SOME ASPECT OF THE TRADITIONAL FISHERIES INDUSTRY IN KADUNA STATE

BY

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DECLARATION

I declare that this work is wholly the author's and has not been part of any presentation for any other qualification.

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THESIS APPROVAL

This thesis by JOSHUA SONNY ONIYE meets the regulations governing the award of the degree of Master of Science of Ahmadu Bello University and is approved for its contribution to scientific knowledge.

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TABLE OF CONTENT

		PAGE
ABSTRACT	.. .. ..	XVI
CHAPTER ONE:		
INTRODUCTION	.. ..	1
I.A.	Subject of study ..	1
I.B.	Components of fish industry	1
I.C.	Justification ..	2
I.D.	Problems	3
I.E.	Objectives	4
CHAPTER TWO		
LITERATURE REVIEW	.. ..	6
II.A.	General	6
II.B.	Fish as food ..	6
II.C.	Fish as item of economic growth	10
II.D.	Fish catch	10
II.E.	Fishing gear ..	13
II.F.	Preservation and processing	16
II.G.	Transportation ..	17
II.H.	Marketing	17
II.I.	Consumption ,,	19
II.J.	Geography of Kaduna State	22
II.J.1	General geography ..	22
II.J.2	Relief	22
II.J.3	Geology	24
II.J.4	Climate	24

PAGE

II.J.5 Rainfall 24

II.J.6 Soil 28

II.J.7 Water bodies .. 28

CHAPTER THREE

RESEARCH METHODS 31

III.A Data collection .. 31

III.A.1 Personal observation .. 31

III.A.2 Interviews .. 32

III.A.3 Questionnaire .. 32

III.B. Photography .. 36

III.C Data analysis .. 36

CHAPTER FOUR

OBSERVATIONS .. ..

IV.A. Socio-economic status of fishermen 7

IV.A.1 Major fishing centres .. 37

IV.A.2 Categories of fishermen 37

IV.A.3 Age, Religion and educational background of fishermen in Kaduna State. 40

IV.A.4 Distribution of fishermen by household size 45

IV.B. Fish production .. 45

IV.B.1 Types of fishing materials in Kaduna State .. 45

IV.B.2 Commercially important fishes of Kaduna State .. 50

IV.B.3 Estimation of weight of fish produced per day at Zaria and Kangimi dams. .. 58

		PAGE
IV.C	Fish processing and preservation	62
IV.C.1	Temporary preservation of fresh fish	62
IV.C.2	Permanent method of preservation and processing ..	62
IV.D.	Transportation ..	64
IV.E.	Marketing ..	73
IV.F.	Consumption ..	73
CHAPTER FIVE		
DISCUSSION	.. .. ..	88
V.A.	General	88
V.B.	Observations ..	88
V.B.1	Kaduna State ..	89
V.B.2	Fishing centres ..	89
V.B.3	Socio economic status of the fishermen ..	91
V.B.4.	Fish production in Kaduna State	93
V.B.5	Fish population in Kaduna State	94
V.B.6	Processing and Preservation of fresh fish in Kaduna State	96
V.B.7	Transportation of fish in Kaduna State	97
V.B.8	Marketing of fish and fish product in Kaduna State ..	98

PAGE

V.B.9 Consumption of fish and cured fish in Kaduna State .. 99

V.B.10 Conclusions .. 102

V.B.11 Prospect and potentials of fish production in Kaduna State 102

CHAPTER SIX

SUMMARY 103

IV.A. Summary 103

IV.B. Recommendations .. 104

REFERENCES 107

APPENDIX 114

LIST OF TABLES

PAGE

TABLE NO

Table I. Comparison of proteins and protein calories 9

Table II. Catch of Marine fish by country, 1974 12

Table III. Fish production by inland states 1976-1977 14

Table IV. Countries importing or exporting more than 100,000 tons of fishery products in 1968 18

Table V. Food fish consumption in 1972-1974 (3 years average) 20

Table VI. Sites where the generalized questionnaires were administered 33

Table VII. No of questionnaires administered to different income groups 35

Table VIII Fishing area of Kaduna State 38

Table IX. Types of fishermen and their percentage in Kaduna State. 42

Table X. Percentage distribution of fishermen by age and Religion 43

Table XI. Percentage distribution of fishermen by years of formal education .. 46

List of tables contd.

		PAGE
Table XII.	Distribution of married fishermen by household sizes	48
Table XIII.	Distribution of fishing materials by localities	49
Table XIV	Occurence of fish species and its abundance in Kaduna State ..	59
Table XV	Percentage of fishermen that own a sourse of transport ..	72
Table XVI	Marketing of fish by fishermen	74
Table XVII	Types of fresh fish preferred by the three income groups in Kaduna State ..	77
Table XVIII	State of fish preferred by the three into income groups	79
Table XIX	State of fish considered as most palatable	81
Table XX	Type (state) of fish considered most expensive	82
Table XXI	Type(state) of fish considered as cheapest	83
Table XXII	Types of fish considered as readily available for consumption by the three different groups	84
Table XXIII	Type of table preparations of fresh fish by the three different groups.	86

LIST OF FIGURES

FIGURE NO.		PAGE
Fig. 1.	Map of Kaduna State showing state boundaries	23
Fig. 2	The relief map of Kaduna State	25
Fig. 3	Vegetation of Kaduna State	26
Fig. 4	Mean annual rainfal of Kaduna State	27
Fig. 5	Soil of Kaduna State	29
Fig. 6	River courses of Kaduna State	30
Fig. 7	Map of Kaduna State showing towns and villages visited	34
Fig. 8	The distribution of fishermen per locality in Kaduna State	39
Fig. 9	Categories of fishermen in Kaduna State expressed as a percentage of total number of fishermen	41
Fig.10	Bar graph showing the age range of fishermen and their percentage in Kaduna State.	44
Fig. 11	Bar graph showing percentage distribution of fishermen by years of formal education	47
Fig. 12	Bar graph showing percentage of fresh fish as preferred in Kaduna State by different income groups	78
Fig. 13	Bar graph showing percentage of fish preferred in Kaduna State	80

PAGE

Fig.14 Bar graph showing state (type) of fish considered as readily available for consumption by the three different groups in Kaduna State. 85

Types of table preparation of fresh fish 87

Market structure for fishing in Kaduna State. 101

LIST OF PLATES.

PAGE

PLATES NOS.

Plate 1. Fishermen using hook and line at Galma river 51

Plate 2. Fisherman displaying clap nets 52

Plate 3. "Gora" (calabash) used for floating while using clap nets and or while tending gill nets. 53

Plate 4. Fisherman in river, using the 'Gora' as float 54

Plate 5. Fishermen in ponds using clap nets 55

Plate 6. Fishermen using cast nets 56

Plate 7. Delapidated canoe used by fishermen in Kangimi dam 57

Plate 8. Gutted salted fish place on smouldering log of wood 65

Plate 9. Fish (mainly Tilapia) split into two halves before sundrying 66

Plate 10. Curled and askewered fish 67

Plate 11. A trader displaying askewered fish arranged on long sticks 68

PAGE

Plate 12. Askewered fish on a smoking kiln. 69 69

Plate 13. A smoking kiln. 70

Plate 14. A middleman conveying fish to market with bicycle (note jute bag pieces that covers the fish). 71

Plate 15. A typical fish stall in Zaria. 72

ABSTRACT

Aspects of traditional fish industry in Kaduna State of Nigeria were investigated. The fishermen were Hausas, more than half of whom were part-time fishermen each with large number of dependants. The major fishing centres are Zaria dam, Kangimi dam, Mairuwa dam (Funtua) and Kudaru.

Gill nets, Cast nets, clap nets, hook-and-line, floating calabashes and canoes were the usual fishing gears. Bulk of the catch consisted of Tilapia, cat fishes (Claridae, Mochokidae and Bagridae), Alestes, Momyrids, Lates niloticus and Labeo species. Of these species, Clarias Lazera, followed by Tilapia sp., were the most economically important fish.

Most fishermen did not process their catch, this is entirely left in the hands of the middlemen that smoke-dried, sun dried, roasted or fried the fishes. Transportation of fish to market was done by middlemen. Over 72% of the fishermen sold all their catches to specific middlemen, these catches were not weighed, they were either sold in pieces or in bulk, and the price of fish depends on size, species and seasonal demand for fish. Among the processed and unprocessed varieties of fish presented to the customers, fresh fish was in highest demand. In view of the high cost of the fresh and smoked fish, the low income earners purchased mainly dried and iced fish. However, preference of a particular type of fish depended mainly on income.

Fisheries in Kaduna State is still in the traditional stage . However, with the introduction of modern fishing gear and fish-processing methods, the fish industry should be able to contribute higher quota to the protein supply of the state.

CHAPTER 1

INTRODUCTION.

IA. Subject of study:

Aspects of traditional fish industry in Kaduna State is the subject of this study. Hence, the research study is addressed to the socio-economic status of the fishermen, method and materials used for fishing, the distribution of various fish species in Kaduna State, traditional methods of fish processing and preservation, the transportation and marketing of fish, and the subsequent utilization of fish and fish products.

IB. Components of fish industry

The fish industry consists of the following four principal sectors:

1. The production sector, which involves harvesting of the fish either from the wild or from fish farms.
2. The preservation and processing sector, which involves the killing, cutting, cleaning, packaging and consequent storage of fish.
3. The transportation sector, which consists of the distribution methods of fish and fish products.
4. Marketing, which involves selling of either or both the unprocessed and processed fish.

IC. Justification:

Fisheries is an integrated activity directed towards the production of more animal protein. The essential amino acids, methionine and Lysine (which are absent in vegetable protein) are readily obtainable from fish (Cushing, 1975). Fish also provide vitamins A, D and E plus other essential minerials such as Iodine, flourine, calcium and potassium (Encydopedia Britannicca p. 344).

Protein deficiency is the major form of malnutrition for Nigerians in particular and the third world in general. Fortunatoly fish and fish products are ready sources of protein. However, about half of the fish consumed in Nigeria has to be imported because our supply cannot meet the demand for fish (Olatunde, 1982). In order to boost fish production, both the federal and state governments as well as individuals, are embarking on programmes that are geared towards improvements in the fisheries industry.

A meaningful revolution in our fisheries industry must begin with a fullscale study of the present status of the traditional fisheries industry, the outcome of which should help in the formulation of goal-oriented policies in fisheries. This work is one of such studies that are geared towards an appraisal of the current fisheries practices. From observations made in this study in relation to the more sophisticated fisheries practices in other parts of the world, certain recommendations would be made on how best to solve the problems of fisheries industry, particularly in Kaduna State.

ID. Problems:

The problems of fishers in Kaduna State which are intended to be tackled in this study are many and varied. These problems are by no means unique to Kaduna State, rather, they are general to many states of the federation.

In the first place there is no adequate data on the number of full-time, part-time and occasional fishermen in Kaduna State; their source(s) of income as well as their sociological status in the community are subjects of this investigation. Therefore, any meaningful appraisal of fisheries industry of Kaduna State must of necessity begin with the fishermen because he is of course, the centre of the fisheries industry.

The second area of fisheries in which data is lacking is the composition of fish species in Kaduna State rivers, the abundance of each species and the nutritional as well as economic importance of the various species. Though, fishermen have recently being complaning about low productivity of rivers and reservoirs, Rehman (1980) suggested that the low productivity of the water bodies in Kano and Kaduna State must have being due to insufficient supply of stocking materials. Low productivity in our rivers could also be attributed to overfishing, bad cropping techniques and inefficiency of the fishing gears. Therefore a knowledge of fish species, techniques and gears used for fishing is a major tool in formulating recommendations for the fisheries industry.

In most fishing areas of the tropics, there are usually no reliable and means of fast transportations to carry the catches from fishing grounds to relatively distant consumer areas (Mann, 1961). Under tropical conditions temperature and humidity is high, and these factors hasten the rate of

especially when fresh fish is not immediately consumed or processed. Even in cases where the fish were processed by smoking, salting or drying, heavy losses are also incurred due to poor transportation, fragile-nature of the dried fish, insect attack and poor processing.

Another area of fisheries in which data are lacking is the fish preferences of Kaduna State residents, these include the type of fish preferred and the state of fish desired for consumption.

IE Objectives:

At the end of this study it would be possible to state categorically

1. The socio-economic position of the fishermen
2. Traditional cropping techniques and types of dominant fish species in each locality.
3. The methods of processing and preservation of fish in the state.
4. The marketing in conjunction with the transportation of fish.
5. The consumption patterns and the categories of consumers and their preferences for processed fish.

The findings of this study are expected to give, not only substantial knowledge into the traditional state of fish industry in Kaduna State, but also provide the basis for formulating recommendations for the promotion of a profit-oriented fisheries industry in Kaduna State of Nigeria.

CHAPTER II

LITERATURE REVIEW

IIA. General

Apart from a few sketchy notes on the fisheries of the northern zone of Nigeria by Reed et al 1967, Aiyedun and Adegboye 1966 and Lysak 1978, very little attention has been paid to fish industries per se in Kaduna State. Most of the work done on fisheries in Kaduna State has been concentrated mainly on the harvesting of fish in Kaduna State. However, as mentioned in the earlier part of this thesis, fish industry extends beyond the production of fish, it also includes preservation and processing, transportation, Marketing and consumption of fish.

In this review, the world picture of fisheries industry will be presented in conjunction with that of Nigeria and an attempt will also be made to highlight the little that is known about the fisheries in Kaduna State.

IIB. Fish as food

Since time immemorial, man has hunted and killed animals to provide meat to eat. The range of species hunted, slaughtered and consumed included reinder, musk, ox, hyena, ass, horse, bison, aurochs (extinct wild ox), ibex, deer as well as wild sheep and goat, wild pig and species of birds. It is also clear that fish and molluscs have been a major part

of man's diet for several thousands of years (Bowman, 1977).

In the world today, particularly the third world, there is rapid increase in population, this has resulted in a huge demand for increase of animal protein and other nutritional requirements. This is crucial in the developing countries where demand for exeeds the supply (Olatunde, 1982). Amino acids are the building blocks of proteins and are much more important than carbohydrates or fats in the synthesis of cytoplasm. In order to grow, the human body must have amino acids for building muscles, skin, hairs, nails, the various organs; the amino acids form enzymes, hormones, nucleoproteins and other cell components. They may release energy when utilized as fuel (Richard and Karl, 1912; Cleveland, 1970).

The consequences of poor diet, especially a diet that lacks proteins of the right kind, are most serious amongst children. Newly weaned children in many countries receive only a starch gruel that may be rich in calories but poor proteins. This deficiency leads to the disease called "Kwashiorkor", which, in its severe form, is characterised by the failure to grow, oedema, damage to numerous body organs and lowered resistant to infection. Malnutrition is widespread among children in most tropical areas, particularly in Asia, Latin America and Africa (Royce, 1972).

Thus in the face of widespread shortage of protein, a static and probably soon to worsen food situation, the fisheries offer hope to people who are in dare need of animal protein.

Apart from providing high protein food, fish also offers vitamins A, D and E, iodine, flourine, calcium and potassium. Fish supply relatively high proportion of amino acids such as lysine, methionine, threonine and tryptophan which are scarce in plant protein (Cushing, 1975; Royce, 1972). "In an adequate human diet, at least 12% of calorific intake need to be protein" (Encyclopedia Britannicca) - this much the fish can provide (see table I).

TABLE 1

Comparison of proteins and protein calories

ITEMS	% PROTEIN (WT)	% PROTEIN (CALORIES)
Fish (flesh)	18-25	48-81
Oyster	10	50
Shrimp	21	87
Beef	17	39
Poultry	21	51

Source : Encyclopedia Britannicca, P. 345.

IIC. Fish as items of Economic growth

Apart from being a source of high level protein, fisheries industry (as an agricultural venture) also provides employment opportunities, it increases the earning power of the people involved thereby conserving foreign exchange that might be spent on food importation. Where productivity of fish (and any other agricultural products) becomes high, the nation might enjoy surplus of such a magnitude as to permit export (Oyatoye, 1982). Nicholas (1963) emphasized the "almost universal importance of having a substantial and reliable agricultural surplus as the basis for launching and sustaining economic growth". Kuznets (1961) also pointed out that a substantial rise in productivity of a resource signifies economic growth. Therefore if ifish production is high, thereby creating surplus, the amount needed to purchase fish will be reduced thus making animal protein to be within the easy reach of the masses, and this is an evidence of economic growth.

IID. Fish catch

The total registered world aquatic production in the year 1970, was 74,000,000 metric tons (excluding whale) of this amount only 7,400,000 metric tons, approximately one seventh of the total, was made up of fishes originating in the fresh waters of lakes, rivers and ponds. The greater portion of the catch, 55,700,000 metric tons,was obtained from marine waters; shell fish accounted for about one tenth of this amount (Encyclopedia Britannicca, P.347).

Idyll (1974), gave the figures in Table II as catch of marine fish by some countries in 1974. In Nigeria, the total domestic fish production in 1972 was estimated as 644,000 tonnes of which rivers and streams accounted for 164,500 tonnes (Anon, 1974). In the second national development plan (1970-1974), the volume of fish available to Nigerians from all sources was estimated at 270,500 metric tons of this figure, imports of stock-fish together with landing of chartered vessels accounted for 190,000 metric tons. This means that we produced 80,5000 metric tons. Olayide et al 1968, estimated desirable demand for fish as 1.356 million metric tons for 1975, 1.775 metric tons for 1980 and 2.337 million metric tons for 1985. For the period between 1975 and 1980 (third national development plan period) fish production was estimated as 644,300 metric tons while the fish demand projection was set for 1.5 million metric tons.

The major water bodies that supply the country's bulk of inland fisheries are rivers Niger, Benue, Cross river, their tributaries and lake chad. The fisheries potential of Kainji dam was estimated by Daget(1961) at between 6,000 and 12,000 tons per year. In lake Chad, Sagua (1982) stated that "about 200,000 tonnes of fish was caught in 1976/1974 and this dropped to 100,000 tons in 1979. In the Niger , Benue and Cross rivers, it is reported that fish produced is consumed locally therefore it is not possible to categorically confirm the present level of exploitation.

TABLE II

Catch of Marine fish by country, 1974)

Country	Catch in million tons
Japan	9,963,000
U.S.S.R.	8,835,000
Peru	4,125,000
U.S.A.	2,696,000
Denmark	1,835,000
India	1,472,000
Phillippines	1,181,000
Canada	923,000
Nigeria	685,000
Poland	675,000
Brazil	572,000

Source: Extracted from "The sea against Hunger"
by Idyll, C.P. 1974.

Total production of fish in Kaduna State was estimated by Federal Ministry of Agriculture at 8000 tonnes in 1971, but more recent estimates are not available. However, Sagua (1982) gave an estimated fish production in Kaduna State as 3,310 metric tons in 1979 (see Table III).

II E. Fishing gears:

Fishing gears have evolved almost from the dawn of man, and innovations have continued ever since man first harvested fish from the wild. Even today, on a world wide basis, the fishing gear varies from the most primitive to the very sophisticated gadget. (Lagler, 1968; Royce, 1972).

Royce (1972), has classified fishing gear as follows:

Hand diggers and collectors: These are mainly hand operated rakes or digging equipment for hunting mollusks, crustaceans or other burrowing animals. Trained mammals or birds are also used as collectors.

Dredges: These are power operated rakes or excavators for fishing out molluscs, crustaceans and other burrowing animals.

Spears: Spears have handles made of either metal or wood with pointed tip made also of metal or wood. Harpoon is another type of spear that has detachable head that is fixed on a line. Harpoons are mainly used for hunting large fish.

Stupefying aids: These are mainly used to stun fishes. Such stupefying aids include poisons, explosive and electricity.

TABLE III

Fish production by inland states 1976-77

(in metric tonnes)

Years	1976	1977	1978	1979
Sub-totals	155,119	156,742	165,274	167,235
STATE:				
Anambra	3,982	3,982	4,039	4,247
Bauchi	3,386	2,412	2,445	2,572
Benue	8,906	9,010	9,141	9,602
Borno	62,886	63,483	70,679	67,797
Gongola	11,443	11,558	11,726	12,337
Kaduna	3,070	3,105	3,149	3,310
Kano	6,527	6,598	6,692	7,037
Kwara	15,358	15,531	15,756	16,557
Imo	1,484	1,500	1,520	1,601
Niger	103	104	104	111
Oyo	298	301	296	321
Plateau	2,630	2,412	2,445	2,572
Sokoto	36,089	36,499	37,029	38,908

After Sagua (1982)

Hooks and lines: These are hand-held castinglines trolling lines towed from boat, set lines (longlines) with many hooks which may or may not be baited and set at various depth in water

Stationary entangling nets: These are stationary nets set at various desired depth. They include the gill and trammel nets with either single or multiwalled mesh.

Stationary enclosures: These are large or small traps made of net and mainly used for coastal and river fish. Rigid net made of metal nets are used for eels and crustaceans.

Mobile enclosing nets: These are trawl nets which are towed along or at mid depth, seines are pulled on bottom of water towards a fixed point, purse seines are floating and has purse line to close bottom of seines. Other mobile enclosing nets include cast net and Lift net.

Fishing with lines, traps, spears, hand or nets used from manually operated boats are primitive. Fishing with medium to large vessels with lines trawls, or purse seines are termed modern fishing equipments. Such vessels have modern method of fish preservation and processing equipments on board.

In Nigeria, inland fishermen use traditional instruments like fish traps, nets, hooks, canoes and calabashes (Reed et al 1967; Solarin and Udolisa, 1978; Fagade, 1972; Amadi; 1977; Olatunde, 1982 and Sagua, 1982). Therefore from the above context of classification, Nigerian fishing equipments could be termed as traditional.

IIF. Preservation and Processing:

If fish captured is not consumed immediately then there is the need to devise ways of reducing or stopping post-humous spoilage. All wet fish are perishable, as micro-organisms on the skin, gills and in the intestinal tract multiply rapidly and decompose amino acids and protein into ammonia, hydrogen sulphide and other compounds which are characteristic of microbial spoilage. Therefore the principal aim of fish preservation is to delay, reduce or inhibit the microbial spoilage (Hansen, 1979).

The various ways of preserving fish includes:

1. Preservation by freezing
   a. Freezing of wet fish
   b. Freezing of cooked and cured fish
   c. Freezing of minced fish.
2. Preservation by drying
   a. Drying whole fish
   b. Drying split fish
   c. Drying fillet fish
3. Preservation by salting
   a. Salting when wet then drying
   b. Drying then salt
4. Preservation by canning or bottling
5. Preservation by smoking.
6. Preservation by frying or cooking.

Methods of processing and preservation in Nigeria include salting, smoking, roasting and drying of the fish. In Lake Chad area, the fish caught is processed into 'Banda". Banda is produced by cutting the fish into chunks of 2-3 inches dried in the sun for about two hours after which dry grass is placed over the fish and set alight. After burning for half an hour, the fish now charred and roughly smoked, is dried in the sun for several days and then packed in sacks. The processed and packed fish (banda) is transported by lorries to distant markets in Nigeria (Reed et al, 1967).

IIG. Transportation:

Rafts, dug out canoes and calabashes that are used for fishing also serve as a form of transport from place of catch to harbour, markets or distribution centres. The ocean trawlers also serve as a made of transport.

The use of refrigerated vehicles have recently been introduced for the transportation of fish to distant markets. Fishermen of lake Tangayika and Malawi in East Africa use bicycles to convey their catch to the markets (Maar et al, 1966).

IIH. Marketing:

Between 1920 and 1950, the primary products sold in the world markets were fresh and cured fish; Later on, herring and industrial fish became the most important in value, but salmon was more valuable in Europe, U.S.S.R. and North American. In the 1960s, the world fish markets changed, primarily as a result of the large landings by Peru and Chile (Bligh, 1972).

TABLE IV

Countries importing or exporting more than 100,000 tons of of fishery products in 1968.

IMPORTERS.		EXPORTERS.	
Country	Thousands of tons.	Country	Thousand of tons. tons.
U.S.A	1,546	Peru	2,412
W. Germany	982	Norway	819
U.K	966	Demark	497
Neitherlands	423	S.Africa	481
France	358	Japan	471
Japan	336	Canada	394
Italy	306	U.S.S.R	320
Belgium	218	Iceland	287
Denmark	192	Chile	213
Sweden	182	Neitherlands	199
Spain	171	Sweden	192
Poland	121	W.Germany	113
		Morocco	104

Source: Food and Agric. Organization of the United Nation (1969) "Year book of fisheries statistics" Vol. 27, F.A.O. Rome - Italy.

The total International Trade in Fishery product in 1968 was about 8.5 million tons. Peru was the leading exporter, accounting for about 28% of the total, and U.S was the leading importer, accounting for about 18%. Other countries with large share of the fish trade are Western Europe, Japan, South Africa U.S.S.R, Chile, Poland and Morocco, (See Table V.)

The inland fisheries of tropical Africa do not contribute much to the world fish market (Bligh, 1972). To confirm Bligh's statement, Daget 1961 remarked that fish caught in Rivers Niger and Benue if not locally consumed by the fishermen's families, they are marketed only locally. According to Sagua (1982), about 20% of the fish caught in Lake Chad is consumed in the immediate vicinity of the lake while the remaining 80% is transported to markets in other parts of Nigeria. The marketing of the Lake Chad fish is a highly organised and complicated system which is under the control of very experienced fish traders. Reed et al, 1967, remarked that fish marketing along River Niger is almost entirely in the hands of women who often drive a hard bargain with their suppliers (their husbands) and even tougher ones with their customers.

II.I Consumption

Average fish consumption per capita in developing countries (7.6kg) is only a little more than half the world average (13.1kg) (Kenneth, 1980). Of the world's fish supplies, 38% are absorbed by the developed countries and another 34% are taken by centrally planned economies, leaving 28% to the developing countries (See table VI).

TABLE V

Food fish consumption in 1972-1974 (3 years Averages)

	Million tons	%	Kg/capita
Developed countries	19.2	38	25.7
Developing countries	14.0	28	7.6
Centrally planned	16.7	34	13.6
World	49.9	100	

Source: F.A.O. commodity projections.

In relative terms, fish is much more important to the consumer in developing world; about 60% of the population in these countries derive more than 30% of their animal protein from fish and fish products and for many countries in all continents, fish must be regarded as a main and indispensable item in the diet. Therefore there can be no doubt that fisheries if properly managed could make a significant contribution to food supplies in developing countries.

Statistical record over the past 15 years shows that per capita consumption of fish in developing countries increased by 600gm since the early sixties, in developed countries by some 3.5kg and in Eastern Europe and the U.S.S.R. by some 9kg (Enoyclopedia Brittanicca). This means that the rich had a greater supply of fish than the poor of the world. Efforts have to be stepped up to bridge the gap between the rich and the poor countries particularly in terms of fish consumption. The Nigerian Federal Department of Agriculture, in 1967, estimated the per caput consumption of animal protein at 28.6kg per annum of which 37% or 10.6kg were from fish. This underlines the importance of fish as an item of diet for a great population of Nigeria (Sagua, 1980).

Actual fish consumption by the inhabitant in Kaduna State is not known and other related fisheries data are not available. Therefore, the need has arisen for an authentic "On the spot" assessment of fisheries in Kaduna State: this is the goal of this study.

II.J Geography of Kaduna State

In order to fully appreciate the level of fisheries industry in Kaduna State it is desirable to obtain a clear picture of the state, especially that part of geography that affects the fisheries set up. This includes relief, geology climate, rainfull and water bodies of Kaduna State.

II.J.1 General Geography

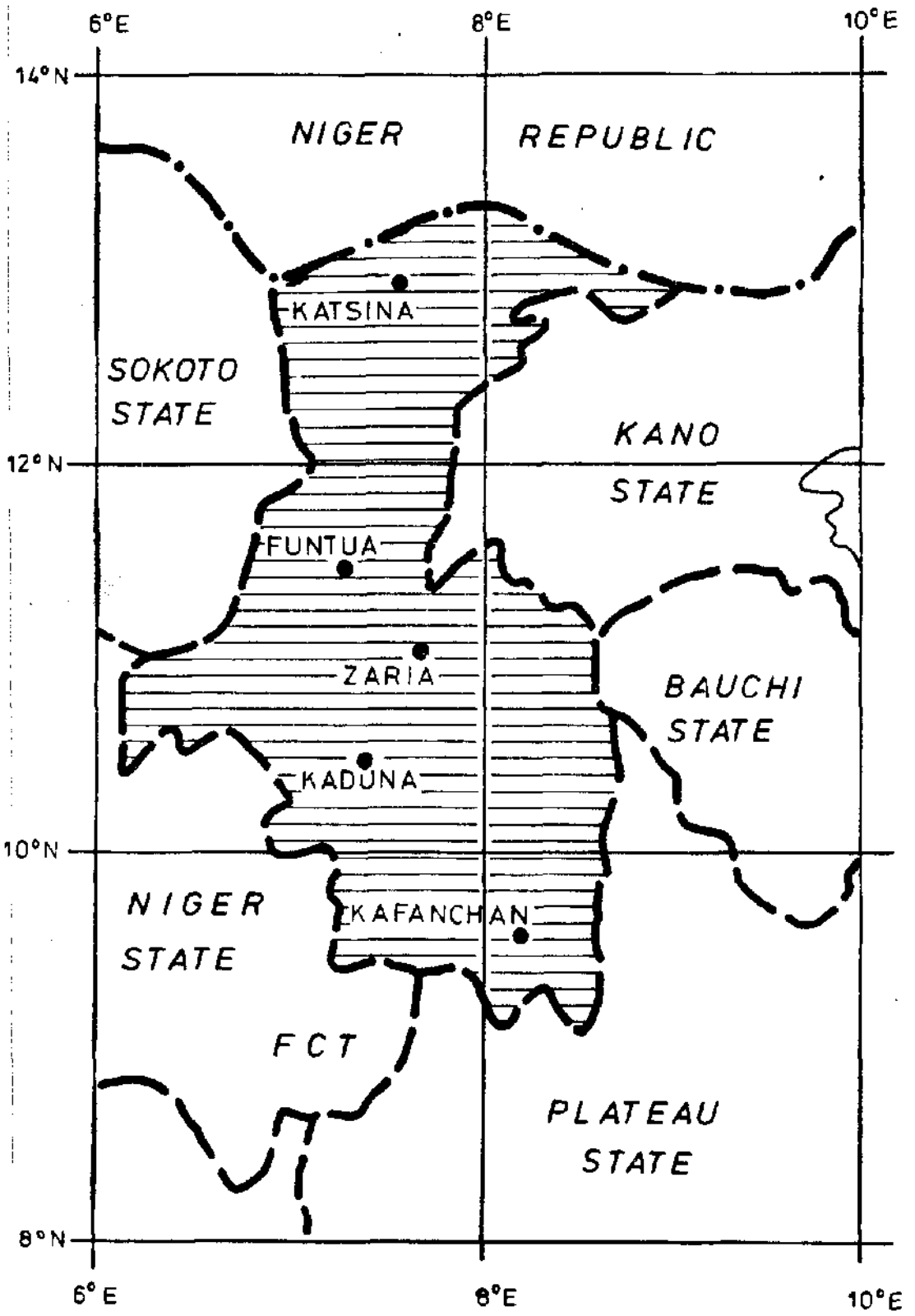
Kaduna State extends from latitude 9°N to Latitude 13° 15'N or approximately 460km from South to North. To the West of the State are Sokoto State and Niger State, Plateau State is to the South East, Kano and Bauchi State are to the East while Niger Republic forms the state boundary to the North (see Fig. 1). The width of the state varies and is widest along a line drawn approximately in a West-East direction from Birnin Gwari to Saminaka Roughly 290km. The state has an approximate area of 70,210km^2 (Abalu, 1979). Within such a large area, soil and climate are naturally variable.

II.J.2 Relief

The Northern area of the state has the broken plains of Hausaland. The topography from Funtua to Katsina is gently undulating and there is a gradual decline in latitude of about 1.5m per kilometer from 671m at Bakori to 503m at Katsina and 457m near the northern frontier (Goddard, 1975)

The central portion of the state forms part of the Hausa land plains and characterised by gently undulating topography and very long gentle slopes (Konan, 1975).

Fig. 1 MAP OF KADUNA STATE SHOWING STATE BOUNDARIES



Scale: 1:40 miles

To the south are the plains of Kaduna State, which give way to the Jema'a platform in the Southernmost part of the state, but there are occasional hills which rise above 600m above sea levels in the area of Jema'a (fig. 2)

II.J.3 Geology

The northern tip of the state is covered by pre-cambrian basement complex rocks. This basement complex rocks includes the oldest known rocks in Nigeria and pricipally composed of igneous and metamorphic rocks such as granite, gneisses, migmatites and extensive areas of schists, quartzite and metamorphosed derivatives of ancient sediments.

The central part of the state have inselbergs of granitic origin which dot the area and are quite conspicuous in the southern part of the old Zaria province.

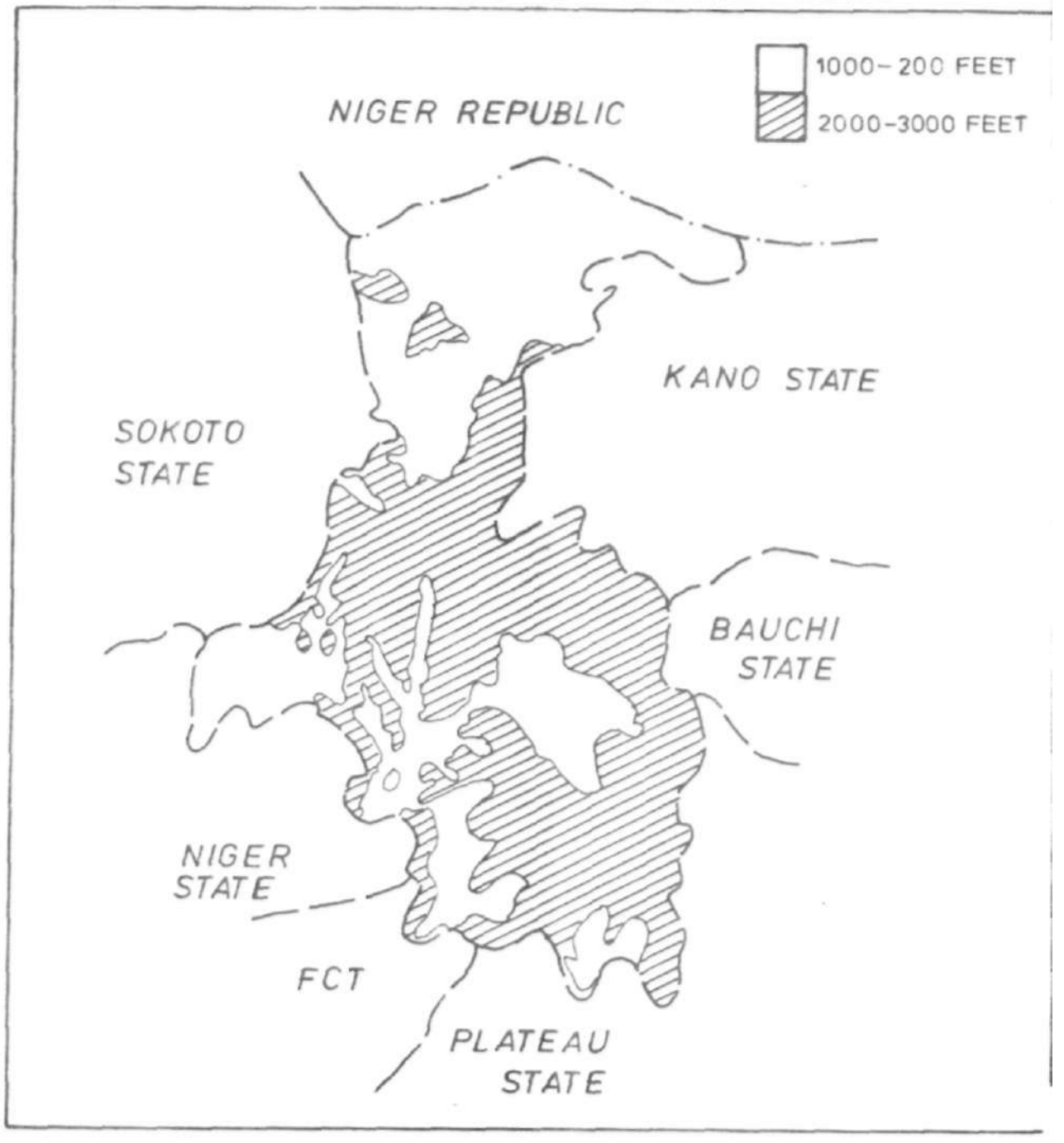
II.J.4 Climate

The climate of the state varies from North to South. In the extreme north there is the sahelian type of climate with highly variable and unpredictable rainfall. In the south there is rainfall for about 7 months of the year. In General, the climate can be described as one characterised by alternating wet and dry season, increasing from south to north (Econs. Survey of Kaduna State: Agric. pp.6) (fig. 3).

II.J.5 Rainfall

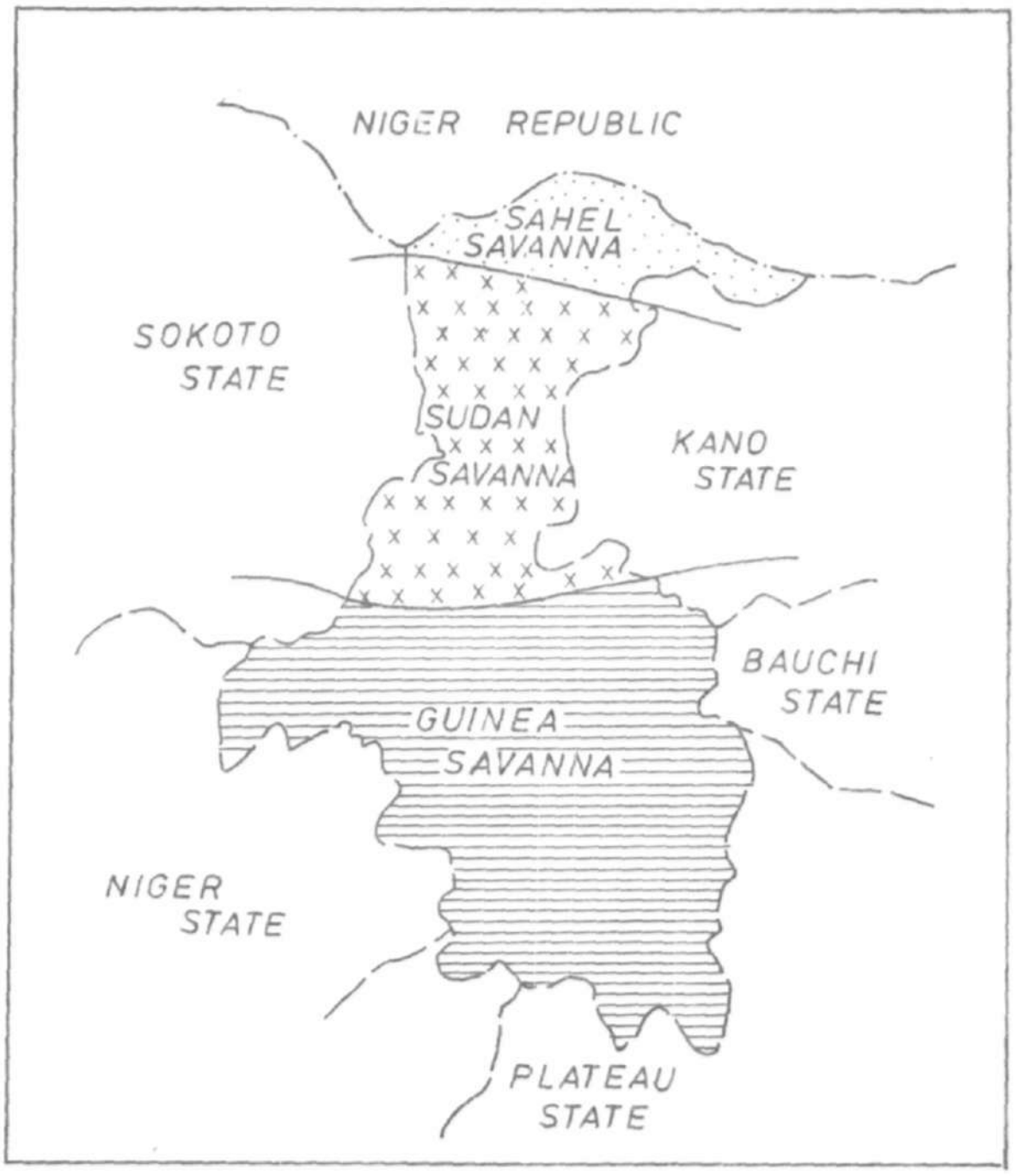
Rainfall decreases from south to north, rain starts around April in the extreme south and June in the far north. The end of the rains come rather abruptly from mid September to early October in the north and central part of the state.

Fig. 2 THE RELIEF MAP OF KADUNA STATE



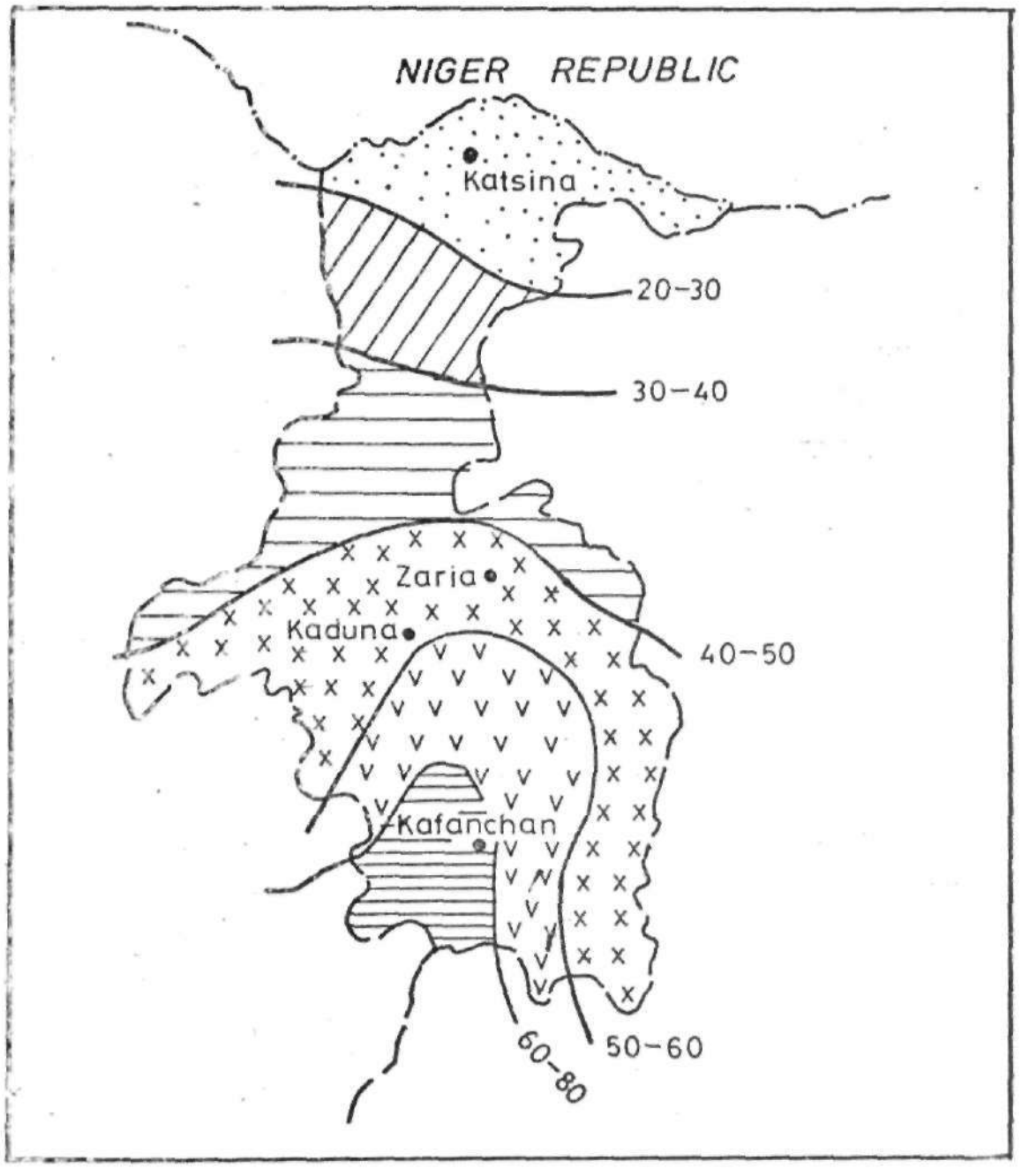
Scale: 1:40miles

Fig. 3 VEGETATION OF KADUNA STATE



Scale: 1:40miles.

Fig. 4 MEAN ANNUAL RAINFALL OF KADUNA STATE



Scale: 1:40 miles

In the south, the end of October normally marks the end of the rains. The average rainy period ranges from 190 days in the south, with a total of about 1600mm of rainfall, and 80 days of rainfall in the North with a total of about 600mm of rainfall. Fig. 4 indicates the rainfall pattern in Kaduna State.

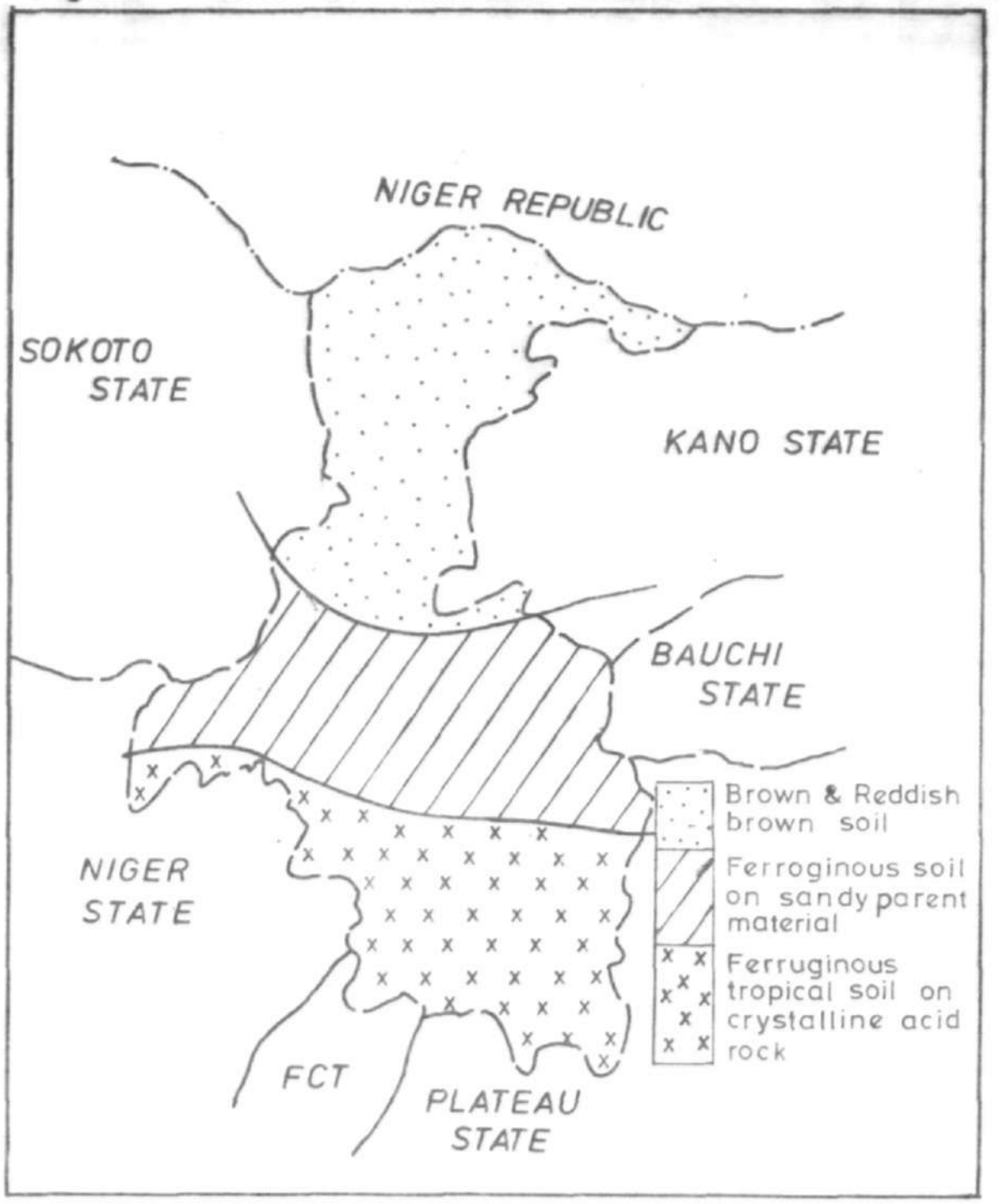
II.J. 6 Soil

As shown in fig 5, brown and reddish-brown soils occur in the northern parts of the state in the old Katsina province (Grove, 1952). The soils in the Funtua-Zaria-Kaduna areas are broadly classified as ferruginous soil on sandy parent material and carries typical northern guinea Zone vegetation. The Southern soils are mostly ferroginous tropical soils, derived from cystalline acid rocks and lithosols. They carry a southern guinea Savanna Zone vegetation. (see fig. 5).

II.J.7 Water bodies

Rivers Kaduna and Gada, both tributaries of the Niger river show significant flow even during the dry season. Other important rivers include Gurara, Galma and Mada. Numerous smaller rivers exist, but most carry little water during the dry season. Man made lakes exists in virtually every local government area, but the most important ones from fisheries point of view are Zaria dam, Kangimi dam, and funtua dam. A rough estimate would be that there are about 2,500 hectares of water surface in Kaduna State that is potentially suitable for moderate stocking actions and organized net fishing (Lysak, 1978). The more permanent river courses of Kaduna State are shown in fig. 6.

Fig. 5 SOIL OF KADUNA STATE



Scale: 1:40 miles

Fig. 6 RIVER COURSES OF KADUNA STATE



Scale: 1:40 miles

CHAPTER III

RESEARCH METHODS

III.A. Data collection

Most of the information obtained in this study were from interviews conducted in Hausa and English languages by the author. The information on the fisheries of Kaduna State was obtained in three ways, namely:

i. Personal observation

ii. Interviews

iii. Questionnaire.

The logistics considered before the administration of the questionnaires include.

a. The use of the maps of Kaduna State to locate rivers and dams where fishing is of economic importance

b. Accessibility of the chosen sites to vehicles

c. The importance of the chosen sites in relation to their local government head-quarters as potential markets.

III.A.1 Personal observation.

In order to have a first hand knowledge of the status of fishery industry in Kaduna State the author visited the various areas in which fishery activities take place. The aspects of fisheries that lent themselves to personal observation and assessment were noted.

Some of the author's personal observations were captured in pictures.

III.A.2. Interviews.

In areas where personal observation was next to impossible, the author was able to gather information by discussing with the individuals that were involved in fisheries. By this means, much information was obtained in areas of fisheries.

III.A.3. Questionnaire:

a. A generalized questionnaire (Appendix 1) was used as a guide for collecting information from the fishermen. A total of eighy two (82) fishermen at the fifteen (15) localities visited were interviewed (see table VI and fig 7)

b. A second questionnaire was also designed (Appendix II) to evaluate consumers preference in terms of type of fish consumed, and state of fish preferred. The consumers were grouped into three (3).

    a. Low income earners: Farmers, fishermen and those on government level 01 to 03.

    b. Middle income earners: Those on level 04 to 07.

    c. High income earners: Those on scale level 08 to 17.

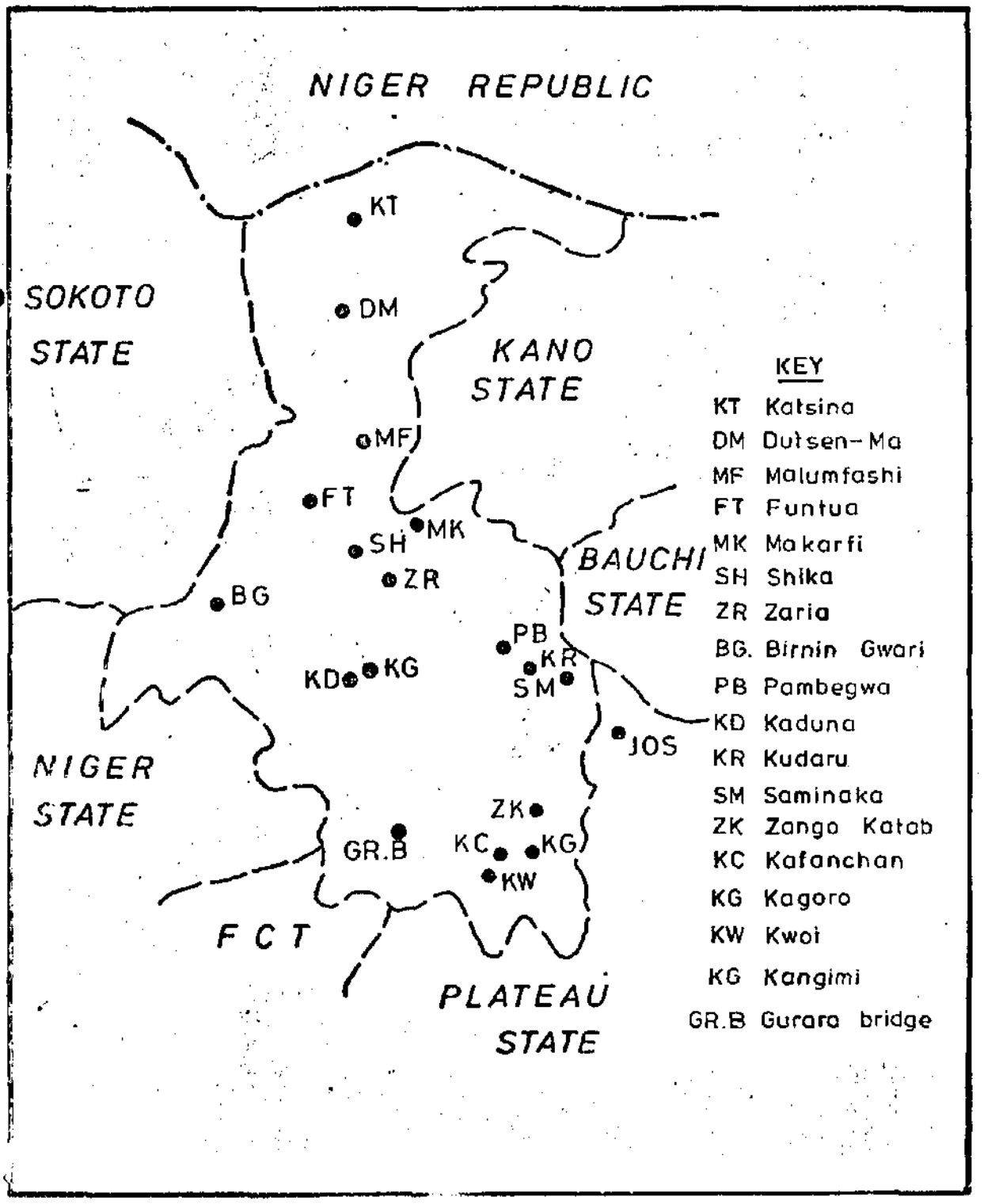
The later questionnaire was randomly distributed between these categories in order to obtain unbiased information. A total of 763 people were interviewed by means of this questionnaire.

TABLE VI

Sites where the generalized questionnires were administered.

Locality	No of fishermen interviewed.
Guria dam + Galma River.	21
Shika	5
Funtua (Mairuwa Dam)	11
Dutsin-Ma	6
Birnin Gwari	4
Kangimi dam	18
Kaduna	5
Bakarfi	3
Katsina (Ajwa dam)	3
Kafanchan	0
Zango Katab	2
Kagoro	0
Kwoi	0
Gurara bridge	2
Ku'aru	2

Fig. 7 MAP OF KADUNA STATE SHOWING TOWNS AND VILLAGES VISITED



Scale: 1:40 miles

TABLE VII

No of questionnaires administered to different income groups.

Groups	No. of questionniares	Percent.
Low income	398	52
Middle income	235	31
Upper income	130	17
Total	763	100

III.B. Photography.

In order to record the personal observations made in this study, a number of photographs were taken to record certain aspects of fisheries in Kaduna State. The camera used was Yashika, model Mg.1 and the type of photography film and paper used were black and white and coloured kodak films, and Kodak developing paper respectively. Developments and printing were carried out in the dark room of the Department of Biological Sciences and by Kowa colour laboratory.

III.C. Data analysis

Data collected were analysed under the following headings.

a. Socio-economic status of fishermen

b. Production of fish

c. Preservation and processing methods

d. Transportation

e. Marketing.

f. Consumption.

Where necessary, some of the data were subjected to statistical analyses.

CHAPTER IV

OBSERVATIONS

IV.A Socio-economic status of fishermen

IV.A.1 Major fishing centres'

The major fishing grounds in the state are Zaria (Zaria dam), Kangimi (Kangimi dam), Funtua (Mairuwa dam) and Kudaru . Of these centres, only Zaria and Funtua can be regarded as permanent settlement, Kudaru and Kangimi fishing centres have semi permanent settlements.

As shown on table VIII, the incidence of fishermen in Kaduna state are as follows in descending order - Zaria, Kaduna Funtua, Dutsin Ma, Shika, Birnin gwari, Makarfi, Katsina, Kagoro and Kafanchan. Of the total number of fishermen interviewed, over 25 percent were in Zaria local government area while more than 20 percent were located in Kaduna Local government area.

IV.A.2. Categories of fishermen

Fishermen interviewed can be classified into three categories.

a. Full time fishermen
b. Part-time fishermen
c. Occasional fishermen

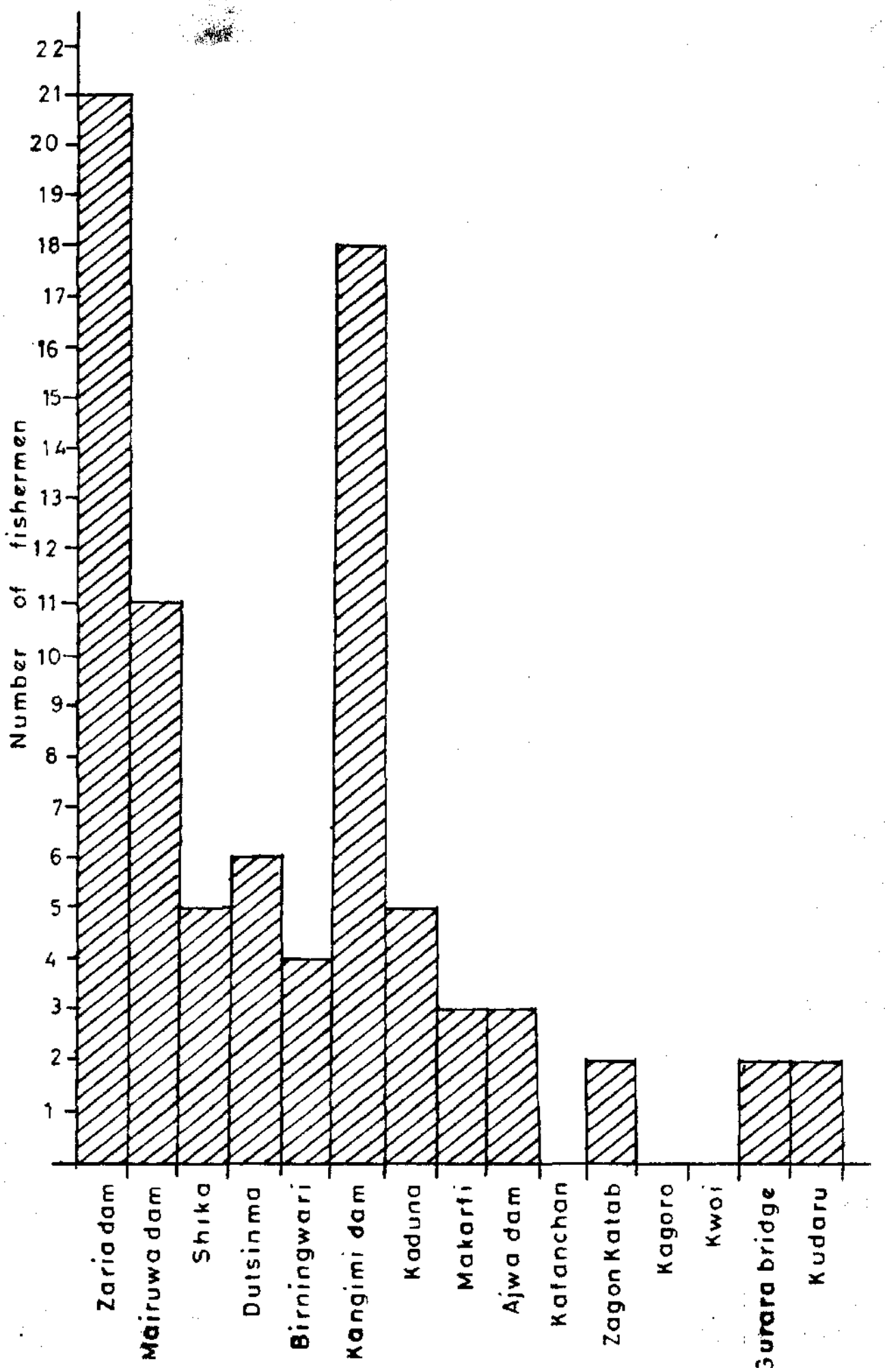
a. Full time fishermen: Men whose occupation throughout the year is fishing. Such men are often referred to as "sarkin ruwa" (King of water) or Head fisherman.

TABLE VIII

Fishing Area of Kaduna State.

Name of towns or fishing Centres	Location (Local Gov)	Nature of settlement	Population of fishermen interviewed.	
			No.	% Total
Zaria(Kuria-Dam).	Zaria	Permanent	21	25.61
Funtua(Mairua wa Dam)	Funtua	"	11	13.41
Shika	Zaria	"	5	6.10
Dutsin Ma	Dutsin Ma	"	6	7.32
Birnin gwari	Birnin Gwari	"	4	4.88
Kangimi (Dam)	Kaduna	Semi permanent	18	21.95
Kaduna	Kaduna	Permanent	5	6.10
Makarfi	Makarfi	"	3	3.66
Katsina (Ajwa Dam)	Katsina	"	6	9.66
Sango Katab	"	"	2	2.44
Gurara bridge	"	Temporary	2	2.44
Kudaru		Semi permanent	2	2.44
			82	100

Fig. 8 : The distribution of fishermen per locality in Kaduna State



b. Part-time fishermen: Are those who are basically engaged in farming but who often supplement their farm-earning with occasional fishing, especially during the peak fishing periods of May, June and October to December; or may be engaged in other trade such as bicycle repairing and sales of provision. Some of them even serve as middle-men for the sales of other household goods, while others were Carpenters and Brick layers.

c. Occasional fishermen: Mainly teenagers and school children who often run to the rivers with line and hook for fishing.

Of the 82 fishermen interviewed 53 or about 65 percent were part-time fishermen, 25 percent were occassional fishermen while the remaining 10 percent were full-time fishermen (see table IX).

IV.A. 3. Age, Religion and Educational background of the fishermen in Kaduna State.

The result of the investigations on the age and religion are summarised in Table X. Over half of the fishermen between the age range of 21-40 years could be termed as active fishermen. Only about 10 percent of the 82 fishermen were 20 years of age. Those within the age range of 41-60 years were only 32.25 percent of the total fishermen. As expected, all the fishermen were muslims.

Fig. 9 Categories of fishermen in Kaduna State expressed as a percentage of total number of fishermen

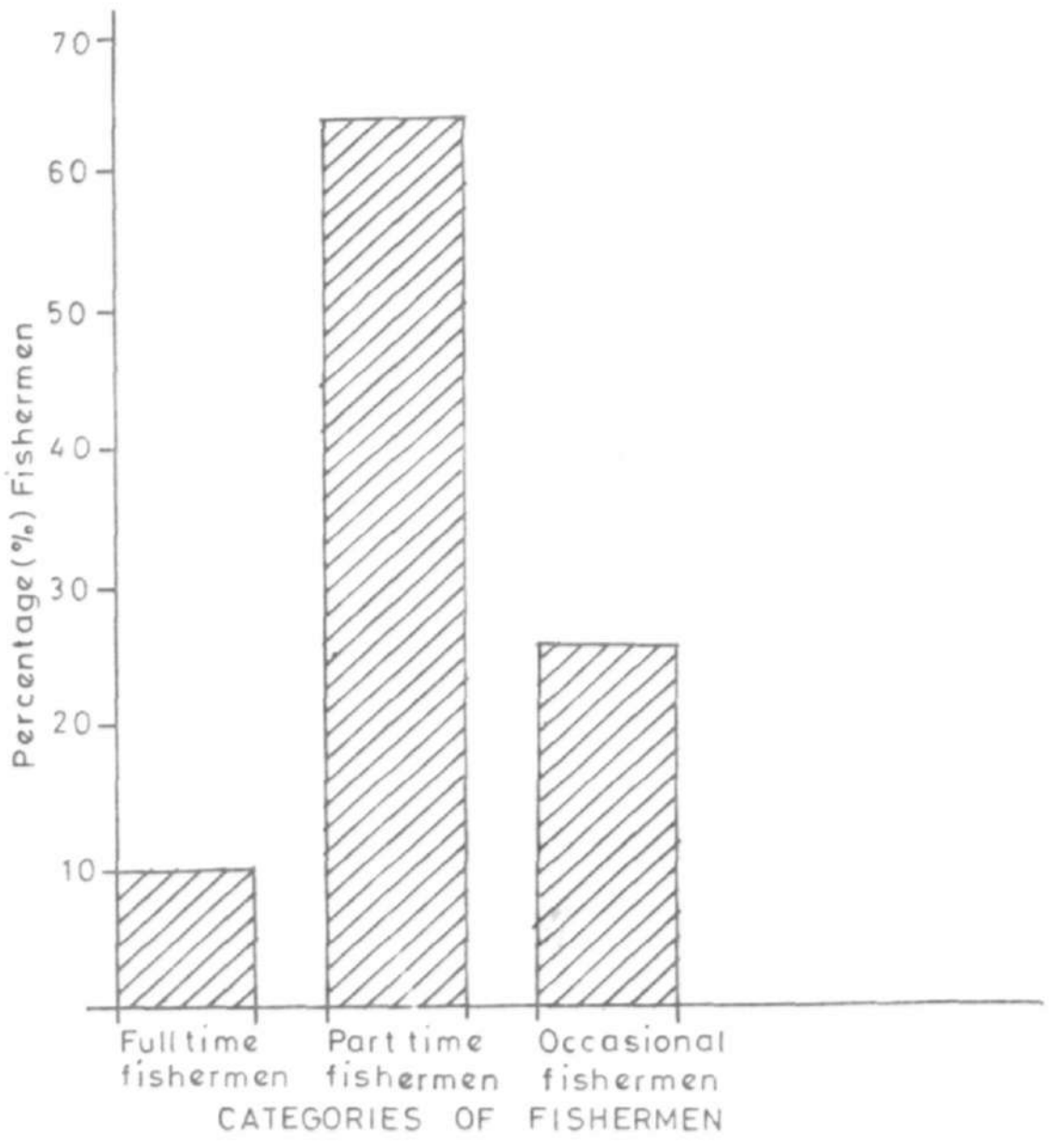


TABLE IX

Types of fishermen and their percentage in Kaduna State.

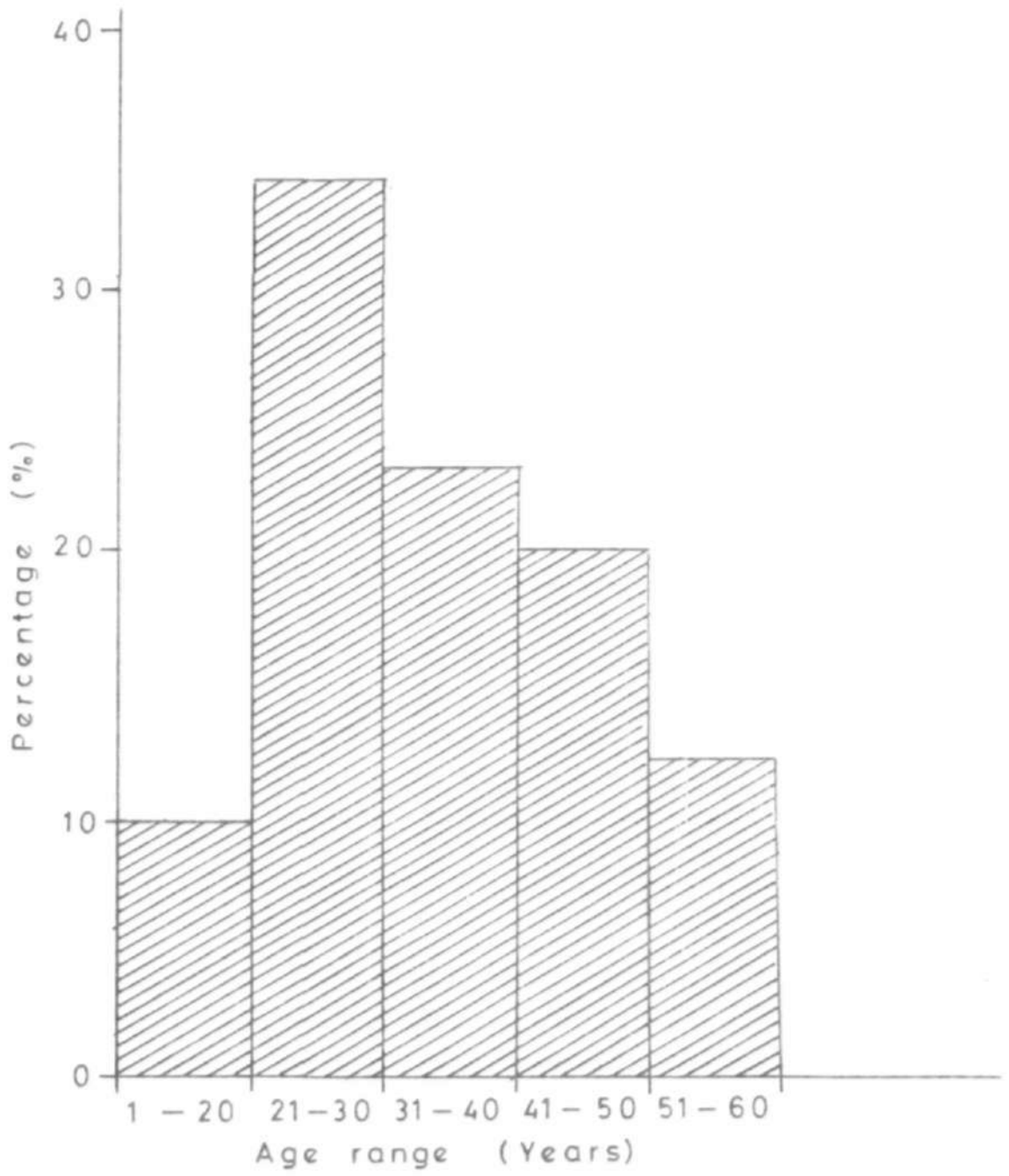
Types of fishermen	Number	Percentage.
Full time fishermen	8	9.76
Part-time fishermen	53	64.63
Occasional fishermen	21	25.61

TABLE X

Percentage distribution of fishermen by age and Religion

Age range (Years)	Number	%	Religion
<20	8	9.76	Islam
21-30	28	34.14	"
31-40	19	23.41	"
41-50	17	20.07	"
51-60	10	12.18	"

Fig. 10 : Bar graph showing the age range of fishermen and their percentage in Kaduna State



As shown in Table XI, over half of the fishermen (58.53%) have no formal western education; while less than 4 percent read above primary six (Class 6) However, all the fishermen calimed to be able to write and read Arabic, which is a form of education.

IV.A.4. Distribution of fishermen by household size

Of the 82 fishermen interviewed 67 or close to 82 percent were married. Each of the married fishermen also maintained a household with a number of dependants.

Table XII shows the distribution of the married fishermen by household sizes.

As mentioned earlier on, 67 of the 82 fishermen were married. Furthermore, of the married fishermen, about 50 percent maintained a household of 5 to 7 persons. Slightly over 10 percent of the married fishermen had households of more than 7 people, while 40 percent maintained between 1 and 4 individuals in their household. (Table XIII).

IV B Fish production

IV.B.1. Types of fishing materials in Kaduna State

The three-prong investigation of the fishing gear used in Kaduna State indicate that a variety of fishing materials are employed by the fishermen. The fishing gear include hook and line, clap nets, cast nets, gill nets, boat and canoes, traps and of course the calabash.

TABLE XI

% Distribution of fishermen by years of formal education.

Years of education	No	Percentage %
0	48	58.53
1-3	26	31.90
4-6	5	5.96
6	3	3.60

Fig.11: Bar graph showing percentage distribution of fishermen by years of formal Education

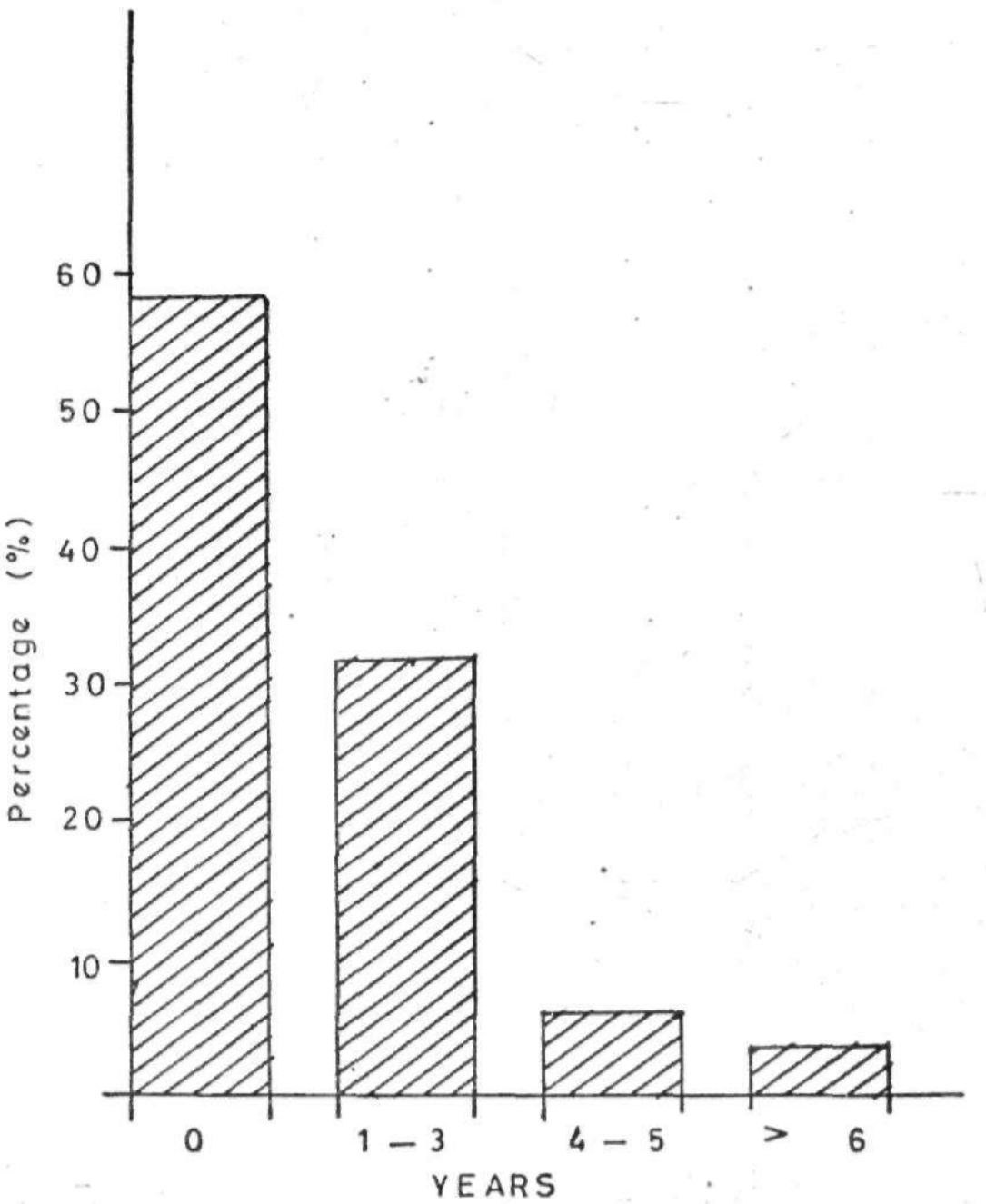


TABLE XII

Distribution of married fishermen by household sizes

Size of household	No of fishermen	Percentage %
1-4	27	40.30
5-7	33	49.25
7>	7	10.45
	67	100

TABLE XIII

Distribution of fishing materials by localities

Materials	Locality where used.
Hook and Line	Birnin gwari, Dutsin Ma, Katsina, Funtua, Zango Katab, Gurara bridge, Shika, Zaria.
Clap nets	Zaria dam, Kangimi dam, Kudaru
Cast net	Zaria dam, Kangimi dam, Kudaru
Gill net	Zaria dam, Kangimi dam, Funtua dam Kudaru
Boat or canoes and calabash.	Zaria dam, Kangimi dam, Kudaru
Traps	Galma river.

These items are shown in plates 1 through 7.

Virtually all the full time and part-time fishermen used cast net and gill nets with which they caught bulk of their fish. Clap net which were used mainly in shallow waters, formed the fishing gear of both the part time and full time fishermen. The use of hook and line is employed mainly by the age group 1-20 years, who constituted the occasional fishermen.

As shown in Table XIII,hook andline, clap and cast nets were used in Zaria,Kangimi and Kudaru. At Zaria Kangimi, Puntua and Kudaru dams, gill nets were set across the river. The use of boat or canoes along with the calabash were popular at Zaria, Kangimi and Kaduna dams. Some of the fishermen on the Galma river (Zaria reservoir) also set traps for the fish.

Over 90% of the fishermen interviewed fish individually, and there were no restrictions to specific fishing sites. Occassionally, group fishing consisting of two of three fishermen was not unusual.

IV.B.2 Commercially important fishes of Kaduna State.

The types of fish caught in Kaduna State represent the well - known species of the Niger-Benue basins (Daget, 1966 Reed et al 1967). As shown in Table XIV, the families of fish represented in Kaduna State include Mormyridae, Clariidae, Citharinidae, Cyprinidae Bagridae,Crysicthys,, Auchenoglanusso Schilbidae Malapteruridae, Mochokidae Centropomidae . . Cichlidae and Alestes species.

Plate 1. Fishermen using hook and line at Galma river.
(These represent the occasional fishermen).



Plate 2. Fisherman displaying clap nets.



Plate 3. "Gora" (calabash) used for floating while using clap nets and or while tending Gill nets.



Plate 4. Fisherman in river, using the 'Gora' as float.

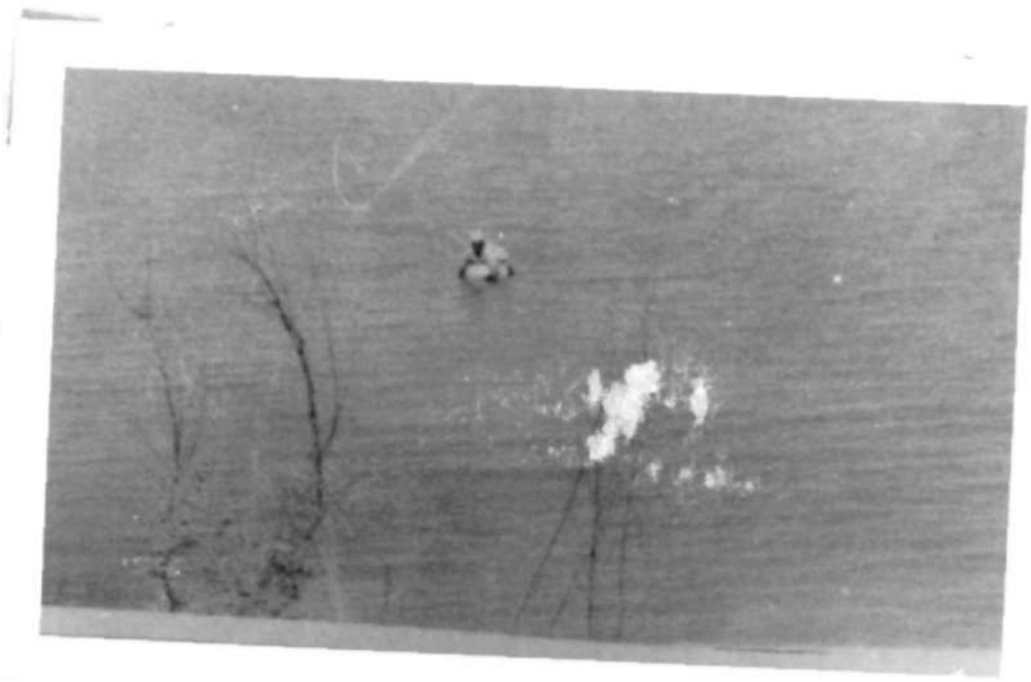


Plate 5. Fishermen in pond using clap nets.



Plate C. Fishermen using cast net



Plate 7 . Canoes used by fishermen in Kangimi dam.



The species caught throughout the year included Clarias lazera, Alestes nurse, Sarotherodon galilaeus and S.niloticus Information obtained from all the fishing centres indicates that the fishermen caught nearly all the representatives of all the fresh water fish families as found in the Niger-Benue river system (Reed et al,1967). Clarias lazera, Tilapia sp, and Alestes nurse formed the bulk of fish found in Kaduna State. Others such as Heperopisus b. Occidentalis, Labeocoubei and Lates niloticus are of considerable abundance in catches. Of these fishes, the biggest species evercaught, as claimed by most fishermen, was Lates niloticus. According to the fishermen the most successful expenditions were those carried out at the begining of the rainy season (May and June) and towards the end of the rainy season (September and October). The least catch was during the rains. Number of fish caught during these periods were their yardstick.

IV.3.3 Estimation of weight of fish produced per day at Zaria dam and Kangimi dam.

Bulk of the fresh fish produced in Kaduna State were from Zaria and Kangimi dams. In order to have a rough estimate of fish produced per day the total catch per day of fish were weighed on five occassions at the two sites. At Zaria dam, an average of 15 to 20 kg of fresh fish were produced per day, while at the Kangimi dam, an average of 10 to 15 kg of fish were produced per day. Therefore in a year, the Zaria dam yielded between 5,475 kgs and 7,400kgs of fresh fish per annum while Kangimi dam produced between 3,650kgs and 5,475kgs of fish per annum.

TABLE XIV

Occurence of fish species and its abundance in Kaduna State.

XXXX = Found throughout the year; XXX = Abundant;

XX = Occassional; X = Rare.

Species	Abundance	Locality
Mormyridae		
Momyrus rume	XX	Zaria, Kangimi
M. deliciosus	XX	Kudaru
Hyperopisus b.Occidentalis	XXX	Kudaru
Petrocephalus bovei	X	Kudaru
Marcusenius senegalensis	XX	Kudaru
Gnathonemus senegalensis.	X	"
Hippopotamyrus pictus	XX	Zaria, Kudaru
Claridae		
Clarias lazera	XXXX	Zaria Kangimi, Funtua, Kudaru Shika.
C. angularis	X	
Alestes		
Alestes baremose	XX	Zaria, Kangimi, Kudaru.
A. nurse	XXXX	" "
A. macrolepidotus	XX	" "

Table XIV contd

XXX = Found throughout the year; XXX = Abundant; XX = Occassional; X = Rare.

Species	Abundance	Locality
Citharinidae		
Citharinus citharus	X	Zaria, Kangimi, Kudaru
C. latus	X	" "
Cyprinidae		
Labeo coubei	XXX	" "
L. Senegalensis	XX	" "
Barbus occidentalis	X	" "
Bagridae		
Bagrus bayad	X	Zaria Kudaru
B. docmac	XXX	" "
B. filamentosus	X	" "
Crysicthys		
Crysicthys auratus	X	Zaria, Kangimi Kudaru
C. nigrodigitatus	X	" "
Auchenoglanus		
A. biscutatus	X	" "
A. Occidentalis	XXX	" "
Schilbidae		
Schilbe mystus	XX	" "
Eutropius niloticus	XX	" "
Physailia pellucida	X	" "
Silurnodon aurius	X	" "

Table XIV contd.

XXXX = Found throughout the year; Abundant = XXX; XX = Occassional;
X = Rare.

Species	Abundance	Locality
Malapteruridae		
Malapterurus electricus	XX	Zaria.
Mochokidae		
Synodontis schall	XX	
S. batensoda	X	O Kangimi
		XX
S. membranaceus		
Centropomidae		
Lates niloticus	XXX	Zaria, Kangimi
		Kudaru
Cichlidae		
Hemichromis fasciatus	XX	
Tilapia zilli	XX	
T. melanopleura	XX	
T. galilaea	XXXX	Zaria, Kangimi,
		Kudaru, Shika,
		Funtua, Katsina
		Dutsin ma,
		Kaduna.
T. niloticus	XXXX	

IV.C Fish processing and Preservation

IV.C.Temporary preservation of fresh fish

While fishing, professional fishermen preserved their catches in calabashes as shown in plate 3 . In some cases, the catchesare preserved in basket which is covered with a thick piece of cloth or jute bags. The fish are kept moist before the arrival of the buyers.

IV.C 2 Permanent methods of preservation

Investigation shows that over 96 percent of the fishermen did not process their catch before they were disposed of. Incidentally, the 4 percent of the fishermen that did process their catch were less than 20years of age. These youths constituted the bulk of the occassional fishermen.

a. Processing for immediate consumption

The method employed mainly by the occasional fishermen was by gutting their catches, scales removed, washed in the river or dam water, then salted before placing the fish on smouldering fire (see plate 8). Such prepared fish are often charred and stained by ash and are consumed on the spot.

b. Sun drying

This method of preservation was carried out mainly by some middlemen as observed at Kangimi. The total length of Tilapia and Hemicromis species which were processed in this manner measured between 8 to 15 cm.

Prior to sun drying, the scales were removed, the fish gutted and the fish was then split longitudinally in such a way that the head is also split into two halves (Plate 9) The prepared fish is then spread on a mat in the sun until it dried, but not brittle. To ensure even drying, the fish is turned periodically.

c. Drying by smoking

The species of fish that is usually preserved by smoking is Clarias. The fish, after been gutted are curled and arranged as shown in plate 10. The skewered fish is then placed on a wire gauze above a mud smoking/drying kiln. Gently smouldering logs are placed under the gauze (in the kiln). The prepared fish is in turn covered with mat, jute bag, tarpaulin, or ugated iron sheets. The fish is turned periodically until it is completely dried. (See plate 11 and 12).

d. Processing and preservation by frying

This type of processing and preservation is normally done by the second or third middlemen . This involved gutting and skewering of average sized fishes like Clarias sp. and other cat fishes. If fish is big, such as Lates niloticus or big Labeo, sp. (size is determined by the processor, the fish is sectioned or cut into pieces. Wheat flour (Golden penny flour) which may or may not be mixed with ground pepper is rubbed on the fish before frying with groundnut oil.

The processor believed that the flour will prevent the fried fish from crumbling and will make it more palatable.

If the fish are small (fingerlings or yearlings) they are not gutted nor sprinkled with flour before frying en masses. The middle men then sold the processed fish directly to consumers in form of snacks.

IV.1. Transportation.

There are two categories of transport in the fishery industry of Kaduna State. In the first instance, there is the need for movement of the fishermen while fishing. The calabash (or "Gora" as it is called by the Hausa) is a form of float used by fishermen for transporation while fishing. Dug out canoes and canoes made from flat planks or boards are also used while fishing. These canoes were propelled manually by paddles and poles; there was no motorised canoe, owned by the fishermen. Secondly, the catch must be transported to the customers.

Over 34% of the fishermen have bicycles, 13.16% have motorcycles and the remaining 52.70% have no mode of transport (See table XV). Only 15.31% of the fishermen convey their catch to the market. The remaining 84.69% sell to middlemen who inturn convey the fish to the market by public transport or other mode of transportation.

Plate 8. Gutted salted fish placed on smouldering log of wood. (Mainly Tilapia and Hemichromis sps.)



Plate 9. Fish (mainly Tilapia) split into two halves before sundrying.



Plate 10. Curled and askewered fish. (**Clarias** sp).



Plate 11. .. trader displaying askewered fish arranged on a long sticks (Clarias sp.)



Plate 12. Askewered fish on a smoking kiln (*Clarias* sp.).

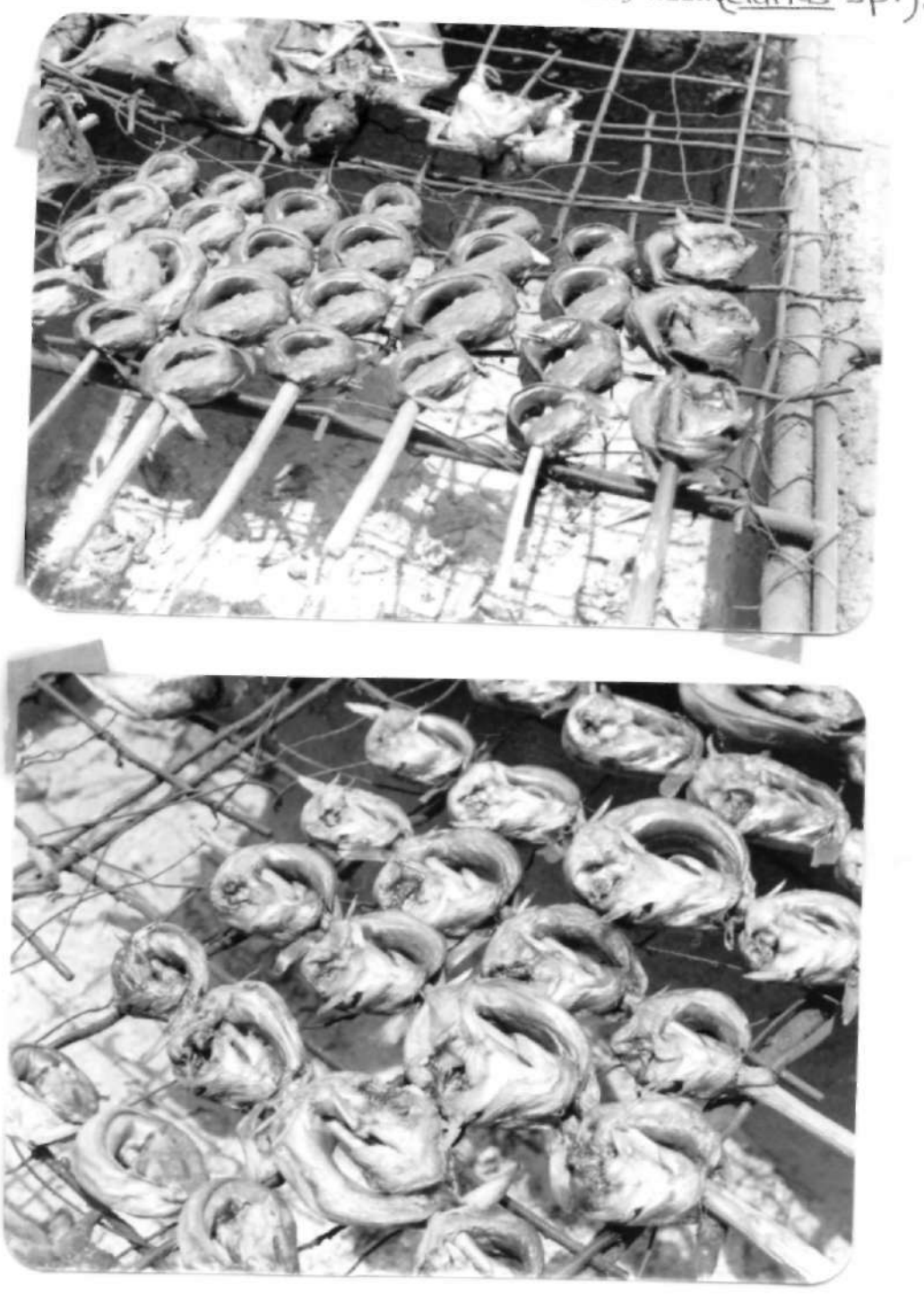


Plate 13. A smoking kiln.



Plate 14. A middleman conveying fish to market with bicycle (note jute bag pieces that covers the fish).



Plate 16. A typical fish stall in Zaria, (fresh fish).



TABLE XV

Percentage of fishermen that own a source of transport

Mode of transport	Number	Percentage
Trecking	43	52.70
Bicycle	28	34.14
Motocycle	11	13.16
Motor	0	0

IV.E Marketing

Of the 82 fishermen interviewed, about 77 percent of them sell all their catch, while 19% sell ¾ of their catch, the remaining ¼ is taken home or given to friends and relatives. Only 4% of the fishermen consume all their catch (see table XVI).

Most of the fishermen sell their catch either in bulk or in pieces. Prices are determined arbitrarily as no form of weighing is carried out for fixing prices. Over 86% of the fishermen sell their catch to the middlemen who are either permanent or temporary middlemen. (By the way, fisherman identifies himself with a particular middleman). The number of fishermen that take their catch directly to the market is 11%. Occasionally, the fishermen do sell to consumers that can afford to go to the landing area, e.g as with the case of Garia Jam.

It was noticed that prices are affected by seasons. The fishermen claimed less catch during the months of July, August and September (Heavy rainy season) and increased catch during the month of May, June, October and November.

IV.F. Consumption

All the married fishermen who constitute 67% of the fishermen take a portion of their catch to their family, while most of the fish is sold. Fish contributes about 50% of the animal protein consumed by the fisherman's family, the remaining 50% is obtained from other sources of protein.

TABLE XVI

Marketing of fish by fishermen

Fishermen that	Number	Percentage
Sell all catch	61	77.0
Sell ¾ of catch	16	19.0
Sell ½ of catch	0	0.0
Sell ¼ of catch	0	0.0
Consume all catch	5	4.0
TOTAL	82	100

A total of 763 consumers were interviewed: 130 or 17% of the respondents belonged to the upper income group, 235 (or 31 percent) were in the middle income group, while the remaining 398 (52 percent) of the respondents belonged to the low income group. As shown on table XVII, all the three income groups have higher preference for Clarias species than any other types of fish. The Clarias species is closely followed by Lates niloticus in terms of preference. Tilapia and Mormyrid species were equally preferred (see fig. 7). Alestes and Labeo species have the lowest preference.

There appeared to be an overwhelming preference for fresh fish amongst the three income groups, next in rank of preference is fried fish then smoked fish (Table XVIII) and fig 8.

As shown in Table XIX, fresh fish was considered as most palatable by the different income groups, this is followed by dried fish.

About 97% of the upper income farmers 100% of the middle and lower income earners considered fresh fish as the most expensive of all types of fish and fish products (table XX). Similar percentage also considered iced fish as the cheapest (Table XXI). Ice fish was considered to be readily available for consumption by the three income groups. Smoked fish was placed second then dried fish, third. Only the upper income earners considered fresh fish as readily available (table XXII) for their consumption (see fig. 9).

58% and 56% of the respondent in the upper and middle income groups, respectively fried their fresh fish before eating it, while 48% of the low income group preferred boiling their fresh fish before making it into stew (see table XXIII)

Popper soup and fried fish made into stew were equally liked by the groups. None of the groups wanted their fish to be smoked before eaten (figure 10).

TABLE XVII

Types of fresh fish preferred by the 3 income groups in Kaduna State.

	Upper income earners.		Middle income earners		Low income earners.	
Fish species	Number	%	Number	%	Number	%
Tilapia sp.	15	11.54	32	13.62	56	14.07
Momyrids	16	12.31	34	14.47	49	12.31
Clarias sp	58	44.62	126	53.62	203	51.00
Lates niloticus	31	23.85	37	15.74	72	18.10
Alestes/Labeo sp	8	6.15	6	2.55	18	4.52
TOTAL	130	100	235	100	398	100

Fig. 12 : Bar graph showing percentage of type of freshfish **as prefered** in Kaduna State by different income groups

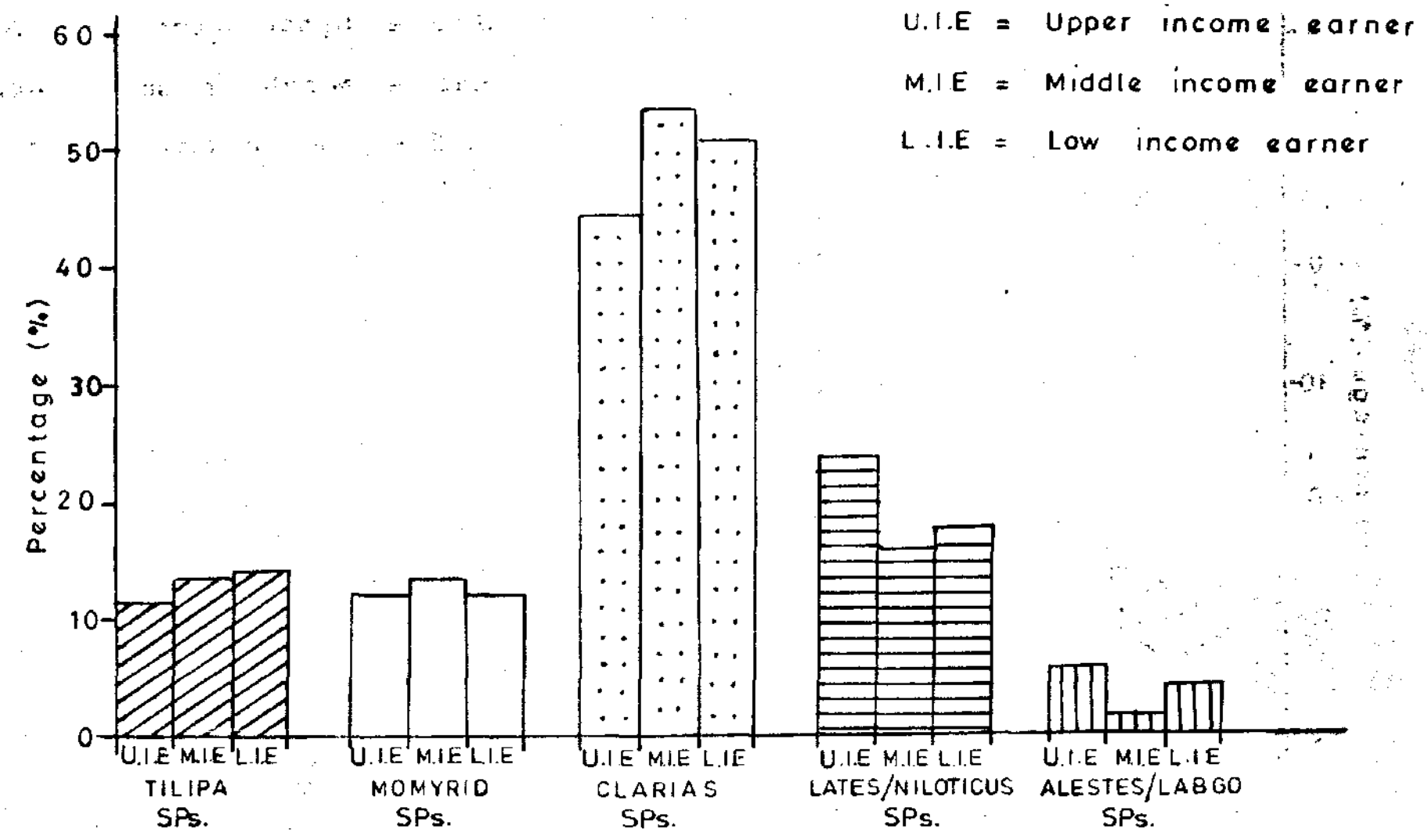


TABLE XVIII

State of fish preferred by the three income groups

	Upper income earners		Middle income earners		Low income earners.	
State of fish	Number	%	Number	%	Number	%
Smoked	6	4.60	10	4.25	86	21.60
Dried	-	-	-	0	16	4.02
Iced	-	-	-	0	5	1.26
Fresh	109	83.85	216	91.91	273	68.60
Fried	15	11.54	9	3.83	18	4.52
TOTAL	130		235		398	

Fig.13 : Bar graph showing percentage of fish preferred in Kaduna State

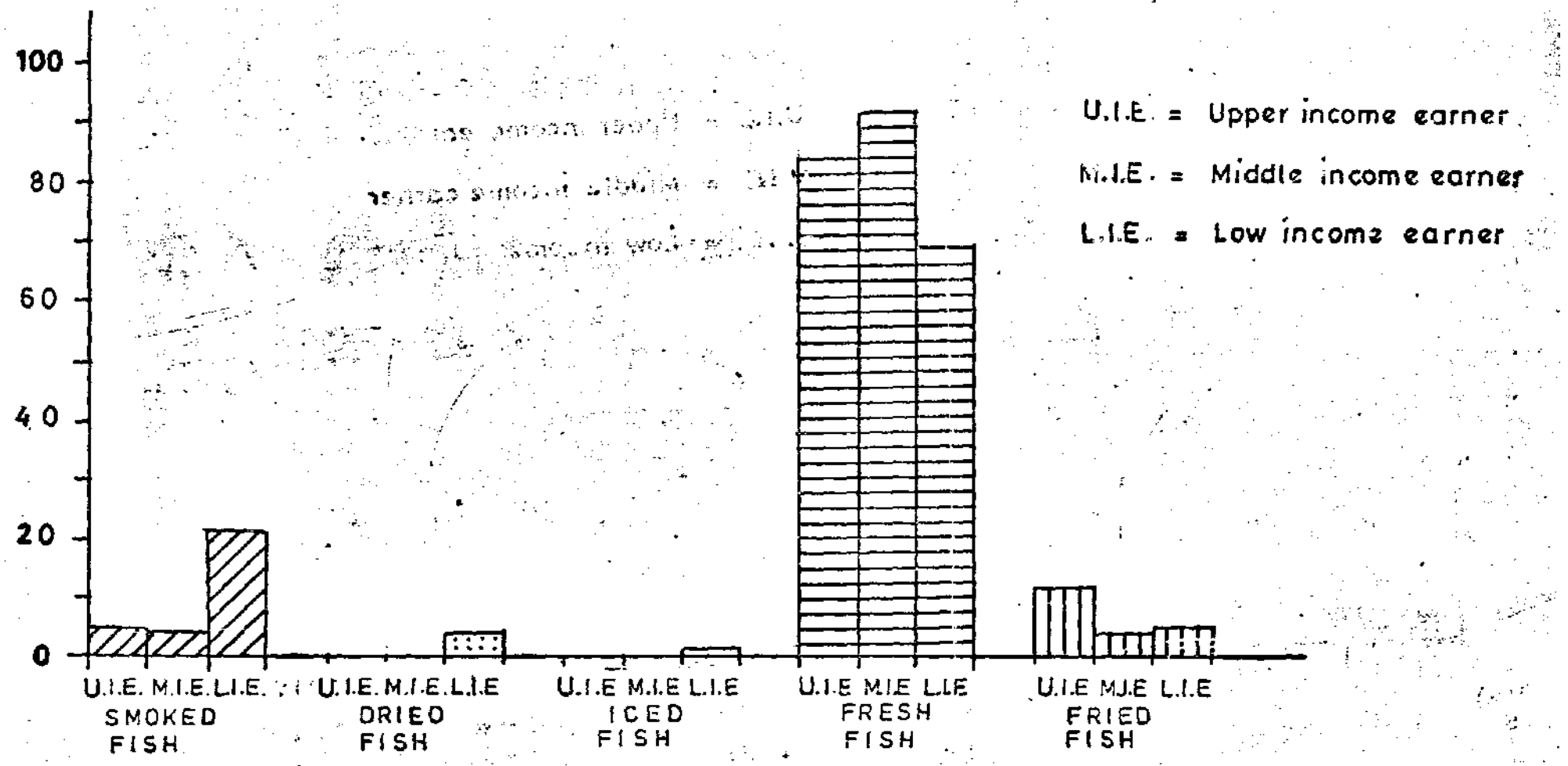


TABLE XIX

State of fish considered as most palatable

	Upper income earners		Middle income earners		Low income earners	
State of fish	Number	%	Number	%	Number	%
Smoked	8	6.15	1	0.43	28	7.04
Dried	-	-	-	-	-	-
Iced	-	-	-	-	-	-
Fresh	122	93.85	234	99.57	370	92.96
Fried	-	-	-	-	-	-
Total	130		235		398	

TABLE XX

Type (State) of fish considered as most expensive

	Upper income earners		Middle income earners		Low income earners	
State of fish	Number	%	Number	%	Number	%
Smoked	4	3,07	-	-	-	-
Dried	-	-	-	-	-	-
Iced	-	-	-	-	-	-
Fresh	126	96.92	235	100	398	100
Fried	-	-	-	-	-	-

TABLE XXI

Type (State) of fish considered as cheapest

	Upper income earners		Middle income earners		low income earners	
State of fish	Number	%	Number	%	Number	%
Smoked	-	-	-	-	-	-
Dried	1	.77	-	-	-	-
Iced	129	99.23	235	100	398	100
Fresh	-	-	-	-	-	-
Fried	-	-	-	-	-	-

TABLE XXII

Type of fish considered as readily available for consumption by the three different groups

	Upper income earners		Middle income earners		Low income earners.	
State of fish	Number	%	Number	%	Number	%
Smoked	2	1.54	9	3.83	3	.75
Dried	1	.77	6	2.55	1	.25
Iced	111	85.40	220	93.62	387	97.23
Fresh	16	12.30	-	-	7	1.76
Fried	-	-	-	-		
Total	130	100	235	100	398	100

Fig. 14 : Bar graph showing state (type) of fish considered as readily available for consumption by the three differet groups in Kaduna state

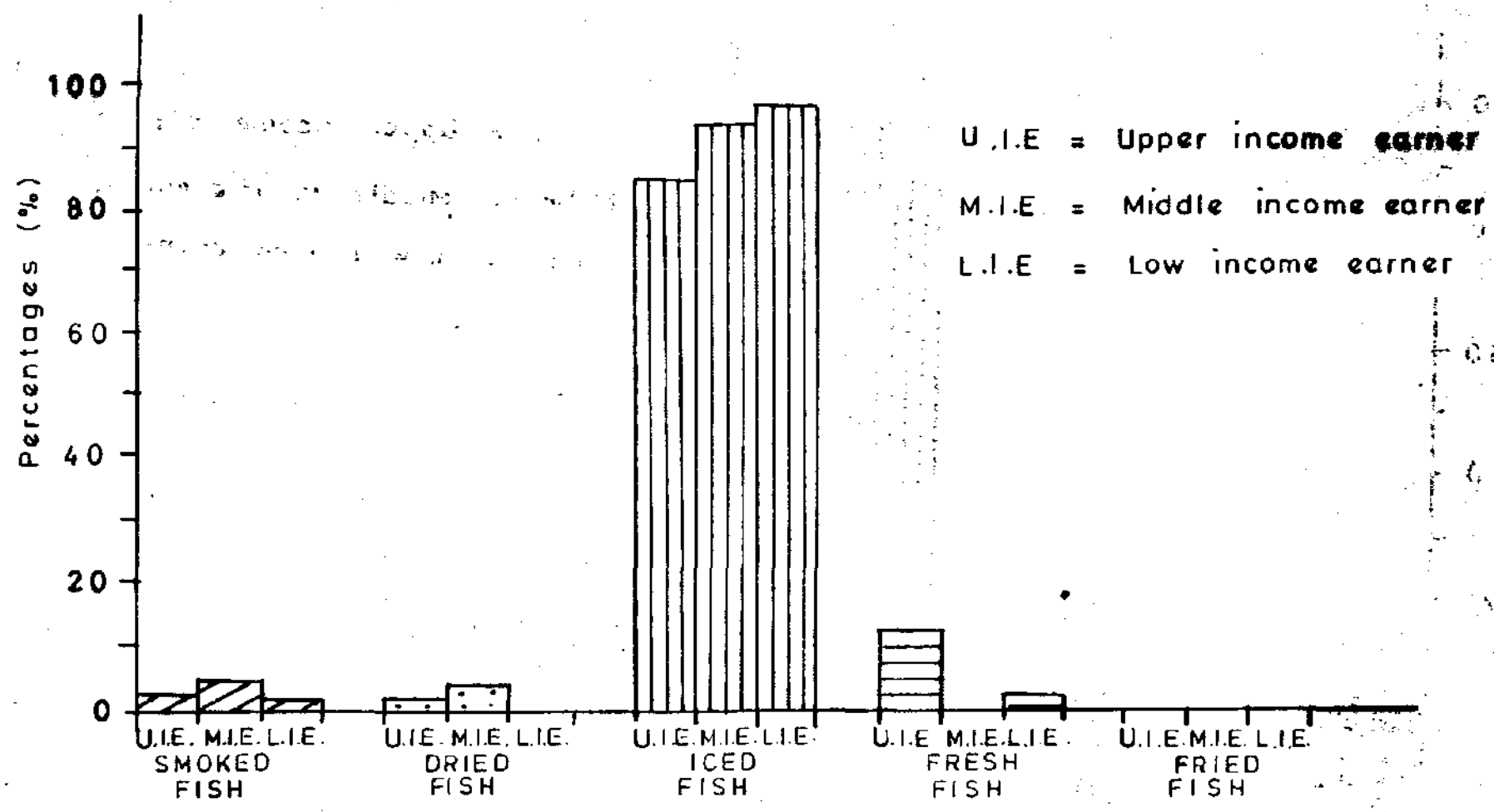
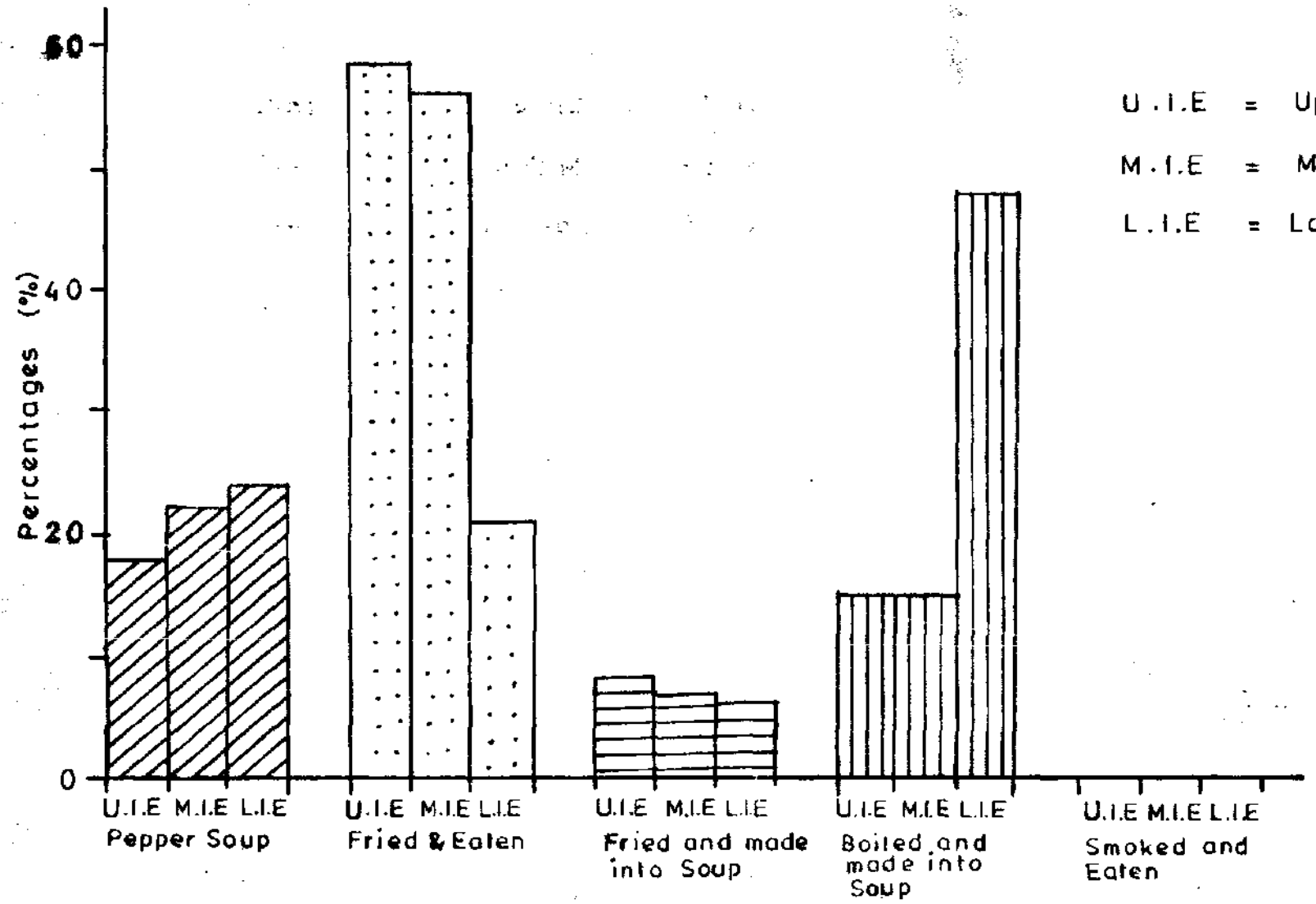


TABLE XXIII

Type of table preparations of fresh fish by the different groups.

	Upper income earners		Middle income earners		Low income earners	
Preparations	Number	%	Number	%	Number	%
Pepper soup	23	17.7	51	21.7	94	23.60
Fried and Eaten	76	58.5	132	56.17	85	21.10
Fried and made into stew	11	8.5	17	7.23	26	6.53
Boiled and made into stew	20	15.4	34	15.00	193	48.5
Smoked and Eaten	-	-	-	-	-	

Fig.15 : Types of table preparations of fresh fish



U.I.E = Upper income earner

M.I.E = Middle income earner

L.I.E = Low income earner

CHAPTER V

DISCUSSION

V. A. General

Fishery is an important subsector of agriculture in the Kaduna State of Nigeria. The state enjoys abundant water supply from rivers such as Kaduna, Gada, Galma, Gurara; plus water from man-made lakes such as the reservoirs at Zaria, Kangimi, Mairuwa and Ajwa amongst others. These water bodies provide about 2,500 hectares of surface water (Lysak, 1978). Dagua (1982) estimated fish production in Kaduna State in 1979 as 3,310kg/annum . These water bodies provide a variety of fishes which are representatives of the Niger - Benue basin fish species (Reed et al 1967) on which the fisheries industry in Kaduna State is based. Although most of the water bodies in the northern part of the state are seasonal, rivers Galma and Kaduna in the southern part of the state are tributaries of river Nigeri and these perennial rivers provide the bulk of the fishes in the state. It is on the Galma and Kaduna rivers that the Zaria dam, Kangimi and Kudaru fishing centres are situated respectively.

V.B. Observations.

In this section, the results of the study will be discussed in relation to the data found in the literature, and the overall appraisal of fishery industry in Kaduna State will be undertaken.

V.B.1. Kaduna State:

The state has three distinct climatic zones. To the extreme northern part of the state is the sahel Savanna zone which is characterised by few seasonal rivers, little rainfall, Sandy soil, high temperature and desert encroachment. It is probable that these adverse climatic factors are responsible for the relatively low fish production in that part of the state.

The middle and southern part of the state exhibits the Sudan and Guinea Savanna vegetations respectively. Rainfall is relatively higher with longer duration than in the extreme north. The rivers in the Guinea zone originated from the Jos plateau and empty into the river Niger . This zone (Guinea) appears to be more favourable to fish production than the extreme northern zone of the state. This is shown by the number of fishermen, fishing centres and the relatively high fish production observed in the Guinea zone. The advantages the Guinea zone has over the other zones are due to the more favourable rainfall, Perennial rivers, soil type and moderate temperatures which are favourable to fishery industry.

V.B.2 Fishing centres.

The principal fishing centres in Kaduna State are at Zaria dam and Kangimi dam. These fishing centres are about 7 to 10 kms respectively from main markets. Kudaru and Funtua (Mairuwa dam) are other important fishing centres.

As indicated in the previous section (V.B.1), the principal fishing centres, namely, Zaria dam and Kangimi dam fall within the Guinea Savanna zone. It is therefore not suprising that more fish is produced at Zaria and Kangimi than at other centres in the state.

The fishing industry at Zaria and Kangimi are very close to ready markets in which the demand for fresh fish far outweighs the supply of fish. At this traditional stage of fisheries, the fish production cannot cope with the demand for fish by the inhabitants of Kaduna (the sprawling state capital) and Zaria (the University town)-cities that are served by Kangimi dam and Zaria dam respectively. The fact that Kaduna and Zaria have very large population that are ready consumers of fresh fish is an added reason which an investment in commercial fisheries is bound to yield high dividends. Below the dams at Zaria and Kangimi are suitable lands which can be converted to fish farms. These farms, if constructed, will readily boost fish production in Kaduna State.

The obvious failure of the fish farms at Maska and Maigana is not unconnected with the seasonality of water supply at these sites. Any future development in the field of fish farms should take into consideration the continuous availability of water at the Zaria, Kangimi and other man-made lakes in the State.

V.B.3. Socio economic status of the fishermen

Full time fishermen in the state are only about 10 percent of the fishermen population, part-time fishermen are 25 percent. The higher percentage of part-time fishermen can be attributed to a well lknown fact about the Hausas of northern Nigeria among whom few of the men depend on one occupation for their income. Some men in addition to having different occupations in dry and rainy seasons also have a third or a fourth occupation which brings in additional income (Konan, 1975). The Hausa fishermen also engage in jobs such as farming, bicycle repairing, house building, carpentry, petty trade and often act as middlemen for sale of other house-hold goods. If this multioccupational attitude of the Kaduna State fishermen can be reduced, so that they devote more time for fishery activities, the fish production in the state might be increased above that of the present status. However, the income from fisheries must be such that the non-participation of fishermen in other occupations does not adversely affect the economic status of the fishermen. Rather the commitment of the fishermen to fishery industry alone should yeild greater income which would be more than compensate fishermen for their lack of extra jobs.

Fishermen in Kaduna State are young active men of ages ranging from 20 -40 years; This age, group constitute about 58 percent of the total fishermen in Kaduna State. This finding agrees with the observation of Mabawonku (1982) who studied the fishing activity with respect to the age of the fishermen in Borno State.

If the age range of fishermen in Kaduna State increases (15 - 50 years) there may be increase in fish availability in the state.

The religion of all the fishermen in the state is Islam, as such, no taboo is associated with consumption of fish and fishing in the state. Therefore unlike pigery which is not acceptable in Islam, there is room for expansion of fishery activities in the state. It is rather unfortunate that over half of the fishermen have no formal Western education, however all of them can read and write Arabic and Ajami (Hausa language but written in Arabic). Therefore there might not be any serious problem when fisheries officers that understand Hausa and Arabic want to carry out extension services in fisheries in Kaduna State.

Another important socio-economic characteristic on which observations were made is the size of the fisheries family or house-hold. As defined by MabawonKus study (1981) " a house-hold represents the number of people living under the same roof and eating from the same pot". If this definition is applied to Kaduna State, then the fishermen in the state are characterised by large households, with dependants that are often greater than three. Such large household constitute a serious drain on the purse of the fishermen. The large household of the fishermen may be responsible for the need to have other jobs apart from fishing. The drain caused by the large household leaves the fisherman very little money with which to purcahse and maintain his fishing gears.

The fishermen's wives are strictly under pudah, therefore they do not participate in the act of fishing but they are responsible for preparing the unsold fish for the table. In contrast, women at Egeria (Ghana), Jebba, Makurdi and Lokoja do participate in some open fishing, (Lawson, 1963 and Reed et al, 1967) processing and marketing. However, wether a woman participates directly or not in the fishing industry, behind every successful fishermen there is a caring woman.

V.B. 4 Fish production in Kaduna State:

In Kaduna State, the most important and widely used fishing net is the gill net, which is closely followed by the cast net. The nets have contributed immensely to the development of artisanal fisheries not only in Kaduna State but throughout the country (Anon, 1969; Fagade, 1972 and Amadi 1977). Clap nets is another fishing gear used in the state, mainly in ponds and receeding waters. Where the river or pond is considerably deep, the clap nets are used in conjunction with the calabash which is a float and a mode of transportation. This mode of transportation with calabash is inefficient if compared with manually operated canoes. Secondly, since the fishermans legs and hands are in the water while using the calabash, he could be infected by deseases such as river blindness, Schistosomiasis and other river burne deseases.

The canoes used by the fishermen in Kaduna State are often delapidated ones which demand more input for operation and maintenance. At Baga, in Borno State, there are over 4,000 boats with about 600 (15%) of them having out-board engines (Mabawonku, 1981). Essien (1982) estimated that a good number of the canoe fisheries of Ikot - Abasi (Cross river state) have out board engines.

Fishermen that own canoes often record more catch than those that uses calabash as mode of transport. No record of fish catch per fisherman was available but an estimated average monthly sale of fish by fishermen ranges from ₦70.00 to ₦120.00 in places like Zaria and Kangimi dam. Whereas in Borno State, fishermen with canoes (non-motorised) reported a lower catch value of about ₦1,200.00 while those with out-board engines have value catches of approximately ₦2,600.00 per month. The differential in sales not only result from the use of out-board engines alone but also from the use of improved gears which are supplied through Government subsidy(Mabawonku, 1981). Nevertheless, the introduction of out-board engines to fishermen in Kangimi and Zaria dams might increase their fish catch.

V.B. 5 Fish population in Kaduna State

Fish species in Kaduna state are highly diversified, however, Tilapia, Clarias and Alestes species form the bulk of the fish catches in Kudaru, Zaria, Kangimi and Puntua dams. Mormyrids, Labeo and Lates niloticus species are also of significant importance.

This findings agree with those of Reed et al (1967) on the fisheries of Northern Nigeria, Adegboye (Personal Communication, 1982) on the fisheries of river Gongola.

The fishermen in Kaduna State claimed to catch less fish during the rainy season and most successful expeditions are at the begining and towards the end of the rainy season. The heavy rains in Kaduna State which fall between June and September cause excessive erosion which consequently make the water turbid, and deoxygenated. These conditions do not favour the production of fish (Lysak, 1978). These factors are probably responsible for the decreased catch during the rains. The fast flowing rivers coupled with the lack of modern transport system also contribute to low fish yield during the rains. During the dry season on the other hand, low water level limits the feeding intensity of existing fish population in running waters, at the same time an increase in temperature well above the optimum of the feeding regime reduces the growth rate of fish. These also coincides with poor oxygen condition in rivers (Lowe-McConnel, 1975; Lysak, 1978).

Successful catch at the begining of the rainy season coincides with abundance of food such as larvae, nymphs and insects; fruits and seeds are also washed down the rivers by the first rains thus the feeding frequency of most fish increases, growth becomes rapid and spawning activities takes place. Cichlids and catfishes often produce their young ones at low water before the floods, or on the first sign of rising waters, their feeding frequency then increases leading to increase in biomass

before the heavy rains (Lowe-McConnel, 1975). This probably result in the abundance of Tilapia and Clarias species (plus other catfishes) in the catches of fishermen before the heavy rainy season.

V.B.6 Processing and preservation of fresh fish in Kaduna State.

In order to prevent or reduce spoilage, the fishermen and middlemen (Traders) in Kaduna State employ various methods of keeping their fish in a state that will be acceptable to the buyers. The major method of temporary preservation which the fishermen employ is simply by preserving fish caught in "Gora" (the floating calabash). This method can be improved upon if the fishermen have canoes with cooler or ice boxes which will keep the fish caught in a fresher condition. In Finnmark, freezing is carried out in boats (Nybo , 1976), in Akosombo, Ghana, inshore vessels operating at the main fishing harbour, Tema, do take ice on fishing trip for Chilling their fish catch, which are mainly Tilapia, Cat fishes, and Mormyrids, in order to minimize losses and improve the condition of fish while off loading (Mensah, 1977).

Some fishermen and Middlemen use pieces of Jute bag or tarpaulin to cover fresh fish, this material is kept moist by occasional sprinkling of water on it. This they believed keeps the fish in fresh condition. Where long distance need to be travelled, the occasional stops to wet the coverleth may increase the time the fish is suppose to get to the market at the same time bacteria activities on the fresh fish will increase

The Jute bag or tarpaulin could also be a proper breeding ground for bacteria and since we are within the tropical region, where there is high rate of evaporation, the wetting of the coverloth might not be effective enough to keep the fish in fresh condition. Therefore, the use of freezing methods will definately reduce the extent of spoilage.

The most preferred fish for smoke drying in the state is the Clarias species. The higher preference might be due to its characteristic flavour after smoke - drying, which other fishes do not have. Unlike the momyrids, the Clarias species have relatively low fatty content and this probably reduces considerably the time for. smoke - dryings.
Unlike Alestes and Tilapia species the Clarias species are less bony and above all the demand for smoked Clarias fishes could be due to the fact that it is the major fish that is smoke-dried in the state.

In most cases, the smoke-drying process is done by the middlemen; they do not only help the fishermen to sell their catches fresh, fried or smoke - dried, they also reduce the labour of the fishermen. Consequently, the middlemen also reduce the earnings of the fishermen. The large household of the fishermen may be involved in the processing aspects of the industry to the finacial advantage of the household.

V.B.7. Transportation of fish in Kaduna

Transportation of fish and fish products is of paramount importance if the rate of spoilage is to be reduced and if faster access, to market and consequently to consumers is to be achieved.

In Kaduna state, the fishermen lack adequate mode of transportation. The calabashes and canoes used in rivers and lakes are propelled manually by the fishermen, thus involving high human energy expe expenditure. In Borno State, the Government has been trying to supply fishermen with canoes at subsidized rates; in some cases, such canoes have outboard motors (Mabawonku, 1981).

Over 53% of fishermen in Kaduna State have no modern means of transport, while 34% amd 16% have bicycles and motor-cycles respectively. Therefore where the fishermen transport their catches to market (which are quite some distance, 7-10kms, from landing sites) the fish is liable to spoilage or deterioration. Furthermore, where middlemen are responsible for transporting the fish to markets, they do so by using motor-cycles and public transport which are rather, improper methods of transporting fish because these modes of transport which are meant for human conveyance are not suitable for fish transportation.

V.B.8 Marketing of fish and fish product in Kaduna State

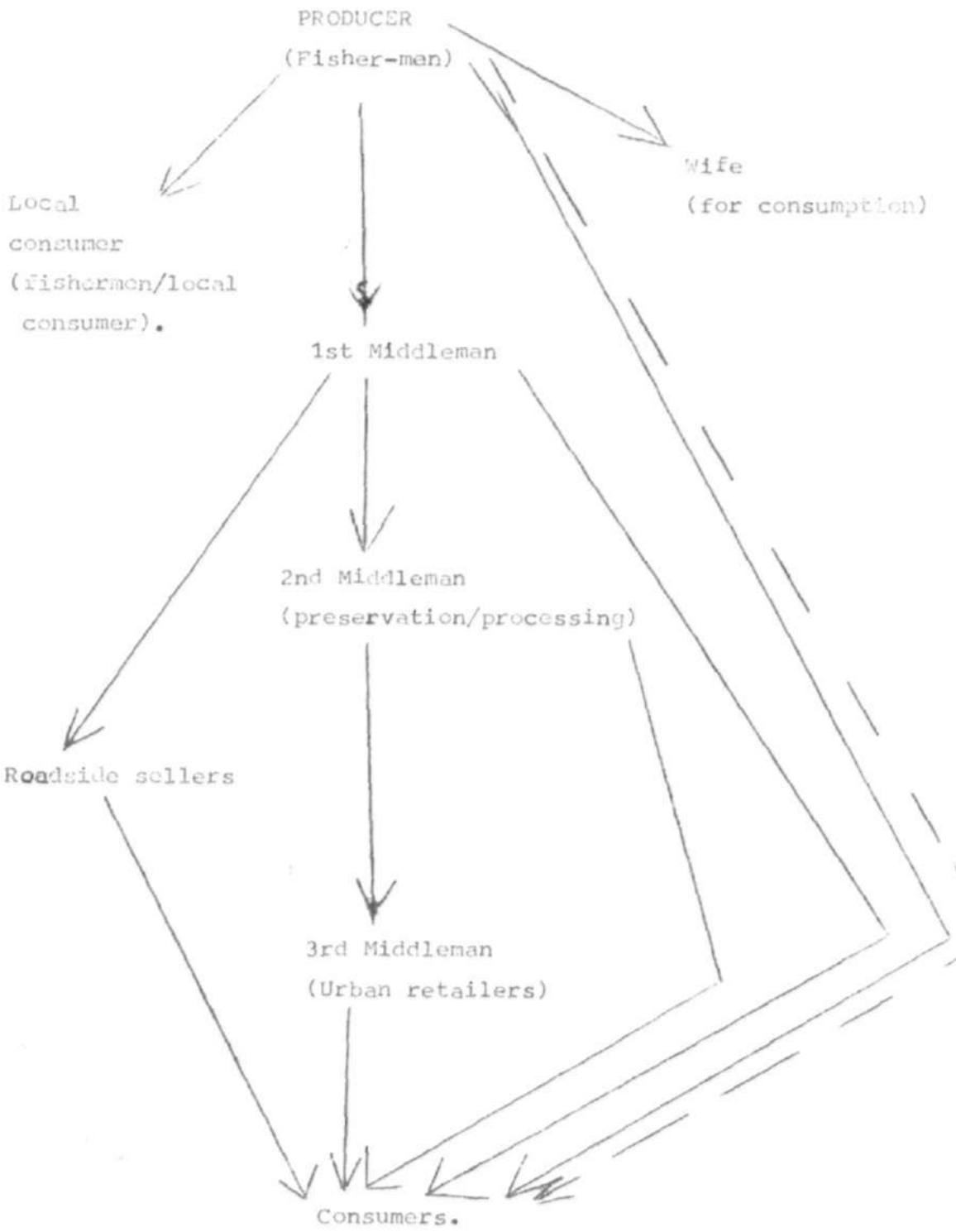
Fish marketing is entirely in the hands of fishermen and the middlemen in Kaduna State. The fishermen sell their catches in bulk or in pieces to known middlemen. It is the middlemen that transport the fish to the market with any mode of transport they deem fit. Fresh fish are transported to market in the early hours of the mornings and late afternoons. In the markets, the price of the fish depends on the species, size and time of the year.

Tilapia species sells for about ₦1.50 to ₦2.00 per kilogram while Clarias species and Lates niloticus sell for ₦3.00 to ₦5.00 respectively. However, like any community the price falls when fish is abundant. Cured fish (smoked or dried) which are normally prepared by the middlemen cost about three times more than its fresh weight price. Thus the bulk of the profit is retained by the middlemen at the expense of the fisherman. But frequently, these middlemen are creditors to the fishermen who are then bound to sell their catch to the middlemen at the latters dictated prices (Moses, 1982). Fig. 16 shows the marketing structure for fish in Kaduna State.

V.B. 9 Consumption of fish and Cured fish in Kaduna State.

The Kaduna State consumers have various fish products for consumption these include fresh fish, smoked fish, sundried fish and fried fish. Therefore the purchase of a particular type of fish might depend on the availability of fish, the consumers taste and preference for particular fish species. According to the investigation, cured fish appeared to be a long standing traditionally desirable fish product and its demand might keep on increasing. Atinmo and Omololu (1981 remarked that the consumers in Nigeria have a natural preference for fresh fish, nevertheless, both the coastal and inland population also eat great quantities of cured fish, mainly smoked and sundried products which are basically produced by artisanal fishermen and retailers who preserve the fish by curing it in the traditional manner.

Fig 16. Market structure for fish in Kaduna State



The fish species preferred by the categorised income groups (upper income earners, middle income earners and earners) in Kaduna State are mainly Clarias, Lates niloticus momyrids and Tilapia species. Class distinction did not appear to affect the preference for fresh fish; all income groups preferred fresh fish though, only the rich can purchase them.

Cured fish (smoke-dried) rank second to fresh fish in terms of public demand and price. This could be due to the extra flavour that smoking adds to the taste of fish. The high cost is not unrelated to the extra labour in curing and the relatively higher percentage of solid matter in smoked fish.

Iced fish was considered as the cheapest and readily available type of fish by respondents in the state,. Icedfish is mostly consumed by the low income earners because it is probably the type of fish they can afford since it is more readily available in the state than fresh fish. The availability of iced fish is due to the effective method of transportation with refrigerated vehicles by various fishing companies, and since the said fish is harvested in large quantities from the sea, it cheap price and acceptability in Kaduna State is understandable.

The level of income plays a dominant role in the household decision making. Actual purchases may not exactly reflect the consumers preference taste or attitude. A consumer may be prevented from purchasing a preferred variety of fish due to

financial constraints he may then resort to his second best choice. Smilarly, past market prices, which form the basis of his decision making may have changed when next he gets to the market. Thus expenditure on items can only provide a relatively rough indication of the inter-relationship between preferences and purchases, and household demand depends upon household income (Lipsey, 1965 , Todaro, 1977 and Mabawonku, 1981).

V.B. 10. Conclusion

The fishery industry of Kaduna State, which is still at the traditional and cottage stage can be moderanized to such an extent that fishery forms a major subsector of animal production in the state.

V.B. 11. Prospects and Potentials of fish production in Kaduna State.

The state is endowed with significant amount of freshwater in form of rivers especially in the central and southern part of the state. These rivers (River Kaduna, Galma and Gurara) form part of the river Niger system and they are all perennial. The Niger river has rich icthyofauna which the above mentioned rivers in Kaduna State also enjoy.

With the above natural prospect in Kaduna State, fish production could be increased above the present status.

CHAPTER VI

VI.. SAMMARY

1. The currents status of fisheries industry in Kaduna State was investigated.

2. The major fishing centres are situated in Zaria and Kangimi areas.

3. Over sixty percent of the fishermen are partime fishermen and their wives do not participate in any form of fishing.

4. The most widely used fishing gears are gill nets, then cast net and clap nets. "Gora" (floating calabash) and delapidated canoes form part of method of transportation in rivers.

5. Fishermen with canoes record higher fish catch than those with Gora.

6. Tilapia, Clarias, Alestes, Momyrids, Labeo and Lates niloticus forms the bulk of the fish catch in Kaduna State.

7. Fishermen claim least fish catch during the heavy rainy season and most successful at the begining and towards the end of the rainy seasons.

8. Temporary method of storing fish is carried out by covering fresh fish with jute bags that is constantly kept moist.

9. A more permanent mode of preservation is by roasting of cichlids by fishermen who are less than 20 years of age.

10. Smoke drying and frying methods are carried out by middlemen.

11. Over half of the fishermen in the state have no efficient means of transporting their fish to the market.

12. Most catches are transported to market by middlemen, who use their bicycles, motorcycles or public transport to convey fish to the markets.

13. Marketing of fish is entirely in the hands of fishermen and middlemen.

14. The price of fish depends on species, size and time of the year.

15. For all income groups, fresh fish is the preferred above all other types of fish products.

16. Demand and consumption of fish depend upon income

17. The traditional fishery industry in Kaduna State is still at the cottage level, and as such, the industry is not as productive as expected.

VI.B. RECOMMENDATIONS.

Based on our observations and the fact that the fishery industry is still at its traditional stage, it is necessary to make certain recommendations to raise the fishery industry from the cottage level to an economically viable venture in the state.

The recommendations are:

1. The Kaduna State government should accelerate the rural developments programme, especially Educational and Health fields, at major fishing centres.

2. The Kwoia dam and Kangimi dam should be developed into permanent fishing settlements and provision of social amenities in such centres should be adequate. Such centres will enhance the dissemination of new techniques and cooperation.

3. Through fishermens cooperatives, the Government should endeavor to supply subsidised (or Loan) fishing gears.

4. Through cooperatives and Extension Services of the fisheries department, the fishermen can be advised on size and age of fishes at which the highest production of high quality fish and fattest individual can be captured.

5. The Government should restock our natural waters with appropriate fish species and the prospect of cage culture should also be considered.

6. Factories for processing, preserving, and packaging should be set up at fishing centres, such factories should endeavor to use locally available materials. Ice making machines should also be at such sites. (Though these would be dictated by the level of production).

7. Faster distribution of fish and fish products in a manner that is acceptable by the consumers can be achieved by effective method of transportation. Where fresh fish will

will be delivered to the market, refrigerated vehicles should be made available because this will prevent or reduce post-human deterioration.

8. It was noticed that the middlemen are also responsible in skyrocketting fish prizes; therefore through cooperatives, prizes can be fixed for weights of different fish species, such cooperatives can gradually eliminate the participation of middlemen and organize a standard market structure for fishermen.

9. Since consumption of fish is a dynamic process and preference of a particular fish and fish products depends on individual and season of the year, bi-annual survey prefrence should be carried out by officer in fishing centres.

10. In any fisheries venture, it is always necessary to determine the chemical and physical parameters as well as the ecosystem of the body of water. Sources of water pollution should be carefully studied and if possible eliminated. Biology, physiology and behaviour (with particular refrence to the food requirements, food conversion rate, growth rate and age) of fish species natural enemies must be carefully worked out. Success in the development of investigations along these lines can only be guaranteed as long as they are based on the unity of progressive theory and practice (Nagel, 1979; ANON, 1977 and Nikolsky, 1963).

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APPENDIX I

A questionnaire on fish and fish products utilization

I. General information

1. State A ☐ LGA D ☐

District B ☐ Town E ☐

Village C ☐ Compound F ☐

2. Name of respondent: Age ☐ Religion ☐

3. Name of village of respondent:

4. What is your major occupation ?

A ☐ Farming D ☐ Civil servic

B ☐ Hunting E ☐ Self employe

C ☐ Fising F ☐ Other (specify

5. Is fishing a major occupation ?

A ☐ Yes B ☐ No.

6. What is the size of your family ?

A ☐ 1 member

B ☐ 2 member

C ☐ 3 members

D ☐ 4 members

E ☐ 5 members

F ☐ 6 members

G ☐ 7 members

7. How many of the members of your family do any fishing

A ☐ 1 member

B ☐ 2 members

C ☐ 3 members

☐ Above 3

II Production and Processing of fish

A. Production

1. How often do you fish, on average ?

A ☐ Every day

B ☐ Twice a week

C ☐ 3 times a week

D ☐ 4 times a week

2. Do you fish in group or individually ?

A ☐ Group

B ☐ Individually

3. Do you fish in a specific area ?

A ☐ Yes B ☐ No.

4. What is the average distance of your fishing area(s) from the village ?

A ☐ less than 1 km.

B ☐ 1 to 3 km

C ☐ 4 to [illegible] 7km

D ☐ 8 to 10 km

E ☐ Above 11 km

5. What equipment do you use in fishing

A ☐ Gun

B ☐ Cutlass

C ☐ Spear

D ☐ Netting (type)

E ☐ Club

F ☐ Knife

G ☐ Trap

H ☐ Others(specify)

6. How much money do you spend on average, per fishing trip, on material needed for fishing ?

A ☐ Nothing

B ☐ ₦1–5

C ☐ ₦6 – 10

D ☐ ₦11 – 20

E ☐ ₦21 – and above

7. How often do you have a successful fishing trip ?

A ☐ Every time

B ☐ ¾ of the time

C ☐ ½ of the [illegible]

D ☐ ¼ of the [illegible]

8. What species do you usually catch ?

A ☐

B ☐

C ☐

D ☐

E ☐

F ☐

9. Which are the larger species you have caught ?

A ☐

B ☐

C ☐

D ☐

E ☐

F ☐

Fish (Name	Number	Average weight if known

10. How do you usually convey catch to the village or market ?

A Head
B Bicycle
C Motorcycle
D Motor car
E Lorry/Truck
F Other(specify)

11. What periods of the year do you have the most successful fishing expeditions ?

A Rainy season
B Dry season
C All year round
D other(specify)
E Other(specify)

12. What periods of the year do you have least successful fishing expeditions ?

A Rainy season
B Dry season
C All year round
D Other(specify)

B. <u>Processing</u>

1. Do you usually process your catch yourself ?

A Yes
B No.

2. Where do you usually do the processing ?

A ☐ Near the spot of catch.

C ☐ In the village

B ☐ At the farm

D ☐ Other (specify.

3. How much time do you spend on average, to process each expedition's catch ?

A ☐ Up to 6 hours

D ☐ 25 - 36 hours

B ☐ 7 - 12 hours

E ☐ More than 36 hours.

C ☐ 13 - 25 hours

4. Do you do the processing alone or are you helped by others ?

A ☐ Alone

B ☐ with others

5. What materials do you usually use for the processing ?

A ☐

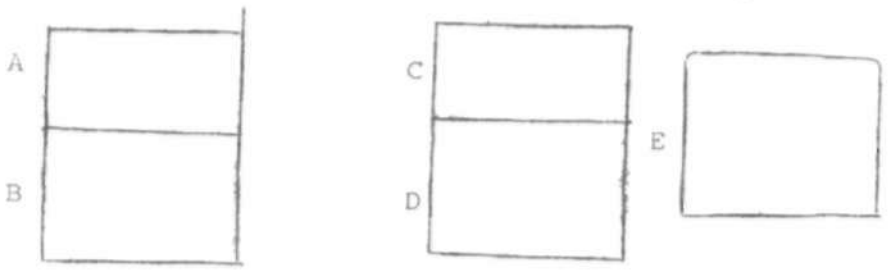
B ☐

C ☐

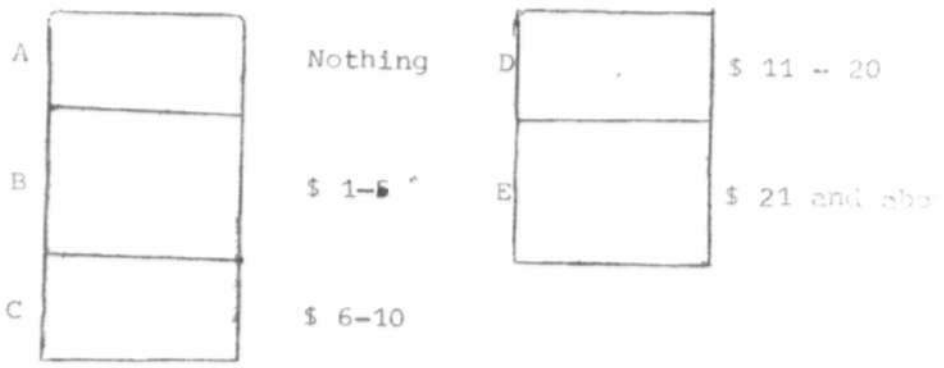
D ☐

E ☐

6. What methods do you usually adopt for the processing



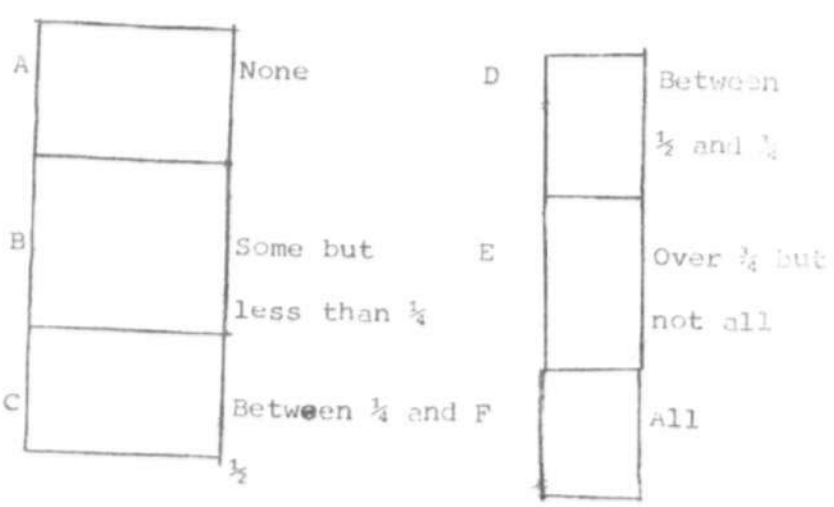
7. How much do you spend on materials, on average, per expedition catch ?



III. End-use of your catch.

A. Consumption

1. Approximately, what proportion, on average of an expedition's catch do you consume in the household ?



2. Approximately, what proportion, on average, of an expedition's catch do you give out (free) to friends and relatives who do not live with you ?

A ☐ None

B ☐ Some but less than ¼

C ☐ Between ¼ and ½

D ☐ Between ½ and ¾

E ☐ Over ¾ but not all

F ☐ All

3. If you were to buy the proportion of your catch that you consume or give away, what is your estimate of its value per month ?

A ☐ Nothing

B ☐ ₦1 – 5

C ☐ ₦6 – 10

D ☐ ₦11 – 20

E ☐ ₦21 and above

4. How much do you spend, on average buying meat of domestic animals per week ?

A ☐ Nothing

B ☐ ₦1 – 5

C ☐ ₦6 – 10

D ☐ ₦11 – 20

E ☐ ₦20 and above

B. Marketing

1. What proportion of an expedition's catch, on average, do you sell ?

A ☐ None

B ☐ Some but less

C ☐ Between ¾ and ½

D ☐ Between ½ and ¼

E ☐ Above ¼ but not all

F ☐ All

2. Where do you sell ?

A ☐ In a market

B ☐ Direct to customers in their houses

C ☐ People come to buy from my house.

D ☐ To middleman that carries it to the market ?

E ☐ Other means (specify)

3. How do you sell

A ☐ In bulk not weighed

B ☐ In Pieces not weighed

C ☐ Other methods (specify)

D ☐ In bulk after weighing

E ☐ In pieces after weighing

4. If you sell in pieces or in bulk by weight, how much do you charge per kilo ?

Species	Price/Kilo

5. If you sell in bulk without weighing, what is the price you get, on average, for a small and large-sized fish of a given species ?

Species of fish	Price of small one	Average price of a large one
1. Tilapia		
2. Clarias		
3. Lates niloticus		
4.		
5.		
6.		

6. Are the prices of fish you sell affected by the season of the year ?

A ☐ Yes B ☐ No.

7. If answer to 6, is yes, when is fish most expensive and cheapest

Highest .....

Lowest .....

8. Do you incur any marketing cost ?

A ☐ Yes B ☐ No.

9. If answer to 8, is yes, give an estimate of such cost per expedition's catch

.....

10. Are you always able to find buyers for all you want to sell ?

A ☐ Yes B ☐ No.

If answer to 10. is No, what do you do with the unsold portion ?

A ☐ Consume at home C ☐ Throw away

B ☐ Give away D ☐ Other (specify)

E ☐ Other (specify)

IV. Problems

Under each of the following headings, state what problems you have.

Problems

Fishing	Transport	Processing	Marketing
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

APPENDIX II

This is a questionnaire meant to evaluate consumer prefrences in terms of type of fish consumed and state of fish preferred.

1. What type of fish do you prefer ? (See diagrams for guide).
   a. Tilapia
   b. Momyrid
   c. Catfish A (Clarias)
   d. Catfish B (Synodontis)
   e. Lates niloticus
   f. Alestes

2. In what state do you want or prefer your fish ? (Underline the appropriate one (s)).
   a. Smoked
   b. Dried
   c. Iced fish
   d. Fresh fish
   e. Fried

2b. Of the above types of fish, which one do you consider as most palatable ?

3a. Which type of fish do you consider as most expensive ?
   a. Smoked
   b. Dried
   c. Iced

3a. d. Fresh fish

e. Fried.

3b. Which type do you consider as the cheapest ?

a. Smoked

b. Dried

c. Iced

d. Fresh fish

e. Fried.

4. Which type of fish do you consider as readily available for your consumption ?

a. Smoked

b. Dried

c. Iced

d. Fresh fish

e. Fried.

After purchasing your desired fish, how do you prepare it for the table ? (Number 1,2,3, as applicable).

a. a. Pepper soup

b. Fried and eaten

c. Fried and made into stew

d. Boiled and made into stew

e. Smoked and eaten

f. Others (please specify).....