REGIONAL PROJECT FOR INLAND FISHERIES PLANNING, DEVELOPMENT AND MANAGEMENT IN EASTERN/CENTRAL/SOUTHERN AFRICA (I.F.I.P.)

IFIP PROJET

RAF/87/099-TD/13/90 (En)   July 1990

CASE STUDIES PRESENTED AT THE IFIP/SWIOP WORKSHOP
ON THE ECONOMIC ASPECTS OF
FISHERIES DEVELOPMENT AND MANAGEMENT
(October 30 to November 9, 1989
Dar-es-Salaam, Tanzania)

1. Ethiopia   7. Zambia
2. Kenya   8. Zaïre
3. Tanzania   9. Burundi
4. Mozambique   10. Rwanda
5. Zimbabwe   11. Uganda
6. Malawi
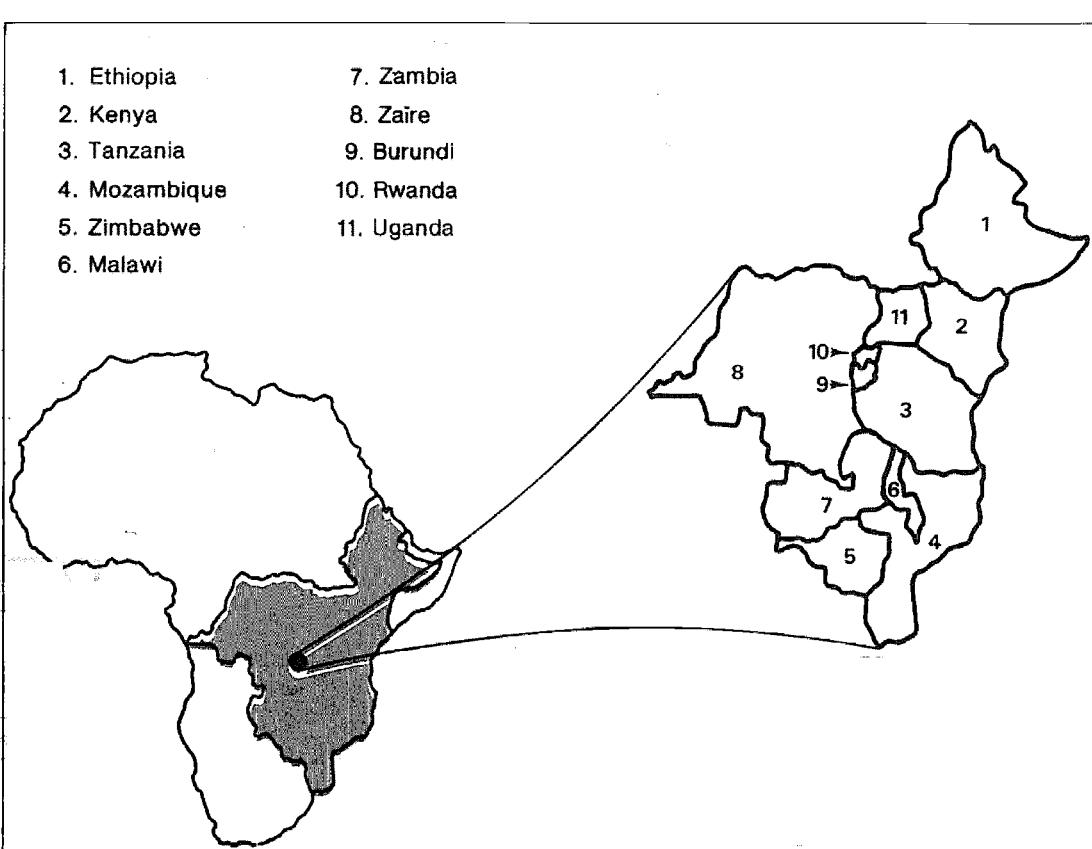
UNITED NATIONS DEVELOPMENT PROGRAMME

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

UNDP/FAO Regional Project   RAF/87/099-TD/13/90 (En)
for Inland Fisheries Planning
Development and Management in
Eastern/Central/Southern Africa

RAF/87/099-TD/13/90 (En)   July 1990

CASE STUDIES PRESENTED AT THE IFIP/SWIOP WORKSHOP
ON THE ECONOMIC ASPECTS OF
FISHERIES DEVELOPMENT AND MANAGEMENT
(October 30 to November 9, 1989
Dar-es-Salaam, Tanzania)

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
UNITED NATIONS DEVELOPMENT PROGRAMME
Bujumbura, July 1990

PREFACE

The IFIP project started in January 1989 with the main objective of promoting a more effective and rational exploitation of the fisheries resources of major water bodies of Eastern, Central and Southern Africa. The project is executed by the Food and Agriculture Organisation of the United Nations (FAO), and funded by the United Nations Development Programme (UNDP) for a duration of four years.

There are eleven countries and three intergovernmental organisations participating in the project: Burundi, Ethiopia, Kenya, Malawi, Mozambique, Uganda, Rwanda, Tanzania, Zambia, Zaire, Zimbabwe, The Communauté Economique des Pays des Grands Lacs (CEPGL), The Preferential Trade Area for Eastern and Southern African States (PTA) and the Southern African Development Coordination Conference (SADCC).

The immediate objectives of the project are: (i) to strengthen regional collaboration for the rational development and management of inland fisheries, particularly with respect to shared water bodies; (ii) to provide advisory services and assist Governments in sectoral and project planning; (iii) to strengthen technical capabilities through training; and (iv) to establish a regional information base.

...

This document includes the eight case studies presented at the Workshop on Economic Aspects of Fisheries Development and Management. The Workshop was held from October 30 to November 9, 1989 at the Kunduchi Fisheries Institute, Dar-es-Salaam, Tanzania. It was co-sponsored by the Regional Project for Inland Fisheries Planning, Development and Management in Eastern/Central/ Southern Africa (IFIP) and the Regional Project for the Development and Management of Fisheries in the Southwest Indian Ocean (SWIOP).

The report of the workshop and the technical papers presented during the workshop were issued by the project in two separate publications.

IFIP PROJECT
FAO
B.P 1250
BUJUMBURA
BURUNDI

Telex : FOODAGRI BDI 5092   Tel. 2.4328

IFIP PUBLICATIONS

Publications of the IFIP project are issued in two series:

A series of technical documents (RAF/87/099-TD) related to meetings, missions and research organized by the project.

A series of working papers (RAF/87/099-WP) related to more specific field and thematic investigations conducted in the framework of the project.

For both series, reference is further made to the document number (13), the year of publication (90) and the language in which the document is issued: English (En) or French (Fr).

TABLE OF CONTENTS

EXPLOITATION LEVELS IN THE BANKS HANDLINE FISHERY OF MAURITIUS AND REUNION AND A PROPOSAL FOR IMPROVING THE FISHERY PERFORMANCE

by

Michael J. Sanders
FAO FISHERIES PROJECT RAF/87/008
P.O. Box 487, VICTORIA, Mahe, Seychelles

ABSTRACT

The major conclusion of this case study was that the fishery, based on ten motherships operated largely on the Saya de Malha and Nazareth Banks, was employing grossly too much fishing effort. The economic yield being foregone each year because of this excess was estimated at Rs 31 million (equivalent to about US $ 2 million). The approach proposed to improve the performance of the fishery was to prescribe an annual fishery quota of 3 500 tonnes, and to apportion this between the fishing companies, along with a provision allowing the trading (e.g. buying and selling) of quotas on the free market. The practical aspects of this approach are discussed.

1. INTRODUCTION

The banks handline fishery presently involves Mauritius (9 vessels in 1989) and Réunion (1 vessel). The fishing grounds are on the banks of the Mascarene Ridge, particularly the Saya de Malha and Nazareth Banks. Fishing trips are of roughly six weeks duration, with the target species being *Lethrinus mahsena* which comprises about 90 percent of catches. The vessels are in fact motherships which carry 10 to 20 dories, each having three handline fishermen.

At present, the fishery is not subject to any specific management regime. Its development has nevertheless been influenced by price control as applied to frozen fish. The presumption here is that in the absence of price control, the additional profitability from the adoption of free market prices would attract additional investment, and hence increase in the number of vessels and fishing effort.

The latter is well demonstrated by the events following the abandonment of price control in 1981. At that time, the number of participating vessels was 5, in 1982 it was 10 and at the re-establishment of price control in 1987 it had increased to 15.

In the following assessment, it is shown that the present catch for the Saya de Malha and Nazareth Banks is about equal to the maximum sustainable yield (MSY), and that the maximum economic yield (MEY) would be attained at roughly one third the present effort.

The latter sections of the paper are devoted to describing the approaches which might be adopted to encourage reductions in fishing effort and hence improved economic benefits. As there are practical difficulties in applying these approaches, the final section is devoted to suggesting how these difficulties might be tackled.

2. THE EXTENT BY WHICH THE PRESENT FISHING EFFORT MIGHT BE EXCESSIVE

In respect to the Saya de Malha and Nazareth Banks, the results (Figures 1 and 2) indicate that the MSYs are about 2 500 tonnes and slightly less than 1 400 tonnes (gutted weight) respectively. (The methodology and inputs are indicated in Appendix 1). Adding these together gives 3 900 tonnes. This is close to the combined catch in 1988 by Mauritius and Réunion, although less by about 400 tonnes. The catch in 1988 is the consequence of a recent and substantial increase in fishing effort and is not sustainable.

From the results, it appears that if it were possible to reduce the fishing effort to about half its present level, the sustainable catch would not be much less than the estimated MSY following the establishment of the new equilibrium. The combined fishing effort on the two banks in 1986 was close to 59 000 man-days. According to the results, the sustainable catch from this amount of effort would be 3 860 tonnes. If instead, a sustained effort of 18 000 man-days was applied on the Saya de Malha Bank and 12 000 man-days on the Nazareth Bank, the catch at equilibrium would be 3 689 tonnes. In other words, halving of the fishing effort would lead to only about 200 tonnes (or 4.4 percent) less catch.

3. SOME ECONOMIC CONSEQUENCES OF THE EXCESSIVE FISHING EFFORT

The catch curves of the previous section were converted to revenue curves, using 15.9 Rs/kg as the landed price. (This was estimated from knowledge of the prevailing fixed prices and an assumption concerning the species mix). The fishing efforts were converted to fishery costs using 1 177 Rs/man-day and 1 100 Rs/man-day. The first of these reflects the costs of an insured vessel with capital annualized at an interest rate of 15 percent, and the second cost of an uninsured vessel with capital annualized at an interest rate of 10 percent.

In considering the economic consequences of the fishing effort regime, the economic yield (here taken as the difference between the sustainable fishery revenue and fishery costs) was used as the indicator of economic performance. In respect to the Saya de Malha and Nazareth Banks, it seems (Figures 3, 4 5 and 6) that the sustainable economic yield from the present level of fishing effort is zero.

This is well supported by the recent history of loan defaults, the voluntary retirement of several vessels from the fishery without replacement, and the general claim by company management that banks fishing is no longer profitable. Furthermore, the sustainable economic yield would increase with decrease in the fishing effort to a maximum value at about one third the present level of fishing effort.

When considering the Saya de Malha and Nazareth Banks combined, the estimated maximum economic yield (at present prices and costs) is about Rs 31 million or roughly the equivalent of US $ 2 million. This is an indication of the annual loss to the economy from the present grossly excessive fishing effort. The annual catch associated with the attainment of this MEY is 3 195 tonnes, achievable from an annual fishing effort of 17 000 man-days.

4. APPROACHES TO IMPROVING THE ECONOMIC PERFORMANCE OF THE FISHERY

Two approaches are discussed in this section. The first, sole reliance on price control, will be judged as obviously impractical, and it has been included only because it involves using the instrument of management (price control) which is presently in place. The second, (individual transferable quotas temporarily combined with price control) is presented as being the preferable approach.

Price Control: As discussed earlier, the appropriate remedy for the fishery is to reduce the fishing effort. This could be achieved by a decrease in the price. In fact it is possible to estimate the price which would achieve a given level of fishing effort, as well as the corresponding catch and economic yield. At present day costs, the price to achieve the maximum economic yield, for

2

example, is about 6 Rs/kg, forty percent of the present price. Applying this price, however, would in practice have drastic short term consequences. The immediate effect of applying this price in 1989 would be for all the companies to cease fishing.

A less drastic but equally impractical approach would be to progressively reduce the price over some years. The short term effect would be to force the least efficient companies out of the fishery and hence lead to a reduction of fishing effort. The profitability of the surviving companies would be even less than at present, which in turn might encourage them to engage in illegal sales on the black market. It would take a long time for any substantial improvement of the economic yield of the fishery to occur (due to the fish being long-lived) and the sole beneficiaries of the improvement would be the consumers.

Individual Transferable Quotas: The basic concept here is that the fishery be subject to an annual catch quota, and that this be apportioned between the fishing companies. In addition, those allocated a portion of the quota would have the right to sell or lease all or part of the portion in a free market. Such an approach will encourage the fishery to move in the direction of improved economic performance.

The latter would arise because, once the companies were assured of their portion of the annual quota, there no longer remains any incentive to increase fishing effort (in order to catch more fish), but rather all attention will be focused on ways to reduce costs and hence to increase profits. There are many potential strategies for reducing costs, including merging the quota entitlements from several vessels onto a single vessel.

In the ideal situation, the fishery quota should be the catch associated with MEY (or whatever other fishery objective is chosen by the managers). Where the prevailing catch is substantially higher, it will be necessary to progressively reduce the fishery quota. In the case of the banks handline fishery, the estimate of annual catch associated with the MEY is 3 195 tonnes (from the Saya de Malha and Nazareth Banks). The catch in 1988 was 4 080 tonnes (by Mauritius) and hence some phasing towards a lower fishing catch will be necessary.

In respect to who should be the beneficiaries from the introduction of individual transferable quotas, it is necessary to appreciate that the fishing companies will only be interested in reducing costs if they are substantial beneficiaries of the improved profits. In other words, it would not be wise for the fishery managers to expropriate much or all of the increased economic yield, as through the lowering of the price of fish or applying a special resource tax.

Finally, another virtue of individual transferable quotas is that it provides the opportunity for the inefficient companies to quit the fishery through gaining some monetary compensation for doing so. While the fishery remains at the very low level of company profitability as at present, the value of the quota entitlements will be small. As, over time, the fishery moves to substantially increased levels of economic yield, the value of the entitlements will increase and may ultimately become very substantial. At this time, the fishery managers will be looking closely at extracting some of this economic yield for the public purse.

5. HOW A REGIME OF INDIVIDUAL TRANSFERABLE QUOTAS MIGHT BE INTRODUCED INTO THE BANKS HANDLINE FISHERY

In the first year of implementation, suppose the fishery quota for the Saya de Malha and Nazareth Banks were set at 3 500 tonnes, after allowing 300 tonnes for Réunion. This would represent a movement towards the catch at MEY (about 3 200 tonnes) plus a margin for possible error (300 tonnes). The next task would be to allocate this amongst the active fishing companies on a percentage basis.

The percentage has been allocated here on the basis of the observed distribution of the catch between the companies in 1988, along with the expected distribution in 1989. The results from these analyses are shown in Table 1.

Table 1: A basis for allocating the first annual quota of 3 500 tonnes

Company Number	Percentage Allocation (%)	Tonnage Allocation (tonnes)
1	41	1 435
2	26	910
3	13	455
4	7	245
"reserve"	13	455
Totals	100	3 500

Note.   "reserve" relates to the performance of a company whose future continuance in the fishery is in some doubt.

Buyers and sellers may prefer to trade in tonnages rather than percentages, but for management purposes, the tonnages traded would need to be converted to percentages. Thus, if a company sells 35 tonnes in a year when the fishery quota is 3 500 tonnes, the company will be selling one per cent. Its future entitlement would be less by 1 per cent.

It would be important that the government fixing of fish prices continue at least past the introduction of individual transferable quotas. As the economic performance of the fishery improves due to reduced fishing effort and costs, it would be possible to consider reducing the price (to extract some of the new found economic yield) or alternatively to abandon price fixing altogether. The latter would represent a "windfall" gain to the companies, which could be avoided if desired by imposing a special resource tax (e.g. for use in fishery research and management). Whichever the decision, as previously mentioned, it will be essential for sufficient of the economic yield to remain with the companies as an incentive for reduction in fishery costs.

An important aspect of implementation concerns the present involvement of Réunion, particularly in respect to fishing the Saya de Malha Bank, much of which is in international waters. The implementation of the management scheme would be in danger of failing in the absence of cooperation from Réunion (and other nations who subsequently might seek to engage in the banks handline fishery). As Réunion is the only other participant at present, the initial approach would be to engage in discussions aimed at their agreeing to a percentage of a combined fishery quota (reflecting their catch of about 300 tonnes in recent years). Any agreement with Réunion should permit the possibility of the companies in both Mauritius and Réunion trading quota.

6. CONCLUDING COMMENT

It seems from what has been presented earlier that the Mauritian Government has few management options. One of these is the maintenance of the status quo and hence price control as the sole instrument of management. Under such a regime the consumers will continue to pay less than they might otherwise under a free market situation. They will, however, be paying almost double the price they would if the fishery were being managed at MEY (provided all the benefits of this economic efficiency were being directed to the consumers, which is unlikely).

The other problem with maintaining the status quo is that the fishing companies and perhaps also the distributors will continue to operate at almost zero profits or seek to undertake illegal activities to achieve profits. This is because they are employing grossly too much fishing effort and are being provided with no incentive to reduce effort. In quantitative terms, the loss of economic yield as the direct consequences of this excessive effort is about Rs 31 million each year.

The only practical remaining option is to employ a management instrument and associated strategy which progressively reduces the fishing effort with a minimum of disruption to the consumers and fishery participants. In the author's view this can best be achieved in this fishery by a combination of individual transferable quotas associated with a possibly temporary maintenance of price control.

4

In considering this option, it should be realized that, as the consequence of the fish being relatively long lived, it will take a considerable time for the catch rates to improve and for the size of the fish in the catches to become significantly larger. That is, it will take time for the potential to substantially increase the economic performance of the fishery to be realized.

Finally, as there has been no previous mention of enforcement difficulties, it is necessary here to make some brief comment. Having in mind the relatively small number of vessels in the fishery and the few landing sites, the problem of monitoring the quantities landed is reasonable. There will need to be an adequate attention to this matter in both Mauritius and Réunion. There will also need to be a register kept in which the identities and entitlements of the participating companies are recorded, along with the details of all buying, selling and leasing of quota.

7. REFERENCES

Bertrand, J. *et al.*, (1986): Rapport du groupe de travail pour une évaluation des ressources en capitaine dame berri des bancs de Saya de Malha, Publication IFREMER., 40 p.

Bautil, B.R.R. and C.R. Samboo, (1988): Preliminary stock assessment for the mahsena emperor *(Lethrinus mahsena)* on the Nazareth Bank of Mauritius. In Proceedings of the Workshop on the Assessment of the Fisheries Resources in the Southwest Indian Ocean. FAO/UNDP: RAF/79/065/WP/41/88/E: 227 p.

Thompson, W.F. and F.H. Bell, (1934): Biological statistics of the Pacific halibut fishery. 2. Effect of changes in intensity upon total yield and yield per unit of gear. Rep. Int. Fish. (Pacific Halibut). Comm. 8. 49 p.

Figure 1: Equilibrium catch, catch rate and mean individual fish weight for a range of annual fishing efforts – Saya de Malha
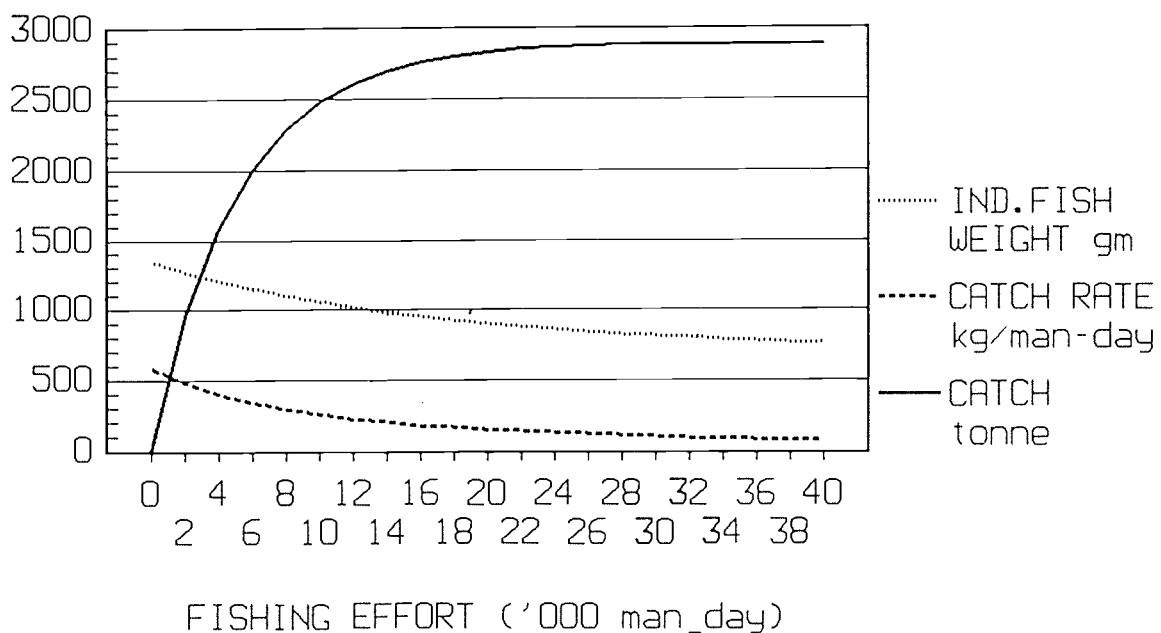
Figure 2: Equilibrium catch, catch rate and mean individual fish weight for a range of annual fishing efforts – Nazareth
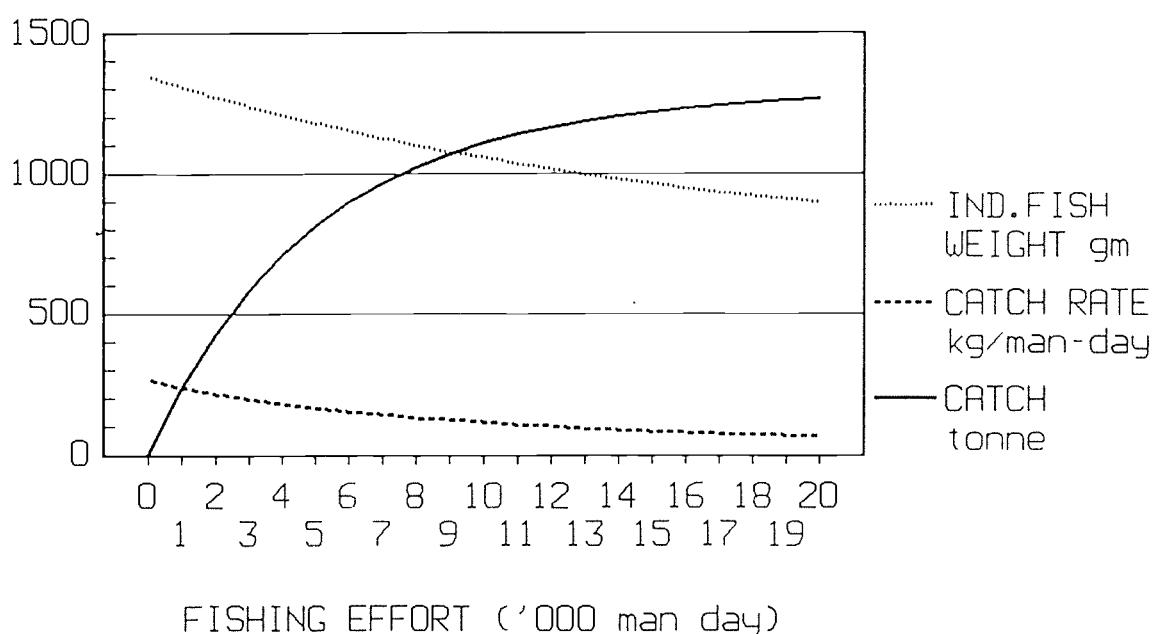
Figure 3: Equilibrium fishery revenue, cost and economic yield for a range of annual fishing efforts – Saya de Malha

(price = 15.9 Rs/kg)
(cost = 1,177 Rs/man-day)

ECON.YIELD (Rs '000)

COST (Rs '000)

REVENUE (Rs '000)

FISHING EFFORT ('000 man-day)
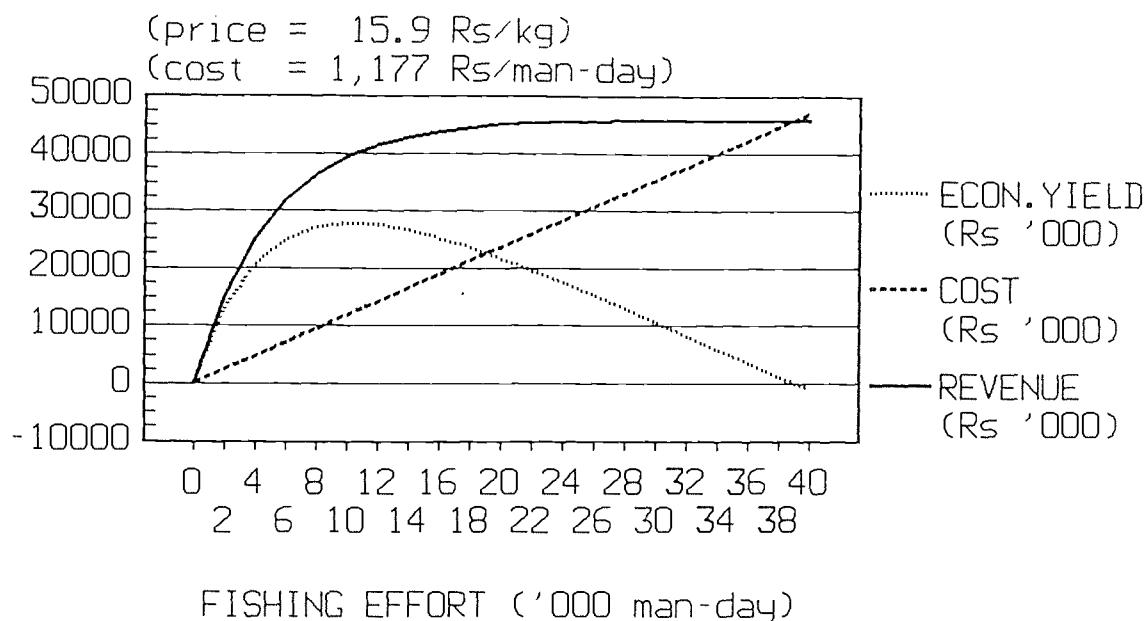
Figure 4: Equilibrium fishery revenue, cost and economic yield for a range of annual fishing efforts – Saya de Malha

(price = 15.9 Rs/kg)
(cost = 1,110 Rs/man-day)

ECON.YIELD (Rs '000)

COST (Rs '000)

REVENUE (Rs '000)

FISHING EFFORT ('000 man-day)

7
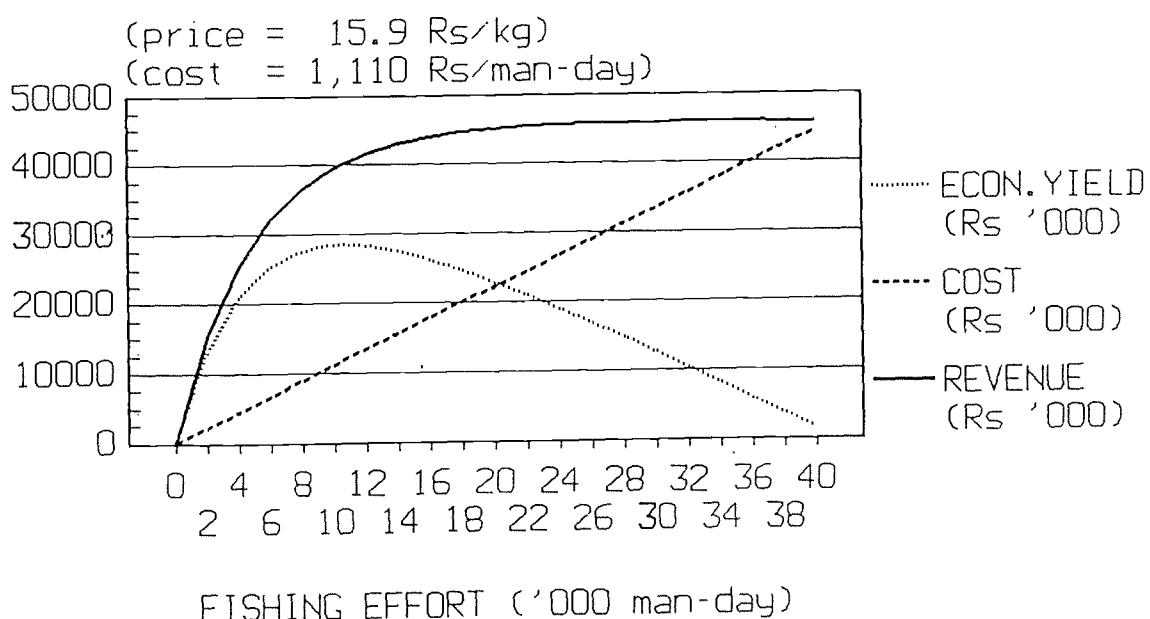
Figure 5: Equilibrium fishery revenue, cost and economic yield for a range of annual fishing efforts - Nazareth

(price = 15.9 Rs/kg)
(cost = 1,177 Rs/man-day)

ECON. YIELD
Rs '000

COSTS
Rs '000

REVENUE
Rs '000

FISHING EFFORT ('000 man_day)
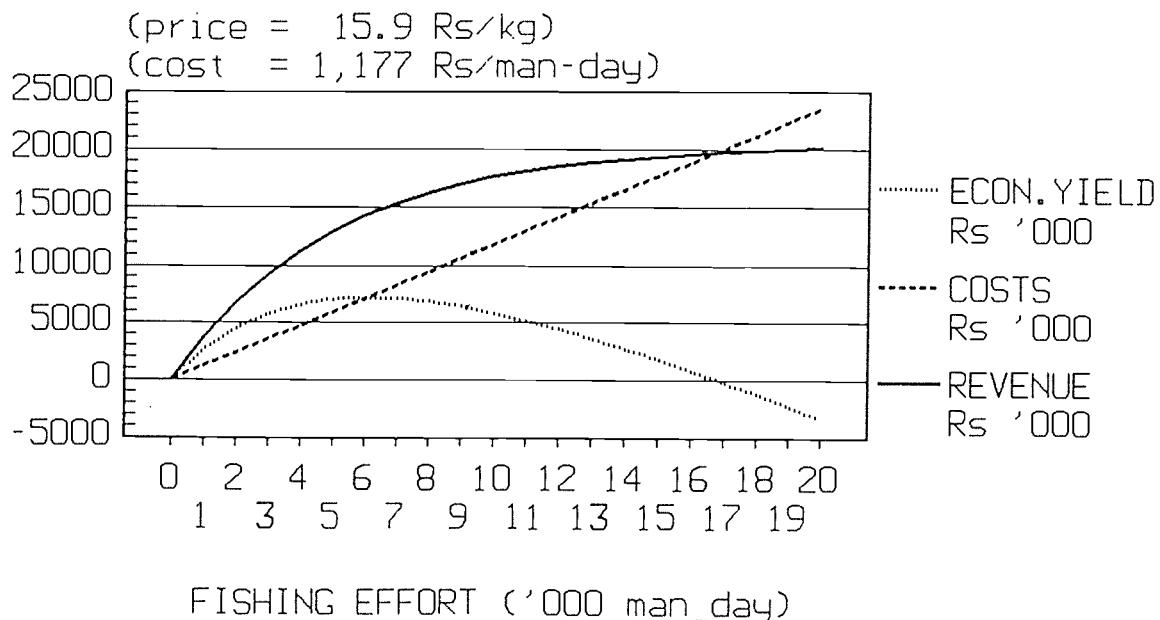
Figure 6: Equilibrium fishery revenue, cost and economic yield for a range of annual fishing efforts - Nazareth

(price = 15.9 Rs/kg)
(cost = 1,110 Rs/man-day)

ECON. YIELD
Rs '000

COSTS
Rs '000

REVENUE
Rs '000

FISHING EFFORT ('000 man_day)
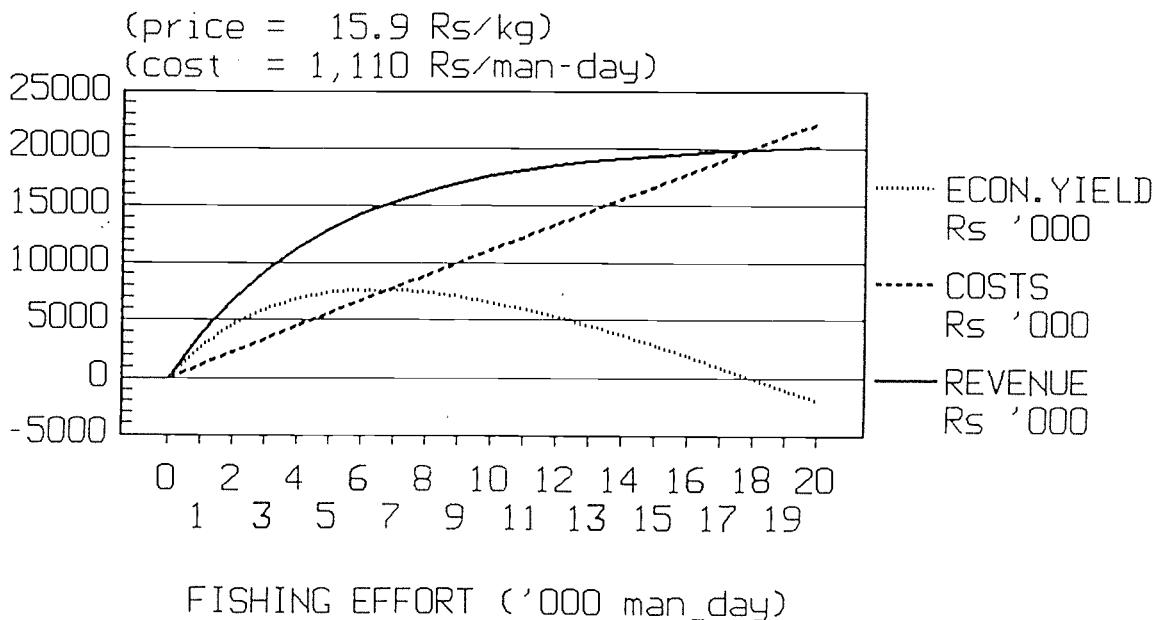
APPENDIX 1

The methodology and data inputs used for the estimations of the equilibrium catch, catch rate and mean individual weight of the fish in the catches for a range of sustained annual fishing efforts

The methodology is largely that described in Thompson and Bell (1984). The lifespan of the fish were considered in time increments of one year. Annual recruitment was assumed to be constant (in order to equate the catch weight in each year from a single year class to the catch in one year from all year classes).

The data inputs are given in the following table:

Growth Parameters:	L (inf)	= 61.00	
	K	= 0.10	
	t_0	= -1.00	
	a (females)	= 0.012	(when weight
	b (females)	= 3.160	is gm and
	a (males)	= 0.016	length is cm)
	b (males)	= 3.077	
Mortality: Parameters (Saya de Malha)	M	= 0.20/yr	
	F	= 0.408/yr	(1982/84
	F	= 0.306/yr	(1983/84
	t_c	= 5.8/yr	
Effort: Parameters (Saya de Malha)	X	= 20 082	man-days (1982/83)
	X	= 14 136	man-days (1983/84)
Catchability: Parameter	q	= 0.209×10^{-4}	
Recruitment:	R	= 14.8×10^{-6} (Saya de Malha)	
	R	= 6.6×10^{-6} (Nazareth)	

Most of the parameter values were taken from Bertrand et al (1986) and Bautil and Samboo (1988). The value for the catchability coefficient (q) was estimated from $q = F/X$, and the number of recruits at the beginning of the first year estimated by trial and error as the number required to achieve the mean catch for 1985 and 1986 from the mean fishing effort in those years.

ARTISANAL FISHERY CENSUS AND SOCIO-ECONOMIC STUDY IN ZANZIBAR

by

Mark Hoekstra
FAO FISHERIES PROJECT RAF/87/008
P.O. Box 487, VICTORIA, Mahé, Seychelles

ABSTRACT

This paper provides a description of the practical aspects of implementing the census and socio-economic study conducted during May-June 1989. It includes a checklist of the data needs, together with the questionnaires. The census questionnaire was used when interviewing the 5 600 fishermen-in-charge and the socio-economic questionnaire was used for ten percent of this number.

1. INTRODUCTION AND BACKGROUND

Zanzibar and Pemba are semi autonomous islands within the Republic of Tanzania. Fish is presently the islands' principal source of animal protein. In Zanzibar, the marine fishery is largely artisanal and is characterized by the use of simple vessels and non conventional fishing gear. The catch is landed at numerous sites along the beach. The fishermen use craft of three basic types: dugout canoes, outrigger dugout canoes and planked boats up to 10 metres in length. All are open · day boats; none use ice. Hand lines, trolling lines, gillnets, encircling nets, a few beach seines and a large number of traps are employed.

In recent years, it has been observed that there is a decline in the total annual landings in Zanzibar islands. This may be the result of intensive fishing by the artisanal fishermen in the nearshore waters or alternatively is an indication of declining effort (specifically nets). This uncertainty on the exact cause of the fall in annual landings is an obstacle to the choice of a strategy for development and management.

Fish landing sites in Zanzibar have been identified during surveys in 1980 and 1985 (Ngoile, 1981; Carrara, 1986). During the two surveys, the fishing units were assessed quantitatively. Due to the time span between them, a comparison could also be made of the evolution in the number of fishing units. This revealed that there was a significant decrease in all types of nets in both islands (except for gillnets in Pemba) and an increase in hand lines and traps.

It has been suggested that economic constraints have hindered the importation of nets. Despite liberalization of trade in Zanzibar, nets are costly and bulky and cannot be easily imported in the required quantities. In order to evaluate the trend in the quantity of fishing units, a third survey was timely and necessary. It was decided to include a study of economic aspects of the artisanal fishery.

The government of Zanzibar is instituting a development plan to alleviate the decline in total annual fish landings described above. The plan includes an initial injection of foreign currency to enable importation of sufficient gear. Successful implementation of the plan depends on an accurate assessment of the present status of the artisanal fishery in order to evaluate the types and quantities of gear needed. The census and socio-economic survey was therefore intended to generate supportive data for gear needs relative to maintaining productivity levels. Furthermore the they would:

- help in improving the frame and raising factors of the new system of catch and effort statistics,

- provide a baseline against which future changes can be measured, and

- could identify areas for further study.

National counterparts would also be trained in the methodology and execution of this type of study.

The execution of the new census and socio-economic survey was undertaken in May-June 1989 as a joint exercise of the Institute of Marine Science, University of Dar-es-Salaam, the Fisheries and Statistics Departments of Zanzibar and the South West Indian Ocean Project of FAO.

As the census and survey were two integral parts of one study and were carried out in parallel they will be dealt with here as one study with two separate components.

2. THE OBJECTIVES

The objectives of the census and socio-economic were formulated as follows:

(a) to assess the total number and distribution of landing sites;

(b) to assess the total number, type and distribution of fishing units, boats and gears

(c) to assess the socio-economic aspects of the fishery

3. SUBJECT MATTERS

After having agreed on the objectives, , the next step was to define the subjects of the study more precisely. A checklist of data needs was drawn up and discussed (Appendix III). The approach taken in designing the questionnaire was first to decide on the outputs and conclusions we wished to achieve. This allowed us to define which statistical tables and cross-tabulations of the results we needed, and from them we could infer the most appropriate questions. Furthermore, it had to be decided which questions to incorporate in the census questionnaire and which in the socio-economic questionnaire.

The socio-economic aspects investigated included the age and lifespan of boats, engines and gear, the sharing system, the availability and use of credit, the geographical and occupational mobility of fishermen, their social and material well-being and the number and characteristics of their dependents.

4. GEOGRAPHICAL AREA AND UNIT OF ENQUIRY

The geographical area for the study were Unguja and Pemba (see maps Appendix I, II), as well as some minor inhabited islands. The unit of enquiry for the census was the fishing economic unit. The respondents were fishermen in charge of a fishing unit. A fishing unit was defined as *"one or a group of fishermen fishing with a boat, or one or a group of fishermen who for most of the year fish without a boat"*. The choice for the unit of enquiry for the socio-economic survey resulted from practical considerations. As the respondents for the census were the fishermen in charge of a fishing unit, they could also be easily approached for the socio-economic questionnaire. Approaching crew members would have involved more time and funds. Furthermore, the socio-economic questionnaire included some questions relating to the fishing economic unit such as the age and lifespan of boat, engine(s) and gear and the sharing system. The fisherman in charge was obviously the best respondent to give details on these matters.

5. QUESTIONNAIRE AND PILOT SURVEY

The large amount of data expected to be generated in this study yielded a powerful argument in favour of a questionnaire design (Appendix IV and V), with pre-coded answer categories. In formulating the questions, it was important that they be easily understood by the fishermen. The choice for a questionnaire with pre-coded answer categories assumes that those distinguished in the questions are exhaustive and mutually exclusive. A pilot survey was thus carried out in the field. This included testing the ability of enumerators to pose the questions correctly, the degree to which fishermen were willing and able to answer the questions and the applicability of the questions and answer categories to the local situation. The questionnaires were translated into Kiswahili.

6. PREPARATION AND PLANNING

During the period of the pilot survey, all statistical enumerators from Unguja and Pemba islands were called to Zanzibar town on Unguja and Wete in Pemba to depict the (temporary and permanent) landing sites in their area on a topographical map (1:50.000). The names of the landing sites were written on the maps. The boundaries of the enumerators' operational areas were drawn in order to check full coverage and/or overlaps during the data collection phase of the study. Subsequently, the statistical enumerators were asked to estimate the number of fishing units in their area. This activity served the following purposes:

(a) it enabled an assessment of requirements for implementation of the study in terms of funds, time and manpower;

(b) it enabled a pre-codification of landing sites for computer programming, as output data were to be broken down to administrative region further to be broken down into East and West coasts.

Subsequently, the resources available for the execution of the study had to be established. A meeting was organised to discuss commitments in terms of funds, transport, manpower and materials to be provided by the different parties concerned. The design of a survey and its requirements in terms of funds, time and manpower should be dictated by its purposes, required validity and reliability. Practical restrictions often prevail with respect to time, funds and available staff (in number and skill). This survey was no exception. The design of the survey and particularly the data collection method was the result of a compromise between the required validity, reliability and available resources.

7. THE EXECUTION OF THE SURVEY

The execution of the census and survey involved (a) a training course for the statistical enumerators on how to carry out the interviews, (b) the actual data collection at the landing sites, (c) supervision and quality checks in the field and (d) coding of the questionnaires, data input and (preliminary) processing.

The training course was conducted for two days in Unguja and two days in Pemba. During the training course training manuals (in Kiswhahili) on how to fill in the questionnaires were handed out to the enumerators. The training course to the enumerators was preceded by a one day training course for supervisors.

Each enumerator was given two types of questionnaires:

(i) census questionnaires which were used to count the number of fishing units and to assess a number of characteristics of the fishing units, and

(ii) socio-economic questionnaires which were used to assess additional characteristics of the fishing unit and the socio-economic position of the fishermen.

Only 10% of the fishermen in charge of a fishing unit were interviewed using the socio-economic questionnaire. The questionnaires were attached in the form of booklets. Each booklet contained 10 census questionnaires and one socio-economic questionnaire attached to the 10th census questionnaire.

Each enumerator was given a number of questionnaires according to the number of fishing units he estimated to exist in the landing sites in his area. Interviews were carried out at the landing sites or at the fishermens' homes when necessary. Each census questionnaire required about 5 minutes to be filled and each socio-economic questionnaire about 30 minutes.

Supervisors were assigned the job of visiting the enumerators at the landing sites to check if the enumerators filled in the questionnaires correctly and rectify any mistakes. Coding was then done by the supervisors. Subsequently, the census data were input into two portable computers using dBase III plus. Pre-coding of the questionnaires and programming (in advance) of output tables enabled fast printouts of the preliminary results.

A total of 21 people (SWIOP and Zanzibar staff) were involved in either preparation and/or supervision of the execution of the study. The preparation of the study i.e. activities 1 to 5 (Table 1) involved an estimated 100 man-days. In total, 34 enumerators were involved in data collection on Unguja Island and 21 on Pemba.

The data collection for the census and socio-economic survey took 10 days on Pemba island and 2 weeks on Unguja island.

Excluding the period spent by the enumerators in actual data collection, the total time involved in training, supervision (checking), coding and data input was estimated at some 230 man-days. The time requirement for analysis and report writing is estimated at another 60-70 man-days.

In this study, some 5,600 fishermen were interviewed using the census questionnaire. Of these fishermen, 10% were also interviewed in parallel using the socio-economic questionnaire.

8. SUMMARY DESCRIPTION OF ACTIVITIES

No generally applicable rules can be given to estimate the time requirements of the activities described above. Much depends on the scope of the survey, the number of interviewers and the number of interviewees. It goes without saying however, that where different institutions and many people are involved and a large number of interviews is to be held, careful timing of activities is essential.

Table 1 provides a summary description of activities together with the time taken for this study. It is clear that a census and a socio-economic baseline survey is much more than just a field study to collect data. Considerable preparation is needed prior to field activities, and time is required afterwards to analyse the data, interpret the results and prepare reports.

Table 1: Summary description of activities during the Zanzibar census and socio-economic survey.

Activities	1988 12	1989					
		1	2	3	4	5	6
1. Preparation of questionnaires & output tables	xxxxxxx						
2. Pre-testing & mapping in Zanzibar		xxxxxxx					
3. Modifying questionnaires prep. of instruction manuals				xxxxxxx			
4. Translation, typing, printing questionnaires & manuals					xxxxx		
5. Computer programming			xxxxxxxxxxxxxxxx				

Activities 6 - 10 in Zanzibar

Activities	1988 12	1989					
		1	2	3	4	5	6
6. Planning logistics of survey					x		
7. Training course(s)						xx xx	
8. Data collection						xxxxxxx	
9. Verification & coding							xxxxxx
10. Data input							xxxx
11. Processing							>>
12. Analysis & reporting							>>

Landing sites on Unguja Island
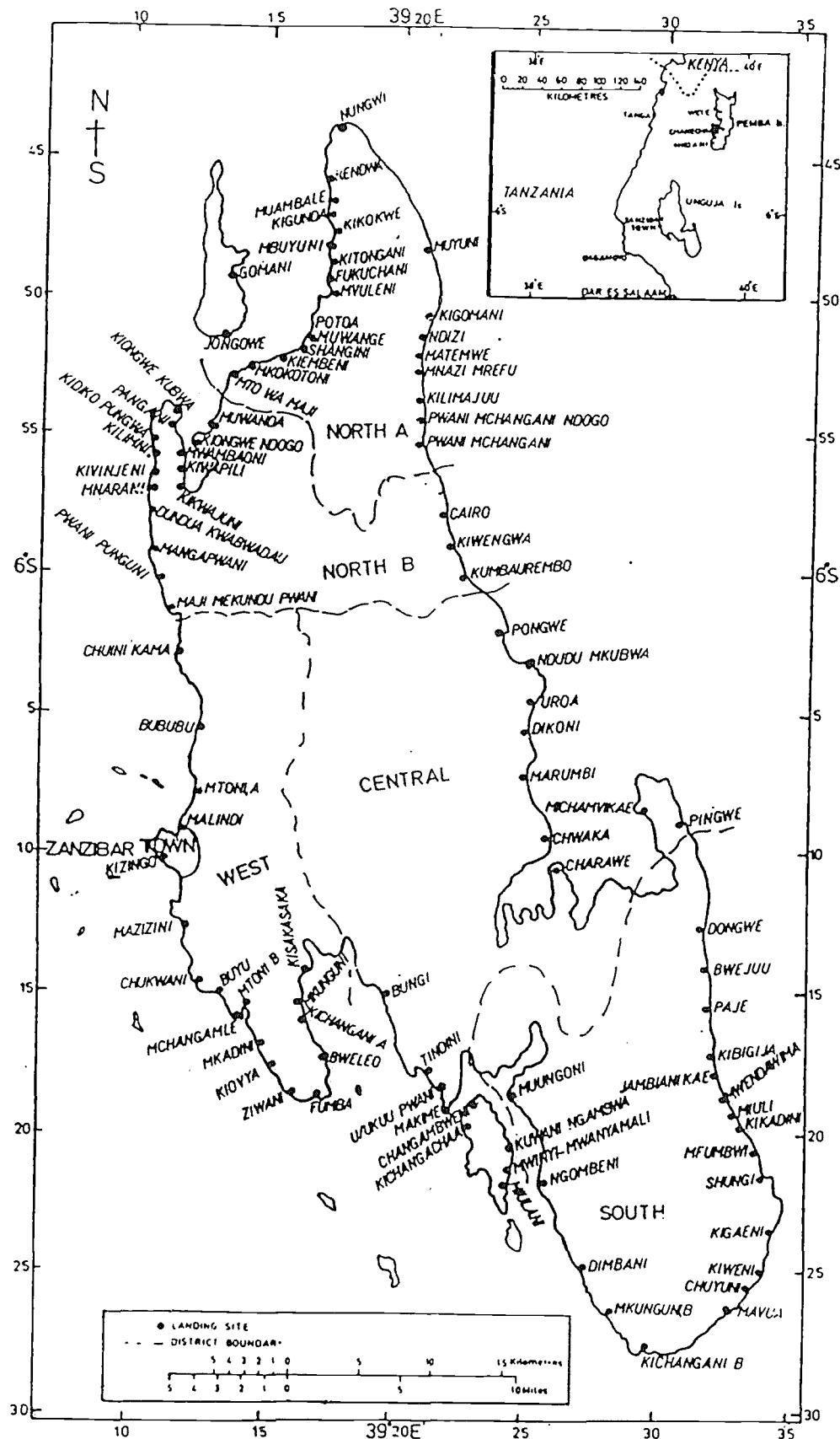
APPENDIX II

Landing sites on Pemba Island
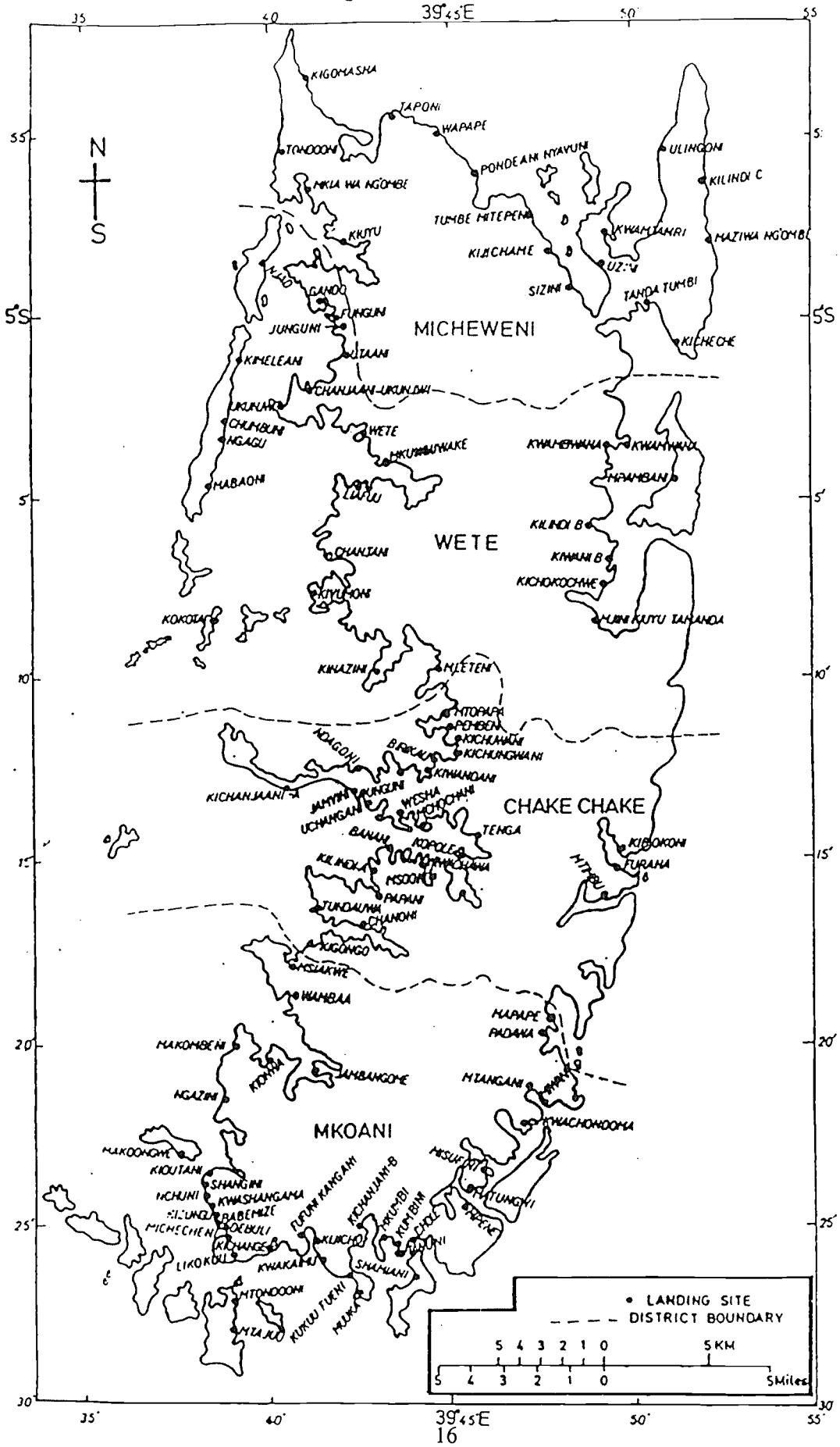
CHECKLIST FISHERY SECTOR SOCIO-ECONOMIC SURVEY FOR ZANZIBAR

Questionnaire 1: A Census of Landing Sites and Fishing Units.

The information to be collected in respect of each unit are as follows:

|	
(i)	Name of landing site
(ii)	Name of fishermen in charge of Unit
(iii)	Whether fishing unit is a visiting one
(iv)	Whether fishing unit includes a boat or otherwise
(v)	Type and length of boat
(vi)	Type of propulsion
(vii)	Horsepower of engine(s) (if applicable)
(viii)	Number of crew (including skipper)
(ix)	Number of units and/or length of fishing gears by type
(x)	Ownership arrangements for each of the boat, engine and gears
(xi)	Main landing sites during N.W. monsoon and S.E. monsoon
(xii)	Main species in the catches (to be used with other information for identifying the type of fishery in which the unit is being engaged).

The target group to be interviewed are the fishermen in charge of fishing units. All such fishermen at all the landing sites on both islands are to be interviewed.

Questionnaire 2: A Survey of the Replacement Costs and Lifespan of the Boats, Engines and Gears; Extent of Fishermen's Residential and Occupational Mobility; Sources of Credit; Extent of Utilisation of Fishing Unit; Number of Household and Family Members; Educational Level achieved by Fisherman and children and Ownership of House, Land, Livestock and selected consumer items.

The information to be collected in respect to each fishing unit are as follows:

(i)	Age of boat, gear and engine
(ii)	Expected lifespan of boat, gear and engine
(iii)	Sharing system
(iv)	Source of financing for each of boat, engine and gears (categories: self, family or friends, middlemen, bank combination or other)
(v)	Size of loan and date when obtained
(vi)	Proportion of loan remaining to be re-paid
(vii)	Rates of interest charged
(viii)	Number of months during past year that Unit was engaged in fishing

The information to be collected in respect to each fisherman in charge are:

(ix)	Name of village of birth
(x)	Name of last village of residence
(xi)	Year when left last village of residence
(xii)	Main employment in last village of residence (categories: fisherman, fish trader, boatbuilder, farmer, government employee, merchant, other)

The information to be collected in respect to the household of each fisherman in charge are as follows:

(xiii)	Age, marital status, education, secondary occupation of fisherman
(xiv)	Number of children
(xv)	Education level achieved by children
(xvi)	Ownership of house and land (utilised by household)
(xvii)	Building material for roof, walls and floor and number of rooms in house
(xviii)	Area of land (utilised by household)

(xix)	Area of land under crops during past year
(xx)	Main crops grown on land during last year
(xxi)	Number of livestock by type (utilised by household)(categories: horses, donkeys, cattle, pigs, goats, sheep poultry, others)
(xxii)	Ownership of livestock
(xxiii)	Ownership of selected consumer items

The target group to be interviewed are a sample (10%) of the fishermen in charge of Units (irrespective of whether the unit includes a boat or otherwise). Such sample groups are to be interviewed in respect to all villages on both islands.

Questionnaire 1

Landing site code

Serial number

CENSUS OF LANDING SITES AND FISHING UNITS, ZANZIBAR 1989

A. IDENTIFICATION PARTICULARS

1. Name of landing site:

2. Date :

3. Name of enumerator

socio-economic

4. Is a socio-economic form attached?   yes 1 ☐   no 2 ☐

B. PARTICULARS OF FISHING UNIT 1)

1. Name of fisherman in charge:

visiting

2. Is the fishing unit a visiting unit at this landing site?   yes 1 ☐   no 2 ☐

crew

3. What is the number of crew (including skipper)/ or fishermen in unit without boat?

4. What is the main type of proplusion of the boat?   propulsion

a.   engine 1 ☐   sail 2 ☐   oar/pole 3 ☐

b. How many people own the boat/engine/gear (Insert 0 in box for boat/engine if unit fishes without a boat)

boat en-gine gear   OWNERS boa eng gear
☐ ☐ ☐   ☐ ☐ ☐

c. What is the financial share of the skipper in boat/engine/gear? (e.g. 1, 1/2, 1/3)

boat en-gine gear   SHARE boa eng gear
☐ ☐ ☐

d. Type of ownership of boat/engine/gear (Mark appropiate boxes)

	boat	en-gine	gear	OWNERSHIP engine boat gear
−Owned by skipper alone	1 ☐	1 ☐	1 ☐	☐ ☐ ☐
−Owned by skipper in partnership with crew	2 ☐	2 ☐	2 ☐	
−Owned by skipper in partnership with family	3 ☐	3 ☐	3 ☐	
−Owned by family member(s) not incl. skipper	4 ☐	4 ☐	4 ☐	
−Owned by middleman	5 ☐	5 ☐	5 ☐	
−Other (specify)............				

5. Type and length of boat (record boat length in local units − pima in appropriate box)

Length (pima)   boat code   length

Mtumbwi/Hori	1	
Ngalawa	2	
Mashua	3	
Dau	4	
Boti	5	
Other (specify).......		

1) A fishing unit is one or a group of fishermen fishing with a boat, or one or a group of fishermen who for most of the year fish without a boat

number

initials enumerator ☐☐☐   ☐☐☐

6. Indicate engines in use and in stock by entering
   the number of horsepower in the appropriate box(es)

	USED horsepower		IN STOCK horsepower		USED inboard

a. inboard   1 [|]   inboard [|]   1 [|]
    engine   engine

         horse-   horse-   horse-   horse-   out-   out-
         power   power   power   power   board1   board2
                                                          used   used
    outboard 2 [|] 3 [|]   outboard [|] [|]   2 [|] 3 [|]
    engine   engine

b. Are there any engines in stock?   yes 1 [ ]   no 2 [ ]   [ ] stock

---

C. SEASONAL MOBILITY OF FISHING UNIT   landing site
   1. Name the landing site/village where you normally land   code
      the catch during the

      North-west monsoon   [   ]

      South-east monsoon   [   ]   [| |]
                                                                  [| |]

D. PARTICULARS OF FISHING GEAR
   1. Indicate the type of gear by entering length or
      number of units in appropriate boxes
                                              *)
                                          most
                                          impor-
      enter length   tant   main species
      in pima   used   in stock   gear   caught

						length used	length stock

Beache seine   1 [| |] [| |] [ ] /   1 [| |] [| |]
Sharknet demers.   2 [| |] [| |] [ ] /   2 [| |] [| |]
Drift gillnet   3 [| |] [| |] [ ] /   3 [| |] [| |]
Demersal gillnet   4 [| |] [| |] [ ] /   4 [| |] [| |]
Surrounding net   5 [| |] [| |] [ ] /   5 [| |] [| |]
Mosquito net   6 [| |] [| |] [ ] /   6 [| |] [| |]
Longline   7 [| |] [| |] [ ] /   7 [| |] [| |]

      enter number of units   units   units
                                                          used   stock

Lights   8 [|] [|] [ ] /   8 [|] [|]
Dinghy's   9 [|] [|] [ ] /   9 [|] [|]
Bottom handline   10 [|] [|] [ ] /   10 [|] [|]
Pelagic handline   11 [|] [|] [ ] /   11 [|] [|]
Big trap   12 [|] [|] [ ] /   12 [|] [|]
Small trap   13 [|] [|] [ ] /   13 [|] [|]
Fixed trap   14 [|] [|] [ ] /   14 [|] [|]
Scoop net   15 [|] [|] [ ] /   15 [|] [|]
Lobster gear   16 [|] [|] [ ] /   16 [|] [|]
Octopus harpoon   17 [|] [|] [ ] /   17 [|] [|]

Other (specify)....

Indicate the most important gear with an asterisk *

E. FISHERY TYPE
   1. Type of fishing [   ]   [|] fishing
                                                                   type

Questionnaire 2

landing site code

serial number

SOCIO-ECONOMIC SURVEY OF FISHING UNITS, ZANZIBAR 1989

A. IDENTIFICATION PARTICULARS

1. Name of landing site   :

2. Date   :

3. Name of recorder   :

4. Name of fisherman in charge:

B. LIFESPAN OF BOAT, ENGINE AND GEAR AND COST AND REVENUE SHARING

Give details of the cost and revenue sharing

	Type/Brand	Age (years)	Expected lifespan from new (years)		proportion of costs	revenue
Boat *)				boat owner(s)		
Engine 1 *)				engine owner(s)		
Engine 2			m o n t h	gear owner(s)		
	no.of units	Age	years	crew/workers		
Gear1				other(s)		
Gear2				specify........		
Gear3						

*)Note:When no boat and/or engine is used indicate by "N.A."in box for type.

C. CREDIT ARRANGEMENTS TO PURCHASE BOAT

1. Did you obtain any loan to finance the purchase of the boat?

yes 1 [ ]   no 2 [ ] —> Go to D

2. Give details:

	Family	Friends	Middleman	Government Bank	Other
Source of loan	[ ]	[ ]	[ ]	[ ]	[ ]
Date of receival (yr/month)	yr mth	yr mth	yr mth	yr mth	yr mth
Loan amount (Tsh)					
Original term of loan (yr)					
Amount loan still outstanding (Tsh)					
Rate of interest	%	%	%	%	%
Indicate if interest is per year or month					

initials [ ][ ] number

D. CREDIT ARRANGEMENTS TO PURCHASE ENGINE

1. Did you obtain any loan to finance the purchase of the engine?

2. Give details: yes 1 ☐   no 2 ☐ ——→ Go to E

	Family	Friends	Middleman	Bank	Other
Source of loan	☐	☐	☐	☐	☐
Date of receival (yr/month)	yr☐ mth☐	yr☐ mth☐	yr☐ mth☐	yr☐ mth☐	yr☐ mth☐
Loan amount (Tsh)	☐☐☐	☐☐☐	☐☐☐	☐☐☐	☐☐☐
Original term of loan (yr)	☐☐	☐☐	☐☐	☐☐	☐☐
Amount loan still outstanding (Tsh)	☐☐☐	☐☐☐	☐☐☐	☐☐☐	☐☐☐
Rate of interest	☐ %	☐ %	☐ %	☐ %	☐ %
Indicate if interest is per year or month	☐	☐	☐	☐	☐

E. CREDIT ARRANGEMENTS TO PURCHASE GEAR

1. Did you obtain any loan to finance the purchase of the gear?

2. Give details: yes 1 ☐ ➤which gear ☐   no 2 ☐ ——→ Go to F

	Family	Friends	Middleman	Bank	Other
Source of loan	☐	☐	☐	☐	☐
Date of receival (yr/month)	yr☐ mth☐	yr☐ mth☐	yr☐ mth☐	yr☐ mth☐	yr☐ mth☐
Loan amount (Tsh)	☐☐☐	☐☐☐	☐☐☐	☐☐☐	☐☐☐
Original term of loan	yr☐ mth☐	yr☐ mth☐	yr☐ mth☐	yr☐ mth☐	yr☐ mth☐
Amount loan still outstanding (Tsh)	☐☐☐	☐☐☐	☐☐☐	☐☐☐	☐☐☐
Rate of interest	☐ %	☐ %	☐ %	☐ %	☐ %
Indicate if interest is per year or month	☐	☐	☐	☐	☐

initials ☐☐☐☐☐ number

F. UTILISATION OF FISHING UNIT

1. Indicate the months during the past year (12 months) that the unit has been engaged in fishing. (Mark appropriate boxes)

1	2	3	4	5	6	7	8	9	10	11	12
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
may	jun	jul	aug	sep	oct	nov	dec	jan	feb	mar	apr

2. Considering only those months when the fishing unit was engaged in fishing indicate the average number of fishing days per month during each of the following two seasons:

   a. the North-East Monsoon ☐☐ days

   b. the South-West Monsoon ☐☐ days

3. Indicate reasons for any unusual loss of fishing time:

   ....

G. RESIDENTIAL AND OCCUPATIONAL MOBILITY OF FISHERMAN IN CHARGE AND OCCUPATION OF FATHER

1. Where do you live? ☐

2. Have you always lived here? yes 1 ☐ ──→ Go to 6

                            no 2 ☐

3. What was your place of birth? ☐

4. How many years ago did you move to your present residential village? ☐☐ years

5. What was your main occupation at your previous village of residence?

   Fisherman   1 ☐
   Farmer   2 ☐
   Govt. employee   3 ☐
   Fish trader   4 ☐
   Boat builder   5 ☐
   Other (specify) ....

6. Did you have a main previous occupation before you became a fisherman?

   a. ──────────── yes 1 ☐   no 2 ☐ ──→ Go to 7

   b. What was your previous main occupation?

      (Mark appropriate box)

   Farmer   2 ☐
   Govt. employee   3 ☐
   Fish trader   4 ☐
   Boat builder   5 ☐
   Other (specify) ....

7. What was your father's main occupation?

(Mark appropriate box)

Fisherman	1 $\square$		Fish trader	4 $\square$
Farmer	2 $\square$		Boat builder	5 $\square$
Govt. employee	3 $\square$		Other (specify).....	

H. FISHERMAN AND DEPENDENTS CHARACTERISTICS

1. Give the following details for the fisherman in charge.

age (year)	MARITAL STATUS				FORMAL EDUCATION			indicate any secondary occupation
	mar-ried	sin-gle	divor-ced	wi-dowed	none	still at school	level attained	
.								

2. How many children do you have? $\square\square$ if none Go to 5

3.a. How many of your children of less than 6 years are not yet in school? (insert number of children in box) $\square\square$

b. How many of your children of 6 years and more have never been to school? $\square\square$

c. How many of your children are still in school? $\square\square$

Give details: (insert number in appropriate boxes)

in primary	$\square\square$
in secondary	$\square\square$
in advanced level	$\square\square$

d. How many of your children finished schooling? $\square\square$

Give details of their grade attained: (insert number in appropriate boxes)

primary	$\square\square$
secondary	$\square\square$
advanced	$\square\square$

5. How many dependents do you have? $\square\square$ (dependents are those persons relying on the fisherman for the major part of their financial support).

Give details on number of dependents:

children (<15 years)	$\square\square$
adults (>=15 years)	$\square\square$

I. HOME CONSUMPTION OF FISH

1. How much fish do you take home from each fishing trip for the consumtion of yourself and others (but not sold).

local unit	$\square\square$
standard unit (kg)	$\square\square$

---

initials $\square\square\square\square\square$ number

J. OWNERSHIP OF HOUSE AND ASSOCIATED LAND (not including shamba)

1. How many houses are you providing for yourself and your dependents? ☐ house(s)

2. Who is (are) the owner(s) of the house(s) and underlying land? (Mark appropriate box)

	FIRST HOUSE		SECOND HOUSE	
	house	land	house	land
Fisherman in charge	1 ☐	1 ☐	1 ☐	1 ☐
Family in household	2 ☐	2 ☐	2 ☐	2 ☐
Other household member(s)	3 ☐	3 ☐	3 ☐	3 ☐
Person outside household	4 ☐	4 ☐	4 ☐	4 ☐
Government	5 ☐	5 ☐	5 ☐	5 ☐
Other (specify)				

3. Does fisherman in charge pay rent for house and/or land?

(Mark appropriate box)

	House	Land
yes	1 ☐	1 ☐
no	2 ☐	2 ☐
not applicable	8 ☐	8 ☐

K. BUILDING MATERIALS OF HOUSE

1. Give details of building materials of the house.

(Mark appropriate boxes)

Floor
- earth 1 ☐
- stone/cement 2
- tiles 3
- other (specify).......

Walls
- palm leaves 1 ☐
- corrugated iron/asbest 2
- wood/stone/mud 3
- stone/cement 4
- other (specify) ....

Roof
- palm leaves 1 ☐
- tin sheets 2
- corrugated iron 3
- corrugated asbestos 4
- roofing tiles 5
- other (specify).........

L. OWNERSHIP OF SHAMBA

1. What is the area of shamba owned by yourself and your dependents? ekari ☐☐☐☐

2. What is the area of shamba owned by fisherman in charge? ekari ☐☐☐☐

3. What is the area of shamba owned by yourself, and your dependents which was harvested in the past year (12 months) ekari ☐☐☐☐

4. Indicate reasons for any land being left idle? ....

initials ☐☐☐ ☐☐☐ number

M. OWNERSHIP OF LIVESTOCK

1. Give the following details of the ownership of livestock.
   (record number in appropriate boxes)

		number owned by fisherman and dependents		number owned by fisherman in charge
cows	1		1	
goats	2		2	
sheep	3		3	
donkeys	4		4	
poultry	5		5	

other (specify)

_____   _____   _____

N. OWNERSHIP OF CONSUMER ITEMS

1. Give the following details of the ownership of consumer items.
   (record number in appropriate boxes)

		number owned by fisherman and dependents		number owned by fisherman in charge
automobile	1		1	
motorbicycle	2		2	
bicycle	3		3	

AN ANALYSIS OF MANAGEMENT OPTIONS FOR THE
SCHOONER FISHERY OF THE SEYCHELLES

by

Philippe Michaud
General Manager,
Seychelles Fishing Authority

ABSTRACT

The paper proposes that the main reasons for the 50 percent decline in active vessels and catches during the 1980's are the poor financial reward on investment and the low earnings of the schooner fishermen. The remedies considered within the paper are to increase the price of fish, to remove the duty on fuel, engines, spares and equipment, to establish a Cooperative Fleet Management Scheme and to return to entrepreneurial ownership of the boats.

1. INTRODUCTION

The schooner fishing fleet plays an important role in the artisanal fishery, as it is the major supplier of fish for the export market and for the tourist industry. It targets certain species (namely groupers and snappers), on the periphery of the plateau, which are normally not caught by other types of vessels. In 1988, an average of 21 schooners operating in the schooner handline fishery accounted for 10.9 % of the total fish landings of Seychelles, compared to 20 % of the total in 1981.

The decline of the schooner fleet is a cause of concern to Government and serious attention is being given by the Seychelles Fishing Authority to finding solutions to reversing the trend.

2. FISHERY DESCRIPTION

2.1 Resources

2.1.1 Demersal Resources

Tarbit in 1979, ORSTOM and the Federal Research Centre for Fisheries (Hamburg) in 1982, estimated the potential of demersal fish of the Seychelles waters. Rather divergent estimates of the biomass and potential production of the handline fish species were obtained from these trawl surveys. Depending on the assumptions made, the maximum biological sustainable yield ranges between 6 500 t and 14 000 t. In view of the fact that only part of this biological production can lead to fruitful exploitation, it is felt that the potential yield for demersal handline species[1] should be around 4 500 t (Lablache et al 1988).

2.1.2 Schooner Catch

The most important species targeted by the schooner fleet is the red snapper (*Lutjanus sebae*). The others consist mostly of high value demersal species. The schooner fishery exploits the 6 500 sq. km of banks of the Mahé Plateau and to a lesser extent the 1 200 sq. km of banks of the Amirantes Plateau. The banks of the southernmost group of islands is barely exploited. All these banks are fished up to 100 m depth. Table 1 shows the catch composition.

---

[1] Excludes carangues, barracudas and pelagic species also caught by handline.

Table 1. Fish Composition by broad categories caught by the Schooner Fleet

SPECIES	1986	YEAR 1987	1988
Red Snapper	177.1	207.2	119.6
Varavara	23.3	40.3	31.9
Job	77.5	109.9	91.3
Maconde	27.8	55.6	44.3
Other Vieille	56.1	72.6	45.7
Capitaine	58.7	87.6	81.9
Carangue	63.0	19.3	12.8
Other Pelagics	10.3	14.3	7.7
Bonite	0.9	1.2	0.2
Other Pelagics	2.7	3.4	1.8
Becune	10.7	11.0	6.7
Sharks	2.1	4.4	0.3
Others	3.8	17.0	7.9
TOTAL	514	643.8	452.1

Source: Seychelles Artisanal Statistics for 1986, 1987 and 1988

2.2 Men, Boats and Gear

2.2.1 Fishermen

About 180 fishermen, 18 % of the full-time fishermen, are employed in the schooner fishery. A socio-economic survey of the fishing community is being carried out at present and should provide more up-to-date information on the number of fishermen. On average, schooners carry 4-6 men, though the larger ones have a crew of up to 8.

2.2.2 Boats

Schooners are decked boats ranging from 8-13 m and equipped mostly with 37-54 Hp Yanmar diesels. There are exceptions: one vessel has a 56 Hp engine and another one (which is the one vessel exploiting the spanner crab fishery) has a 120 Hp engine. Most of the schooners are built of wood. Table 2 shows how the schooners compare in numbers with the rest of the fleet.

Table 2: Numbers of boats by type operated on the Seychelles Plateau for a selection of years

Boat Types	Number of boats							Other Information (crew, propulsion, length)
	1977	1982	1984	1985	1986	1987	1988	
Pirogues	273 *	115	100	126	162	148	135	(2-6 men, oars, outboard, 5-7 m)
Outboards	–	216	227	222	209	182	180	(2 men, outboard, 5-7 m)
Whalers	48	54	39	37	53	60	70	(5-10 men, inboard, 8-12 m)
Schooners	27	40	38	26	21	24	21	(4-7 men, inboard, 9-16 m)
TOTAL	348	360	404	410	445	414	406	

* *Some wooden boats with outboard engines included.*

2.2.3 Gear

Lablache & Carrara, 1989, in "Schooner handlining in Seychelles" described the fishing methods as follows:

> *"The sole fishing method practised by the schooners is handlining. The fishing gear consist of a cotton main line and a monofilament leader with several branch lines with 2/0 to 4/0 size barbed hooks. The main line is weighted at the bottom with about 700 gm of iron. The number of hooks varies according to the target species: for larger species, such as snappers and big groupers, 4 to 8 hooks are used; for relatively small species such as Lethrinidae and small groupers, 10-15 hooks are used."*

Since 1985, a few schooners started using electric reels; five use echo sounders. The navigation equipment on board the schooners is usually limited to a compass.

2.3 Marketing the Catch

Fish is sold by fishermen to the Seychelles Marketing Board (SMB), to the open market or through middlemen. The SMB purchased 32.2 % of total landings by the artisanal fishery (1 396.6 MT) in 1988, mostly (67 %) by the 8 SMB Centres on Mahé and the rest through the 3 Centres on Praslin and La Digue. The Victoria collection centre purchases about 50 % of the fish purchased by the SMB. The major species purchased and other relevant information are given in Table 3.

Table 3: Fish Purchased by SMB

	1987	1988
Fish purchased (t)	1 560	1 396.6
% of total catch	39	32.2
Purchase by centre at Victoria (t)	980	668
Composition of major species:	26	18.6
-red snapper	26	18.6
-job	18	17.2
-carangue	14.4	
-vielles	15	13.9
-capitaines	8	10.2

Source: SFA & SMB

Most of the catch of the schooners (Annex 2) is sold to the SMB. In view of the fact that the product is perishable and the volumes are fairly substantial compared to that of other vessels, it is difficult for the fishermen to dispose of the catch elsewhere fast enough. Some fish especially semi-pelagic species like carangues (Carangidae) are often sold directly by the fishermen in the central market where it fetches a much higher price than that paid by the SMB.

Some premium fish is also sold directly by the fishermen on the local market at much higher prices than those paid by SMB.

SMB which has the monopoly for fish export, handles both fresh and frozen fish. Some figures on fish exports are provided below.

29

Table 4. Fish Exports (Fresh & Frozen)

	1985	1986	1987	1988
Volume (MT)	753	370	592	474
Value SR'm	10.56	5.78	8.0	10.27
Main species: Red Snapper, Grouper, Pelagics				

3. MANAGING THE FISHERY

3.1 History of Management

3.1.1 Origins

The schooner fishery is relatively recent, dating back to 1974, soon after the opening of Seychelles International Airport. This made it possible to export fish fresh on ice to Réunion and Europe. Initially, three main companies and some private owners were operating. The companies geared the fishery for the export market and were also involved in the marketing of the catch. Of 40 schooners operating, 20 belonged to these companies.

In 1981, Government created the Fisheries Development Company (FIDECO) and acquired the schooners belonging to the private companies. All export of fish was then carried out by the parastatal, Fish Export Company, a subsidiary of the Seychelles National Commodity Company (SEYCOM). FIDECO had workshops, storage facilities, ice plants and some fish processing facilities. The crew of the schooners were remunerated on the basis of their catch. FIDECO operated 19 schooners and there were around 20 others in private hands.

3.1.2 Seychelles Fishing Authority (SFA)

In 1984, the SFA was created by Government with the basic objective of being the executive arm of Government in all matters concerning fisheries (research, fisheries management, negotiating fisheries agreements, control of foreign fishing operations, management of fishing port). SFA has over the years divested its interest in commercial operations. Immediately after its formation, the management of fishing schooners previously owned by FIDECO was transferred to SFA, but the Government retained ownership. A budget was allocated to SFA for subsidizing the operation of these schooners.

3.1.3 Hire Purchase Agreements

It became clear at the time that state ownership of schooners was neither in the interest of the fisherman nor in that of the Government. It was therefore decided to transfer these schooners to meritorious fishing skippers on a hire-purchase basis. The 10 remaining schooners were repaired and passed on to fishermen at around 50 % of their estimated value. The repayment period was three years without interest payment. SFA continued to aid and assist these fishermen whenever required. It also tried to ensure that vessels were being properly maintained.

3.2 Financial Support to the Fishery

3.2.1 Loans to Purchase Boats

Loans on soft terms are provided by the Development Bank of Seychelles (DBS) on the following conditions:

i) The applicant must be a fisherman with proven experience and/or must be associated with someone with professional experience.

ii) The applicant must, if successful, be engaged in fishing on a full-time basis.

iii) The operation must be viable to ensure that the bank should recover its funds.

iv) The applicant must finance 10 % of the investment from his own funds.

v) He must provide acceptable collateral.

The loan application is vetted by the SFA and the Ministry of Agriculture and Fisheries. Basic loan terms are:

Rate of Interest : 10 %;

Loan repayment period : 6-7 yrs. Grace period of up to 8 months;

Vessel must be insured;

Life insurance on the applicant must be taken

The rates of interest charged by commercial banks are in the region of 16 %. Personal guarantees are also required. In the case of DBS loans, SMB often acts as the guarantor.

3.2.2 Loans to Purchase Gears

The same conditions apply as for the purchase of boats. In general, the vast majority of loans are for the purchase of boats and engines. There are very few loan applications for the purchase of fishing gear. This is understandable, as the fishing gear consists essentially of lines and hooks and constitutes more of a recurrent expense.

On a few occasions, in order to encourage their use, electric reels (through a special arrangement) were sold by the SFA on a hire-purchase basis. Payments were collected by the DBS on behalf of SFA. This arrangement might be reviewed in the future, as it is preferable that fishermen pay refunds directly to SFA.

3.2.3 Investments in Storage and Processing Facilities

Storage and processing facilities are owned and managed by the SMB (Fish Division). SMB now has storage capacity for 600 t of fish. It also processes fish into fillets.

3.2.4 Investments in Port Facilities and Infrastructure

The Fishing Port consists of two sections, the international zone where access is mainly restricted to foreign going vessels and the local or artisanal zone used by the local fishing fleet. For the purposes of this paper, only the artisanal zone will be described.

Heavy investments have been made in the 1985-1989 National Development Plan in providing facilities for the local fleet. These projects include land reclamation, repair of quays, berthing facilities, offices, fuel pumps, ice plants, provision of social amenities for fishermen and a marine engine workshop. Most of these investments have been financed from foreign sources including the African Development Bank, the United States, Japanese and French Governments. Certain other facilities, such as repair the existing slipways and winches for hauling fishing boats are in the process of being provided.

As most, if not all, the fishing boats regularly use the Fishing Port of Victoria and, as conditions do not really exist for the building of ports elsewhere, all capital investments have been made in this port. The only minor exceptions concern the provision of a breakwater at Bel Ombre and fish collection centres in the various landing sites on Mahé, Praslin and La Digue.

3.3 Other Management Strategies

3.3.1 Licensing

Under Seychelles Fisheries Regulations, all fishing vessels have to be licensed. The licence fee is minimal and has been introduced with the intention of obtaining a more accurate picture of the fishery and also with the possibility of being used for regulatory purposes.

The licensing regulations are not being strictly enforced, and out of the 400 estimated fishing vessels operating, only 120 vessels were licensed in 1988. However, most likely because of their size and as they operate from the Fishing Port, all schooners are presently licensed.

3.3.2 Training of Fishermen

The School of Maritime Studies which forms part of the Seychelles Polytechnic provides a two year course. The course includes marine carpentry, net repair, navigation and some practical skills in trap construction and fishing techniques.

Some limited practical training is provided by the technical unit of SFA Research Division. These have included courses in navigational skills for skippers, practical training for young fishermen who either attended or graduated from the Polytechnic, and training in the use of echo sounders and electric reels. This extension service is carried out either on their own boats or on SFA research vessels. It involves SFA research technicians going on fishing vessels to give practical demonstrations for one or two fishing trips.

3.3.3 Introducing New Technologies

New types of fishing gears are tested and passed on to fishermen in an effort to make the fishery more remunerative and create an incentive for more fishermen to join the industry. Emphasis has been put on the improved use of echo sounders and of electric reels. Some fishermen were helped in the exploitation of the spanner crab, a resource which hitherto had not been exploited.

The Research Section at the SFA has equally been placing FADs in various areas of the Mahé Plateau.

3.3.4 Resource Conservation

Legislation, with the help of the SWIOP project of the FAO, has been enacted to provide the means for the proper management of resources. In practice, however, the management regulations in force are at present limited, partly due to the fact that most stocks are not being over-exploited. All fishing nets are licensed and fishing with nets is not permitted in marine parks and protected areas.

There has been a complete ban since 1985 on the fishing of lobsters due to over-exploitation in the past. It is most likely that this restriction will shortly be lifted as the stock has managed to recover substantially. Female turtles (hawksbill and green) are protected and a permit has to be obtained for the capture and sale of male turtles. The possibility of introducing a quota system is under consideration.

4. ECONOMIC PERFORMANCE OF THE SCHOONER FISHERY

4.1 Profitability to Boat Owners

The schooner fishery has over the past eight years been experiencing low rates of return on capital invested. Various papers have been written on this and government is preoccupied by the state of affairs. David Parker, an FAO economist attached to SFA, carried out an economic evaluation of the fishery and the summary on his findings on the net cash position of the skipper/owner and the rate of return on Investment (ROI) on three categories of schooners is given below.

The results of the La Digue boats are obtained from data from Parker and also more up-to-date revenue figures.

Table 5: Expected Net Cash Position of Skipper/Owner and Return on Investment

	CASE I Typical Schooner		CASE II Chantal (1)	CASE III La Digue (2)	
	2 trips per month	2.5 trips per month		Without e/reels	With reels
Assumed capital employed	186 000	186 000	375 000	403 000	430 000
Catch per day (kg)	220	220	400	258	400
Crew (including skipper)	5	5	8	6	6
Days fishing per trip	5	5	5	6	6
Days to/ from/trip	1.5	1.5	2	2	2
Catch per trip (kg)	1 100	1 100	2 000	1 584	2 400
Gross cash flow (SR)	5 342	6 666	11 300	9 068	15 131
Fisherman pay per month	1 526	1 907	2 260	2 267	3 783
Net cash per month	1 344	2 679	3 905	(2 353)	3 710
ROI	5.64 %	11.79 %	14.24 %	4.11 %	16.54 %

Notes: 1. 'Chantal' is one of the more sophisticated schooners with an echo-sounder and electric reels.

2. 'La Digue schooner' is a new generation schooner, 11.6 m long, utilizing echo-sounders and electric reels.

It is difficult to say what constitutes an acceptable rate of return on investment, but it can nevertheless safely be said that a rate of return ranging between 5.64 % and 14.2 % is too low, considering the risks involved and the difficult working and living conditions on board schooners. What is also serious is that the net cash return to the fisherman/skipper of a typical schooner is less than that of the crew.

4.2 Recovery of Loans

4.2.1 Ex-FIDECO Vessels

The ex-FIDECO vessels were repaired and sold on a hire-purchase basis to fishermen at around 50% of their actual (estimated) value. The owners/hirers/skippers were previously employed by FIDECO and were selected on the basis of their competence and seriousness. The table below shows the performance of the various operators.

Table 6: Situation of ex-FIDECO boats as of 30.06.89

Name of boat	Sale Price SR	Engine Hp	Arrears SR	Arrears Months	Notes
Queen	33 000	37			Repossessed February 1989; to be sold by tender
Dick	38 000	37			Loan fully repaid June 1989
Serre	38 000	37	450	1	
Tousanie	50 000	37			Repossessed May 1988 and sold by tender
Mami	23 000	37			Repossessed February 1989 and sold by tender
Alert	35 000	37			Repossessed June 1989 and to be sold by tender
Virgilant	32 000	37			Repossessed and sold by tender
Innocent	33 000	37	6 560	6	
Chantal	101 000	56			Repossessed February 1989 and sold by tender
Sousmarin	17 000	27	4 151	9	

The situation is disappointing, considering that vessels were sold at half their actual value and that the terms of repayment were generous. No deposit or personal contribution was required from the fishermen. Even 'Chantal', which was considered to be one of the most successful schooners, was 22 months in arrears before it was repossessed. For all vessels, warnings had to be given regularly to the hire-purchasers concerning their indebtedness. In many cases, it seemed that the repossession of the boats by SFA came as a relief to the hirer/purchaser.

Two reasons for this state of affairs can be given. Firstly the returns on the investment to the skipper/owner are low. Secondly there is a tendency for many owners to regard the revenue from the sale of fish as profit or 'take-home' pay. Most owners are greatly tempted not to leave something aside for depreciation and contingencies. In many instances, as the fishermen had no money to repair their vessels, SFA had to advance funds in order to carry out repairs. At times, hirer/purchasers do not even have enough money to finance the next trip. Hence they have to seek assistance of middlemen for finance. Eventually, these middlemen become co-owners of the vessels.

4.2.2 Loans from the Development Bank of Seychelles (DBS)

Most schooners, especially in view of their cost which has been increasing, are financed from loans from the DBS. The 'Lekonomi', which is a 6.5 m fibreglass boat with a 12 Hp diesel engine, has been a popular boat since it was launched in 1985. Table 7 shows the various categories of loans given by the DBS.

Table 7 : Approved and disbursed loans for fisheries sector from 1985 to June 1989 by Development Bank of Seychelles

Source : Development Bank of Seychelles

Types of Loan	1985 No. of Applicants	1985 Loan Amount	1986 No. of Applicants	1986 Loan Amount	1987 No. of Applicants	1987 Loan Amount	1988 No. of Applicants	1988 Loan Amount
Vessel Repair and Renovation	1	15,200.00	2	30,000.00	1	11,200.00	1	100,000.00
Schooners	1	114,000.00	0	0.00	0	0.00	3	618,000.00
Whalers	0	0.00	0	0.00	5	599,000.00	2	296,000.00
Lekonomie	0	0.00	0	0.00	7	389,000.00	4	329,300.00
Small Fibreglass	11	264,400.00	2	98,400.00	2	65,000.00	5	119,000.00
Engines, Spares and Accessories	22	198,500.00	7	125,400.00	4	91,400.00	11	302,000.00
TOTAL	35	592,100.00	11	254,100.00	19	1,155,600.00	26	1,764,800.00
Transfer loan from previous years	1	116,346.00	3	21,115.00	1	13,759.00	2	56,312.00
GRAND TOTAL	36	708,446.00	14	275,215.00	20	1,169,359.00	28	1,821,112.00

Source: Development Bank of Seychelles

4.3 Maintaining the Fleet

Most of the fleet is badly maintained, though there are a few owners who take good care of their vessels. These are essentially entrepreneurs who own one or two vessels. Because of the wooden construction, more maintenance is required and the situation can deteriorate very rapidly if no remedial action is taken. Parker estimated the maintenance costs based on a schooner like 'Chantal' as follows:

	SR
Slipping every 6 months (R 600 x 2 + slipway rental)	2 100
Anti-fouling compound	1 500
Paint for all exposed woodwork (10 litres)	2 150
Caulking repairs	450
Rigging repairs	2 000
Sail repairs and renewal	4 500
Engine spare parts	859
Service of electrical and electronic equipment	112
Renewal of sacrificial anodes	200
Safety equipment (renewal every 3 years)	496
Total annual maintenance and service costs	15 867
Equivalent in monthly terms	1 322

The figure would be slightly lower in the case of a typical 35 Hp schooner (R 1 050) and slightly higher for the 'La Digue boats'. The variation between the boats is not great, as it costs much the same to overhaul any engine or boats in this size class. These figures which are 1987 prices have to be revised upwards. An indication of price increases for spare parts is given at Annex 1 Table 2.

4.4 Recruitment of Fishermen

There are often changes in the boat crews and at times there is a need to bargain for their recruitment. As a rule, there is a tendency for the best crew to join the best skipper and vessel. However, it is evident that there are very few young fishermen joining the schooner fleet. Young people wishing to join the fishing industry prefer to work for the foreign tuna fleets when there are jobs available. Salaries are more than twice those which can be earned on schooners.

5. ANALYSIS OF OPTIONS TO IMPROVE THE FISHERY PERFORMANCES

5.1 Liberation of Fish Prices for Export Species

5.1.1 Objectives of the SMB (Fish Division)

The main objectives of the SMB have been to provide a stable supply of fish to consumers at reasonable prices and prices set in advance for producers. In general, a higher price is paid to fishermen during the months of July to September. As a result of this, fish during periods of glut has been absorbed by the SMB and the population has been provided with fish in times of scarcity during the bad fishing season (south-east monsoon).

In the case of the export market, the problem has been to provide regular supplies of premium fish to clients. This fish, mainly grouper and snapper, is also the same species as those purchased by hotels and the tourist trade. The problem faced by the schooner fishery is in a certain way directly passed on to the SMB and its export market, as the export fish is caught mainly by schooners; few other vessels have the capacity of fishing at the edge of the Mahé plateau. It is difficult to say exactly what proportion of the schooner catch is destined for the export market as no separate statistics are kept. On the basis of certain assumptions, it can be estimated that at least 70 % of the schooner catch is exported or destined for hotels and restaurants.

5.1.2 Increase in price of fish paid to schooners.

Table 8. Simulations based on price increases of fish and removal of duty on fuel

	Average schooner		Chantal	La Digue boats	
	2 t per month	2.5 t per		without e/reels	with reels
Base Case					
(a)	1 344	2 679	3 905	(2 353)	3 710
(b) %	5.64	11.79	14.24	4.11	16.54
10 % price increase					
(a)	2 156	3 689	5 544	(1 085)	5 675
(b)	9.36	16.44	18.44	6.94	20.65
Duty free fuel					
(a)	1 979	3 474	5 244	(1 262)	5 306
(b)	8.56	15.54	17.76	6.55	19.88
10 % price increase & duty free fuel					
(a)	2 787	4 484	6 833	5	7 271
(b)	12.29	20.1	21.87	9.38	23.99

(a) Net Cash/Month   (b) ROI

5.1.2 Benefits of price increases.

A 10 % price increase improves appreciably the net cash available to the skipper/owner of all categories of schooners and brings it to a level which could seriously interest potential investors. The exception being the 'La Digue' boats without electric reels.

5.1.3 Constraints associated with price increases.

A price increase will in the short run reduce profits of the SMB (Fish Division). Again, because of non-availability of statistics, it will be difficult to calculate how much it will cost the SMB and how far SMB can go towards increasing the price. Furthermore, a blanket price increase on all species could create a problem, as all fishermen will demand the same treatment. If this is done, there will be an increase for all fish species sold. Whilst the fish destined for the export and tourist market might be easily sold, it will be more difficult to sell the catch on the local market. In order to determine with some precision the exact results of a price increase, more information is required on the demand elasticity for fish in the local and export markets. Equally, much more information is required on the economic and financial return of the SMB (Fish Division). This is unfortunately beyond the scope of this paper. A study on the impact of price changes to SMB and on the consumer (local and overseas) would merit serious consideration. It might also be desirable to study the necessity for SMB to benefit from certain concessions on the price of electricity and on trades tax paid on equipment. Benefits like these are often granted to export-oriented industries.

A price increase will have to be restricted only to certain species of fish, those of a high degree of freshness for the export and tourist markets. This will be easier to implement and will target much more the schooner fishery. It should also be possible for the SMB to use prices in order to improve the quality of the fish sold by the fishermen.

There is a possibility that this price of fish unless specifically restricted to schooners will lead many whalers[2] to convert and go for these species. This is a real possibility as substantial amounts of premium fish are also caught by whalers as shown below.

Table 9. Main Species of Export fish caught by Whalers & Schooners in 1988

Species	Whalers (t)	Schooners (t)
Red Snapper	129.2	119.6
Job	228.1	91.3
Maconde	32.7	44.2
Capitaine	121.7	81.9

If SMB increases the price of premium fish, not only schooners but also whalers will benefit. It might however be difficult for SMB to restrict the price increase only for fish from schooners. Government can also control the operations of whalers by setting limits whereby whalers would not operate beyond a certain range, as there are serious safety factors to be considered.

5.2 Removal/Subsidy of Duties on fuel, safety equipment, engines and spare parts.

5.2.1 Description of duties

The trades tax (duty) payable on a representative sample of items which fishermen use is given at Annex 1, Table 1. Some of these, such as trades tax on engines, affect especially the capital cost of the investment, whilst others influence operating costs. Fishermen often complain of the ever increasing cost of spare parts. The price of fuel is very significant in the operating cost as it represents 40 % of costs of a typical schooner and it goes up to 50 % of costs in the case of the La Digue boats. Whilst the price of fuel has stayed stable (R 4.07/litre in 1986 and R 4.27/litre 1989), the duty is high.

5.2.2 Effect of removal of trades tax on engines

The engine cost is an important component of the capital cost of a schooner. The average schooner costs SR 180 000 - SR 250 000 including the SR 63 000 for a 37 Hp. engine. The trades tax on an engine of that size is 15 % and comes to approximately SR 7 000. However, in the case of engines over 50 Hp. it is 50 %. In practice and upon request to the Ministry of Finance, engines used by fishermen are allowed a reduced trades tax of 15 %.

5.2.3 Effect of removal of trades tax on fuel.

Trades tax on fuel is in the region of 100 % and fuel consumption is an important cost component. Removal of the tax as shown in Table 7 very much helps cash flow and rate of return on investment.

5.2.4 Difficulties in the removal of trades tax.

The removal of trades tax on items and equipment should be fairly easy to monitor and control. However, the removal of the tax on fuel will be difficult to control and the temptation for fraud will be great. One way of dealing with that problem could be to have a tax rebate but instead of it being based on the fuel consumed it would be paid based on the fish sold to the SMB. Payments could be made every quarter, calculated on the amount of premium fish sold.

5.3 Introduction of New Fishing Technologies

5.3.1 Developments to date

The two tools to improve fishing are the echo sounder and the electric reel. In its effort to improve the economic performance of the schooners in particular, SFA, has been promoting the use of echo sounders and electric reels since 1985. The use of the echo sounder is catching on and whilst only five schooners are presently equipped with them their use is more widespread with the smaller 'Lekonomi' boats. The introduction of electric reels has so far been slow and at present

---

2   Whalers are open wooden vessels ranging from 6-12 m. These vessels are usually utilized for day trips although there is a tendency for certain whalers to be equipped with an icebox and switch to trips of 3-5 days.

only three vessels use them, two being the 'La Digue' boats and the other a 21 m vessel being operated by the SMB. The 'Chantal' has since ceased to use reels, essentially because of the inability of the crew to keep them in good operating order.

5.3.2 Constraints faced

Echo sounders are relatively expensive and it cost around R 26 000 (without duty) to install 4 reels on a schooner. They also have a fairly short life both because of bad handling and problems encountered in having them repaired.

Electric reels are expensive, even duty free, and in the past reels have been repossessed because of repayment problems. Their use require a certain, even though limited, know-how which unfortunately many skippers lack.

5.3.3 Solutions proposed

The author shares the conclusions of B.R.R. Bautil in "An analysis of the increases in catch rates and values from outfitting the schooner 'Chantal' with an echo sounder and electrically powered fishing reels" that "*while the installation of the echo sounder and reels increased the fishing power (and gross revenue earning power) of the 'Chantal' compared to the other schooners, this does not necessarily lead to the conclusion that all (or most) of the vessels should be fitted with these gears*".

Electric reels should be fitted only on vessels whose owners are serious, not experiencing financial difficulties and able to maintain them properly. The loan arrangements for electric reels should be reviewed and managed directly by SFA. Steps must be taken to ensure that a proper maintenance service for echo sounders is provided.

Reels should be provided duty-free as their introduction is still in a promotional phase. The same should apply for echo-sounders.

The ongoing projects of the African Development Bank (ADB) and the International Centre for Ocean Development (ICOD) are contributing in improving the efficiency, comfort and reliability of the fleet.

5.4 Establishment of Cooperative Fleet Management

5.4.1 Description of set-up

Cooperative fleet management would provide a service whereby one or more individuals would be responsible for looking after some aspects of the fishing operations. The role of the management body could be as wide as the fishermen wishes it to be. Preferably, the body should be involved in providing financial and accounting services to the grouping. It would keep accounts for each schooner, establish maintenance schedules for the boats, collect receipts from sales, distribute the share of the return from the trip to the crew, make provisions for depreciation, settle loan payments etc. The management could be paid wholly or partly by the fishermen.

5.4.2 Anticipated Benefits

The system would allow the fishermen to manage their accounts wisely and enable them to plan their operations more sensibly. As a result of this, the number of trips they make could be increased and so would profits. Gradually, some of them could be encouraged to open bank accounts and manage their funds more prudently.

5.4.3 Constraints to Implementation

In Seychelles, there are no associations of fishermen nor is there cooperative fleet ownership. The idea is tempting, but there is a lack of experience existing in this field locally. Recently there has been an interest in the part of fishermen in forming an association, but unless there are strong leadership qualities on the part of a few of them it is difficult to see it getting off the ground.

With the existing low rates of return and take-home cash, it is difficult to see how prudent management and this cooperative scheme would enable the fishermen to earn a sufficiently attractive living in order to improve their material condition substantially. Those involved in management would need to be honest and devoted, as it would be extremely easy to benefit from the weakness of the fishermen due to their lack of education (inability to read and write) and also due to their drinking problems.

The remuneration of the management staff must be sufficient to attract motivated and serious individuals, but on the other hand fishermen on their own might not be able to afford this service.

5.5 Return to Entrepreneurial Ownership of boats and marketing

5.5.1 Description and purpose of option

Prior to 1981, Government had no direct involvement in the production and marketing aspects of the artisanal fishing industry which was all in private ownership. Artisanal fish landings in 1979 were 4 900 t and the fish exports for that year were 428 t.

It is not possible, nor is it desirable, to turn back the clock. What has to be done, however, is to see how the situation can be improved for the benefit of the fishing sector. The freeing of marketing to individuals is not realistic in view of the fact that SMB has invested considerably and has the necessary infrastructure, cold stores, ice plants etc. To allow investment in these facilities will not be an efficient use of resources. Furthermore, quality control and the maintenance of the good reputation of Seychelles fish abroad is better safeguarded with one well established supplier.

What is required are entrepreneurs with business and managerial skills and some capital in order to provide for contingencies. At present, there are no legal constraints for private individuals to own or manage one or more schooners. The only constraint is that they are not allowed to benefit from DBS loans. It is proposed that loans for schooners and semi-industrial vessels should be given to entrepreneurs.

5.5.2 Anticipated Benefits

Most of the existing skippers/owners do not have the necessary experience to manage their operations, even though they are excellent fishermen. It is necessary for Government to state clearly that it would welcome entrepreneurs, whilst at the same time still help and encourage fishermen to own their vessels. It will nevertheless have to monitor the situation very closely.

A serious entrepreneur would make provision for a fund for depreciation and contingencies. This is presently a serious problem, as often fishermen do not have enough money for the next trip. Certain economies of scale could also be made in the maintenance and repair of vessels and engines. Entrepreneurs should also be able to speak in one voice and alert government to certain problems and constraints faced by the industry. A sharp businessman would also be more willing to try new fishing techniques and take risks which the ordinary fishermen will never take. In the future, it will be necessary to exploit further the deep-water resources at the edge of the plateau and this can only be gone with bigger vessels and modern technology.

5.5.3 Constraints to Implementation

Previously, private companies also exported fish and must have made substantial profits. It is important that the proposed measure be accompanied by some other measures such as a rebate on the sale of fuel, reduction of trades tax and an increase in the price of premium fish. People will not invest if the rates of return are not attractive especially as interest earned on a savings or deposit account ranges from 9 to 14 % p.a.

6. CONCLUDING COMMENTS

The revitalization of the schooner fishery will take place only if the financial returns to the fishermen are adequate and if there is good management. These two conditions are mutually inclusive as serious investors will be attracted only if the return on their investment is sufficient to compensate for the risks involved. The capital employed to operate a schooner, though not considerable, is nevertheless important by Seychelles standards, and good shore management is necessary. This could be carried out by a cooperative fleet management system though in practice it is felt that this will not be feasible, at least at this present stage of our development.

This paper proposes that Government states that private entrepreneurs be encouraged to invest in schooners and larger size vessels and therefore benefit from facilities from the DBS. At the same time, a review should be carried out on trades tax on machinery and equipment used by the

fishing fleets. Similarly, the funds obtained from the tax on fuel should be used as a tax rebate and paid to fishermen for premium fish sold to the SMB.

SMB should at the same time consider increasing the price of premium fish. However, a serious study on this is required in order to calculate the impact of this measure on SMB profits and on its export market. As Seychelles is not the only exporter of tropical fish, any measures to increase prices might have to be done cautiously. It is important to realize, however, that the long term viability of the SMB and of its export trade will only be possible if the fleet is successful. This is essential, as eventually schooners will have to become bigger and more efficient as they will have to go further to maintain and increase the catch. In order for the artisanal fishing industry to become semi-industrialised, the returns on the investment will have to be sufficient for the increased risks.

Government's effort in introducing more comfortable and efficient fishing vessels will not succeed unless it is accompanied by other measures to make the returns on investments attractive enough for entrepreneurs to invest in these boats.

7. BIBLIOGRAPHY

Johnsen, T., 1985. Simulations of the profit potential for different boat types introduced as a supplement to or replacement for the schooner fleet of Seychelles. SWIOP Doc. RAF/79/065/WP/25/85.: 25 p.

Lablache, G., and G. Carrara, 1984. Schooner handlining in Seychelles. SWIOP Doc. RAF/79/065/14/84. : 45 p.

Lablache, G., Moussac, G., Jivan Shah, N., 1987. Summary of the artisanal fisheries of Seychelles. Mimeo. Seychelles Fishing Authority. Table 3.3. : 12 p.

Moussac de, G., 1987. Seychelles Artisanal Fisheries Statistics for 1985. SFA Techn. Rep./R&D/004, Seychelles.

Moussac de, G., Seychelles Artisanal Fisheries Statistics for 1986. SFA Techn. Rep./R&D/003, Seychelles.

Moussac de, G., 1988. Seychelles Artisanal Fisheries Statistics for 1987. SFA Techn. Rep./R&D/005, Seychelles.

Nageon de Lestang, J., 1982. FIDECO's first year (1982). Mimeo. Seychelles Fishing Authority report. : 16 p.

Nageon de Lestang, J., 1986 a. The present status and future prospects of the fisheries of Seychelles. Mimeo. Seychelles Fishing Authority report.: 15 p.

Nageon de Lestang, J., 1986 b. Working document on the present state of the fisheries loan scheme in Seychelles. Mimeo. Seychelles Fishing Authority.: 16 p.

Parker D., The Future of the Schooner Fishery. Problems of Financial Viability and Recruitment of Fishermen Mimeo report: 25 p.

Tarbit, J., 1987. Demersal fisheries development in Seychelles and the evaluation of new fishing vessel designs and operating strategies. Mimeo. report to SFA.: 33 p.

Seychelles Fishing Authority, Seychelles Artisanal Fisheries Statistics for 1988. SFA Tech. Rep./SFA/R & D/009.

ANNEX 1

Table 1. Wholesale mark-up, Trades Tax and Retail Mark-up on a sample of items used by fishermen.

Item	Wholesale Mark-Up	Trades Tax	Retail Mark-Up
Engines not exceeding 50 Hp	15	15	15
Engines exceeding 50 Hp	20	50	15
Rope	20	15	15
Anchor	20	40	15
Compass	15	25	10
Life jacket	20	15	15
Raincoat	25	50	15
Electric reels	20	15	15
Echo sounders	15	25	10
Spare Parts			
1. If landed cost per item is less than SR 100	70	30	20
2. If landed cost per item is between SR 100-500	50	30	20
3. If landed cost per item is between SR 500-1 000	30	30	20
4. If landed cost per item is more than R 1 000	30	30	10

Source: Trades Tax Regulations 1987

Table 2. Shop Price between 1986 – 1989 of a sample of items per unit used by fishermen

Item	1986	1987	1988	1989
A. SPARES				
Zinc	56.90	56.90	65.50	71.50
Gauge		246.30	378.40	
Valve	54.00	54.00	69.85	75.95
Tube	73.65	116.50	115.55	
Valve	84.80	108.05	167.10	167.10
Plug	13.95	13.25	14.85	23.75
Plunger	449.90	412.15	466.08	
Seal	69.80	69.80	72.95	86.00
Chain	240.75	272.65	513.10	
Spring	27.95	27.95	60.00	60.00
Manifold	1 041.90	1 041.90	1 808.05	1 808.05
Fuel Strainer	454.65	454.65	713.05	719.05
B. FISH HOOKS				
No. 4 Pkt.	38.70	50.65	52.25	51.65
No. 6 Pkt.	16.20	21.20	21.85	21.60
No. 7 Pkt.	12.45	16.30	16.80	16.60
C. ENGINE				
3 TE-C 3 cyl. 37 Hp	47 064.00	4 166.00	59 593.00	63 508.00 (1)

(1) Replaced by Model 37D-C 39 Hp as previous model discontinued.

Source: Indian Ocean Marine Ltd.

ANNEX 2

Table 1. Fish Species caught by Schooner Fleet

SPECIES	1986 (MT)	1987 (MT)	1988 (MT)
Bourgeois	155.9	188.5	101.8
Bordemar	21.2	18.7	17.8
Vara Vara	23.3	40.3	31.9
Job Gris	60.5	46.5	49.0
Job Jaune	16.9	63.3	42.3
Batrican	0.1	0.1	0.0
Vielle Maconde	27.8	55.6	44.3
Vieille Platte	43.7	48.9	26.9
Toiffe	4.2	7.9	6.2
Croissant	3.8	7.1	5.6
Other Vielles	4.4	8.7	7.0
Capitaine Blanc	11.6	13.1	13.8
Gueule Longue	4.6	7.2	2.8
Lascar	24.1	54.2	52.6
Dame Berrie	1.9	3.4	3.1
Capitaine Rouge	11.1	7.1	7.5
Bacsous	5.4	2.6	2.1
Carangues	63.0	19.3	12.8
Saumon	1.3	7.5	4.1
Sailfish	0.7	0.6	0.5
Kingfish	1.9	1.5	1.6
Yellowfin	6.4	4.7	1.5
Bonite	0.9	1.2	0.2
Dog Tooth	1.4	1.6	0.5
Dorade	1.3	1.8	1.3
Tazar	0.7	1.2	1.4
Becune	10.0	9.8	5.3
Requin	2.1	4.4	0.3
Others	3.8	17.0	7.9
Crabs			19.8
TOTAL	514	643.8	471.9

APPENDIX I

List of the most important commercial species caught by schooners

SCIENTIFIC NAME   COMMON NAME

LUTJANIDAE

Aprion virescens   Job

Lutjanus sebae   Bourgeois

Lutjanus sanguineus   Bordemar

Lutjanus bohar   Vara Vara

Pristipomoides filamentosus   Job Jaune

LETHRINIDAE

Lethrinus miniatus   Gueule Longue

Lethrinus variegatus   Bacsous

Lethrinus caeruleus   Dame Berry

Lethrinus enigmaticus =   Lascar
(Lethrinus crocineus)

Lethrinus nebulosus   Capitaine Rouge

PENTAPODIDAE

Gymnocranius rivulatus   Capitaine Blanc

SERRANIDAE

Epinephelus chlorostigma =   Vieille Maconde ou Macondais
(Epinephelus aredatus)

Epinephelus fasciatus   Madame di lo, Vieille Rouge

Epinephelus tukula   Vieille Tukula

Epinephelus flavocoeruleus =   Vieille Platte
(Epinephelus leprosus)

Epinephelus macrospilos   Vieille Chat

Cephalopholis miniatus   Vieille Ananas

Variola louti   Croissant queue jaune

Cephalophilis sonnernati   Monsieur Hangard

THUNNIDAE - SCOMBRIDAE

Gymnosarda unicolor   Thon les dents (Dog-tooth tuna)

Katsuwonus pelamis   Skipjack, Listao

Xiphias gladius	Swordfish
Istiophorus platypterus	Sail fish
Thunnus obesus	Big eye tuna, Patudo
Coryphaena hippurus	Dorade, Dolphin, Coryphene
Acanthocybium solandri	Kingfish, Wahoo

SPHYRAENIDAE

Sphyraena fosteri	Becune
Sphyraena barracuda	Tazar

CARANGIDAE

Carangoides fulvoguttatus	Carangue Platte
Carangoides gymnosthethus	Carangue Balo
Seriola sp.	Saumon
Elagatis bipinnulatus	Galate

COST-BENEFIT OF WOODEN TRAWLERS AND
TRADITIONAL CANOES OPERATED FROM MWANZA (LAKE
VICTORIA)

by

D. Parker
FAO FISHERIES PROJECT TCP/COI/8851
c/o UNDP, B.P. 648, MORONI, Comores

ABSTRACT

This paper considers two investment projects, a trawler producing 257 tonnes per annum and an eight-canoe investment producing the same catch. The results of cost-benefit analysis from both the financial and the economic viewpoint indicate the canoe project to be superior, with the trawler project being a bad investment in economic terms.

1 INTRODUCTION

This illustrative case study was used as an exercise for participants at the workshop on Economic Aspects of Fisheries Management and Development held in Dar-es-Salaam between 30 October and 10 November 1989. It was intended as a follow-on exercise to the paper given by the author on Techniques of Cost Benefit Analysis (a summary of concepts, terminology and methods in Project analysis). The case study is intended to be read in conjunction with that paper.

The case is based on a real fishery and the data provided were those used in a relatively simple analysis of the financial performance of the Mwanza trawler and of the traditional Lake Victoria canoe which was undertaken as part of a wide-ranging contribution by a team of FAO consultants to the formulation of a five year plan for Tanzania. The data available are believed to be more or less correct but are not complete. Part of the exercise is to identify the additional information needed.

The original analysis undertaken by the consultants was limited in scope and was not a full cost-benefit analysis *per se*, nor did it probe far into economic issues. However, in view of the interesting nature of this case in a fishery known to many of the participants at the workshop, it was chosen as one suitable for further examination as a means of illustrating some of the possibilities and limitations of cost-benefit analysis as applied to projects.

The basic cost data for the Mwanza wooden trawler and also of the traditional canoe which had been collated for the original analysis were given to the participants and they were invited to answer the following :

a   Consider the costs and benefits of investing in trawlers on the lake.

b   Examine the cost and revenue data supplied and consider how the data could be organized using a spreadsheet to undertake a discounted cash flow analysis of the trawler project, initially according to financial criteria. What key assumptions merit further investigation and which assumptions might you want to vary in order to see how they affect the project?

c   What additional information would be needed in order to undertake an economic analysis? What other external factors should be considered?

d   How useful is the cost benefit approach in deciding the pros and cons of the trawler fishery vis-à-vis the traditional canoe - what are its limitations and uses?

As time did not permit a full discussion of these issues, the following notes are intended as a summary of the main issues and as a means of drawing out some key points.

2 BASIC DATA

A. Traditional Canoe:

7.5m; crew of 4; 30 gillnets; 200 fishing days/year; Labour costs (wage element of crew) Tsh 240,000/yr.

Hull	Tsh 40,000	life 5 yrs	maintenance 5%
Oars & sails	6,000	3	10%
Gear	36,000	2	15%
Average catch per day	160 kg		

B. Trawler

12m; crew 5; 2 trawls; 105 Hp diesel engine; 215 fishing days/year; 150 litres/day fuel consumption; lube oil costs are 5% fuel costs; crew costs Tsh 610,000 per annum. Miscellaneous costs Tsh 40,000 per annum.

Hull	Tsh 2,700,000	life 15 yrs	maintenance 5%
Engine	2,000,000	10	10%
Machinery	900,000	10	10%
Gear	550,000	4	20%
Average catch per day	1,200 kg		

C. Other information

Fuel costs Tsh 40/1
Fish price Tsh 20/kg
Insurance costs 8% of investment =Tsh   7,000   canoe
                      Tsh 492,000   trawler

Finance costs for both are based on a loan of 85% of investment, one year of grace and repayment over 4 years for the canoe and 10 years for the trawler, at an effective interest rate of 27.5%.

Actual debt servicing effects are provided below:

Year	Canoe	Trawler	
0	70,000	5,227,000	Loan
1	(19,000)	(1,437,500)	Capital rep + Interest
2	(42,400)	(2,018,300)	"
3	(36,000)	(1,858,600)	"
4	(29,700)	(1,698,900)	"
5	(1,539,200)	"	
6	(1,379,500)	"	
7	(1,219,800)	"	
8	(1,060,000)	"	
9	(900,300)	"	
10	(740,900)	"	

3 SETTING OUT THE FINANCIAL DATA

The schedules (I and II) show the financial data already provided but duly set out in a spreadsheet as for a discounted cash flow analysis. We shall start with the trawler which is shown in schedule

I. (The much simpler case of the canoe is shown in schedule II.) It can be seen that each year has its own vertical column and that the various cost and revenue items are tabulated horizontally.

3.1 Key Parameters

The first data entered into the spreadsheet are key parameters which affect many of the other values shown. One of the great advantages of a spreadsheet is that parameters which affect the values of other magnitudes and which we may need to manipulate can be set out prominently, in this case near the top of the tabulation, and then other values dependent on those parameters can be linked into them by means of a formula in the dependent cell. So by changing the value in the spreadsheet of one of the key parameters all other values dependent on it will change automatically and instantaneously. This includes even the complex "functions" such as IRR (Internal Rate of Return), for which the software manufacturers provide a code. This code (essentially a little program) can be inserted in a cell formula and (when fed with certain basic information such as the column or row of values concerned), will calculate the answer.

In an analysis of this kind, the variables one would expect to have most influence on the financial outcome of the project are the price of fish, catch rates, number of fishing days per year, fuel price and fuel consumption. These have been extracted and have been given prominence in the table.

It should be noted that it may be desirable to show different values for these in later years to reflect, for example, diminishing catch rates or a fall in the relative price of fish, or a rise in the relative price of fuel. Perhaps an increase in effective fishing days per year might also be a parameter to be modified as the crew become more experienced. In such cases, the key parameters can be extended across the years in question and instead of linking dependent values to one cell as in Schedule I, the dependent value for each year can be linked to the key parameter relevant to the year in question. Schedule III is an illustration of how this might be done. The variations in the key parameters shown are purely illustrative.

Changes are best handled in a sensitivity analysis, but part of the art of project analysis is to find a good base case. In the days before computer spreadsheets the time taken to calculate an IRR tended to discourage project analysts from additional calculations and so to stick with the first set of calculations as their base case, even when further investigations suggested another base might be more realistic and closer to the most likely outcome. Fortunately, this is no longer a problem. Once the basic model of the project has been set out, initial sensitivities can be explored very easily and the base case discussed with the other project team members and relevant technical experts. Indeed, early exploration of key parameters may enable a weakness in project design to be spotted quickly, perhaps in time to introduce a modification. A discounted cash flow spreadsheet employed in the analysis of a project is not only a model of the project it is a working model.

For example, a vessel with inadequate hold capacity would have to return to port too often, thus increasing many cost items. Such a weakness would show up in a good vessel project model. The naval architects could then be asked to examine the possibilities for a bigger fish hold. A vessel should be a compromise resulting from the interaction of various parameters, such as capital cost, catch rates (and hence how quickly the hold fills up), the size of the hold (and thus how long is a trip going to be), how far away is the port, fish preservation methods used, etc.

3.2 Capital Items

These are shown when the investment actually occurs. The longest lived item determines the project length. Other items which have to be replaced in the course of the project are duly shown according to the life expectancy provided. Note that no account is taken of depreciation because to include it when we have already taken investments in full would be double counting.

3.3 Recurring Items

These are costs of a regularly recurring nature which are a function of time rather than the intensity of use of the vessel.

Maintenance costs often take two forms: time related maintenance, as shown here, and use related maintenance. In the case of the latter type it might be appropriate to make an allowance for this under variable costs in the next category below.

Insurance should always be considered even when it is unobtainable since the risk of loss of the vessel is real and if not born by the insurance company is born by the owner. In a fishery with many boats it may not be so difficult to estimate how often a boat is lost "on average" and to translate the figure into an annual cost so as not to overstate return on investment.

Crew costs may well be more complex than as shown in the basic data provided in this case. Most successful fisheries operations involve payment to the crew on a largely performance related basis, which might mean we would be advised to modify our crew costs to be a function of gross revenue or catch. This is easily done with a spreadsheet.

Management costs tend to diminish as the number of boats in the fleet increases. It is worth probing the assumptions about management and whether all shore based support costs have been properly accounted for.

3.4 Variable costs

These are costs which vary according to the activity level of the enterprise, in this case with the frequency of trips of the vessel (which means the number of fishing days as this is a day fishing boat).

Fuel is easily the most important element. Oil is usually closely related to fuel costs and that is so in this example. Again, an element of crew costs is sometimes linked to the number of fishing days, but the information available to us is only on a fixed annual basis.

4 FINANCIAL RESULTS

Schedule I shows a not unattractive project with an internal rate of return of 30.42%, a level which could be expected to attract investors, as it has done. At our chosen accounting rate of interest of 12%, the project has a positive net present value of 6.36 million Tanzanian shillings.

Out of curiosity, we have also calculated the return to equity by netting out all the effects of debt servicing. The return to equity is certainly attractive at 39.42% and helps to explain the interest of entrepreneurs in this fishery and the construction of trawlers.

However, turning to Schedule II which illustrates, using the same approach, the financial profitability of the traditional canoe, we notice that the results are spectacularly better.

We are applying a technique aimed at the economical use of scarce capital to a "project" which is highly labour intensive and which involves minimal investment. Thus, the return to ownership of the canoe is likely to be very high, expressed in percentage terms. In the present case, it is meaningless even to attempt to calculate it since the cost of the canoe and gear is repaid four times over in the first year.

So at this stage with such a discrepancy between the apparent profitability of the two fishing units/techniques, it is perhaps appropriate to ask a few probing questions. First, have we got our sums right? Are the assumptions reasonable and in accordance with reality?

For example, is our information about fishing days per year reasonable? Fishing ventures are highly sensitive to such a measure - the IRR of the trawler (we can quickly calculate with our spreadsheet) is reduced to below the discount rate of 12% (the accounting rate of interest) if we reduce the number of effective fishing days per year to 162, something which could easily happen with a few breakdowns. Similarly, in the case of the canoe, by reducing the catch to 90 kg/day and the fishing days to 170 we arrive at an IRR of 33.7% a reasonable sort of figure when considering return on investment and one which we could at least talk about in the same context as that of the trawler.

Another feature of the canoe model which needs probing is the large cost element attributable to "labour": it accounts for 94% of costs. With so little in the way of other costs, the return on investment figure is thus bound to be determined by how one classifies the wage element.

In the earlier analysis from which our basic data are drawn, the labour costs were explained as subsistence cost for the crew, who are presumed to benefit both as fishermen and as sharing

owners of the canoe. The "labour" element should be the equivalent of an opportunity wage, so that the revenue line shows only the return to ownership. It is obviously important to be sure of the definition and estimation of this dominant element of costs.

The return to capital is after all the difference between what these fishermen could earn simply as fishermen without shares in ownership and what they earn when sharing in the ownership (this is the concept of opportunity cost once again, the opportunity cost of their labour which in this financial analysis should be what they could earn working on somebody else's boat, or in agriculture or manual labour). So perhaps the subsistence element is understated.

For example, if, say, the "labour" costs were 580,000 Tsh rather than 240,000 Tsh, equivalent to about 725 Tsh ($5.10 at 142 Tsh to US$1.00) a fishing day per man instead of 300 Tsh per fishing day ($2.80), then the IRR of the canoe becomes both measurable and more like the sort of figure one is used to seeing as a return on investment, about 24%. In this regard it is germane to point out that according to an estimate made for 1986 (Bonzon 1988, page 9, section 1.3.3.1) the average fisherman's income in Tanzania was $1,200. Based on 200 fishing days a year this is about $6 day. This figure however is actually higher than the combined benefits of an average fisherman as owner and as fishermen in the present model. This tends to support the argument that the return to ownership is over-estimated because the wage element is under-estimated.

Nevertheless the difference between the returns on investment for the two types of craft are still important based on the information we have been given, and we need to consider what that means. Both techniques are profitable (again assuming our figures are correct), one apparently startlingly so and the other reasonably so. Our analysis so far has been entirely in financial terms so why then is not everyone falling over themselves to invest in canoes? Perhaps they are! Some further enquiries are warranted.

It must be remembered that the trawler owner operates in the formal sector and he will need to find resources from his own savings and probably also from the supply of other people's savings in the market for loanable funds. If the government is the owner then it will also be drawing on investment funds which have alternative uses. It is therefore quite proper to apply DCF (Discounted Cash Flow) type analysis to establish the return that can be obtained from this project vis-à-vis alternative investments.

The situation of the canoe fishermen is different, at least from an institutional point of view. The canoe of the fisherman is also realized only by saving, consumption foregone and possibly an investment of his own labour (rather like the embodied labour concept of Marxist economics). But the fact that this saving and investment takes place in the same individual or group of individuals in the informal sector and away from formal capital markets calls into question the validity of making a straight comparison between IRR for the trawler and for the canoe and certainly warrants a very close review of the assumptions used in costing the canoe operation. It also illustrates the dualism of this type of economy where capital markets operate in a world remote from the artisanal fisherman and to which he may not easily have access either as a saver looking for interest on his savings or as a borrower. Fortunately in this case the highly profitable canoe can be put to work without mobilizing funds from the formal sector. It is also obvious that the private investor is unlikely to want to become involved in investing in canoes (difficulties of control and extraction of profits) and unlikely also that the fishermen would need or tolerate such investment.

We have taken our financial analysis to its limits, and we are still confronted with the situation where the canoe is very profitable but where also private businessman would be tempted to invest in a profitable trawler operation. From a financial point of view there is nothing to suggest that the two techniques are anything but alternative methods and the continuation of the two, side-by-side, appears to reflect institutional characteristics of the economy.

But the analysis has not provided any clear answers so far, especially concerning the management of the fishery and the policy to pursue. Next let us consider whether an economic analysis can shed any light on the issues.

5 SHADOW PRICING FOR THE ECONOMIC ANALYSIS

The objective of an economic analysis is to examine the costs and benefits of investment projects from the point of view of the economy as a whole. Schedule IV shows a modification of the original financial analysis of the trawler in which the costs and benefits have been modified by conversion factors to arrive at valuations based on economic efficiency prices.

Conversion factors take care of transfer payments and the conversion of market prices to border prices. (They do not, however, account for external costs and benefits, "externalities", which are discussed in section 6.)

The table below shows the basis of the conversion factors employed. The numéraire is border prices. The figures are not based on real information and are for illustrative purposes only. Furthermore, they have been kept deliberately simple as this case is purely illustrative. Only two standard conversion factors have been used, one for traded goods/elements and one for non-traded goods/elements. The other CFs are thus based on some combination of these. Two shadow wage rates are used, one for semi-skilled and one for unskilled workers and it is assumed that these have already been translated into border prices.

(1) Item	(2) % after adjusting transfer payments	(3) % of (2) traded SCFt=1	(4) % of (2) non-traded SCFnt=0.7	(5) Conversion Factor
Hull	100%	40%	60%	(.4)+(.6x.7)= 0.820
Engine	100%	100%	–	1.0
Machinery/Gear	100%	95%	5%	(.95)+(.05x.7)= 0.985
Maintenance (trawler)	100%	60%	40%	(.6)+(.4x.7)= 0.880
Insurance	70%	50%	50%	.7((.5)+(.5x.7))= 0.595
Management	100%	100%	1.00	
Fuel & lube oil	90%	100%	0.90	
Others	100%	100%	0.70	
Fish	100%	100%	0.70	
Shadow wage semi-skilled	0.95			
Shadow wage unskilled	0.60			

Transfer payments occur in two cases, in the form of payments of profit on insurance over and above actual probabilities of loss and also in the form of tax on fuel assumed to be 10%.

In this simple example, where there are in effect only two standard conversion factors, one for traded goods and one for non-traded, the CF technique is equivalent to that of shadow pricing foreign exchange elements and using domestic prices as the numéraire. In a more sophisticated analysis the conversion factor approach is preferable in that it pays more attention to the composition of individual non-traded elements and items.

It can be seen that the effect of shadow pricing reduces the IRR of the trawler operation below the acceptability criteria, below the ARI, and yields a negative NPV. Clearly this is a project where there is an important difference between private profitability and social profitability.

So our analysis has yielded an important result. Indeed we can say that given the information supplied the project is not desirable from the point of view of the national economy.

Applying the economic analysis to the canoe fishery, which is done in Schedule V does not in fact shed much additional light on the analysis because as in the case of the financial analysis the returns are so spectacularly high anyway.

6 EXTERNALITIES

We have now reached the point where it is clear that the apparently favourable verdict on the trawler project given in the financial analysis is proved to be suspect from an economic viewpoint.

But are there other external costs or benefits which we have overlooked because they have not been quantified, such as pollution? Maybe, we do not have full information, but in fisheries it is always essential to ask questions about the effect of a project on the resource base and on other fisheries.

In the financial analysis there was no reason to suppose that the two "projects" that is to say canoes and trawler were mutually exclusive. Unimpeded access to the fishery is presumed and the purchase of a trawler does not immediately seem to affect the canoe fishermen.

But there clearly is a sense in which these two technical solutions to catching fish are alternatives. The canoes and the trawler fish the same stocks and produce the same product (the price of fish from both is the same). Moreover if the fish resource is to be optimally exploited, there must be some optimum level of effort. From a social point of view it is important to prevent excess fishing activity and also to exploit the stocks using the most economically appropriate techniques. In the long run trawlers and canoes are competing for the same resource and more trawlers would have a negative effect on the canoe fishery. Thus an external consequence of the trawler project would be costs to the canoe fishery and since the canoe fishery is more economically efficient in producing the same product from the same source then we are forced to conclude that the trawler project is a mistake.

In more concrete terms one trawler catches almost exactly the same quantity of fish as eight canoes. Thus an 8 canoe investment project is mutually exclusive of a one trawler project and *vice versa* in the long run. Ultimately the two projects are alternative technical solutions to the problem of catching about 257 tonnes of fish a year and one of those solutions is more cost effective than the other, especially when viewed from an economic point of view.

7 CONCLUSIONS

1. A discounted cash flow spreadsheet analysis is a useful way of examining the anatomy of an investment project. It is a working model which can be used to test the sensitivity of key parameters and even seek out weaknesses of project design. It helps to organize the quantitative information available in a logical way and to prompt further research to fill missing pieces of information.

2. The financial DCF analysis reveals a marked discrepancy between the canoe and the trawler. The canoe appears spectacularly profitable, although this may be partly due to the treatment of the fishermen's returns as between "wages" and "ownership of the canoe".

3. The trawler is also apparently an attractive investment to an entrepreneur from a financial point of view. Sharp differences between the canoe owners and the trawler owner are likely in respect of their access to funds and their economic or business "culture" which would explain the businessman's preference for the trawler as a means of investing in this fishery.

4. An analysis using the conversion factor approach with evaluation at border prices showed the trawler to be a bad proposition as a project from an economic point of view.(The factors used were purely illustrative in view of the shortage of relevant economic data in the brief.)

5. An economic evaluation of the canoe did not produce any significant additional revelations *vis-à-vis* the financial evaluation in view of the highly labour intensive nature of the operation and the small amounts of capital employed. However, the effect of shadow pricing is *inter alia* to increase the relative attractiveness of the canoe method of fishing, in view of the low foreign exchange component of inputs.

6. In the long run, the canoe and the trawler are alternative methods of producing the same product. If for institutional or political reasons, or due to the all too familiar tendency towards over-capitalization in open-access fisheries, the trawlers were to "crowd out" the canoes, then the results would be grossly inefficient from an economic point of view. Not only is the trawler an economically less efficient way of catching a given quantity of fish, but the growth of trawling would have negative effects on the economy and society dependent on canoes. These external effects would not normally be identified in a financial analysis.

7. Economic cost-benefit analysis, when properly applied, is a comprehensive and systematic way of examining the full economic implications of a project proposal, including the external effects which a financial analysis would normally overlook. It can, therefore, play an invaluable rôle in improving the quality of investment and management decisions in a fishery. It is limited only by the quality of data available and the degree of rigour employed in researching all the ramifications of the project.

SCHEDULE I TRAWLER FEASIBILITY FINANCIAL ANALYSIS

Key Parameters

Parameter	Value	Unit
No of days fishing/yr	215	
Fuel cons/day	150	ltr
Price fuel	40	Sh/ltr
Fuel costs/day	6,000	Sh
Catch/day	1,200	Kgs
Price of Fish	20	Sh
Revenue/day	24,000	Sh

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Capital Items																	
Hull	(2,700,000)																900,000
Engine	(2,000,000)										(2,000,000)						274,000
Machinery	(900,000)										(900,000)						
Fishing Gear	(550,000)				(550,000)				(550,000)				(550,000)				
Total	(6,150,000)	0	0	0	(550,000)	0	0	0	(550,000)	0	(2,900,000)	0	(550,000)	0	0	0	1,174,000
Recurring Costs																	
Maintenance		(535,000)	(535,000)	(535,000)	(535,000)	(535,000)	(535,000)	(535,000)	(535,000)	(535,000)	(535,000)	(535,000)	(535,000)	(535,000)	(535,000)	(535,000)	(535,000)
Insurance		(492,000)	(492,000)	(492,000)	(492,000)	(492,000)	(492,000)	(492,000)	(492,000)	(492,000)	(492,000)	(492,000)	(492,000)	(492,000)	(492,000)	(492,000)	(492,000)
Crew		(610,000)	(610,000)	(610,000)	(610,000)	(610,000)	(610,000)	(610,000)	(610,000)	(610,000)	(610,000)	(610,000)	(610,000)	(610,000)	(610,000)	(610,000)	(610,000)
Management		(78,000)	(78,000)	(78,000)	(78,000)	(78,000)	(78,000)	(78,000)	(78,000)	(78,000)	(78,000)	(78,000)	(78,000)	(78,000)	(78,000)	(78,000)	(78,000)
Total	0	(1,715,000)	(1,715,000)	(1,715,000)	(1,715,000)	(1,715,000)	(1,715,000)	(1,715,000)	(1,715,000)	(1,715,000)	(1,715,000)	(1,715,000)	(1,715,000)	(1,715,000)	(1,715,000)	(1,715,000)	(1,715,000)
Variable Costs																	
Fuel		(1,290,000)	(1,290,000)	(1,290,000)	(1,290,000)	(1,290,000)	(1,290,000)	(1,290,000)	(1,290,000)	(1,290,000)	(1,290,000)	(1,290,000)	(1,290,000)	(1,290,000)	(1,290,000)	(1,290,000)	(1,290,000)
Lube oil		(64,500)	(64,500)	(64,500)	(64,500)	(64,500)	(64,500)	(64,500)	(64,500)	(64,500)	(64,500)	(64,500)	(64,500)	(64,500)	(64,500)	(64,500)	(64,500)
Others		(40,000)	(40,000)	(40,000)	(40,000)	(40,000)	(40,000)	(40,000)	(40,000)	(40,000)	(40,000)	(40,000)	(40,000)	(40,000)	(40,000)	(40,000)	(40,000)
REVENUE		5,160,000	5,160,000	5,160,000	5,160,000	5,160,000	5,160,000	5,160,000	5,160,000	5,160,000	5,160,000	5,160,000	5,160,000	5,160,000	5,160,000	5,160,000	5,160,000
NET CASH FLOW	(6,150,000)	2,050,500	2,050,500	2,050,500	1,500,500	2,050,500	2,050,500	2,050,500	1,500,500	2,050,500	(849,500)	2,050,500	1,500,500	2,050,500	2,050,500	2,050,500	1,174,000
Discount rate (12.0%)	1.00000	0.89286	0.79719	0.71178	0.63552	0.56743	0.50663	0.45235	0.40388	0.36061	0.32197	0.28748	0.25668	0.22917	0.20462	0.18270	0.16312
PV of net cash flow in year n	(6,150,000)	1,830,804	1,634,646	1,459,505	953,595	1,163,509	1,038,847	927,542	606,027	739,431	(273,516)	589,470	385,141	469,922	419,573	374,619	191,505

NPV   6,360,618   IRR   30.42%

Banker's return

Debt service effects	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	5,227,000	(1,437,500)	(2,018,300)	(1,858,600)	(1,698,900)	(1,539,200)	(1,379,500)	(1,219,800)	(1,060,000)	(900,300)	(740,900)						
Net Cash flow to equity	(923,000)	613,000	32,200	191,900	(198,400)	511,300	671,000	830,700	440,500	1,150,200	(1,590,400)	2,050,500	1,500,500	2,050,500	2,050,500	2,050,500	1,174,000
pv of equity	(923,000)	547,321	25,670	136,591	(126,087)	290,125	339,949	375,766	177,911	414,774	(512,066)	589,470	385,141	469,922	419,573	374,619	191,505

NPV equity   3,177,183   IRR to equity   27.50%

SCHEDULE II   FINANCIAL PERFORMANCE OF TRADITIONAL CANOE

Key Parameters

Catch per day Kg	160
Number days fishing	200
Price Sh/Kg	20
Revenue/fishing day	3,200

	Year 0	1	2	3	4	5
Investment						
Canoe	-40,000					
Oars sails	-6,000			-6,000		
Nets	-36,000		-36,000		-36,000	
Recurring Costs						
Labour		-240,000	-240,000	-240,000	-240,000	-240,000
Maintenance		-8,000	-8,000	-8,000	-8,000	-8,000
Insurance		-7,000	-7,000	-7,000	-7,000	-7,000
Revenue		640,000	640,000	640,000	640,000	640,000
Net Cash flow	-82,000	385,000	349,000	379,000	349,000	385,000
Discount R	0	1	1	1	1	1	1
Present value	-82,000	343,750	278,221	269,765	221,796	218,459
NPV	1,249,991					

Effect of Debt servicing	70,000	-19,000	-42,000	-36,000	-30,000	
Net Cash Flow to Equity	-12,000	366,000	307,000	343,000	319,000	385,000
PV of above	-12,000	326,786	244,739	244,141	202,730	218,459
NPV EQUITY	1,224,854					

SCHEDULE III   TRAWLER FINANCIAL FEASIBILITY (MODIFIED CASE)

Key Parameters	Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	..
No of days fishing/yr		150	180	215	215	215	215	215	215	215	215	215	215	215	215	215	
Fuel cons/day		150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	
Price fuel		35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	
Fuel costs/day		5,250	5,250	5,250	5,250	5,250	5,250	5,250	5,250	5,250	5,250	5,250	5,250	5,250	5,250	5,250	
Catch/day		1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	
Price of Fish		20	19	18	17	16	15	15	15	15	15	15	15	15	15	15	
Revenue/day		24,000	22,800	21,600	20,400	19,200	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	

	Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	..
Capital Items																		
Hull		-2,700,000																500,000
Engine		-2,000,000										-2,000,000						
Machinery		-900,000										-900,000						
Fishing Gear		-550,000				-550,000				-550,000				-550,000				
Total		-6,150,000	0	0	0	-550,000	0	0	0	-550,000	0	-2,900,000	0	-550,000	0	0	0	500,000
Recurring Costs																		
Maintenance			-535,000	-535,000	-535,000	-535,000	-535,000	-535,000	-535,000	-535,000	-535,000	-535,000	-535,000	-535,000	-535,000	-535,000	-535,000	
Insurance			-369,000	-369,000	-369,000	-369,000	-369,000	-369,000	-369,000	-369,000	-369,000	-369,000	-369,000	-369,000	-369,000	-369,000	-369,000	
Crew			-610,000	-610,000	-610,000	-610,000	-610,000	-610,000	-610,000	-610,000	-610,000	-610,000	-610,000	-610,000	-610,000	-610,000	-610,000	
Management			-78,000	-78,000	-78,000	-78,000	-78,000	-78,000	-78,000	-78,000	-78,000	-78,000	-78,000	-78,000	-78,000	-78,000	-78,000	
Total			-1,592,000	-1,592,000	-1,592,000	-1,592,000	-1,592,000	-1,592,000	-1,592,000	-1,592,000	-1,592,000	-1,592,000	-1,592,000	-1,592,000	-1,592,000	-1,592,000	-1,592,000	
Variable Costs																		
Fuel			-787,500	-945,000	-1,128,750	-1,128,750	-1,128,750	-1,128,750	-1,128,750	-1,128,750	-1,128,750	-1,128,750	-1,128,750	-1,128,750	-1,128,750	-1,128,750	-1,128,750	
Lube oil			-39,375	-47,250	-56,438	-56,438	-56,438	-56,438	-56,438	-56,438	-56,438	-56,438	-56,438	-56,438	-56,438	-56,438	-56,438	
REVENUE			3,600,000	4,104,000	4,644,000	4,386,000	4,128,000	3,870,000	3,870,000	3,870,000	3,870,000	3,870,000	3,870,000	3,870,000	3,870,000	3,870,000	3,870,000	
NET CASH FLOW		-6,150,000	1,181,125	1,519,750	1,866,813	1,058,813	1,350,813	1,092,813	1,092,813	542,813	1,092,813	-1,807,188	1,092,813	542,813	1,092,813	1,092,813	1,092,813	500,000
Discount rate	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
PV of net cash flow in year n		-6,150,000	1,054,576	1,211,535	1,328,760	672,894	766,487	553,653	494,333	219,233	394,079	-581,866	314,157	139,326	250,444	223,611	199,653	81,561
NPV	1,172,438																	
IRR	0																	

57

SCHEDULE IV TRAWLER FEASIBILITY ECONOMIC ANALYSIS

Key Parameters

Parameter	Value	Unit
No of days fishing/yr	215	
Fuel cons/day	150	ltr
Price fuel	40	Sh/ltr
Fuel costs/day	6,000	Sh
Catch/day	1,200	Kgs
Price of fish	20	Sh
Revenue/day	24,000	Sh

Base values / Conversion Factor (Year 0 economic values)

Capital Items	Base	Conversion Factor	Economic
Hull	-2,700,000	1	-2,214,000
Engine	-2,000,000	1	-2,000,000
Machinery	-900,000	1	-900,000
Gear	-550,000	1	-541,750
Total			-5,655,750

Recurring Costs	Base	Conversion Factor	Economic
Maintenanc	-535,000	1	-470,800
Insurance	-492,740	:	-292,740
Crew	-610,000	1	-579,500
Management	-78,000	1	-78,000
Total			-1,421,040

Variable Costs	Base	Conversion Factor	Economic
Fuel	-1,290,000	1	-1,161,000
Lube oil	-64,500	1	-38,700
Others	-40,000	1	-28,000
REVENUE		1	3,612,000

Yearly Schedule

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Hull (salvage)																	738,000
Engine											-2,000,000						274,000
Machinery											-900,000						
Gear					-541,750				-541,750				-541,750				
Capital Total	-5,655,750	0	0	0	-541,750	0	0	0	-541,750	0	-2,900,000	0	-541,750	0	0	0	1,012,000
Maintenance		-470,800	-470,800	-470,800	-470,800	-470,800	-470,800	-470,800	-470,800	-470,800	-470,800	-470,800	-470,800	-470,800	-470,800	-470,800	
Insurance		-292,740	-292,740	-292,740	-292,740	-292,740	-292,740	-292,740	-292,740	-292,740	-292,740	-292,740	-292,740	-292,740	-292,740	-292,740	
Crew		-579,500	-579,500	-579,500	-579,500	-579,500	-579,500	-579,500	-579,500	-579,500	-579,500	-579,500	-579,500	-579,500	-579,500	-579,500	
Management		-78,000	-78,000	-78,000	-78,000	-78,000	-78,000	-78,000	-78,000	-78,000	-78,000	-78,000	-78,000	-78,000	-78,000	-78,000	
Recurring Total	0	-1,421,040	-1,421,040	-1,421,040	-1,421,040	-1,421,040	-1,421,040	-1,421,040	-1,421,040	-1,421,040	-1,421,040	-1,421,040	-1,421,040	-1,421,040	-1,421,040	-1,421,040	
Fuel		-1,161,000	-1,161,000	-1,161,000	-1,161,000	-1,161,000	-1,161,000	-1,161,000	-1,161,000	-1,161,000	-1,161,000	-1,161,000	-1,161,000	-1,161,000	-1,161,000	-1,161,000	
Lube oil		-38,700	-38,700	-38,700	-38,700	-38,700	-38,700	-38,700	-38,700	-38,700	-38,700	-38,700	-38,700	-38,700	-38,700	-38,700	
Others		-28,000	-28,000	-28,000	-28,000	-28,000	-28,000	-28,000	-28,000	-28,000	-28,000	-28,000	-28,000	-28,000	-28,000	-28,000	
REVENUE		3,612,000	3,612,000	3,612,000	3,612,000	3,612,000	3,612,000	3,612,000	3,612,000	3,612,000	3,612,000	3,612,000	3,612,000	3,612,000	3,612,000	3,612,000	3,612,000
NET CASH FLOW	-5,655,750	963,260	963,260	963,260	421,510	963,260	963,260	963,260	421,510	963,260	-1,936,740	963,260	421,510	963,260	963,260	963,260	1,012,000
Discount rate	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
PV of net cash flow in year n	-5,655,750	860,054	767,905	685,629	267,877	546,580	488,017	435,730	170,241	347,361	-623,578	276,914	108,191	220,754	197,102	175,984	165,070

NPV: -565,909

Economic IRR: 0

SCHEDULE V ECONOMIC ANALYSIS OF TRADITIONAL CANOE

Key Parameters

Catch per day Kg	160
Number days fishing	200
Price Sh/Kg	20
Revenue/fishing day	3,200

	Year	0	1	2	3	4	5
	Conversion Factors						
Investment							
Canoe	1	-28,000					
Oars sails	1	-5,910			-5,910		
Nets	1	-36,000		-36,000		-36,000	
Recurring Costs							
Labour	1		-144,000	-144,000	-144,000	-144,000	-144,000
Maintenanc	1		-5,600	-5,600	-5,600	-5,600	-5,600
Insurance	1		-4,165	-4,165	-4,165	-4,165	-4,165
Revenue Fish sales	1		448,000	448,000	448,000	448,000	448,000
Net Cash flow		-69,910	294,235	258,235	288,325	258,235	294,235
Discount R 0			1	1	1	1	1
Present value		-69,910	262,710	205,863	205,224	164,113	166,957

NPV   934,957

CREDIT FOR FISHERMEN ON LAKE TANGANYIKA -
THE EXPERIENCE OF THE PROJECT FOR
INTEGRATED TECHNICAL ASSISTANCE AND CREDIT
FOR ARTISANAL FISHERMEN ON LAKE TANGANYIKA

by

U. Tietze
Fishing Technology Service
Fishery Industries Division, FAO

ABSTRACT

This case study describes the revolving loan fund operated by the Cooperative and Rural Development Bank of Tanzania (CRDB) in the context of the FAO project for Integrated Technical Assistance and Credit for Artisanal fishermen on Lake Tanganyika. This is one of the few successful projects in Africa with regard to credit recovery from small-scale fisherfolk. It is the only one where loan recoveries in local currency are automatically converted into foreign currency for importation of fishing inputs to be supplied on credit. The study analyses the operation of the revolving loan fund and proposes further improvements.

1. INTRODUCTION

The project for Integrated Technical Assistance and Credit for Artisanal Fishermen on Lake Tanganyika has been operational since January 1983. It is the continuation of earlier projects, the emphasis having changed gradually from assistance in developing fishing methods and improvement of fish processing techniques to integrated development assistance and provision of credit to artisanal fisherfolk.

The area of operation of the projects is the Kigoma Region of Lake Tanganyika, the northern and central part of the Tanzanian shore of Lake Tanganyika, along which about 25 project villages are located. Credit for fishery inputs was initially provided exclusively as group loans to Ujamaa villages, and to individual borrowers later.

2. FISHERY AND ECONOMIC ENVIRONMENT

According to a project evaluation mission carried out in October 1987, the development of artisanal fisheries on the Tanzanian side of Lake Tanganyika reached its maximum in the years 1973/74, when a thorough Catch Assessment Survey indicated that catch levels in twelve consecutive months totalled about 50 000 tonnes. Estimates of the lake's pelagic fish potential provided by FAO in 1978 are of the order of 10 kg/ha of 130 000 tonnes for Tanzanian waters of Lake Tanganyika. Considerable annual fluctuations in fish stocks occur, but this estimate is thought to represent a safe aim for fisheries development, preventing over-investment in years of temporary fish abundance. Compared to the 1973-74 catch values, there would thus have scope for a nearly 2.5-fold increase in fish catches. In spite of very high official statistics produced by means other than the Catch Assessment Survey, which had to be discontinued for lack of funds, total fish catches have declined drastically to reach levels as low as 25 000 tonnes in recent years, the main reason being the lack of imports of fishing gear, equipment, engines and spare parts. The

quantity of gear present in the Kigoma region (data from Regional Fisheries Officer) would seem to indicate that a total catch figure of 25 000 tonnes is a likely estimate for this region.

Table 1: Estimated Annual Catch of Kigoma Region

No. of fishing gear	Type of gear/daily catch/ no. of fishing days per year	Total est. catch by gear
300	Beach seine nets x 150 kg x 240 days	10 800 t
375	Lift nets x 75 kg x 240 days	6 750 t
1 100	Scoop nets x 25 kg x 240 days	6 600 t
6	Purse seiners x 150 tonnes each	900 t
	TOTAL	25 050 t

Resources therefore seem to justify further expansion of fishing activities. This situation is likely to continue as population density is low, infrastructure and roads are virtually non-existent and main consumer markets are far from the fishing grounds.

The present shift of emphasis towards private sector development and the liberalization of importation of fishing gear and equipment is considered by all concerned to be a contributing factor to the recovery of the fisheries sector.

In addition, rural credit policy changes are being planned and implemented, resulting in a re-orientation of further development of the credit delivery mechanism of the project towards a higher degree of need orientation, timeliness and flexibility. The CRDB is reviewing its organizational set-up and introducing changes to improve its operational efficiency and extend its branch network to reach a larger number of rural people, particularly the poorer sections. In this context, non-security-based lending could play an important role and more appropriate lending procedures and loan administration could be introduced to ensure the desired socio-economic results and satisfactory loan recovery rates.

Another significant change which occurred in the process of project implementation is the increased participation of women in project activities, in environmental activities such as tree planting, in fisheries-related activities such as smoking and with regard to credit.

3. IMPLEMENTATION OF THE CREDIT SCHEME - ACHIEVEMENTS AND CONSTRAINTS.

Loans are disbursed for fishing equipment such as outboard engines, lamps, lift nets and accessories used in lift net fishing with light attraction.

While initially credit was channeled to Ujamaa villages as group loans, the group lending approach was discontinued later on in favour of loans to individual fishermen. Fishermen request loans on their own initiative. Requests are forwarded through the village chairman to the regional CRDB office in Kigoma. The Project Officer (Fisheries) visits the applicant in his village to certify his credit-worthiness and the fisherman is asked to complete a loan application form. Individual borrowers who could provide a high cash equity were selected. The Project Officer prepares a technical and financial appraisal report, including calculation of Net Present Value (NPV) and Internal Rate of Return (IRR). The application and appraisal report are then scrutinized by the Regional CRDB Manager and, if endorsed, forwarded to the Regional Loans Committee for recommendation. This committee is headed by the Director of Planning of the region and composed of the heads of all regional departments, the Secretary being the regional CRDB Manager. If recommended by the committee, the application and appraisal report are then forwarded to the head office of CRDB in Dar-es-Salaam for sanctioning.

Borrowers are visited every two months for loan recovery by the Project Officer or Credit Supervisor. Repayment notices are issued in the case of delayed payment.

The mechanism for the conversion of loan repayments in local currency into foreign currency for further importation of fishing equipment introduced during the first phase of the project works reasonably well; US $ 199 243 have been converted since May 1985.

Several of the group loans disbursed to the Ujamaa villages had not been repaid because the equipment had not been properly used, due to organizational weaknesses at village level. Attempts were made to recover instalments and interest on these loans but did not meet with much success.

The two courses of action available were either foreclosure or writing off of the loans. The first alternative was considered more suitable, as it seemed prudent to sell the assets and equipment remaining in custody of the village authorities. The value of this equipment had increased considerably because of devaluation and scarcity of goods, and they fetched high enough prices to cover the arrears, including those towards interest payments.

After foreclosing some of the group loans to Ujamaa villages, the group lending operation was replaced by lending to individual fishermen. As of September 1989, two batches of altogether 42 loan applicants had received credit worth T. Shs.[1] 7 340 776.56. The two tables below show loan disbursements and recoveries for both batches of borrowers.

Table 2: Loan Recoveries and Disbursements to Individuals 1st Group Loanees (in T. Shs.)

Number	Account Number Disbursed	Loan Amount Due	Total Amount	Cumulative Repayment
1.	650006	143 600.00	52 483.23	98 680.00
2.	650007	143 600.00	81 666.81	117 387.00
3.	650008	142 187.00	52 583.23	131 680.00
4.	650009	143 600.00	110 028.78	112 571.10
5.	650010	279 200.00	185 356.08	215 790.10
6.	650011	171 000.00	115 748.64	118 781.10
7.	650012	186 336.10	195 046.10	161 926.76
8.	650013	173 017.31	126 956.30	143 769.50
9.	650014	171 000.00	141 120.45	174 239.49
10.	650015	177 385.15	126 956.30	164 205.15
11.	650016	174 102.33	107 820.00	126 956.32
12.	650017	171 100.00	99 153.74	136 097.00
13.	650018	171 100.00	94 306.31	103 978.30
14.	650019	171 100.00	94 995.00	127 590.89
15.	650020	171 100.00	94 306.31	100 995.00
16.	650021	118 000.00	69 549.90	75 000.00
17.	650022	171 100.00	127 590.89	148 425.00
18.	650023	163 646.31	33 081.36	116 000.00
19.	650024	163 646.31	123 109.12	126 875.00
20.	650025	171 000.00	120 000.00	24 421.10
21.	650026	171 000.00	146 667.73	178 782.75
22.	650027	167 000.00	65 741.20	65 901.72
23.	650028	143 334.16	86 879.00	110 990.39
24.	650029	118 000.00	66 238.00	86109.40
25.	650030	112 000.00	58 000.00	56 603.34
26.	650031	143 600.00	144 117.90	172 941.48
27.	650032	118 000.00	91 728.26	111 599.40
28.	650033	115 000.00	76 003.35	65 901.72
29.	650034	142 187.00	52 438.46	94 221.50
1st Group =Sub-total T. Shs.		4 614 295.36	2 939 572.00	3 460 397.40

[1] T. Shs. = Tanzanian Shillings.

Table 3: Loan Recoveries and Disbursements to Individuals 2nd Group Loanees (in T. Shs.)

No.	Account No.	Loan Amount	Total Amount	Cumulative Repayment	Disbursement Date
1.	650046	267 880.53	23 233.71	70 718.90	Dec. 87
2.	650047	Disbursement not effected within grace period			
3.	650049	110 816.85		17 000.00	May 88
4.	650050	Disbursement not effected within grace period			
5.	650051	220 052.60		30 000.00	May 88
6.	650012	198 742.80	39 102.45	91 360.00	Jan. 88
7.	650059	218 580.00	22 731.42	136 219.00	Jan. 88
8.	650054	290 436.10		Nil	May 88
9.	650055	Disbursement not effected within grace period			
10.	650056	294 633.00		52 410.00	June 88
11.	650057	Disbursement not effected within grace period			
12.	650058	Disbursement not effected within grace period			
13.	650059	442 080.00	39 160.68	34 480.00	Jan. 88
14.	650061	198 794.50	39 974.22	142 704.50	Sept.87
15.	650060	264 411.60	21 746.58	71 127.50	Jan. 88
16.	650062	220 052.60	Disbursement not effected within grace period		
17.	650067	193 943.20		25 000.00	May 88
18.	650068	300 068.90		33 000.00	May 88
19.	Legal documents awaited from Head Office				
20.	Legal documents awaited from Head Office				
2nd Group Sub-Total = T.Shs.		2 726 481.20	185 949.00	704 019.90	
GRAND TOTAL = T. Shs.		7 340 776.56	3 125 521.00	4 164 417.30	

Loan Recovery Rate (%)

$$\text{T. Shs.} \quad \frac{4\ 164\ 417.30}{3\ 125\ 521.00} \quad \times \quad 100 \quad = \quad 133.24\ \%$$

While the earlier group loans to Ujamaa villages had been fully recovered by foreclosing loans which had not been repaid, loans extended to individual fishermen were being recovered at the rate of 133.24 % as of September, 1988 which means that loans were being repaid in advance of the due date.

In addition to extending credit to fishermen, the project became increasingly involved in cash sales, which is documented by the Table 4 below. For the period from September 1987 to 1988, fishing equipment worth T. Shs. 6 000 782.55 was sold on a cash basis to fishermen, while the total value of all credits in kind was only T. Shs. 5 772 840.65. Needless to say, cash sales are directed to the more affluent members of the fishing community while credit aims at the poorer sections. As a reason for the large number of cash sales, a strong demand for fishing equipment which could not be fully met by credit disbursements was cited. This was attributed to the limited number of loan applications which can be entertained at a time because of the procedures adopted for the processing of loan applications.

Table 4: Cash Sale Compared to Credit (in T. Shs.)

A. Number of individuals who purchased fishing gear in cash from 1/9/87 to 1/9/88

Number	Item	No. of fishermen
1.	Lift nets	64
2.	Fishing floats	Nil
3.	Twines	"
4.	Polyropes	"
5.	Volvo Penta engines	"
6.	Volvo Penta spare parts	332
7.	British Seagull spare parts	69
8.	British Seagull engines	12
	TOTAL	477

B. Value of cash sales as compared to loans from 1/9/87 to 22/9/88
B1: NETS

Loans:

Dimension of net pieces	Number of pieces x cost per piece		Total Value (T. Shs.)
10 mm x 800 md x 100 =	6	@ 56 937.25 =	341 623.50
10 mm x 800 md x 100 =	10	@ 74 108.20 =	741 882.00
10 mm x 800 md x 100 =	12	@ 94 404.55 =	1 132 854.60
12 mm x 800 md x 100 =	4	@ 54 667.55 =	218 669.60
19 mm x 800 md x 100 =	4	@ 31 823.40 =	127 293.60
TOTAL	36	TOTAL	2 562 323.40

Cash:

Dimension of net pieces	Number of pieces x cost per piece		Total Value (T. Shs.)
10 mm x 800 md x 100 =	40	@ 56 937.25 =	2 277 490.00
12 mm x 800 md x 100 =	32	@ 54 667.40 =	749 356.80
10 mm x 800 md x 100 =	4	@ 94 404.55 =	1377 618.20
19 mm x 400 md x 100 =	3	@ 31 295.65 =	93 886.95
30 mm x 15 md x 50 =	6	@ 5 574.90 =	34 649.40
60 mm x 15 md x 100 =	3	@ 12 012.00 =	366 036.00
TOTAL	88	TOTAL	4 899 037.35

B2: FLOATS, TWINES, POLYROPES

Loans:

Item	Number	Cost			T. Shs.
Fishing floats	530	@	83.95	=	44 493.50
Twines	14	@	621.55	=	8 701.70
Polyropes	32	@	5 397.75	=	172 728.00
			TOTAL	=	225 923.20

Cash: NIL

B3: SEAGULL OUTBOARD ENGINES

Loans:

Item	Number	Cost			T. Shs.
British Seagull Engines	3	@	76 742.65	=	230 227.95
	3	@	91 812.10	=	2 754 366.20
TOTAL	6				2 984 366.20

Cash:

Item	Number	Cost			T. Shs.
British Seagull Engines	3	@	91 812.10	=	1 101 745.20
TOTAL CASH SALES					6 000 782.55
TOTAL SALES ON CREDIT					5 772 840.65

3.2. Transaction Costs of Bank Charges and Interest Rates

Transaction costs incurred by the bank while operating the fisheries credit programme can be subdivided into cost of funds, cost of loan administration, and clearing and handling charges for the imported fishing equipment.

Table 5 below shows that the transaction costs of the bank amount to 17.5 % of the volume lent. The figures include a sizeable component (T. Shs 447 736.40 for the period July 1987 to June 1988) towards clearing and handling charges of the imported goods.

Regarding the cost of credit for borrowers, the handling and clearing charges were passed on to the borrower as a mark-up of the loan amount, while other lending costs were covered by the interest on the loan which was revised monthly and ranged from 12 to 17 %. While the repayment towards principal minus the mark-up remained in the revolving loan fund, repayment towards interest plus repayment towards mark-up remained with the bank to cover their operation costs and to provide for a profit margin.

Table 5: Transaction costs of CRDB Regional Office, Kigoma July 1987 to June 1988 (in T. Shs.)

Code	T. Shs.
1. COST OF FUNDS FOR REGIONAL OFFICE	
- Ongoing portfolio	148 045
- New disbursements (amount disbursed from July 1987 to June 1988)	22 277
Sub-total	170 332
2. LOAN ADMINISTRATION	
Personnel Costs	
- Salaries	572 930
- Medical Expenses	45 730
- Uniforms	51 800
Sub-total	670 460
Business Direct Expenses	
- Bank charges	3 170
- Business licence	36 000
- Postage and telephones	32 930
- Regional Loans Committee	14 540
Sub-total	86 640
Miscellaneous Expenses	
- Rent and rates	148 010
- Electricity and water	10 380
- Maintenance and repair	36 230
- Office and general	49 790
- Hired service	10 660
- Entertainment	17 000
- Maintenance and Repair - office equipment	87 360
- Library and publication	460
- Typing and stationery	52 960
- Conference and seminars	81 070
- Transport and vehicles	295 570
- Transport fuel	238 520
- Travelling and subsistence	314 520
Sub-total	1 342 100
Loan administration Sub-total	2 099 200
Share of fisheries lending in loan administration Sub-total (38 %)	797 696
3. CLEARING AND HANDLING CHARGES DURING PERIOD	
Date	
14-08-87	35 247.70
07-12-87	45 221.80
28-12-87	36 257.90
04-05-88	331 003.00
Sub-total	447 730.40
TOTAL	1 415 758.00

Transaction costs expressed as a percentage of lending:

$$\frac{1\ 415\ 758.00}{8\ 093\ 951.60} = 17.5\ \%$$

3.3. Constraints

While the loan recovery is excellent, a major shortcoming of the credit programme is the small number of loans which have been disbursed so far to individual fishermen. One reason seems to be the elaborate procedures for loan application, appraisal and sanctioning which, while ensuring an excellent repayment rate, prevent the credit programme from meeting the demand for credit by expanding the operations and covering a larger number of fishermen.

A second major constraint of the credit scheme is its emphasis on borrowers who can provide a high cash equity, thus neglecting poorer sections of the fishing community, particularly women.

The third major constraint is the erosion of the purchasing power of the revolving loan fund due to the fact that only the loan principal is revolving while interest and mark-up remain with the bank. The erosion of the revolving fund is aggravated by the high inflation rate and by devaluations of the Tanzanian Shilling.

4. NECESSARY IMPROVEMENTS TO THE CREDIT SCHEME

4.1. Diversification of Lending Programme

A mission was carried out in September 1988 to recommend changes in the operation of the revolving loan fund in order to increase the timeliness, simplicity and flexibility of credit delivery, particularly to the poorer sections of the fisherfolk population. The recommendations of the mission are summarized below. The implementation of the recommendations was reviewed by a very recent evaluation mission, the findings of which were not available when this case study was prepared.

The mission found that in view of the shortcomings identified above, there was a need for the lending institution involved, CRDB, to re-vamp its lending policy to artisanal fisherfolk and take steps to increase lending in order to reach a larger number of borrowers. A more flexible and streamlined credit deliver and recovery system was needed.

It was further noted that the large number of cash sales was not in accordance with the objectives of Phase II of the project. The purpose of the project is to establish a credit-cum-supply and technical assistance system for artisanal fisherfolk, particularly for the poorer sections, not to supply fishing gear to those who have large amounts of ready cash available. Cash sales are only permitted for engine spare parts and for the purpose of repairing fishing gear.

One measure to extend the credit programme to poorer and disadvantaged sections of the fishing communities is the inclusion of special credit schemes for women. A preliminary enquiry in Mwamgongo and Mtanga villages showed that there was a demand for credit for fish marketing, tailoring, canteens, handicrafts, bakery and goat rearing. It was recommended that groups of women should be eligible for loans for beach seines. A survey of other villages to identify needs and demands, in order to expand the lending programme for women, was suggested.

In addition to extending the credit programme to women, the inclusion of additional fishing gear, the bottom-set gillnet, was proposed. This net is relatively cheap and available on the local market, manufactured in Tanzania. It was suggested that CRDB should use their own funds as credit for this equipment.

With regard to the demand for credit in fishing villages, it was noted that there are many unemployed young people who could take up productive activities if initial investments could be provided on credit. CRDB should play an active role in the provision of this credit.

4.2. Cost of Lending and Interest Rates, Charges and Equity

In accordance with the project's plan of operation and the evaluation report of the previous phase of the project, modifications regarding cash contributions of borrowers and charges referred to as mark-up were considered necessary.

The aim of these proposed changes was to ensure that:

- the credit programme is not limited to wealthy borrowers who can afford large cash equity contributions, but is extended to average and poor fisherfolk, including women and young people, who cannot contribute substantial amounts of cash. The achievement of this aim is supported by the introduction of lending procedures appropriate for non-security-based lending.

- the purchasing power of the fund is maintained by passing on cost increases and risks to the ultimate borrower rather than covering these, particularly the latter, by institutional subsidies such as replenishments of the fund. The role of replenishments was anyhow to be limited to provide for the uncertainties which are involved when calculating anticipated bad debts, and foreign exchange rate fluctuations.

In order to safeguard the purchasing power of the revolving fund, it was to be protected against bad debts and against the increase in costs of the assets to be provided on credit due to devaluation of the T. Shs. The transaction costs of credit, consisting of cost funds, loan administration costs and handling charges, and a margin for the bank were also to be provided for.

These cost elements were to be covered by the interest and by a mark-up which was to be added to the loan component. The total loan amount thus consisted of the amount covering the cost of the asset (minus the equity contribution of the borrower) plus the mark-up. It was further suggested that the borrower contribute a cash payment of 10 per cent of the cost of the asset.

In quantitative terms, the elements were calculated by the mission as below:

(a) *Bad Debts:* It was assumed that 10 per cent of the loans might not be repaid, which is why 10 per cent of the loan amount towards cost of asset was to be charged to the borrower to safeguard the fund against bad debts. The charge was to be included in the loan amount and annually reviewed.

(b) *Increase of cost of assets* due to devaluation of T. Shs. against the US $ was assumed during 1989. This charge was to be included in the loan amount and to be annually reviewed. The provisions against bad debts and foreign exchange fluctuations can be considered a fund stabilization component.

(c) *Bank transaction costs consisting* of loan administration costs plus costs of storage and transport of the assets. Ten per cent of the loan amount towards cost of the assets was considered loan administration costs, while another 15 per cent should be considered handling costs (storage and transportation). While the loan administration costs were covered by the interest rate, the handling costs were to be charged to the borrower as part of the loan. As shown above, the present transaction costs are slightly lower (17.5 %), so the estimate still includes a safety margin.

(d) *Margin and interest for bank:* It was proposed to charge 15 per cent as interest on the loans, so that 5 per cent of the loan amount can be considered as margin for the bank (15 % - 10 % since there are no real costs of funds).

In total, the additional loan elements represent 35 per cent of the loan amount towards cost of the asset. While the loan administration costs as well as the bank's margin are covered by the interest rate, the fund stabilization component, composed of the provisions against bad debts and foreign exchange rate fluctuations and the handling charges, were to be included in the loan as a mark-up which amounts to 35 per cent of the loan amount towards the cost of the assets.

The fund stabilization component is intended to ensure that the demand for credit declines and eventually comes to a halt should the financial viability of the credit programme decline. The

decline may be caused by an extraordinary increase in the cost of the assets resulting from extreme foreign exchange rate fluctuations. It may also be caused by non-repayment of loans due to lack of financial viability of the fishing operation as a result of economic resource over-exploitation or willful default.

At the same time, the fund stabilization component should provide an incentive for the borrower to repay the loan, as the better repayment the smaller the loan amount will be of future loans.

Table 6 below shows the composition of the financial outlay proposed by the mission as well as the sub-division of the loan components.

Table 6: Proposed Composition of Financial Outlay

Total Financial Outlay		
I	II	III
Loan amount towards cost of asset (90 % of cost of asset)	Mark-up (35 % of cost of asset) – Fund stabilization charge (20 %) Handling charge – (15 %)	Cash contribution of borrower (10 % of cost of asset)
Sub-Division of Loan Components (expressed as percentage of loan amount)		
Loan share towards cost of investment	Loan share towards fund stabilization	Loan share towards handling of assets
72 %	16 %	12 %

Whilst it was proposed that 12 per cent of the loan recovery should remain with the bank to provide for a margin and to cover the bank's loan transaction cost, 88 per cent of the repayments of the loan should remain in the revolving fund. The fund stabilization charge and the handling charge were to be annually reviewed.

4.3. Liquidity of Revolving Fund.

With a view to improving the liquidity of the revolving fund, an overdraft facility on the CRDB Project External Account at NBC Foreign Branch, Dar-es-Salaam, was recommended, the facility to be restricted to 50 per cent of the value of each Letter of Credit deposited against the External Account of NBC at Head Office in Dar-es-Salaam. The approval of the Bank of Tanzania was to be obtained.

At present considerable delays are experienced in the transfer of funds from the Collection Account of NBC Kigoma (Suspense Account) to the CRDB project External Account of NBC Foreign Branch. Telegraphic transfer was recommended for the speedy transfer of funds. Figure 1 shows the proposed modification of credit delivery and recovery and of the transfer of funds.

LENDING PROCEDURES

Figure 1: Proposed procedures for loan approval and documentation

Loan application
|
Application forwarded through
village chairman
|
Application recommended by
Regional Loans Committee
|
Application approved by Regional Manager
|

Above T. Shs. 500 000	Below T. Shs. 500 000
Application forwarded to Head Office, Development Division	Loan Agreement signed by R.M., Documentation
Appraisal by Division Manager, Chief Manager, Director Development Banking	Procurement and Disbursement by R.M. in cooperation with Project Manager
Approval by G.M. Chairman of CRDB	Statements of Loan approvals to be regularly forwarded to Head Office for monitoring
Loan Documentation	

It was also recommended by the mission that the grace period for the repayment of loans be reduced from six to three months. Debt servicing should start as soon as the borrower obtains the necessary equipment and inputs to commence fishing operations.

4.4. Lending Procedures

With regard to appraisal of loan applications, there appeared to be a duplication of work at Head Office. A loan proposal was appraised by the Regional Manager, recommended to the Regional Loans Committee, and then submitted to Head Office. At Head Office the application was again appraised by the Development Division and registered. It was further examined by the Divisional Manager, and registered. It was further examined by the Divisional Manager, the Chief Manager, the Director of the Development Division, and in certain instances even by the General Manager.

With a view to introducing flexibility and speeding up loan approvals, it was recommended that procedures be streamlined and special activity forms for loans be used for loan appraisal by the Project Officer at the Regional Office. Standardized financial reports and loan schemes contained in the lending programme were to form the basis of loan appraisal and loan approval.

The following procedure was suggested for the majority of applications (see Figure 2).

(a) Fisherfolk express interest in obtaining loan from CRDB.

(b)   Project Officer scrutinizes the person and, if satisfied, asks her/him to fill in a loan application form plus activity form. The Project Officer fills in or updates a village profile. The loan application should refer to a scheme listed under the lending programme. However, the lending programme should be flexible with regard to the requirements of the borrower; borrowers need not apply for all assets listed under the particular scheme, if they own some assets or propose to share these with others.

(c)   Based on the activity form/village profile and standard scheme economics given in the lending programme, the application is appraised at CRDB Regional Office. There is no need for detailed financial analysis of individual loan applications. Only diversions from standard scheme economics should be noted in the appraisal report and justified.

(d)   If appraised affirmatively, the loan application is forwarded to the Regional Loans Committee. After being recommended, the application goes to the Regional Manager for sanctioning. If sanctioned, the Regional Manager signs the loan agreement on behalf of the bank. All documentation is carried out at the Regional Office, with the exception of the case of loans above T. Shs. 500 000, which are appraised and sanctioned at Head Office.

(e)   The loan is disbursed.

(f)   Statements of loan approvals, together with copies of appraisal reports, should be regularly sent to Head Office for monitoring, but not for appraisal and approval.

(g)   Lending programmes should be regularly monitored by Head Office, where any changes in lending programmes should be approved and new lending programmes developed.

Figure 2: Credit delivery and recovery/transfer of funds

CRDB Kigoma

Loan agreements

Cash
transactions
for spare parts
for engines

Individuals loanees

Individual buyers

Loan repayments

CRDB Kigoma_____Cash payments

15 % loan interest and 12 % of
repayment towards principal to
reimburse bank for advance of
handling charges to CRDB
Ordinary Collection Account
INBC Kigoma

88 % of loan repayments towards
principal. CRDB Special Fisheries
Collection Account at NBC Kigoma

CRDB Ordinary Collection
Account/NBC Market Street
Branch DSM

Telegraphic transfer to

CRDB Account/NBC Lumumba
Branch DSM

CRDB Project External Account at
NBC Foreign Branch in DSM

THE TANZANIAN EXPERIENCE IN FISHERIES PLANNING

by

Harold S. Mongi
Senior Fishery Planning Officer
Fisheries Division
Ministry of Lands, Natural Resources and
Tourism
Dar-es-Salaam, Tanzania

ABSTRACT

This paper summarizes Tanzania's relatively underutilized fishery resources, suggests causes for the inadequate exploitation and summarizes new attempts at rectifying the situation. Tanzania is endowed with considerable fishery resources which only about half are being exploited. Their full exploitation could make the nation nutritionally self-sufficient in animal protein but negative balance of payments has hampered importation of raw materials for manufacturing fishing nets and of other equipments not locally manufactured. This has been caused by negative balance of payments has hampered importation of raw materials for manufacturing fishing nets and of other equipments not locally manufactured. This has been caused by negative balance of payments. Another major constraint has been inefficient development planning caused by both institutional deficiencies and by inadequate planning skills, a joint policy and planning project by FAO and the fisheries division contributed significantly in identifying the deficiencies by facilitating participation of fishermen and private sector in drawing out development priorities, by identifying structural and institutional constraints and solutions to effective policy formulation, development planning, monitoring and evaluation schemes, and efficient utilization of scarce human and material resources.

1. A REVIEW OF FISHERY RESOURCES

1.1   Introduction

Tanzania mainland as a coastal state is exceptionally endowed with some of the largest freshwater lakes in the world with substantial fish resources. It has an areas of 939,470 km" of which an estimated 53,483 km" (5,7%) are freshwater, a coastline about 800 km long with narrow continental shelf and has a population estimated at 22.5 million out of whom about 60,000 people are full time fishermen and another 300,000 are engaged in part time fishing and fisheries related activities like fish processing, marketing, net marketing, marine engine repair, boatbuilding and production of other accessories. Freshwater fisheries account for over 80 percent of the landed catch. The total fish production for the years 1975-1987 is summarized on Appendix I.

Available fish stocks in both marine and freshwater are not well documented because of inability of carry out stock assessment surveys, and where these have been done they were not only inconclusive but they are now obsolete because they were not subsequently continuously evaluated. However, from extrapolation of recorded data, fishing performance and field observations it has been observed that certain traditional fisheries are wither being fully or are nearing full exploitation whereas others are being little exploited.

The fishing industry is an important producer of animal protein, offering quicker return on investment capital than animal husbandry in increasing animal protein. Fish become more important in the lower income groups as other animal protein, mainly meat and poultry becomes more expensive. In the years 1985 and 1986 the sector's contribution to the national GDP was 6.5 percent and 6.2 percent respectively, while its contribution to the GDP of agriculture in the years 1985-1987 was 10.5 percent, 9.7 percent and 7.2 percent respectively.

The fishing industry offers a big potential for export trade which until now has depended on marine products mainly constituting prawns, beche-de-mer, shells and lobsters. Foreign exchange earning have recently increased fast from US $ 3.5 million in 1987 to US $ 5.7 million in 1988 and the projection for 1989 is US $ 10 million. (Appendix II). The export potential from Nile perch in Lake Victoria could easily more than double these earnings if the resource is fully exploited.

The per capita fish consumption is estimated to have increased from 12 kg in 1980 to 15 kg in 1987. Indications are that fish consumption will continue to increase as fishing gear and equipment become more available.

1.2   The inland fisheries

Tanzania owns about 50% of L. Victoria, 45% of L. Tanganyika, 20% of L. Nyassa and several minor lakes, dams, reservoirs, swamps and rivers. These fisheries employ 48,000 full time fishermen and over 240,000 occasional fishermen using about 18,000 small crafts which operate close to the shore using gill nets, seines, lines and traps. The major fish species exploited are sardines, nile perch, haplochromis, catfishes and tilapias.

Lake Victoria is a multi species fishery which until 1970's was dominated by tilapias and haplochromis, the latter offering a big potential for manufacture of animal feeds. This balance has recently been altered by sudden emergence of Nile Perch. By 1980, 25 years after its introduction, its catches were insignificant but then began to increase extremely fast and by 1982 and 1986 over 21,000 tons and 97,700 tons respectively were recorded in Mwanza gulf. This sudden increase has had an impact on the indigenous fish stocks especially on the haplochromines which have formed the main food of the Nile Perch. However, there are indications that many tilapias, the cyprinid *Rastrineobola argentea* important as food and for manufacture of animal feeds, and other important catfishes can coexist with the nile perch.

Nile perch is presently little exploited by artisanal fishermen using large meshed gill nets. Commercial exploitation is presently constrained by lack of handling facilities and poor transport system.

In Lake Tanganyika the fish stocks consist of two sardines *Stolothrissa tanganica* and *Limnothrissa miodon* and their predator *Luciolates spp*. Of the four riparian countries traditional fisheries in Tanzania are least developed and commercial fisheries are still rudimentary concentrating most of the effort within 5 km from shore which is range accessible by the rowed canoes. There is therefore a big potential for expansion of both traditional and commercial fisheries.

Fishing is mainly done by scoop nets and partly by lift nets using light attraction. Sardines are mainly sun dried and marketed for food and for manufacture of animal feeds. A significant unrecorded export trade for sardines exists with neighbouring countries, currently estimated at 1000 tons annually.

Lake Nyassa is known to have very diverse fish fauna but productivity from the Tanzania side of the Lake is low due to steep shore giving way to deep waters. The fishermen use poor craft and gear which can only operate close to the shore. Fishing is mainly by use of gillnets, scoop nets, while long lines and traps are used at river mouths. The fish exploited consist mainly of haplochromines, catfishes, cyprinids and other minor species.

The remaining lakes Rukwa, Kitangiri, Mtera dam, Nyumba ya Mungu dam, other smaller lakes, swamps, dams, and rivers have similar fisheries as the main lakes. They share common problems of lack of fishing gear, poor craft and remote inaccessible fish landing sites which cause heavy post-harvest losses due to inadequate transport system, insect infestation and inadequate processing skills and facilities.

1.3 Marine fisheries

The marine waters are exploited mainly by an estimated 12,000 full time and 60,000 part time fishermen spread along the 800 km coast line and outlying islands. Fishing is carried out using non motorized canoes and dhows which employ a variety of traditional and modern fishing gear.

Pelagic species are caught by trolling lines, set nets and drift nets. Other common fishing methods are: beach seines, cast nets, stake traps and scoop nets.

Commercial fishing is by trawling and purse seining, the latter with encouraging catches. Trawling is limited by coral formation and is presently mainly concentrated on the estuarine areas of the rivers Rufiji, Ruvu, Wami and Pangani. Commercial trawling for prawns was up to three years age mainly performed by Tanzania Fisheries Corporation (TAFICO) yielding about 150 tons annually for export. Recently a number of chartered vessels have been introduced. Production for year 1988 was 1280 tons out of which 813 tons were from commercial trawlers and 467 tons from artisanal fishermen. Data on standing stocks and sustainable yield is not available and although the planning figure is 2000 tons different estimates have put the sustainable yield at between 3000 and 4000 tons.

1.4 Aquaculture

Tanzania being a subsistence agricultural country has considerable potential for developing aquaculture which can be integrated with agriculture and animal husbandry by the rural communities.

It can maintain a steady fish supply to rural communities situated far away from the capture fisheries as well as creating employment and additional income. Experience from two projects run by religious organisations indicates that with good seed supply and proper management advice rural communities in areas where conditions permit are willing to take up aquaculture, without interrupting their agricultural activities and at minimum cost. The level of development of the rural communities cannot yet adapt mariculture of aquatic resources like fish, prawns seaweeds and oysters as part of a rural employment diversification programme to provide income, food and foreign earnings.

2. THE PLANNING FRAMEWORK AND PRACTICE IN THE FISHERIES SECTOR

2.1 The planning framework

In the past seventeen years the government administration has undergone two major changes which have rendered the planning process ineffective if not inoperative. Until 1972 each ministry was responsible for policy formulation and development planning and implementation for the sectors under it up to the village level. There was a local government service which supervised district councils which were to some extent autonomous. The councils could collect modest revenues to finance limited development activities, leaving major development issues to ministries under the central government. Under this set up, district fisheries officers were responsible for development planning in their districts. These plans were submitted to regional fisheries officers who gave them a regional outlook, especially where there is inter district shared resources, before submission to the ministry. At the fisheries directorate level the plans were revised to fit in the national fisheries policy and submitted to the Ministry of Finance.

In 1972 it was considered that central planning was unable to take care of grassroots problems of the rural communities and that decision making was not only slow but was also prone to error. It was decided therefore to decentralize the system to move decision making closer to the people. District and regional development directors were charged with development of their respective areas, the former being answerable to the latter and the latter to the Prime Minister.

District and regional plans were submitted to respective District Development Committee (DDC) and Regional Development Committee (RDC) for approval before submission to the Prime Minister's office for onward transmission to the Ministry of Finance. Technical staff were also administratively and technically answerable to their respective directors. Ironically, even the

District Councils which were already quite close to the people, together with the local government service, were abolished.

This decentralization scheme immediately created three major problems.

(i) The central government departments lost control of the planning process although they remained nationally responsible for policy making and implementation.

(ii) It wrongly assumed existence of competent planning and technical skills at district and regional levels.

(iii) Mobility of skills to where they were required most became rigid.

In response to persistent criticism of the decentralisation scheme, the government at least reacted by re-centralizing the agriculture ministry. As a further modification, in 1982 stronger local government service and district councils were reconstituted but with more confounding effects on the planning process. The new district councils, vested with wider powers for revenue collection, were charged with all development activities hitherto performed by central ministries, and all technical personnel were absorbed. Each district council reports to the ministry of local government directly, regional supervision being limited only to some administrative supervision by the regional commissioner and by submission to RDC of those plans requiring government subvention. Harmonization of district plans into regional plans is thus near absent.

The fisheries planning framework is thus a dichotomy which can be summarised as follows. The directorate of fisheries prepares development plans which are of national character such as training, research, surveillance and inter- regional infrastructures. These plans are submitted to the Ministry of Finance through the Economic Planning Commission (EPC). Formulation of specific exploitation and management plans for individual fisheries is left to the regions. In the regions each district fisheries officer formulates the development plan for submission to the DDC, which in turn submits it to the RDC for onward transmission to the ministry of local governments, EPC, and Ministry of Finance. It can be seen that the regional fisheries officer has no planning role on the districts and the director of fisheries does not have a moderation role on the regional plans.

2.2   Past planning experiences

In addition to the short comings of the planning framework it can also be stated that up to year 1987/88 the fisheries division, like other government departments did not have a well defined development planning process. The practice was to establish a set of wide policy objective without stating specific objectives and the specific strategies to realize them. Annual project proposals which were a mere list of activities to be financed were listed, varying year after year, and were not related to a particular programme. Because clear objectives, strategy constraints and solutions were not defined, the desired development goals in the fishing industry have not been achieved. The government development plans were thus an amalgamation of discrete activities from various departments and institutions.

Two national projects of long term or recurring nature initiated a decade ago, which were perceived to be catalysts for major fisheries development, viz. fish receiving stations (FRS), and village fishing units (VFU), merit analysis.

2.2.1   Fish Receiving Stations

The FRS were built in presumed potentially high production areas. Save for four urban centres of Mikindani, Dar es Salaam, Tanga and Mwanza with mains electricity, the rest were in rural and trading centres and depended on diesel generators for power. Facilities included small block ice plants of capacity 3-5 tons/day, cold rooms of capacities 3-10 tons, fish auction stalls, net mending sheds and engine repair workshops.

The objective was to preserve surplus catch which could be retailed in neighbouring villages and in distant urban centres. More specifically, the objectives below would have been achieved;

(i) Increased income for fishermen

(ii) Reduction of post harvest losses

(iii) Availability of fish in hygienic conditions

(iv) Employment of fish traders

(v) Increased food supply, especially animal protein

But the strategies for achieving these important goals were not well spelt out and consequently the following technical as well as operational constraints rendered them inoperative.

(i) It was generally assumed that in all major landing sites there was excess production without carefully evaluating the supply and demand. To date the excess landing requiring these facilities has not been achieved because the artisanal supply is generally outstripped by demand.

(ii) Small excess quantities resulting from late landings, from lack of buyers due to occasional bad weather, or from seasonal fluctuations cannot absorb the cost of icing and cold storage without rendering the retail price prohibitive. In such situations hot smoking or sun drying facilities would be most appropriate.

(iii) Running of diesel generators in rural areas requires constant supply of gasoil, replacement parts, as well as availability of competent technicians. Availability of these inputs was not ascertained. Proof that supply of these inputs is poor even today can also be demonstrated by inoperative rural water supply schemes due to inoperative diesel water pumps. Needless to say, refrigeration mechanics are rare even today.

2.2.2 Village Fishing Units

These VFU were an integral part of the FRS and were made up of one to several planked boats of different sizes according to type of the fishery and driven by outboard or inboard motors.

The fishing methods were either beach seining or gill netting. These mechanised units were operate by the district or regional fisheries officers. Although there were no clearly defined objectives an guidelines for their operation the broad expectations could be summarised as:

(i) demonstration of mechanised (efficient) fishing to artisanal fishermen;

(ii) exploitation of resources beyond the reach of normal artisanal crafts; and

(iii) increasing the contribution of the Fisheries Department to government revenue.

Again, these objectives were so broad and without defined strategies and concomitant constraints so that not only were they not achieved but in some cases they were contradictory to government policy as it can be seen by evaluating each objective.

(i) The artisanal fisherman is normally not yet fully integrated into the money economy and is mostly content with his pattern of life. He is normally content with his fishing skills. He will therefore not look at mechanised fishing units run by government officers from an economic point of view of improving his earnings. Attitudes apart, there will also be the question of his financial capability of acquiring these equipments.

(ii) Some inshore fisheries were either seen to be approaching the maximum sustainable yield or already being over exploited as a result of prolonged fishing pressure caused by small range of the rowed or sail canoes. The VFU would exploit distant resources and land more fish and catalyse the fishermen to copy. Again this expectation was doomed by the same considerations as discussed above.

(iii) The policy of the government is not to increase its revenues by engaging directly in production but to facilitate production and then raise revenue through levies on services and through direct and indirect taxation. At best the VFU should have been aimed at improving extension services and, where appropriate, training fishermen where possibilities existed for offering them credits. As it were, all the fish sales from the VFU were according to government financial regulations immediately recorded as government revenue which could not be ploughed back

into the operations. Thus the VFU were not self supporting and sooner or later collapsed.

2.3   New attempts at development planning

As already pointed out, this inefficient planning was a general national problem. In an attempt to improve it, the government has adopted what has been termed "programme planning approach" whereby a development programme is defined over a period and then objectives, goals, constraints, strategies and projects are identified.

Based on this approach the fisheries development goals were redefined as below from which the current government five year development programme (1988/89- 1992/93) has been drawn up under three broad categories:

(i)   rehabilitation programmes relating to previous years projects unfinished or needing rehabilitation;

(ii)   recurrent programmes like continuous improvement of training and research institutions; and

(iii) new investment programmes.

2.3.1   Increased production

2.3.1.1 Specific objectives

(i)   To increase production to about 500,000 tons during the five year plan;

(ii)   To provide adequate and appropriate fishing crafts and gear;

(iii) To increase per capita fish consumption from 16 kg (1986) to about 20 kg (1992);

(iv)   To increase income and employment;

(v)   To produce surplus for manufacture of animal feeds and for export trade.

2.3.1.2 Specific strategies

(i)   To assist the local net making factories in expansion programmes and in obtaining adequate raw materials to satisfy national demand for nets;

(ii)   To improve the traditional craft for increased carrying capacity for more fishing gear and storage facilities, and for increased stability to reach more distant rich fishing grounds;

(iii) To expand and equip existing boatyards to cater for emerging semi- industrial sector;

(iv)   To introduce more efficient fishing methods which can result in increased catch per unit effort;

(v)   To exploit resources hitherto little or not yet exploited;

(vi)   To promote fish culture both in inland and marine waters.

2.3.2   Promotion of fish trade

Fish as a highly perishable product needs proper handling facilities, both at production and consumption levels, as well as development of proper products and distribution network.

2.3.2.1 Specific objectives

(i)   To minimise post harvest losses by establishing facilities for handling excess fish at landing sites in order to minimise income loss to fishermen;

(ii)   To develop products with long shelf life in order to reduce income loss to traders and the product to reach the consumer in good hygienic conditions;

(iii) To establish distribution networks to facilitate distant internal trade.

2.3.2.2 Specific strategies

(i) To develop and disseminate simple processing techniques which are within fishermen's financial resources in the fishing villages. As appropriate, hot smoking and sun drying facilities should be established as a common facility;

(ii) In urban high production areas, freezing facilities will be established in response to an emerging semi industrial sector;

(iii) To liaise with other national institutions in establishing transport networks from production areas to consumer areas and to export exit points.

2.3.3   Research

The need for research cannot be over emphasized. But it must be stressed that research limitation should not hinder utilisation of an obvious resource especially when its exploitation is still absent or rudimentary. Such situations can be demonstrated by the Nile Perch controversy. Equally important is the need to correctly set research priorities in accordance with national needs and available human and material resources. Research aimed at serving immediate needs should take preference over that aimed at long term needs and at general contribution to academic knowledge.

2.3.4   Statistical data base

The need for correct statistical data as an essential tool for development planning has long been recognised, and fisheries statistical data collection dates back to 1964.

However, within the last decade the data collection process has been impeded by changes in government administration set up and by lack of necessary tools. In spite of this, reasonable inferences for economic planning can be drawn from the data base. In many traditional fisheries optimum exploitation seems to have been achieved and in some fisheries there may already be over exploitation. There are some fisheries where data is not adequate but by deduction they can be seen to be open to increased fishing effort.

2.3.5   Training

Achievement of the other objectives is dependent on the quality of technical skills of producers and advisors. Since more than 95% of the total production comes from the artisanal sector, it is obvious that in the short term any increased production must come from this sector, which underscores the importance of having proper training scheme for this sector.

A training programme for technical personnel who can form effective extension service and carry out other developmental and research activities must be carefully planned to meet immediate needs and then to increase the skills in line with actual development of the industry.

2.3.5.1 Specific objectives

(i) To develop a specific training programmes for young men with minimum primary education in practical fishing skills as a new generation of fishermen;

(ii) To train technicians who can advise artisanal fishermen in skills relevant to their gear, in simple processing techniques, and to carry out repairs for fishing motors;

(iii) To train higher cadres who will be trainers for the extension staff, and offer supportive services to the industry such as research and data collection and processing;

(iv) To train staff who will run the fisheries administration and manage small scale fishing enterprises.

2.3.5.2 Specific strategies

(i) To set up production units in specified areas in which new recruits will learn to fish by practice. Part payment of their labour will go to a special fund which at the end of the programme will be used to buy new set of fishing vessels and nets for the group. Training in basic book keeping will be offered as a major tool for managing credit schemes;

(ii)　Setting up training institutes which will offer relevant technical skills.

3. THE EXPERIENCE OF FAO/FISHERIES DIVISION PLANNING PROJECT

In recognition of the inadequate sectorial development, the government therefore requested and got the assistance of Food and Agriculture Organisation (FAO) of the United Nations Organisation through project TCP/URT/6763 for joint evaluation of the current situation and recommendation of short term remedial development strategies. The project lasted for 5 months from November 1987 during which period field missions were jointly conducted by FAO consultants and local senior personnel.

A national seminar was held on 2-4 May, 1988 at the University of Dar es Salaam, followed by a donors conference held on 29th September, 1988.

3.1　Field missions

All regions with significant fishery potential were grouped into zones and zonal centres. In each zone all fishery areas were visited and interviews conducted with fishermen, fish traders fisheries field staff, district and regional fisheries officers, and private and public institutions interested in fisheries development. After the visits, round up discussions were conducted at zonal centres involving representatives of fishermen and fish traders, and district and regional fisheries officers.

The zonal seminars provided a unique opportunity for fishermen to exchange ideas with government officials and to discuss common problems of exploitation and management of shared resources. A summary of situations and solution recommendations and project proposals were drawn for submission to the national seminar.

3.2　National seminar

Participants to the seminar were drawn from a diversity of public institutions relevant to the industry, private entrepreneurs, representatives of small scale fishermen from each region, financial institutions, religions organisations, and donor agencies. Papers were presented on topics intended to steer wide and detailed discussion of major fishery development issues. Private institutions and entrepreneurs presented papers on issues of their interest while fishermen made oral submissions of their problem and of their perception of desirable fishery development.

A representative panel was drawn from the participants to monitor the deliberations and to draw major policy and planning recommendations which, together with the project proposals, were recommended for submission to a donors conference.

3.3　Donors conference

Invitations were extended to local offices of major donor agencies, to embassies of major donor countries, to non governmental organisations and to internal and external banking institutions. Even though the timing of the conference did not permit responses from the respective head offices and foreign governments, it became evident that donors already with short and medium term aid commitments to other sectors of the economy will unlikely make adjustments to accommodate the fisheries sector.

3.4　Major findings and lessons from the planning project

(i)　The fundamental objective of the government should be nutritional self sufficiency and economic self reliance. The fisheries sector is already a major animal protein supplier with potential response to increasing demand by up to 200,000 tons annually;

(ii)　Given that over 95% of present production is artisanal, that greater part of the resources is mainly amenable to traditional technologies, capital intensive modern technologies should be discouraged in favour of traditional ones using inexpensive equipments for short and medium term increase in production and employment and for equitable income distribution;

(iii)   The current negative balance of payments notwithstanding, the government should steadily allocate foreign exchange to the sector to meet the high import content of fishing equipments in order to achieve nutritional self sufficiency. This will consequently develop exportable products to make the sector self sufficient in foreign exchange requirements;

(iv)   Foreign and hitherto concentrated in financing public enterprises, in training high skills, and in conducting expensive stock assessment surveys should be directed to supply of fishing equipment, training of basic technical skills and improving data collection and evaluation;

(v)   The current planning framework with three uncoordinated levels (central, regional, district) is a major constraint to integrated development based on clear policies and strategies. This constraint is compounded by generally inadequate appreciation by government administration of importance of proper economic analysis, planning, monitoring and evaluation at sectorial level. Pooling of scarce resources becomes difficult, and technical back- up available at central level is not available to districts;

(vi)   For short and medium term improvements in fisheries planning and management, training and utilisation of human and material resources should be improved. Training of planning skills which are minimal merits priority. The present practice of training high level theoretical technical skills at the expense of practical low level skills in high demand should be discouraged. Public investments have hitherto remained idle or underutilised and should therefore be discouraged in favour of private investment. Existing training and research institutions should be restructured for more efficient use of scarce technical skills, equipment and budgetary allocations.

SUMMARY OF FISHERMEN, GEARS AND CATCH FOR YEARS 1975-1987

MARINE WATER

YEAR	FISHERMEN	FISHING VESSEL	GILLNETS	SHARK NETS	PURSE SEINE	TRAWLNET	SEINES	LONGLINE	HANDLINE	TRAPS	IB ENGINE	OB ENGINE	CATCH TONNES	VALUE 000 SH
1975	3483	3057	3210	2084	-	-	88	-	-	4402	19	112	31193.3	94126.0
1976	11157	3717	5846	2331	-	-	892	-	5127	8383	-	-	48491.4	200707.0
1977	10033	4128	4751	3228	591	-	413	-	-	6193	33	390	46337.6	268806.5
1978	9799	4498	3188	3048	492	-	424	509	5400	7993	29	367	46707.5	267151.2
1979	8124	2906	3911	2210	255	-	423	-	3377	1367	33	82	33104.3	122466.6
1980	7596	2238	3995	-	148	-	80	-	3053	2934	14	32	29365.0	235277.6
1981	13176	3614	5810	2937	-	-	7642	-	-	5270	33	272	35586.3	279981.2
1982	13499	3434	5507	2315	-	-	-	-	7629	5910	27	266	52901.8	510018.8
1983	9495	2382	5214	1583	222	-	47	231	4618	8728	36	76	34485.5	460888.6
1984	13783	3556	6955	2342	462	18	490	2	6757	6552	32	104	40890.1	1149533.4
1985	11392	3045	4942	3093	1288	17	580	159	12357	6668	39	177	42847.3	1676269.2
1986	12619	3690	8842	3590	3	7	1299	121	13478	12318	49	228	46984.7	1672741.8
1987	12739	3595	9549	3193	3	11	1631	135	10708	10940	65	245	39094.7	1561307.1

FRESH WATER

YEAR	FISHERMEN	FISHING VESSEL	GILLNETS	SHARK NETS	PURSE SEINE	TRAWLNET	SEINES	LONGLINE	HANDLINE	TRAPS	IB ENGINE	OB ENGINE	CATCH TONNES	VALUE 000 SH	GRAND TOTAL CATCH TONNES	GRAND TOTAL VALUE 000 SH
1975	36865	15743	145745		-	-	5630	-	46678	1208	8	285	160366.4	227813.1	191559.7	321939.1
1976	49951	23328	264273		2522	-	3218	-	96121	945	-	-	190783.6	340736.0	239275.0	541443.0
1977	35966	15517	175695		2004	-	6151	-	283568	28	57	153	214307.7	449132.4	260643.3	717938.9
1978	32903	11783	100120		1125	-	693	-	286550	2163	29	367	112737.8	360262.6	159445.3	627413.8
1979	44808	19649	124959		4278	-	561	-	380464	1850	11	7	144421.1	435400.3	177525.4	557866.9
1980	38821	14162	228063		1187	-	8	-	1639917	5261	10	244	204048.1	703357.2	233341.1	938634.8
1981	40175	17800	140350		-	-	-	-	-	-	-	-	221400.0	858900.0	256986.3	1138881.2
1982	43472	21375	140243		11793	-	-	-	265438	-	8	206	157428.1	1457312.3	210329.9	1967331.1
1983	45904	22516	215564		2398	-	5418	-	711749	2013	48	308	205706.2	1744033.9	240191.7	2204922.5
1984	43822	18100	163919		1780	17	4874	-	623820	3265	66	225	237203.1	2685678.8	278093.2	3835212.2
1985	48390	17924	124856		2769	7	4049	39	486003	1640	33	341	257904.3	4342151.4	300751.6	6018420.6
1986	52771	18712	191659		314	4	9010	-	514091	4137	59	410	339106.9	6076908.4	386091.6	7749650.2
1987	51502	17988	118039		498	8	7114	45161	631256	3000	48	415	303433.1	6095966.8	342527.8	7657273.9

Source: Fisheries Division

SUMMARY OF EXPORT EARNINGS FOR YEARS 1987 - 1989

PRODUCT	1987		1988		1989*	
	Wt - Kg	Value - US $	Wt - Kg	Value - US $	Wt - Kg	Value - US $
Prawns	557,100.0	3,059,434.36	1,280,997.0	4,803,020.23	1,800,000.0	10,800,000.00
Lobsters	13,300.5	68,898.32	20,579.0	230,841.30	30,000.0	150,000.00
Crabs	5,872.0	14,594.00	1,820.0	7,690.00	10,000.0	30,000.00
Fish (dry frozen)	18,213.0	19,810.04	11,940.5	19,100.21	125,000.0	125,000.00
Shells	168,024.0	101,853.78	108,314.0	128,019.00	158,000.0	632,000.00
Beche-de-mer	129,680.0	306,776.81	133,004.0	442,335.60	190,000.0	950,000.00
Fish offals	3,150.0	5,620.00	17,948.0	36,898.88	25,000.0	50,000.00
Squids, Octopus	1,001.0	1,500.00	4,700.0	36,550.00	16,000.0	48,000.00
Sea weeds	17,000.0	6,300.00	81,000.0	26,315.35	90,000.0	36,000.00
Fish fillets	-	-	-	-	200,000.0	400,000.00
Others	873.0	4,094.63	3,246.3	20,862.30	35,000.0	17,500.00
TOTAL	914,183.4	3,588,881.94	1,663,574.0	5,751,630.97	2,679,000.0	13,238,500.00

*Projected
Source: Fisheries Division

THE STATUS AND MANAGEMENT OF THE LAKE KARIBA FISHERIES (Zambia/Zimbabwe)

by

Dr. C. Machena
Officer-in-charge
Lake Kariba Fisheries Research Institute

ABSTRACT

This paper gives an overview of the status of both the artisanal and commercial fisheries of Lake Kariba. Discussion on research programmes and management strategies is carried out in the context of the biology of the fish, specifically on the extent to which the fish are adapted to the lacustrine or pelagic systems. Fisheries management is not without problems. These are also highlighted and some measures to resolve these are given in the context of a sub-regional DANIDA/NORAD sponsored project on the lake. The paper gives emphasis on the situation on the Zimbabwe side based on the experience of the author.

1. INTRODUCTION

Lake Kariba (16 28' to 18 6' S ; 26 40' to 29 03' E, (Table 1) had an annual fish landing of 36 749 tonnes in 1988 with a total landed value of Z$ 54,000,000[1] and this is entirely a capture fishery which is both commercial and artisanal. The need for an effective management programme for this fishery is clear.

Lake Kariba is shared between Zambia (45%) and Zimbabwe (55%). Whereas the Kariba fishery is the most important for land locked Zimbabwe, Zambia which is also land locked enjoys the exploitation of other important fisheries e.g. on Lake Tanganyika, Mweru, the Kafue flood plains etc.

The commercial fishery exploits the pelagic *Limnothrissa miodon* (locally known as kapenta) a freshwater sardine endemic to Lake Tanganyika. *Limnothrissa* was introduced in the lake in 1967/68 to exploit the pelagic water which comprised an open niche (Balon, 1971 ; Bell-Cross & Bell- Cross, 1971). In 1988 the commercial fishery landed 30 000 tonnes (18 000 tonnes from Zimbabwe and 12 000 tonnes from Zambia) with a total landed value of Z$ 40 000 000.00 (Machena et al., 1989).

The artisanal fishery is traditional and unmechanised and is based on gill- netting in the inshore areas. It is operationally simple and requires a low capital outlay. The fishery landed 6 749 tonnes in 1988 (4 537 tonnes in Zambia and 2 212 tonnes in Zimbabwe) with a retail value of Z$ 14 000 000.00 (Murphree et al., 1989).

The introduction of the pelagic sardines created an economically viable industry on the lake. A programme of fisheries and limnological research on the lake has also been developed to enhance an understanding of the fisheries ecology.

This paper gives an overview of the status of both the artisanal and commercial fisheries on the lake, with emphasis on the Zimbabwean side. Discussion on research programmes and management strategies is carried out in the context of the biology of the fish, specifically on the extent to

---

[1] £1.00 = Z$ 3.50

which the fish are adapted to the lacustrine or pelagic systems. Fisheries management is not without problems. These are also highlighted and some measures to resolve these are given in the context of a sub-regional DANIDA/NORAD sponsored project on the lake. What needs to be emphasised is that fisheries management has been conducted separately on the lake by the two countries because political of factors. The sub-regional project is viewed as setting the basis for an effective joint management programme (between the two countries).

2. THE INSHORE FISHERY

2.1   Fish Composition and Ecology

Table 2 lists 41 species of fish recorded in Lake Kariba. Of these 65% are predators, 26% are omnivores and 9% are herbivores. In the category of predators only *Hydrocynus forskahlii* Cuvier is more specialised. *Hydrocynus* is an active and efficient piscivore preying on fish up to 40% of its own length (Bell-Cross, 1976). The fry and fingerlings, however, occupy a different habitat and are generalised predators feeding on zooplankton, aquatic insects and fish (Bowmaker, 1973 ; Kenmuir 1975 ; Mitchell, 1976). The rest of the predators *Mormyrops deliciosus, Mormyrus Longirostris, Marcusenius macrolepidotus, Alestes imbeli, A. lateralis, Microlestes acutidens, Hippopotamyrus discorhyncus, Heterobranchus longifilis, Clarius gariepinus, Eutropius depressirostris, Synodontis zambezensis, S. nebulosus, Haplochromis dalingii, H. codringtoni* and *Pseudocrenilabrus philander* tend to be generalised (Machena, 1988). The feeding habits of these are discussed by Kenmuir (1975), Burne (1971), Joubert, (1975), Mitchell (1976) and Bell-Cross & Minshull (1988). The following comprise the food items but their relative importance in the diet varies from species to species:-*Caridina* and *Cyclaestheria* (crustacea), *Povilla adusta* nymphs, anistopteran nymphs, tricopteran larvae *Chaoborus* larvae, chironomids, terrestial insects, mollusca, fish etc. For example, the mormyrids prey heavily upon *Caridina* and *Povilla* nymphs whilst molluscs (*Bulinnus, Biomphalaria, Cubicula* etc.) are important as prey items for *Synodontis zambezensis, Serranochronmis codringtoni, S. giardi, S. carlottae, Clarius gariepinus.*

The fact that the majority of the fish species of Lake Kariba are benthic and predatory (Mitchell, 1976) is significant in emphasizing the riverine origin of these fishes before the formation of the lake. Lowe-McConnel (1987) points out that most rivers provide a little diversified habitat. Because of the rapid flow of the river planktonic and submerged macrophytes may not form important food items. The fish therefore depend to a large extent on benthic items, allochthonous material e.g. insects and other fishes. The nature of the Zambezi River before the formation of the lake fits the description of Lowe- McConnel (1987).

The Zambezi River was described by Jackson (1961) as a sand bank river. During the rainy season, the river flooded violently inundating flood plains for a short space of time. After the rains, in the dry season, flood waters receded and the river dwindled and flowed in deep sand banks. Aquatic vegetation was therefore scarce. The river was therefore a much less structured environment than a seasonal water body with well developed benthic, littoral and pelagic habitats.

The fish fauna of the river had therefore a preponderance of generalised predators with a few species making up the greater part of the biomass. The two *Labeo* spp, the two *Distichodus spp, Hydrocynus, Clarius,* and *Alestes imberi* comprised the bulk of the biomass (Jackson, 1961). Cychlids were poorly represented in catches. There were only low quantities of *Tilapia rendalii Orechromis mortimeri* and *Seranochromis condringtoni* (Jackson, 1961). Predation by *Hydrocynus* was intense and was a major controlling factor of other fish populations.

What needs emphasis is that the ecological preferences of the fish in the lake have not changed much from the situation in the river before lake formation. In other words most of the fish have not adapted to lacustrine conditions. Their current abundance and distribution are determined by proximity to rivers and the distribution of preferred food items. Variation in these two factors also influenced the development of the fish population during the filling phase of the lake (Kenmuir, 1984).

A dependence on rivers by a large number of the species e.g. Cyprimids, Distochodus, *Hydrocynus,* Siluriids follows the need to utilise the river for spawning purposes. The species are

therefore found in proximity to rivers with the exception of the *Hydrocynus* (Fig.1). Before lake formation there was an ecological need for spawning – runs up flooded rivers as the flooded river plains provided more food. This was important for the fingerlings before they had to face the harsh environment in the river when flood waters receded.

The cichlids are an exception and were able to colonise the estuarine waters.

Overally the fish fauna of the Zambezi river before flooding was not able to colonise the pelagic waters but only approximately 30% of the lake surface area in the shallow water and rivers around the lake's margins (Coke, 1968, Balon, 1974). This has a bearing on the nature of management strategies adopted for the inshore fishery e.g. prohibition of fishing in rivers. This is also why there was a need for a successful introduction of *Limnothrissa miodon* to exploit the pelagic niche.

2.2 Biomass estimations

Estimations of the fish biomass of the inshore areas of Lake Kariba were carried out by Balon (1974), Mitchell, (1976) and Marshall & Langerman (1984). Balon and Mitchell worked in shallow areas where they were able to block off coves with nets and poison all the fish with rotenone within the enclosures. Balon sampled deeper area than Mitchell. This approach limited the programme to shallow coves and bays which could be completely netted off. Marshall & Langerman conducted their sampling by using an explosive grid (cortex with pentoline boosters at two metre intervals) and extrapolating the weight of the fish covered from each from each quadrat to one hectare. This approach was more flexible and permitted sampling in deep water and rocky shores that were not easily accessible. Whereas Balon's work was more extensive, covering large areas of the lake, Mitchell limited his sampling to the eastern basin while Marshall & Langerman collected their data from 13 transects spaced to cover the whole lake. These differences in approach may explain the differences in the results. The biomass estimates of these workers are summarised in Table 3.

Marshall and Langerman's (1984) ichythiomass values are much lower than those of Balon (1974) and Mitchell (1976). Whereas the ichythiomass range given by Balon (1974) of 276 kg/ha to 1 225 kg/ha is similar to that of Mitchell (1976) of 46 kg/ha to 1 400 kg/ha, both these ranges are much higher than that of Marshall & Langerman (1984). However because Marshall & Langerman did not sample in water more than 6 m deep, they increased their ichythiomass value by 12%, to allow for fish biomass not sampled in water between 6 and 15 m depth. Coke (1968) took 88% of his total fish sample from water 6 m deep. With this adjustment Marshall & Langerman came with a total biomass estimate of 10 000 tonnes.

Following the indication of Mahan & Balon (1977) that only 46.4% of the inshore biomass of Kariba consists of economically preferred species Marshall & Langerman (1984) argue that the inshore fishery is therefore based on only a biomass of 4 500 tonnes. This would appear to be a considerable underestimate when it is realised that the inshore fishery of both Zambia and Zimbabwe yielded 6749 tonnes in 1988. Despite this underestimation, however, the point to bear in mind is that the inshore fishery resource of Lake Kariba is low and sets a definite limit on yields.

Both Mitchell (1976) and Marshall & Langerman (1984) describe a correlation between ichythiomass and vegetation cover. The development of vegetation described by Mitchell (1969), Marshall & Junor (1981), Machena and Kautsky (1988), Machena (1989) led to the development of benthic fauna (McLachlam, 1969; McLachlam & McLachlam, 1971). Generally vegetation increases habitat diversification.

2.3 The set up of the inshore fishery

There are 2831 artisanal gill-netting fishermen on Lake Kariba. Of these 1931 are operating on the Zambian shore and 892 on the Zimbabwean shore.

The set up of the fishermen on the Zambian shore is quite different from that on the Zimbabwean side. Fishermen in Zambia are at liberty to camp and fish where they please along the shore. They are not forced to settle in groups or co-operatives (Murphree et al., 1989). Consequently Zambian fishermen are widely dispersed all over the shore line. This makes collection of fisheries statistics and enforcement of fisheries regulations rather difficult.

The fishermen on the Zimbabwean side are located in 40 fishing camps (Murphree et al., 1989). Locations of these camps are shown in Fig.2. Areas C2, C4 to C7 contain independent fishermen. Areas C1 and C3 contain contract fishermen. Independent fishermen operate individually whereas contract fishermen operate in the concession areas of one major company Irvin & Johnson (Pvt) Ltd (I&J) (Machena, 1985). Since 1986 however, the contract fishermen have mobilised themselves into two cooperatives in C1 and one in C3. I&J still owns both concessions and hence has a monopoly to purchase fish from respective cooperatives. There is a fourth co-operative with its own newly awarded concession next to area C1. This brings the number of gill-net fishing co-operatives to four, with a total of 102 members.

As shown in Fig 2, the boundaries of these fishing areas were adjusted twice, in 1972 and 1976 to accommodate increasing heavy boat usage and recreational fishing in the area close to Kariba (K1 in Fig. 2a).

The shore areas, outside the areas indicated above are permanently closed from fishing. These areas belong to the Department of National Parks and Wildlife Management. The Department does not allow permanent settlement in such areas.

2.4   Number of fishermen

The number of fishermen varies frequently. Changes have taken place since fishing began in 1958. At that time 407 fishermen were in operation in the Zambian side (Scudder, 1982) and this number increased to 2 000 by 1962. Zambian fishermen fell below 500 by 1967.

Fishing in Rhodesia started in 1963 and fishermen reached the highest number at 1 000 in 1966 (Minshull, 1973). The number in Rhodesia declined markedly in 1970 and between that time and 1974, there were only 210 to 280 fishermen (Marshall et al., 1982). This number declined further to about 130 to 140 in 1977.

During the Rhodesian war fishermen were not recorded but the first full scale enumeration took place in 1983 when 643 fishermen were recorded (Bourdillon et al., 1985, Murphree, 1985). This number had increased by 39% to 893 in 1988 (Murphree et al., 1989). Enumerating in Zambia also show that fishermen increased from 1674 in 1986 to 1939 in 1988, a 15% increase.

Changes in the number of fishermen in the early years of the fishery are related to changes in fish yields. Fish yields were initially high but declined in the late 1960's due to ecological factors (Coche, 1974). The decline in the mid 1970's was related to closure of fishing camps and reduced fishing activities during the war.

The recent increase in fishermen suggests increases due to demographic growth and the effects of drought. The early 1980's were drought years in Southern Africa and because of failed farming and the state of the economy especially in Zambia more people went into fishing. These were not necessarily licensed fishermen. They simply acquired nets and started fishing.

2.5   Development of fishing co-operatives

Development of fishing co-operatives has initiated in Lake Kariba. Artisanal fisheries are generally considered a poor credit risk because of the nature of their fishing operations. Catches and income are often very seasonal and variable and loan repayment could be irregular. Co-operatives can form an established organisational structure through which the government and financiers can interact with. Co-ops can be credit worthy even though individual fishermen are not (Copac, 1984).

2.6   Fish yields and marketing

Table 4 gives inshore fish yields in the early development of the artisanal fishery. Early fish yields were good (Jackson, 1960, Minshull, 1973). The fishery benefited from a high nutrient level following flooding of new land and vegetation. The decline in fishing followed the rapid depletion of nutrients from the system. The lake has a replacement time of 3 years as water is continually lost through the hydro-electric turbines. Catches stabilised at 1 200 tonnes on the Zimbabwean side.

The inshore fish yields of 6 749 tonnes (4 537 in Zambia and 2 212 in Zimbabwe) for 1988 cited earlier may give an overall impression of increased fish productivity as compared to say 1963

(Table 4). This is hardly the case as productivity has decreased as compared to the early development of the fishery. The increased yield is a reflection of the high number of fishermen. In Zimbabwe fishermen generally realised an average of Z$ 100 per month and the reasons for this has been outlined in Machena, (1986). Outstanding amongst the problems fishermen face are the remote nature of most fishing camps and the related lack of dependable buyers.

The fishermen have for a long time depended on one commercial company and fish traders. The fish traders are unreliable. Because of the sheer distances, and costs involved their services are unpredictable. The commercial company forms the more dependable buyer in camps it services and so in effect establishes a monopoly and effects this in purchasing fish at low prices. The company provides cooler boxes and ice blocks to some camps and has boats which buy fish from these.

In a detailed analysis of the fishing communities in the inshore fishery Murphree (1985) points out clearly that despite low fish yields and low income the fishery has a tremendous impact in this impoverished area bearing in mind that over 4 000 people in the area are wholly or partially dependent on it. The area is marginal in terms of agriculture - low rainfall and poor soils as well as tsetse infestation. Most of the area has been set aside for wild life management.

The contradictions between heavy demand on the fishery and the low fishery potential underline the root problem the Department faces in managing this fishery.

3. THE PELAGIC FISHERY

3.1   Development of the fishery

The introduction of the sardine *Limnothrissa miodon* (Bell-Cross, 1971) to utilise the pelagic water (which was an unoccupied niche) is a success story. After introduction of 360 000 live fish in 1967 to 1968, the first evidence of their establishment came in 1969 when they were found in the stomach content of tiger fish *Hydrocynus forskahlii* (Bell-Cross & Bell-Cross, 1971). Experimental fishing was carried out between 1970 and 1974 (Begg, 1974). A variety of fishing methods were examined by the Lake Kariba Fisheries Research Institute. These included pumping, use of explosives, drifting small-mesh gill-nets which did not succeed (Marshall et al., 1982). The hand scooping technique with the use of kerosene lamps for lighting (as used in Lake Tanganyika) was not successful either.

Limnothrissa behaves differently in Lake Kariba as compared to Lake Tanganyika. Whereas in Lake Tanganyika they come feeding to the surface at night, they generally remain below 10 m in Lake Kariba. Also visibility in Lake Kariba is much lower than in Lake Tanganyika. As a result of these factors, heavy vessels with powerful lights and which can support large lift nets are required for fishing in Lake Kariba.

The commercial fishery is highly mechanised utilising fishing vessels each equipped with a winch (hydraulic or manual), a propulsive motor and a generator. The vessel itself is a platform mounted on two cylindrical pontoons. The winch operates a lift net (with a diameter varying between 60 and 90 m and a depth of 14 m) which is lowered to more than 10 m into the water during the fishing. The generator is a power source. Fishing is carried out at night when the fish are light attracted above the lowered net. Mercury vapour bulbs are often used. In addition to these basic items, some of these vessels are now equipped with echo sounding devices which are increasing efficiency in the industry. Each fishing vessel with all this equipment costs well over Z$ 60 000.00, a figure far beyond the means of the local fishermen. It is not surprising therefore that the local fishermen are excluded from this fishery.

The commercial fishery is much more productive than the artisanal fishery. In 1988, the commercial fishery alone landed 30 000 tonnes with a total value of Z$ 40 000 000.00 assuming most were marketed when dry. The common processing technique is brining (dipping freshly caught kapenta for 10 to 15 minutes in brine) and sun drying on racks (for 2 to 3 days) when vessels reach the harbour in the morning. One company markets frozen sardine. This company has freezing facilities on shore and provides ice for its boats.

3.2   Biomass estimates

Estimates of the biomass of *Limnothrissa* have been carried out by Lindem (1989) and Marshall (1985a, 1988). Marshall estimated biomass by fish capture using a conical lift net without the aid of light. These studies were carried out between 1981 and 1983. He obtained estimates ranging from 1 to 723 kg/ha with an overall mean of 59.23 kg/ha . Marshall's biomass estimates were made in the eastern part of the lake and extrapolated for the whole lake.

The density of the sardines in the lake has also been assessed using hydroacoustics. Lindem (1988) carried out 12 survey transects over the whole lake using a portable Simrad EY-M echo-sounder operating at 70 kHz. The survey gave biomass values ranging between 16 and 120 kg/ha with a mean of 37 kg/ha. It is generally understood that the *Limnothrissa* spawns twice a year in Kariba and develops from egg to adult in 5 to 6 months. The production potential of this fish is therefore high and this is why the fishery can support yields of up to 60 kg ha/year.

The hydro-acoustic technique was used for the first time in Lake Kariba. It was carried out in the pre-project phase of the sub-regional SADCC ZAMBIA/ ZIMBABWE Lake Kariba Project. The idea was to test the feasibility of the technique in the Kariba system. Length frequency curves obtained using this technique correlate well with length frequency analysis of commercially caught fish.

The equipment and the technique have been recommended for use in the main project phase.

The hydroacoustic analysis was carried out in one month only - September 1988 and this month coincides with the peak fishing period. Biomass estimates would need to be carried out over the whole year and over a number of years to get an impression of seasonal as well as annual variation.

3.3   Fishing Areas

This was initially based at Kariba town. With the expansion of the fishery other areas were opened up. These are Bumi, Chalala, Sengwa and Binga/Mlibizi. These areas lie west of Kariba. These areas were opened up to spread the fishing pressure over the whole lake.

3.4   Sardine yields

Annual sardine catches in Kariba have increased from 66 tonnes in 1973 when fishing started (Marshall et al., 1982) to 18 000 tonnes in 1988 on the Zimbabwe side (Table 5). Increase in yields reflect increase in fishing pressure as more permits were issued after 1973. Yields from the Zimbabwean side are also shown by area of the lake (Table 6). Total catches from the lake (30 000 tonnes) in 1988 equivalent to a production of 60 kg/ha/year and this is high production.

This yield is much higher than yield predicted from models. Machena & Fair (1986) predicted a figure of 27 kg/ha. Marshall (1985b) predicted a value of 27 kg/ha. Prediction models e.g. Melack's (1976) model often used fish yields as one of the regression parameters. Therefore their utility would be dependent upon fishing intensity in the lakes where the data were collected.

The catches of *Limnothrissa* in the lake show a distinct seasonal pattern with a major peak in August and a minor in April/May (Fig. 3). This pattern is determined by the sequence of physio-chemical events in the lake (Marshall, 1988). The lake is dependent on the inflow of rivers for its supply of nutrients. As most of the river flow is seasonal the bulk of nutrients are introduced in the rainy season (November to March). The lake is monomictic and turn-over takes place in June to July contributing to another input of nutrients into the surface waters.

Marshall (1982) has demonstrated a relationship between catches and the flow of the major river feeding the lake. Such a relationship indicates the dependence of the sardine population on weather conditions. These factors need to be considered where management strategies pertain. For example the effect of rainfall levels over a number of years on fish stocks needs to be averaged to gauge the level of stocks over varying climatic conditions.

3.5   Catch and effort data and mean fish length

The relationship between catch and effort is shown in Table 7, from the time commercial fishing began. Catch decreases with increasing effort. When the data are plotted in another way (total catch against effort, Fig. 4) total catch increases with effort. This is clear with each of the fishing

areas on the Lake Kariba - Bumi, Chalala, Sengwa and Binga/Mlibizi. There is some difference on the plot comprising data for the whole lake. An asymptote seems to have been attained. So far as the Zimbabwe fishery is concerned, current fishing is probably close at maximum level.

Since the catch data from the Zambian fishery are not included, the plots do not reflect the actual situation on the lake. The plots can only be taken to give an indication of the actual situation.

Data from the Zimbabwean sardine fishery are fairly accurate and can be relied upon to give an indication of the performance of the fishery.

Mean fish length varies with season following seasonal differences in the availability of nutrients. Mean length has also varied annually. According to Marshall (1988) mean length varied from 55.16 mm to 49.88 mm in 1983. Analysis of commercial catches have shown mean length was 5.17 and 5.61 mm in 1987 and 1988 respectively. Mean length analysis tends to indicate that over fishing has not yet set in.

3.6   Development of Co-operatives

The first 2 co-operatives in the pelagic fishery started fishing operations in June 1987. They have been successful and as a result the government has encouraged the formation of 4 more. Following the success of the first 2 co- operatives which were funded by the EEC and the government, other credit organisations like banks have shown much interest in funding more co- operatives. This is an interesting turn of events as far as locals are concerned in the Kariba fishery. This also emphasizes the point that an organised group of poor people is likely to attract funding than individuals. But the encouraging response of credit organisations only follows the success of the co-operatives. No doubt the situation would have been different if the co-operatives had collapsed.

Reasons for the success of these co-operatives are outlined in Machena (1986). Formation of these co-operatives was initiated by the Lake Kariba Fisheries Research Institute and the Department readily gave them permits. Credit is given to the government through forming the proper structures for aiding co- operative development.

4. RESOURCE MANAGEMENT AND RELATED PROBLEMS

The management of the Lake Kariba fisheries is aimed at maintaining optimum sustainable yields of fish populations by promulgating and enforcing conservation principles. All fishery and aquatic resources in Zimbabwe belong to the government and are managed by the Department of National Parks and Wildlife Management. The Department has a number of research establishments at each of the major water bodies within the country. The Lake Kariba fishery is managed by the Lake Kariba Fisheries Research Institute which is based in the Kariba town.

4.1   Staff establishment

The Institute has an establishment of 5 research ecologists and 39 supporting staff. These include general hands, enumerators, typists and the executive officer. Efforts to increase the staff establishment to meet the increasing need for management and coverage of more fishing villages in enumeration are in vain as the government desires to cut on public expenditure. In fact over the past year, all vacant posts have been frozen.

4.2   Research Programme

The Institute is responsible for fisheries research, fisheries data collection, extension work within the fishing communities and management of the fisheries. Research is carried out to continually assess the level of stocks and to understand environmental factors that influence the biomass of fish in the lake.

Current research programmes include assessing the level of both inshore and pelagic fish stocks; the way environmental factors affect fish species and biomass distribution; the movement of fish between areas closed from fishing and heavily fished areas as well as the movement of pelagic fish species.

Do protected or "reserve" areas serve the function of providing fish to restock heavily fished areas bearing in mind a lot of the fish species are territorial? A lot of trees that were submerged when the lake formed are still standing. Do these areas with standing trees provide a different habitat and are they colonised by different fish species? What factors control the movement of pelagic fish stocks? These are some of the problems that the research projects attempt to answer.

4.3   Policy, administration and management problems

(a) The inshore fishery

The following refers particularly to the Zimbabwean fishery.

(i)   Licensing and gear regulation

All Zimbabwean fishermen require a licence and pay an annual licence fee of $20.00. The minimum gill-net mesh size enforced is 100 mm. There is no restriction on the number of nets permitted. The bulk of the commercially important fish species are mature by the time they are caught in 100 mm mesh nets.

It has not been easy to enforce minimum gear mesh size as nets are set in water continuously. The fishermen have a habit of inspecting nets and collecting the fish at regular intervals and leave the nets set. Hence inspection of the nets at fishermen's houses would be fruitless. Fishermen also make their own nets and they would not be strict in ascertaining the required minimum mesh.

Zimbabwean companies that make or import gill-nets are under instructions to sell gill nets only to fishermen with fishing permits. But of late a lot of unregistered traders have been importing nets from Mozambique and sell these to anyone who can afford them.

(ii)   Fishing areas

As outlined earlier rivers are important for spawning-runs of a lot of inshore fish species. These are problem areas as they provide "easy catch" for the fishermen, particularly during flood periods. Often nets are set right across the river and this potentially reduces recruitment.

As outlined earlier also, "reserve" areas coincide with National Parks land and are set aside to provide fish stocks for heavily fished areas. The Department has not experienced problems of fishing in these areas.

(iii)   Controlling the number of fishermen

It is difficult for political and social reasons to limit the number of local fishermen. More locals tend to go into fishing in times of economic hardships and this makes the fishery much more of an open access resource. This has created problems of decreased catch per unit effort and has contributed significantly to the alarming degree of fishing in prohibited areas and the agitation fishermen are making for more fishing grounds. Murphree et al. (1988) have shown that during periods of economic hardship fishermen have increased by 39% and 15% in Zimbabwe and Zambia respectively. This is a world-wide problem. In Mauritius for example there are 3 500 fishermen in waters that can only support 1 000 and fishermen in Chile increased from 12 000 to 30 000 in ten years (Copac, 1984).

(iv)   Enforcing laws and regulations

It requires a lot of men, money and time to continually patrol the big lake and take fish poachers to court. These resources are limited at the Lake Kariba Fisheries Research Institute. Worse, the Institute is at one end of the lake and the other end is 377 km away, making access time consuming and expensive. For example a return boat trip to the end of the lake costs the Institute over Z$1 000 and takes three days.

What is needed is to put up a new sub-station at the other end of the lake but again resources are limiting. The other problem is that poachers are not scared of court action because the small fines they have to pay are easily recovered from continued poaching.

Co-operatives have not been much of a problem. They derive much benefit from co-operative operations that they do not risk losing their fishing licence.

(v) Data collection

Trained enumerators visit each village for a ten day period in each month and they record the following information:

(a) number of active fishermen.

(b) number and weight of fish species caught.

(c) number and size of nets owned by each fisherman.

(d) number of boats.

(e) price realised for fish sold.

Co-operatives and concessionaires are required to submit the details of fish caught. The precision of data collected is low, as enumerators are unable to visit all villages because of the size of the lake. Only 15 out of 40 villages are visited each month and data from these are extrapolated to get yields for the whole lake. It is much easier to collect data, as fishermen are grouped in fishing camps. However, from time to time fishermen leave their camps and go and illegally settle on some areas far from camps. This makes coverage of these fishermen difficult.

On the Zambian shore fishermen settle wherever they choose, and data collection is a problem.

(b) The pelagic fishery

(i) Licensing and gear regulation

Licences are issued annually by the Department of National Parks and Wildlife Management. A number of conditions are attached to the licence and violations of these can lead to withdrawal of the licence. No person or company may fish on the Zimbabwean side without a licence. Licences cost $1 200.00 per unit per year.

The stipulated mesh size of the nets should not be less than 10 mm when stretched. Smaller meshed nets are not permitted.

(ii) Fishing areas

Fishing takes place on the whole lake although there are more companies operating close to Kariba. This is because Kariba is more accessible to Harare.

Fishing is not permitted to waters less than 20 m deep. These areas are usually shore areas where sardine breeding takes place. A lot of these areas have submerged trees which often form a hazard to nets. These trees also provide a diversified habitat in the inshore areas.

(iii) Closed season

Catch and effort in the sardine fishery are closely monitored and the Department reserves the right to enforce a closed season should the need arise.

(iv) Catch returns

Licence holders are required to submit a monthly catch return, which includes nightly catches of both sardines and tigerfish. Importance is attached to these returns as reliable statistics are essential for monitoring the fishery. Data collection in the pelagic fishery is therefore much more complete than in the inshore fishery, so these data are relied on heavily.

5. ZAMBIA-ZIMBABWE LAKE KARIBA PROJECT

5.1   Introduction

The above project aims to strengthen research capabilities of the Zambian and Zimbabwean research institutions and to facilitate joint management of a shared fishery resource in Lake Kariba. Because of political factors, research on the lake has been carried out separately by the

two countries. This is hardly rational for the pelagic fishery is a joint resource and a coordinated management system is necessary.

Much organisation, capital expenditure and training are required to develop a viable fishery that may go along way to meet the developmental needs of a country. Both Zambia and Zimbabwe are fraught with foreign currency problems and have not been in a position in to meet all research facilities particularly research equipment that needs foreign currency. Besides, the Sinazongwe Fisheries Training Centre in Zambia was destroyed during the Rhodesian war.

The project therefore also aims to provide infrastructural facilities that the two respective countries have been unable to meet.

5.2   The Pre-project phase

The pre-project phase lasted one year from April 1988 to May 1989. This phase was instituted to identify in detail the specific problems and requirements in the organisation and management of both the artisanal and commercial fisheries in Lake Kariba. On the basis of these, the pre-project was to identify the scope and programme activities of the main project.

These recommendations have been sent to the donors for comment and it is hoped that the main project will take off the ground in early 1990.

Specific aims and programmes of the main project are summarised below. It has been necessary to divide the project into the commercial fishery and the artisanal fishery sub-projects because the different characteristics of the two fisheries will entail a different approach. A pre-project study of the artisanal fishing communities was carried out by Murphree et al., (1989).

5.3   The commercial fishery sub-project

(a) Objectives

(i)   To develop a rationalised and sustained system of joint management of the pelagic fishery of Lake Kariba. The pelagic fishery is shared between Zambia and Zimbabwe and has been managed separately.

(ii)   To increase fish production.

(b) Target groups

Members of staff of both the Department of fisheries in Zambia and the Department of National Parks and Wildlife Management in Zimbabwe.

(c) Programmes to meet the objectives

(i)   To train and facilitate the training of fisheries staff at both technical and professional levels abroad, regionally and locally. Emphasis will be on the regional and local training.

(ii)   To upgrade the facilities at fisheries research centres in both countries. The Zimbabwean Institute (L.K.F.R.I.) will have a modest expansion. The Zambian institution (SFTC) will have a major rehabilitation.

(iii)   To establish joint research programmes to obtain data on stocks and on the population dynamics of the pelagic species that will enable formulation of joint management strategies designed to have an economically viable industry on a sustained resource.

(iv)   To establish a uniform data collection system of fisheries statistics and set up a computerised data base.

(v)   To conduct an economic appraisal of the commercial fishery.

(vi)   To develop planning and monitoring programmes of all activities.

(d) Expected outputs

   (i)   Lake Kariba Fisheries Research Institute and Department of Fisheries (Zambia) will be strengthened through staff training and improvement of infrastructure.

   (ii)   A long term programme of collaborative research on and monitoring of Lake Kariba kapenta stocks will have been established.

   (iii)   A viable framework for continuous joint assessment and management of the commercial kapenta fishery of the lake will have been established.

5.4 The artisanal fishery sub-project

(a) Objectives

   (i)   To increase the productivity of the artisanal fisherfolk.

   (ii)   To increase fish production.

(b) Target groups

Artisanal fishing communities including fishing co-operatives and fish traders.

(c) Programmes to meet the objectives

   (i)   To research the bottle necks in the operations of the artisanal fishing communities and to recommend on their improvements.

   (ii)   To test and introduce better processing techniques.

   (iii)   To improve on extension programmes aimed at benefitting artisanal fishing communities and developing artisanal kapenta fishing.

   (iv)   To examine means of increasing a viable participation of women within the artisanal fishing communities.

   (v)   To advise, test and if appropriate introduce gear suitable for an artisanal kapenta industry and where appropriate improve on the current inshore artisanal fishing gear. If this were possible, the artisanal fishermen will participate in viable fishery.

(d) Expected outputs

   (i)   A joint long-term programme of biological and socio-economic study will have been established.

   (ii)   Long-term development and management plans for the lake and lake shore resources will have been developed.

   (iii)   Security of access for the lake shore community will have been established.

   (iv)   Investigations will have been made into reducing post harvest losses, increasing the role of women and of the commercial kapenta fishery of the lake will have been established.

6. CONCLUSION

The donor funded sub-regional project as witnessed in the pre-project phase will create a platform for dialogue and enhance communication between the two Departments, which could have been difficult without it. Collaboration will largely be on research and management of the pelagic fishing which is the shared resource. Although the approach will be the same on the inshore fishery problems, the Departments are likely to work less jointly on this fishery because the inshore fishery resource is not shared.

Furthermore, as the kapenta fishery is very productive and highly profitable, expected project outputs are likely to be significant where this fishery is concerned. Output in respect of input is expected to be marginal in the inshore fishery for reasons already advanced earlier. This pertains largely to the large number of fishermen exploiting a fishery of low potential.

The artisanal fishery sub-project will be initiated through a workshop. It is hoped the workshop will recommend an integrated approach in resource use in the area. Since inshore fishing alone is hardly viable fishermen should combine fishing with other economic activities. To facilitate this Murphree et al., (1989) have recommended a land use study of the lake shore area. The potential exists for fishermen to participate in wildlife management, crocodile ranching etc. which are profitable ventures.

In the main document a request has also been made for a sub-station at the western end of the lake. This will include an office, a store and accommodation for an officer and scouts. This will facilitate working and enumerating in the area.

The main project is intended to last 5 years and maybe extended if the need exists. Hopefully the problems identified in this document will be successfully addressed through this project.

7. REFERENCES

Balon, E.K., (1971): First catches of Lake Tanganyika clupeids (kapenta - *Limnothrissa miodon*) in Lake Kariba. Fish. Res. Bull. Zambia, 5 : 175-185.

Balon, E.K., (1974): Total production, available production and yield of major fish taxa from Lake Kariba. Monogr. Biol. 24 : 428-45.

Begg, G.W., (1974) The distribution of fish of riverine origin in relation to limnological characteristics of five basins of Lake Kariba. Hydrobiologia 44 : 277-285.

Bell-Cross, G., (1976): The fishes of Rhodesia, Salisbury. Natural Museums and Monuments of Rhodesia.

Bell-Cross, G. & Bell-Cross, B. (1971) Introduction of *Limnothrissa miodon* and *Limnocaridina tanganicae* from Lake Tanganyika into Lake Kariba. Fish. Res. Bull. Zambia, 5 : 207-14.

Bell-Cross, G. and Minshull J.L., (1988): The fishes of Zimbabwe. Harare. National Museums and Monuments of Zimbabwe.

Bowmaker, A.P.M., (1973): A hydrobiological study of Mwenda rivers and its mouth. PhD thesis. University of Witwatersrand. Johannesburg.

Bourdillon, M.F.C. Cheater, A.P. & Murphree M.W., (1985) Studies of fishes on Lake Kariba. Gweru. Mambo Press. 185 pp.

Burne, R.H., (1971): A comparative study of the diets of *Labeo congoro, Labeo altivelis* and *Tilapia mossambica* in the Sanyati Basin of Lake Kariba. Lake Kariba Fish. Res. Inst. Proj. Report no. 12.

Coche, A.G., (1974): Limnological study of a tropical reservoir. In : Lake Kariba : a man-made tropical ecosystem in Central Africa (E.K. Balon & A.G. Coche (Eds) p1-246. Junk.

Coke, M.O., (1968): Depth distribution of fish on a bush cleared area of Lake Kariba, Central Africa. Trans. Am. Fish. Soc. 97 : 460-465.

COPAC,(1984): Small-scale fisheries co-operatives. Some lessons for the future. Copac occasional paper No. 2.

Jackson, P.B.N., (1960): The ecological effects of flooding by the Kariba Dam upon middle Zambezi fishes. Proc. Ist Fed. Sci. Congress 1960, Salisbury, Rhodesia.

Jackson, P.B.N., (1961): Ichthyology. the fish of the middle Zambezi, Kariba studies. (1): 1-36. National Museums and Monuments of Southern Rhodesia.

Joubert, C.S.W., (1975): The food and feeding habits of *Mormyrops longirostris* Peters 1952 (Pisces : Momyridae) Lake Kariba. Kariba stud. 5 : 68-85.

Kenmuir, D.H.S., (1984): Fish populations changes in the Sanyati Basin, Lake Kariba, Zimbabwe 5. Afr. J. Zool. 19 : 194-209.

Lindem, T., (1988): Results from the hydro acoustic survey. Lake Kariba, September, 1988. University of Oslo.

Lowe-McConnel, R.H., (1987): Ecological studies in tropical fish communities. Cambridge University Press. London.

Machena, C., (1985): The survey of the artisanal fishery on the Zimbabwean side of Lake Kariba. Zimbabwean agricultural journal 82 : 205-208.

Machena, C. (1986): Identification of the problems and needs of the local black fishermen in the Kariba fishery (Zimbabwe). Proceedings. International Conference on Fisheries. Rimouski Canada. August 10- 15. 1986.

Machena, C., (1988): Predator-prey relationships, fisheries productivity and fish population dynamics in Lake Kariba - a review. In : Predator-prey relationships population dynamics and fisheries productivity of large African Lakes. FAO CIFA/OP 15 pp. 26-44.

Machena, C. & Fair P., (1986): Comparison of fish yields from production models between Lake Tanganyika and Kariba. Hydrobiologia 137 : 29-32.

Machena, C., (1989): Ecology of the hydrolittoral macrophyte communities in Lake Kariba, Zimbabwe. PhD thesis. University of Uppsala.

Machena C. & Kautsky, N., (1988): A quantitative diving survey of benthic vegetation and fauna in Lake Kariba, a tropical man-made lake. Freshwater. Biol. 19 : 1-14

Machena, C. Jokonya, P. & Chimanga, R., (1989): 1988 Fisheries statistics. Lake Kariba- Zimbabwe side. Lake Kariba Fish. Res. Inst. Proj. Report no. 58.

Mahon, R. & Balon E.K., (1977): Fish production in Lake Kariba reconsidered. Env. Biol. Fish. 1 : 215-218.

Marshall, B.E., (1979): Fish populations and the fisheries potential of Lake Kariba. S.A.J. Sci. 75 : 485-8.

Marshall, B.E., (1982): The influence of river flow on pelagic sardine catches in Lake Kariba. J. Fish Biol. 20 : 465-470

Marshall, B.E., (1985a): A study of populations dynamics production and potential yield of the sardine *Limnothrissa miodon* (Boulenger) in Lake Kariba. PhD thesis. Rhodes University. Grahams-town, South Africa.

Marshall, B.E., (1985b): Limnology and fisheries management in Zimbabwe. Verh. Internat. Verein. Limnol. 22 : 2671-2675.

Marshall, B.E., (1988): A preliminary assessment of the biomass of the pelagic sardine *Limnothrissa miodon* in Lake Kariba. J. Fish. Biol. 32 : 515-524.

Marshall, B.E. & Junor, F.J.R., (1981): The decline of *Salvinia molesta* in Lake Kariba. Hydrobiologia 83 : 477-484.

Marshall, B.E. & Langerman, J.D., (1984): A preliminary reappraisal of the biomass of inshore fish stocks in Lake Kariba Fisheries Research 6 : 191- 199.

McLachlan, A.J., (1969): The effect of aquatic macrophytes on the variety and abundance of benthic fauna in a newly created lake (Lake Kariba). Archiv. fur. Hydrobiologie. 66 : 212-231.

McLachlan, A.J. & McLachlan, S.M., (1971): Benthic fauna and sediments in a newly created Lake Kariba (Central Africa). Ecology 52 : 800-809.

Minshull, J.L., (1973): The establishment of a fishery among the resettled Batonka people at Lake Kariba, Rhodesia. Commission Internationale des Grands Barrages, Madrid. pp 413-419.

Mitchell, D.S., (1969): The ecology of Vascular hydrophytes in Lake Kariba. Hydrobiologia 34 : 448-464.

Mitchell, S.A., (1976): The marginal fish fauna of Lake Kariba. Kariba studies 8 : 109- 161.

Murphree, M.N., (1985): The inshore fishing industry of the Binga District. A socio- economic study. Mimeograph. Centre for Applied Social Sciences. University of Zimbabwe. 63 pp.

Murphree, M.W. Metcalfe, S. Kanondo, V & Mukasa D., (1989): Pre-project socio-economic study of the artisanal fishery on Lake Kariba. Zambia/Zimbabwe SADCC Fisheries Project. Lake Kariba Fisheries Research Institute.

Scudder, T. Boom and Bust., (1982): Long-term consequences of Kariba Lake Fisheries. Outline of paper presented at the 1982 AAA session (108) on Heterogeneous Adaptation to Economic Development Community level. Unpublished 9pp.

Table 1: Main features and morphology of Lake Kariba at a water level of 485 m.a.s.l.

Length	277	km
Width (mean)	19.4	km
Depth (mean)	29.2	km
Depth (maximum)	120	m
Area	5 364	km
Volume	156 x 10	m

Table 2: Fish species recorded from Lake Kariba - Modified from Balon (1974)

ANGUILLIDAE	*Anguilla nebulosa labiata* (Peters, 1852).
CLUPEIDAE	*Limnothrissa miodon* (Boulenger, 1806)*.
MORMYRIDAE	*Mormyrops deliciosus* (Leach, 1818)*.
	Hippopotamyrus discorhynchus (Peters, 1852).
	Marcusenius macrolepidotus (Peters , 1852).
	Mormyrus longirostris (Peters 1952)*.
CHARACIDAE	*Hydrocynus forskahlii* (Cuvier).
	Alestes lateralis (Boulenger, 1900).
	A. imberi (Peters, 1852).
	Micralestes acutidens (Peters, 1852).
DISTOCHONONIIDAE	*Distichodus mossambicus* (Peters, 1852)
	D. schenga (Peters, 1852).
CYPRINIDAE	*Barbus poechii* (Steindachner, 1911).
	B. paludinosus (Peters 1852).
	B. unitaeniatus (Gunther, 1866).
	B. lineomaculatus (Boulenger, 1903).
	B. fasciolotatus (Gunther 1868).
	B. marequensis (Smith, 1841).
	Labeo cylindricus (Peters, 1852).
	L. congoro (Peters, 1852).
	L. altivelis (Peters 1852).
	Opsaridium zambezense (Peters, 1852).
SCHILBEIDAE	*Schilbe mystus* (Linnaeus, 1762).
	Eutropius depresirostris (Peters, 1852).
CLARIDAE	*Clarias gariepinus* (Burchell, 1822)*.
	Heterobrachus longifilis (Cuvier & Valenciennes, 1840).
MALAPTERURIDAE	*Malapterurus electricus* (Gmelin, 1789).
MOCHOKIDAE	*Synodontis zambenzensis* (Peters, 1852).
	S. nebulous (Peters, 1852).
CYPRINODONITIDAE	*Aplocheilichthys johnstoni* (Gunthur, 1893).

CICHLIDAE

Serranochromis codringtoni (Boulenger, 1908)*.

S. giardi (pellegrin, 1904).
S. carlottae (Boulenger, 1905).
S. macrocephalus (Boulenger, 1899).
S. robustus jallae (Boulenger, 1896).
Pharyngochromis darlingi (Boulenger, 1911).
Pseudocrenilabrus philander (Weber, 1987).
Oreochromis (formerly *Sarotherodon*) *andersoni* (Castelnau, 1861).
O. macrochir (Boulenger, 1912).
O. mortimeri (Trewavs, 1966).
Tilipia rendalli (Boulenger, 1896)*.

* Principal commercial species.

Table 3: Standing stock of major fish families in Lake Kariba.

	Balon (1974)		Mitchell (1976)		Marshall & Langerman (1984)	
	kg ha	%	kg ha	%	kg ha	%
Anguillidae	–	–	–	–	–	–
Mormyridae	206	34	249	58.5	22	0.95
Characidae	60	9.9	16	3.7	59.3	26.0
Distichodontidae	6	0.4	0.5	0.1	–	–
Cyprinidae	6	1.0	14.5	3.4	26.5	11.60
Schilbeidal	9	1.5	1.2	0.3	–	–
Clariidae	66	10.9	20	4.7	0.06	0.03
Malapteruridae	48	8.0	10	2.3	8.7	3.80
Mochokidae	21	3.5	21.4	5.0	10.9	4.77
Cyprinodontidae	–	–	–	–	–	–
Cichlidae	166	27.5	94	22.0	120.6	52.86
TOTAL	561		426		228.2	
Sampling period	1968-1971		1972-1974		1981-1982	

Table 4: Inshore fish yields in Lake Kariba in the early development of the artisanal fishery in the lake. Data from Minshull (1973).

YEAR	ZAMBIAN SHORE (tonnes)	ZIMBABWEAN SHORE (tonnes)	TOTAL (tonnes)
1962	3 000	–	3 000
1963	4 000	1 750	5 750
1964	2 100	2 650	4 750
1965	1 633	2 450	4 083
1966	1 473	2 100	3 573
1967	1 100	1 800	2 900
1968	800	1 700	2 500
1969	?	1 400	1 400
1970	?	1 200	1 200
1971	?	1 200	1 200

Table 5: The total catch (t) of Limothrissa in Lake Kariba

YEAR	ZIMBABWE	ZAMBIA	TOTAL
1973	66	–	66
1974	488	–	488
1975	656	–	656
1976	1 050	–	1 050
1977	1 172	–	1 172
1978	2 807	–	2 807
1979	5 139	–	5 139
1980	7 993	–	7 993
1981	11 137	872	12 009
1982	8 511	2 663	11 174
1983	8 602	4 970	13 572
1984	10 404	6 198	16 602
1985	14 818	9 027	23 845
1986	16 094	12 000	28 094
1987	15 824	13 000	28 824
1988	18 000	12 000	30 000

Table 6: Limnothrissa landings (t) on the Zimbabwean side of Lake Kariba by area of the lake.

YEAR	KARIBA	BUMI	CHALALA	SENGWA	BINGA/ MLIBIZI
1974	488	-	-	-	-
1975	656	-	-	-	-
1976	1 050	-	-	-	-
1977	1 172	-	-	-	-
1978	2 772	-	-	35	-
1979	1 475	78	8	82	96
1980	5 959	173	1 261	115	485
1981	7 408	285	2 879	175	390
1982	5 249	234	2 605	113	310
1983	5 590	170	2 566	99	177
1984	6 286	305	3 417	84	312
1985	9 179	-	5 229	105	305
1986	9 077	319	5 312	4 847	1 832
1987	8 194	288	4 847	1 832	663

Table 7: The relationship between catch per unit effort (tonnes per unit-night) and fishing effort (unit-nights) for the sardine fishery on the Zimbabwean side of the lake.

	KARIBA		BUMI		CHALALA		SENGWA		BINGA/MLIBIZI	
YEAR	CATCH	EFFORT	CATCH	EFFORT	CATCH	EFFORT	CATCH	EFFORT	CATCH	EFFORT
1974	0.78	616	-	-	-	-	-	-	-	-
1975	0.56	1 297	-	-	-	-	-	-	-	-
1976	0.54	1 833	-	-	-	-	-	-	-	-
1977	0.44	3 113	-	-	-	-	-	-	-	-
1978	0.42	8 995	-	-	-	-	0.34	96	-	-
1979	0.33	14 404	0.34	195	0.18	43	0.30	319	0.22	570
1980	0.24	22 818	0.21	789	0.20	5768	0.20	695	0.20	1 282
1981	0.30	24 393	0.17	1 670	0.29	5768	0.26	668	0.23	1 188
1982	0.22	23 776	0.16	1 459	0.25	9953	0.21	539	0.24	1 291
1983	0.23	24 481	0.16	1 036	0.22	10560	0.18	565	0.17	1 063
1984	0.25	25 344	0.28	1 077	0.26	13261	0.17	503	0.24	1 293
1985	0.40	27 815	0.36	-	0.30	14389	0.23	449	0.27	1 145
1986	0.35	26 153	0.26	1 245	0.36	15140	0.53	1 688	0.30	1 475
1987	0.26	29 702	0.15	1 506	0.30	15966	0.50	3 544	0.36	1 828

Figure 1: The distribution of the major families in the main Lake basins. Redrawn from Marshall et al. (1982).
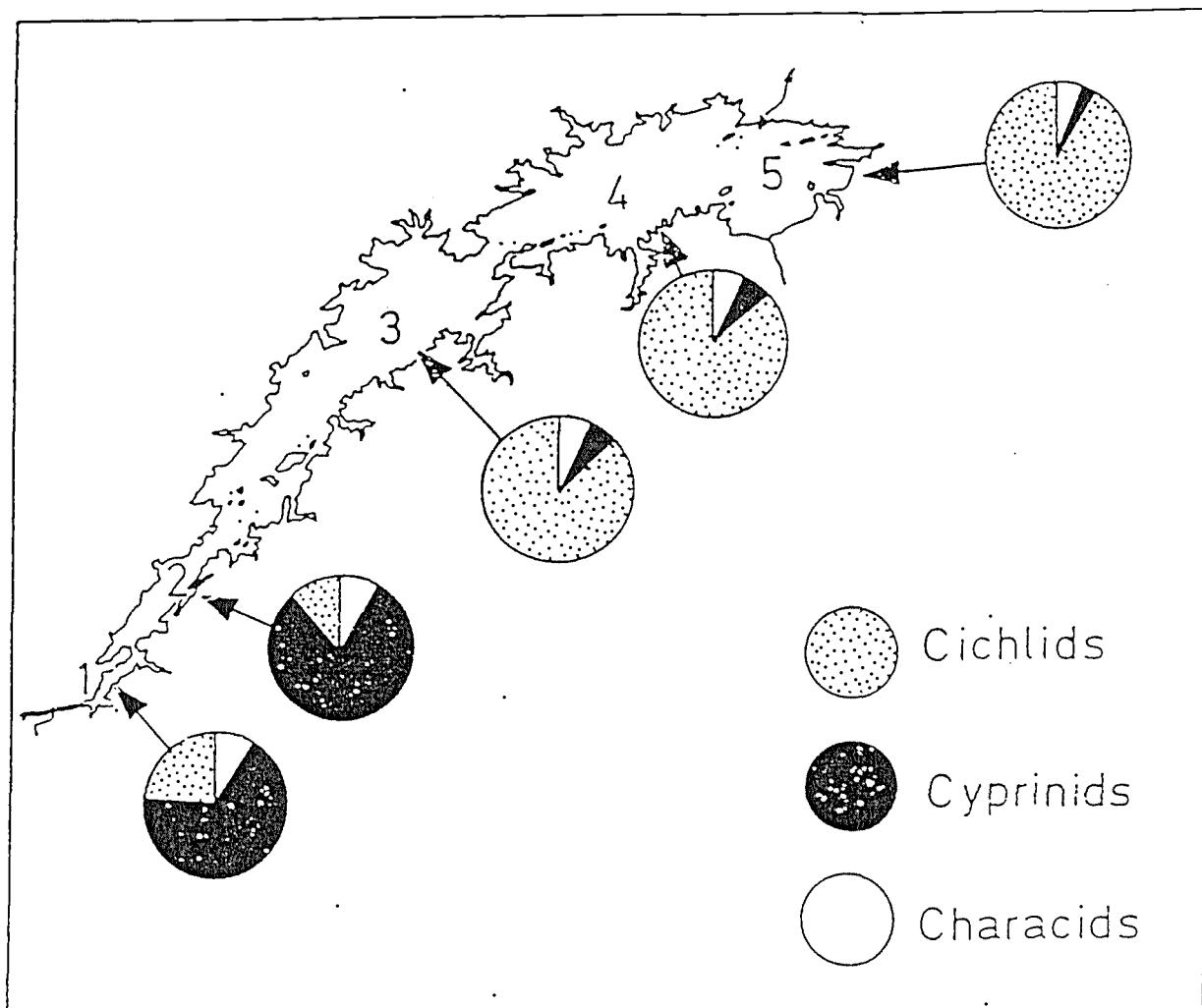
Figure 2. The allocation of inshore fishing areas on the southern shore of Lake Kariba. National Parks and wildlife areas have been omitted from (a) and (b) for clarity. (a) 1962 – July 1972; (b) August 1972 – November 1976; (c) from December 1976. Strippled areas are those allocated to concessionaires, solid areas are those allocated to local fishermen.
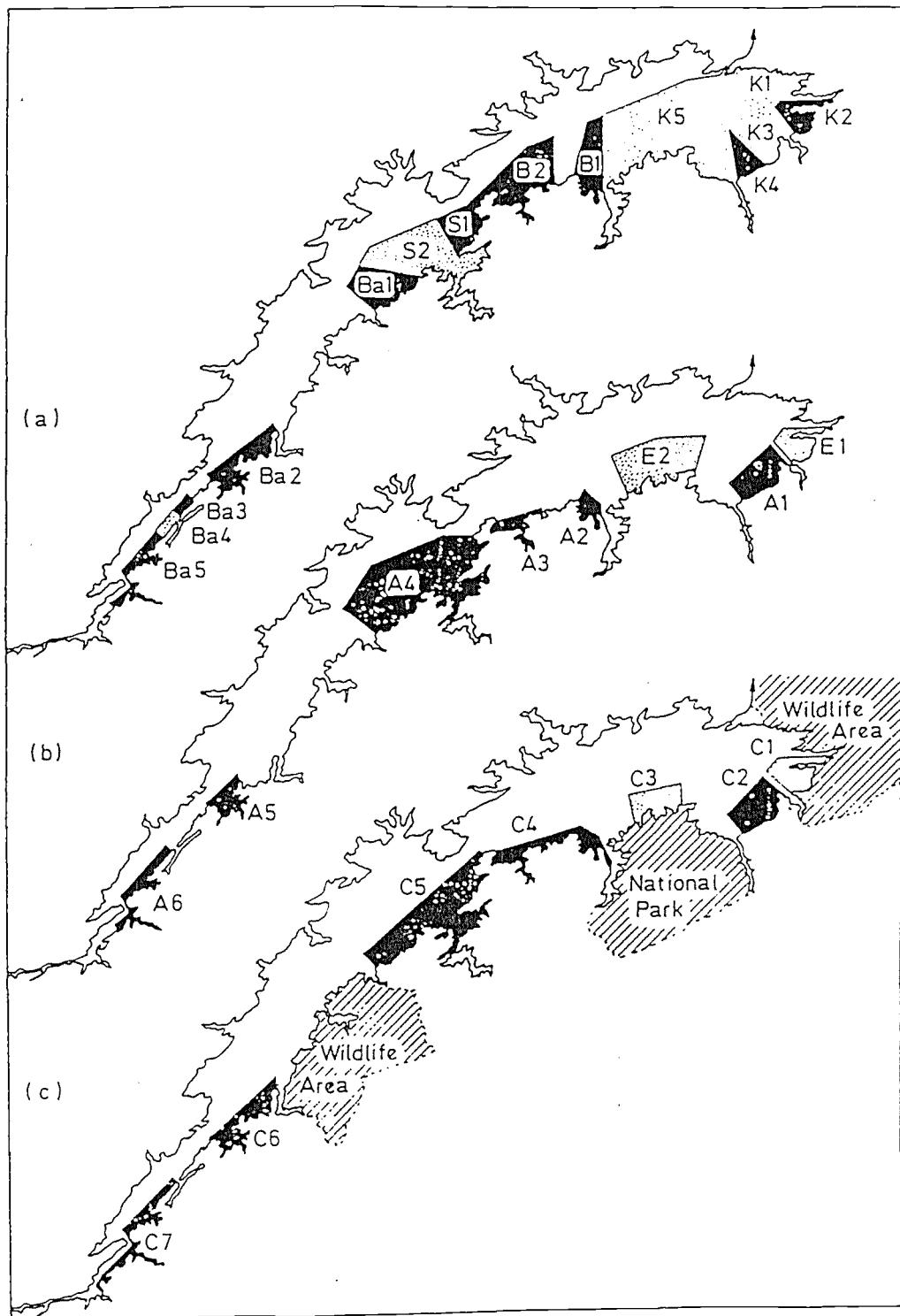
Figure 3. Sardine catches made by vessels based at Kariba 1974 - 1985. The vertical broken lines indicate the months of April to August in each year. Redrawn from Marshall (1988).
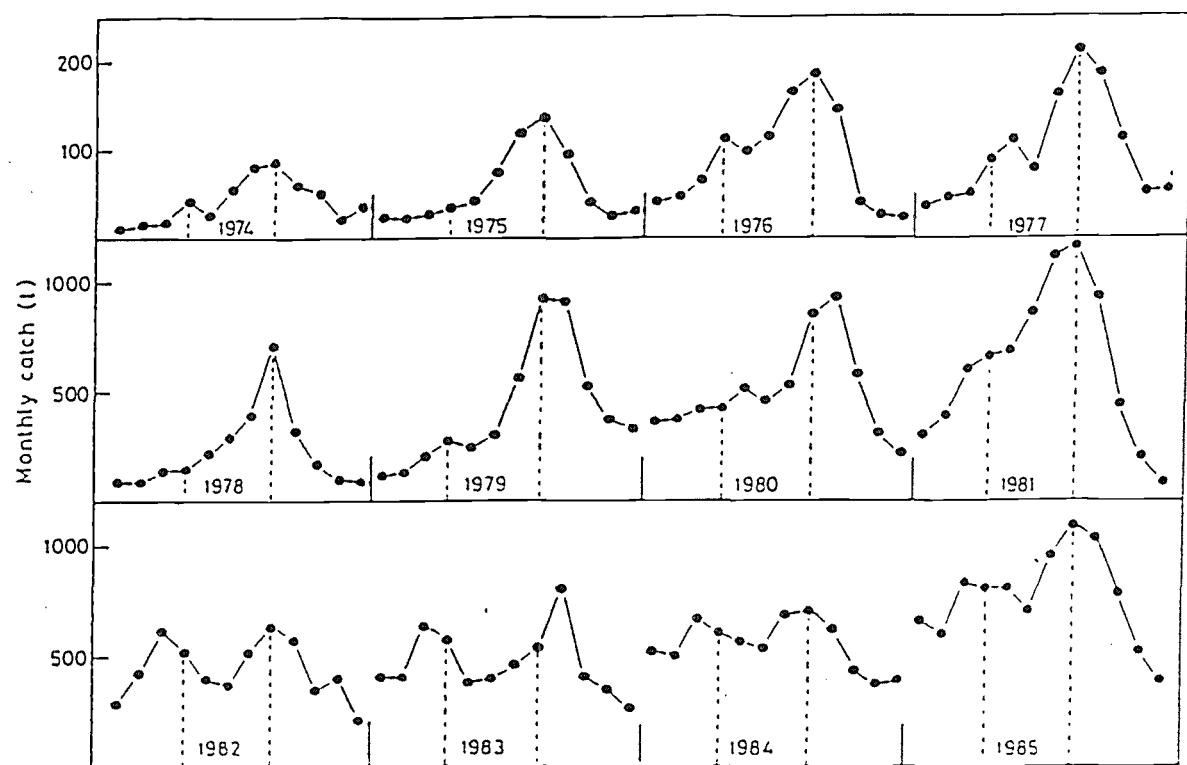
Figure 4.

Relationship between Effort and Catch in Lake Kariba

catch in thousand tons

Effort unit-night (Thousands)
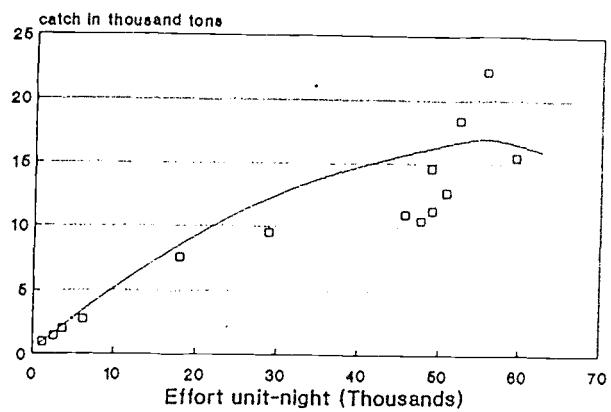
Relationship between Effort and Catch in Binga/Mlibizi

catch in tons

Effort (in unit-night)
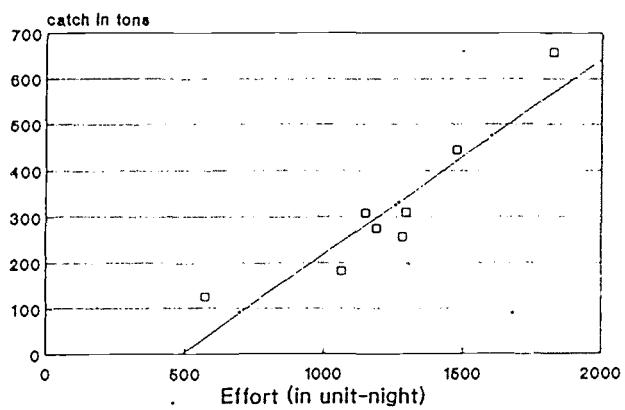
Relationship between Effort and Catch in Sengwa

catch in tons

Effort unit-night

105
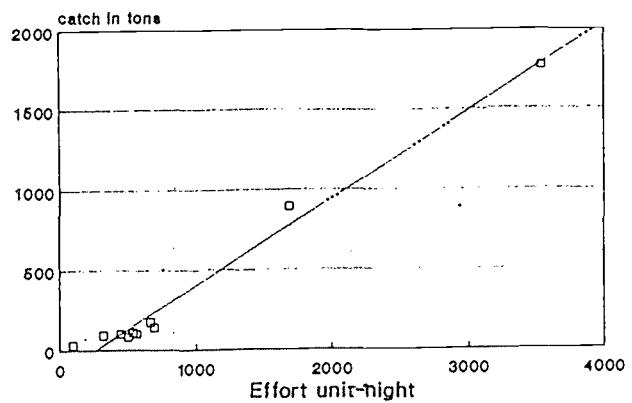
SOCIO-ECONOMIC ASPECTS OF FISHERIES DEVELOPMENT AND MANAGEMENT IN UGANDA: THE 'FISHIN' PROJECT

by

O.K. Odongkara
Senior Economist, Fisheries Department,
P.O. Box 4, Entebbe, Uganda

and

J.E. Reynolds
Socio-Economist, FAO/UNDP Project UGA/87/007
P.O. Box 521, Kampala, Uganda

ABSTRACT

The socio-economic work with which this report is concerned is a component of UGA/87/007 "Fisheries Statistics and Information Systems" (FISHIN), a project executed by FAO with funding by UNDP and a contribution in kind from the host Uganda Government. It was initiated in 1987 against a background of severe deficiencies in the statistical and related information systems which are critical to adequate planning, development and management of the national fisheries. Following a review of these deficiencies and their underlying causes, recent planning, development, and management initiatives being undertaken by Government and donor agencies are noted. The socio-economic investigations being undertaken through the FISHIN Project are then discussed, including details of project objectives and the resources, constraints, methodology, and practical preparations involved in survey work.

1. INTRODUCTION: THE HISTORICAL CONTEXT

The monitoring machinery of the Uganda Fisheries Administration operated quite well up to the early 1970s. During the subsequent 15 years or so the country experienced a traumatic period of civil strife, economic disruption, and general decline. The ability of established national institutions to function effectively in support of the nation's socio-economic welfare suffered severely, mainly as a result of three factors. These included: lack of motivation amongst official personnel as their terms and conditions of service steadily deteriorated; lack of job and indeed any sort of security in the country; and the rampant incidence of incompetent people finding their way into responsible public offices.

The period after 1973 also saw major economic decline in Uganda. Production fell drastically and remained low as a result of faulty economic management decisions and other factors. This led to shortages of goods and high prices on the domestic market. The fall in production also led to a fall in the country's exports and the resulting deteriorating balance of payment position, limiting the country's ability to meet the country's import requirements (MPED 1976, IMF 1980). For the Fisheries Department this meant that resources and basic inputs for statistics collection, processing, and evaluation could not be easily obtained. Essential items like weighing scales, stationery, and calculators, not to mention more expensive equipment like vehicles and computers, were simply no longer available in sufficient quantities. Even funds to meet the day to day field data recording expenses were inadequate and irregularly available.

A series of internal wars commencing in 1978 contributed further disastrous consequences for the country's welfare. Not only were vital resources diverted to underwrite war efforts, but there was widespread destruction of structures, looting of equipment, and disruption of activities as the fighting raged on. The fisheries information systems came to a standstill in many areas during this time. Equipment and many volumes of useful records were lost or destroyed through the looting which went with the wars and continued for some while thereafter.

As the statistics monitoring activities continued to remain low or moribund over many years, fisheries personnel remained out of practice, with obvious negative effects on their professional skills. Both field data collection staff and the data processing staff at Headquarters suffered in this way. Furthermore, newly recruited officers had little or no opportunity to acquire much in the way of practical skills.

The overall state of affairs led gradually to a crippling loss of capability in the Fisheries Department to monitor the resource base and its exploitation. Thus a complete reversal was experienced in the status of fisheries information systems from that which existed up to the early 1970s.

As part of a general Government programme to rehabilitate different sectors of the economy and restore production and institutions to their previous levels, various measures have been taken (MPED 1987). For the fisheries, several foreign funded projects were formulated which entailed strong input supply components (MAIF 1983). These include:

(a) IFAD/World Bank Agricultural Rehabilitation Project (ARP) and later, Agricultural Development Project (ADP), which has been supplying inputs mainly on Lake Kyoga.

(b) World Bank (IDA Credit) which financed the purchase of yarn and spare parts for the Uganda Fish Net Manufacturers Company to enable them to resume production.

(c) Euro Action Accord, for the supply of inputs to Lake Albert and the Albert Nile.

(d) EEC - Artisanal Fisheries Rehabilitation Project (AFRP), to channel supplies to areas not covered by the projects above.

(e) Uganda Commercial Bank (UCB), Rural Farmers Credit Scheme, covering the whole country.

(f) Italian Government Funded Integrated Fisheries Development Project, covering areas on Lakes Victoria and Kyoga.

(g) The People's Republic of China Government aided Sino-Uganda Fisheries Joint Venture, planned to undertake fishing on Lake Victoria.

The effects of the gear supply programme were reinforced by the fact that earlier on, during the period of gear scarcity, certain labour intensive fishing practices were adopted and these practices have continued to be used even with increased input supplies. These include beating the water to drive fish into the nets (popularly known as "tycoon" fishing), the active use of gill nets as surrounding nets, and the use of beach seines and cast nets. (Reynolds and Gréboval 1988; SEC Fld Rpts 1989).

In the field of distribution, two projects were set up to facilitate the handling, preservation, and processing of the products for better marketing. These included:

(a) A People's Republic of China-aided project to construct an ice plant and fresh fish marketing centre in Kampala; and

(b) The Italian Government-funded Integrated Fisheries Development Project, which involved two fish processing schemes: improved hot smoking and chilling/cold smoking of fish.

In another development, there has been a massive importation of commercial vehicles in the country to alleviate the transport problem, and this was accompanied by a programme of road repairs undertaken on most of the major and a few of the minor roads to facilitate communication

and the marketing of various products (MPED 1987, MF various years). These two factors have enhanced fish trade quite considerably.

Transformations in the mode of exploitation and the very composition of the fisheries resource were also occurring in the early 1980s. On Lake Kyoga, the widespread use of illegal fishing gear and fishing practices adopted in the period of gear shortages, in the face of the Fisheries Department's weakened ability to enforce regulations, led to changes in size composition of catches particularly for the main species, *Lates niloticus*. This situation was aggravated by the decline in the water level over the last decade by about 1.5 metres due to prolonged drought, causing reduction in the breeding and nursery grounds, thus diminishing the productivity of the lake. (Marriot et al. 1988; Reynolds and Gréboval 1988; Twongo 1988).

On Lake Victoria, the explosion of the Nile perch after 1983 (Okaronon et al. 1985), widely discussed in various scientific and popular fora, was a major event in the fishery. Tremendous changes have taken place in the industry as a result of this development (Reynolds and Gréboval 1988). There have been increases in production and changes in catch composition, with the Nile perch taking over the lead from the tilapia. The quantities of canoes and gear on the lake increased and the gear composition changed in favour of larger meshes. Processing and marketing activities and patterns of consumer preference have all adjusted to the new realities of the fishery.

2. RECENT PLANNING AND MANAGEMENT INITIATIVES

The events of change described above have had far reaching consequences for the industry. It is imperative that national fisheries management and planning authorities take the full implications of these events into careful account. However, because of the collapse of Fisheries Department monitoring capabilities since the mid-1970s, the information base is fraught with problems of incompleteness and unreliability which pose severe hindrances to the meaningful management and planning of the industry. In an attempt to redress this situation several measures have been instituted. The main ones include:

(a) Strengthening the Fisheries Training Institute through budgetary allocations and an EEC grant, in order to train personnel to staff the statistics system.

(b) Upgrading the research capabilities of the Uganda Freshwater Fisheries Research Organization (UFFRO) through budgetary allocations, for better resource investigations.

(c) Use of assistance from the International Development Research Corporation (IDRC) to fund the Nile Perch Project at UFFRO, which is investigating developments in the Nile perch fishery and the related industry.

(d) Inclusion of a fishery component in the IFAD/World Bank ADP, in order to survey, evaluate, and generate an action plan for the Lake Kyoga fisheries.

(e) The implementation of three EEC-funded studies, namely:

    i. The Fisheries Sector Survey 1988, by the Planning Unit of the Ministry of Animal Industry and Fisheries, to provide preliminary data on the sector that could be used for planning as well as a guide for further investigations.

    ii. The AFRP/UFFRO Fishery Survey 1988/89, initiated as a follow-up study to evaluate the impact of the input supply programme of the AFRP.

    iii. A fishery survey in Queen Elizabeth National Park (Lakes Edward and George), undertaken as a part of the Conservation of Natural Resources Project.

(f) Establishment of the Italian Government-funded Integrated Fisheries Development Programme.

3. FISHERIES STATISTICS AND INFORMATION SYSTEMS

Whilst the above mentioned undertakings are expected to make major contributions, the Fisheries Department regards Project UGA/87/007, FISHIN, as the principal means through which shortcomings in the statistical data and information systems should be corrected. Priority target regions for the Project are those which include the fisheries of Lakes Victoria, Edward and George. The Project was officially commenced in October 1988, with the posting of the CTA and the preliminary activities of the Project Bio- Statistical (BIOSTAT) group. The work programme of the Project Socio-Economic (SEC) group got underway rather later, in May 1989.

3.1. Objectives

The broad objectives of Project activities are those of fisheries staff development, characterization and analysis of the industry, and plan formulation. The training objective will largely be achieved on an in-service basis, through the participation of Fisheries Department Headquarters, Regional, and local personnel in workshops and refresher courses to be organist through the FISHIN Project (FAO/UNDP 1987).

Different types of field censuses and survey exercises will be mounted in order to generate a comprehensive socio-economic information base on the fishing industry in the six project Regions of Tororo, Jinja, Entebbe, Masaka, Kalangala and Kichwamba. Initially the information compiled from the field exercises will simply complement that which is now being collected on a routine basis by Fisheries Department staff. Eventually, however, the current system will be revised and upgraded to allow for the regular monitoring of socio-economic factors within the industry. Survey work will incorporate a census of fishing and processing units and a country-wide study of long distance fish marketing. Findings would provide a basis for development planning in the industry.

3.2. Resources

Total Project cost is approximately US $ 1 million, with an external component of about US $ 0.9 million to meet the provisions for inputs, foreign technical personnel and operating costs. The Project is equipped with four landrover type vehicles, seven motor-cycles, eight powered boats, thirty bicycles, weighing scales, and other minor items necessary to the conduct of field investigations. For the purpose of the survey administration and data analysis the six regional field offices and Project headquarters have been provided with typewriters, along with calculators, stationery, and basic office supplies. Two IBM micro-computers have been installed at Project offices in Fisheries Department Headquarters to serve data storage and analysis needs as well as to facilitate the production of reports.

Survey personnel are under the overall supervision of the project Chief Technical Advisor (CTA) and the National Project Director (NPD). The core SEC working group is headed by an FAO-fielded Socio-economic Advisor (SEA) who collaborates with two counterpart fisheries economists provided by Government. It is responsible for the identification of information requirement priorities, the design, planning, and supervision of all aspects of socio-economic survey activities, analysis of field investigation results, and the reporting of principal findings.

The field staff consists of the six Regional Fisheries Officers in the survey regions and a total of about 30 Assistant Fisheries Development Officers (AFDOs), Fisheries Assistants (FAs) and Fish Marketing Assistants (FMAs). These personnel will be deployed to assist in the supervision of field data collection. There is provision for consultants of various specialities to be utilized as and when the need arises.

3.3. Constraints

An important task in the planning of the survey has been the identification of anticipated bottlenecks that might hinder the successful implementation survey activities. These consist mainly in limitations of financial resources and personnel. Original estimates of the costs on the project have now become inadequate because of continuous marked inflation in the country. It has therefore become necessary to seek increases in the Project budget. The situation with regard to the local component of the budget is even more difficult. Funding provided to meet the Government contribution to the Project is quite limited, and the process of obtaining its release

from the Treasury can bring delays. In addition, it is very difficult to obtain upward revisions to accommodate inflation pressure because of the strict expenditure controls instituted under the national budget management.

National staff limitations are another source of constraint. The number of survey personnel, both at the Headquarters and in the field, is inadequate for the magnitude of the work needing to be done. The expertise of many of these staff also needs to be improved on, as explained earlier. Furthermore, the level of motivation of these staff, as in the rest of the Civil Service Group in the country, is rather low due to poor remuneration and the generally difficult working conditions.

Field staff are also faced with the problem of lack of mobility to organize survey activities. This should be alleviated through the provision of Project motor-cycles, motor-boats and bicycles for the work in each region. Regions are large areas, however, generally covering about three districts. The situation is made more difficult by the poor state of the roads to most of the landings. The marketing survey, which is to cover the whole country, is expected to come up against the problem of insecurity which still lingers on in a few areas. This has not only disrupted normal activities in these areas but is expected to hinder investigations in the affected places.

3.4. Methodology

The implementation of survey work has been planned through a series of activities from which the required socio-economic information would be built up. These include the compilation of existing information; preliminary field trips to the survey areas; fishing unit and on-shore facilities censuses; sample surveys of activities of fishing operators, traders and consumers; and a national fish marketing study. The programme of work is schematically laid out in Annex 1.

(a) Existing information on the industry is being evaluated so as to determine areas of thin or deficient coverage. This is being done through scanning available literature and establishing contacts with other institutions or projects whose activities involve studies and characterizations of the fisheries sector, particularly those noted in Section 3 above. A field document is now being drafted which will provide an inventory of available information and identify priority areas for further investigation.

(b) A series of preliminary field trips has been undertaken by the SEC Group, to cover the major fishery regions and marketing centres. The purpose of these visits is to gain necessary orientation to local circumstances, and to meet Fisheries Department field staff, fisherfolk, traders, consumers, and community leaders. General information on landing sites, fishing communities, fishing and fish processing activities, marketing and the related transport and storage facilities, are all now being collected. This will lay the groundwork for more intensive surveys. The trips are being documented by a series of SEC Group Field Reports (SEC Fld Rpts) which are circulated to relevant institutions/personnel for their information and comments.

(c) A census will be conducted of the fishing units and fish transportation, processing, storage, marketing and other service facilities. The fishing unit count will cover the entire shorelines of the relevant lakes within the Project regions. The use of aircraft for this exercise is envisaged. Fisheries Department field staff will be deployed to help in ground operations. Findings will be reported in a Technical Report (SEC TR).

(d) The inventory of available information and census findings noted above will be used to guide the formulation of the main socio-economic survey of fisherfolk, traders and consumers. In the survey, investigations will focus on landing communities, fishing operations, and the disposal, processing and storage of catches. These investigations will look into a wide array of issues, including: sizes and services/amenities establishments of fishing settlements; participation of local community members in fishing as boat, gear, or labour owners; alternative income opportunities which are available and their relative importance; mobility of the fisherfolk, including reasons for migration, timing, and destinations involved; and community organization, in terms of the structure, functions, and local significance

of such institutions as Fishing Committees, Co-operative Societies, the Head Fisherman (Gabunga), etc. Qualitative and quantitative information will be collected on the fishing factors and the economics of fish production, estimating the returns to the various factors and determining how the different forms of production organization affect these returns. In connection with catch disposal, the question of prices received by the fishing operators, how they are determined, and the factors influencing them will be examined, as will in turn the availability of buyers, storage, transportation, and access road facilities. Processing operations in terms of modes used, facilities available, and the economics of the operations will be investigated. Post-harvest sector investigations will cover such other aspects as the number of people employed in the processing activities, participation by women, the problem of woodfuel supply, and the demand for the various types of processed fish products. Stratified random sampling will be used in the survey, with the actual stratification scheme to be determined on the basis of preliminary census findings in order to ensure representativeness. Survey schedules will be designed as appropriate but will be pre-tested in trial locations prior to the commencement of investigations. The Fisheries Department field staff, and any additional personnel deemed necessary, will be enlisted and trained to conduct the field interviews and data collection. The SEC Group will be responsible for the processing and analysis of data and the preparation of SEC Fld Rpts and TRs on all findings.

(e) A national fish marketing study will be undertaken which will also cover long distance trade and marketing activities related to those fisheries regions which are not part of the core Project regions -- namely, Lakes Kyoga and Albert. Investigations will focus on the organization of fish marketing in the country, bearing on such points as the number of people employed and the institutions involved in it, the facilities available, the pattern of fish trade and the main destinations as well as the factors hindering the free flow of fish through the country. The economics of fish trading activities will be investigated to determine ways of minimizing costs for the benefit of both traders and customers. Fish consumption patterns will be studied as well, with a view towards identifying consumer tastes and preferences on the market and other relevant factors such as fish prices vis-a-vis consumers' incomes. A separate SEC TR will present the findings of this study.

3.5.   Practical Preparations

In preparation for the implementation of this survey, a number of activities have had to be carried out. After completing the project initiation legalities, the first task was to recruit the personnel for the Project. This consisted of the fielding of the two advisors, namely the CTA and the SEA, by FAO. At the same time national Civil Service staff, who included the NPD, the BIOSTAT and SEC counterparts, and field personnel, were assigned duties. Service and supporting staff were also hired directly by the Project. Availability of the right candidates for the various technical posts was not easy and although the project officially went into operation in October 1988, staffing was not complete until May 1989, resulting in the re-scheduling of the survey exercises.

At the time staff were being assembled, the tasks of securing release of funds and procurement of inputs were also initiated. This was important to ensure smooth programme implementation. In the event, however, procurement has taken a considerable period of time. Most of the inputs, including vehicles, computers, motor-cycles, outboard engines, typewriters, bicycles and other small items have had to be ordered from suppliers overseas, with delivery time lags of over six months.

Major preparations have also had to be planned in the area of training for the national staff to improve on their professional capabilities. The following activities have been provided for:

(a) In-service training for the SEC counterparts, conducted on a routine basis for the duration of the project, is planned to provide experience in survey design and implementation and offer skills in the use of computers.

(b)   Refresher courses will be organist periodically for both the headquarters and field staff to upgrade their skills in field data collection.

(c)   A national workshop has been planned for the SEC counterparts and the senior departmental staff to discuss the rehabilitation of the information systems proposals.

(d)   The SEC counterparts will be encouraged to participate in regional workshops on fisheries management and planning organist by the FAO/UNDP Regional Project for Inland Fisheries Management in Eastern/ Central/Southern Africa (RAF/87/099). Such participation would enhance their professional experiences and skills. A programme of study tours to neighbouring countries is also being planned with this purpose in mind.

(e)   Arrangements have been made for the SEC counterparts to attend short- term intensive courses in fisheries planning, management, development, and marketing at an overseas institution. These courses are scheduled for January–March and April–July 1990.

Another important practical preparation for the survey consists of undertaking trials of various types. These would be done prior to the survey activities in a few areas. Under this arrangement, the designs of the questionnaires would be tested, and the results used to improve on the survey schedules to be used. The trial runs would also provide indications of how to improve investigation approaches and techniques, and give an opportunity for survey personnel to acquire field experience before the main survey exercises commence.

4. CONCLUSION

Fisheries administrative capabilities in Uganda, particularly as reflected in the operations of the monitoring, reporting, and information systems so crucial to effective management and development of the resource base, were considerably weakened as a result of events of civil war, economic disarray, and prolonged misrule which commenced in the 1970s and continued more or less unabated until very recently. In consonance with the national programme for reconstruction now being mounted, the Fisheries Department with the assistance of several donor governments and agencies is instituting an array of measures and projects intended to foster general recovery of the fishing industry, including re-establishment of effective administrative services.

With regard to data collection and information systems, it is intended that the FISHIN Project, UGA/87/007, will play a central role in rehabilitating and upgrading monitoring and reporting mechanisms, facilities, and staff skills. The aim is improve and tune these systems so that they are operating effectively once again and can continue to do so on a sustained basis.

The Project team is an interdisciplinary one, composed of national and international staff with backgrounds in both bio-statistics and socio- economics. Team members collaborate closely with one another in organizing and implementing their activities and sharing the available resources in hardware and personnel. Close collaboration is also maintained when it comes to dealing with the various constraints which impede Project undertakings both in the office and the field. As noted in this report, these are mainly to do with budgetary limitations in the context of the country's difficult economic circumstances. Acquisition of goods and services with available financial resources sometimes proves exceedingly difficult and expensive. Other manifestations of such limitations are to be seen in low staffing levels, low levels of training and in-service skill development, and poor motivation in some instances.

Socio-economic (SEC) group activities under FISHIN are only of recent commencement but are being fully integrated with those of the bio-statistic (BIOSTAT) group members of the team to realize the entire package of Project objectives. As detailed earlier in the sections on methodology and practical preparations, steps are being taken to strengthen the socio-economic data/information base of the Fisheries Department, and to ensure its effective operation on a permanent basis, through a programme involving: an inventory of existing literature and other archival resources; a preliminary assessment of present conditions in the six Project regions, and of the present state of socio-economic data collection in terms of quality, parameters measured, and

need for expansion and/or improvement; fishing unit and on-shore facilities censuses; field surveys of fisherfolk, traders, and consumers; and a national marketing study to cover areas outside of the core Project regions.

An integral part of this work programme is training to foster the development of national staff professional skills. In addition to routine in-service training, counterpart personnel will be invited to participate in refresher courses and workshops organist by the Project team, and also to participate in regional study tours and intensive short courses in fisheries management, development, and marketing at institutions abroad.

5. REFERENCES

International Monetary Fund (IMF), 1980: "IMF Survey" Vol.9 No. 5, Washington DC pp 66-67.

FAO/UNDP Project UGA/87/007, 1987: "Project Document". Kampala.

FISHIN (Fisheries Statistics and Information Systems), 1989: "Socio- economic Field Reports", (SEC Fld Rpts), FAO/UNDP Project UGA/87/007, (mimeo).

FD (Fisheries Department, The Republic of Uganda), various years: "Annual Report". Government Printer, Entebbe, Uganda.

Marriot, S.P., P.R. Manacop and T.T. Twongo, 1988 "Report on the Survey of Lake Kyoga". (Preliminary Draft).

MAIF (Ministry of Animal Industry and Fisheries, The Republic of Uganda), 1983: "Blue Print for Fisheries Development in Uganda". Kampala.

MF (Ministry of Finance, The Republic of Uganda), various years: "Background to the Budget". Government Printer, Entebbe, Uganda.

MPED (Ministry of Planning and Economic Development, The Republic of Uganda), 1976: "The Action Programme - A Two Year Economic Rehabilitation Plan - 1977/78 to 1978/79". Government Printer, Entebbe, Uganda.

----------,1987: "The Reconstruction and Development Plan - 1987/88 to 1990/91". Government Printer, Entebbe, Uganda.

Okaronon, J.O., T.O. Acere, and D.L. Ocenodongo, 1985: "The Current State of the Fisheries in the Northern Portion of Lake Victoria (Uganda). FAO Fish. Rep.,(335):89-98

Reynolds,J.E. and D.F. Greboval, 1988: "Socio-economic Effects of the Evolution of Nile Perch Fisheries in Lake Victoria:a Review. CIFA Tech. Pap.,(17):148 p.

Twongo, T., 1988: "Recent Trends in the History of Lake Kioga - Uganda. In D. Lewis (ed.), Predator-prey relationships, population dynamics, and fisheries productivities of large African lakes. CIFA Occas.Pap., (15) 140-51.

FISHIN PROJECT, SOCIOECONOMIC WORKPLAN

MAY 1989	On-going Counterpart Training; SEC Field & Technical Reports.	Assemble past and present fishery industry census information and related documentary material; evaluate current categories and methods of enumeration.
		Preliminary field trips/review of Project Regions.
		Workshop on issues of present statistical system and plans for new data collection approaches with regional fisheries staff.
JAN. 1990	Fishing Unit and On-Shore Facility Censuses.	Fishing unit census exercise (with BIOSTAT Group); aerial counts and landing site verifications as needed. Drafting, testing, finalization, implementation survey schedules.
		Onshore processing, storage, transport facilities census. Drafting, testing, finalization, implementation survey schedules.
		Census of inland distribution and marketing facilities. Drafting, testing, finalization, implementation survey schedules.
		Identify sample populations of fisherfolk, processors, traders and consumers.

JUNE 1990	Socio-Economic Survey.	Local sample surveys to determine fishing settlement characteristics, income distribution, returns to labour, access to amenities/services, organizations/cooperatives, patterns of product distribution and consumption, etc. Drafting, testing, finalization, implementation survey schedules.
SEPT. 1990	National Fish Marketing Survey.	Review organization national marketing system (available literature, previous studies) and evaluate existing marketing statistical system. Survey of institutions and people involved/employed in national marketing system; main product flows, constraints, fish consumption patterns. Drafting, testing, finalization, implementation survey schedules.
JAN. 1991	Recommendations for and implementation of new data collection system.	Review results field investigations plus need to devise new approaches to and categories of enumeration. Convene workshop of national fisheries officers to formulate recommendations and plans for implementing new system.

LIST OF IFIP REPORTS - LISTE DES RAPPORTS PPEC

I. TECHNICAL DOCUMENTS / DOCUMENTS TECHNIQUES

Gréboval D., A. Bonzon, M. Giudicelli and E. Chondoma, Baseline Survey
1989 Report (1987) on inland fisheries planning, development and
management in Eastern/Central/Southern Africa. UNDP/FAO Regional
Project for Inland Fisheries Planning (IFIP). RAF/87/099-**TD/01/89**
(En): 104p.

Gréboval D., A. Bonzon, M. Giudicelli and E. Chondoma, Rapport sur l'étude
1989 de base (1987) sur la planification, le développement et
l'aménagement des pêches continentales en Afrique Orientale/
Centrale/Australe. Projet Régional PNUD/FAO pour la Planification
des Pêches Continentales (PPEC). RAF/87/099-**TD/01/89 (Fr)**: 110 p.

Gréboval D., and B. Horemans (eds), Selected Papers presented at the
SADCC/FAO Training Workshop on Fisheries Planning, Victoria
Falls, Zimbabwe, 15-24 Novembre 1988. UNDP/FAO Regional Project
for Inland Fisheries Planning (IFIP). RAF/87/099-**TD/02/89 (En)**:
138 p.

Horemans B., et Maes M. (éds), Rapport de la consultation technique sur les
1989 lacs Cohoha et Rweru partagés entre le Burundi et le Rwanda
(Bujumbura, 13 et 14 Décembre 1989). Projet Régional PNUD/FAO
pour la Planification des Pêches Continentales (PPEC).
RAF/87/099-**TD/03/89 (Fr)**: 94 p.

Gréboval D., Management of the New Fisheries of Lake Victoria: Major socio-
1989 economic issues. UNDP/FAO Regional Project for Inland Fisheries
Planning (IFIP), RAF/87/099-**TD/04/89 (En)**: 25 p.

Gréboval D. (ed), Principles of fisheries management and legislation of
1990 relevance to the Great Lakes of East Africa: Introduction and
case studies. UNDP/FAO Regional Project for Inland Fisheries
Planning (IFIP), RAF/87/099-**TD/05/90 (En)**: 41p.

Gréboval D. (éd), Principes d'aménagement et de législation des pêcheries
1990 des grands lacs de l'Afrique de l'Est: Introduction et études de
cas. Projet Régional PNUD/FAO pour la Planification des Pêches
Continentales (PPEC). RAF/87/099-**TD/05/90 (Fr)**: en préparation.

Bean C.E., Introductory guide to the economics of fisheries management.
1990 UNDP/FAO Regional Project for Inland Fisheries Planning (IFIP),
RAF/87/099-**TD/06/90 (En)**: in preparation.

Report of the IFIP/SWIOP Workshop on Economics Aspects of Fisheries
1990 Development and Management. UNDP/FAO Regional Project for Inland
Fisheries Planning (IFIP), RAF/87/099-**TD/07/90 (En)**: 22p .

Corsi F., Evaluation des pêcheries zaïroises des lacs Idi Amin/Edouard et
1990 Mobutu Sese Seko. Projet Régional PNUD/FAO pour la Planification
des Pêches Continentales (PPEC). RAF/87/099-**TD/08/90 (Fr)**: 64p.

Rapport de la première réunion du Comité consultatif du projet régional
1990   pour la planification des pêches continentales. Projet Régional
            PNUD/FAO pour la Planification des Pêches Continentales (PPEC).
            RAF/87/099-**TD/09/90 (Fr)**: 24p.

Report of the First Meeting of the Advisory Committee of the Regional
1990   Project for Inland Fisheries Planning. UNDP/FAO Regional Project
            for Inland Fisheries Planning (IFIP), RAF/87/099-**TD/09/90 (En)**:
            22p.

Report of the Symposium on Socio-economic aspects of Lake Victoria
1990   Fisheries. A Symposium organized by the IFIP Project under the
            framework of the CIFA Sub-comittee for Lake Victoria, 24-27
            April, Kisumu, Kenya, UNDP/FAO Regional Project for Inland
            Fisheries Planning (IFIP), RAF/87/099-**TD/10/90 (En)**: 24p.

Report on the Technical Consultation on Lake Mweru shared by Zaire and
1990   Zambia, 08-10 August, Lusaka, Zambia, UNDP/FAO Regional Project
            for Inland Fisheries Planning (IFIP), RAF/87/099-**TD/11/90 (En)**:
            44p.

Rapport de la Consultation Technique sur le lac Mweru partagé par le Zaïre
1990   et la Zambie, 08-10 Août, Lusaka, Zambie, Projet Régional
            PNUD/FAO pour la Planification des Pêches Continentales (PPEC).
            RAF/87/099-**TD/11/90 (Fr)**: 45p.

Papers presented at the IFIP/SWIOP Workshop on Economic Aspects of
1990   Fisheries Development and Management. UNDP/FAO Regional Project
            for Inland Fisheries Planning (IFIP), RAF/87/099-**TD/12/90 (En)**:
            122p.

Case studies presented at the IFIP/SWIOP Workshop on Economic Aspects of
1990   Fisheries Development and Management. UNDP/FAO Regional Project
            for Inland Fisheries Planning (IFIP), RAF/87/099-**TD/13/90 (En)**:
            115p.

II. WORKING PAPERS / DOCUMENTS DE TRAVAIL

Bean C.E., Selected abstracts of basic references and current literature in
1989   fisheries economics. UNDP/FAO Regional Project for Inland
            Fisheries Planning (IFIP), RAF/87/099-**WP/01/89 (En)**: 51p.

Ssentongo G. W., Fish and fisheries of shared lakes of Eastern/Central/
1989   Southern Africa. UNDP/FAO Regional Project for Inland Fisheries
            Planning (IFIP), RAF/87/099-**WP/02/89 (En)**: 19p.

Nfamara J.D., Recent observations on the fisheries of lake Tanganyika.
1990   UNDP/FAO Regional Project for Inland Fisheries Planning (IFIP),
            RAF/87/099-**WP/03/90 (En)**: 16p.

Horemans B., Socio-economic surveys of the artisanal fisheries on Lake
1990   Malawi: a case study (Part I: preparatory work). UNDP/FAO
            Regional Project for Inland Fisheries Planning (IFIP),
            RAF/87/099-**WP/04/90 (En)**: in preparation.