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November 1992

REPORT ON THE SYMPOSIUM ON BIOLOGY, STOCK ASSESSMENT AND EXPLOITATION OF SMALL PELAGIC FISH SPECIES IN THE AFRICAN GREAT LAKES REGION

> by Eric J. Coenen

FINNISH INTERNATIONAL DEVELOPMENT AGENCY

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Bujumbura, November 1992

The conclusions and recommendations given in this and other reports in the Research for the Management of the Fisheries on 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.

#### 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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#### <u>GCP/RAF/271/FIN</u> <u>PUBLICATIONS</u>

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\* 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 ON THE SYMPOSIUM ON BIOLOGY, STOCK ASSESSMENT AND EXPLOITATION OF SMALL PELAGIC FISH SPECIES IN THE AFRICAN GREAT LAKES REGION

#### BUJUMBURA, 25 - 28.11.1992

1. The Symposium on Biology, Stock Assessment and Exploitation of Small Pelagic Fish Species in the African Great Lakes Region was jointly organized by the FINNIDA/FAO/AGFUND GCP/RAF/271/FIN LTR (Research for the Management of the Fisheries of Lake Tanganyika) Project and the FAO/UNDP RAF/87/099 IFIP (Inland Fisheries Planning, Development and Management in Eastern/ Central/Southern Africa) Project.

2. The venue of the Symposium was the Conference Room of the 'Lycée du Saint-Esprit' at Kamenge, Bujumbura and was attended by 54 participants and observers from Burundi, Kenya, Malawi, Rwanda, Tanzania, Uganda, Zaïre, Zambia, Zimbabwe, Europe, Japan and FAO Headquarters in Rome, Italy (see Appendix III). The Symposium brought together information on the pelagic fishes of Lakes Kivu, Kariba, Victoria, Tanganyika, Itezhi-Tezhi, Mweru-Luapula and Malawi.

## DAY 1: OPENING OF THE MEETING AND SESSION ON LAKE KIVU

3. At 10.00 a.m., Mr. P.M. Biabatantou, FAO Representative to Burundi, welcomed the participants and observers on behalf of FAO and the two organizing regional projects. He underlined the commercial and nutritive importance of small pelagic fish species in the catches of most of the lakes in the region concerned and stressed the need for a better knowledge of these pelagic species and their stocks to assure the optimum management of their resources.

4. At 10.15, the Symposium was officially opened by His Excellency L. Nduwimana, Minister of Management, Tourism and Environment in Burundi. In his speech, the Minister stressed the need for closer regional collaboration in order to bring together the scientific results on small pelagic species and to analyze critically the different methodologies used. He also remarked that a better knowledge of their stocks and how to manage them optimally could contribute significantly to satisfy the needs of animal proteins in the diet of millions of people in the African Great Lakes Region.

5. During the afternoon session, two papers on *Limnothrissa* miodon from Lake Kivu were presented and discussed, followed by a general discussion on Lake Kivu.

6. Before closing the first day's session, Prof. 0. Lindqvist, Scientific Coordinator of LTR, briefed the audience on the importance of establishing a hydrodynamic model for Lake Tanganyika and the use of satellite imagery for the

determination of temperature and chlorophyll distribution and the study of upwelling phenomena.

#### DAY 2: SESSIONS ON LAKES KARIBA AND VICTORIA

7. During the morning session, participants from Zambia and Zimbabwe presented four papers on *Limnothrissa miodon*, introduced into the Lake Kariba reservoir. The general discussion on Lake Kariba focused on the difficulty of using length frequency data (no progression of modes visible) ; high mortality rates; the use of otoliths in growth studies; and the difficulties in obtaining reliable catch statistics.

8. In the afternoon, researchers from Uganda and Kenya presented three papers on *Rastrineobola argentea* and its predators from Lake Victoria, followed by a general discussion on the lake (predator-prey relationships; the Nile perch introduction; the quasi disappearance of haplochromines; changes in limnological characteristics; the water hyacinth infestation; the planned Lake Victoria Regional Research Project; etc.).

### DAY 3: SESSION ON LAKE TANGANYIKA

9. Participants from Burundi, Tanzania, Zambia and Zaïre presented eight papers on *Limnothrissa miodon*, *Stolothrissa tanganicae* and their predators from Lake Tanganyika. Subjects discussed included the research on clupeids in the littoral zone of the lake; the general decline of the industrial fisheries; changes of abundance and distribution of the clupeids and their predators; the need for continued stock assessment; the use of length frequency data for the estimation of population parameters; etc. During the general discussion, the audience was also briefed on the activities and planned research programme of the regional FINNIDA/FAO/AGFUND Lake Tanganyika Research (LTR) Project.

10. Before closing the session, Dr. A. Thompson outlined different sampling methodologies used for *Engraulicypris* in Lake Malawi.

### DAY 4: SESSION ON LAKES ITEZHI-TEZHI, MWERU-LUAPULA AND MALAWI AND CLOSURE OF THE SYMPOSIUM

11. Dr. R. Mubamba, Chief Fisheries Research Officer of Zambia, presented two papers: on the recent introduction of Lake Tanganyika clupeids into the Lake Itezhi-Tezhi reservoir and a general review of the biology and exploitation of small pelagic fishes in Zambia. 12. The third paper of the day presented preliminary information on the biology of *Poecillothrissa moeruensis* and several other species of the Ichisense, complex in Lake Mweru-Luapula, Zambia.

13. The last paper of the Symposium dealt with growth studies of the endemic pelagic cyprinid *Engraulicypris sardelia* in Lake Malawi.

14. As a means to reach conclusions and to determine follow up, a framework was developed to evaluate the status of knowledge on small pelagic fishes and their fisheries. Several criteria were reviewed for each lake and reservoir in turn, except for Zambia for which lakes other than Kariba and Tanganyika were lumped together.

15. The discussion revealed that, as would be expected, there was much variation in the state of knowledge about the <u>biology</u> and <u>life history of the small pelagics</u>. Generally, knowledge was relatively complete on length-weight relationships, food, prey species and seasons of reproduction. It was relatively weak on migrations and movements, ageing, fecundity, growth and mortality. One of the principal problems is the difficulty in acquiring quantitatively representative samples of eggs, larvae and juveniles. Because of this problem there is a dearth of information on growth, mortality, movements and migrations. The participants recommended to consider organizing <u>a workshop on experimental fishincf and sampling techniques</u> that could improve the situation significantly.

Similarly, measuring daily growth through otoliths is a technique that is not widely practised, but potentially, a source of very useful information for resource assessment. Therefore, it was recommended to consider organizing a workshop on such ageing techniques.

16. Concerning the <u>status of the pelagic fish stocks and the</u> <u>state of exploitation</u>, it was judged that Lake Kivu is underexploited based on recent hydroacoustical and catch surveys; that Lake Tanganyika is heavily exploited, but the exploitation is patchy; that Lake Kariba appears to be heavily exploited; that Lake Victoria is heavily exploited, but only inshore; and that Lake Malawi is unexploited over most of its area. Among Zambian lakes exploitation varies, but in Mweru pelagics appear to be fairly heavily exploited.

<u>Stock</u> assessment based on hydroacoustics is under way on Lake Kariba through a joint Zimbabwe-Zambia project sponsored by DANIDA/NORAD. On Lake Malawi the ODA/SADCC project is focused on a comprehensive assessment of stocks and limnology. A similar programme will get under way shortly on Tanganyika through the FAO/FINNIDA LTR project. Considering the apparent instability of Lake Victoria, stock assessment and limnology of open waters are a high priority, but no project is yet in place to carry out the assessment. On Lake Kivu hydroacoustical and catch surveys have been completed recently; however, the preoccupation is for the continuation of at least the catch and effort programme, KIVUSTAT. On Lake Mweru the status of stocks is through inferences from catch and biological data.

<u>Satellite</u> <u>limnology</u> (inferences about upwelling from temperature; inference about primary production and turbidity from colour) is a technology that can be useful on many large lakes. ODA/SADCC and LTR via the University of Kuopio are pursuing this technology. It was thus recommended that LTR and ODA/SADCC should look into the possibility of sharing their satellite technology and extending their coverage to other lakes in the region once the techniques are proven and their costeffectiveness established.

17. The contribution of small pelagics to the <u>fisheries</u> are very important, or potentially important, on the lakes considered. on Kariba, the pelagic fishery contributes about 90 % of the total yield. On Kivu and Tanganyika pelagics contribute about 80 %. In Zambia, overall, pelagics contribute about one-half. On Malawi, the open waters are not yet exploited and this is also the case with Victoria.

18. <u>Fishery statistics</u> are a problem on virtually every lake. There are problems of sustainability of programmes, of large temporal and spatial gaps in data collection, outdated approaches, of changes in landing places that are difficult to respond to on a timely basis and lack of motivation of personnel. This is confounded by the existence of different statistical procedures among countries sharing water bodies. Generally, it can be stated that statistics from industrial fisheries are more reliable than are those from artisanal fisheries, but the latter are often much more important than the former.

19. Regulation of fishing is little practised, but needed on almost all of the lakes.

20. The need for <u>development</u> <u>activities</u> varies from lake to lake. Some relatively modest development activities could be most useful. For example, the sophistication of light attraction methods varies from fishery to fishery. Light attraction is a significant fishing cost and more economical approaches could contribute significantly to fisher's livelihood. Therefore, it was recommended to look into the possibility of a consultancy and the <u>preparation of a manual on</u> <u>efficient light attraction</u>.

21. <u>Socioeconomic studies</u>, one of the basic sources of information on which to base management decisions, are not up to the required intensity on most of the lakes.

22. After this general discussion, at around 12.00 a.m., the symposium was closed by the two project managers of both organizing projects, thanking all participants and observers

for their interesting contributions and wishing them a safe trip back to their respective home countries.

23. The Proceedings of the Symposium will be published by FAO Headquarters, Rome, as a CIFA Technical Paper.

#### APPENDIX I : AGENDA AND TIMETABLE

<u>Wednesday</u> 25.11.1992

10.00	- 10.30	Opening ceremony
10.30	- 11.00	Break
11.00	- 12.00	Administrative arrangements
12.00	- 14.00	Lunch
14.00	- 15.00	Presentation of two papers on Lake Kivu
15.00	- 15.30	Questions-discussion concerning above papers and general discussion on Lake Kivu
15.30	- 16.00	Break
16.00	- 17.00	Presentation on hydrodynamic models and the use of satellite imagery

17.00 - 18.30 Cocktail

Chairman/Discussion leader: Dr. G. Hanek

## Thursday 26.11.1992

09.00	-	10.30	Presentation of four papers on Lake Kariba
10.30	-	11.00	Break
11.00	-	12.00	Questions-discussion on above papers and on Lake
			Kariba in general

# Chairman/Discussion leader: Dr. C. Machena

12.00	-	14.00	Lunch
14.00	-	15.30	Presentation of three papers on Lake Victoria
15.30	_	16.00	Break
16.00	-	17.00	Questions-discussion on above papers and on
			Lake Victoria in general

Chairman/Discussion leader: Mr. G. Ssentongo

<u>Friday</u> 27.11.1992

09.00 - 10.30 Presentation of three papers on Lake Tanganyika 10.30 - 11.00 Break 11.00 - 12.00 Presentation of two papers on Lake Tanganyika

Chairman/Discussion leader: Mr. F.C. Roest

Lunch
Presentation of three papers on Lake Tanganyika
Questions-discussion on above papers
Break
Questions-discussion on Lake Tanganyika in general
Presentation of LTR Project's objectives, activities and scientific workprogramme Presentation of various sampling methodologies for <i>Engraulicypris</i> in Lake Malawi

Chairman/Discussion leader: Mr. E. Coenen

<u>Saturday</u> <u>28.11.1992</u>

<pre>10.30 - 11.00 Break 11.00 - 11.45 Global discussion: general conclusions recommendations 11.45 - 12.00 Closing Ceremony</pre>	09.00 - 10.30	Presentation of four papers on Lakes Itezhi- Tezhi, Mweru-Luapula and Malawi and on small pelagic fishes in Zambia Questions-discussion on above papers and on these lakes in general
	10.30 - 11.00 11.00 - 11.45 11.45 - 12.00	Break Global discussion: general conclusions recommendations Closing Ceremony

Chairman/Discussion leader: Dr. J. Kapetsky

### APPENDIX II LIST OF ABSTRACTS OF SYMPOSIUM PAPERS ACCORDING TO ORDER OF PRESENTATION

#### <u>Wednesday</u> afternoon 25.11.1992 : LAKE KIVU (2 papers)

SPAWNING SEASON AND MIGRATORY ACTIVITY OF LARVAE OF LIMNOTHRISSA MIODON (BOULENGER) IN THE SOUTHERN PART OF LAKE KIVU (ZAÏRE)

by

## KANINGINI MWENYIMALI UNECED-FUNDP NAMUR, BELGIUM

#### ABSTRACT

From July 1990 to December 1991 (18 months), larvae of a small clupeid, *Limnothrissa miodon*, were caught daily from 5.30 a.m. to 6.00 a.m. with a tulle net in two stations of the inshore waters of Lake Kivu. Fishing cycles (24 hours) were organised inshore with the same material and with a modified plankton net at different depths of the pelagic area. The larvae were caught inshore during the period of observation and in the pelagic area where they carried out vertical migrations during the circadian cycle.

Results indicate that L. *miodon* spawns in Lake Kivu throughout the year and probably in both inshore and pelagic areas. The sites and conditions of the fry of *L. miodon still* have to be determinated.

Keywords : Limnothrissa miodon; larvae; Lake Kivu; inshore; pelagic area; fry.

#### THIRTEEN YEARS OF EXPLOITATION OF *LIMNOTHRISSA MIODON* (BOULENGER) IN LAKE KIVU (RWANDA-ZAÏRE)

by

## M. MUGHANDA RURAL DEVELOPMENT INSTITUTE BUKAVU, ZAÏRE

and

## A. MUTAMBA LAKE KIVU FISHERY PROJECT GISENYI, RWANDA

#### ABSTRACT

Ever since the Fishery Development Project in Lake Kivu started in November 1979, catches steadily increased until 1987. From that period, landings have shown significant changes as a result of a decrease in abundance and the development of "outside-project" markets. This downward trend was reversed by the end of 1989, and despite the presence of "outside-project" markets, landings have returned to higher levels. This paper provides a brief summary of the Lake Kivu fishery and reviews past and recent statistics and fishing trends of *Limnothrissa* miodon Boulenger as reflected in available catch, abundance and effort data collected through a catch assessment survey called KIVUSTAT, acoustic surveys and fishing units censuses. Future development needs for this *Limnothrissa* fishery are also emphasized.

## Thursday morning 26.11.1992: LAKE KARIBA (4 Papers)

## FITTING A VON BERTALANFFY GROWTH MODEL TO LENGTH-AT-AGE DATA OF LARVAL *LIMNOTHRISSA MIODON* FROM LAKE KARIBA

by

MORRIS Z. MTSAMBIWA LKFRI LAKE KARIBA KARIBA, ZIMBABWE

#### ABSTRACT

The von Bertalanf f y growth model was fitted to lengthat-age data of larval *Limnothrissa miodon* (Boulenger) from Lake Kariba. The length-at-age data were generated from counting daily growth increments in the otoliths of the larvae. The use of the VBGF is done on the assumption that linear methods should be replaced by nonlinear fitting techniques and that age as determined from growth increments in otoliths is a true nonstochastic independent variable. Another important consideration is that the asymptotic length used in this model is one defined for larval and not adult fish as is usually the case when the VBGF is used to describe growth in fish. by

## P. CHIFAMBA LKFRI LAKE KARIBA KARIBA, ZIMBABWE

#### ABSTRACT

The freshwater sardine, Limnothrissa miodon was introduced into the lake near sinazongwe during 1967/8 and has boosted the production of the Lake Kariba fishery. The sardine fishery contributes about 80 % of the total fish yield. By 1970 the sardine occurred in all parts of the lake, which showed that the fish has great capacity for reproduction and dispersal.

Even though sardines are found in virtually all parts of the lake there is a trend of increasing size of fish with increased distance form the shore. Alevins are found only in marginal areas, juveniles in marginal areas and sub-limnetic areas, subadults in the sub-limnetic and adults in sub-limnetic and limnetic areas. During some time of the year the adults were shown to occur in the shallow area as well.

Based on occurrence of larvae, breeding takes place throughout the year although there is no agreement on the peak breeding periods. The breeding period extends either from June to August and from January to March or alternatively, from September through to March. In spite of intensive limnological sampling, no eggs were found in areas deeper than 40 m which suggests that the fish might be spawning in water between 10-40 m in areas adjacent to steeply shored rocky marginal areas. It is assumed that the eggs hatch on the bottom and the alevins swim to the margins where they are found from 1 cm in length upward.

Recruitment takes place from February through to August, possibly as a result of the September to March spawning and is reflected in the catches.

The fish in Lake Kariba are stunted with the size of fish in the fishery ranging from 4.0 to 5.0 cm compared to the sizes in Lakes Tanganyika and Kivu. The K values are comparable to those in other lakes although maturity is reached at a smaller size than recorded for the other lakes. The higher mortality rate in Lake Kariba could be the cause f or the very f ew f ish reaching a large size. Food availability is a likely reason for the high natural mortality rate.

Although a lot is already known about the life style of sardines in Lake Kariba, gaps in our knowledge still exist particularly in our understanding of the relationship between sardine and zooplankton production, breeding and recruitment abundance cycles and migration.

#### LIMNOTHRISSA IN MAN-MADE LAKES: DO WE UNDERSTAND THE IMPLICATIONS OF THEIR SMALL SIZE ?

by

## B.E. MARSHALL DEPARTMENT OF BIOLOGICAL SCIENCES UNIVERSITY OF ZIMBABWE HARARE, ZIMBABWE

#### ABSTRACT

Small body size is a feature of *Limnothrissa miodon* introduced into the man-made Lakes Kariba and Cahora Bassa. Recent reliable determinations of their growth confirm the earlier high estimates of their mortality. This high mortality is consistent with the small body size of the fish. A similar allometric relationship applies to the production/biomass ratios. Because most fish die after a few months, there is no relationship between f ishing ef f ort and catch. Regulating effort may therefore contribute little to the management of this stock. The greatest risk to the fishery is a collapse of recruitment and there is an urgent need to understand the factors that regulate reproduction.

#### CATCH TRENDS OF LIMNOTHRISSA MIODON IN LAKE KARIBA

by

J.M.C. LUPIKISHA DEPARTMENT OF FISHERIES CHILANGA, ZAMBIA

#### ABSTRACT

Monthly catches over the years show a bimodal distribution with peaks in January/February and August/September and these appear to be related to nutrient inflow and lake turnover respectively. Catch trends of *Limnothrissa miodon* since 1982 (Zambia) and 1974 (Zimbabwe) are examined. In both countries catch per boat-night has increased from 200 (in 1983) to 300 kg/boat-night. Factors which may have led to these trends are discussed.

#### <u>Thursday afternoon 26.11.1992: LAKE VICTORIA (3 papers)</u>

## SEASONAL ABUNDANCE, VERTICAL MIGRATION AND THE FISHERY OF DAGAA RASTRINEOBOLA ARGENTEA IN THE UGANDAN WATERS OF LAKE VICTORIA

by

S.B. WANDERA UFFRO, JINJA, UGANDA

#### ABSTRACT

Rastrineobola argentea now ranks second to Nile perch among fish catches from Lake Victoria. Adults of this species occur at the bottom of the lake during daylight and move to the surface, where they are fished by light attraction at night. Quantities of Rastrineobola argentea landed show distinct seasonal fluctuations that correlate with periods of peak breeding. Artisanal fishermen's catches reveal that new cohorts of R. argentea enter the fishery when they are predominantly immature. The species grows within the fishery and gives peak catches when most of them have attained maturity. Knowledge of these peak breeding and recruitment periods is among the useful information required in the management of this fishery in order to ensure its sustainable exploitation.

## GROWTH, MORTALITY AND GEAR SELECTION OF RASTRINEOBOLA ARGENTEA (PELLEGRIN) IN THE WINAM GULF OF LAKE VICTORIA, KENYA

by

J.O. MANYALA KMFRI KISUMU, KENYA

#### ABSTRACT

Growth parameters from length-frequency-analysis of Rastrineobola argentea in Lake Victoria are presented for 1990/91 (Lw = 63.4 mm SL, K = 0.94  $\pm$  0.1 yr<sup>-1</sup> and Z = 3.28 yr<sup>-1</sup>). Observed selection of 5 mm mosquito seine net is compared to modelled selection from length-converted catchcurve analysis. Estimated parameters are compared to previous studies on the same species and other small pelagics from other African Great Lakes. Simple programmes for Bhattacharya analysis, Gulland & Holt plot, catch curve and selection modelling for use with Sharp EL 5050 range of programmable calculators are included in appendices I - IV. A general

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reduction in  $L_{00}$  has been observed for *R. argentea* in Lake Victoria since 1973.

## IMPORTANCE OF PREDATION MORTALITY BY NILE PERCH ON SMALL PELAGIC FISH SPECIES IN THE AFRICAN GREAT LAKES

by

R. OGUTU-OHWAYO UFFRO JINJA, UGANDA

#### ABSTRACT

Lates spp. (Nile perch) and other large predators such as Hydrocynus spp. contribute much to predation mortality of small pelagic fish species in many African lakes; Lates spp. are major predators of Rastrineobola argentea in Lakes Victoria, Kyoga and Nabugabo, Alestes spp. in Lake Albert, Engraulicypris stellae in Lake Turkana, Alestes dageti and Micralestes acutidens in Lake Chad, Limnothrissa miodon and Stolothrissa tanganicae in Lake Tanganyika. Hydrocynus species are major predators of small pelagic species in Lakes Albert, Turkana, Tanganyika and Kariba. Therefore, when determining exploitation rates and management of the stocks of small pelagic species, the role of predation and management of the predators should be considered.

#### Friday 27.11.1992: LAKE TANGANYIKA (S papers)

## DYNAMICS OF THE FISH STOCKS OF NORTHERN LAKE TANGANYIKA IN 1973-1980 WITH SPECIAL REFERENCE TO LIMNOTHRISSA MIODON

by

F.C. ROEST IAC, WAGENINGEN THE NETHERLANDS

#### ABSTRACT

The present paper attempts to describe and analyze the role of Limnothrissa miodon in the pelagic fishery in northern Lake Tanganyika for the period 1973-1980.

# BIOLOGICAL RESEARCH ON *LIMNOTHRISSA MIODON* POPULATIONS OF THE LITTORAL ZONE IN THE BURUNDI SECTOR OF LAKE TANGANYIKA

by

## Prof. G. NTAKIMAZI UNIVERSITY OF BURUNDI, BUJUMBURA

#### ABSTRACT

Up to now, biological research on *Limnothrissa miodon* populations in Burundian waters used samples from commercial catches originating from artisanal and industrial fishing units which exclusively fish in pelagic waters.

In the framework of a project with the objective to study the biotopes and fauna of the littoral zone of the northern basin of Lake Tanganyika, and the relationships with the earthly ecosystem ('écotone'), we plan to analyze more systematically all species of economic interest including *Limnothrissa miodon*.

Once a month, 5 different littoral zone stations (having a depth of less than 5m) are sampled using gillnets. For the moment, the small number of samples taken does not allow to draw conclusions yet. After the completion of at least two years of sampling, we hope to have a better understanding of reproduction cycles, growth of populations of *Limnothrissa miodon* and the importance that the different biotopes of the littoral zone represent in this context.

## ECONOMIC SITUATION OF THE BURUNDI FISHERIES DURING THE LAST TWELVE YEARS

by

Antoine KIYUKU DEPP, BUJUMBURA, BURUNDI

#### ABSTRACT

A synthesis of the economic information on the different types of fisheries operating in the Burundi part of lake Tanganyika is presented. Observations are forwarded based on existing statistical data in the Department and a comparison is made based on several criteria such as profitability, invested capital, catches (quantity and value), supply of fish according to its origin, and the relationships between different types of fishing during these last years. The paper also tackles the evolution and the price structure of marketed fish.

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## VARIATION IN ABUNDANCE AND DISTRIBUTION OF *LIMNOTHRISSA* MIODON IN THE TANZANIAN SECTOR OF LAKE TANGANYIKA: THE NEED FOR CONTINUED STOCK ASSESSMENT.

by

John D.R. BAYONA TAFIRI, DAR-ES-SALAAM, TANZANIA.

#### ABSTRACT

Limnothrissa miodon, a clupeid which largely occupies inshore waters, is capable of moving into pelagic waters where it is prone to industrial exploitation at sizes between 60 mm and 175 mm in fork length. The influx of the species in the pelagic zone usually reaches a peak between October and November. Time series trends in the species abundance and distribution were evaluated based on the available catch and effort data from the industrial fisheries for the period 1974 through 1987. A low but stable abundance pattern was demonstrated despite a drastic increase in the level of exploitation. However, an exceptional increase in abundance of the species in the pelagic zone was observed between 1977 and 1982, accounting for 0.5% to 11.6 % of the total industrial landings and coinciding with a drastic decline in abundance of Stolothrissa tanganicae, its competitor. Possibly this exposed L. miodon to tense predation by Lates mariae, resulting into negatively correlated oscillations in abundance of the two species. The lack of independent catch statistics for artisanal exploitation of the species, the escalating effort but generally yielding poor harvests from the lake are among the major bottlenecks, underscoring the importance of stock assessment to the optimization of exploitation of fish stocks.

# THE FISHERY OF STOLOTHRISSA TANGANICAE REGAN, 1917 IN THE TANZANIA WATERS OF LAKE TANGANYIKA

by

## K. I. Katonda TAFIRI KIGOMA, TANZANIA

#### ABSTRACT

The pelagic fish community of Lake Tanganyika is composed of six endemic species: two clupeids, Stolothrissa tanganicae and Limnothrissa miodon, and four centropomids, Lates stappersii, L. mariae, L. microolepis and L. angustifrons. Over 80 % of fish production in the Lake is contributed by the six species. Of the pelagic species, Stolothrissa tanganicae is the most abundant and important commercial species. High growth rate, early sexual maturity, short life-span and high natural mortality leading to the rapid succession of generations, are basic features of the population biology of S. tanganicae which has enabled the species to tolerate high levels of exploitation. Most of S. tanganicae is preserved by drying in the sun on sand beaches. Water transport carried out by large plank-built canoes and a weekly service by MV Liemba (or MV Mwongozo) has provided a useful service to traders of dried S. tanganicae along the coast of Lake Tanganyika. Marketing problems and statistics data collection on S. tanganicae are discussed.

## DEMOGRAPHICAL FEATURES OF STOLOTHRISSA TANGANICAE, LIMNOTHRISSA MIODON AND LATES STAPPERSI IN THE NORTHWESTERN END (ZAÏRE) OF LAKE TANGANYIKA

by

Mulimbwa N'SIBULA CRSN/UVIRA, ZAIßRE

and

P. MANNINI FAO-IFIP Project, Bujumbura, BURUNDI

#### ABSTRACT

The clupeids Stolothrissa tanganicae, Limnothrissa miodon and the centropomid Lates stappersi are pelagic fish of Lake Tanganyika and constitute a very important protein resource for the people living around the lake. Their biology has been studied by several authors whose work is actually summarized in the recent natural history review of the lake by Coulter (1991). Even if fish populations have no boundaries, no research work on the biology of these stocks has been published from the Zairian side of the lake since Marlier (1957).

Fishery statistics would suggest a decreasing trend of yield. The related socioeconomic implications are very serious. Biological information which is needed for the development and management of the fishery is inadequate. The present study constitutes a preliminary assessment of relevant population dynamics aspects of the three main species supporting the fishery.

## POPULATION PARAMETERS OF TWO CLUPEIDS, STOLOTHRISSA TANGANICAE AND LIMNOTHRISSA MIODON, IN THE NORTHERN PART OF LAKE TANGANYIKA, BASED ON LENGTH FREQUENCY DATA FOR THE PERIOD 1988 - 1990.

by

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and

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#### ABSTRACT

Two sardines, Stolothrissa tanganicae and Limnothrissa miodon, endemic clupeids of Lake Tanganyika, dominate the catches of pelagic fish in most years in the northern part of the lake. From the length frequency data by months, for the period 1988 1990, estimates of growth parameters (K,  $L_{00}$  and Phi prime), mortality rates (Z, M and F) and exploitation rate (E) are estimated using ELEFAN program routines as well as the recruitment pattern.

The results are presented and compared on two sides of the lake as well as with other studies.

#### THE EFFECT OF INCREASED FISHING PRESSURE ON THE CATCHES OF LIMNOTHRISSA MIODON IN SOUTHERN LAKE TANGANYIKA

by

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#### ABSTRACT

Limnothrissa miodon is one of the most important pelagic species of southern lake Tanganyika. More than 20 years data have been collected on the catches of the species in the southern arm of the lake. This was analyzed using basic techniques. Several graphs were produced. Time series trends in both the industrial and artisanal fisheries showed similar results. The industrial fisheries which is concentrated around the south-western arm of the lake reflected symptoms of overfishing whereas artisanal fishing which is practised on a much larger scale by the local populations indicated that the same could be the case. The total annual catches generally increased in the first 14 years of the period under review but has since adopted a downward trend. The effort has increased more than ten-ford over the same period resulting in a continuously falling CPUE. The effort in the artisanal fishery has gone down in the last four years resulting in a artificial increase in the CPUE in this category of the fishery. Τι. miodon is most probably under the threat of being overfished.

Keywords : Limnothrissa miodon; overfishing; catches; fishing effort; catch per unit effort

## <u>Saturday 28.11.1992: LAKES ITEZHI-TEZHI, NWERU-LUAPULA AND</u> <u>MALAWIAND PELAGIC FISHES IN ZAMBIA (4 papers)</u>

## INTRODUCTION OF LAKE TANGANYIKA SARDINES INTO ITEZHI-TEZHI RESERVOIR, ZAMBIA

by

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#### ABSTRACT

Lake Itezhi-tezhi, the second largest man-made body in Zambia, was created in 1977 and it lies on the Kafue River. The lake has a surface area of 370 km2 and it is oligotrophic. The deepest point of the lake is 55 m and its mean depth is 15.4 m.

In March 1992, the lake was stocked with 4,000 sardines from the Mpulungu waters in the south of Lake Tanganyika. The fish were shipped in a small aircraft over a distance of about 1200 km. To be fully stocked, the lake will require about 20,000 fry. With this introduction, it is hoped that fish production will increase in this small lake.

Keywords : Introduction; Lake Tanganyika; Itezhi-tezhi reservoir; Zambia; sardines.

#### THE BIOLOGY AND EXPLOITATION OF SMALL PELAGIC FISHES IN ZAMBIA

by

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#### ABSTRACT

The most important fish species of the small pelagics in Zambia are represented by 5 species of the CLUPEIDAE and 2 species of the CYPRINIDAE. The genera *Stolothrissa* and *Limnothrissa* are endemic to Lake Tanganyika although the latter has been translocated to Lakes Kariba and Itezhi-tezhi. *Poecilothrissa* are most abundant in Lake Mweru, whereas *Microthrissa* are predominant in Lake Mweru-wa-Ntipa while *Engraulicypris* are particularly dominant in Lakes Bangweulu and Mweru.

Literature review has shown that the biology of *Stolothrissa* and *Limnothrissa* is well documented. on the other hand, the biology of *Poecilothrissa*, *Microthrissa*, *Barbus* and *Engraulicypris* is not well known. However, nearly all of the pelagics considered here spawn several times in a year and are mainly planktivorous. They are all shoaling fish and are attracted to light at night.

Most of the pelagics in Zambia are caught at night by light attraction. The most common f ishing gear used include seine net, lift net, dip net and scoop net. In the last 5 years catches of the clupeids in Lake Tanganyika have varied from 4400-6000 tonnes per annum. The catches of Limnothrissa on the Zambian sector of Lake Kariba have varied from 5800-7500 tonnes per annum during the same period. In 1990 the estimated catch of the small pelagics on the Zambian sector of Lake Mweru was 7000 tonnes. In Lake Mweru-Wa-Ntipa catches of Microthrissa and Barbus have shown an average catch of about 4000 tonnes per annum since 1989. During 1992 catches of Engraulicypris in Lake Bangweulu have been estimated to be about 300 tonnes. The bulk of small pelagics in Zambia are processed by sun-drying while some from Tanganyika and Kariba are blast frozen. Small proportions of the Tanganyika small pelagics are canned on the Copperbelt towns. Much of the small pelagics product is transported by public buses and private lorries, some of which Most of the fish is sold to the markets are refrigerated. along the line of rail particularly in Lusaka and Copperbelt Provinces. The clupeids from Tanganyika are more expensive than all other pelagics from other lakes.

Keywords Zambia; Lake Tanganyika; Lake Mweru; Lake Mweru-WaNtipa; Lake Bangweulu; Lake Kariba; Lake Itezhitezhi; small pelagics; clupeids; cyprinids; Stolothrissa; Limnothrissa; Poecilothrissa;

GCP/RAF/271/FIN-TD/06 (En)

Microthrissa; Barbus; Engraulicypris; biology; fishing gear; annual catch; processing; marketing.

## PRELIMINARY REPORT ON THE BIOLOGY OF POECILLOTHRISSA MOERUENSIS POLL, 1948 (CLUPEIDAE) WITH NOTES ON SEVERAL OTHER SPECIES OF THE CHISENSE COMPLEX OF LAKE MWERU-LUAPULA, ZAMBIA

by

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#### ABSTRACT

On Lake Mweru-Luapula a major fishery has developed on a species complex called 'chisense' within less than one decade. Little is known about the yield and stocks and about the biology and life history of the most abundant species of the complex, *Poecillothrissa moeruensis*. The paper presents information on the feeding biology, fecundity, and variations between stocks in inshore and offshore waters in various parts of the open lake and the Luapula River. Some ideas on migratory behaviour may be presented. Preliminary data on species composition of the 'chisense' stocks are presented. Data on fchisensel fishing from a recent frame survey conducted in the area give indications of the size of the fishery and its methods. As research on the 'chisense' species complex has started recently the paper presents scattered information and hypothesis on which future research can be based.

#### GROWTH IN USIPA (ENGRAULICYPRIS SARDELLA)

by

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#### ABSTRACT

Usipa (Engraulicypris sardella) is an exploited pelagic cyprinid (endemic to Lake Malawi) reaching a maximum total length of about 130 mm. Records of growth rates are scarce in literature although a number of historical length frequency data sets of Usipa caught in beach seines exist. This paper is a further contribution towards the knowledge of growth of Usipa. In this presentation historical length frequency data are analyzed using the Overseas Development Administration (O.D.A.) sponsored Length Frequency Distribution Analysis (LFDA) computer package. Additionally, result of the current work on the estimation of daily growth rates using rings visible on ground sections of sagittae otoliths is also presented. Growth ring counts were made using a PC based Bioscan Semi-Automated Image Analysis System which display an enhanced image on a video monitor screen.

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