AN EVALUATION OF THE ARTISANAL FISHERIES RESOURCES OF THE CROSS RIVER STATE OF NIGERIA

by

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ABSTRACT

The Cross River State marine and freshwater artisanal capture fisheries are divided into four categories according to the type of resources being exploited. Schaefer's production model is applied to each of the fisheries to estimate the maximum sustainable yields (Ymax). The total potential yield for all the Fisheries in natural waters is 178,650 tonnes year^{-1}. This potential is unlikely to be achieved as more fishermen are abandoning the occupation due to the scarcity of boats, outboard engines and nets. Even if the full potentials were realized the production would still be short of what the State should produce by about 30.5%. Investment opportunities which, if effected can help to narrow the gap between the available and the desired level of production are enumerated.

INTRODUCTION

The coastal and riverine communities of that part of Nigeria now known as the Cross River State (formerly South-Eastern State) have been fishing from time immemorial. Catches from the State play a significant role in the National and State economy. According to the latest statistics available at the Federal Department of Fisheries, in 1983, the Corss River State (CRS) caught 157,376 tonnes (t) of fish, representing 31.4% of the total national catch for that year. The contribution of artisanal fisheries to Nigeria's domestic fish production is 97% (indicating that only about 3% comes from industrial fisheries). In the CRS, almost 100% of the domestic fish output is from artisanal fisheries, there being no functional industrial fishing enterprise in the State at present. This paper deals with the resources available to the small scale (artisanal) fisheries of the Cross River State marine and inland waters.

Potential yield estimates are essential not only for the management but also for rational planning of the fishery resource exploitation and utilization. Earlier attempts to estimate the potentials of the CRS fisheries have been

made by Moses (1979; 1980; 1981a; 1981b; 1986b) and Canovex Ltd (1979). A considerable amount of literature now exist on the fisheries potentials of Nigeria of which the CRS forms a part: Longhurst (1961; 1965), Williams (1978), Bayagbona et al (1971), Domain (1980), Bayagbona and Ajayi (1980), Ajayi (1982), Ajayi and Talabi (1984). Some of these estimates have been based on very scanty or no data at all. Detailed long series of catch-effort statistics now available for several water bodies in different parts of the country tend to reveal how unrealistic some of these estimates have been. Longhurst (1961) for example, gives the maximum potential yield of Nigeria inshore waters as 28,500 t. yr^{-1} (made up of only 25,000 t from artisanal and 3,500 t from industrial fisheries); but it is now known that catches from this source exceed 200,000 t yearly. Similarly, Canovex Ltd of Canada (1979) after due consultation with Longhurst and Gulland, came out with a figure of $5tkm^{-2}y^{-1}$ "as a reasonable estimate" of the potential of marine fish catch off the CRS. But as pointed out by Moses (1981a), available statistics in the area in 1979 indicate a catch rate of 30.7 $tkm^{-2}yr^{-1}$, a much higher figure than those predicted by Longurst or Canovex. Because of the great importance of fisheries in the economy of this State, it is necessary to re-evaluate the resource potentials in the light of the present availabe data.

In the present paper, 17 years data series of catch-effort statistics (1969 - 1985) are fitted into Schaefer's production model to obtain the maximum sustainable yield (Y_{max}) of the various artisanal fisheries, which, for this purpose, are classified as follows:-

1. Coastal pelagic (bonga, Illisha and sardinella) fishery
2. Demersal finfish fishery
3. Crayfish fishery, and
4. Freshwater fishery.

The four categories are sufficiently different and important (See Table 1) to allow each to be treated as a distinct fishery and apply the production model. At present, other models which put heavy demand on data - such as of demographic composition, growth, mortality, recruitment and absolute biomass, are not suitable for application to these fisheries because such data do not exist.

Geographical Setting

The Cross River State with a surface area of 28,585 km^2 is located at the south-eastern corner of Nigeria (Latitude $4°25^1$ - $7°00^1$N; Longitude $7°17^1$ - $9°30^1$C). It is bounded in the south by the Atlantic Ocean, in the east by the

Republic of Cameroun and in the west and north by Rivers, Imo, Anambra and Benue States. The official (projected) population (from the Statistics Division of the State Ministry of Finance and Economic Planning) for 1986 is 5.8 million.

The physiography is rather simple: two spurs from the Cameroun highlands, in a horse-shoe shaped fashion, form the Obudu Hills in the north and Oban Hills in the south respectively. Stretching away from inside the "horse-shoe" first in a westward direction and then southwards to the coast is the fairly extensive Cross River plain (Figure 1). The State as a whole is well watered, principally by the Cross River; the two other river systems are the Qua Iboe with its drainage basin mainly in the State and the Imo whose drainage basin lies mainly outside the State.

The climate is tropical with rather well marked dry season (October/November-April) and wet season (May-September/October). Table 2 summarizes the mean climatic conditions of the area. The vegetation varies from mangrove swamp forest in the coastal area through tropical evergreen forest (dominated by oil palm) to derived savanna in the northern zone.

Hydrography

The length of the coastline is 129 km. Generally, the Nigerian continental shelf is narrow; its greatest width is attained off the Cross River State where the 200 m isobath is 76 km off the Imo River and 140 km off the Cross River. The total shelf area is 8,005 km^2 (Moses, 1981a). The Cross, Qua Iboe and Imo Rivers all open into the sea with no or very little delta formation. For this reason, large quantities of organic debris are brought into the coastal waters and this is an important factor in the enrichment of these waters. The bottom deposit is mainly silt (mud) mixed in some places with sand. Thus, inspite of the fact that this area does not experience appreciable upwelling, primary productivity is high (200 g Cm^{-2}) (Moses, 1981a) and the ecological conditions created are particularly favourable to the occurrence of two of the most important living resources of the CRS, viz, the bonga, Ethmalosa fimbriata and shrimp, particularly Penaeus notialis). However, the area is not completely devoid of phenomena that help to mix the water and bring nutrients up to the euphotic zone; for it has been observed that during the rainy season (corresponding to the northern summer) a branch of the eastward flowing Guinea Current meets a westward current from Cameroun off the Cross River estuary. The hydrographic disturbance caused by this phenomenon is strong enough to make the depth of the bottom in this area quite irregular with hollows in several places - a condition that often seem to discourage shrimpers trawling for shrimps in the area.

Hydrologically, the whole Cross River State is dominated by the Cross River, a flood river with numerous tributaries, a drainage basin (within Nigeria) of 40,000 km^2 and a fairly extensive flood plain covering some

2,500 km². The mean annúal fish catch from this system (17 year data series) is 5,500 t. It has been shown that for this system, the catch in a particular year (T) is strongly correlated with the intensity of flooding and draw-down (in time and space) measured one year earlier than T (i.e. in year T-1) (Moses, 1986a). The second river system is the Qua Iboe River which rises near Umudike but has most of its drainage basin within the CRS. Its area of flood plain is small. Statistics of catch in this system are poor; it is estimated that annual freshwater catch does not exceed 100 t. The third river system, the Imo River, has its main drainage basin outside the CRS, which shares only the lower course and estuary with Imo and Rivers State. Its contribution to the CRS freshwater fish production is insignificant but its estuarine and barackishwater zone yield large quantities of fish, particularly bonga, catfish (Chrysichthys), snappers and mullets. Estimated catch from the system is about 300 t yr^{-1}.

METHODOLOGY - DATA BASE

The catch-effort statistical data used in this paper were derived from two sources:

a) Most of the data presented were collected by the CRS Fisheries under the State's fisheries statistics programme directed by the author. Details of the method used are described in Moses (1986a; 1986b).

b) The second source is the statistics collected by the Federal Department of Fisheries and NIOMR (see Tobor et al, 1977; FDF, 1980). The methodology employed in (a) and (b) had certain features in common: there was first a frame survey followed by catch assessment surveys; proportional probability sampling was used in both cases in selecting landing sites (as the primary sampling unit). However, while the Federal programme in the State was limited in time and personnel (data collectors), quite a large number of data collectors were available for the State programme and the data were collected regularly every month during the period 1969 - 1982. The method used in the State also differed from the Federal one in that the landing sites to be visited in the former were selected fresh every month whereas in the latter, the sites were fixed.

Status of CRS Artisanal Fisheries

Pre-civil war statistics of fish catch do not exist because the CRS was not created by then. However, Moses (1980) reviewing the subject concludes that such catches amounted to about 40,600 t yr^{-1}. During the Civil War, fishing, particularly in the coastal waters was reduced to an insignificant level and there are no statistics for that period. Table 3 shows the transition of the CRS fish production between 1969 and 1985. The main features of the State fisheries are illustrated in Figures 2, 3 and 4.

Estimation of Maximum Sustainable Yield (Y_{max})

Figures 5a, 5b, 5c and 5d are Schaefer plots for the four categories of the CRS fisheries to determine the maximum sustainable yield (Y_{max}). In Table 4, the results are compared with the (Y_{max}) estimated by other methods (where such figures exist). The last column of this table shows the revaluated estimate (based on the Schaefer's method, calculations from primary productivity and other available estimates) considered reasonably good by this paper bearing in mind the present state of knowledge.

DISCUSSION

Figures 2 shows that there has been a general continuous rise in the CRS fish production. During the period 1969 - 1971, the fishery was struggling to recover from the effect of the Nigerian Civil War. Full recovery occurred in 1972. The importance of the CRS fisheries to the economy of the country can be deduced from the fact that less than 40% of the catch is consumed within the State while over 60% go to other States of the Federation. The four categories into which the fisheries have been divided are discussed:

Coastal Pelagic (Clupeid) Fishery

Catches from this fishery include bonga (Ethmalosa fimbriata) which forms 83.1%, shad (Ilisha africana) and, in very minimal quantities, the flat sardinella (Sardinella maderensis) (= Sardinella eba/cameronensis) which together make up about 16.9% of the total clupeids. The mean catch of this group of coastal pelagics is 30,620 t and the Y_{max} is estimated at 45,000 t. Other coastal pelagics - the carongids are not included in this estimate. The most abundant and commercially important species of the clupeids is E. fimbriata. Perhaps because of this, more research effort has been concentrated on the species and more is known about the ecology, biology, growth and population dynamics. E. fimbriata occurs throughout West Africa from Mauritania to Angola with very high concentrations in the non-upwelling zones off Sierra Leone - Liberia and Nigeria - Cameroun (Irvine, 1948; FAO, 1984; Shotton, 1984; Boely and Freon, 1980). The fish prefers areas with muddy bottom, especially where rivers open widely into the sea and bring in large quantities of organic debris; tolerates high fluctuations in salinity (5% - 35%) and warm water (temperature > 25°C). In Nigeria, the highest biomass concentration is found in the area east of the Niger Delta between Imo and the Cross River estuaries. Recent studies in this area (Moses, 1986b) using the length-frequency method developed by Pauly (1983), give the data shown in Table 5. The present mean catch of bonga (25,030 t) is about 83% of the Y_{max} and close to its optimum economic yield (Y_{ec}). According to Gulland (1971), the optimum yield of a fishery is taken when the fishing mortality

Table 1 - Mean specific composition of catches of Cross River State artisanal fisheries 1973 - 1982

Type of fish	Mean Catch (t)	Mean Catch (%)	Price ₦.kg^{-1}	Nominal Value (Million Naira)
Barracuda (Sphyraenidae)	3337	2.8	1.0	5.3
Bonga (Ethmalosa fimbriata) and other Clupeids	30815	26.2	0.72	23.8
Catfishes (Chrysichthys, Airus)	9456	8.0	1.00	9.5
Crayfish	19690	16.8	0.60	12.5
Croakers (Sciaenidae	9567	8.1	1.00	9.6
Grunters (Pomadasyidae)	1112	0.9	1.20	1.3
Horse macherels (Carangidae)	3115	2.7	1.20	3.7
Mullets (Mugilidae)	3226	2.7	0.70	2.3
Rays and Skates	4561	3.9	1.00	4.6
Sharks	5673	4.8	1.00	5.7
Snappers (Lutjanidae)	3894	3.3	1.60	6.2
Soles and other flat fishes (Pleuronectiformes)	3894	3.3	1.00	3.9
Threadfins (Mainly Polydactylus quadrifilis)	7898	6.7	1.60	12.6
Cichlidae	556	0.5	0.50	0.3

Other Marine fishes not included eslewhere	4894	4.2	0.50	2.4
Freshwater fishes	5800	4.9	1.00	5.8
Total	117488	100%		104.0

Table 2 - Average climatic conditions of the Cross River State

Month	Temperature °C			Relative Humidity (%)	Evapora-tion rate (mm.dy^{-1})	Hours of Sunshine Calabar	Rainfail	
	Max.	Min.	Mean				Calabar	Ikot Okpora
January	32.8	23.9	28.4	84	3.9	5.4	39	15
February	33.2	23.8	28.5	82	4.3	5.7	60	35
March	32.1	23.5	27.8	85	4.0	4.6	123	115
April	31.7	23.3	27.5	87	3.9	4.8	212	210
May	30.9	23.3	27.1	88	3.6	4.8	244	225
June	29.9	22.9	26.4	90	3.1	3.7	324	380
July	28.0	22.4	25.4	92	2.3	2.2	444	325
August	27.4	22.4	24.9	92	2.4	1.7	460	445
September	27.4	22.2	24.8	92	2.6	2.0	423	540
October	28.2	22.5	25.4	90	3.1	3.5	260	265
November	29.7	22.8	26.3	89	3.4	4.6	100	135
December	31.3	22.5	26.9	85	3.7	5.3	46	35
Total								

Table 3 - Fish catch in the Cross River State, 1969 - 1985

Year	Fish Catch by Type						
	Demersal fin fish	Crayfish	Bonga (Ethmalosa)	Sardinellas & other Clupeids	Total Marine fish catch	Total Fresh water fish catch	Grand Total
1969	9.1	1.4	2.5		12.7	2.8	15.8
1970	7.8	1.6	3.6		13.2	2.8	15.8
1971	9.6	3.1	6.4		19.1	3.2	22.2
1972	42.3	10.0	18.9		71.2	4.2	75.4
1973	37.4	12.4	19.8	4.4	74.0	4.8	78.8
1974	54.3	14.5	27.3	6.1	102.1	4.9	107.1
1975	62.6	11.9	17.2	4.7	96.4	3.6	100.0
1976	78.3	18.8	20.8	5.1	123.0	4.9	127.9
1977	89.3	19.5	23.6	4.6	137.0	4.6	141.6
1978	80.0	20.1	27.3	4.6	132.0	5.4	137.4
1979	81.5	20.9	28.9	4.7	136.0	7.6	143.6
1980	56.9	25.1	28.5	5.1	115.6	6.9	122.5
1981	60.1	19.3	27.7	5.0	112.1	5.0	117.1
1982	73.8	23.9	29.0	5.7	132.4	5.8	138.2
1983	86.0	25.1	34.8	6.6	152.5	4.9	157.4
1984	45.2	18.4	21.6	4.4	89.6	7.1	96.7
1985	34.2	15.0	19.5	4.0	72.7	7.2	79.9

Table 4 - Estimates of maximum sustainable yields (Y_{max}) of Cross River State artisanal capture fisheries

Fishery	Mean catch (17 year data series	Available potential yield estimates $Y_{max} \times 10^3 t$	Reference and methodology	Y_{max} by Scaefer's model $\times 10^3 t$	Revaluated $Y_{max} \times 10^3 t$
Marine fisheries					
1. Coastal pleagic (bonga, Ilisha and sardinella fishery	30.6	131.1	Moses (1980) Schaefer's model based on 8 years data series; Moses (1980a), Schaefer's	44.8	45.0
2. Coastal and estuarine finfish fishery	61.9	139.9	model based on 11 years data series and on	96.3	96.3
3. Crayfish fishery	18.2	194.4	primary productivity respectively.	24.2	29.5
Total marine fisheries	110.7	155.1		165.3	170.8
Freshwater fisheries					
4. Cross River system	5.5	7.6	Moses (1981b) based on (i) mean yield from	7.65	7.7
5. Qua Iboe, Imo River systems	0.3	0.3	other African flood rivers; (ii) relationship between catch and basin area (see Welcomme (1975; 1979).	-	0.3
Total freshwater fisheries	5.8	7.9			8.0
GRAND TOTAL (CRS artisanal fisheries)	116.5	163.0			178.8

Table 5 - Size at age, growth, mortality, exploitation and maximum sustainable yield of *E. fimbriata* of the Cross River inshore waters

Age Group (yr)	0	I	II	III	IV	V
Total length (cm)	5.0	13.7	19.5	23.5	26.5	27.7

Growth parameters: L_∞ = 30.0 cm; K = 0.43; t_o = - 0.20

Length-weight relationship: $\log w = 1.67 + 2.98 \log l$ where w = weight (g), l = total length (cm)

Mortality coefficients: Z = 1.26; M = 0.49; F = 0.66

Exploitation ratio, $E = \frac{F}{Z} = 0.57$

Present mean catch = 25030 t yr^{-1}

Maximum sustainable yield (Y_{max}) = 30075 t yr^{-1}

Optimum economic yield (Y_{ec}) = 24000 t yr^{-1}

Source: Moses (1986 b)

Table 6 - Growth parameters for some species of demersal fish exploited in Nigerian inshore waters

Species	$L\infty$ (cm)	K	t_o	L_{max} (cm)	References
Pseudotolithus elongatus	48.04	0.28	-0.04	45.6	Nawa (1986)
Chrysichthys nigrodigitatus	68.38	2.39	-0.29	62.0	Nawa (1986)
Cynoglossus goreensis	82.10	0.097	-0.01	78.0	Nawa (1986)
Pseudotolithus typus	61.2	0.37			Longhurst (1964)
←	103.0	0.29			Bayagbona (1968)

(F) is about equal to the natural mortality (M), or $E = \frac{F}{Z} = 0.5$ since $Z = F + M$. Considering the level of the present mean catch and the exploitation ratio ($E = 0.57$) it is concluded that the present level of exploitation of E. fimbriata is about optimum.

No comparable data for the other clupeids of Nigerian waters are available. However FAO (1980) gives the following inrespect of Sardinella maderensis of the nearby Gabon - Angolan waters:-

Growth parameters: $L_{oo} = 24.92$cm, $K = 0.984$, $t_o = 0.287$
Fecundity (F_c) = 418W - 18974. Where W_6 = weight (g).
Length-weight relationship $W = 5.94 \times 10^{-6} L^{3.183}$.

Length at first capture (l_c) = 21.24cm

Total mortality coefficient (Z) = 1.93.

There is need for more research on the breeding cycle spawning grounds, growth, mortality, gear selectivity, recruitment and biomass estimation not only of E. fimbriata but also of the other clupeids (particularly of Ilisha africana) of the Nigerian inshore waters in order to formulate rational exploitation and management policies for these very valuable species.

Coastal demersal finfish fishery

The artisanal fishery exploits mostly the community of demersals that Fager and Longhurst (1968), Longhurst (1965) and Williams (1968) refer to as estuarine sciaenid sub-community. The catch is dominated by the croakers (Pseudotolithus elongatus, Pseudotolithus typus, and Pseudotolithus brachygnathus), catfishes (Chrysichthys nigrodigitatus, Arius spp) sole (Cynoglossus goreensis), snappers (Lutjanus spp), shinynose (Polydactylus quadrifilis), groupers (Epinephelus spp) grunters (Pomadasys jubilini) and the ray (Trygon).

Fishing is carried out mainly with bottom set gillnets. Catches are higher in the dry season than in the wet season. The present mean catch is 61900t yr^{-1} and the potential estimated by the Schaefer plot is 96300t. Biological data for most of the species involved do not exist.

Table 6 gives the growth parameters of a few species, the first three of which were obtained for the stock in the Cross River estuary.

The estimated maximum sustainable yield of 96,300t for this fishery is equivalent to a catch of 12.0t km^{-2} and appears to be reasonable considering the relatively high yield of artisanal coastal/estuarine fisheries on which the estimate is based. Earlier low estimates of 3.0 - 5.0t km^{-2} of Longhurst and Canovex must be seen as referring primarily to stocks available to bottom trawl fishery which is not considered in this paper.

Crayfish fishery

Although there is a high standing crop of penaeid shrimps off the ooast of Cross River State (Bayagbona et. al. 1971) and artisanal fishermen in this sector often catch large size penaeid as well as palaemonid shrimps, the population of crustaceans exploited by artisanal and subsistence fishermen here consists of tiny carideid shrimps (Palaemonidae) and juveniles of Penaeus notialis which use the sediment rich coastal, estuarine and brackishwater mangrove swamps as their nursery grounds. (Moses 1972, 1980, 1985). Large quantities of these

tiny crayfish are caught yearly (18200t yr-1, based on 17 year data series). The smoke-dried product is commonly known in Nigeria as Crayfish. Crayfish and smoked bonga bonga are the mainstay of CRS fisheries. Although several species are exploited in the fishery, ecologically all the species form a sufficiently distinct community exploitable with the same type of gear. The fishery is suitable for the application of the Schaefer model by means of which a maximum sustainable yield (Y_{max}) of 29,500t yr-1 has been derived. Most of the crayfish marketed in Nigeria comes from the CRS. There is room for further expansion of this fishery. There is also the possibility of diversifying the product offered to consumers. Already there is a product that is being marketed with the trade mark "Obu" and appear to be pure ground crayfish.

Freshwater fishery

Fish production from freshwater capture fisheries is of high economic value not only to the riverine people of the CRS but also to non-riverine hinterland communities in and outside that state. A study of the movements of freshwater fish caught in the state shows that such products are sold as far as Enugu and Umuahia (Fig. 6). The present mean catch is 550t and the potential is estimated at 8050t. The catch is, however, highly affected by hydrometeorological conditions existing a year prior to the time of recording; and unless the floodplains are modified through the construction of dams, fish farms or by the culture of fish in certain other enclosures (such as fish cages) production from this sector is unlikely to reach this potential. It was shown, however, that if the reservoirs sites identified by ENPLAN in the Cross River Basin (see Moses 1979) were developed (with fish production in mind) yield from such reservoirs could reach 21000t.

General Comments

The present mean catch of fish in the CRS (based on 17 year data series) is 115730t. Of these 44000t or a little less than 40%) is available for consumption within the state, while the rest (some 71730t) are exported to other parts of the Federation. It is estimated that about 16,400 of frozen fish, tinned fish and other imported fish products are also available for consumption in the State making the total 60400t. With a population of 5.8 million the per caput consumption of fish is 10.4 kg yr-1 (=28.5g dy-1). Since edible portion of fish (i.e. flesh less bone scales and entrails) contains 20% protein this consumption rate converts to 5.7g fish protein per caput per day. Olayide et. al. (1972) gives 12g per caput per day for CRS in 1969. If this figure is to be taken seriously it is obvious that the rate of fish consumption has fallen drastically in recent years. This may be due to reduced importation of frozen fish. The mean fish protein consumption for Nigeria is 10g per caput per day. If this national average is to be attained in the CRS, then the present demand for fish protein stands at 21170t which converts to 10585t whole fish. This means that even when the domestic catch is being supplemented by the consumption of imported fish products the deficit in the State still stands at about 35000t. The CRS which has more resources than the neighbouring inland states ought to produce sufficient fish to satisfy the demand of these states which is estimated to be about 18000t. That is, assuming that importation of fish cannot be stopped completely but would, for the foreseeable future, continue to make up not less than 10% of the total consumed fish, the CRS should be able to produce about 257000t of fish for herself and her neighbours.

of course from the analysis and discussion in this paper the potentials for production from artisanal capture fisheries (which stands at only 178600t cannot meet this demand even if the full potentials are developed; but it would appreciably lower the gap between demand and supply.

As pointed out by Moses (1983) there is a lot of waste of the present fish catch in Nigeria due to post harvest losses. The causes of such losses are numerous and include the size of dugout canoes, fishing method, poor handling, processing and preservation of the processed fish among others. Post harvest losses effectively reduce the amount of fish available for consumption. Presently, the problem of the availability of fish is being aggravated by the scarcity and high cost of fishing nets. Some daring fishermen in the CRS travel as far as to Gabon to smuggle in some nets. These problems could be alleviated if investment were to be intensified in the following areas:

(a) Bulk smoking of fish, particularly of bonga.

(b) Canning of bonga.

(c) Canning of ground crayfish (which has already been started and is being marketed under the trade mark "Obu".

(d) Boat building. There is need for small wooden boats slightly larger than the dugout, but with prices within the reach of the average artisanal fishermen. The FRP boats produced by ALMARINE are too expensive for the ordinary local fishermen.

(e) Outboard motors assembly plant. Most of the bonga fishermen in the CRS have become so used to the motorization of their boats that now that they can no longer acquire this item the number of fishermen entering the fishery is reducing.

(f) Net manufacturing. Many fishermen have abundoned fishing because of the scarcity of nets. Others who still have serviceable outboard motors resort to meeting trawlers mid-sea to buy from them trash fish for sale on land.

(g) Culture of fish in cages.

Conclusion

Although the fisheries resources of the CRS waters are not as rich as the resources of areas that experience coastal upwelling the potentials of the different categories of fisheries have not been fully exploited. There is even much reduction in effort due to the present state of the nation's economy which causes the scarcity and high cost of essential fishing equipment such as nets, boats and outboard motors. It is necessary to increase investment in the various areas of fisheries if the protein requirement of the country is to be met. Opprotunities for such investment in the various aspects of CRS fisheries exist.

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ANNEXURE

PAPER: "An evaluation of Artisanal Fisheries ..." by B.S. MOSES. Although this paper is concerned with the resources available to the artisanal fisheries, no detailed study of the economics of operation of the small scale fisheries is available. Also no detailed cash flow of any industrial fishing venture that is operating in the Cross River State is accessible because companies do not open their books to any intruder.

The cash flow shown in this annexure is extracted from the feasibility report prepared in the middle 1970s for the exploitation of the rather rich shrimp resources of the inshore waters east of the Niger Delta. In 1973-74 the Cross River State (then South Eastern State) government in colloboration with two Japanese companies (Nichiro Gyoko Kaisha Fisheries Company and Mitsubishi Corporation) carried out a pre-investment study and resource survey of the shrimp resources of this area with a chartered Japanese shrimp trawler Nisshin Maru No. 56 (30m double-rigged). The result of the exercise was very encouraging (see Moses 1980). For 180 days operation, the vessel caught 53,000kg shrimps and 95,000kg fish by-catch (which included some quantity of cephalopods).

Based on the encouraging results obtained, a shrimp fishing project feasibility was prepared. The feasibility report was accepted; the project was not executed because the Government and the Japanese group failed to agree on the management fee the Japanese group was going to charge. The resource situation has not changed and the feasibility study is still valid provided adjustments are made to take account of the present depressed economy.

Feasibility of Shrimp Trawling Venture in the Cross River State

Cash Flow/Summary of Expenditure & Profit (Unit = 1000)

Item		1st Year	2nd Year	3rd Year	4th Year	5th Year
A.	Income					
1.	Equity Capital					
1.1.	Capital	600				
1.2.	Loan	2750				
2.	Sales of fish and shrimps	2953	3443	3861	4300	4908
		6303	3443	3861	4300	4908
B.	Expenditure					
1.	Equipments & Materials					
1.1.	10 D/R 135GT trawlers	3003				
1.2.	Office building, fixtures vehicles, etc.	647				
1.3.	Fishing nets & equipment	63	69	73	76	80
1.4.	Fuel and lubrication	1041	1139	1196	1256	1318
1.5.	Other consumable items: Spare parts, etc.	128	140	147	154	162
	Sub-Total	4819	1348	1416	1486	1560

ANNEXURE (CONTD.)

2.	Labour Expenses					
2.1.	Salary	212	263	280	337	357
2.2.	Sea going allowance	91	114	136	164	196
2.3.	Foodstuff	88	96	101	106	111
2.4.	Welfare	7	9	11	13	15
2.5.	Provision of retiring benefits	40	51	63	75	90
2.6.	Other expenses on crew	28	35	36	43	41
	Sub-Total	466	568	627	738	810
3.	Loan Repayment & Interest					
3.1	Loan repayment	300	600	600	600	650
3.2	Interest on Loan	150	120	97	75	67
	Sub-Total	450	720	697	675	717
4.	Other Expenses					
4.1.	Repairs & Maintenance of vessels and plants	2	25	50	75	100
4.2.	Administration	144	132	151	174	200
4.3.	Cold storage charges	89	90	92	96	101
4.4.	Miscellaneous expenses	65	122	127	113	120
4.5.	Depreciation	640	508	401	317	252
	Sub-Total	940	877	821	775	773
	Expenditure Total	6675	3513	3561	3674	3860
C.	Profit after depreciation but before tax	(372)	(70)	300	626	1048

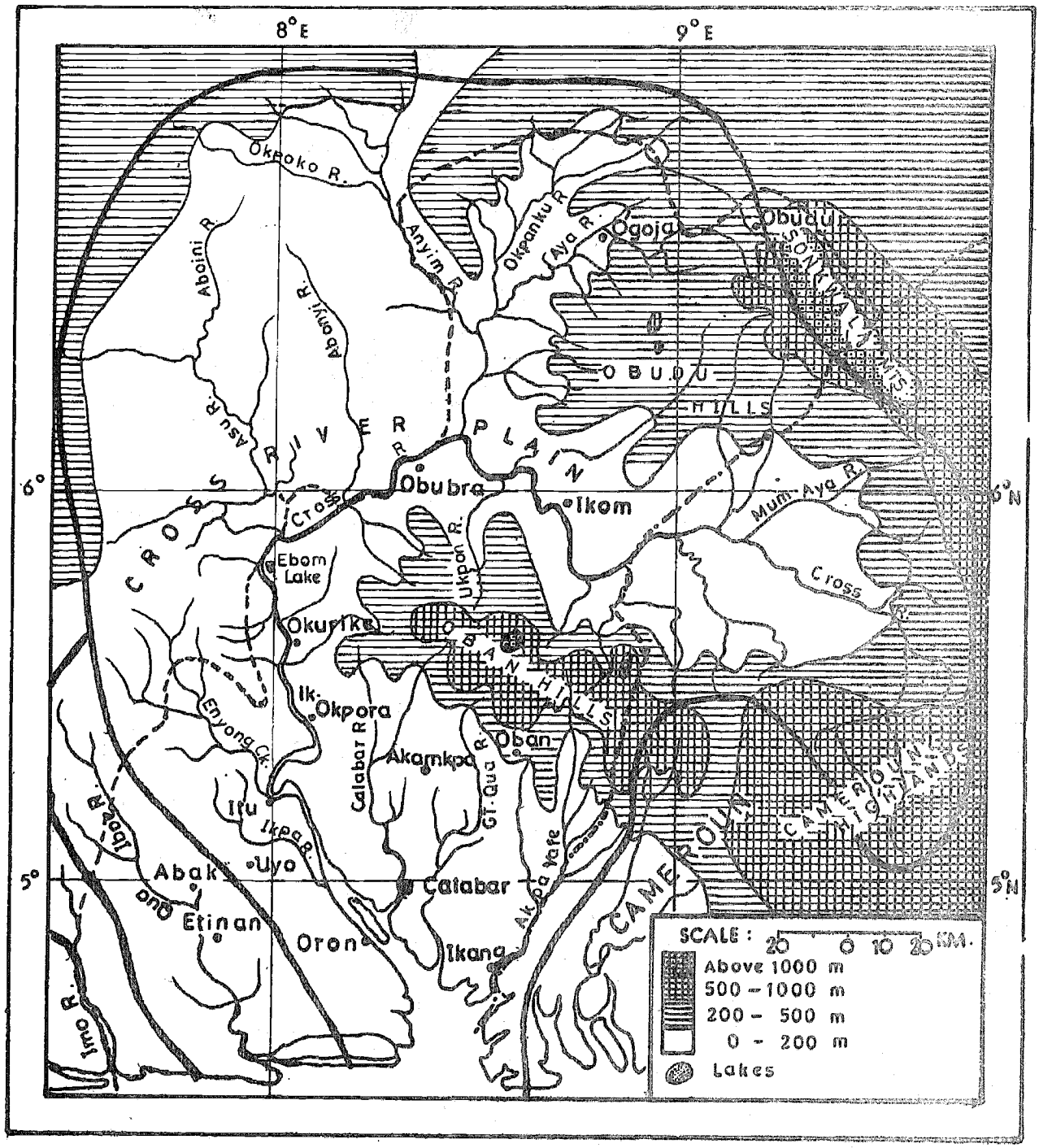


Fig.1 Map showing the CRS river systems and their drainage basins.

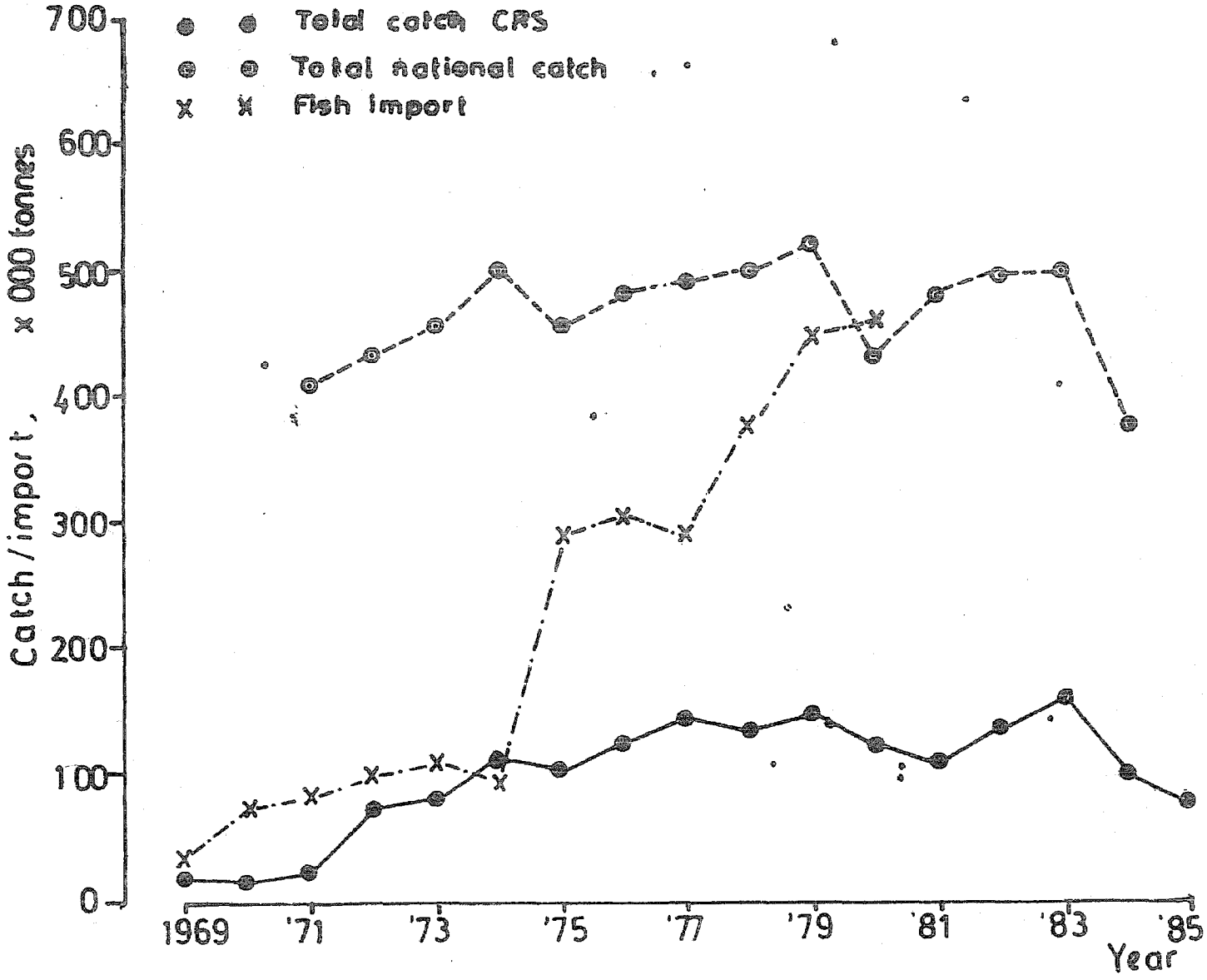


Fig. 2. Graph showing the Cross River State and national fish catch and national fish import, 1969–1985.

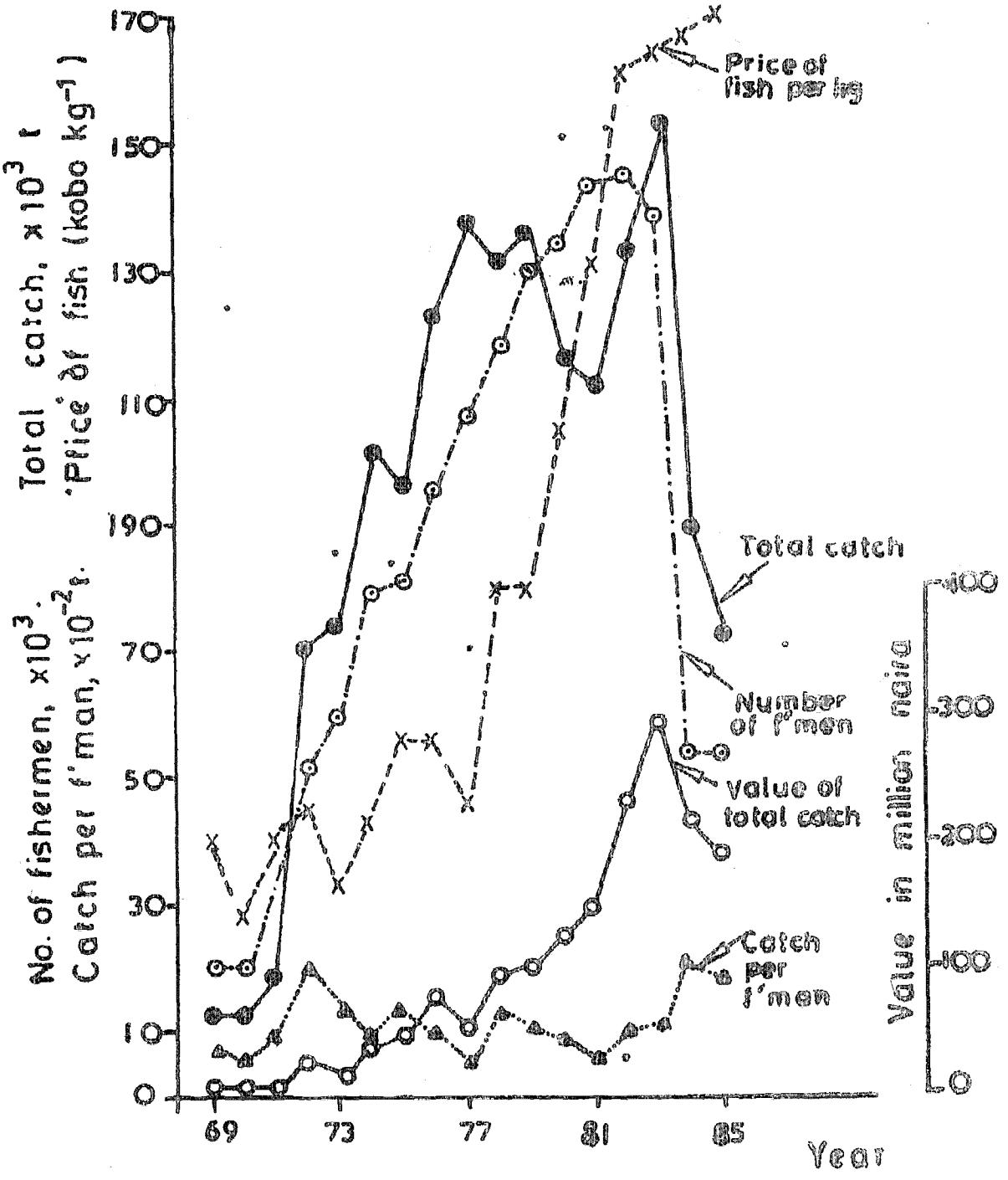
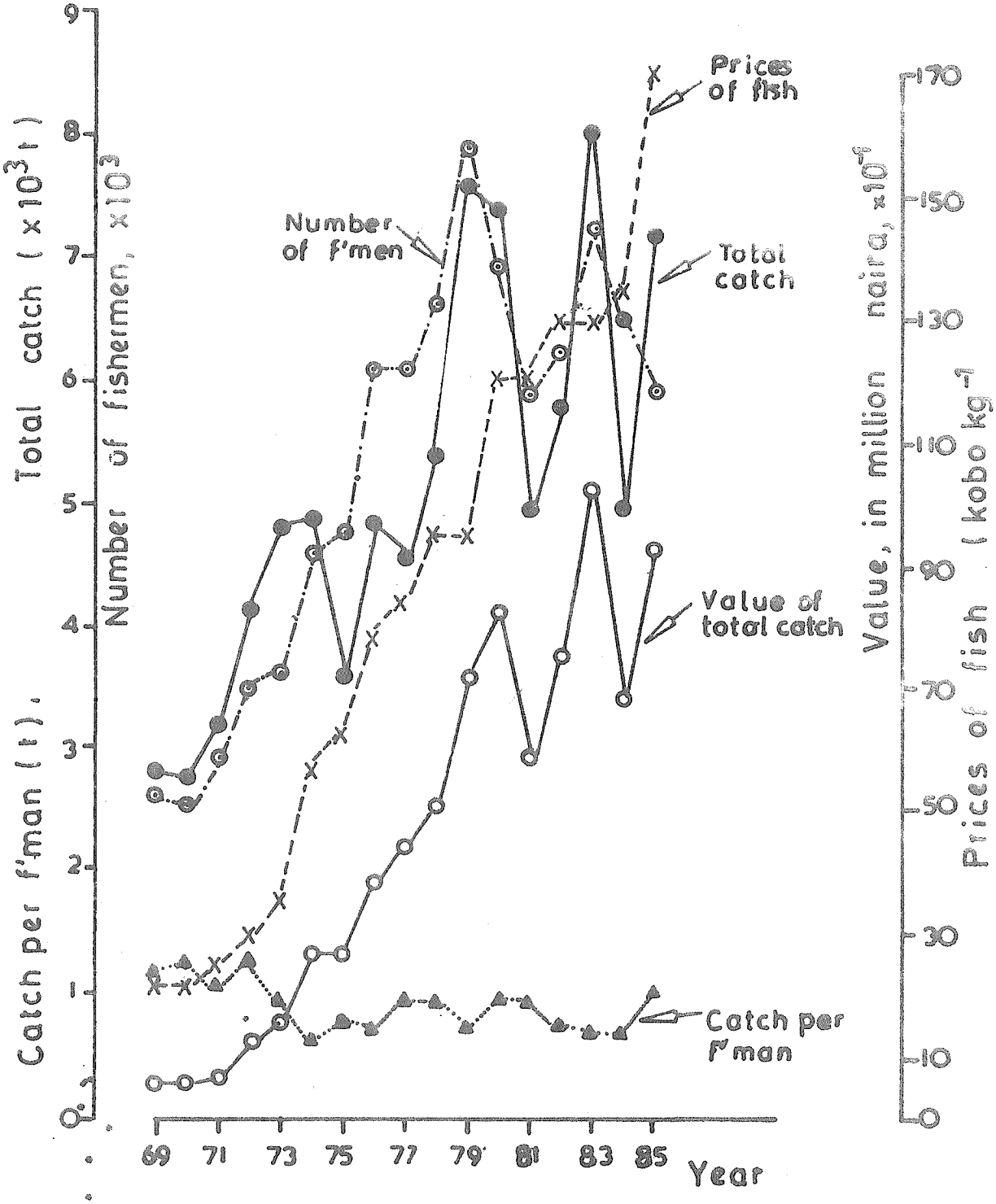


Fig.3 Evolution of the artisanal marine fisheries of the Cross River State of Nigeria, 1969-1985.



Fig·4 Evolution of the artisanal freshwater fisheries of the Cross River system, C.R.State, Nigeria (1969 - 1985)

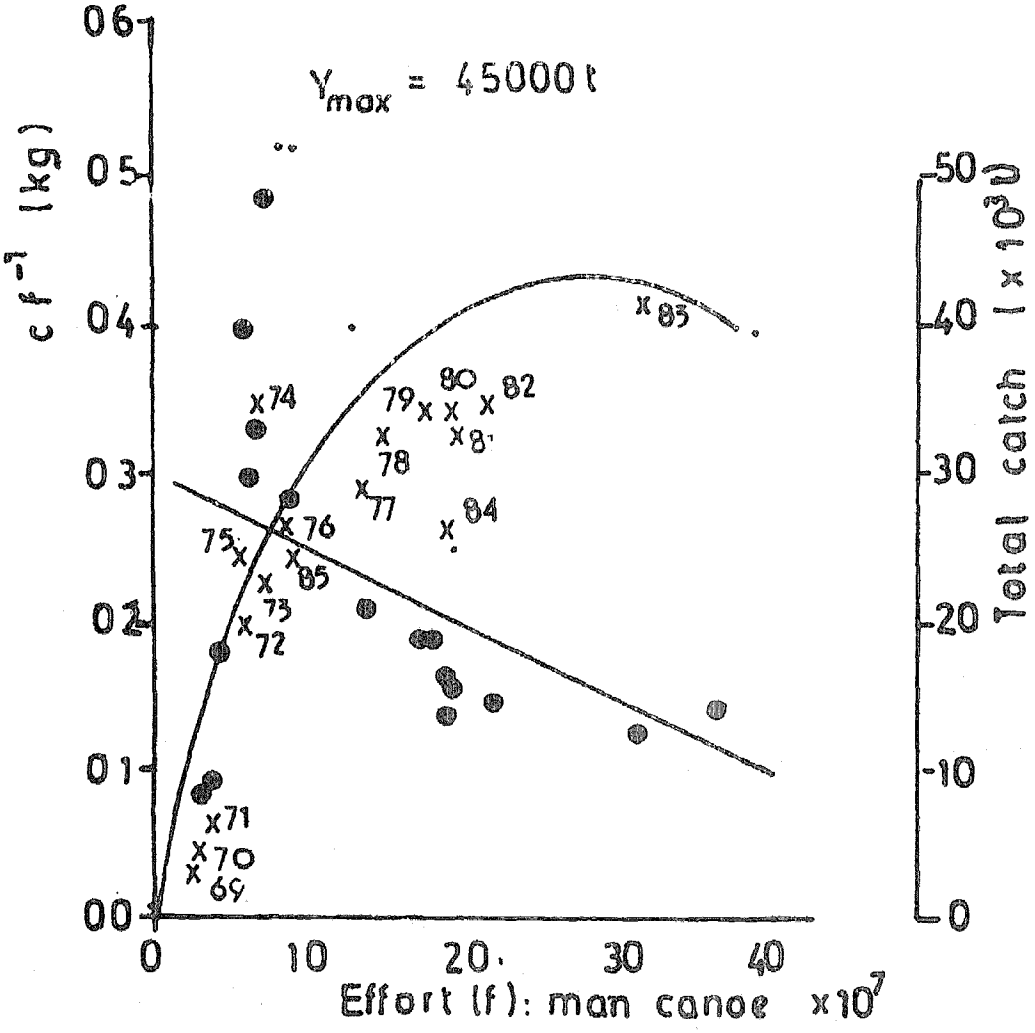


Fig. 5a. Schaefer's model plot for coastal pelagics (Ethmalosa, Ilisha and Sardinella) stocks off Cross River State.

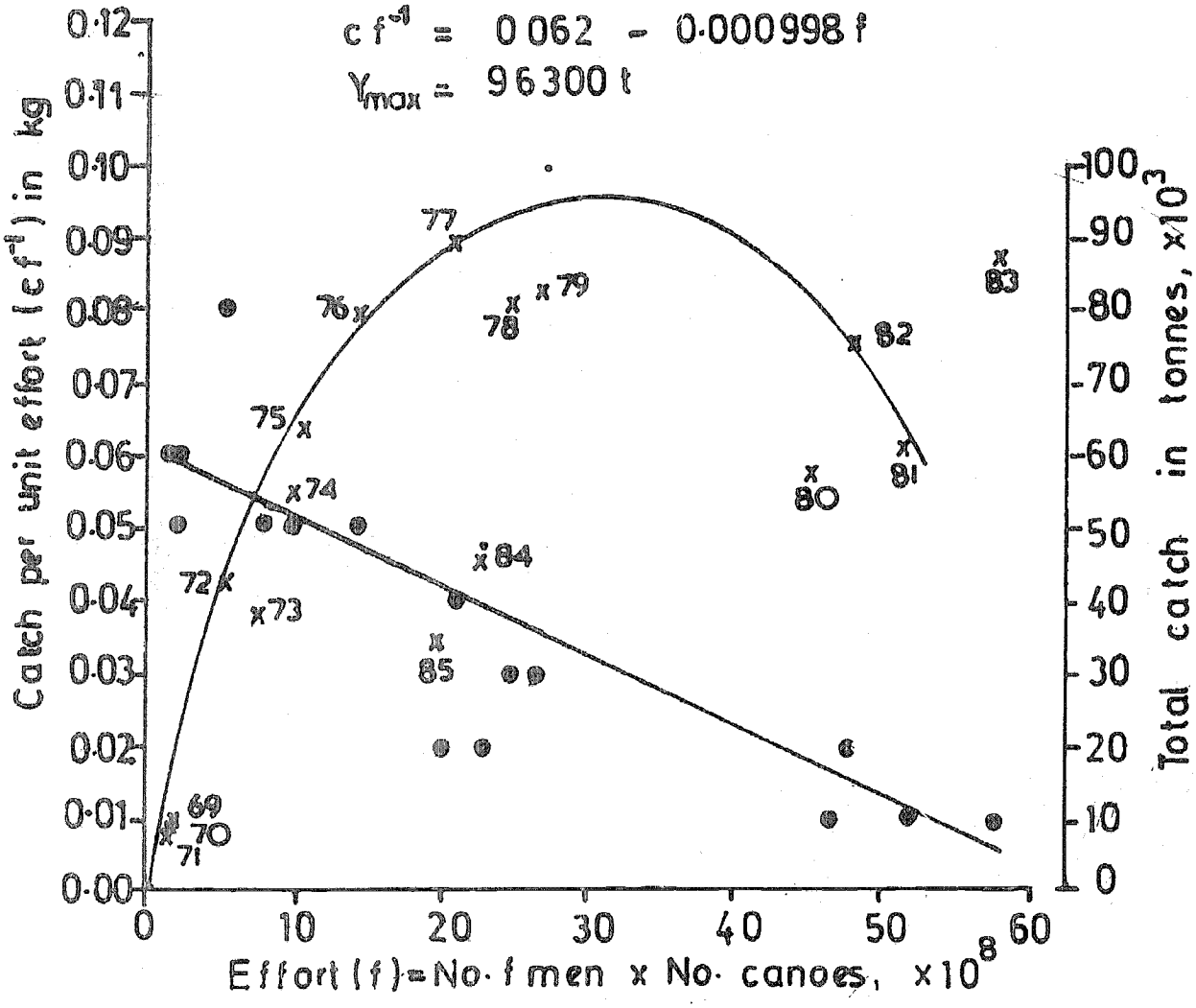
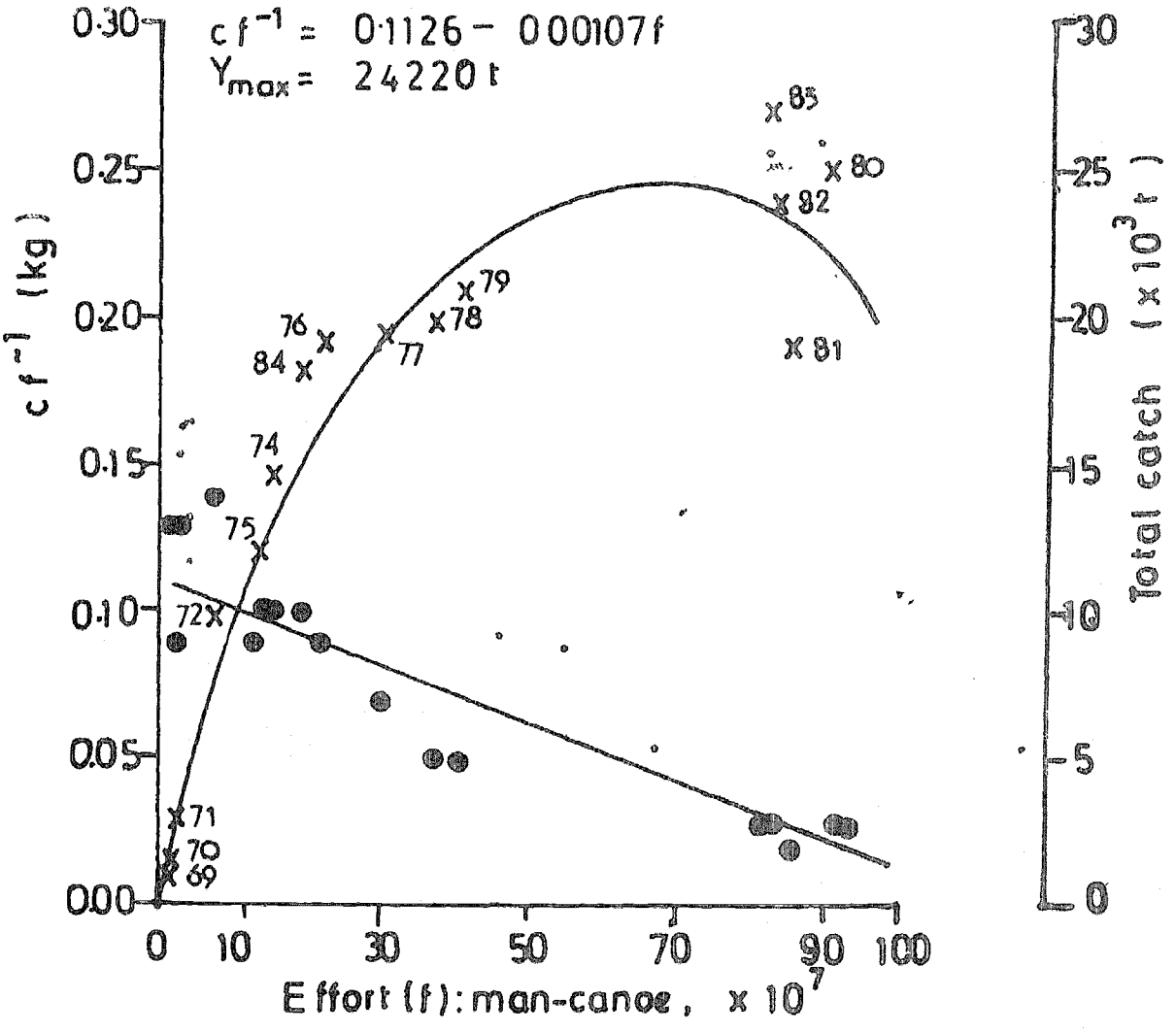


Fig. 5b. Schaefer's model plot for CRS artisanal demersal fishery



Fig·5. c· Schaefer's model plot for crayfish fishery of CRS.

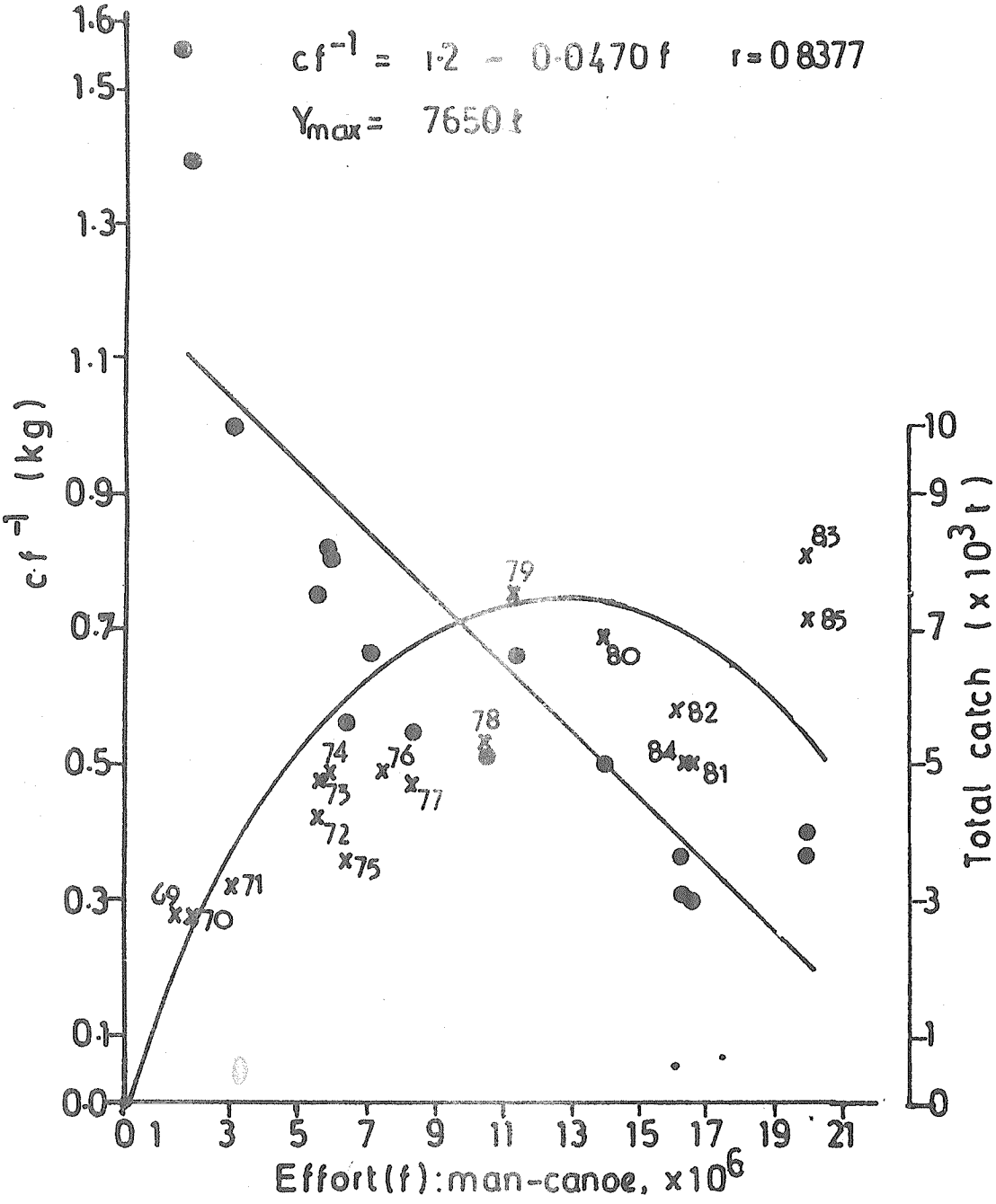


Fig.5 d. Schaefer's model plot for CRS freshwater fishery.

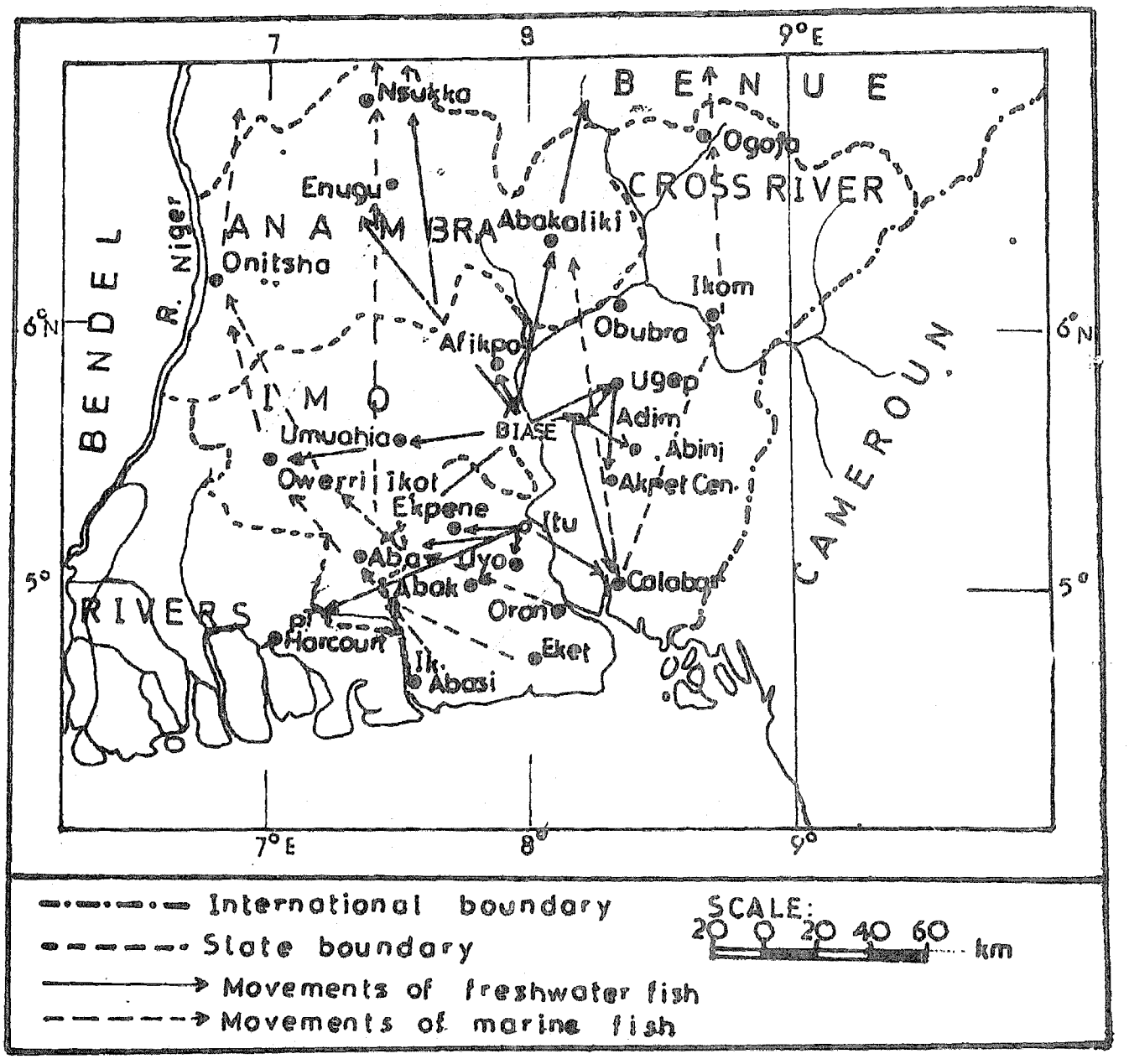


Fig. 6 Map of the eastern states of Nigeria showing the distribution of fish from Cross River State.