ensure compliance with their fisheries regulations and to monitor closely the behaviour and performance of the fishers. Hence, the necessity of improving the effectiveness of the MCS system to ensure the sustainable use of Lake Tanganyika fisheries resources.

46. Choice of the most suitable MCS system by fisheries managers in any of the four lacustrine States should be based on three considerations:

- a) the cost of the proposed MCS system;
- b) the feasibility of the MCS approach; and
- c) the characteristics of national fisheries.

46. The cost of the proposed MCS system should be commensurate with the value of the fishery to the users or society. The feasibility of a MCS approach heavily depends on human and financial resources available to the various agencies, administrations or institutions responsible for its carrying out. The type of MCS system to be adopted should be tailored to the characteristics of the fishery.

## Lake Tanganyika Monitoring Programme (LTMP)

47. The Lake Tanganyika Monitoring Programme (LTMP) designed under LTR auspices is consistent with the FAO *Code of Conduct for Responsible Fisheries* guidelines as -

- a) feasibility is undeniably one of the underlying principles that guided the devising of the LTMP, as proposed monitoring measures have been thoroughly tailored to the availability of both human and equipment resources in each research station around the lake;
- b) the cost of implementing the LTMP, which will require an estimated US\$ 10,000 per country and per calendar year and another US\$ 10,000 to be made available to the Regional Co-ordinator to carry out his or her functions, has clearly been kept to a minimum;
- c) characteristics of local fisheries have been reflected in the LTMP. The LTMP offers a specific approach for the collecting of data and the monitoring of commercial fisheries in Zambia.

46. A time frame and financial scheme designed to ensure the longterm sustainability of the monitoring programme should be incorporated in the LTMP, bearing in mind that current funding for the LTMP is of limited duration.

47. It is further recommended that a comprehensive set of regulations be developed in all four lacustrine States and that the carrying out of periodic frame surveys, designed to assess the state of the fishing industry, be required by every fisheries legislation.

48. In terms of the feasibility of management measures proposed in the FFMP, it is observed that:

- a) The establishment of prohibited fishing areas (beach seining and industrial fishing) would need to be complemented by the devising of alternative enforcement schemes such as the involvement of fishers and local communities in enforcement activities.
- implementation of licensing ceilings b) The for both industrial fishing units in the south and lift net units in the north should be accompanied by the inclusion of specific the FFMP encouraging provisions in the negotiation and conclusion of access agreements between lacustrine States. Such a measure is designed to ensure the redeployment of fishing units that would no longer be authorised to operate in their traditional fishing grounds.
- c) In view of the fact that licensing systems have never been enforced in the Lake Tanganyika area, and noting also that there is widespread local opposition to the idea of imposing any restriction on individual access to the lake fisheries, a strong educational campaign would be required to accompany the introduction of measures involving licensing as a means to control individual entry into the fishery.
- d) Implementation of measures providing for the control of access by local communities and the establishment of community-based management structures and mechanisms would require sound knowledge of customary fishing rights and traditional authorities around the lake.

52. In order to ensure the proper implementation of the management measures proposed in the FFMP, it is recommended to:

- a) introduce some form of participatory mechanisms in both fisheries legislation in Burundi and Tanzania;
- b) ensure consultation with fishers and other stakeholders prior to the devising of fisheries regulations in all four lacustrine States;
- c) use existing traditional authorities and customary fishing rights, where appropriate, to facilitate control of access to inshore fisheries by local communities;
- d) devise mechanisms of enforcement involving local communities; and
- e) reassess the regime of sanctions provided for in fisheries legislation of all four lacustrine States.

# SUGGESTED ACTION BY THE COMMITTEES

52. The Committees are invited to:

- a) review and adopt the FFMP as proposed in Part I of this document;
- b) consider and adopt a programme for the implementation by the Sub-Committee and the member States of the FFMP; and
- c) further consider and encourage the implementation of the proposals made for legal, institutional, and MCS requirements in support of the FFMP made in Part II of this document.

Table	1.	Lake	Tanganyika	Framework	Fisheries	Management
Plan:	Core	Elements				

INITIAL ACTION	CCRF 'PRINCIPAL	FFMP RECOMMENDED ACTION
AREAS	P' REFERENCE	
	POINT	
A. Overall policy	Process,	1) Implementation of CCRF by
matrix	Precaution,	competent authorities of
	Partnership, Prop	respective States as the policy
	rietorsnip,	matrix for the shared fisheries
	POILCING*	2) Further adopt and purgue
		management policy directions in
	Process•	support of:
	1100000	a) Adaptive or interactive
	Process,	management practices;
	Precaution	b) Multi-disciplinary
		monitoring capability for
	Partnership,	measurement of continuity
	Policing•	and change across bio-
		physical and socio-economic
	Proprietorship,	dimensions;
	Partnership,	c) Partnerships with local
	Policing•	stakeholder groups in
	_	management decision-making
	Process,	and in fashioning modalities
	Precaution•	of enforcement and
		compliance;
		a) Allocation of access and fighing rights at logal
		community levels: and
		e) Use of integrated
		development strategies and
		coastal area management
		models.
B. Partnership		1) Facilitate community-based
and Resource	Partnership•	<b>management</b> (co-management)
Access		structures and operational
	Process,	arrangements.
	Precaution,	2) Provide for <b>community</b>
	Partnership•	outreach activities with a
	Proprietorship,	strong environmental education
	Policing•	component.
		5) Allocate Control of access
		community-based
C Institutional	Partnershin Doli	4) Increase government budget
Modalities	ratenetship,Poil	allocations to figherica
MOUGITUTED	C111g=v	research and administrative
	Partnership.	agencies.
	Policina•	5) Encourage local community
	<b>-</b>	involvement in fisheries
		management decision-making and
	Process•	enforcement activities.
		Modify Terms of Reference for
		CIFA Sub-Committee for Lake
		Tanganyika.
D. Legal		Follow up comprehensive

Modalities	Process,	programme for modification of
	Precaution,	existing and draft fisheries
	Partnership,Prop	<b>legislation</b> , in order to
	rietorship,	correct current situation with
	Policing•	respect to:
		a) Generally outdated state of
		existing legislation;
		b) Inadequate/ non-existent
		regulations applying
		specifically to Lake
		Tanganyika; and
		c) Poor enforcement.
E. Possible	Process,	1) Beach seining. Initiate
Technical	Precaution,	gradual process leading to
Measures to	Policing•	total retirement/phasing out of
Regulate Fishing	/ /	beach seining on the lake.
	Policing•	2) As a step towards this
	-	objective, establish and
	Process,	enforce 'beach seining
	Precaution,	prohibited' areas.
	Policing•	3) For purse seine fishery,
		encourage gradual reduction of
	Poliging	ten wears ago either through
	FOIICING	unit retirement or transfer to
		other fishing zones
		4) As a step towards this
		objective, establish and
		enforce <b>`off-limits' areas for</b>
		industrial units should be
		considered for both the extreme
		north and extreme south sub-
		basins.
F. Possible Input	Process,	Establish and enforce licensing
Controls to	Precaution,	ceilings for both industrial
Regulate Fishing	Policing•	units in the south and liftnet
		units in the north (waters
		north of Karonda).

#### APPENDIX 6

# SEVENTH MEETING OF THE LTR COORDINATION AND INTERNATIONAL SCIENTIFIC COMMITTEES Lusaka (Zambia), 18-21 May 1999

# COLLABORATION WITH OTHER PROJECTS ON LAKE TANGANYIKA

## INTRODUCTION

1. The LTR co-operates with three other major projects, which are active on Lake Tanganyika. These are the following: (a) the UNDP/GEF project RAF/92/G32 'Pollution Control and Other Measures to Protect Biodiversity in Lake Tanganyika (LTBP)'; (b) the Government of Burundi/AfDB project 'Développement de l'Aquaculture et de la Pêche Artisanale (DAPA)'; and (c) the U.S. National Science Foundation supported project 'International Decade for the East African Lakes (IDEAL)'. The details concerning LTR's co-operation with all three projects are now detailed below.

#### LAKE TANGANYIKA BIODIVERSITY PROJECT

2. The objectives and other details of this project were presented at the 6<sup>th</sup> Session of CIFA Sub-Committee for Lake Tanganyika (Lusaka, 16-17.10.1993). Initial co-operative undertakings between the two projects were reported at the 7<sup>th</sup> Session of CIFA Sub-Committee for Lake Tanganyika (Rome, 27-28.11.1996). Since that time the frequency and intensity of contacts between the two project increased considerably resulting in an effective co-operation. Specifically, it consisted of the following actions and activities:

3. Inter-Agency Agreement between UNOPS and FAO - this agreement, designed to meet the specific requirements of LTBP, was signed on 12.1.1996. Under the terms of this agreement the LTR was to provide the LTBP with an improved water circulation model of Lake Tanganyika. This IAA was a major undertaking for the LTR. Lasting two years, and costing some 1 million US dollars, it involving the following key activities:

- preparation of detailed work programme, including the specifications of all required equipment and other materials;
- recruitment of both the international and national hydrologists;
- installation and testing of highly sophisticated Acoustic Doppler Current Profiles (ADCP) and other equipment;
- training of national hydrologists;
- execution of three major lakewide scientific cruises with R/V Tanganyika Explorer (16-27.11.1996; 8-16.4.1997; 24.8-4.9.1997);

- use of the LTR hydrodynamics instruments and data recorders (meteorological stations, water level recorders, Conductivity-Temperature-Dissolved Oxygen profiler, two buoy based workhorse sentinel ADCPs, flow cylinders and sedimentation traps); and
- rigorous data analyses including the numerical modelling.

The final report on this agreement entitled 'Flow, Thermal Regime and Sediment Transport Studies in Lake Tanganyika' was completed in December 1997.

Sharing resources - both projects carry out 4. their activities in co-operation with and using the infrastructures of same national institutions around the lake *i.e.* in the Department of Fisheries in Bujumbura (Burundi) and Mpulungu (Zambia) and in the Tanzania Fisheries Research Institute in Kigoma (URT). This situation provides many opportunities to share resources. Co-operation ranges from sharing the services of the same national scientists and technicians to sharing scientific respective project's technical documentation, equipment, and some administrative support (use of e-mail facilities, etc) at all three main research stations.

5. Direct co-operation - frequent contacts among both the international and national personnel of both projects, at all levels, has encouraged the direct exchange of assistance on technical work. Examples include: (a) participation of the LTBP staff in the preparation of the LTR Monitoring Programme; and (b) participation of the LTR staff in the LTBPs Strategic Action Planning (SAP) activities.

## PROJECT DAPA

6. This is a new project which started in May 1998. It is a project of the Government of Burundi and the African Development Bank (AFDB) and is executed by the Burundi's Ministry of Agriculture and Livestock with the technical assistance of ARCADIS Euroconsult. The project's value is approximately 7 million U.S. dollars and its duration is 4 years.

7. DAPA consists of three segments *i.e.* (a) aquaculture development; (b) fisheries management; and (c) improvement of the artisanal fisheries methods. The latter two are of special interest to this Sub-Committee and LTR. Solid and regular contact has already been established between DAPA and LTR. Collaboration so far consists of: (a) sharing the technical documentation and information; (b) sharing some of the LTR facilities; and (c) technical discussions aimed at the development of Framework Management Plan Accompanying Measures for the northern part of Lake Tanganyika.

## PROJECT IDEAL

8. This project is in preparatory phase. Its objectives are (a) to obtain long, high-resolution records of climatic change in tropical East Africa, and (b) to provide a comprehensive training programme for African students and scientists, and strengthen African institutional capabilities in the aquatic sciences, that will result in research partnership between African and the northern hemisphere limnologists and paleoclimatologists. The financial support has not been fully mobilized, and project activities thus remain rather limited.

9. Collaboration between the LTR and IDEAL to date includes (a) regular exchange of information; and (b) to a partial sub-charter of the R/V Tanganyika Explorer in 1997.

#### SUGGESTED ACTION BY THE COMMITTEES

10. The members of the Committees are invited to consider national, regional and international collaboration around Lake Tanganyika and also provide guidance for enhancing further cooperation on the Lake.

APPENDIX 7

#### REPORT OF THE SEVENTH MEETING OF THE LTR

# COORDINATION AND INTERNATIONAL SCIENTIFIC COMMITTEE

## Lusaka (Zambia), 18-21 May 1999

### STRENGTHENING THE FUTURE ROLE OF THE SUB-COMMITTEE

#### INTRODUCTION

Following the decisions taken at the Seventh Session of the CIFA Sub-Committee for Lake Tanganyika (Rome, Italy, 25-28 November 1996), the Secretariat recommends that the Sub-Committee's Terms of Reference be revised as proposed hereunder.

#### PROPOSED TERMS OF REFERENCE

The functions of the CIFA Sub-Committee for Lake Tanganyika include the following:

- a) facilitate discussions for all related fisheries matters, including coastal zone management, environment and water quality;
- b) promote the exchange and dissemination of fisheries information;
- c) develop and recommend conservation and management measures;
- d) facilitate periodic elaboration and implementation of a regional fisheries management plan and its components;
- e) harmonize national measures for the sustainable utilization of the living resources of the Lake;
- f) advise on the direct or indirect effects of introduction of non-indigenous aquatic animals and plants into the waters of Lake Tanganyika and all the waters connected therewith consistent with the FAO Code of Conduct for Responsible Fisheries and the United Nations Convention on Biological Diversity and any other relevant international instruments;
- g) facilitate periodic elaboration and implementation of a regional monitoring programme and its components;
- h) facilitate the harmonization of fisheries regulations for Lake Tanganyika;

 establish ad hoc subsidiary committees to perform such of its functions and subject to such conditions, as the CIFA Sub-Committee for Lake Tanganyika may determine;

j) continue to explore ways and means of establishing an autonomous intergovernmental organization or arrangement;

k) seek international financial assistance to support fisheries development and management programmes;

- facilitate, recommend and co-ordinate training and extension activities in all aspects of fisheries;
- m) report to CIFA at each session on its activities during the preceeding inter-sessional period.

## SUGGESTED ACTION BY THE COMMITTEES

The Committees are invited to review the revised Terms of Reference and adopt them as appropriate.

APPENDIX 8

#### SEVENTH MEETING OF LTR

#### COORDINATION AND INTERNATIONAL SCIENTIFIC COMMITTEES

## Lusaka (Zambia), 18-21 May 1999

## LAKE TANGANYIKA FISHERIES MONITORING PROGRAMME: PROGRESS REPORT

#### INTRODUCTION

1. The initial proposal for a Monitoring Programme for Lake Tanganyika was presented during the 5<sup>th</sup> Joint Meeting of LTR Coordination and International Scientific Committees in 1996. In 1988, at the 6<sup>th</sup> Meeting of LTR Coordination Committee, the programme was finalized based on the formulation of the LTR Working Group on Monitoring. The same meeting requested that a more detailed programme is elaborated, field tested, detailed budget proposed and the scientific equipment in all research stations verified, etc. All of these tasks were carried towards the end of 1998 and all the details of the Lake Tanganyika Fisheries Monitoring Programme (LTFMP) presented in the LTR Technical Document No. 90.

#### SCOPE OF LTFMP

2. The LTFMP will be an integral part of the Framework Fisheries Management Plan for Lake Tanganyika. Its objective is the continued study of some of the key parameters of the lake ecosystem which are indicators of the lake productivity. It will be carried out on regional basis using the national expertise developed during the LTR project execution in each of the four lacustrine States. Consequently, the local researchers and laboratory technicians attached to the appropriate departments or research institutions will run the LTFMP at each field research station (Bujumbura, Uvira, Kigoma and Mpulungu) which each will be managed by Officer-in-Charge (O-i-C). The O-i-Cs will be responsible for the implementation of the LTFMP under the supervision of the Regional (National) Coordinator to be appointed on a yearly basis among the most experienced national scientists. A reporting system was proposed and will be established to ensure the flow of information among the research stations, the Regional (National) Coordinator and the University of Kuopio, Finland which will assume the overall coordination and supervision of the LTFMP.

#### LTFMP PROGRESS REPORT

3. The following actions were initiated and carried out so far this year:

- 3.1 The LTR Coordinator proposed the Terms of Reference for the post of the Regional (National) Coordinator and the Officers-in-Charge (O-i-C) of different research stations in December 1998. Subsequently the relevant authorities of all lacustrine States were requested to officially appoint staff to fill these positions.
- 3.2 The following persons were subsequently named to fill the above mentioned posts: Mr. Roger Kanyaru as the firts Regional (National) Coordinator, Mr. Saidi Badende as the O-i-C of LTFMP in Bujumbura, Burundi, Mr. Mulimbwa N'Sibula as the O-i-C of LTFMP in Uvira, D.R.C., Mr. Chitamwebwa as the O-i-C of LTFMP in Kigoma, Tanzania and Mr. L. Mwape as the O-i-C of LTFMP in Mpulungu, Zambia.
- 3.3 The LTR equipment supplied to all research stations was verified, list of needed spare parts and other necessities prepared and the laboratories prepared for the start of LTFMP.
- 3.4 Five (5) new computers (MB PII AOPEN AX6BC, 350 Mhz, hard disc 6.4 GB, 17 inch color monitor) were ordered, received, e-mail modem and LTFMP software installed and distributed to all stations.
- 3.5 Specifications and invoice proformas for the new cars were obtained; these will be ordered upon receiving approval from RAFR.
- 3.6 On 6 May 1999, Mr. H. Dagg (RAFR) authorized the Allotment Advices for the national execution as requested by the LTR Coordinator. These were issued to the FAO Representations in Burundi, Tanzania and Zambia for the disposal of the Regional (National) Coordinator and all four O-i-Cs. As specified in the LTR Technical Document No. 90, the disbursement of these funds will follow the procedures concerning the national execution as outlined in the FAO Field programme Circular No. 6/98. As a result of this, the LTFMP was officially started in the D.R.C. on 12 May 1999 and in Burundi the following day.
- 3.7 Authorization of the extension of the assignment of the LTR Coordinator in Burundi was requested and granted by Burundi authorities and approved by the FAO Director General.
- 3.8 Three meetings have already been held with the O-i-Cs of Bujumbura and Uvira to better prepare the activities and to resolve important matters.

# PROPOSED ACTIONS FOR THE COMMITTEES

The Committees are requested to: (a) adopt the LTFMP Progress Report as appropriate; and (b) decide the tenure and rotation system for the appointment of the Regional (National) Coordinator.

#### SEVENTH MEETING OF LTR

## COORDINATION AND INTERNATIONAL SCIENTIFIC COMMITTEES

## Lusaka (Zambia), 18-21 May 1999

#### SUMMARY OF THE LTR SCIENTIFIC REPORT

#### INTRODUCTION

1. The short-term objectives of the Lake Tanganyika Research Project Scientific Programme were set initially

during the project appraisal phase and formulated later at the Project Scientific Coordination Committee, as 'Understanding the mechanisms which are related to the lake's limnological and hydrodynamic processes and which through various biological interactions influence the patters of fish production of the lake'. The Programme, divided into eight sub-components, was expected to provide an adequate reference basis for formulation of a lake-wide fisheries management policy, aiming at the maximum sustainable utilisation of the pelagic fish stocks, so as to supply high-protein food for the human populations of the lacustrine States.

#### IMPLEMENTATION

2. The scientific studies were implemented since 1992 in the three full years Scientific Sampling Programme

that included physical, chemical and biological sampling weekly or fortnightly at three field stations. The field personnel at each station led and supervised by the project's staff and the scientific coordinator ran the Programme. Due to its unique spatial and temporal coverage, the intensive field programme allowed to make seasonal conclusions and to some extent also areal comparisons but the five-year project duration was still quite too short for any reliable long-term observations, conclusions and predictions. A total of 20 lake-wide surveys was executed, using the project's R/V Tanganyika Explorer, for hydrophysical, limnological, fish biological and acoustics studies. The sampling strategy on these surveys were planned as multidisciplinary as possible in order to study the physical and ecological interactions as well as dynamics in the lake pelagics. The hydrodynamic modelling of the lake was tested and validated with comprehensive field data from automatic water recorders and current profilers combined with the level meteorological data on board the vessel and at field stations. Considerable amount of on-the-job training of the counterpart researchers and technicians was provided.

#### HYDRODYNAMICS AND HYDRODYNAMIC MODELLING

3.The hydrophysical studies focused at the wind driven water circulation and current patterns, upwelling of the nutrient-rich hypolimnetic waters, and the general role of these forces in regulating the nutrient and energy distribution in the lake's biological production. Two-dimensional model in vertical plane was used to simulate the thermocline tilting along the main axis of the lake. Later the lake-wide horizontal model together with two high-resolution flow and sediment transport models was developed. Finally, two atmospheric models were used to provide a realistic wind distribution for the flow models.

4. The results in the lake revealed during both seasons a high spatial variation in flow pattern. The horizontal structure of this pattern is dominated by large scale gyres of which location and direction is affected mostly by regional bathymetry and wind forcing. Apart from the classic major upwelling in the southern-most part of the lake, reaching down to 150-220 meters, several areas of upwelling and downwelling were identified elsewhere near shallow shores with peak values occurring during dry season. It was shown the lake-land breeze system as regulated by mountain slopes and trades, highly affects such short-term current patterns. No hypolimnetic effects by incoming river waters could be seen. Strong mixing of surface waters occurred in fairly limited areas of river month.

5. Satelite borne remote sensing technology using NOAA-AVHRR imagery was applied to hydrophysical modelling and to monitoring the temperature variations of lake surface waters. Studies on chlorophyll *a* and related vegetation indices (NDVI) were not suitable to monitor the primary production patterns as the maximal chlorophyll *a* concentration was usually found in quite deep waters (around 30 m) and *in vivo* fluorescence of chlorophyll a often approached zero values during the day due to strong solar irradiance. Ground-truth data obtained from 1-m subsurface thermal sensor on meteo-buoy was used to develop own parameters for temperature data.

### LIMNOLOGY

6. Basic limnological studies have dealt with the distribution and availability of macronutrients, patters of primary production and the seasonal changes in the physical limnology affecting the water chemistry and nutrient regime. The tilting thermocline results in a density imbalance that acts as a store of potential energy. Internal waves of 23 days during the dry and 35 days during the wet season were observed. Vertical mixing, thermocline tilting and upwelling were strongest as expected during the dry, windy season and occurred particularly in the Mpulungu area. These changes were caused by seasonal trade winds. The degree of wind shear stress on the lake surface was strongest in the southern end of the Lake.

1. The access of nutrient rich waters to the productive euphoric layer is the primary factor affecting the phytoplankton production. The level and occurrence of primary production is mainly determined by the partial mixing within the epilimnion and the relation between mixing depth and euphotic depth, which in turn depends on the vertical distribution of temperature relative to ambient irradiance.

2. Fluorescence and chlorophyll a profiles showed the values approaching 1 mg m-3 down to 50-60 m depth, in sunny weather a surface depression around noon, and often a maximum in fairly deep water at 30-40 m. Phytoplankton in Lake Tanganyika is probably thus capable to perform photosynthetic activity in moderately large depths though exposed to limited light intensity.

#### ZOOPLANKTON BIOLOGY

3. Upwelling and mixing create, together with the titling thermocline a more turbulent environment in the south than in the major parts of the lake where the hydrophysical conditions are more stratified. In the south the zooplankton was utilising a vertical space extending down to the depth around 220 m, while in the north the respective depth was only a half of that. Then, on the other hand, the depth range of zooplankton and its migration behavior was not particularly different in the area of Kalemie Strait that was characterized by complex horizontal and vertical flow patterns and frequently varying current directions. Mesozooplankton community in its species composition or biomass revealed no conspicuous gradient in the north-south axis of the lake.

4. Macro-zooplankton communities did not show any consisted areal patterns either. The peak abundances of medusae were found randomly either in he north or in the south, and during many cruises the densities were rather evenly distributed in studies areas. Similarly the shrimp abundance were equally high both in the north and south, though fairly often their densities were at highest in the south. In spite of their modest role in the plankton biomass and production, the atyid shrimps were very important in the diet of pelagic fish.

#### FISH BIOLOGY AND ABUNDANCE

5. The studies in fish biology combine results on basic population parameters of dominant pelagic species catch assessments and stock size and distribution as conducted in catch studies, fish biology analyses, and acoustics surveys. The three target species, *Stolothrissa tanganicae*, *Lates stappersii*, and *Limnothrissa miodon*, in the order of importance, contributed from 63% to 89% of the total catch weight.

6. The catch frequency and CPUE distribution showed S. tanganicae stock is very unevenly distributed in the Lake, during most of the survey months the stock was found in the northern half of the lake from Kalemie area northwards. A clear horizontal migration occurs with post-larval juveniles concentrating offshore in the open areas of the Lake and thereafter the young stages recruiting first to the industrial fishery and then to lift-net fishery closer to inshore areas. Mostly a single major cohort which is recruited during the dry season and makes the exploitable stock during the successive wet season supposes S. tanganicae fishery. The availability of S. tanganicae resources in the local fishing grounds is very irregular, are primarily determined by predation avoidance towards L. stappersii and by prey preference on copepod mesozooplankton.

7. L. miodon is more evenly distributed in the lake than S. tanganicae. The juveniles stock comprising the post larval stage occurs in shallow water the fish are subject to unselective beach seine fishery in certain areas. Large L. miodon occur exclusively offshore outside the range of artisanal fishery.

8. L. stappersii stocks consist apparently of several annual cohorts and therefore the sudden changes in stock size and composition are less likely than those in clupeids. Juvenile and adult L. stappersii stocks co-occur within the same geographical areas but less the juveniles are more mobile in their distribution. Fish biology data or analyses of population genetic discreteness have evidently move and mix among subbasins leading into significant exchange of individuals among different parts of the lake. L. stappersii stocks can, in the managerial point of view, be divided into northern and southern sub components.

9. Only three of the major acoustic surveys gave non-biased results of fish biomasses and abundance distributions. The total biomass of the three dominant species varied between 91,193 through 304,463 tons with 95% confidence limits of 45,014 through 145,577 tons respectively. The areal differences were pronounced and partly caused by real fish mass movements.

#### TROPHIC STRUCTURE

10. Fish biomass of pelagic zone of Lake Tanganyika has been claimed to be exceptionally large in relation to the phytoplankton biomass, and the trophic efficiency to be high at secondary levels. A new view of the trophic structure of Lake emerging from the carbon energy flow and Tanganyika is biological production data obtained at the project indicating the pelagic food webs and production to fall in the avearage range of deep, nutrient poor lakes. New measurements confirmed the relativity low Dissolved Organic Carbon (DOC) levels in the surface waters of Tanganyika suggesting not a major role of Dissolved Organic Matter (DOM). Contrary to earlier claims, the recent results with unique temporal and spatial coverage trophic efficient between indicate the zooplankton and phytoplankton is actually low, and likewise, the fish production seems to be relatively low in comparison with the primary production.

## FISHERIES IMPLICATIONS

11. The assessments of ecosystem structure and production were conducted at the LTR Project in order to study the role of

physical factors in regulating the biological community, the spatial and temporary dynamics within the pelagic food web, and other phenomena affecting the highly fluctuating pelagic fish yield. Although the trophic efficiency and production potential of fish assemblages were studied in detail, the results were primary used in providing the ecosystem level, scientific reference for the establishment of the lake-wide fisheries Management Plan, rather than to submit a single level of MSY or Total Allowable Catch as a planning or management tool. The pelagic fish community and its interactions with the environment on one hand, and with fishermen society on the other, were proven to be much too dynamic and complex by nature to be managed by such static approach.

12. The fish production estimates can be compared with the realized catch that show a clearly increasing trend. Dominated by traditional and artisanal units and therefore subject to uncertainties in data collection, the total annual catch was estimated as 167,000 tons in 1992, and 196,670 tons in 1995. The highest catch amounted in Burundi (111 kg ha<sup>-1</sup> yr<sup>-1</sup> in year 1995) the other figures being 62 kg ha<sup>-1</sup> yr<sup>-1</sup> (Congo), 53 kg ha<sup>-1</sup> yr<sup>-1</sup> (Zambia) and 40 kg ha<sup>-1</sup> yr<sup>-1</sup> from late 1970s is close to the present yield in Burundi where the fishing pressure is highest.

13. The realised catch of the planktivorous fish was in the whole lake about 22%, and in the most heavily fished northern waters 66% of the estimated production; for piscivorous fish in the whole lake the corresponding figure was 70%. These figures suggest that the present fishing pressure in Lake Tanganyika is very high: normally only 20-25% of fish production can be harvested. The catch evolution in the northern-most part of the lake indicates high exploitation pressure on *L. stappersii*. Similarly, the decline of catch per unit effort (CPUE) in the industrial fishery outside Mpulungu indicates a decrease of the catchable stock and possible over-exploitation of *L. stappersii*.

14. The physical, limnological and fish biology studies of the LTR project have provided a strong basis for planning and designing the monitoring programme that will through environmental followup, combined with basic ecological and fish biology data, give indications of significant environmetal changes and trends in fish populations. Monitoring the lake ecology, fish populations and catch provide one reference basis of sustainable fisheries management.

## SUGGESTED ACTION BY THE COMMITTEES

15. The Committees are invited to review and adopt the LTR Scientific Summary as appropriate.