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REPORT OF THE SECOND JOINT MEETING OF THE LTR'S COORDINATION AND INTERNATIONAL SCIENTIFIC COMMITTEES

by

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FOOD AND AGRICULTURE ORGANIZATION
OF THE UNITED NATIONS

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PREFACE

The Research for the Management of the Fisheries on Lake Tanganyika project (Lake Tanganyika Research) 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).

This project aims at the determination of the biological basis for fish production on Lake Tanganyika, in order to permit the formulation of a coherent lake-wide fisheries management policy for the four riparian States (Burundi, Tanzania, Zaïre and Zambia).

Particular attention will be also 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 buildup of effective coordination mechanisms to ensure full collaboration between the Governments concerned.

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GCP/RAF/271/FIN PUBLICATIONS

Publications of the project are issued in two series:

A series of technical documents **(GCP/RAF/271/FIN-TD)** related to meetings, missions and research organized by the project.

A series of working papers **(GCP/RAF/271/FIN-WP)** related to more specific field and thematic investigations conducted in the framework of the project.

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REPORT OF THE SECOND JOINT MEETING
OF THE LTR'S
COORDINATION AND INTERNATIONAL SCIENTIFIC COMMITTEES

Lusaka (Zambia) , 14-15.10 1993

1. The second Joint Meeting of the Coordination and International Scientific Committees of Project GCP/RAF/271/FIN Research for Management of Lake Tanganyika was held from 14 to 15 October 1993 in Lusaka, Zambia.

ITEM 1: OPENING CEREMONY AND ELECTION OF THE CHAIRMAN

2. Mr. G. Mudenda, Director of Fisheries of Zambia welcomed all participants and honorable guests. Then Mr. R. Kanyaru, Director of Fisheries of Burundi, who, in his function as Chairman of the First LTR Joint Meeting of the LTR's Coordination and International Scientific Committees. He thanked the Government of Zambia and Department of Fisheries for hosting the Second LTR Joint Meeting and the Sixth Session of the CIFA Sub-committee for Lake Tanganyika in their country. He noted that the two meetings will enable the delegates to evaluate the work done by LTR during its preparatory phase and to discuss and solve on a regional basis the major problems hampering the development of the Lake Tanganyika fisheries.

3. Mr. George K. Mburathi, FAO Representative in Zambia, welcomed the members of the Committees on behalf of Mr. Edouard Saouma, Director- General of FAO, and of Dr. W. Krone, Assistant Director-General a.i. of FAO Fisheries Department. He thanked the Government of Zambia for hosting the meeting. He expressed gratitude to the Government of Finland for funding of this regional project which can be instrumental in further fostering the cooperation among its member governments. He stressed the need and importance of coordination among the countries bordering the lake for an optimum fisheries management and environmental protection of the shared resources, and invited the international assisting community to enhance such collaboration.

4. Mr. S. Zukas, Minister of Agriculture, Food and Fisheries of Zambia, welcomed all members and Dr. O. Lindqvist, Professor of the University of Kuopio (Finland) and Chairman of the project's International Scientific Committee. He praised the cost-effectiveness and usefulness of having combined the projectís and the CIFA Sub-Committee meetings for Lake Tanganyika. Many international symposia are taking place on place on the need to preserve the environment and the bio-diversity of the Lake Tanganyika. They are an indication of the growing interest of the international community. They were invited to pay due attention to the fisheries management to
ensure the continued availability of an important source of food and employment, without forgetting the interests of the artisan fishermen. The policy measures recently introduced in Zambia would no doubt facilitate the task. Joint effort in implementation of studies

and enforcing measures was an important step towards the ultimate aim of easing the fishing pressure by protection of the lake environment and fishery resources.

5. The Second Joint Meeting of the Coordination and International Scientific Committees was attended by delegates from Burundi, Tanzania, Zambia and Zare, representatives of the University of Kuopio (Finland), observers from various Institutions and countries and FAO. The list of participants is given in Annex 1.

6. Mr. G. Mudenda, Director of Fisheries of Zambia and Tanzania, were elected new Chairman and Vice-Chairman, respectively.

ITEM 2: ADOPTION OF THE AGENDA

7. The Agenda was adopted as presented in Annex 2.

ITEM 3: LTR COORDINATOR'S REPORT: SUMMARY OF LTR'S PREPARATION PHASE (JANUARY 1992 - JUNE 1993)

8. Dr. G. Hanek, LTR's Coordinator, presented a summary of all activities of the LTR preparation phase. All planned activities and some additional activities were carried out in time as given in Annex 3.

9. All delegates congratulated the Project for the good and timely work carried out so far and expressed the hope that it will continue at the same speed in the future.

10. The Zaïrian delegation pointed out that, despite the project document, up to now Zaïre had not received all of the scientific equipment and that the rehabilitation of premises in Kalemie had not taken place. They also expressed the hope that the budget foreseen for Zaïre would be reserved for Zaïre.

11. The LTR Coordinator observed that despite of continuing civil unrest in the country, the Project has been trying to do the maximum to involve the researchers from Uvira and to initiate some activities in the Kalemie-Moba area. He also pointed out that funds destined for Zaïre were not shifted to other countries.

It was also observed that LTR is faced with a budgetary deficit of more than 500,000 US$ due to the devaluation of the Finnish Mark.

ITEM 4: LTR SCIENTIFIC COORDINATOR'S REPORT: LTR SCIENTIFIC SAMPLING PROGRAM

Prof. O.V. Lindqvist, the Project's Scientific Coordinator, presented the details of

the ongoing activities of LTR's Scientific Sampling Program (SSP) and the different sub-components as given in Annex 4. He pointed out that some data collection already started during the preparatory phase and that the SSP became fully operational in July 1993.

14. It was started that an increase of the AGFUND equipment contribution to LTR to relieve its present financial constraints would prove to be very difficult since the agreement between FAO and AGFUND is only renewed periodically. Efforts should be done to explore other sources of additional financing.

15. It was observed that the Scientific Coordinator's report could be longer and more detailed and should be distributed earlier. It was also noted that the participation of national counterparts in the elaboration of LTR Technical Documents/Field Manuals and in data analysis should be ensured.

16. It was also observed that the International Scientific Committee should be more active in regularly planning for LTR's future scientific activities. It was recommended that the two committees meet separately, one day after the other, in order to allow for more detailed discussions.

17. It was agreed to propose the replacement of the first evaluation mission scheduled after the completion of the preparatory phase with an internal project evaluation. This would be based on the LTR Coordinator's progress reports and a report by Prof. O. Lindqvist, the Project's Scientific Coordinator, after his visit to all LTR main stations next week.

ITEM 5: PRESENTATION OF R/V TANGANYIKA EXPLORER

18. Dr. J. Kapetsky briefed the Joint Meeting on the available options to obtain a major research vessel for lake wide specific surveys and on the reasons for chartering a vessel (36 months charter agreement) that will be built according to LTR's specifications and needs. The specifications of the vessel were explained (for details see Annex 5) and detailed plans of the vessel were shown

Delegates raised several questions regarding the research vessel:

a) a vessel to continue surveys after the project ends;
b) why a copy of the charter contract had not been distributed;
c) disposal of the vessels equipment after the charter ends;
d) if there were legal compensation clauses in the contract in case of delays in construction of the vessels, and
e) why the countries were not consulted beforehand.

The FAO delegates noted that

a) the project document does not specifically provide for the purchase of a research vessel;

b) nor for her to be left for the riparian states after project life;
c) that chartering a vessel for projects is common practice in FAO;
d) that the existing smaller research vessels will remain in the countries;
e) that there are standing procedures regarding disposal/transfer of project equipment after project life; and
f) that the contract includes a bank guarantee. Copies of the charter contract will be made available to the riparian countries.

ITEM 6: PROPOSAL OF LTR SCIENTIFIC PROGRAM FOR 1994

21. Prof. Lindqvist introduced the scientific program for the year 1994 as given in Annex 6. He stated that the research program for 1994 will continue generally as planned earlier and is based on the initial results and the experiences from the preparatory phase of 1992 - 1993. Regular ground-truth data collection for remote sensing studies and study of carbon-energy budget will be added in 1994. A major addition to the program will be the main research vessel (hydro-acoustic surveys), planned to became operational by mid-1994. To gain the required data and information of both physical and biological parameters, the LTR Scientific Program in 1994 and onwards will include six main lines of study as follows:

a) hydrological modeling with automatic recorders and field measurements; model development;
b) remote sensing: satellite data analyses combined with ground-truth data to achieve a basic for operational remote sensing;
c) regular weekly, monthly and seasonal sampling of hydrographic, limnology and plankton at each substation to provide continuous background information;
d) regular sampling of fish for population analyses, stock size variation and genetic analyses;
e) combined hydroacoustic-trawl-zooplankton surveys together with measurements of hydrology, primary and heterotrophic production, and microbial communities on board the R/V Tanganyika Explorer; and
f) continuation of fishery statistics through air and ground surveys.

22. It was stated that laboratory rearing of crustaceans is very difficult and thus a more intensive training will be required. These studies will not be carried over a long period of time and will be executed by very qualified scientists. Clarification was sought as to whether LTR plans to cooperate with remote sensing studies at Lake Malawi and whether the LTR aerial surveys would be supplemented by ground frame surveys at the same time. The question of laboratory rearing of crustaceans was clarified. It was explained that there are differences in remote sensing technology used by the Lake Malawi project with that of the University of Kuopio. Nevertheless,

LTR is regularly in touch with Lake Malawi project also on all other scientific matters. Lastly it was noted that all efforts will be made to complement the aerial surveys with ground frame surveys.

23. It was proposed that sampling be expanded to cover the inflowing rivers. It was further stated that satellite images should be made available to participating countries. Prof. Lindqvist responded by saying that the expansion of LTR program is the objective but that there are limitations and that involvement of other projects like GEF is hoped for. Dr. Mubamba asked verification on primary production studies and hydrodynamics (evaporation). The Scientific Coordinator explained that indeed evaporation data will be required for the model. Prof. Sarvala agreed that line measurements are required for primary production studies as to how far in the basic research of fish biology we can enter.

24. It was observed that studies on fish genetics are important but need to be supported by additional biological studies. It was also observed that life histories of pelagic fish species are not know and should thus be studied. Prof. Lindqvist responded that LTR has limitations and that priorities have to be established.

25. It was proposed that the members of the LTR International Scientific Committee should take part in cruises and that LTR should financially support visits to field stations by members of LTR International Committee. Prof. Lindqvist agreed that these visits should be organized and that LTR will consider these arrangements whenever possible.

ITEM 7: DATE AND VENUE OF THE NEXT MEETING

26. Budgetary constraints are a major limitation on meetings. Nevertheless, there is a need to improve communications among the members of particularly the International Scientific Committee. The delegation of Tanzania proposed that the Third Joint Meeting of both committees be held in Kigoma, Tanzania, subject to approval by the Government. Both committees agreed that the Third Joint Meeting of the LTR Coordination and International Scientific Committees be held in the first week of October 1994.

ITEM 8: ANY OTHER MATTERS

27. Cooperation with IAEA (International Atomic Energy Agency). FAO recently received a visit from IAEA, then a proposal outline for LTR to assist the Division of Physical and Chemical Sciences with a study of isotopes in Lake Tanganyika. The proposal involves measurements of isotopes of hydrogen, oxygen and carbon. Measurements are to be taken in vertical profiles in the open lake and at river mouths.

The preliminary evaluation of the proposal is that

(a) part of the sampling program corresponds to the planned program for the R/V Tanganyika Explorer and Sampling for the IAEA study could be accomplished with little extra effort and cost to LTR
(b) the expected results will benefit LTR's hydrodynamic and carbon energy budget sub-programs.

The follow-up be to make an independent assessment of the scientific merit of the proposal, communicate with IAEA to clarify that

a) the results will be submitted for publication as an LTR Technical Paper
b) the cost to LTR will be minimal
c) that sampling must await the research vessel and that rivers are not yet included in the LRT sampling scheme.

30. Should the investigation of scientific merit be positive and should IAEA agree to LTR's conditions, then a formal letter of agreement would be written to cover the isotope study.

31.GEF Project. Dr. George Coulter, mission leader and one of the authors of the GEF project, provided an overview of the essentials as follows: The Project, entitled 'Pollution Control and other Measures to Protect Biodiversity on Lake Tanganyika' is expected to be finally approved within a few weeks after which it will be circulated to the countries for signature.

The project will have four key investigative lines: sediment pollution related to poor land use practices, biodiversity preservation through under-water reserves, lake circulation in order to track pollution and impacts of fishing on biodiversity. The project will operate at four centers corresponding geographically to those of LTR. Regarding staff, there will be a Coordinator, liaison officer and a trainer. Much emphasis is to be put on training particularly in the area of raising environmental awareness. There will be a number of implementing agencies that will operate on a contract basis.

33. The meeting noted that there will be ample opportunities for cooperation between LTR and GEF in scientific, technical and operational areas, particularly with regard to LTR's hydrodynamic studies and in GEFís impacts of fishing. The importance was also noted of establishing the details of the collaboration (avoidance of duplication of scientific investigations, use of the research vessel, sharing facilities, compatibility of equipment, communications and data exchanges) as soon as the GEF project becomes operational. It was stated that a framework for cooperation already exists in the form of UN inter-agency agreements. Thus, putting the interagency mechanism into operation between UNDP and FAO is the first priority.

ITEM 9: ADOPTION OF THE REPORT

34. The Coordination and International Scientific Committees adopted the report on the 15th of October, 1993.

35. The delegation of Burundi thanked all members and encouraged the project to continue with the same vigor.

ANNEX 1.

**SECOND JOINT OF THE MEETING
OF THE LTR'S
COORDINATION AND INTERNATIONAL SCIENTIFIC COMMITTEES**

Lusaka (Zambia), 14 - 15. 10. 1993

LIST OF PARTICIPANTS

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Dr. Boniface NYAKAGENI	Conseiller	Ministère de l'Agriculture et de l'Elevage Département de la Pêche et De la Pisciculture B.P. 631 Bujumbura, BURUNDI

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ZAIRE

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Dr. Gashagaza Masta MUKWAYA	ChargÈ de Recherche	Centre de Recherche en Science Naturelles B.P. 73 Uvira, ZAIRE

ZAMBIA

Mr. H.G. MUDENDA	Director	Ministry of Agriculture, Food And Fisheries Department of Fisheries P.O. Box 350100 Chilanga, Zambia

Dr. R. MUBAMBA	Assistant Director (Fisheries)	Ministry of Agriculture Food and Fisheries Department of Fisheries P.O. Box 350100 Chilanga, ZAMBIA

FINLAND

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Prof. H. MOLSA	LTR Deputy Scientific Coordinator	University of Kuopio P.O. Box 1627 SF-70211 Kuopio, FINLAND
Prof. J. SARVALA	Scientist	Department of Biology University of Turku FIN-20500 Turku, FINLAND

OBSERVERS

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Mr. D.D. BANDULA	Senior Fisheries Officer	SADC Inland Fisheries Unit Department of Fisheries P.O. Box 593 Lolongwe, MALAWI
Mr. R MATIPA	Fisheries Expert	PTA Secretariat P.O. Box 30051 Lusaka, ZAMBIA
Mr. L. MWAPE	Officer-in-Charge	Department of Fisheries Mpulungu Station P.O. Box Mpulungu, ZAMBIA

FAO

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Dr. J. KAPETSKY	Senior Fishery Resources Officer	FAO, FIRI (F-503) Via delle Terme di Caracalla 00100 Rome, ITALY
Mr. G.V. EVERETT	Senior Fishery Planning Officer	FAO, FIPP (F-405) Via delle Terme di Caracalla 00100 Rome, ITALY
Mr. G. SSENTONGO	Fishery Liaison Officer	FAO, FIPL (F-411) Via delle Terme di Caracalla 00100 Rome, ITALY

SECRETARIAT

Dr. G. HANEK	LTR Coordinator	LTR B.P. 1250 Bujumbura, BURUNDI
Mr. E. COENEN	Biostaticien	LTR B.P. 1250 Bujumbura, BURUNDI
Dr. P-D. PLISNIER	Limnologist	LTR B.P. 1250 Bujumbura, BURUNDI
Ms. B. BARICAKO	Secretary	LTR B.P. 1250 Bujumbura, BURUNDI

ANNEX 2.

SECOND JOINT MEETING
OF THE LTR'S
COORDINATION AND INTERNATIONAL SCIENTIFIC COMMITTEES

Lusaka (Zambia), 14 - 15. 10. 1993

ANNOTATED AGENDA

Item 1: Opening ceremony and election of the Chairman

Item 2: Adoption of the Agenda

Item 3: LTR Coordinator's Report: summary of LTR's preparation phase (January 1992 - June 1993)

Item 4: LTR Scientific Coordinator's Report: LTR Scientific Sampling Programme

Item 5: Presentation of R/V Tanganyika Explorer

Item 6: Proposal of LTR Scientific Program for 1994

Item 7: Date and venue of the next meeting

Item 8: Any other matters

Item 9: Adoption of the report

ANNEX 3.

**SECOND JOINT MEETING
OF THE LTR'S
COORDINATION AND INTERNATIONAL SCIENTIFIC COMMITTEE**

Lusaka (Zambia), 14 - 15. 10. 1993

PROJECT COORDINATOR'S REPORT: SUMMARY OF LTR'S PREPARATION PHASE (JANUARY 1992 - JUNE 1993)

1. INTRODUCTION

While several consultancies were fielded towards the end of 1991, the project 'Research for the Management of the Fisheries on Lake Tanganyika' (= LTR) became fully operational on the 3rd of January, 1992. Its execution is scheduled for five years in two phases i.e. preparation phase (18 months) and operational phase (42 months). The Work Plan for the preparation phase has been established in the LTR's Project Document (pages 31 and 32 refer). All of the principal activities listed therein were executed; in fact a number of additional activities was carried out. Consequently, this report covers the achievements of LTR's entire preparation phase i.e. from January 1992 to the end of June 1993.

2. RESULTS

2.1 Establishing a single administrative headquarters in Bujumbura

All necessary permits were secured and the construction started on the 8th of January, 1992. Four months later the LTR staff was able to start working in the newly constructed premises; it includes the reception, laboratory, library/meeting room and 4 offices, a total of 360 m^2. In addition, a 56 m^2 storage/depot facilities were renovated and, lastly, a 10 car parking lot was constructed.

2.2. Establishing sub-stations at Bujumbura, Kigoma, Mpulungu and Kalemie

In Bujumbura: it was not necessary since it is a part of LTR headquarters.

In Kigoma : an extensive rehabilitation of Tanzaniaís Fisheries Research Institute (TAFIRI) facilities in Kigoma started on the 6th of February, 1992. We have rehabilitated a large number of TAFIRI offices and laboratories, guest-house and one other house. Both the office/laboratory complex and guest house + house for LTR expert were fenced. The work was completed in 3 months.

In Mpulungu: although all necessary arrangements were made early the work started only in October 1992. After overcoming numerous difficulties the rehabilitation of Zambiaís Department of Fisheries (DOF) facilities was completed and inaugurated, by H.E. the Ambassador of Finland to Zambia, Mr. Ilari Rantakari, on the 26th of June, 1993.

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

2.3. Establishing a Project Coordination Committee

All of the permanent member of the LTR's Coordination Committee were named by their respective Government. The first Meeting of this committee was held in Bujumbura from the 20th to the 22nd of May, 1992.

2.4. Establishing an International Scientific Committee

All the permanent members of the LTR's International Scientific Committee was also named. The first Meeting of this committee was held from the 20th to the 22nd of May 1992.

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

All these arrangements were confirmed by all beneficiary Governments; thus LTR's personnel, equipment and information moves freely.

2.6 Securing a project-wide radio link

Seven high frequency SSB radios were purchased and six of them already installed as follows: in LTR's headquarters in Bujumbura, in LTR's stations in Kigoma , in Mpulungu and Uvira, in TAFIRI headquarters in Kunduchi and Zambiaís Department of Fisheries headquarters in Chilanga. The seventh radio will be installed on LTR's main research vessel.

2.7. Providing facilities for other interested researchers

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

2.8. Organizing in-project training of counterpart personnel and a continuous program of meetings, seminars and workshops.

Five training courses were organized so far as follows:

1. in hydrodynamics was held in Bujumbura from the 22nd to the 27th of April 1993. Course leader was Mr. Timo Huttula and a total of 12 persons took part;

2. in fish biology - was held in Bujumbura from the 29th of March to the 9th of April 1993. Course leader was Mr. Ero Aro and there were 8 participants;

3. in plankton biology - was also held in Bujumbura from the 29th of March to the 9th of April 1993. Course leader was Dr. Ilppo Vuorinen and 10 persons took part;

4. in limnology - it was conducted by Dr. P-D. Plisnier in Bujumbura for our Burundians and Zaïrians colleagues on the 28th and in Kigoma from the 29th of June to the 4th of July 1993 for our colleagues from Tanzania; and

5. in computer use - was a continuing process in all LTR stations; in addition LTR Headquarters staff were trained to use Excel (version 4.0).

Symposium on Biology, Stock Assessment and Exploitation of small Pelagic species in African Great Lakes Region was organized and held in Bujumbura from the 25th to the 28th of November 1992. It was attended by 36 participants and 18 observers from 9 countries out of the african region concerned, 2 european countries, Japan and FAO Headquarters. 21 papers on the biology, stock assessment and exploitation of small pelagic fish species in Lakes Kivu, Kariba, Victoria, Tanganyika, Itezhi-thezi, Mweru-Luapula and Malawi/Niassa were presented.

Meeting of Project Managers of stock assessment projects of East African Lakes - was also organized and held on the 30th of November 1993 in LTR Headquarters. Six projects were represented: Zambia/Zimbabwe SADCC Fisheries Project, Mweru-Luapula Fisheries Research Program, UK/SADCC Lake Malawi/Niassa Pelagic Fisheries Project, Belgium/CEPGL Applied Hydrobiology Project, IFIP and LTR.

First Workshop on the Coordination and Standardization of Fisheries Statistics for Lake Tanganyika - all arrangements were made for this workshop to be held in Bujumbura from the 26th to the 30th of July 1993.

Preparation of the 2nd Joint Meeting of the LTR Coordination and International Scientific Committees - has already started; all arrangements were made to hold this meeting in the Mulungushi International Conference Center, Lusaka, Zambia from the 14th to the 15th of October 1993.

Preparation of the Sixth Session of the CIFA Sub-Committee for Lake Tanganyika - has also started; all arrangement were made to hold the meeting in the Mulungushi International Conference

Center, Lusaka, Zambia from the 18th to the 19th of October 1993.

2.9 Providing a literature and information service to all research workers and participants in the project

LTR Documentation Center has been established. Today more than 3,000 references have been inputed on Documentation Center's computer.

2.10 Reporting regularly the progress of the projectís wok to the Donor and beneficiary Governments

Section 2 of this report details all reports prepared during LTR's fist 18 months.

2.11 Undertaking PR and information exercises

LTR logo was developed early and LTR stickers produced and distributed widely. LTR Newsletter has been developed and is now published regularly every 3 months; thus first five issues were published and widely distributed. There is a very positive reaction to LTR Newsletter.

2.12. Establishing project data banks

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

2.13. Collating and analyzing available historical data

The collection, collation and analysis of historical data on Lake Tanganyika continues. Many of our colleagues in all four riparian took part in this important but time consuming task. This work is coordinated by LTR Biostatician.

2.14 Initiating an analysis of available remote sensing data relevant to the overall limnology and hydrology of the lake

This work has also started; it is carried out at the University of Kuopio. The required facilities were established and the methodology for satellite image analysis was set up. Eight NOAA-11 data sets were purchased and the data processing initiated. It is using an UNIX based graphic workstation and an image analysis software package. Lastly, a computer network connection for weather satellite images acquisition to check the cloud coverage over the lake has been set up.

2.15 Organizing the procurement of equipment and of the fisheries research vessel and the rehabilitation of three auxiliary vessels

Considerable efforts were devoted to prepare and fully equipment all LRT stations. A large amount of general, office and scientific equipment and material was ordered , tested and subsequently distributed to each LTR station. All of our stations are now fully operational and equipped to carry out a complex scientific program.

The procurement of the fisheries research vessel was our major problem so far simply because the projectís budget was never sufficient to procure a vessel capable to carry out all the required tasks. Consequently, a number of the solutions was considered and, finally, it was agreed that the LTR will charter a vessel which will be build to our specifications by Burundi based company. After exhaustive negotiations the contact to build and eventually charter the fisheries research vessel was signed by all parties on the 1st of July 1993.

An extensive rehabilitation efforts were required to provide serviceable auxiliary vessels to LTR stations. Consequently, three auxiliary vessels were rehabilitated as follows: R/V Echo from LTR/Kigoma, R/V Sangala for LTR/Bujumbura and R/V Silver Shoal for LTR/Mpulungu. All are now fully operational, fully insured and back in their respective home ports ready to carry out sampling program.

AT THIS POINT IT SHOULD BE NOTED THAT THE WORK PLAN FOR THE LTR PREPARATION PHASE, AS GIVEN IN PROJECT DOCUMENT (PAGES 31 & 32 REFER) HAS BEEN FULLY EXECUTED. FURTHER, IT SHOULD BE NOTED THAT THE LTR HAS CARRIED OUT A LARGE NUMBER OF ADDITIONAL ACTIVITIES DURING ITS PREPARATION PHASE. THOSE MOST IMPORTANT WERE THE FOLLOWING :

2.16. Preparation of LTR Scientific Program

A complex scientific program has been proposed by LTR Scientific Coordinator during the First Joint Meeting of the LTR Coordination and International Scientific Committees in May 1992. It has six sub-components as follows:

1. hydrodynamic modeling of Lake Tanganyika;
2. remote sensing;
3. fish population and plankton biology;
4. genetic structure of pelagic fish populations;
5. limnology and carbon/energy budget; and
6. fisheries statistics.

During numerous working sessions this program has been refined in great details. It was subsequently decided that each scientific sub-component will have its overall coordinator as well as its ‘Field Coordinator’. Lastly, the determination and selection of sampling stations, sampling frequencies, selection and training of national colleagues, experimental sampling and sampling dates for each station were all concluded. Thus all is ready to start the LTR Scientific Program on the 20th of July, 1993.

2.17. Aerial frames surveys of the Lake Tanganyika fisheries

The first ever aerial frame survey of Lake Tanganyika fisheries was carried out, successfully, from the 29th of September to the 3rd of October 1992; the Lake's entire shore was video-taped and the results published in two LTR Technical Documents. Since then, a second aerial frame survey was carried out, also successfully, from the 19th to the 21st of May 1993. The data is now being analyzed.

2.18. Installation of hydrodynamic equipment

During the first hydrodynamic cruise (from the 28th of February to the 12th of March 1993) a number of instruments was installed as follows: one fully automatic lake meteorological station + thermistor string have been installed in the lakeís southern basin. A fully automatic land weather station had been installed in Bujumbura harbor and three Druck water level pressure sensors were installed in Bujumbura, Kigoma and Mpulungu. From these instruments the LTR is now getting some 1 Mb of data every month. During the second hydrodynamic cruise (from the 11th to the 24th of May 1993) the proper functioning of these instruments was verified, Data unloaded, Data Storing Units set and Data Processing initiated.

2.19 Ornamental fish trade

Due to the uniqueness of Lake Tanganyika the ornamental fish trade is quite important. A number of companies in each riparian state is involved. The LTR fielded several missions in order to obtain the required data for the preparation of a base line document on this highly specialized business. The results will be published in one of the LTR's Technical Documents.

2.20 Lake Tanganyika Fisheries Directory

In order to facilitate better communication and cooperation among the fisheries professionals of the four riparian states an attempt has made to compile the first issue of the Lake Tanganyika Fisheries Directory. Its initial stratification contains eight categories as follow:

1. Government structure of the fisheries sector;
2. Fisheries professionals;
3. Fisheries training, education and/or research institutions;
4. Fisheries private sector ;
5. Public and/or parastatal fishing companies;
6. Fisheries organizations, associations and cooperatives;
7. Suppliers of fishing gear and material; and
8. Projects.

The updated and expanded issues of this directory will be published each year.

2.21 LTR Personnel

The recruitment of LTR National and International personnel has been about completed; we now await the arrival of 4 Associated Professional Officers whose recruitment is quite advanced. The following provides a list of persons, their functions and EOD which are permanently attached to the LTR. These are the following:

NAME	FUNCTION	ENTRY ON DUTY
International		
HANEK George	Project Coordinator	03. 01. 1992
COENEN Eric	Biostatistician	10. 05. 1992
PLISNIER P. -D.	Limnologist	04. 10. 1992
MANNINI Piero	Fisheries Biologisst	14. 12. 1992
KOTILAINEN Pekka	Apo-Fisheries Biologist	13. 10. 1992
KURKI Heini	Apo-Fisheries Biologist	06. 01. 1993
National		
VARAYANNIS Roger	Civil Engineer	01. 02. 1992
BARICAKO, B.	Secretary	14. 12. 1992
BANKUMUHARI, M.J.	Secretary	14. 12. 1992
MAFURUGUTU, H.	Clerk/ Driver	26. 10. 1992
GASASE Bonus	Driver	16. 12. 1992

There is a considerable number of Nationals of all four participating countries which are attached to LTR on more or less permanent basis. These are the following :

NAME	SUBCOMPONENT
In LTR Headquarters in Bujumbura, Burundi	
BAMPOYE , P.	Limnology
GAHUNGU, E.	Fish Biology
GASHAGAZA, M.	Fish Biology
KABANDANA, L.	Fish Biology
KIMBADI, S.	Hydrodynamics & Limnology
KIYUKU, A.	Zooplankton
MULIMBWA, N.	Zooplankton
NIKOMEZE, E.	Hydrodynamics
NYAKAGENI, B.	Limnology
NZEYIMANA, E.	Zooplankton
TUMBA, J. M.	Hydrodynamics
	Skipper of R/V Sangala
	Mechanic of S/V Sangala
In LTR Station in Kigoma, Tanzania	
CHALLE, N.	Skipper of R/V Echo
CHATTA, M.	Mechanic of R/V Echo
CHITAMWEBWA, D.	Zooplankton
KALANGALI, A.	Zooplankton
KATONDA, K.I.	Fish Biology
KIHAKWI, A.	Hydrodynamics & Limnology
KISSAKA, M.	Hydrodynamics & Limnology

LYOBA, E.	Hydrodynamics & Limnology
MUHOZA, S.	Zooplankon

In LTR Station in Mpulungu, Zambia

CHIPULU, E.	Hydrodynamics & Limnology
CHOMBA, W.	Fish Statistics
KABAKWE, D.	Fish Biology & Fish Statistics
KAOMA, N.	Hydrodynamics & Zooplankton
LUKWESSA, C.	Limnology
MAKASSA, L.	Hydrodynamics & Zooplankton
MBANDA, M.	Fish Biology
MILINDI, G.	Fish Biology & Fish Statistics
MUTALE, L.	Fish Statistics
MWAPE, L.	Hydrodynamics & Zooplankton
MWENDA, M.	Zooplankon & Fish Biology
SHAPOLA, R.	Limnology & Zooplankon
SICHIVU, S.	Limnology & Zooplankon
SYAPILA, M.	Fish Biology
ZULU, I.	Zooplankon
CHANCA, M.	Skipper of R/V Silver Shoal
CHINCA, N.	Mechanic of R/Vsilver Shoal

The following consultancies were carried out:

NAME	**SUBJECT**	**DATES**
PIERONI, M.	Civil Engineer	03-07.06. 1991
REYNOLDS, J.E.	Biostatistics	07.09-07.12. 1991
OLIVEIRA, A.	Naval Architect	15.03-18.04. 1992
MITSON, R. M.	Acoustics	13-21.09. 1992
MANCINI, M.	Administration	20-27.10. 1992
MOLSA, H.	General	20-27.02. 1993
HUTTULA, T.	Hydrodynamics	20.02-14.03. 1993
NIEMINEN, J.	Hydrodynamics	20. 02-14.03. 1993
PELTONEN, A.	Hydrodynamics	20.02-14.03. 1993
MANCINI, M.	Administrator	13-19.03. 1993
ARO, E.	Fish Biology	27.03-08.04. 1993
VUORINEN, I.	Plankton Bioloy	27.03-10.04. 1993
ROEST, F.	Fish Statictics	04-23.04. 1993
HUTTULA, T.	Hydrodynamics	08-23.05. 1993
PELTONEN, A.	Hydrodynamics	08-23.05. 1993
NIEMINEN, J.	Hydrodynamics	08-23.05. 1993

ANNEX 4.

SECOND JOINT MEETING
OF THE LTR'S
COORDINATION AND INTERNATIONAL SCIENTIFIC COMMITTEES
Lusaka (Zambia), 14 - 15. 10. 1993

SCIENTIFIC COORDINATOR'S REPORT: THE SCIENTIFIC SAMPLING PROGRAM IN 1992 - 93

1. INTRODUCTION

This report gives the outlines of the Project's scientific sampling program and describes the activities already initiated at the field stations for its execution. The period reported here covers the Project preparation phase. The main stations are each equipped with a small (auxiliary) research vessel for pelagic sampling. The stations also possess now the necessary scientific sampling equipment, laboratory facilities, and data entry and processing facilities.

Local personnel were trained in one-to-two-week intensive courses in February-July 1993, with the purpose to cover the field work, installation and maintenance of the hydrodynamic equipment, data collection and processing for each research component. The sub-component leaders, the consultants from Finland or project personnel, took the main responsibility in planning and execution of the training of the field personnel.

The team of sub-component leaders prepared, in cooperation with the Project Scientific Coordinator and his Deputy, the sampling program, and also planned the purchases of scientific equipment in each specific area of research. The scientific field coordinators managed the implementation of the sampling program. During the preparatory phase they have developed a standardized procedure to carry out the program at each project site.

In addition to the automatic hydrological measurements, the scientific program includes:

a) regular weekly sampling for hydrodynamics, limnology, zooplankton and fish biology,

b) intensive sampling (with 24-hr cycle) of certain limnological parameters and zooplankton every six weeks (done alternatively under a full or new moon period).

Scientific program management

Scientific Coordinator	Prof. Ossi V. Lindqvist
Deputy Coordinator	Hannu Molsa, Assoc. Prof.

Component leader	Field Coordinator	Component
Timo Huttula	Pekka Kotilainen	Hydrodynamics
Jussi Parkkinen		Remote sensing
Ilppo Vuoorinen	Heini Kurki	Zooplantkton
Eero Aro	Piero Mannini	Fish biology
Liisa Kuusipalo	Piero Mannini	Fish genetics
Pierre D. Plisnier	Pierre D. Plisnier	Limnology
Kalevi Salonen/ Jouko Sarvala	Pierre D. Plisnier	Carbon/energy
Eric Coenen	Eric Coenen	Fishery statistics

Field measurements and data collection began in full scale in July 1993 except for the automatic hydrological recording which had already started in March 1993.

Scientific field Coordinators, and their associated staff together with their local counterparts collect the data and initiate their processing, and report the results through the component leaders further to the Scientific Coordinator at the University of Kuopio.

The findings of the research are summarized and discussed at the Project Scientific Committee and the Coordinating Committee.

2. ACTIVITIES WITHIN EACH RESEARCH COMPONENT

2.1. Hydrological modeling

Aims

To understand the upwelling (and doweling) phenomena of the nutrient rich deep waters and their effects on the pelagic biological production.

The first part of the model building is based on temperature and oxygen data in the lake, and particularly in its southern end, and on mixing properties and wind conditions. This can be later expanded to include other weather stations over the lake and also the watershed and nutrient input components.

Activities

Installation of the fully automatic land-based weather station (Aanderaa) at the Bujumbura harbor and water-based meteostation off Mpulungu to register wind profile and heat flux in air. Wind measurements are made also with portable anemometers.

Installation of the thermistor chain attached with the meteostation at Mpulungu, and submersible chains near Kigoma and near Utinta (Tanzania). Eleven temperature probes in depths from the surface down through 300 meters.

Water level recording stations (Druck water level pressure sensors) at Bujumbura, Kigoma and Mpulungu harbors.

Salinity-temperature-oxygen (CTD-O_2) profiles were obtained during cruising along the lake. Manual current measurements with flow cylinders.

Training of the local counterpart personnel for installation and maintenance of the equipment, unloading of the data and reporting of the results. The analyses of the hydrodynamic data of the first three months has started.

Development of the hydrodynamic model and improvement of the computer software for data handling were initiated.

Results

Data about wind conditions and temperature regimes in lake Tanganyika during the dry season in 1993 have been processed. Water temperature time series from the station at the southern end of the lake were used for estimation of vertical thermal diffusivity. Results of numerical experiments with two-dimensional vertical hydrodynamic model showed the importance of correct approximation of the wind field over the lake and parameterization of vertical mixing.

2.2. Remote sensing by satellite

Aims

To understand the spatial and seasonal distribution of the upwelling phenomena in relation to surface temperatures and chlorophyll, and to map the pelagic production patterns. These patterns will be related to the hydrodynamic model.

Activities

Eight NOAA-11 data sets for Lake Tanganyika were purchased and processing of the temperature and chlorophyll data were initiated. The University of Kuopio has established the required image analysis facilities (UNIX based graphic workstation and image analysis software) for the projectís use in Finland. A computer network connection for weather satellite image acquisition to check the cloud cover the lake has also been established.

Results

The results obtained so far have to ascertained with ground-truth data. Initially the lake appears to be highly dynamic, with variable chlorophyll patterns even on subsequent days. An apparent upwelling phenomenon at the southern end has been observed once (or maybe twice). Its extent conforms preliminarily with the early theoretical hydrological model in relation to real wind speeds and strength patterns.

2.3 Fish and zooplankton biology

Aims

To understand the stock size variations and basis of production of pelagic fish species. Proper comparison in ecosystem and stock structures will be made between areas of heavy vs. low fishing pressure.

To study horizontal and vertical migrations of the ecosystem components as well as the reproduction biology and recruitment of pelagic fish as possible 'explanations' for the availability of pelagic fish for fishing.

The population dynamics and life-histories of the main (crustacean) zooplankton and their role in the pelagic production chain form a basis for fish production.

Generally, the main emphasis will be on the predator-prey relationships between the fish species (and their cohorts) and between fish and zooplankton, towards understanding of species interactions and their possible role in the production regulation. The studies on the selection of plankton food by the clupeids will be started with combined trawl and hydro-acoustic sampling as soon as the project's main research vessel is operational and available.

Activities in fish biology

Population analyses to support preliminary stock assessment and studies of population dynamics of the two pelagic clupeids (*L. miodon* and *S. tanganicae*) and the predatory Nile perch species *Luciolates* and *Lates* spp.

Studies of catch composition and stock sizes include

- four samples per week from artisan units,
- once a month, deck sampling aboard an industrial purse seiner,
- once a month, beach seine sampling.

Activities in zooplankton studies

Weekly zooplankton sampling at permanent stations off each field station (combined sample from 0-100m). there is also zooplankton material from the lake pelagic collected during the

whole-lake cruise in May (Dr. Huttula as leader of the expedition).

Intensive zooplankton sampling every sixth week either at full moon or new moon (four times a day, from depths 0, 20, 40, 60, 80, 100, 120, and 140 m).

Results

Preliminary analyses of the data available revealed that Cyclopoid copepods were more numerous than Calanoids, which was not expected on the basis of the existing literature, where the Calanoid *Tropodiaptomus simplex* is repeatedly presented as the most important mesozooplanktonic species. This was further corroborated when sampling was started in Kigoma in July. The reason for this may also be that the northern areas of the lake may differ from its southern end in this respect. The sampling stations were also relatively close to the shore, where Cyclopoids should be more abundant. The analyses of materials collected from the whole lake area should shed light on this question.

The presence of numerous freshwater medusae was noted; they may interfere with the forthcoming acoustic surveys and experimental trawling.

The survival of copepod eggs on passage through the clupeid intestine was observed.

2.4 Genetic structure of pelagic fish

Aims

To help to evaluate the possible discreteness of pelagic fish stocks and their possible migrations.

Activities

Preliminary samples of Limnothrissa, Stolothrissa and Luciolates have been collected at three lake sites.

The RAPD-DNA analytical method was tested at the University of Joensuu, Finland. Even dried fish samples proved feasible.

Results

The RAPD-DNA method appears suitable for species identification. No population/stock analyses yet made.

2.5 Limnology and carbon/energy budget

Aims

To follow up the main characteristics of water quality, and their seasonal and spatial variation. Also distribution of eroded materials and/or possible pollutants affecting the biological production of the lake or accumulating in organisms.

To understand the major phenomena of upwelling (downwelling) of the lake water and its importance towards biological production.

To provide ground-truth data for remote sensing.

To understand the mechanisms whereby the energy/biological production is channeled towards the pelagic fish component in the ecosystem

- The role of the dissolved organic matter (DOM) in the biological production of the lake,
- Bottom-up and top-down regulation of food web as alternative regulatory mechanisms.

Activities

Weekly limnological sampling program (15 parameters from 4 to 9 depths from 0 to 110 m + max depth measured; plus Secchi disc values) at each field station.

Intensive limnological sampling program once a month (24-h cycle, eight times a day).

Provisional seasonal program four times a year; eight parameters from six depths.

2.6 Fishery statistics

Aims

To formulate a common fishery statistics and data collection system in each country, which then can be related to biological production patterns, with the final aim of its being a central component in any future fisheries management plan.

Activities

Two aerial frame surveys of the Lake Tanganyika fisheries.

- Collection of industrial fisheries statistics in Kalemie, Zaïre.
- Assistance to the frame survey for Lake Tanganyika within Burundi.
- Field missions to assess fisheries statistical procedures.
- Execution of a workshop on the coordination/standardization of fisheries statistics for the Lake Tanganyika.

Results

Recommendations of the statistical workshop will be presented to the Second Joint Meeting of the Project and future Activities will then depend on the decisions taken.

A major outcome of the statistical workshop was that the statistical reporting should be standardized but not the fishery statistics data collection systems.

ANNEX 5.

**SECOND JOINT MEETING
OF THE LTR'S
COORDINATION AND INTERNATIONAL SCIENTIFIC COMMITTEES**

Lusaka (Zambia), 14 - 15. 10. 1993

PRESENTATION OF R/V TANGANYIKA EXPLORER

1. Introduction

A comprehensive summary regarding the procurement of the main research vessel was presented during the First Joint Meeting of the LTR's Coordination and International Scientific Committees (LTR/92/4 REFERS). As none of the options outlined therein was workable, two others were pursued as follows.

2. International tender to construct a fishery research vessel

Detailed documentation was prepared by FAO's Fishing Technology Service by summer 1992. This included the outline of specifications of the vessel to be built, selection of a number of shipbuilding firms, bidding schedule and all other required tender documents. Out of 12 shipbuilding firms which were invited to tender only five responded by the closing date i.e. the 5th of November, 1992. Of those received, four bids were declared valid and one not valid. Unfortunately, all received bids far exceeded the LTR's budgetary allocation limits as the lowest bid amounted to $698,731 and the highest to $1,580,000. Even the lowest bid was some 75% in excess of the funds available to the project for the purchase of such a vessel.

Even during the tender proceedings outlined above there were numerous other attempts made to secure a suitable fisheries research vessel. Despite the fact that a number of people tried to resolve this problem no solution was found. This matter was further complicated by the fact that the exigencies and technical requirements for such a vessel were continuously moved upwards with consequent budgetary implications.

3. Charter of fishery research vessel

Towards the end of 1992 the project has received the following offer:

The Lake Tanganyika Shipyard, a Bujumbura based company, offered to construct a fisheries research vessel, at their own expenses and according to FAO technical specifications, providing that LTR commits itself to charter it for a certain period. Time consuming negotiations started early in January 1993 and, after numerous verifications and clarifications a contract for the charter of the fisheries research vessel from the Lake Tanganyika Shipyard was signed on the 1st of July 1993.

The fisheries research vessel will be named R/V Tanganyika Explorer. Its construction started on the 1st of September, 1993 and, according to the initial indications, its construction should be completed in eight months i.e. by the end of April 1993. We have prepared a poster presentation which displays the details plans of R/V Tanganyika Explorer. It also provides its main characteristics i.e. the overall length: 25.30 meters; breadth: 6.86 meters and draught: 2.00 meters. As apparent from our poster presentation there will be sleeping space for 18 scientists and 6 crew. In addition, R/V Tanganyika Explorer will be fully equipped, able to mid-water trawl as she will be propelled by 550 hp Cummins engine, and will have the latest navigation, electronic and acoustic equipment. Lastly, threw will spacious wet and dry laboratories, fully equipped.

ANNEX 6.

SECOND JOINT MEETING
OF THE LTR'S
COORDINATION AND INTERNATIONAL COMMITTEES
Lusaka (Zambia), 14 - 15. 10. 1993

PROPOSAL OF LTR SCIENTIFIC PROGRAM FOR 1994

1. INTRODUCTION

The scientific program for the year 1994 will continue generally as planned earlier, and will be based on the initial results and the experiences from the preparatory phase of 1992 - 1993. With main stations, their personnel and facilities fully operational, the program for 1994 can be implemented basically as it was started this year, with some modifications.

Regular ground-truth data collection for remote-sensing studies and study of carbon-energy budget are new components in the program of 1994. A major addition to the program is the main research vessel (hydro-acoustic surveys), planned to be operational by mid-94.

The studies on board the vessel will require integrated sampling of hydrography, limnology, fish and plankton, as well as hydrological measurements, all of which provide keys on pelagic food webs, their composition, and functions. The general sampling strategy on the research vessel aims at obtaining as many simultaneous samples of physical, chemical and biological parameters as possible. This is necessary for understanding and choosing (if ever possible) between the alternative mechanisms that affect and regulate the pelagic production in general and fish production in particular.

The fundamental questions to be addressed in this connection are whether the fish production is:
1.) directly supported by the primary production and zooplankton production which both in turn might be dependent on the upwelling events at the lakeís southern end, or 2.) the whole biological pelagic production in the Lake pelagics is based on exceptional efficiency and turnover of resources (nutrients, energy) which might be the consequence of species interactions (predation, competition) and community adaptations (behavior, life-history evolution) within these interactions. This may again be augmented by the strong mixing of the water column, already documented, and by the exceptionally large vertical migration of the ecosystem components. The first alternative, which resembles the so called bottom-up regulation, emphasizes studies on hydrodynamics and biological production. The second

alternative, following the hypothesis of top-down community regulation, requires predator/prey studies and life-history analyses of the key species.

Both of the above alternative regulation mechanisms may be relevant and not necessary mutually exclusive in Lake Tanganyika. To gain data and information of both physical and biological parameters, the LTR Scientific Program in 1994 and onwards will include five lines of study:

1. hydrological modeling with automatic recorders and field measurements; model development;
2. remote sensing: satellite data analyses combined with ground-truth data to achieve a basis for operational remote sensing;
3. regular weekly, monthly and seasonal sampling of hydrography, limnology and plankton at each substation to provide continuos background information;
4. regular sampling of fish for population analyses, stock size variation and genetical analyses;
5. combined hydroacoustic-trawl-zooplankton surveys together with measurements of hydrology, primary and heterotrophic production, and microbial communities on board the Tanganyika Explorer.
6. Continuation of fishery statistics through air and ground surveys.

Training will be provided to cover all new activities.

2. ACTIVITIES IN EACH RESEARCH COMPONENT

2.1 Hydrological modeling

Analyze the data from automatic weather stations and water level recorders.

Make CTD, current and wind measurements on board the vessel during cruises.

Develop and test the two-layer hydrological model of the lake.

Make manual current measurements with flow cylinders.

2.2 Remote sensing

NOAA-11 data sets from Nairobi and/or Pretoria will be purchased and the processing of the temperature and ìchlorophyllî data will be continued. The UNIX based graphic workstation and image analysis software will be at disposal at the University of Kuopio in Finland.

The image acquisition is planned to take place during the time of upwelling with simultaneous ground truth data collection.

2.3. FISH AND ZOOPLANKTON BIOLOGY

Activities in fish biology

Population analyses regularly done from catch samples to support future stock assessment and studies of population dynamics of two pelagic clupeids (*L. miodon* and *S. tanganicae*) and the predatory Nile perch species *Luciolates* and *Lates* spp.

The analyses will include age and fecundity determinations.

Combined hydroacoustics-trawl surveys:

- hydroacoustic surveys on species composition, abundance, size distribution, and migration of pelagic species;
- fish samples taken with a pelagic trawl for identification, measurements and stomach samples;
- zooplankton samples with Gulf V sampler.

Fish growth and abundance data will be later used for an application of a bioenergetic model to estimate fish food consumption.

Zooplankton studies

Regular and intensive zooplanktoon sampling at permanent sites off each field station will continue, including samples for biomass determination.

Zooplankton sampling combined with hydroacoustic-trawling.

Laboratory rearing of key crustacean species to study their life-history parameters. These data will be required for zooplankton production calculations.

2.4 GENETIC STRUCTURE OF PELAGIC FISH STOCKS

Sampling of pelagic clupeids and their predators for analysis of the discreteness of stocks continued after analysis of the preliminary data of 1993. Further analyses performed in Finland.

2.5 LIMNOLOGY AND CARBON/ENERGY BUDGET

2.5.1 Basic limnology

Regular weekly and moon phase related intensive limnological sampling program will continue at each field station.

Ground-truth data for remote sensing of temperature and chlorophyll a.

2.5.2 The Carbon/energy budget

During the introductory visit, the routine research methods will be tested in order to find optimally integrated field and

laboratory practices. This will be followed by a training period of local counter parts.

The sampling includes:

1. surface sampling to obtain a preliminary picture of the horizontal distribution of primary production over a seasonal scale; and

2. sampling at the fixed stations off field stations in order to have an idea of the production and distribution of organic matter in the oxic water layers of Lake Tanganyika.

Basic determinations:

- phytoplankton primary production using the radiocarbon method with acidification and bubbling; simulated *in situ* method with incubation on board
- chlorophyll *a*
- decomposition of organic matter
- bacterial biomass
- particulate (POC) and dissolved organic carbon (DOC) and phosphorus

Special studies during cruises:

- microheterotrophic production
- structure of microbial communities

2.6 FISHERY STATISTICS

Implementation of workshop recommendations and continuation of ground and air surveys.