A BIOLOGICAL SURVEY OF THE FISHES OP SHIRORO LAKE; NIGER STATE, NIGERIA.

BY

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MAY, 1989.

DECLARATION

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

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CERTIFICATION

This thesis entitled: "A Biological Survey of the Fishes of Shiroro Lake, Niger State, Nigeria", by Adamu Wakili Zinze meets the regulations governing the award of the degree of Master of Science (Fisheries) of Ahmadu Bello University and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

Dedicated to my wife, Laraba; my son, Arnold,

and my daughter, Annabel.

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I am greatly indebted to my supervisor, Prof. A.A. Olatunde who not only suggested the project, but exercised the greatest of patience, understanding and resourcefulness throughout the period of the study.

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ABSTRACT

A biological survey of fish species in Shiroro Lake, Niger State was conducted between April 1987 and March 1988. The specimens were bought from the fishermen at three villages located around the lake. Information from the fishermen showed that the methods of capture were by gill nets, hook and line, fi3h traps and fences.

A total of 1,38U specimens of fish from 13 families comprising 22 genera and 31 species were studied. Most of the species were immature, of one age group and were in good condition throughout the period of investigation.

Growth in Brycinus nurse and Oreochromis niloticus was observed to be isometric and negative allometric respectively. Eight species viz: Labeo senegalensis, Auchenoglanis occidentalis, Schilbe uranoscopus, Clarias gariepinus, Malapterurus electricus, Lates niloticus, Sarotherodon galllaeus and Tilapia zilli showed positive allometric growth.

The fishes exhibited differences in the dietary items selected. Most of them were found to be predators, feeding mainly on fish, insects,crustaceans and molluscs.

There were significant differences ($P<0.05$) between the observed and the expected sex ratio of Schilbe uranoscopus and Hemichromi8 bimaculatus. For most of the species, the sex ratio was approximately 1:1.

TABLE OF CONTENTS

	PAGE
TITLE	i
DECLARATION	ii
CERTIFICATION	iii
DEDICATION	iv
ACKNOWLEDGEMENTS	v
ABSTRACT	vi
TABLE OF CONTENT	vii
LIST OF TABLES	x
LIST OF FIGURES	xii
LIST OF APPENDICES	xiv
CHAPTER ONE: INTRODUCTION	1
CHAPTER TWO: LITERATURE REVIEW	3
2.1 FISH POPULATION	3
2.2 FOOD AND FEEDING HABITS	7
2.3 FECUNDITY	10
CHAPTER THREE: MATERIALS AND METHODS	12
3.1 STUDY AREA	12
3.2 METHOD OF OBTAINING FISH SAMPLES	13
3.3 LABORATORY MEASUREMENTS AND FISH IDENTIFICATION	14
3.4 SEX DETERMINATION AND GONAD CLASSIFICATION	16
3.5 DIET ANALYSIS	18
3.5.1 FREQUENCY OF OCCURRENCE METHOD	18
3.5.2 POINTS METHOD	18
3.6 FECUNDITY	20
3.7 LENGTH-WEIGHT RELATIONSHIP	21
3.8 CONDITION FACTOR	21
3.9 SEX RATIO	21

Table of Contents (cont'd.) PAGE

CHAPTER FOUR: RESULTS 22
4.1 SPECIES COMPOSITION 22
4.1.1 POLYPTERIDAE 22
4.1.2 MORMYRIDAE 22
4.1.3 CHARACIDAE 22
4.1.4 HEPSETIDAE 22
4.1.5 CYPRINIDAE 28
4.1.6 BAGRIDAE 28
4.1.7 SCHILBEIDAE 28
4.1.8 CLARIIDAE 28
4.1.9 MALAPTERURIDAE 28
4.1.10 MOCHOKIDAE 29
4.1.11 CENTROPOMIDAE 29
4.1.12 ANABANTIDAE 29
4.1.13 CICHLIDAE 29
4.2. GROWTH 29
4.2.1 SIZE DISTRIBUTION 29
4.3 LENGTH-WEIGHT RELATIONSHIP 30
4.4 CONDITION FACTOR 48
4.5 FOOD AND FEEDING HABITS 66
4.5.1 POLYPTERIDAE 66
4.5.2 MORMYRIDAE 66
4.5.3 CHARACIDAE 66
4.5.4 HEPSETIDAE 68
4.5.5 CYPRINIDAE 68
4.5.6 BAGRIDAE 68

Table of Contents (cont'd.) PAGE

4.5.7 SCHILBEIDAE 72

4.5.8 CLARIIDAE 73

4.5.9 MALAPTERURIDAE 73

4.5.10 MOCHOKIDAE 73

4.5.11 CENTROPOMIDAE 73

4.5.12 ANABANTIDAE 79

4.5.13 CICHLIDAE 79

4.6 SEX RATIO 86

4.6.1 POLYPTERIDAE 86

4.6.2 CHARACIDAE 86

4.6.3 CYPRINIDAE 86

4.6.4 BAGRIDAE 86

4.6.5 CLARIIDAE 90

4.6.6 MALAPTERURIDAE 90

4.6.7 CENTROPOMIDAE 90

4.6.8 CICHLIDAE 90

4.7 REPRODUCTION CYCLE AND FECUNDITY 92

CHAPTER FIVE: DISCUSSION 93

SUMMARY AND CONCLUSION 98

REFERENCES 99

APPENDICES . . . . . .

LIST OF TABLES

TABLES		PAGE
1	Generalized classification of maturity stages in fish	17
2	Classification of stomach fullness	19
3	Fish fauna of Shiroro Lake	23
4	Abundance of fish species in Shiroro Lake April 1987 - March 1988	25 25
5	Description of Length-weight relationship for ten fish species from Shiroro Lake	13
6	Mean condition factor for different length groups of some fishes in Shiroro Lake	51
7	Statistical analysis for significant difference between condition factor of males and females of ten fish species	53
8	Relative importance and frequency of occurrence of dietary items in the stomach of Brycinus nurse	67
9	Relative importance and frequency of occurrence of dietary items in the stomach of Hepsetus odoe	69
10	Relative importance and frequency of occurrence of dietary items in the stomach of Labeo senegalensis	70
11	Relative importance and frequency of occurrence of dietary items in the stomach of Auchenoglanis occidentalis	71
12	Relative importance and frequency of occurrence of dietary items in the stomach of Chrysichthys nigrodigitatus	72
13	Relative importance and frequency of occurrence of dietary items in the stomach of Schilbe uranoscopus	74
14	Relative importance and frequency of occurrence of dietary items in the stomach of Clarias gariepinus	75
15	Relative importance and frequency of occurrence of dietary items in the stomach of Malapterurus electricus	76
16	Relative importance and frequency of occurrence of dietary items in the stomach of Synodontis schall	77

List of Tables (cont'd.)

TABLES		PAGE
17	Relative importance and frequency of occurrence of dietary items in the stomach of Lates niloticus	78
18	Relative importance and frequency of occurrence of dietary items in the stomach of Sarotherodon galilaeus	80
19	Relative importance and frequency of occurrence of dietary items in the stomach of Oreochromis niloticus	82
20	Relative importance and frequency of occurrence of dietary items in the stomach of Tilapia zilli	83
21	Relative importance and frequency of occurrence of dietary items in the stomach of Hemichromis fasciatus	85
22	Relative importance and frequency of occurrence of dietary items in the stomach of Hemichromis bimaculatus	87
23	Sex ratio of some fishes in Shiroro Lake	88
24	Monthly variations in the sex ratio of some fish in Shiroro Lake	89
25	Statistical analysis for significance difference between observed and expected sex ratios of some fishes in Shiroro Lake	91

FIGURE | LIST OF FIGURES | PAGE

1 Map of Nigeria showing the location of Shiroro Lake 1:

2 Map of Shiroro Lake showing sampling stations 15

3 Length frequency distribution of Brycinus nurse . 31

4 Length frequency distribution of Labeo senegalensis 32

5 Length frequency distribution of Auchenoglanis occidentalis 33

6 Length frequency distribution of Schilbe uranoscopus 34

7 Length frequency distribution of Clarias gariepinus 36

8 Length frequency distribution of Malapterurus electricus 37

9 Length frequency distribution of Lates niloticus 38

10 Length frequency distribution of Sarotherodon galilaeus 40

11 Length frequency distribution of Oreochromis niloticus 41

12 Length frequency distribution of Tilapia zilli . . 42

13 Length-weight relationship (scatter diagram) of Brycinus nurse (males and females combined) 45

14 Length-weight relationship (scatterdiagram) of Labeo senegalensis (Males and females combined) . . 45

15 Length-weight relationship (scatterdiagram) of Auchenoglanis occidentalis(males and females combined). 46

16 Length-weight relationship (scatterdiagram) of Schilbe uranoscopus (males and females combined). . 46

17 Length-weight relationship (scatterdiagram) of Clarias gariepinus (males and females combined) . . 47

18 Length-weight relationship (scatterdiagram) of Malapterurus electricus (males and females combined) 47

19 Length-weight relationship (scatterdiagram) of Lates niloticus (males and females combined) 49

20 Length-weight relationship (scatterdiagram) of Sarotherodon galilaeus (males and females combined) 49

FIGURE — List of Figures (cont'd.) — PAGE

21 Length-weight relationship (scatterdiagram) of Tilapia zilli (males and females combined) 50

22 Length-weight relationship (scatterdiagram) of Oreochromis niloticus (males and females combined) 50

23 Monthly variations in the condition factor of Brycinus nurse (both sexes combined) 55

24 Monthly variations in the condition factor of Labeo senegalensis (both sexes combined) 56

25 Monthly variation in the condition factor of Auchenoglanis occidentalis (both sexes combined) . 57

26 Monthly variation in the condition factor of Schilbe uranoscopus (both sexes combined) 58

27 Monthly variation in the condition factor of Clarias gariepinus (both sexes combined) 59

28 Monthly variation in the condition factor of Malapterurus electricus (Both sexes combined) . . 61

29 Monthly variation in the condition factor of Lates niloticus (both sexes combined) 62

30 Monthly variation in the condition factor of Sarotherodon galilaeus (both sexes combined) . . . 63

31 Monthly variation in the condition factor of Oreochromis niloticus (both sexes combined) 64

32 Monthly variation in the condition factor of Tilapia zilli (both sexes combined) 65

APPENDIX | LIST OF APPENDICES | PAGE

1	Length and weight measurement of some fishes in Shiroro Lake	114
2	Mean condition factor of fish in Shiroro Lake . .	116

CHAPTER ONE

INTRODUCTION

The building of dams and reservoirs of all sizes is increasing in Nigeria. The need for hydroelectric power, in addition to the need for industrial and municipal water supplies, irrigation waters, flood control, development of inland fisheries and improved water transportation and communication spur on the building of the dams.

The country has a total reservoir of 2,755.35km^2 with ten of the reservoirs having an area of greater than 100km^2 (Ita, et al. 1985a). They include Dadin Kowa and Kafin Zaki lakes in Bauchi State; Obanliki reservoir in Cross River State; Kiri reservoir in Gongola State; Tiga and Chalawa Gorge reservoirs in Kano State; Shiroro lake in Niger State; and Goronyo reservoir in Sokoto State. Others are Kainji lake shared by Niger, Sokoto and Kwara States and Jebba lake shared by Kwara and Niger States. The biology of the fishes in some of these lakes have been well documented (Adeniji and Ita, 1976; Imevbore and Bakare, 1970; Lelek 1972, 1973, 1975; Lewis, 1974a; Imevbore and Okpo, 1975; and Blake, 1977a, 1977b).

Apart from the immediate post-impoundment fishery survey of Shiroro lake done by Ita et al. (1985b), the biological studies of the fishes in the lake are yet to be investigated. In this study the main objectives are to investigate:

(a) the species composition of the fish in the lake;

(b) growth pattern with reference to length-weight relationship;

(c) food and feeding habits;

(d) condition factor;

(e) sex ratios;

(f) fecundity and

(g) reproductive cycles of common species.

CHAPTER TWO

LITERATURE REVIEW

2.1 Fish Population in Lakes:

The creation of man-made lakes has stimulated much research into how riverine fish communities become converted into lacustrine ones. Studies on man-made lakes are reviewed by Lowe-McConnell (1966), Obeng (1969) and Ackermann et al. (1973). After a man-made lake is formed, some fishes formerly living in the river adapt themselves to the new environment whereas other species gradually disappear and become replaced by different species. The pattern is a general increase in abundance followed by a steady decline (Jackson, 1966). The species which show an initial increase in abundance are generally those that are preadapted to the lacustrine environment. They include cyprinids, silurids, centrachids, cichlids and clupeids (Jackson, 1966; Lowe-McConnell, 1977; Symoens et al. 1981; Fernando and Holcik, 1982).

The works of Petr (1969a) and Lawson (1969) on Lake Volta, Ghana showed interesting patterns in the distribution and abundance of fish populations during the filling phase of the reservoir. The characids and the mormyrids were unable to exploit the changed condition. They decreased in fishermen's catches soon after the lake started to form. Cichlid fish increased and Tilapia became commercially important. Similar observation has been reported for Lake Kamburu, Kenya (Dadzie, 1980). Ten years after the formation of the Lake Volta, Alestes species became commercially important (Petr, 1974). Vande[illegible] (1982) studied the distribution and abundance of

fish stock in Lake Volta; fish abundance was high in the southern part of the lake.

Harding (1966) studied the hydrology and development of fishes in Lake Kariba, Zambia. He also found that there was an initial increase in fish populations followed by a decline. He recorded 29 species, out of which nine proved to be of commercial importance. The species included Distichodus mossambicus, Distichodus schenga, Labeo altivelis, Labeo congoro, Clarias mossambicus, Tilapia mossambica, Tilapia melanopleura, Hydrocynus vittatus, and Sargochromies codringtoni. Balon and Coche (1974) reported 40 species in this lake. Fish kills typified the initial filling phase of Lake Kariba and Volta (Harding, 1966; Ewer, 1966) and Lake Brokopondo, South America (Leentvaar, 1966). In Lake Brokopondo, Plecostomos species which are strictly rapid dwellers could not escape the anaerobic conditions of their new environment and so died in large numbers.

Bailey (1978) studied the ecology of fishes in Nyumba ya mungu reservoir, Tanzania. He found 20 species of fish with a large number of them living in the littoral and the broad, shallow upstream region of the lake.

In Nigeria, Kainji lake is the most thoroughly studied man-made lake (Sagua, 1979). Lelek (1972, 1973, 1975) has given the possible trend in fish population changes in the lake. In his studies he found that the family Citharinidae was the most abundant followed by Mochokidae, Characidae and Mormyridae. The most important commercial family being the Cithrinidae followed by Characidae, Centropomidae and Mochokidae.

Lewis (1974a) studied the effect of the formation of the lake upon the indeginous fish population. He obtained similar results, with Mormyridae being the least abundant. Lelek (1975) recorded only one percent of Mormyridae which was earlier reported as abundant by Banks et al. (1965) and Motwani and Kanwai (1970). The populations of most of the mormyrids continue to decline and some even disappeared altogether(Blake, 1977). A survey study reported by Lewis (1974b) showed that Kainji lake has 22 families of fish comprising 47 genera and 92 species.

Other man-made lakes have also been studied in Nigeria. During the ichthyological survey of IITA reservoir, Ibadan, Moriarty (1979) recorded six species of fish. They were Hepsetus odoe, Clarias lazera, Pelmatochronis guentheri, Hemichromis fasciatus and Sarotherodon galilaeus. The percentage composition of the least abundant species, Hepsetus odoe, was 0.07 and the most abundant, Sarotherodon galilaeus was 93.96. Ita (1979a) reported 23 species of fish for Tiga lake, Kano. He observed that the family Cichlidae was the most abundant followed by Bagridae. Antony et al. (1986) studied the ichthyofauna of Quree reservoir, Plateau State. They identified four fish species viz: Oreochromis niloticus, Tilapia zilli, Oreochromis galilaeus and Lates niloticus. The percentage composition of the four fish species were 33.3, 42.6, 19.5 and 4.6 respectively; like IITA reservoir and Tiga lake, the family Cichlidae was the most abundant accounting for 95.4% of the total population.

In a preliminary report on the immediate post-impoundment fishery survey of Shiroro reservoir by Ita et al. (1985b), it was also shown that family Cichlidae dominated the catch despite the high mean depth (22.4m) of the lake. Lates niloticus ranked third in terms of abundance in the experimental samples (16.2%) and fourth in commercial landings (15.8%).

Abdullahi (1987) carried out a biological survey of the fishes of Kangimi reservoir, Kaduna State. He recorded ten families comprising of 16 genera and 25 species. The family Cichlidae was the most abundant while Bagridea and Mochokidae were the least.

Many publications document the Ichthyofauna of natural lakes e.g. Fryer and Iles (1972). Fernando and Holcik (1982) have shown that there are more species of fish in tropical Africa than there are in natural lakes in the tropics outside Africa. A large number of endemic species is reported in natural lakes of tropical Africa: 193 in Lake Tangayika, 209 in Lake Victoria and 244 in Lake Malawi (Fryer and Iles, 1972). In these lakes the fauna is largely composed of Cichlidae (Lowe-McConnell, 1969; Fryer and Iles, 1972 and Beadles, 1974) with species of the genus Haplochromis being the most numerous. In the tropics outside Africa where Lacustrine fish fauna is poor as low as 29 and 25 species of fish have been reported for Lake Lanao, Philippines (Brooks, 1950) and Lake Titicaca, South America (Everett, 1973) respectively.

The works of Reynold (1974) and Imevbore and Okpo (1975) on Volta and Kainji lakes respectively have shown that the build up and maintenance of fish populations in lakes depend on the food available, the fish breeding period, the sex ratio and the physical factors necessary for successful spawning. The annual flooding of drawdown zone vegetation during impoundment have been found to have effect on fish population. This fluctuations in lake level have been studied in detail at Kariba (McLachlan, 1969, 1970, 1971; Begg, 1973; Kenmuir, 1975 and also at Kainji Bidwel, 1976).

Reviews of the factors affecting fish production in lakes and reservoirs by Eschmeyer and Hubbs (1938), Lagler (1952), Adesanya (1969) Everhart *et al.* (1975), Oglesby (1977), Ita (1979b) and Henderson (1979) all show that fisheries productivity of lakes and reservoirs depend on their morphology, fertility and climate.

2.2 Food and feeding Habits:

Fishes exhibit a great diversity of feeding habits and considerable selection in the food they consume; and it is known that these choices are important to their relative fitness. Lagler *et al.* (1977) believed that the diversity in feeding habits is the result of evolution leading to structural adaptations for getting food from equally diversified situations that have evolved in the environment.

Although a voluminous amount of literature is available on the food and feeding habits of fishes, there are very few comprehensive fish food studies available in literature which relate the food and feeding habits to the

environment and the anomalies in it. One comprehensive study in this category is that of Imovbore and Bakare (1970) on non-cichlid fishes of River Niger in the Kainji reservoir area. The study revealed that environmental factors affect the availability of food and that these in turn affect the distribution and the growth of fish.

In another food and feeding habit study using 6,474 fish specimens from nine families, Imovbore and Okpo (1975) were able to group the fishes of Kainji lake into Plankton feeders, herbivores, mudsuckers, fish predators and omnivores. More importantly, they found that a great proportion of the total fish population was depending on plankton for food and that they were generally well fed. Olatunde (1978a, 1979b) studied the food and feeding habits of Eutropius niloticus, Physailia pellucida and Schilbe mystus in Kainji lake and reported that E. niloticus fed mainly on insects, P. pellucida on Crustaceans and immature insects and S. mystus mainly on fish and insects. Lewis (1974a) observed Hydrocynus forskali and Hydrocynus brevis in the lake to be piscivorous. The work of Arawomo (1976) revealed that Citharinus species in the lake feed mainly on plankton, epipelic blue green and green algae.

On the basis of extensive studies on the food and feeding habits of fishes in Kangimi lake, Kaduna State, Abdullahi (1987) concluded that insects, especially the immature stages form an important food item for most of the species. The food and feeding habits of Sarotherodon galilaeus in IITA

reservoir, Ibadan have been studied by Fagade (1983). He found this species to feed on a wide variety of plant materials than food of animal origin. The food in the full stomach of the fish constituted 0.55% of the body weight.

Studies on food and feeding habits of fishes were also carried out in man-made lakes and reservoirs in other African countries. For example, Dorgeloh (1985) studied the food preference of the rainbow trout, Salmon gaideneri, Barbus aeneus and Clarias gariepinus of Sterkfontein lake. He found that all the three species fed on benthic organisms (mainly chironomidae) and plant materials consisting of Potamogeton, Lagarosiphon and Phragmites reeds. Bailey (1978) reported for Nyumba ya Mungu reservoir two omnivorous fish species viz: Barbus species and Synodontis punctalatus.

Fluctuations in water level have an effect on food and feeding habits of fishes. McLachlan (1981) reported that one great demand of fish in impounded water is that the water level remain relatively stable so that vegetation may be established and animal population stabilized since these provide food for the fish. In a paper outlining a guideline for dam design and operation to optimize fish basins, Bernacsek (1984) stated that macrophytes in the littoral zone of reservoir provide both shelter for juveniles and also a large surface area for the growth of aufwuchs which are important source of food for many fish species. Macrophytes have also been reported by McLachlan (1969, 1970), Mitchell (1969) and Matthes (1970) to increase abundance and diversity of benthic invertebrates, which in turn support

increased production of omnivorous and insectivorous fish species. This formation of aufwuchs, growth of macrophytes and the annual formation of floodplains during the gradual rising of water have been given as the main factor responsible for high population of fish in tropical and sub-tropical impoundments in Africa (Petr, 1975).

Feeding habits of individual fish species inhabiting natural lakes in the tropics have been described by many workers: Corbet (1961) and Qijen (1982) for the Victoria: Eccles (1975), Fryer and Iles (1972) for the African great lakes; and Lowe (1952) for the Malawi. Lowe (1952) reported that several macrophagous species of Tilapia in Lake Malawi preferred phytoplankton, but at times fed on despsits when their preferred food was in short supply. In the same lake, Fryer (1961) reported Tilapia variabilis as a deposit feeder.

2.3 Fecundity:

Fish fecundity study is stimulated mainly by the interest in fish racial characters, death, population dynamics and the desire to understand their production. Fish fecundity have been found to be lower where there is parental care. For example, the mouth brooding species generally are found to spawn only 75-250 eggs per female (Bardach et al, 1972). Lowe (1955) has recorded 3,706 eggs from 57cm specimen of Oreochromis niloticus, a mouth brooder from Lake Albert. Species that lack the protective mouth-brooding trait produces up to 5000 eggs (Bardach et al, 1972).

Rinne and Wanjala (1983) studied the maturity, fecundity and breeding season of the major cat fishes in Lake Victoria. They found varied fecundity for five species, Porcus docmac 2,000 - 88,000; Clarias mossambicus, 5,000 - 192,000 Synodontis victorie, 1,500 - 15,799; Synodontis afro-fisheri, 200 - 1,500; and Schilbe mystus, 16,000 eggs. They observed pulses in reproductive activity in all the species studied and the pulses were generally positioned between the established rainy seasons for East Africa.

In Sudan, Bishai (1977) studied the reproduction of Alestes in Jebel Auliya reservoir and found temperature to be important factor for the onset of spawning. In a similar study Siddiqui (1977) recorded 751 eggs for Tilapia leucostica in Lake Naivasha, Kenya. In Nigeria, Olatunde (1978b, 1979c) studied the sex, reproductive cycles and variations in the fecundity of the family Schilbeidae in Lake Kainji. He found all the species in the family to show sexual differences in size. Most of the species bred during the rainy season and fecundity varied from species to species.

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study Area:

In 1957, the former Northern Nigeria government and the former Electricity Corporation of Nigeria jointly authorised an investigation of the hydroelectric potential of the River Kaduna at Shiroro gorge by Sir Alexander Gibbs and Partners in collaboration with Messrs Preece, Cardew and Rider. The report was published in 1959. Work on the dam which has a generating capacity of 600 mega watt began in 1978 and by 1988 100% of the civil works and 40% of the electro-mechanical supplies and installations had been completed. The scheme has involved the resettlement of some 20,461 people (Adamu, 1984) exceeding the earlier expected 7,000 people in 20 villages (Motor, 1975).

The dam site is located at Shiroro gorge on the Kaduna river (Lat. $9^{o}58'12"$, Long. $6^{o}5'18"$) about 550m downstream of the confluence of the Kaduna and Dinya rivers in Niger State. It is 150km upstream of the confluence with the Niger river, approximately 2.5km upstream from the village of Shiroro, 90km airline distance south-west of the city of Kaduna and 50km northeast of Minna.

The reservoir created in May 1984 lies completely in Niger State and within the Guinea savannah vegetation zone covering an area of about $350km^2$ when the reservoir is raised to a maximum power pool elevation of 382m (Main, 1977a). It is approximately 47km long with a maximum width of 16km (Main, 1977a).

It has a storage capacity of 7 billion m^3 (7×10^9 Cu.M) and a mean depth of 22.4 metres (Ita et al, 1985b). It is the largest man-made lake in Niger State which has a total area of reservoir of $722.43km^2$ (Ita et al, 1985a).

The climate of the reservoir is tropical with a distinct rainy season and dry season. The peak of the rain-fall occurs between July and September. The morphometric, hydrological and historical aspects of the reservoir are described elsewhere (De Preece, 1949; Russ, 1957; Gibbs et al, 1959; Knill, 1962; Trusswell and Cope, 1963; Grant, 1969; Motor, 1975 and Main 1977a, 1977b, 1977c) and so are the general features of the reservoir fishery (Ita et al, 1985b). See Fig. 1 for the location of the reservoir.

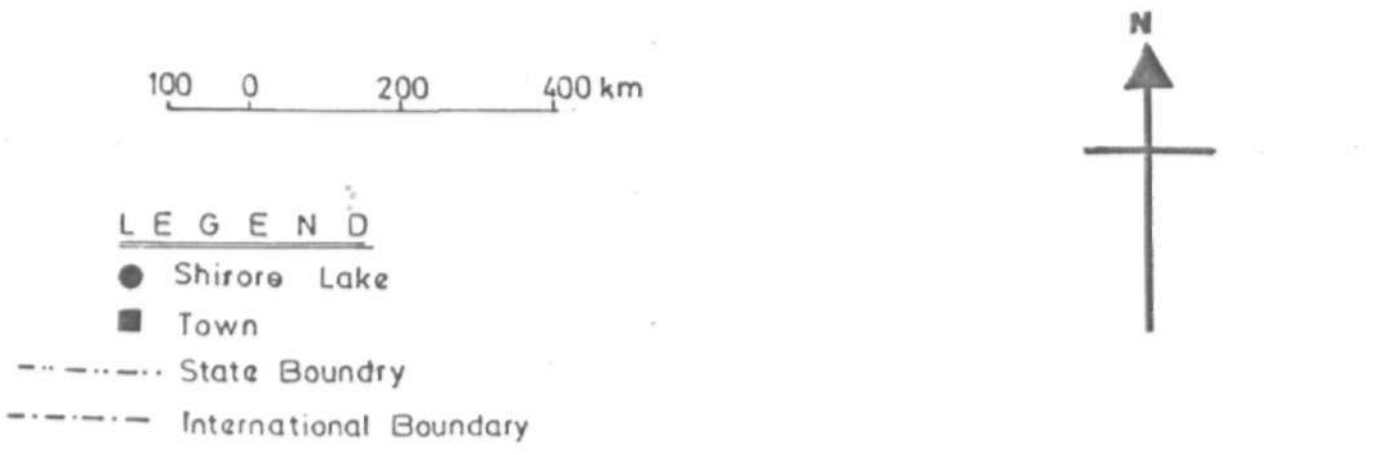
3.2 Method of obtaining Fish Samples:

Commercial fishermen on Shiroro lake use mainly surface and bottom set gill nets (12.7mm - 228.6mm stretched mesh size), cast nets, clap nets, lift nets, long lines, rod and line fish traps and fish fences. The fish are mostly caught in the night time and are landed in the morning as from 7.00 a.m. Most of the fishermen land their catches at Zumba, Guni and Shekwodna (Fig. 2).

Fish were sampled immediately after they were landed. They were collected at the first landing to prevent intermediate losses (e.g. removal of unmarketable fish, unpopular species, undersize fish, etc) and some kept by the fishermen for their own consumption. The number of individual selected for fish species depended on the number of each fish species in the total



FIG 1: MAP OF NIGERIA SHOWING THE LOCATION OF SHIRORO LAKE



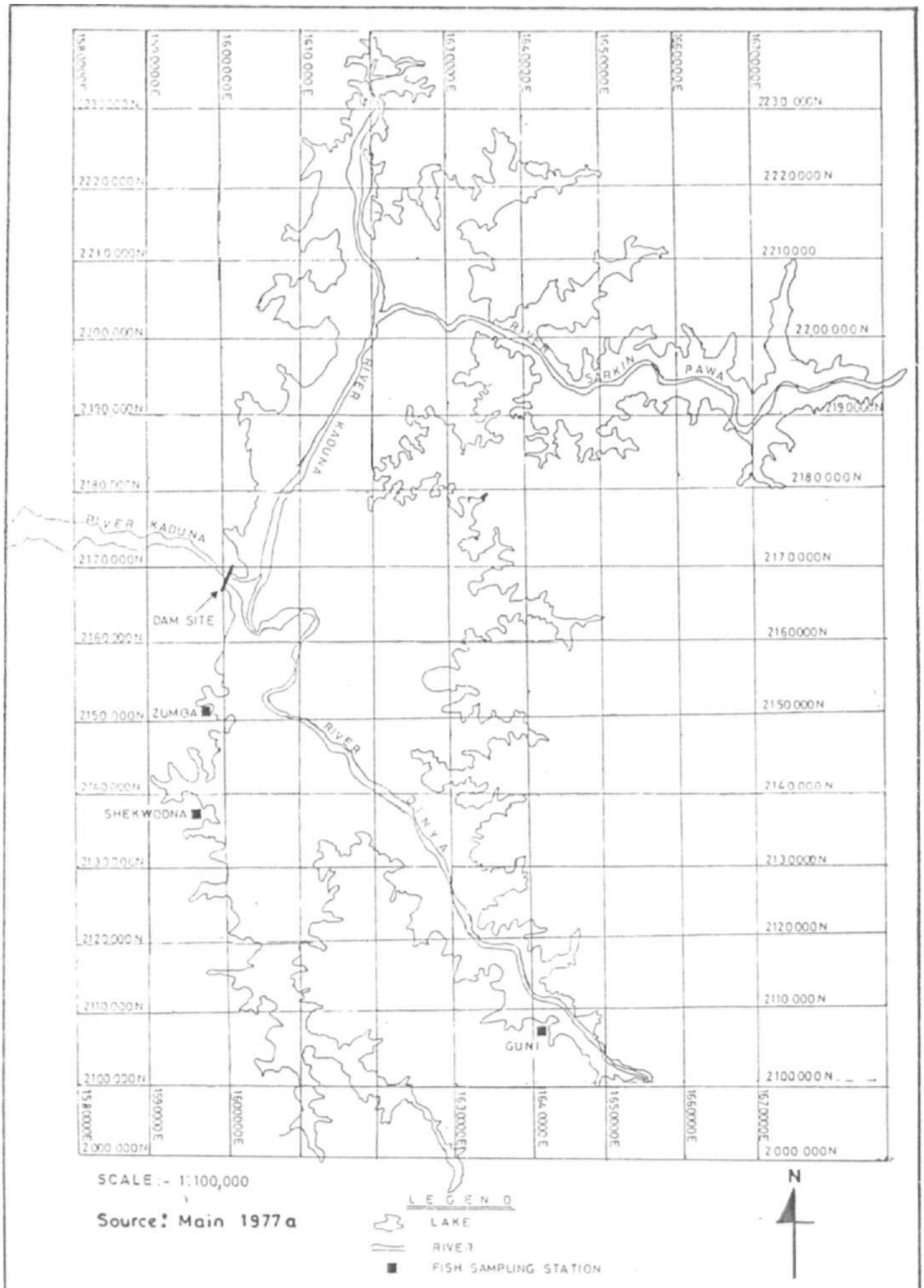


FIG. 2: MAP OF SHIRORO LAKE SHOWING FISH SAMPLING STATIONS

catch. The fish were purchased once at the end of every month from the fishermen and brought to the laboratory in Zaria, packed in ice. The sampling was done for 12 months between April 1987 and March, 1988.

3.3 Laboratory Measurement And Identification:

In the laboratory, each fish was identified up to the species level. The identification was done with the aid of Reed et al. (1967), Lewis (1974b) and Holden and Reed (1978). Confirmation of the species was done by my supervisor. After identification, the following measurements were made:

(a) Weight: The fish were blotted dry and weighed to the nearest 0.1gram. using Mettler electronic balance.

(b) Standard length: The length from the tip of the mouth to the end of the hypural bone which could be located by slightly bending the caudal fin. This was measured to the nearest 1mm.

3.4 Sex Determination and Gonad Classification:

The fish were dissected in order to determine the sex and the gonadal maturity stages. The gonadal maturity stages were based on a model of maturity scale modified after Nikolsky (1963) and Olatunde (1978b), (Table 1). Doubtful gonadal tissue were squashed between glass slides and searched under dissecting microscope for oocysts. Female gonads in stage iv were removed, splitted longitudinally, turned inside out and preserved in labelled jars containing Gilson fluid (Simpson, 1951) for at least three months for future fecundity studies.

TABLE 1: GENERALIZED CLASSIFICATION OF MATURITY STAGES IN FISH

Maturity Stages	Gonad Conditions	DESCRIPTION OF GONADS	
		Female	Male
I	Virgin	Ovaries are small, colourless and not easily separated into sexes.	Testes are small with thin out-growth and are not easily identified.
II	Immature or developing	Ovaries are oblong, translucent and quite visible to the naked eyes. Developing eggs invisible to the naked eyes.	Testes are thin, visible to the naked eyes and have thin out-growth.
III	Matured or developed	Eggs visible and the colour changes from cream to yellow depending on the fish.	Testes swollen, white with conspicous finger like out-growth.
IV	Fully matured	Ovaries have reached maximum development; they are very large but eggs are not shed when a slight pressure is applied to the fish belly.	Testes white and swollen, milt not running when a slight pressure is applied to the fish belly.
V	Running or spawning	Same as in Stage IV above but eggs are shed when slight pressure was applied on the abdomen.	Same as in the Stage IV above, but milt was running with slight pressure applied on the abdomen.

Modified After Nikolsky (1963) and Olatunde (1979a)

3.5 Diet Analysis:

From each specimen, the stomach was removed and placed in a bottle containing 4% formalin. For determining the food items, each stomach was opened and the contents were examined under a dissecting microscope. Fine materials were identified with the aid of a compound microscope. Individual food items sorted out were identified with the help of Edmondson (1959) and Wickstead (1965) up to class and in some cases gen eric levels The stomach contents were analysed using frequency of occurrence and the points methods as recommended by Hyslop (1980).

3.5.1 Frequency of occurrence method:

The method involves finding out the number of times that each of the various food items occurred in the total number of fish stomachs examined. The merits and demerits of this method have been discussed by Allen (1935).

The method is able to show the number of individual fish in the sample that ate particular food items, but does not give information on the number or quantity and does not take into consideration the accumulation of food organism resistant to digestion.

3.5.2 Points method:

The method involves awarding points to the stomach according to the degree of their fullness and to the food items according to the volume they occupied in relation to the total food contained in the stomach and the points awarded to that stomach (Hynes, 1950), (Table 2). This method is subjective,

TABLE 2: CLASSIFICATION OF STOMACH FULLNESS

STOMACH STATUS	DESCRIPTION	POINT AWARDED
Full	The stomach bulges considerably with food, stomach wall very thin and transparent	100
¾ full	The stomach is almost full but does not bulge	75
½ full	Food occupies only halve of the stomach volume	50
¼ full	Stomach wall very flabby sometimes looked as if empty.	25
Empty	No visible food in the stomach when dissected and examined under the microscope.	0

Source: Olatunde (1978a)

but has the advantage of being rapid and easy. It requires no special apparatus for measurement and it is not influenced by the frequent occurrence of small organisms in large numbers. It also does not involve trying to count large number of small and broken organisms and does not give the spurious impression of the accuracy which is given by some other methods (Hynes, 1950). The points for food items got in individual fish were added and the percentage contribution of each was determined for each species of fish.

3.6 Fecundity:

Fecundity, the number of ripening eggs in the female prior to the spawning period (Bagenal, 1967) was determined for some fishes using Simpson (1959) dry gravemetric method. Gonads in Gilson fluid were periodically shaken to assist the penetration of the preservative and the liberation of the eggs from the ovarian tissue (Bagenal, 1970; Olatunde, 1978b). After three months of preservation, the preservative was decanted off and the eggs washed thoroughly with water. The water was decanted off and the eggs were blotted dry using filter paper. They were left further to dry at room temperature for 24 hours. The dried eggs were weighed and two random subsamples of 200 eggs each were weighed individually and the average weight of the two subsamples were calculated. To obtain estimate of the fecundity, the total weight of the eggs was divided by the average weight of the samples weight and the quotient multipled by 200.

3.7 Length-weight Relationship:

Weight was plotted against length for males and females combined for those species whose total number exceeded 40. A regression of weight against length was also calculated using the equation:

$$W = aL^b \text{ (Lecren 1951)} \quad \ldots\ldots\ldots\ldots (1)$$

where W = Weight of fish (gm)

L = standard length of fish (cm)

a = constant

When the value of b = 3, equation (1) assumes that the geometric proportions of the body are not changed (Lagler, 1952).

3.8 Condition Factor (K):

Condition factor (K) was calculated using the formula described by Worthington and Ricardo (1930).

$$K = \frac{100.W}{L^b} \quad \ldots\ldots\ldots\ldots (2)$$

where K = the condition factor

W = weight of the fish (gm)

L = standard length of fish (cm)

b = exponent obtained from the conventional length-weight relationship equation 1 above.

Calculations of K were made for males and females combined of the various species examined. Calculations were also made for separate sexes and for different standard length group.

3.9 Sex Ratio:

The sex ratio of the species with observable gonads during the period of study were calculated.

CHAPTER FOUR

R E S U L T S

4.1 FISH COMPOSITION

A total of 1,384 fish specimens were examined during this study. Table 3 gives the list of species that were encountered during the period of study. The table shows that there were 13 families made up of 22 genera and 31 species. Table 4 shows the monthly occurrence of each of the species in the samples.

4.1.1 Polypteridae:

The family Polypteridae was represented by one genus and one species, **Polypterus senegalus**. It occured only in February sample.

4.1.2 Mormyridae:

The family was represented by two genera and two species. They were Mormyrus rume and Mormyrops deliciosus. M. rume was uncommon, occurring five times in the twelve samples. The two representatives of this family were found present in the lake throughout the year.

4.1.3 Characidae:

Only one genus and two species represented this family. They were Brycinus nurse and Brycinus macrolepidotus. B. nurse was common and B. macrolepidotus rare.

4.1.4 Hepsetidae:

This was represented by one species Hepsetus odoe. It was common, occuring in all samples.

TABLE 3: FISH FAUNA OF SHIRORO LAKE

POLYPTERIDAE

Polypterus senegalus CUVIER AND VALENGENNES 1829

MORMYRIDAE

Mormyrus rume CUVIER AND VALENCIENNES 1846

Mormyrops deliciosus (LEACH 1818)

CHARACIDAE

Brycinus nurse (RUPPELL 1832)

B. macrolepidotus (CUVIER AND VALENCIENNES 1869)

HEPSETIDAE

Hepsetus odoe (BLOCH 1794)

CYPRINIDAE

Labeo senegalensis CUVIER AND VALENGENNES 1842

L. coubie RUPPELL 1832

L. parvus BOULENGER 1902

Barbus occidentalis BOULENGER 1902

Barilius senegalensis STEINDACHNER 1870

BAGRIDAE

Porcus docmac

Auchenoglanis occidentalis CUVIER AND VALENGENNES 1840

Chrysichthys nigrodigitatus (LACEPEDE 1803)

C. furcatus GUNTHER 1864

SCHILBEIDAE

Schilbe uranoscopus RUPPELL 1832

S. mystus LINNAEUS 1762

CLARIIDAE

Clarias gariepinus (BUCHELL)

Heterobranchus longifilis CUVIER AND VALENCIENNES 1840

Table 3 (cont'd.)

MALAPTERURIDAE
Malapterurus electricus (GMELIN 1789)
MOCHOKIDAE
Synodontis violaceus PELLEGRIN 1919
S. nigrita CUVIER AND VALENCENNES 1840
S. gambiensis GUNTHER 1864
S. schall (BLOCH AND SCHNEIDER 1801)
CENTROPOMIDAE
Lates niloticus (LINNAEUS 1762)
ANABANTIDAE
Ctenopoma kingsleyae GUNTHER 1896
CICHLIDAE
Sarotherodon galifaeus (ARTEDI)
Oreochromis niloticus LINNAEUS 1757
Tilapia zilli (GERVAIS 1848)
Hemichromis fasciatus PETERS 1857
H. bimaculatus GILL 1862

TABLE 4: MONTHLY OCCURRENCE OF FISH SPECIES IN COMMERCIAL LANDINGS FROM SHIRORO LAKE (APRIL 1987 - MARCH 1988)

SPECIES	A(1987)	M	J	JL	A	S	O	N	D	J(1988)	F	M	COMMENT
CHARACIDAE													
Brycinus nurse	.	.	.	.	.	.	.	.	.	.	.	.	Common
HEPSETIDAE													
Hepsetus odoe	.	.	.	.	.	.	.	.	.	.	.	.	"
CYPRINIDAE													
Labeo senegalensis	.	.	.	.	.	.	.	.	.	.	.	.	"
BAGRIDAE													
Auchenoglanis occidentalis	.	.	.	.	.	.	.	.	.	.	.	.	"
SCHILBEIDAE													
Schilbe uranoscopus	.	.	.	.	.	.	.	.	.	.	.	.	"
CLARIIDAE													
Clarias gariepinus		.	.	.	.	.	.	.	.	.	.	.	"
MALAPTERURIDAE													
Malapterurus electricus	.	.	.	.	.	.	.	.	.	.	.	.	"

Table 4 (cont'd.)

SPECIES	A(1987)	M	J	JL	A	S	O	N	D	J(1988)	F	M	COMMENT
CENTROPOMIDAE													
Lates niloticus	•	•	•	•	•	•	•	•	•	•	•	•	Common
CICHLIDAE													
Sarotherodon galilaeus	•	•	•	•	•	•	•	•	•	•	•	•	"
Oreochromis niloticus	•	•	•	•	•	•	•	•	•	•	•	•	"
Tilapia zilli	•	•	•	•	•	•	•	•	•	•	•	•	"
MORMYRIDAE													
Mormyrus rume	•	•				•				•		•	Uncommon
BAGRIDAE													
Chrysichthys nigrodigitatus	•		•	•	•	•				•	•	•	"
POLYPTERIDAE													
Polypterus senegalus											•		Rare
MORMYRIDAE													
Mormyrops deliciosus						•		•					"
CHARACIDAE													
Brycinus macrolepidotus		•	•					•					"

Table 4 (cont'd.)

SPECIES	A(1987)	M	J	JL	A	S	O	N	D	J(1988)	F	M	COMMENT
CYPRINIDAE													
Labeo coubie	•							•					Rare
L. parvus													
Barbus occidentalis				•									"
Barilius senegalensis			•										"
BAGRIDAE													
Porcus docmac			•										"
Chrysichthys furcatus						•						•	"
SCHILBEIDAE													
Schilbe mystus						•		•		•	•		"
CLARIIDAE													
Heterobranchus longifilis								•					"
MOCHOKIDAE													
Synodontis violaceus								•					"
S. nigrita								•					"
S. schall													"
S. gambiensis					•				•	•			"
ANABANTIDAE													
Ctenopoma kingsleyae	•										•	•	"
CICHLIDAE													
Hemichromis fasciatus								•	•	•	•		"
H. bimaculatus										•	•		"

KEY

Number of times species occurred in twelve samples	Comment
9-12, 5-8, 1-4	Common, uncommon, Rare

4.1.5 Cyprinidae:

The family was represented by three genera and five species. They were Labeo senegalensis, Labeo coubie, Labeo parvus, Barbus occidentalis and Barilius senegalensis. Apart from L. senegalensis, other species of this family occurred rarely.

4.1.6 Bagridae:

This family had three genera and four species. They were Porcus docmac, Auchenoglanis occidentalis, Chrysichthys nigrodigitatus and Chrysichthys furcatus. P. docmac was rare and found in the rainy season sample. C. furcatus was also rare but was present in the lake throughout the year. A. occidentalis and C. nigrodigitatus were common.

4.1.7 Schilbeidae:

The family Schilbeidae was represented by two species of Schilbe. They were Schilbe mystus and Schilbe uranoscopus. S. mystus was rare. The two species of this family were found both in rainy and dry seasons samples.

4.1.8 Clariidae:

The family was represented by two genera and two species. They were Clarias gariepinus and Heterobranchus longifilis. Only one specimen of H. longifilis was observed and was during dry season. C. gariepinus was common.

4.1.9 Malapteruridae:

This was represented by one species Malapterurus electricus. It was common and occurred throughout the year.

4.1.10 Mochokidae:

Mochokidae was represented by four species of which Synodontis schall was the most common. The other species which were rare Synodontis nigrita, Synodontis violaceus and Synodontis gambiensis. The four species were observed in the dry season samples.

4.1.11 Centropomidae:

Lates niloticus which occurred throughout the year represented the family.

4.1.12 Anabantidae:

The family Anabantidae was represented by one rare species, Ctenopoma kingsleyae.

4.1.13 Cichlidae:

This was represented by four genera and five species; Sarotherodon galilaeus, Oreochromis niloticus, Tilapia zilli, Hemichromis fasciatus and Hemichromis bimaculatus. H. fasciatus and H. bimaculatus were rare, while others were common.

4.2 GROWTH

Size Distribution:

The standard length and weight ranges of common species are shown in Appendix 1. Figures 3-12 show the length frequency distribution of the males and females separate and both sexes combined of the common species.

4.2.1 Brycinus nurse:

The standard length of the females of B. nurse were found to range between 9.20 - 15.50cm for a weight of 15.87 - 75.18g

while the standard length of the males were found to range between 8.00 - 15.50cm for a weight of 4.00 - 81.35gm (Figure 3a). Most of the specimens had length between 10.90 - 13.90cm (Figure 3b).

The length and weight frequency distributions of the males and of the females separate were positively skewed.

4.2.2 Labeo senegalensis:

Figure 4a shows the length frequency distribution of males and females separate of L. senegalensis while figure 4b shows that of the males and females combined. A distinct peak is seen between 18.70 - 20.50cm in the two figures. The length and weight frequency distributions of the males and of the females separate were positively skewed.

4.2.3 Auchenoglanis occidentalis:

Figure 5a shows the length frequency distribution of males and females separate of A. occidentalis. Most of the males had length between 15.70 - 19.50cm and females between 11.90 - 15.70cm. The length and weight frequency distributions of males were leptokurtic and positively skewed, while that of the females were platykurtic and also positively skewed. Most of the specimens of A. occidentalis lie between 15.80 - 19.50cm standard length (Fig. 5b).

4.2.4 Schilbe uranoscopus:

Most of the males and females of S. uranoscopus had length between 14.70 - 17.30cm (Fig. 6a and 6b). The length frequency distributions for males and females separate were negatively

FIG·3: LENGTH FREQUENCY DISTRIBUTION OF BRYCINUS NURSE

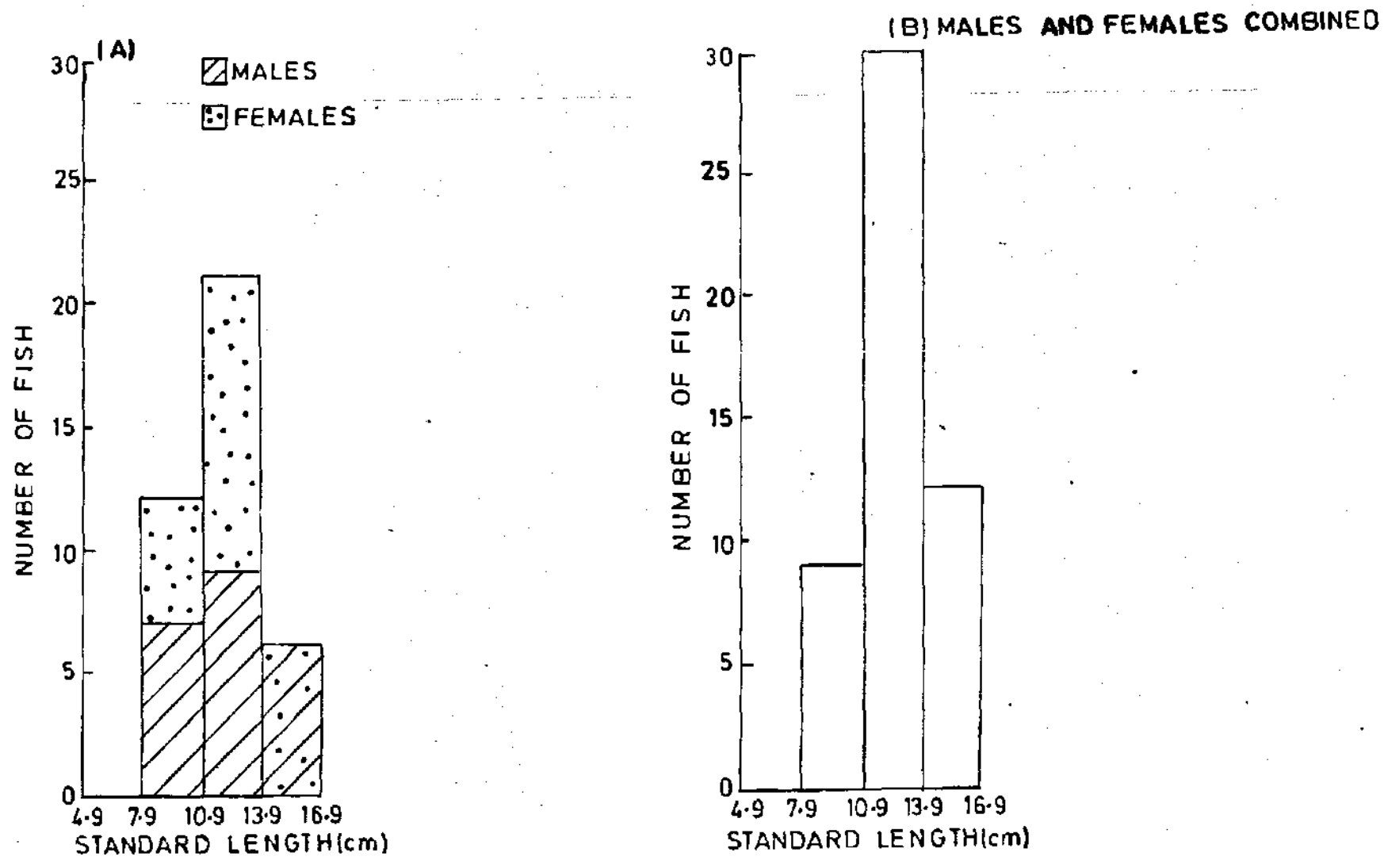


FIG.4:LENGTH FREQUENCY DISTRIBUTION OF LABEO SENEGALENSIS



FIG. 5: LENGTH FREQUENCY DISTRIBUTION OF AUCHENOGLANIS OCCIDENTALIS

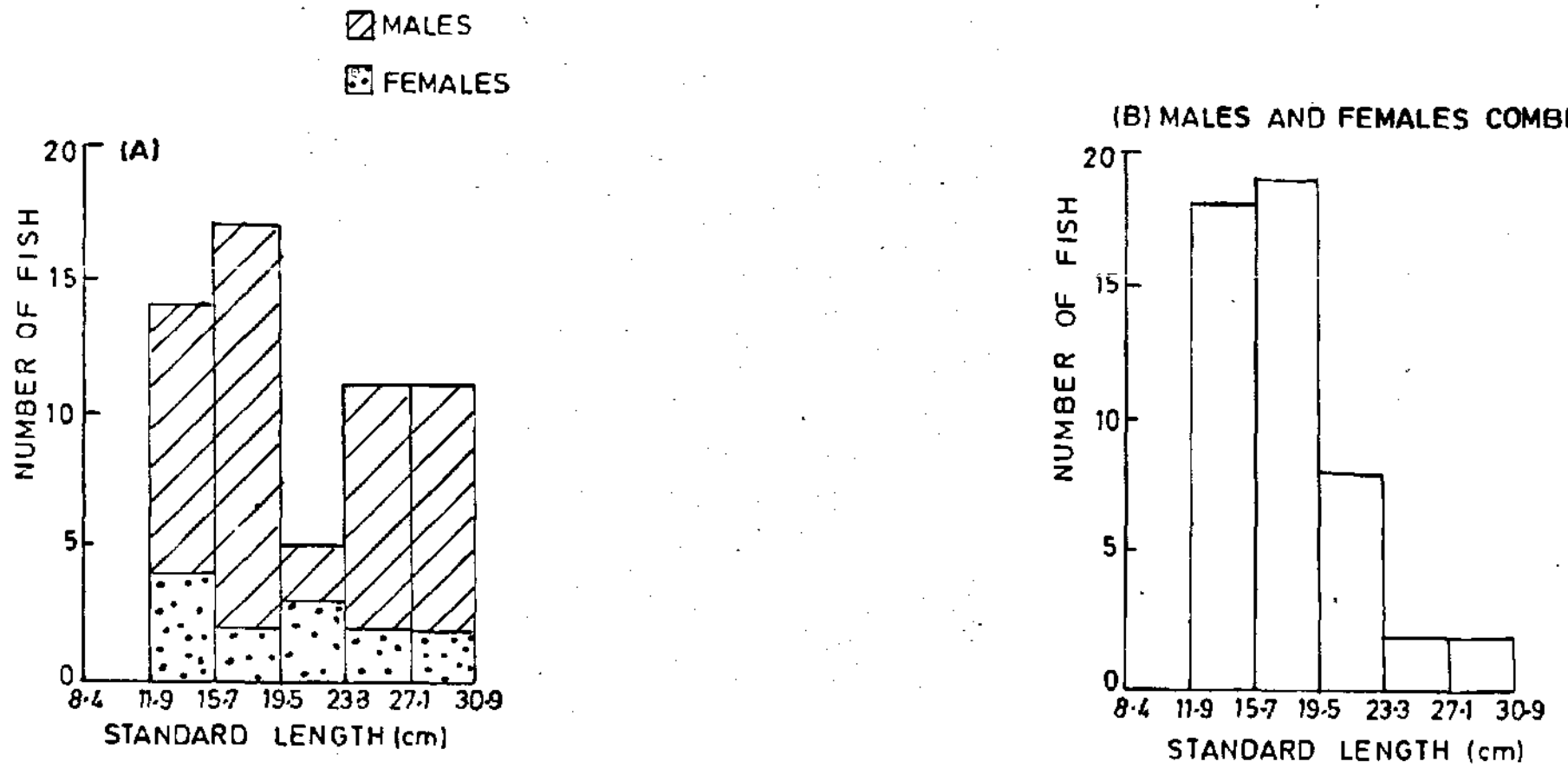
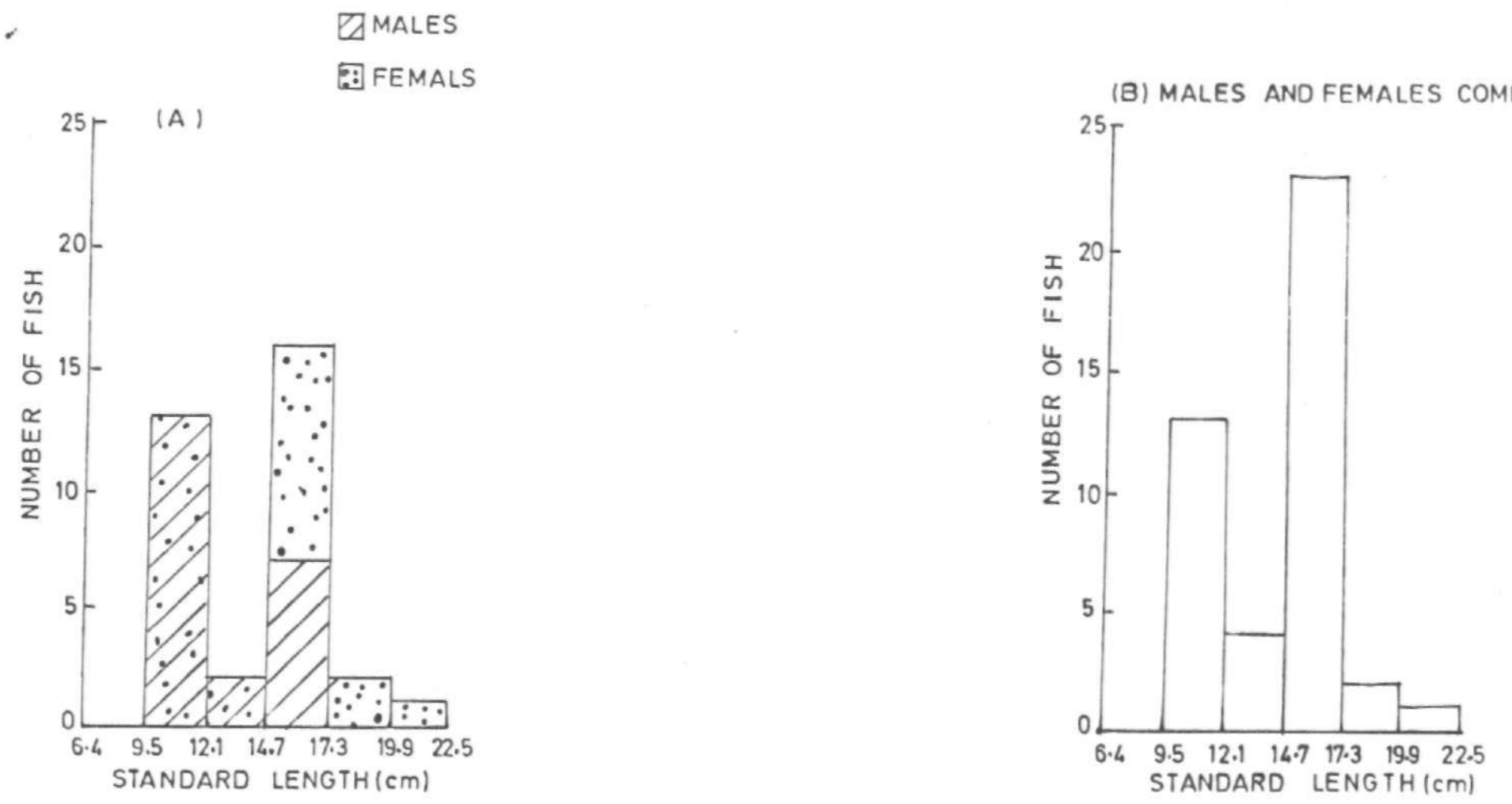


FIG.6:LENGTH FREQUENCY DISTRIBUTION OF SCHILBE URANOSCOPUS



skewed. That of the females was slightly platykurtic and the one for males leptokurtic. The weight frequency distributions for the males and females separate were positively skewed.

5.2.5 Clarias gariepinus:

The length frequency distribution of C. gariepinus is shown in Fig. 7b. Most of them lie between 16.50 - 24.10cm. Most of the females were also in this length group (Fig. 7b). The length frequency distribution for males and females separate were positively skewed. Their weight frequency distributions were also positively skewed but leptokurtic.

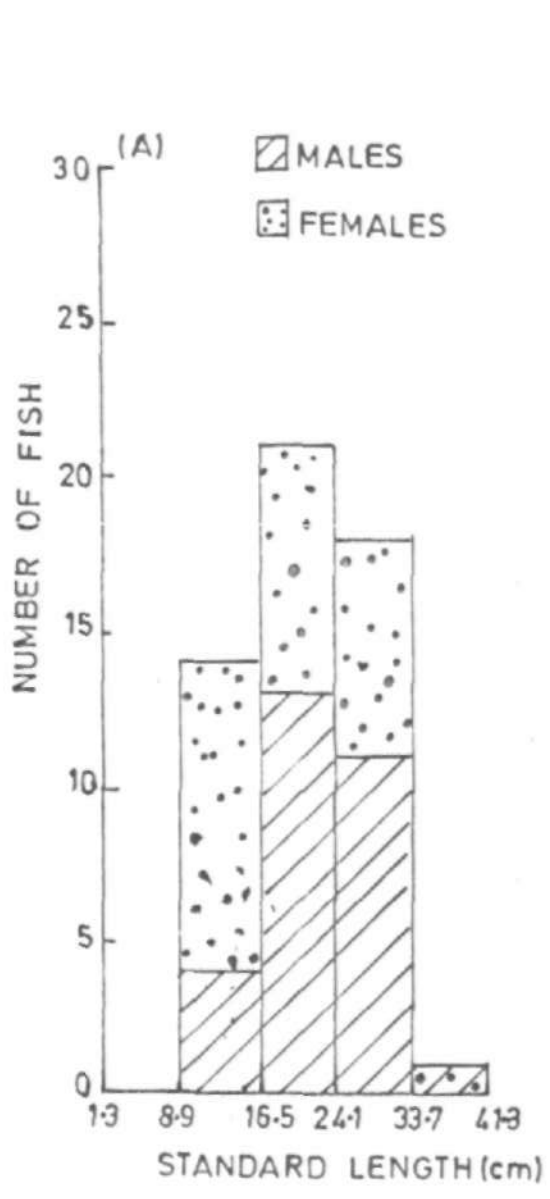
4.2.6 Malapterurus electricus:

A distinct peak is seen between 13.50 - 18.10cm standard length in Fig. 8b that shows length frequency distribution of males and females combined for M. electricus. Figure 8a shows that most of the males lie between 13.50 - 18.10cm. Most of the females also lie between the above length group. The length and weight frequency distributions for males and females separate, were found to be leptokurtic and positively skewed.

4.2.7 Lates niloticus:

Figure 9b shows that about 46% of the specimens of L. niloticus examined had standard length between 12.60 - 16.80cm. There were more females in the above length group (Fig. 9a). The length and weight frequency distributions were leptokurtic and positively skewed.

FIG·7; LENGTH FREQUENC DISTRIBUTION OF CLARIAS GARIEPINUS



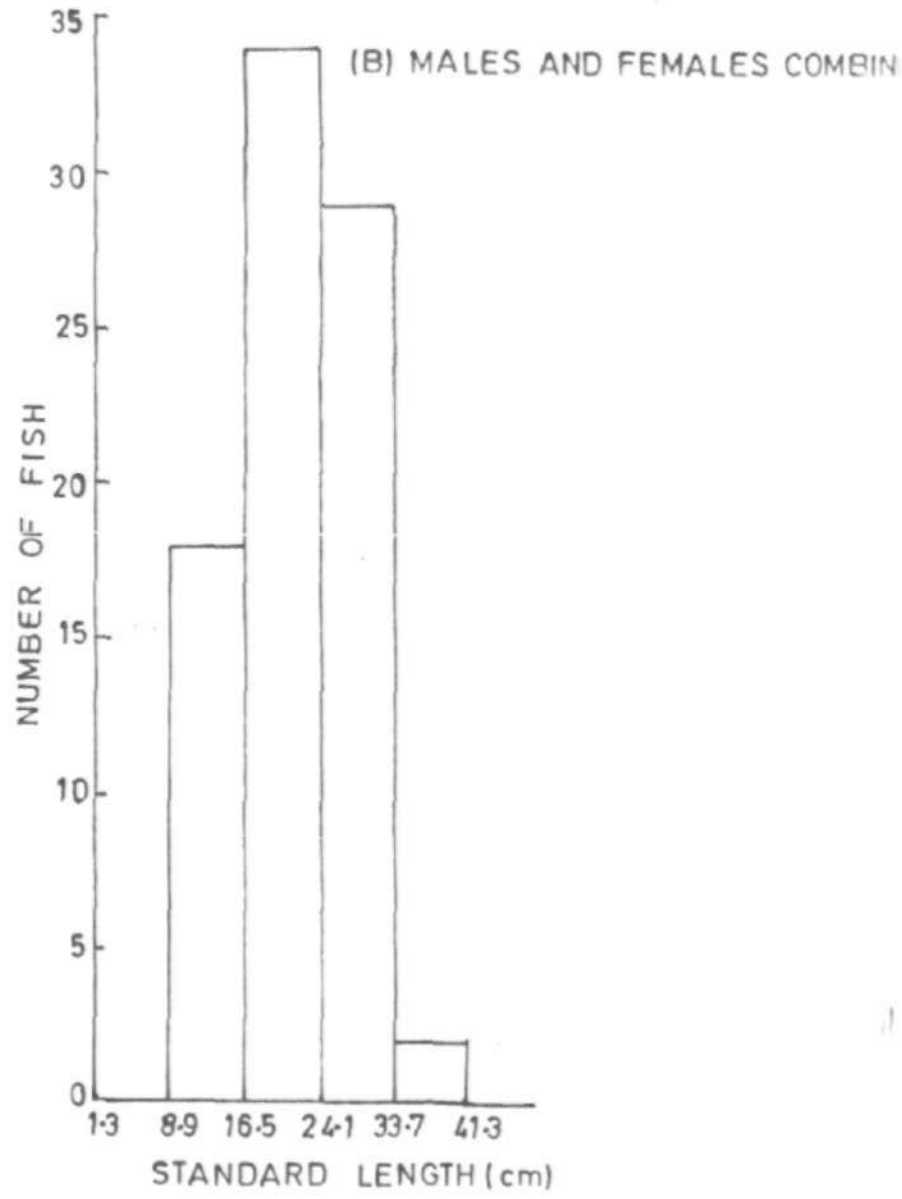
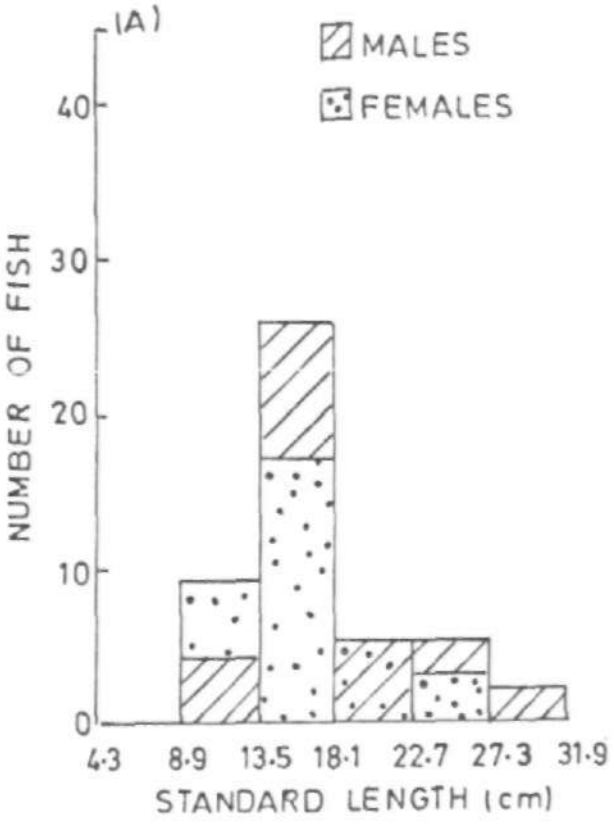


FIG. 8: LENGTH FREQUENCY DISTRIBUTION OF MALAPTERURUS ELECTRICUS



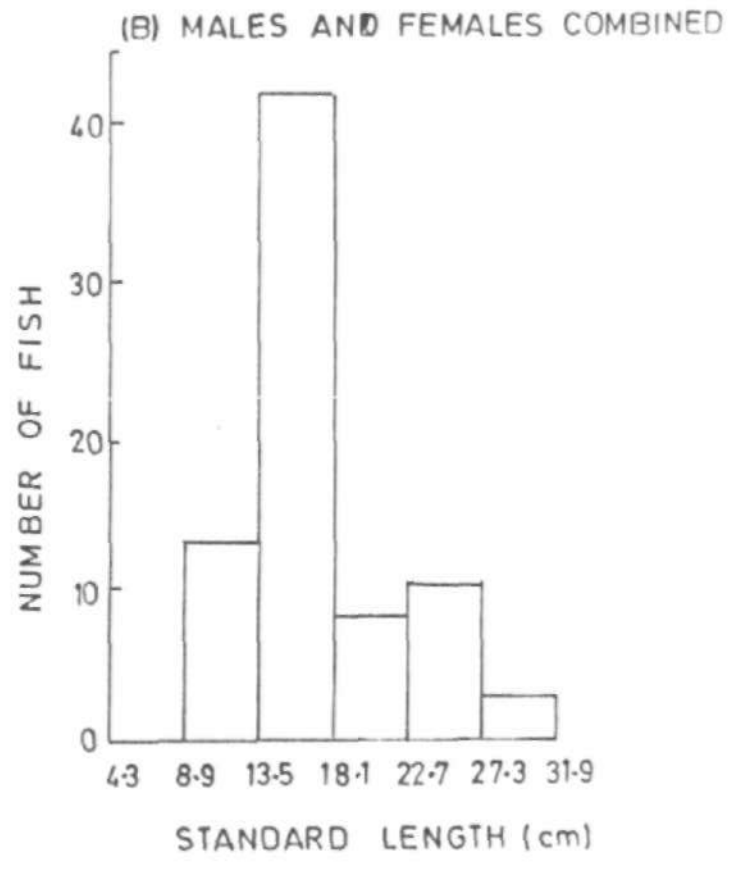
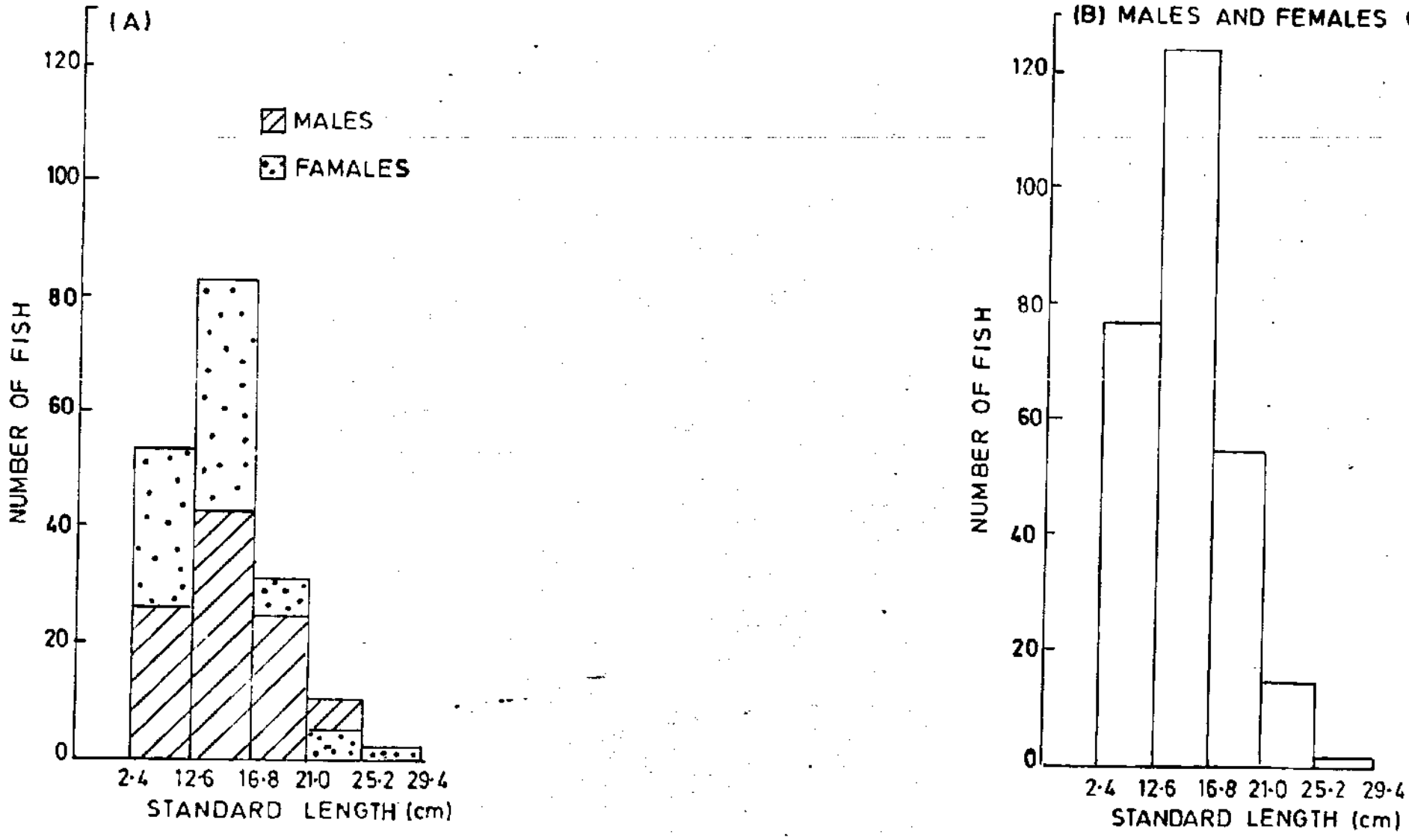


FIG-9: LENGTH FREQUENCY DISTRIBUTION OF LATES NILOTICUS



4.2.8 Sarotherodon galilaeus:

More males and females of S. galilaeus were present in the length group of 6.90 - 11.90cm (Figure 10a). Figure 10b shows that over half of the specimens were in the above standard length group. The length and weight frequency distributions were leptokurtic. The length frequency distribution for females was platykurtic.

4.2.9 Oreochromis niloticus:

Figure 11a shows distinct peaks between 6.90 - 9.50cm and 9.50 - 12.10cm standard length for the females and males respectively. Most of the specimens were found in 9.50 - 12.10cm standard length group (Fig. 11b). The length and weight frequency distributions were platykurtic and positively skewed.

4.2.10 Tilapia zilli:

Figure 12b shows the standard length frequency distribution of T. zilli. Most of the specimens were between 11.80 - 14.40cm. However, the length frequency distribution for only males (Fig. 12a) shows that most of them lie between 9.20 - 11.80cm. The females were in the modal class of 11.80 - 14.40cm. The weight frequency distributions for males and females separate, were leptokurtic and positively skewed.

4.3 LENGTH-WEIGHT RELATIONSHIP

The length-weight relationships of the fish expressed in the form of scattergrams are presented in Figures 13-22. The relationships can best be described by the equations in Table 5.

FIG.10;LENGTH FREQUENCY DISTRIBUTION OF SAROTHERODON GALILAEUS

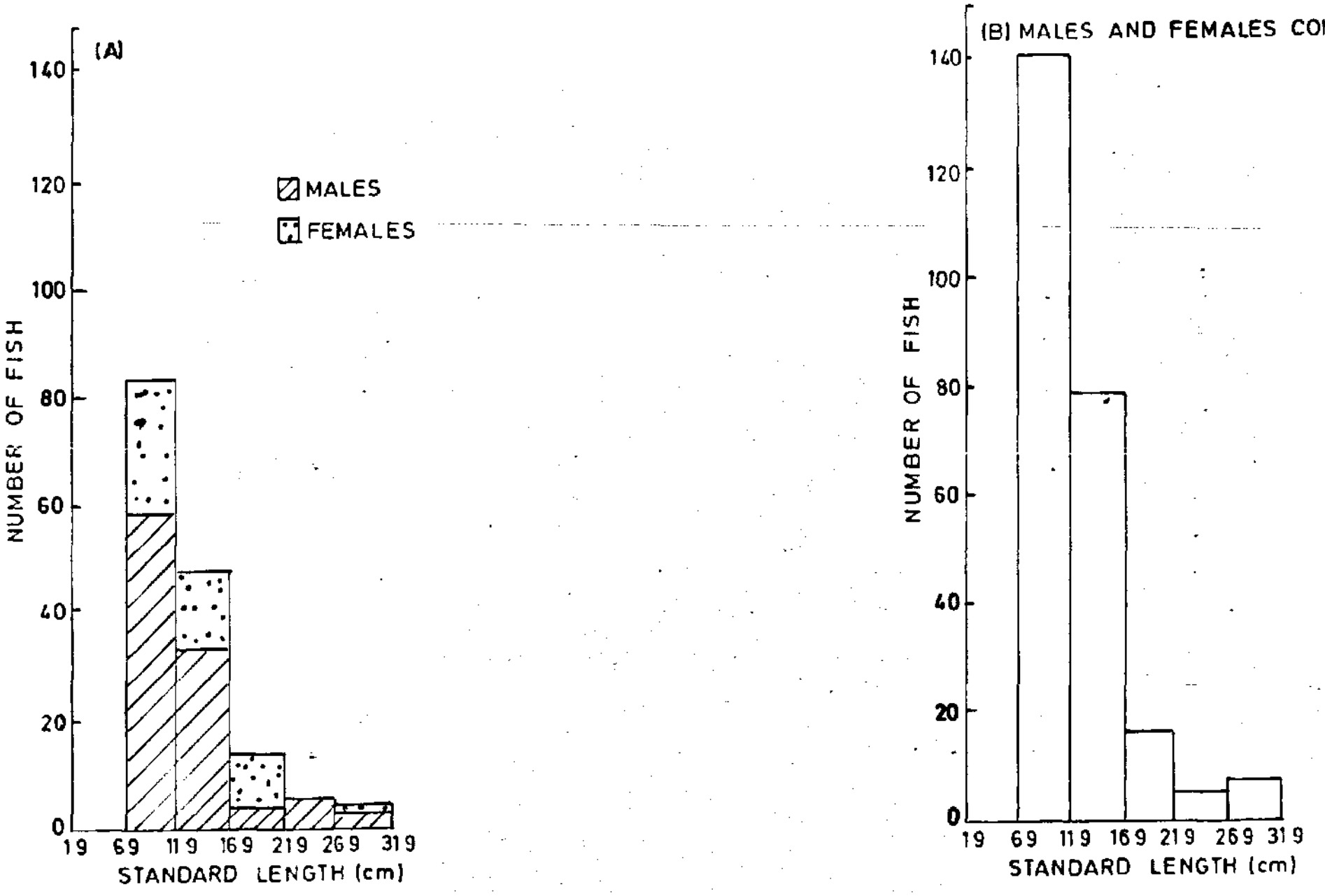
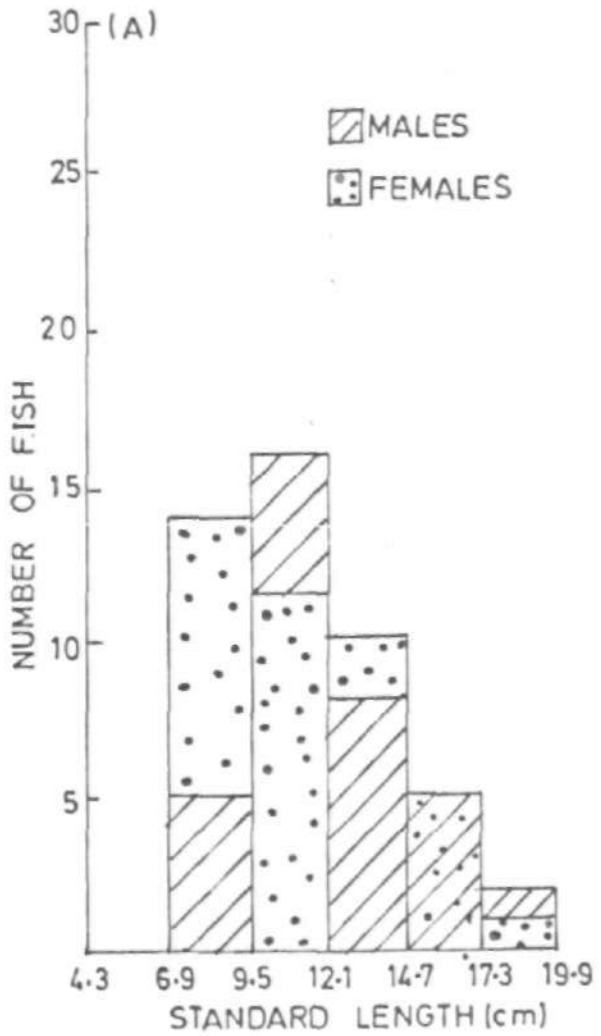
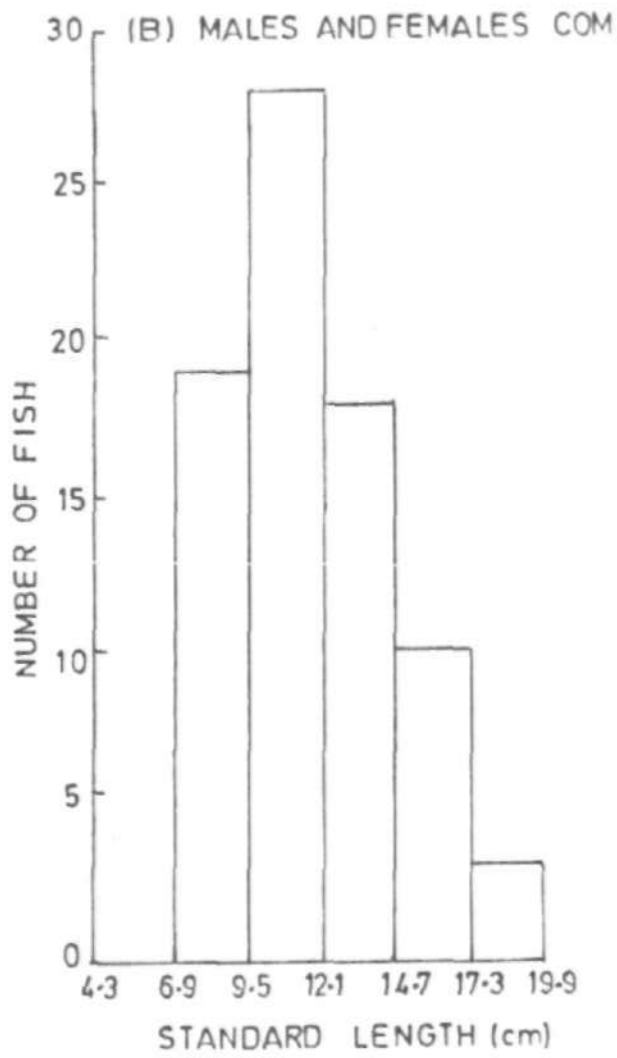
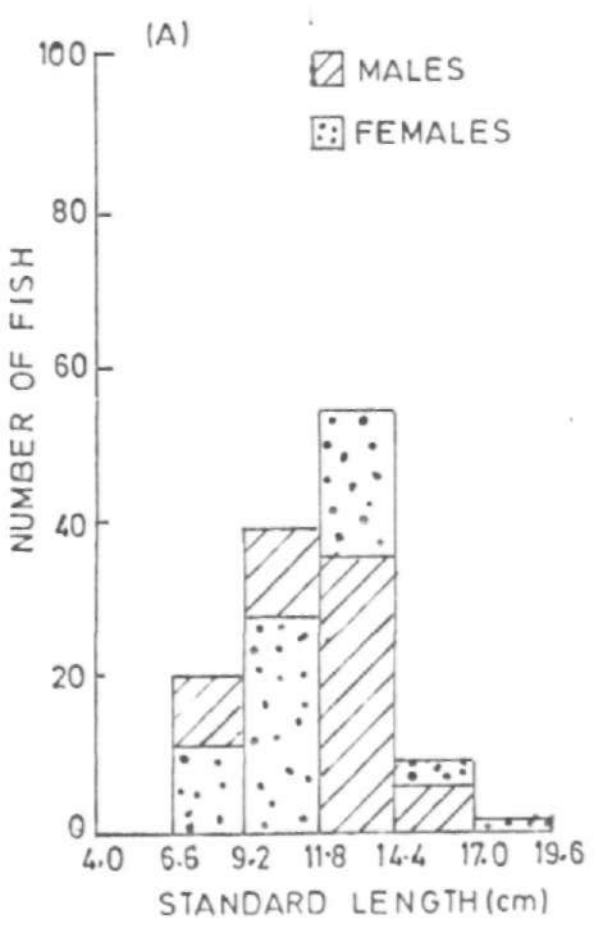


FIG.11: LENGTH FREQUENCY DISTRIBUTION OF OREOCHROMIS NILOTICUS





FIG·12:LENGTH FREQUENCY DISTRIBUTION OF TILAPIA ZILLI



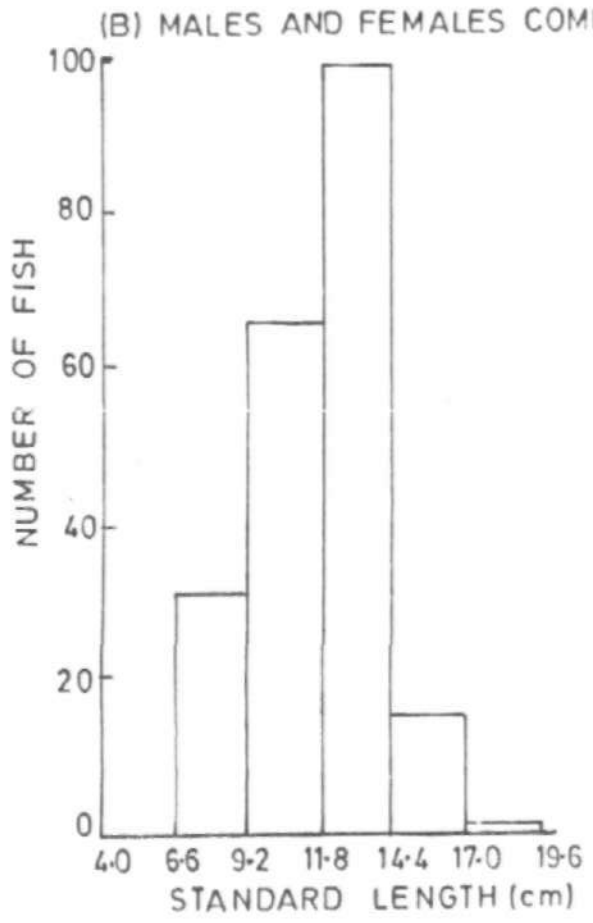


TABLE 5: DESCRIPTION OF LENGTH-WEIGHT RELATIONSHIP FOR TEN FISH SPECIES FROM SHIRORO LAKE

FISH SPECIES	LENGTH-WEIGHT RELATIONSHIP	PATTERN OF GROWTH
Brycinus nurse	y = 2.65x + 0.26	Isometric
Labeo senegalensis	y = 5.00x + 1.76	Positive allometric
Auchenoglanis occidentalis	y = 4.34x + 1.18	Positive allometric
Schilbe uranoscopus	y = 3.46x + 0.11	Positive allometric
Clarias gariepinus	y = 4.30x + 0.42	Positive allometric
Malapterurus electricus	y = 4.35x + 0.57	Positive allometric
Lates niloticus	y = 3.65x + 0.24	Positive allometric
Sarotherodon galilaeus	y = 3.70x + 0.68	Positive allometric
Oreochromis niloticus	y = 2.06x + 0.24	Negative allometric
Tilapia zilli	y = 3.45x + 0.37	Positive allometric

4.3.1 Brycinus nurse:

Growth in B. nurse was observed to be isometric. The b value was approximately 3. Figure 13 shows a high correlation between the length and the weight of the fish (Fig. 13).

4.3.2 Labeo senegalensis:

This had high value of b, making its growth pattern to be highly positive allometric. The correlation coefficient between the length and the weight of the fish was found to be 0.75 (Fig. 14).

4.3.3 Auchenoglanis occidentalis:

A. occidentalis had positive allometric growth. There was high correlation between the length and weight of the fish (Fig. 15).

4.3.4 Schilbe uranoscopus:

Growth in S. uranoscopus was observed to be slightly positive allometric. There was low correlation coefficient between length and the weight of the fish.

4.3.5 Clarias gariepinus:

This also had positive allometric growth pattern (Table 5). Figure 17 shows the scattergram of the lengths and weight of the species.

LENGTH — WEIGHT RELATIONSHIP

FIG-13 : BRYCINUS NURSE
(MALES AND FEMALES COMBINED)

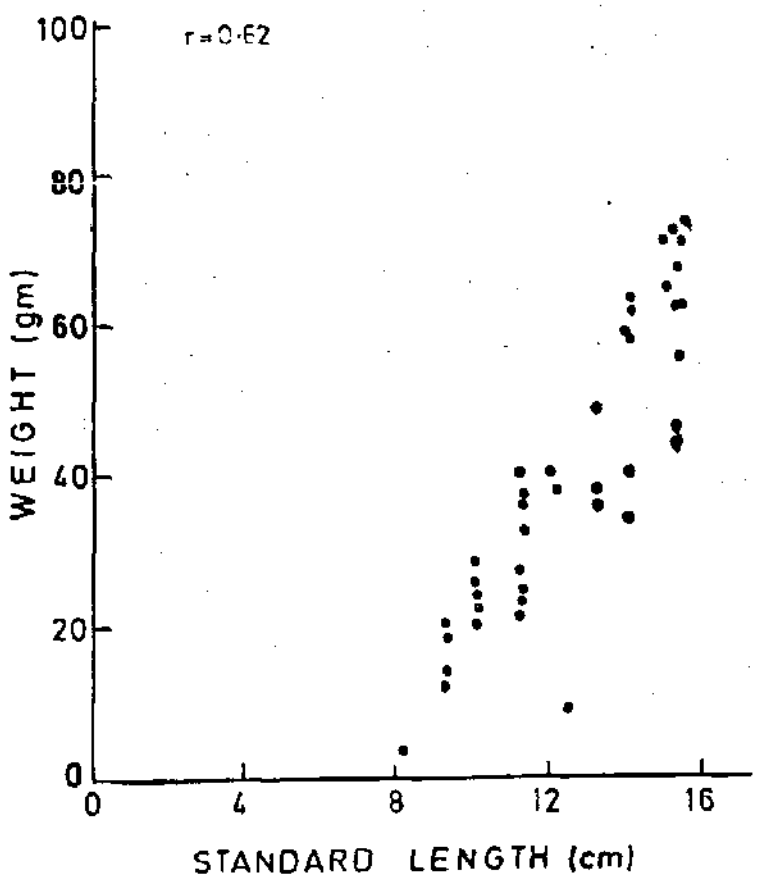
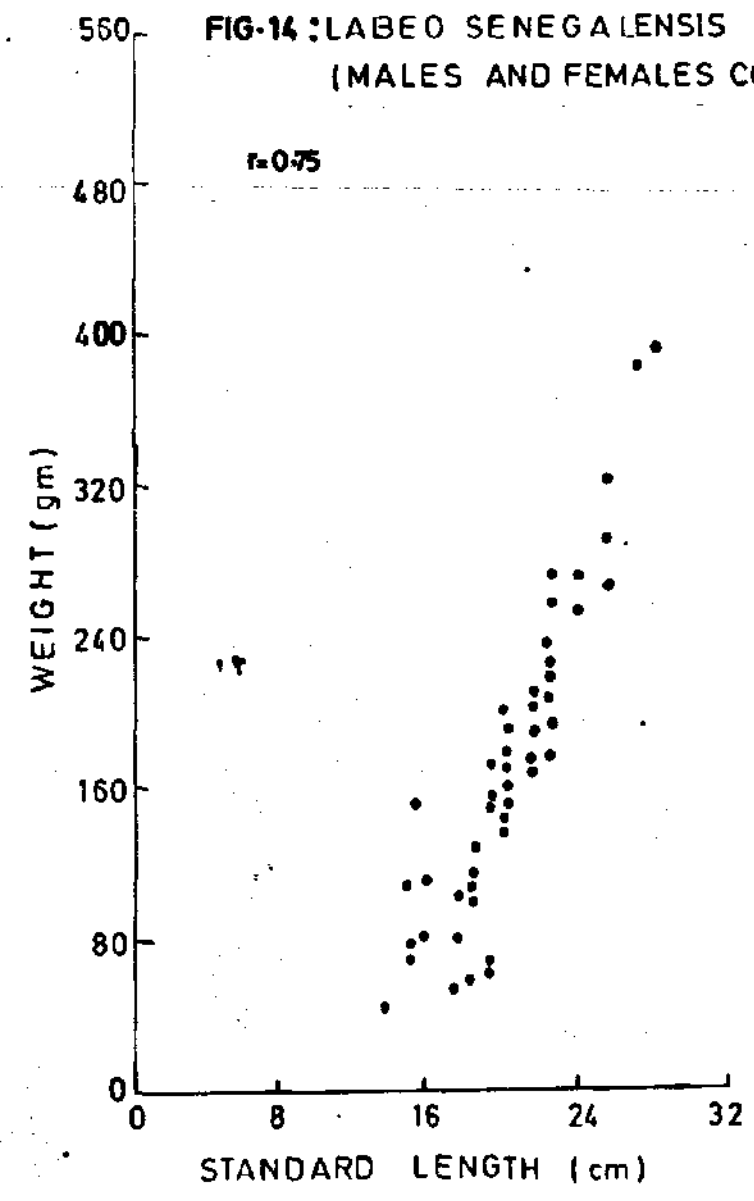


FIG-14 : LABEO SENEGALENSIS
(MALES AND FEMALES COMBINED)



LENGTH - WEIGHT RELATIONSHIP

FIG.15 : AUCHENOGLANIS OCCIDENTALIS
(MALES AND FEMALES COMBINED)

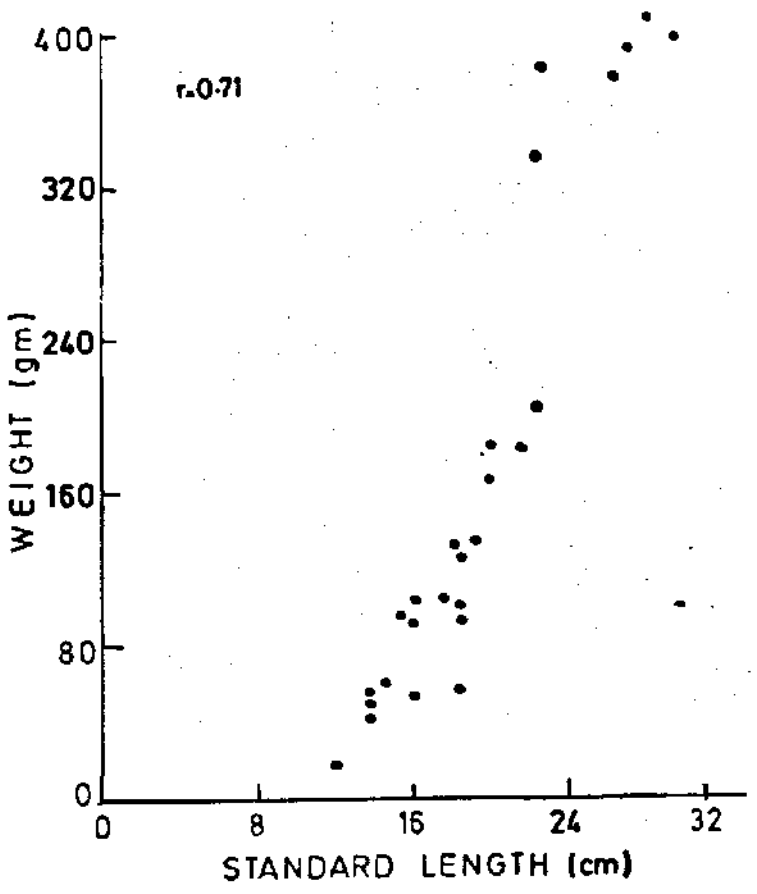
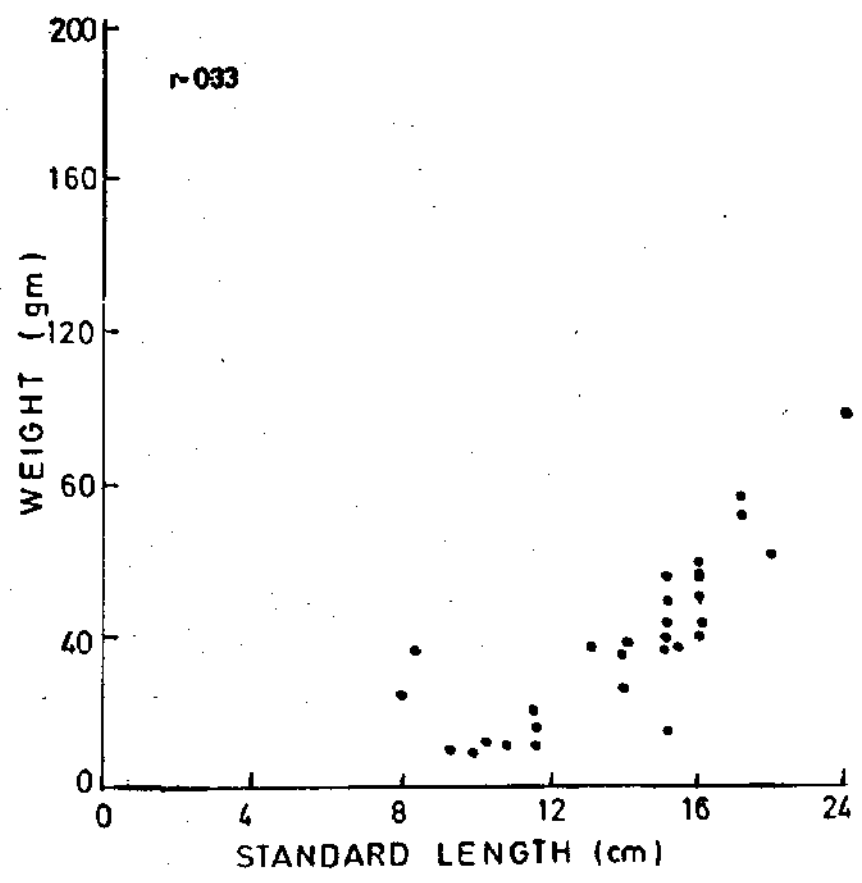
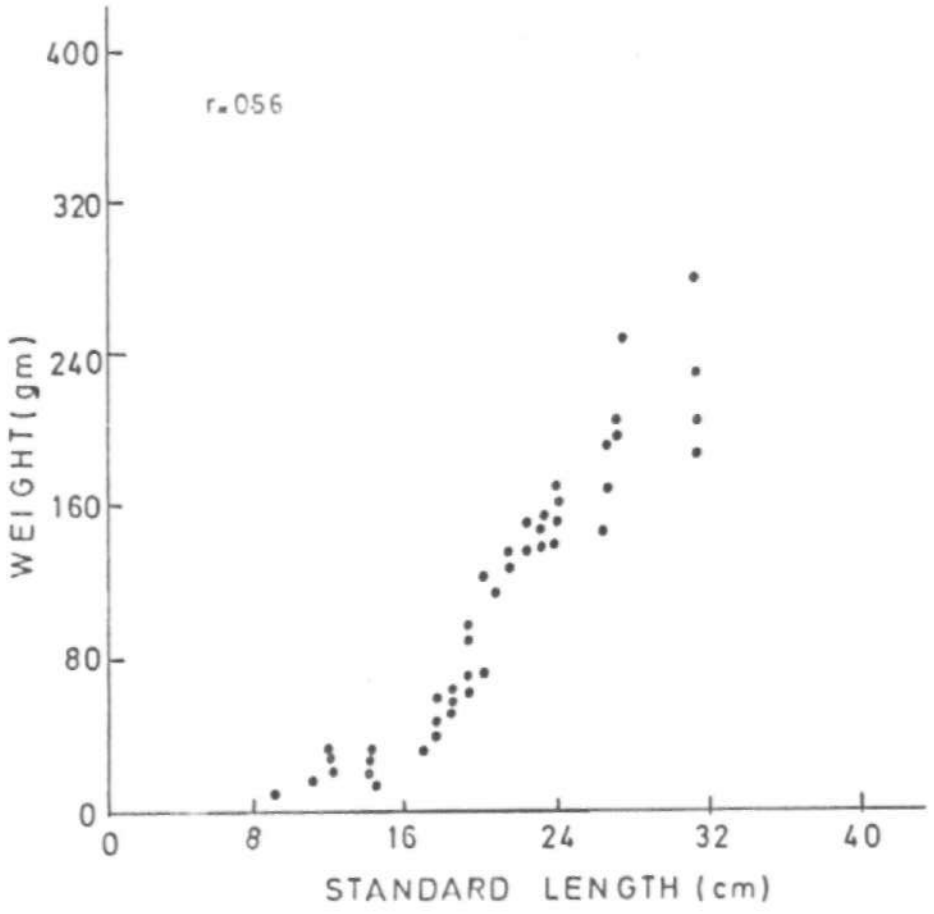


FIG.16 : SCHILBE URANOSCOPUS
(MALES AND FEMALES COMBINED)

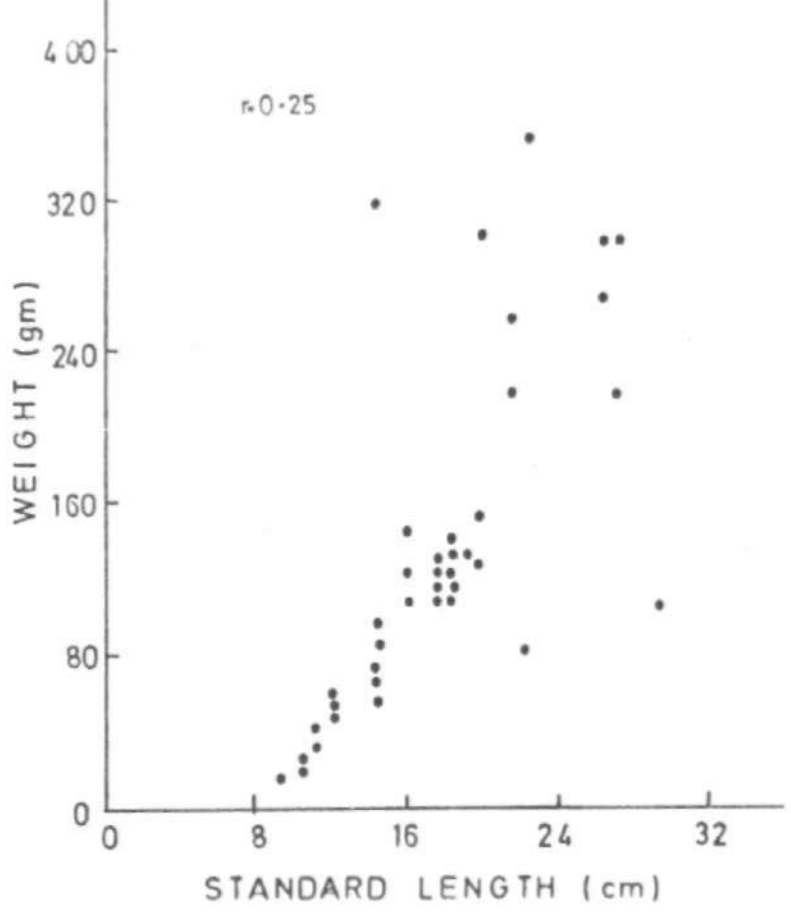


LENGTH – WEIGHT RELATIONSHIP

FIG:17 :CLARIAS GARIEPINUS
(MALES AND FEMALES COMBINED)



FIG·18:MALAPTERURUS ELECTRICUS
(MALES AND FEMALES COMBINED)



4.3.6 Malapterurus electricus:

M. electricus showed a positive allometric growth with low correlation between the length and weight. Figure 19 shows the scattergram of the relationship.

4.3.7 Lates niloticus:

L. niloticus had b value greater than 3 indicating positive allometric growth.

4.3.8 Sarotherodon galilaeus:

This species like most of the other species had positive allometric growth. The value of correlation coefficient was high (0.98).

4.3.9 Tilapia zilli:

T. zilli showed positive allometric growth. Those fishes that showed positive allometric growth, grew heavier for their length. Length and weight are positively correlated (r= 0.94) (Fig. 21).

4.3.10 Oreochromis niloticus:

O. niloticus showed a negative allometric growth. The b value was less than 3 indicating that the fish grew longer for its weight. The length and weight were highly correlated. (r= 0.88) (Fig. 22).

4.4 Condition Factor (K)

The mean condition factor for different length group of the common species examined are shown in Table 6. Monthly variations in the condition factor and statistical analysis for significant difference between the condition factor of males and females are on Figures 23-32 and Table 7 respectively.

LENGTH - WEIGHT RELATIONSHIP

FIG.19: LATES NILOTICUS
(MALES AND FEMALES COMBINED)

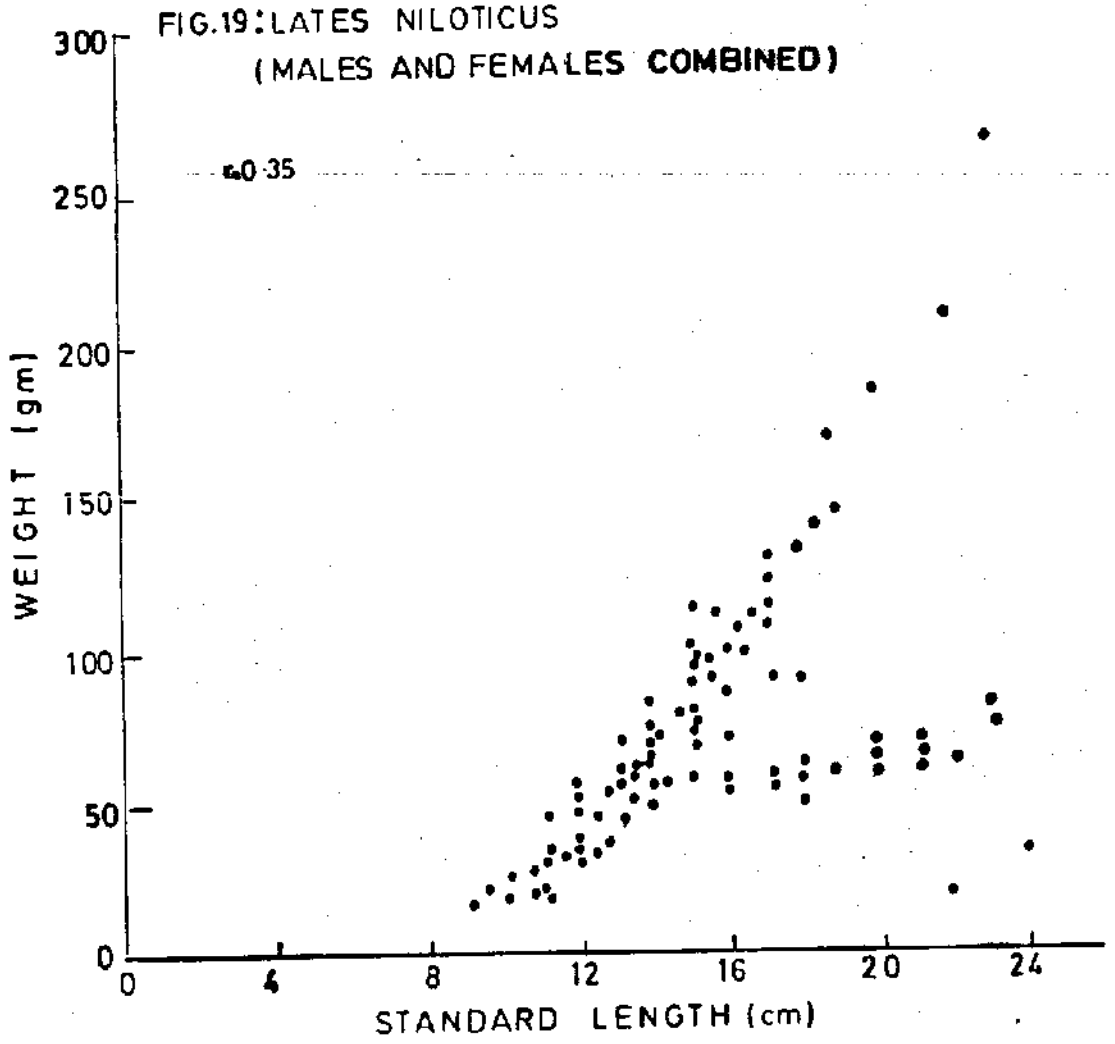
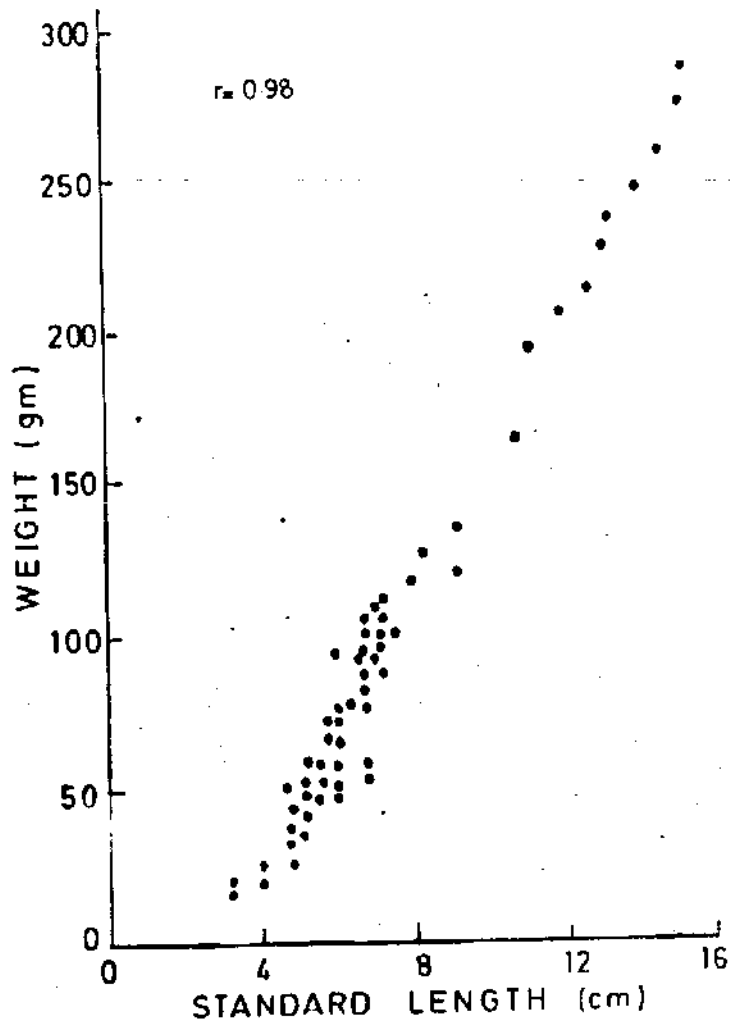


FIG.20: SAROTHERODON GALILAEUS
(MALES AND FEMALES COMBINED)



LENGTH - WEIGHT RELATIONSHIP

FIG-21 : TILAPIA ZILLI
(MALES AND FEMALES COMBINED)

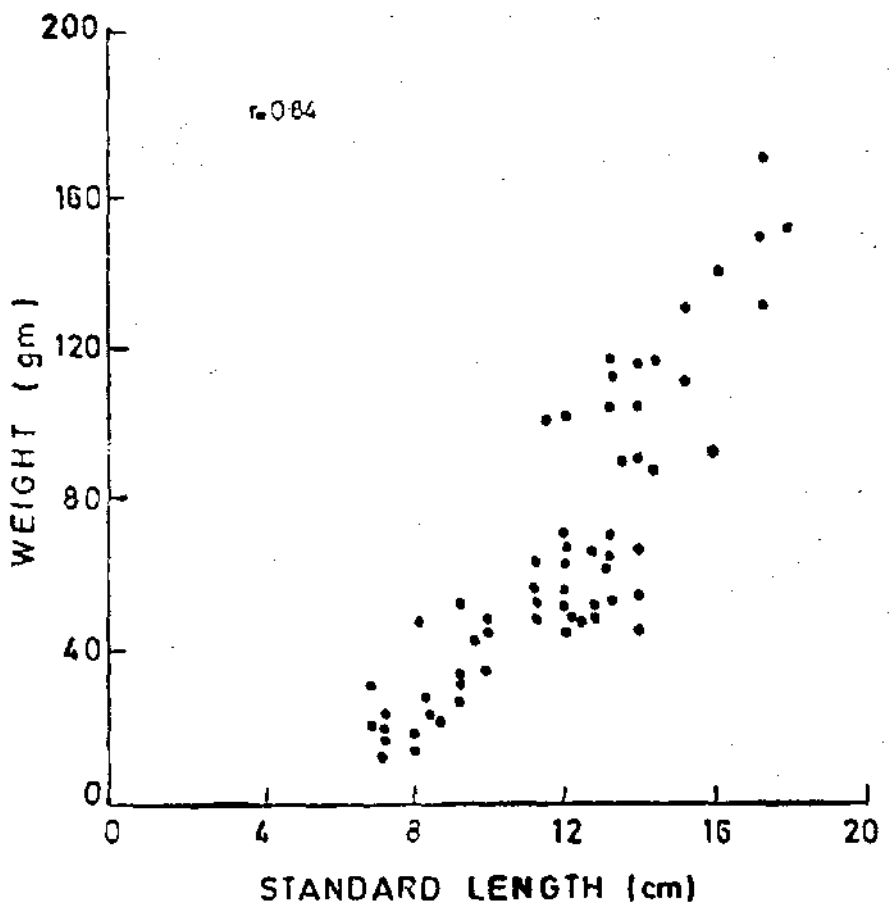


FIG-22 : OREOCHROMIS NILOTICUS
(MALES AND FEMALES COMBINED)

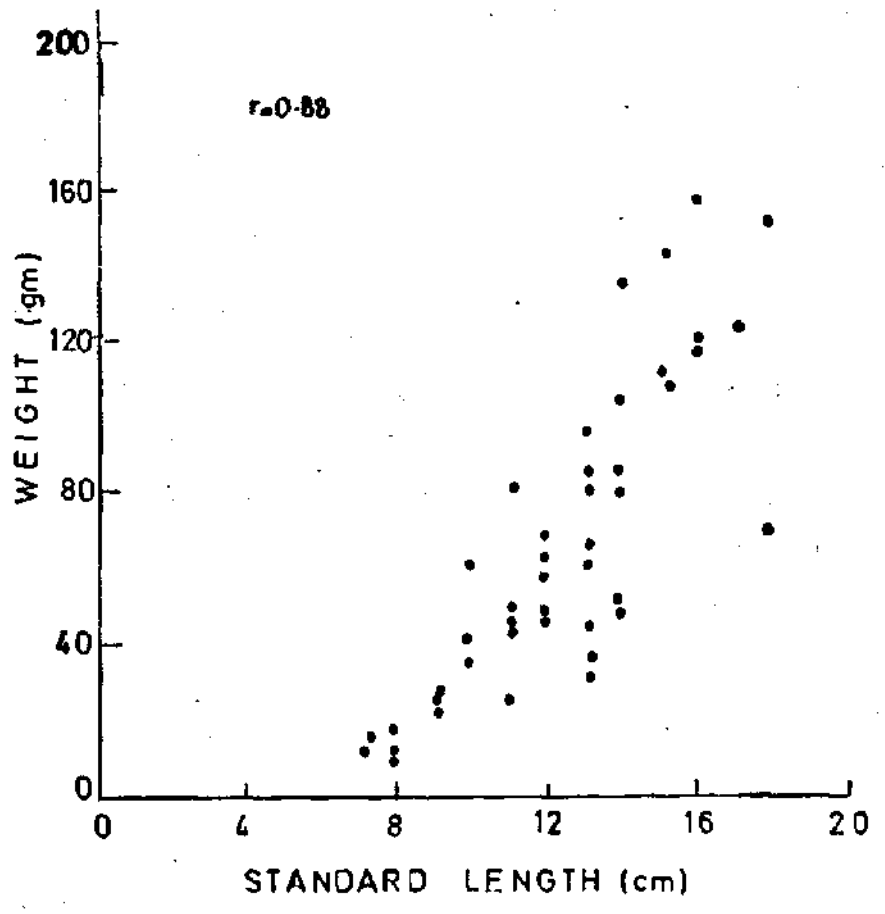


TABLE 6: MEAN CONDITION FACTOR FOR DIFFERENT LENGTH GROUP OF SOME FISHES IN SHIRORO LAKE

FISH SPECIES	SEX	NUMBER EXAMINED	STANDARD LENGTH GROUP (CM)	'K' RANGE	MEAN	STANDARD DEV.
B. nurse	M	16	8.0 - 13.9	0.78 - 3.18	2.15	0.53
		6	14.0 - 19.9	1.26 - 2.50	1.73	0.57
	F	32	8.0 - 13.9	1.62 - 2.99	2.21	0.33
		7	14.0 - 19.9	1.47 - 2.13	1.93	0.22
L. senegalensis	M	14	11.2 - 18.7	1.16 - 4.48	2.18	0.75
		30	18.8 - 26.3	1.27 - 2.52	2.02	0.23
		10	26.4 - 32.0	1.93 - 2.14	2.03	0.10
	F	11	11.2 - 18.7	1.00 - 3.16	1.90	0.61
		20	18.8 - 26.3	0.54 - 2.78	1.82	0.53
		3	26.4 - 32.0	1.93 - 2.14	2.03	0.20
A. occidentalis	M	30	12.0 - 19.5	0.99 - 4.48	1.95	0.84
		7	19.6 - 27.1	2.12 - 2.77	2.24	0.24
		1	27.2 - 34.7	1.85-	1.85	-
	F	6	12.0 - 19.5	1.98 - 2.30	2.11	0.15
		4	19.6 - 27.1	1.78 - 3.14	2.29	0.68
		1	27.2 - 34.7	1.63-	1.63	-
S. uranoscopus	M	9	12.2 - 17.3	0.76 - 1.47	1.08	0.26
	F	13	7.09 - 12.19	0.70 - 1.19	1.00	0.17
		18	12.20 - 17.3	0.50 - 1.59	1.25	0.29
		3	17.4 - 22.5	1.05 - 1.39	1.22	0.24
C. gariepinus	M	17	9.0 - 24.1	0.78 - 1.24	1.04	0.11
		12	24.2 - 39.3	0.63 - 1.07	0.94	0.15
	F	35	9.0 - 24.1	0.78 - 2.0	1.13	0.24
		19	24.2 - 39.3	0.70 - 1.21	1.02	0.15

Table 6 (cont'd.)

FISH SPECIES	SEX	NUMBER EXAMINED	STANDARD LENGTH GROUP (CM)	'K' RANGE	MEAN	STANDARD DEV.
M. electricus	M	30	9.0 - 18.1	1.74 - 3.20	2.39	0.38
		10	18.2 - 27.3	0.69 - 3.76	2.0	0.90
	F	25	9.0 - 18.1	1.70 - 3.54	2.70	0.40
		8	18.2 - 27.3	1.70 - 2.41	2.06	0.26
		2	27.4 - 26.5	0.41 - 0.45	0.43	0.02
L. niloticus	M	66	8.5 - 16.8	1.24 - 3.30	2.23	0.42
		34	16.9 - 25.2	0.62 - 2.33	1.46	0.65
	F	135	8.5 - 16.8	0.75 - 3.70	2.25	0.40
		36	16.9 - 25.2	0.50 - 2.66	1.69	0.71
S. galilaaeus	M	90	7.0 - 16.9	1.45 - 7.08	3.93	0.79
		8	17.0 - 26.9	1.09 - 2.31	1.44	0.38
		3	27.0 - 36.9	1.06 - 1.20	1.13	0.7
	F	130	7.0 - 16.9	1.51 - 6.30	3.87	0.74
		13	17.0 - 26.9	1.03 - 4.94	1.75	1.09
		4	27.0 - 36.9	0.94 - 1.0	0.97	0.03
O. niloticus	M	21	7.0 - 12.1	2.56 - 6.12	3.68	1.06
		13	12.2 - 17.3	1.50 - 4.95	3.04	1.07
		2	17.4 - 22.5	1.19 - 2.58	1.88	0.98
	F	26	7.0 - 12.1	2.28 - 4.94	3.82	0.54
		15	12.2 - 17.3	1.60 - 4.37	3.30	0.65
		1	17.4 - 22.5	2.58-	2.58	-
T. zilli	M	59	6.7 - 11.8	2.54 - 6.12	4.26	0.79
		43	11.9 - 17.0	2.04 - 5.06	3.22	0.74
	F	38	6.7 - 11.8	2.43 - 8.75	4.22	0.55
		63	11.9 - 17.0	2.04 - 5.39	3.23	0.85
		1	17.1 - 22.2	2.43-	2.43	-

TABLE 7: STATISTICAL ANALYSIS FOR SIGNIFICANCE DIFFERENCE BETWEEN CONDITION FACTOR OF MALES AND FEMALES OF TEN FISH SPECIES

FISH SPECIES	SEX	NUMBER EXAMINED	RANGE	MEAN + SE	t	MEAN SIGNIFICANTLY DIFFERENT	'P' VALUE
Brycinus nurse	M	22	0.78 - 3.18	2.04 ± 0.12			
	F	39	1.47 - 2.99	2.15 ± 0.05	-1.00	NO	
Labeo senegalensis	M	54	1.16 - 4.48	2.10 ± 0.07			
	F	34	0.54 - 3.16	1.86 ± 0.09	2.21	YES	<0.05
Auchenoglanis occidentalis	M	38	0.99 - 4.48	2.03 ± 0.09			
	F	11	1.63 - 3.14	2.14 ± 0.12	-0.65	NO	
Schilbe uranoscopus	M	9	0.76 - 1.47	1.08 ± 0.09			
	F	34	0.07 - 1.59	1.13 ± 0.05	-0.42	NO	
Clarias gariepinus	M	29	0.63 - 1.24	1.01 ± 0.03			
	F	54	0.70 - 2.1	1.10 ± 0.03	-0.91	NO	
Malapterurus electricus	M	40	0.69 - 3.76	2.32 ± 0.09			
	F	35	0.41 - 3.54	2.43 ± 0.11	-0.78	NO	
Lates niloticus	M	100	0.62 - 3.30	1.96 ± 0.86			
	F	171	0.50 - 3.70	2.15 ± 0.54	-2.49	YES	< 0.05
Sarotherodon galilaeus	M	101	1.06 - 7.08	3.69 ± 0.11			
	F	147	0.50 - 6.30	3.85 ± 0.38	-0.52	NO	
Oreochromis niloticus	M	36	1.19 - 6.12	3.32 ± 0.20			
	F	42	0.60 - 4.94	3.54 ± 0.11	-0.98	NO	
Tilapia zilli	M	102	2.04 - 8.73	3.83 ± 0.09			
	F	102	2.04 - 5.39	3.57 ± 0.09	2.10	YES	<0.05

4.4.1 Brycinus nurse:

Most of the males of B. nurse had high condition factor. Their females had low values with no significant difference between them. There was no difference between the dry and the rainy seasons condition factor (Fig. 23).

4.4.2 Labeo senegalensis:

L. senegalensis had low condition factor in March. The species had fluctuating condition factor.. There was a significant difference between the mean condition factor of males and females (Fig. 24).

4.4.3 Auchenoglanis occidentalis:

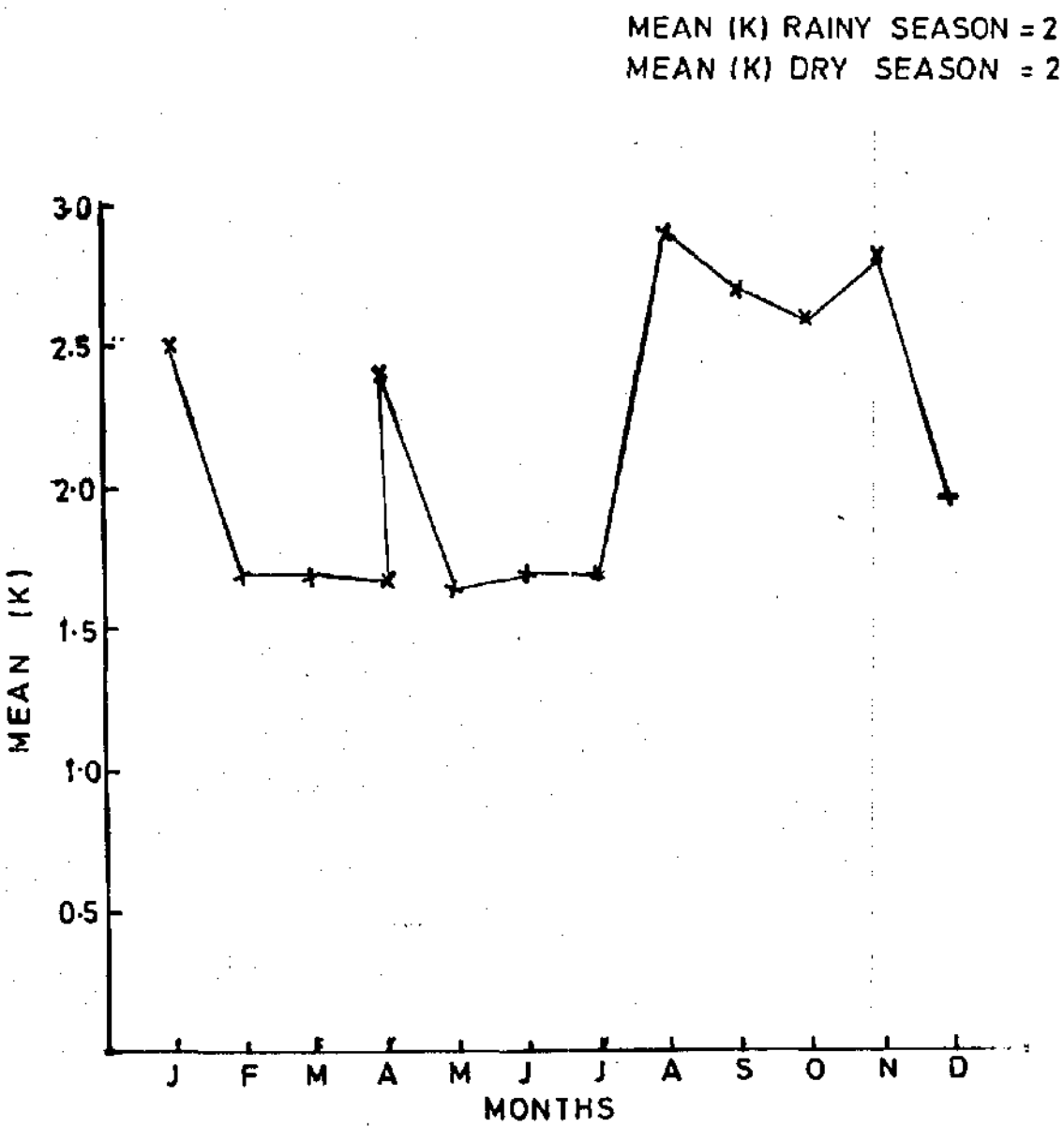
The larger size group of the males of this species were in better condition than the smaller size group. The reverse was true for the females. The dry and the rainy season condition factors were similar (Fig. 25).

4.4.4. Schilbe uranoscopus:

There was no significant difference between the condition factors of males and females of S. uranoscopus. There was no difference between the dry and the rainy seasons condition factors. Larger size group were in better condition than the smaller size group (Fig. 26).

4.4.5 Clarias gariepinus:

Condition of small and large size group were similar (Table 6). There was no significant difference between the condition factors of males and females (Fig. 27).



FIG·23: MONTHLY VARIATION IN THE CONDITION FACTOR (K) OF BRYCINUS NURSE (BOTH SEXES COMBINED)

MEAN (K) RAINY SEASON = 1·96
MEAN (K) DRY SEASON = 2·14

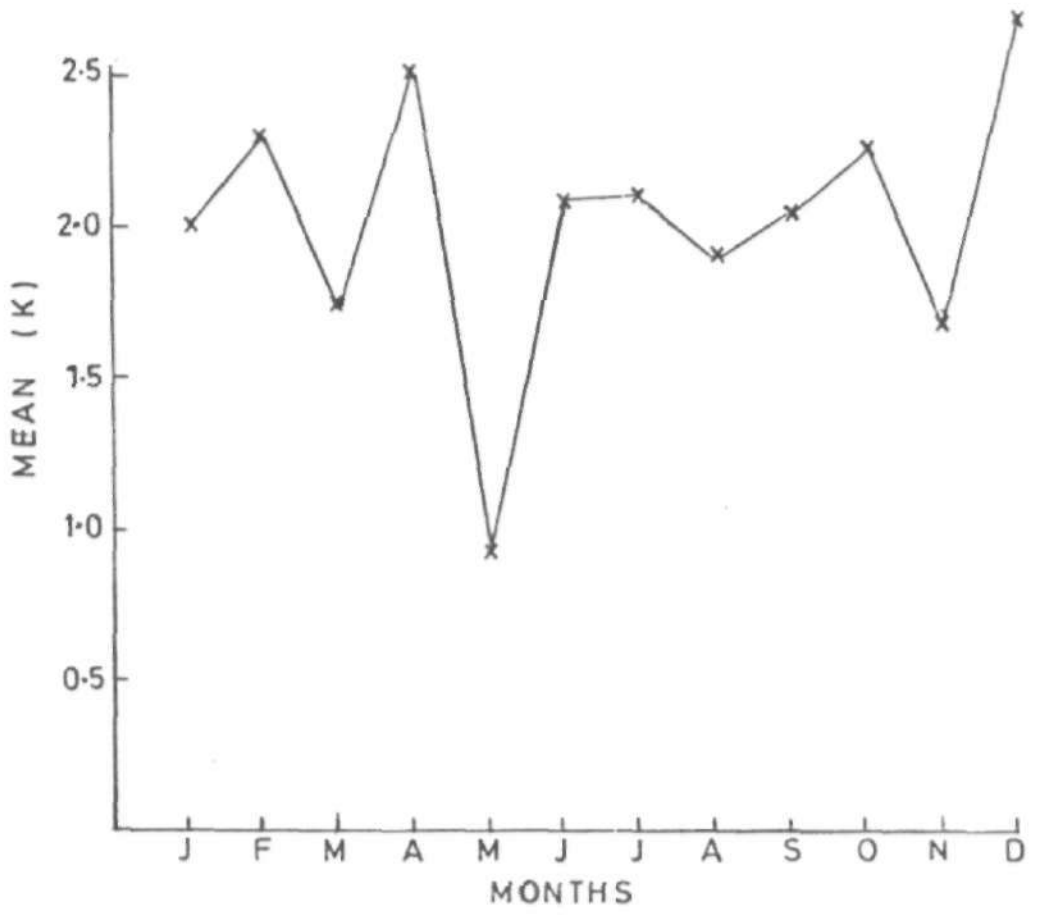


FIG.24 :MONTHLY VARIATION IN THE CONDITION FACTOR (K) OF LABEO SENEGALENSIS (BOTH SEXES COMBINED)

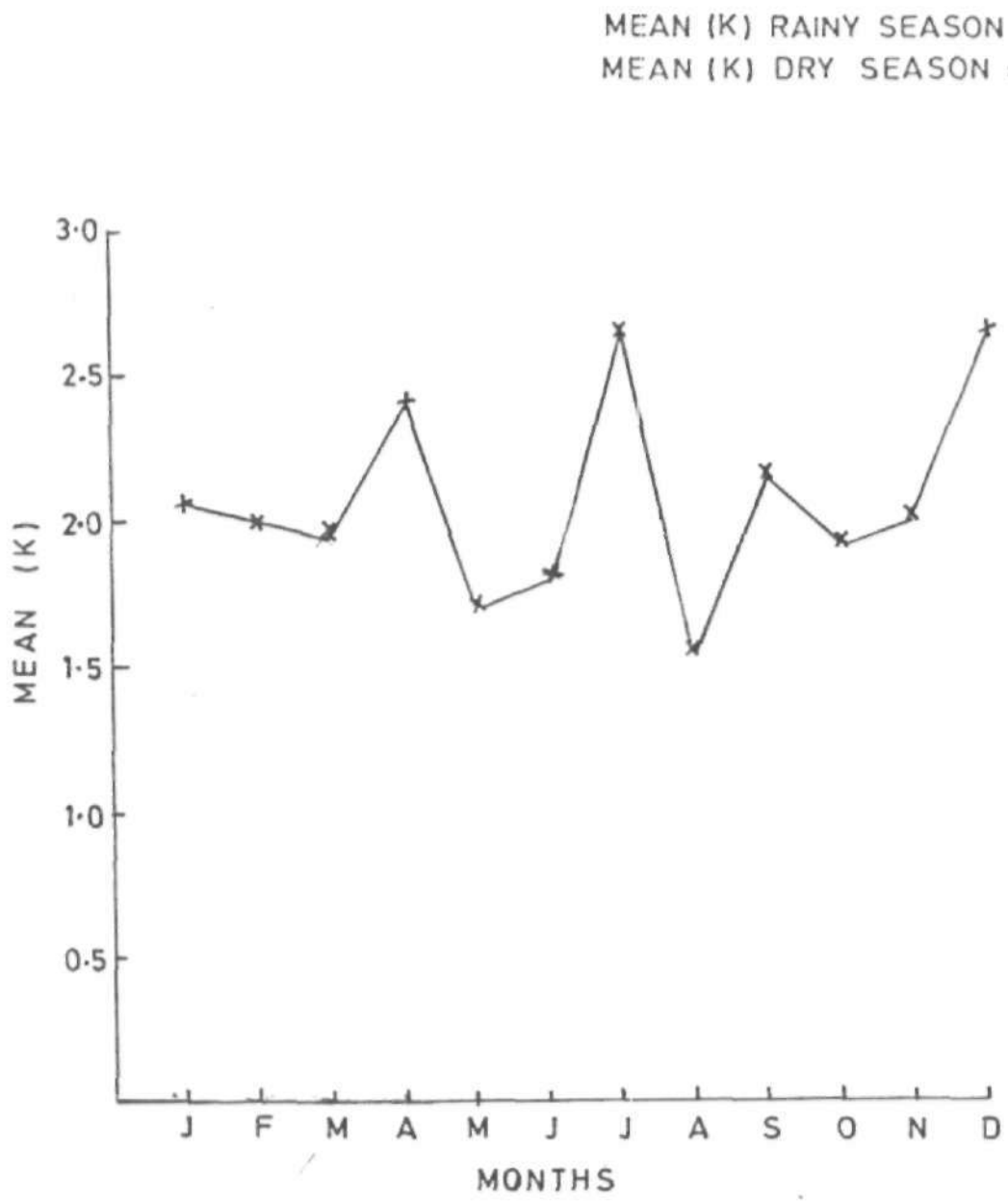


FIG.25: MONTHLY VARIATION IN THE CONDITION FACTOR (K) OF AUCHENOGLANIS OCCIDENTALIS (BOTH SEXES COMBINED)

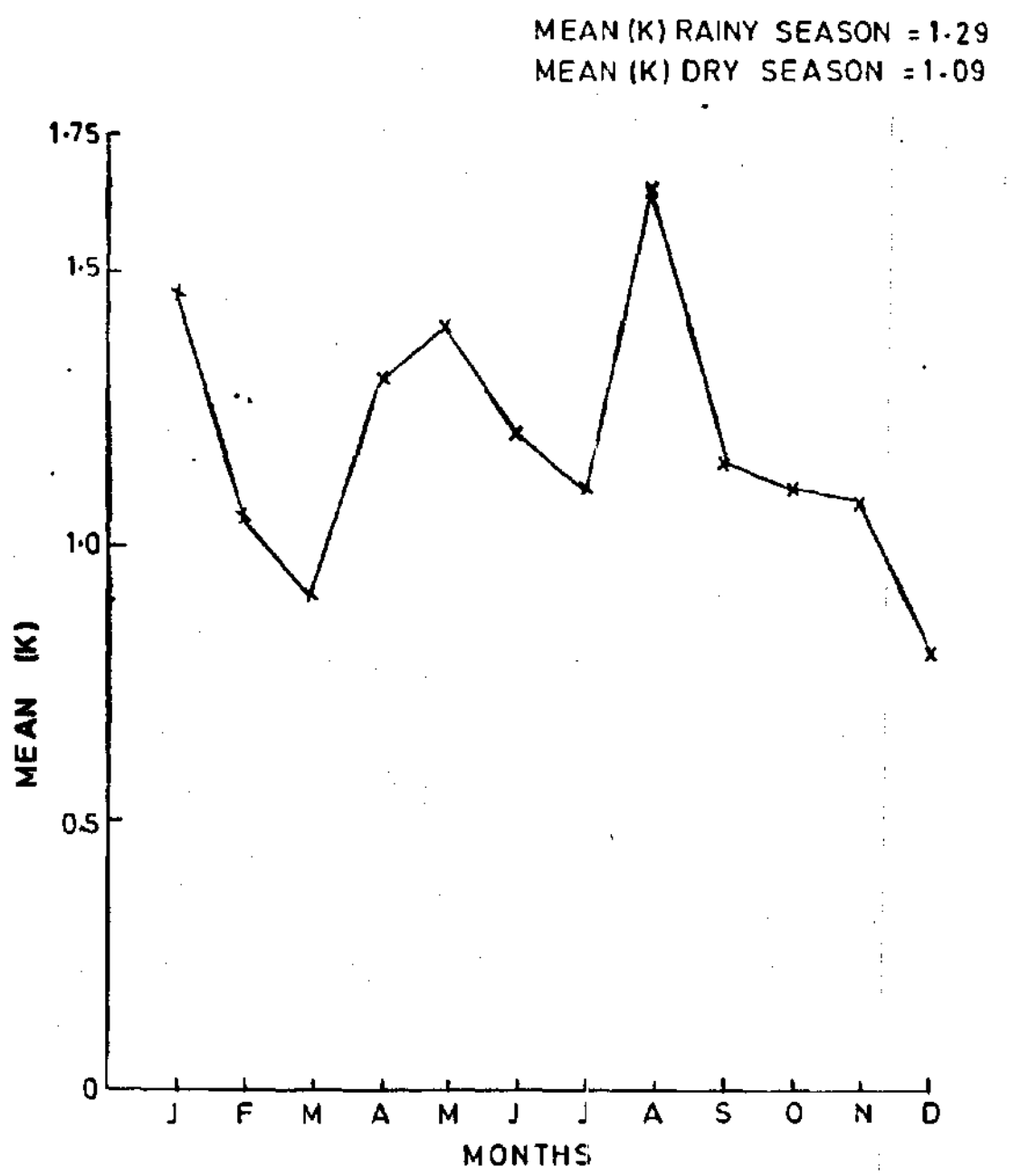
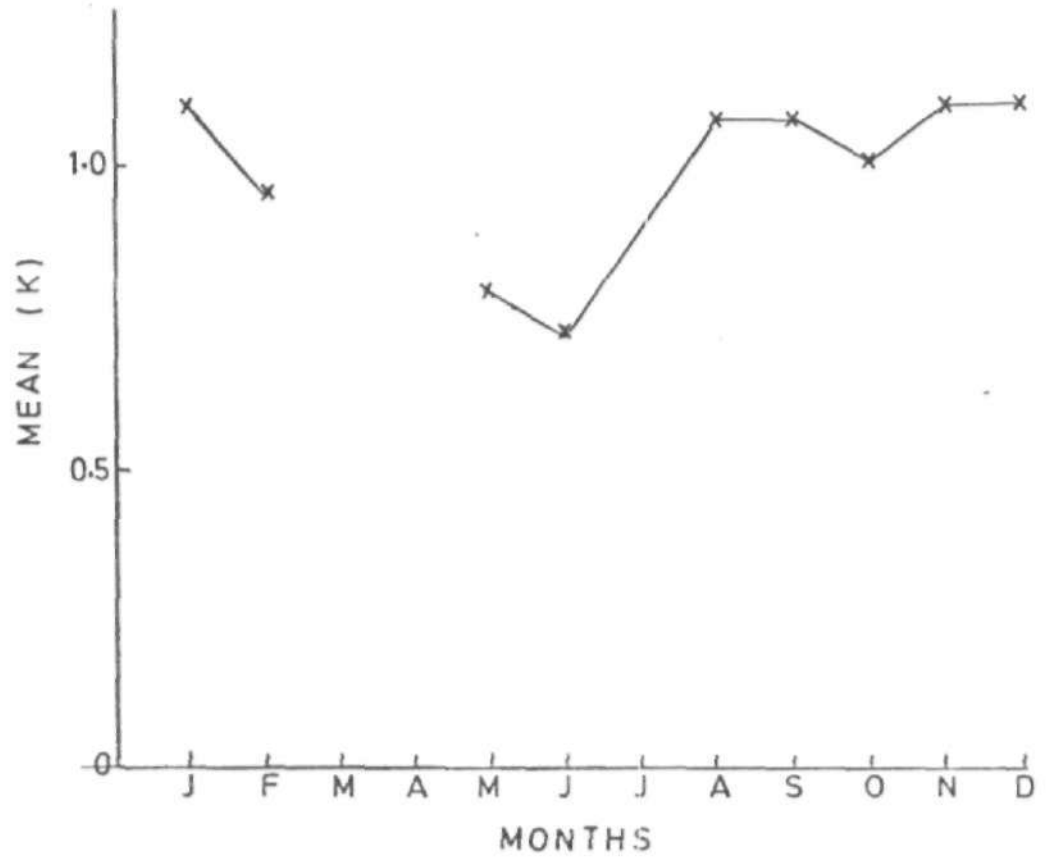


FIG.26 : MONTHLY VARIATION IN THE CONDITION FACTOR (K) OF SCHILBE URANOSCOPUS (BOTH SEXES COMBINED)

MEAN (K) RAINY SEASON = 0·90
MEAN (K) DRY SEASON = 1·05



FIG·27: MONTHLY VARIATION IN THE CONDITION FACTOR (K) OF CLARIAS GARIEPINUS (BOTH) SEXES COMBINED)

4.4.6 Malapterurus electricus:

The smaller size group of the males of M. electricus were in better condition than the larger size group. The reverse was true for the females. There was difference between the rainy season and the dry season condition factor (Fig. 28).

4.4.7 Lates niloticus:

During the period of study, there was no much fluctuation in the condition factor of this species. This resulted in little difference between the dry and the rainy seasons condition factor (Fig. 29). There was a significant difference ($P = 5\%$) between the mean condition factors of the males and females.

4.4.8 Sarotherodon galilaeus:

The condition of small and large size groups were similar. There was no difference between the dry and the rainy seasons condition factors.

4.4.9 Oreochromis niloticus:

There was no much difference between the dry and the rainy seasons condition factors. This species had its lowest condition factor in September. Like S. galilaeus the condition of small and large size groups were similar (Fig. 31).

4.4.10 Tilapia zilli:

There was no difference between the dry and the rainy seasons condition factors. This was as a result of little fluctuations in the condition factor throughout the period of

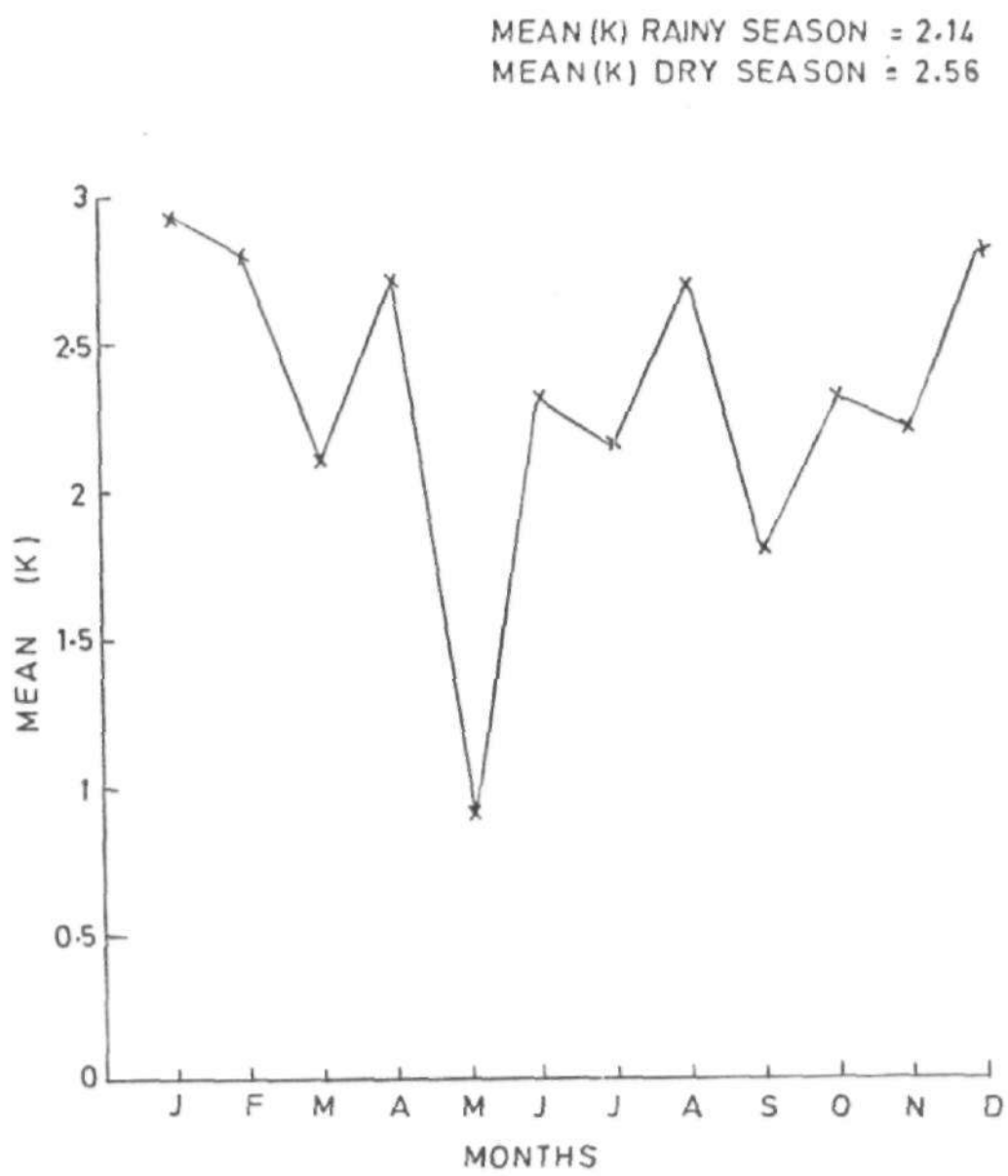
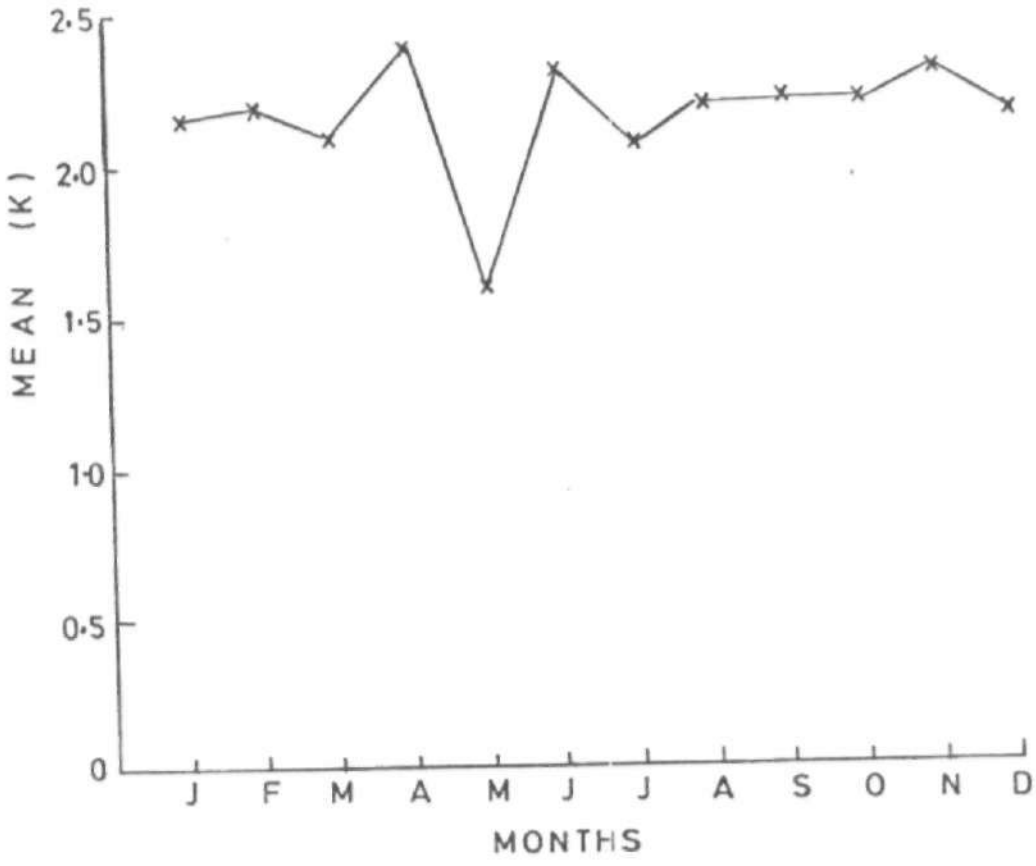


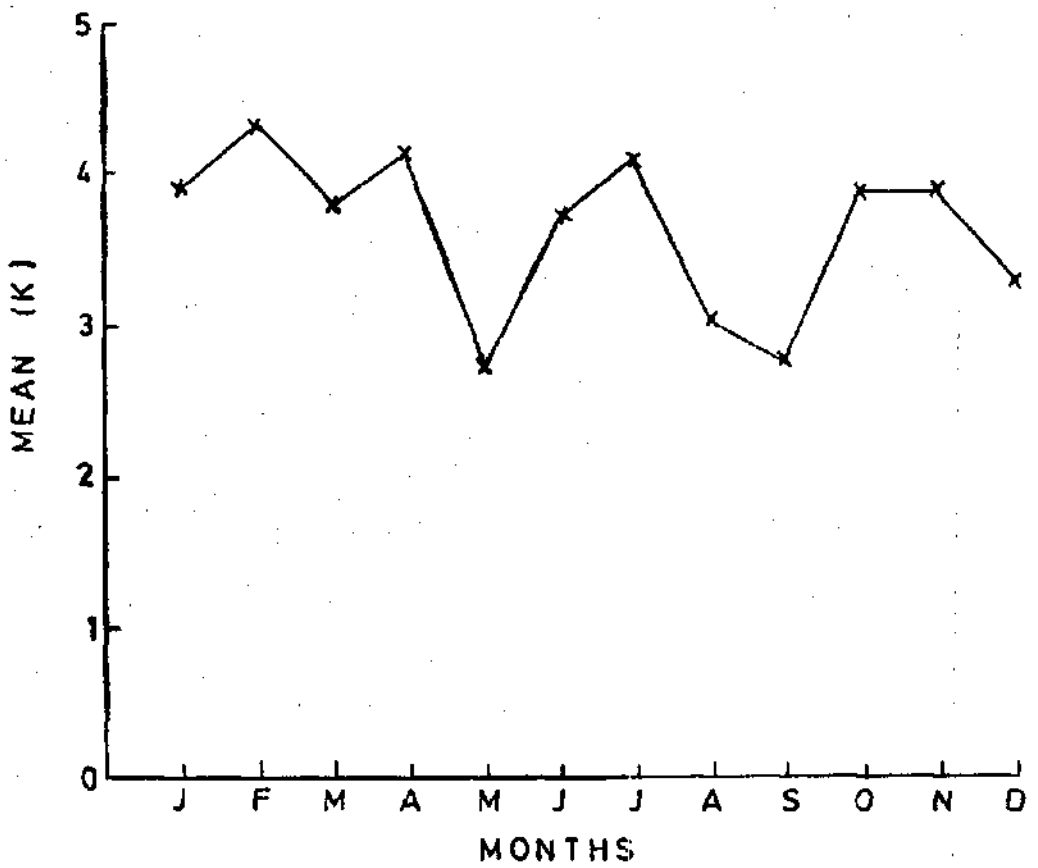
FIG.28. MONTHLY VARIATION IN THE CONDITION FACTOR (K) OF MALAPTERURUS ELECTRICUS (BOTH SEXES COMBINED)

MEAN (K) RAINY SEASON = 2·41
MEAN (K) DRY SEASON = 2·20



FIG·29 :MONTHLY VARIATION IN THE CONDITION FACTOR(K) OF LATES NILOTICUS (BOTH SEXES COMBINED)

MEAN (K) RAINY SEASON = 3·40
MEAN (K) DRY SEASON = 3·90



FIG·30: MONTHLY VARIATION IN THE CONDITION FACTOR (K) OF SAROTHERODON GALILAEUS (BOTH SEXES COMBINED)

MEAN (K) RAINY SEASON = 3·27
MEAN (K) DRY SEASON = 3·58

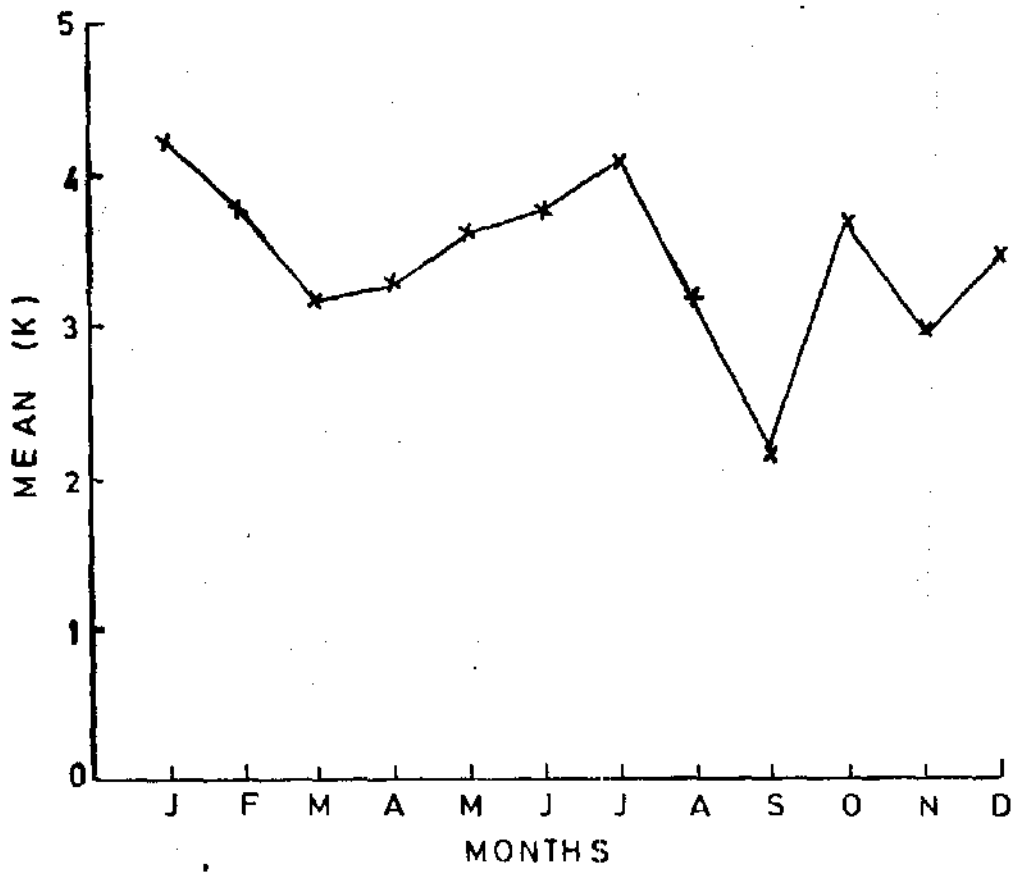
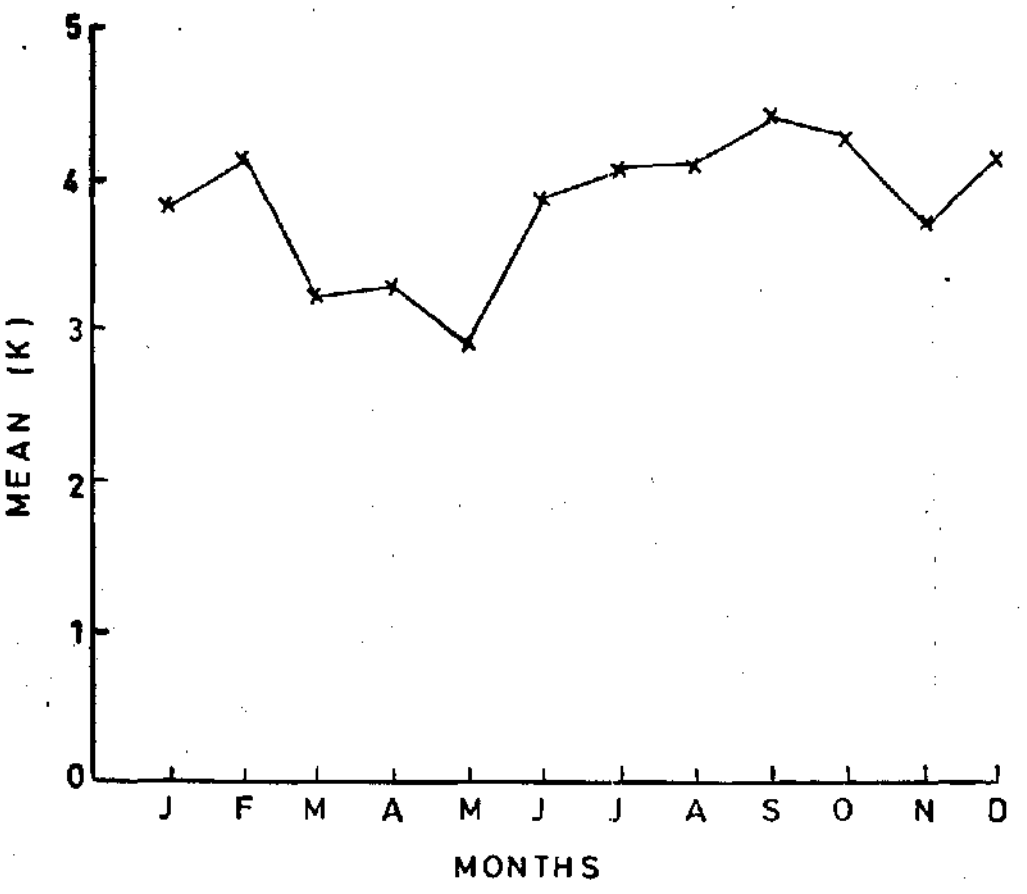


FIG. 31 : MONTHLY VARIATION IN THE CONDITION FACTOR (K) OF OREOCHROMIS NILOTICUS (BOTH SEXES COMBINED)

MEAN (K) RAINY SEASON = 3·80
MEAN (K) DRY SEASON = 3·89



FIG·32: MONTHLY VARIATION IN THE CONDITION FACTOR (K) OF TILAPIA ZILLI (BOTH SEXES COMBINED)

study. The males had condition factor significantly different ($P<0.05$) from that of the females (Figure 32 and Table 7).

4.5 FOOD AND FEEDING HABITS.

The composition of total diet by frequency of occurrence and points for fishes whose total number with food in them exceeded ten are on Tables 8-22. The results obtained for the stomach analysis are summarized below.

4.5.1 Polypteridae:

Polypterus senegalus:

The content of 18 stomachs from specimens whose total length varied from 9.0 - 11.5cm were examined. Fifteen of the stomachs were empty. The food of the fish was found to consist almost entirely of insects.

4.5.2 Mormyridae:

Mormyrus rume: The stomachs of seven M. rume were examined. Two of the stomachs were empty while the rest contained insects, grass, and detritus.

Mormyrops deliciosus: One out of the three specimens examined had empty stomach. The two others contained insects and detritus.

4.5.3 Characidae

Brycinus nurse: Sixty-one specimens were examined of which 59 of them were found to contain plant materials, Crustaceans, insects and molluscs (Table 8).

Brycinus macrolepidotus. It fed mainly on plant materials.

TABLE 8

RELATIVE IMPORTANCE AND FREQUENCY OF OCCURRENCE OF DIETARY ITEMS IN THE STOMACH OF BRYCNUS NURSE

NUMBER OF STOMACH EXAMINED	61
NUMBER OF STOMACH WITH FOOD	59 (96.7%)
NUMBER OF STOMACH WITHOUT FOOD	2 (3.3%)

DIETARY ITEMS	PERCENTAGE FREQUENCY OF OCCURRENCE	PERCENTAGE OF TOTAL POINT AWARDED
INSECTA		
Adult insects. Coleoptera	6.8	2.8
Odonata	8.5	2.8
Diptera	23.7	4.4
Immature insects. Mosquito pupae	1.7	0.2
Ephemeroptera larvae	39.0	0.5
Chironomid larvae	27.1	2.0
TOTAL INSECTA		12.7
CRUSTACEA		
Capepoda. Cyclop sp	30.5	6.3
Asellus sp	6.8	0.1
Cladocera Daphnia sp	89.8	15.5
TOTAL CRUSTACEA		21.9
ANNELIDA		
Oligochaeta Nais sp	5.1	0.4
MOLLUSCA		
Gastropoda. Physa sp	11.9	1.9
Ancylus sp	6.8	2.0
TOTAL MOLLUSCA		3.9
FISH		
Fish remain. Scales	3.4	0.8
AMPHIBIA		
Frog. Tad pole	5.1	1.1
HIGHER PLANTS		
Leaves	83.1	5.8
grass	96.6	2.3
Fruits	11.9	1.3
Seeds	42.4	24.5
Plant fragments	71.2	25.3
TOTAL HIGHER PLANTS		59.2

4.5.4 Hepsetidae

Hepsetus odoe: Twenty-three specimens were examined ten of which were found to feed mainly on fish. Table 9 shows that they also fed on insects and plant debris, the rest had empty stomachs.

4.5.5 Cyprinidae

Labeo senegalensis: A variety of food substances were found in the specimens examined. The diet was mainly Diatoms, algae and Desmids (Table 10).

Labeo coubie: One specimen was examined and found to contain large quantity of mud and sand.

Labeo parvus: Six specimens were examined and found to contain algae, detritus and insects.

Barilius senegalensis: Two specimens were examined. They were found to be carnivorous feeding mainly on fish and insects.

4.5.6 Bagridae

Porcus docmac: One out of the two specimens examined had fish as the principal constituent of the diet.

Auchenoglanis occidentalis: The fish was found to be predatory. Animal material was the principal constituent of the diet. The most important animal component, Daphnia sp. accounted for 22.2% of the total diet. 34.7% of the total specimens examined had empty stomach (Table 11).

Chrysichthys nigrodigitatus: The food consisted of insects as well as molluscs; particularly Gyraulus and Protomonautes species. Other food materials are listed in Table 12.

TABLE 9

RELATIVE IMPORTANCE AND FREQUENCY OF OCCURRENCE OF DIETARY ITEMS IN THE STOMACH OF HEPSETUS ODOE

NUMBER OF STOMACH EXAMINED	23
NUMBER OF STOMACH WITH FOOD	10 (43.5%)
NUMBER OF STOMACH WITHOUT FOOD	13 (56.5%)

DIETARY ITEMS	PERCENTAGE FREQUENCY OF OCCURRENCE	PERCENTAGE OF TOTAL POINT AWARDED
INSECTA		
Immature insects. Tricoptera larvae	50	0.3
Unidentified insect remain	20	0.1
TOTAL INSECTA		0.4
HIGHER PLANTS		
Plant debris	20	0.7
FISH		
Fish remain	100	98.9

TABLE 10

RELATIVE IMPORTANCE AND FREQUENCY OF OCCURRENCE OF DIETARY ITEMS IN THE STOMACH OF LABEO SENEGALENSIS

NUMBER OF STOMACH EXAMINED	88
NUMBER OF STOMACH WITH FOOD	70 (79.5%)
NUMBER OF STOMACH WITHOUT FOOD	18 (20.5%)

DIETARY ITEMS		PERCENTAGE FREQUENCY OF OCCURRENCE	PERCENTAGE OF TOTAL POINT AWARDED
DIATOMS.	Diatoma sp	28.6	5.3
	Coscinodiscus sp	71.4	2.1
	Melosira sp	50.0	0.1
	Navicula sp	92.9	12.7
	Nitzschia sp	14.3	2.1
	Cyclotella sp	7.1	4.6
	Synedra sp	28.6	8.3
TOTAL DIATOMS			35.2
DESMID	Gonatozygon sp	17.1	0.6
	Docidium sp	42.9	5.0
	Closterium sp	64.3	8.4
TOTAL DESMID			14.0
GREEN ALGAE	Spirogyra sp	14.3	5.1
	Ulothrix sp	7.1	0.5
	Volvox sp	42.3	2.2
	Chlorella sp	17.1	1.1
BLUE-GREEN ALGAE.	Nostoc sp	14.3	4.0
	Microcystis sp	85.7	1.4
	Anabaena sp	11.4	1.0
TOTAL ALGAE			15.3
Detritus		100.0	35.5

TABLE 11

RELATIVE IMPORTANCE AND FREQUENCY OF OCCURRENCE OF DIETARY ITEMS IN THE STOMACH OF AUCHENOGLANIS OCCIDENTALIS

NUMBER OF STOMACH EXAMINED	49
NUMBER OF STOMACH WITH FOOD	32 (65.3%)
NUMBER OF STOMACH WITHOUT FOOD	17 (34.7%)

DIETARY ITEMS		PERCENTAGE FREQUENCY OF OCCURRENCE	PERCENTAGE OF TOTAL POINT AWARDED
INSECTA			
Immature insects.	Odonata nymph	15.6	10.0
	Ephemeroptera larvae	37.5	12.0
	Cyrinus sp larvae	18.8	12.3
TOTAL INSECTA			34.3
CRUSTACEA			
	Copepoda. Cyclop sp	78.2	11.6
	Cladocera. Daphnia sp	93.7	22.2
	Ostracod larvae	81.3	1.8
TOTAL CRUSTACEA			35.6
MOLLUSCA			
	Lamellibranchs	6.3	5.6
	Detritus	31.3	24.5

TABLE 12

RELATIVE IMPORTANCE AND FREQUENCY OF OCCURRENCE OF DIETARY ITEMS IN THE STOMACH OF CHRYSICHTHYS NIGRODIGITATUS

NUMBER OF STOMACH EXAMINED	25	
NUMBER OF STOMACH WITH FOOD	17	(68%)
NUMBER OF STOMACH WITHOUT FOOD	8	(32%)

DIETARY ITEMS		PERCENTAGE FREQUENCY OF OCCURRENCE	PERCENTAGE OF TOTAL POINT AWARDED
INSECTA			
Immature insects.	Ephemeroptera nymph	100.0	34.5
	Odonata nymph	88.2	12.6
TOTAL INSECTA			47.1
CRUSTACEA			
	Daphnia sp	64.7	13.3
MOLLUSCA	Protomonautes sp	35.3	2.1
	Gyraulus sp	64.7	15.7
	Unidentified gastropd remain	100.0	14.6
TOTAL MOLLUSCA			32.4
	decaying matter	52.9	7.2

4.5.7 Schilbeidae

Schilbe uranoscopus: Twenty-two specimens out of 43 examined contained food. Large quantity of insects and fish made up the diet (Table 13).

Schilbe mystus: The fish was found to feed on fish, insects gastropods and plant debris.

4.5.8 Clariidae

Clarias gariepinus: The fish was found to feed mainly on fish. Other dietary items included insects, frogs and unidentified weeds. Thirty-two out of a total of 83 specimens examined had empty stomach (Table 14).

4.5.9 Malapteruridae

Malapterurus electricus: The stomachs of 75 M. electricus were examined. Twenty-three of them contained food. [illegible] The fish fed mainly on insects and fish fry (Table 15).

4.5.10 Mochokidae

Synodontis schall: The main dietary items observed in the stomach of S. schall were crustaceans, molluscs, fish scales and detritus (Table 16).

4.5.11 Centropomidae

Lates niloticus: Two hundred and seventy-one specimens were examined, 109 of them contained partly digested fish in their stomachs in addition to Odonata nymphs. About 60% had [illegible] empty stomach (Table 17).

TABLE 13

RELATIVE IMPORTANCE AND FREQUENCY OF OCCURRENCE OF DIETARY ITEMS IN THE STOMACH OF SCHILBE URANOSCOPUS

NUMBER OF STOMACH EXAMINED	43
NUMBER OF STOMACH WITH FOOD	22 (51.2%)
NUMBER OF STOMACH WITHOUT FOOD	21 (48.8%)

DIETARY ITEMS	PERCENTAGE FREQUENCY OF OCCCURRENCE	PERCENTAGE OF TOTAL POINT AWARDED
INSECTA		
Adult insects. Isoptera	40.9	4.1
Diptera	13.6	1.9
Dictyoptera	45.5	2.1
Orthoptera	13.6	1.1
Ephemeroptera	13.6	0.7
Odonata	86.4	6.2
Coleoptera	27.3	1.1
Immature insects.		
Hymenoptera larvae	40.9	11.3
Hemiptera larvae	13.6	0.6
Ephemeroptera larvae	4.5	1.0
Odonata larvae	100.	13.4
Unidentified insect remain	100.	13.0
TOTAL INSECTA		56.5
FISH		
Fish Fry	86.4	15.4
Unidentified fish remain	100	28.1
TOTAL FISH		43.5

TABLE 14

RELATIVE IMPORTANCE AND FREQUENCY OF OCCURRENCE OF DIETARY ITEMS IN THE STOMACH OF CLARIAS GARIEPINUS

NUMBER OF STOMACH EXAMINED	83	
NUMBER OF STOMACH WITH FOOD	51	(61.4%)
NUMBER OF STOMACH WITHOUT FOOD	32	(38.6%)

DIETARY ITEMS	PERCENTAGE FREQUENCY OF OCCURRENCE	PERCENTAGE OF TOTAL POINT AWARDED
INSECTA		
Adult insects. Odonata	49.0	0.5
Orthoptera	5.9	0.1
Coleoptera	78.4	0.1
Hymenoptera	2.0	0.2
Immature insects. Odonata nymph	39.2	0.5
Chaoborus larvae	19.6	0.3
Chironomid larvae	94.1	2.6
Cyrinus sp larvae	2.0	0.8
Ephemeroptera larvae	7.8	0.1
Unidentified insect remain	100.0	4.5
TOTAL INSECTA		9.7
FISH		
Fish remain	100.0	78.3
AMPHIBIA		
Frog remain	19.6	9.7
HIGHER PLANTS		
Unidentified weeds	3.9	2.3

TABLE 15

RELATIVE IMPORTANCE AND FREQUENCY OF OCCCURRENCE OF DIETARY ITEMS IN THE STOMACH OF MALAPTERURUS ELECTRICUS

NUMBER OF STOMACH EXAMINED	75
NUMBER OF STOMACH WITH FOOD	23 (30.7%)
NUMBER OF STOMACH WITHOUT FOOD	52 (69.3%)

DIETARY ITEMS	PERCENTAGE FREQUENCY OF OCCURRENCE	PERCENTAGE OF TOTAL POINT AWARDED
INSECTA		
Hymenoptera	17.4	7.6
Chironomous larvae	13.0	5.4
Ephemeroptera larvae	34.8	13.9
Unidentified insect remain	95.7	20.3
TOTAL INSECTA		47.2
FISH		
Fish Fry	87.0	22.7
Unidentified fish remain	91.3	30.1
TOTAL FISH		52.8

TABLE 16

RELATIVE IMPORTANCE AND FREQUENCY OF OCCURRENCE OF DIETARY ITEMS IN THE STOMACH OF SYNODONTIS SCHALL

NUMBER OF STOMACH EXAMINED	26
NUMBER OF STOMACH WITH FOOD	20 (76.9%)
NUMBER OF STOMACH WITHOUT FOOD	6 (23.1%)

DIETARY ITEMS	PERCENTAGE FREQUENCY OF OCCURRENCE	PERCENTAGE OF TOTAL POINT AWARDED
CRUSTACEA		
Canthocamptus sp	35.0	1.1
Diaptomus sp	55.0	12.8
Simocephalus sp	15.0	11.2
Daphnia sp	90.0	22.1
Asellus sp	20.0	0.1
TOTAL CRUSTACEA		47.3
MOLLUSCA		
Gyraulus sp	100.0	25.6
Ancylus sp	25.0	0.9
Anodonta sp	75.0	13.5
TOTAL MOLLUSCA		40.0
FISH		
Fish scales	25.0	10.0
Detritus	5.0	2.7

TABLE 17

RELATIVE IMPORTANCE AND FREQUENCY OF OCCURRENCE OF DIETARY ITEMS IN THE STOMACH OF LATES NILOTICUS

NUMBER OF STOMACH EXAMINED	271	
NUMBER OF STOMACH WITH FOOD	109	(40.2%)
NUMBER OF STOMACH WITHOUT FOOD	162	(59.8%)

DIETARY ITEMS	PERCENTAGE FREQUENCY OF OCCURRENCE	PERCENTAGE OF TOTAL POINT AWARDED
FISH		
Tilapia zilli	89.9	96.2
Oreochromis niloticus	6.4	1.3
Unidentified fish remain	71.6	1.7
TOTAL FISH		99.2
INSECTA		
Immature insect.		
Odonata nymph	18.3	0.8

4.5.12 Anabantidae

Ctenopoma kingsleyae: Seven stomachs of C. kingsleyae were examined, six had food and one had none. This species was found to be mainly insectivorous. Plant debris were found in one of the stomachs examined.

4.5.13 Cichlidae

Sarotherodon galilaeus: A large number of this species examined had food consisting of some plankton comprising of a few green algae, blue-green algae, desmids and large numbers of diatoms and crustaceans. Other food items were insect remains and plant fragments (Table 18).

Oreochromis niloticus: The main food of this species were diatoms and desmids. Diatoma and Melosira species were the most important diatoms, while Closterium species was the most important desmid eaten. Seventeen out of 78 species examined had empty stomach (Table 19).

Tilapia zilli: The composition and relative importance of the dietary items in the stomachs of T. zilli is shown in Table 20. Animal materials was the principal constituent of the diet and accounted for 70.1% by point. Of the plant foods Diatoms were the most important. They formed about 11.2% by points.

Hemichromis fasciatus: It fed mainly on fish. Insects and plant debris were also found in its stomach. Twenty-four specimens were observed in which three had empty stomach (Table 21).

TABLE 18

RELATIVE IMPORTANCE AND FREQUENCY OF OCCURRENCE OF DIETARY ITEMS IN THE STOMACH OF SARCTHERODON GALILAEUS

NUMBER OF STOMACH EXAMINED	248	
NUMBER OF STOMACH WITH FOOD	236	(95.2%)
NUMBER OF STOMACH WITHOUT FOOD	12	(4.8%)

DIETARY ITEMS	PERCENTAGE FREQUENCY OF OCCURRENCE	PERCENTAGE OF TOTAL POINT AWARDED
DIATOM		
Asterionella sp	21.2	2.1
Naviculla sp	19.1	6.0
Synedra sp	4.2	0.1
Diatoma sp	12.7	10.2
Cymbella sp	1.3	0.5
TOTAL DIATOM		18.9
DESMID		
Docidium sp	6.4	2.5
Gonatozygon sp	14.8	3.0
Closterium sp	89.0	8.3
TOTAL DESMID		13.8
Green Algae. Chlorella sp	24.5	5.0
Spirogyra sp	93.2	4.2
Ulothrix sp	61.4	3.7
Oedcgonium sp	64.8	3.1
Volvox sp	12.3	5.5
Cladophora sp	8.9	1.3
Blue-green Alage. Nostoc sp	78.4	2.3
Anabaena sp	64.4	1.6
Rivularia	16.5	2.0
Oscillatoria sp	4.2	0.5
TOTAL ALGAE		29.2

TABLE 18 (CONT'D.)

DIETARY ITEMS	PERCENTAGE FREQUENCY OF OCCURRENCE	PERCENTAGE OF TOTAL POINT AWARDED
CRUSTACEA		
Copepoda. Cyclop sp	76.3	5.8
Asellus sp	52.1	2.7
Cladocera: Daphnia sp	86.4	13.2
TOTAL CRUSTACEA		21.7
INSECTA		
Insect remain	12.7	9.5
HIGHER PLANTS		
Plant fragments	84.7	6.9

TABLE 19

RELATIVE IMPORTANCE AND FREQUENCY OF OCCURRENCE OF DIETARY ITEMS IN THE STOMACH OF CHROCHROMIS NILOTICUS

NUMBER OF STOMACH EXAMINED 78

NUMBER OF STOMACH WITH FOOD 61 (78.2%)

NUMBER OF STOMACH WITHOUT FOOD 17 (21.8%)

DIETARY ITEMS	PERCENTAGE FREQUENCY OF OCCCURRENCE	PERCENTAGE OF TOTAL POINT AWARDED
DIATOM		
Synedra sp	11.5	5.6
Diatoma sp	39.3	19.0
Melosira sp	46.0	19.1
TOTAL DIATOM		43.7
DESMIDS		
Dociduim sp	16.4	4.5
Closterium sp	19.7	17.1
TOTAL DESMID		21.6
CRUSTACEA		
Cladocera. Daphnia sp	96.7	15.2
ALGAE		
Green Algae: Oedogonium sp	85.2	10.9
Spirogyra sp	21.3	3.8
TOTAL ALGAE		14.7
Detritus	80.3	4.8

TABLE 20

RELATIVE IMPORTANCE AND FREQUENCY OF OCCURRENCE OF DIETARY ITEMS IN THE STOMACH OF TILAPIA ZILLI

NUMBER OF STOMACH EXAMINED 209

NUMBER OF STOMACH WITH FOOD 196 (93.8%)

NUMBER OF STOMACH WITHOUT FOOD 8 (6.2%)

DIETARY ITEMS	PERCENTAGE FREQUENCY OF OCCURRENCE	PERCENTAGE OF TOTAL POINT AWARDED
DIATOM		
Diatoma sp	5.1	1.2
Cyclotella sp	3.1	0.4
Fritillaria sp	1.0	4.3
Nitzschia sp	13.3	0.1
Navicula sp	12.8	2.0
Fragilaria sp	4.1	5.2
TOTAL DIATOM		13.2
ALGAE		
Green Algae. Protococcus sp	26.5	0.8
Spirogyra sp	97.0	0.9
Volvox sp	27.6	1.6
Zygnema sp	13.3	0.3
Scenedesmus sp	18.4	2.1
Blue-green Algae. Anabaena sp	93.9	3.5
Microcytis sp	33.2	0.1
Oscillatoria sp	28.1	1.5
TOTAL ALGAE		10.8
INSECTA		
Adult insects. Odonata	92.9	18.5
Ephemeroptera	53.6	12.1
Tricoptera	81.6	6.3
Diptera	86.7	13.5
Orthoptera	38.3	0.6
Immature insects. rat-tailed Maggot (Eristalis sp)	6.1	0.2
Ephemeroptera larvae	5.1	1.8
Phanton larvae (Chaoborus sp)	10.2	1.2

TABLE 20 (CONT'D.)

DIETARY ITEMS	PERCENTAGE FREQUENCY OF OCCURRENCE	PERCENTAGE OF TOTAL POINT AWARDED
Insect remain	96.9	15.3
TOTAL INSECTA		69.5
CRUSTACEA		
Capepoda: Cyclop sp	2.0	1.0
HIGHER PLANTS		
leaves	2.6	2.0
Seeds	99.0	0.1
Fruits	1.0	1.3
TOTAL HIGHER PLANT		3.4
Detritus	91.8	2.1

TABLE 21 ..

RELATIVE IMPORTANCE AND FREQUENCY OF OCCURRENCE OF DIETARY ITEMS IN THE STOMACH OF HEMICHROMIS FASCIATUS

NUMBER OF STOMACH EXAMINED 24
NUMBER OF STOMACH WITH FOOD 21 (87.5%)
NUMBER OF STONACH WITHOUT FOOD 3 (12.5%)

DIETARY ITEMS	PERCENTAGE FREQUENCY OF OCCURRENCE	PERCENTAGE OF TOTAL POINT AWARDED
INSECTA		
Adult insect: Coleoptera	54.1	2.0
Gyrinus sp larvea	23.8	0.6
Unidentified insect remain	47.6	8.0
TOTAL INSECTA		10.6
FISH		
Fish Fry	85.7	20.0
Fish remain	95.2	60.0
TOTAL FISH		80.0
HIGHER PLANTS		
Plant debris	19.0	9.4

Hemichromis bimaculatus: These species fed mainly on insects, crustaceans and fish. These dietary items together formed 99.2 % of point score for the total diet (Table 22).

4.6 SEX RATIO

The sex ratio of some species is given in Table 23. The monthly variation in sex ratio is shown in Table 24. Sex ratio was not calculated for all the species encountered during the period of study because some were too few in number and for some, only one sex was recorded.

4.6.1 Polypteridae:

Polypterus senegalus: The sex ratio, male:female was 1:2 (Table 23) with no significant difference between them.

4.6.2 Characidae:

Brycinus nurse: The sex ratio was 1:2 (Table 23). Male specimens were absent from four months samples.

Hepsetus odoe: Like the B. nurse, the sex-ratio of H. odoe was 1:2. There was no wide variations in the sex ratio throughout the year.

4.6.3 Cyprinidae

Labeo senegalensis: Although there were more males of L. senegalensis than females in the sample, there was [illegible] difference in the sex ratio.

4.6.4 Bagridae

Auchenoglanis occidentalis: There was high sex ratio in favour of mal during the dry season than the rainy season (Table 24). More males were present in the sample studied.

TABLE 22

RELATIVE IMPORTANCE AND FREQUENCY OF OCCURRENCE OF DIETARY ITEMS IN THE STOMACH OF HEMICHROMIS BIMACULATUS.

NUMBER OF STOMACH EXAMINED 12
NUMBER OF STOMACH WITH FOOD 11 (91.7%)
NUMBER OF STOMACH WITHOUT FOOD 1 (8.3%)

DIETARY ITEMS		PERCENTAGE FREQUENCY OF OCCURRENCE	PERCENTAGE OF TOTAL PIONT AWARD
INSECTA			
Adult insects:	Odonata	81.8	14.8
	Coleptera	54.5	0.2
Immature insects:	Odonata larvae	9.1	30.5
Unidentified insect reman		100.0	0.3
TOTAL INSECTA			45.8
CRUSTACEA			
Diaptomus sp		63.6	22.4
Daphnia sp		27.3	5.0
TOTAL CRUSTACEA			27.4
FISH			
Fish Fry		36.4	12.5
Unidentified fish remain		72.7	14.0
TOTAL FISH			26.5
HIGHER PLANTS			
Plant debris		9.1	0.3

TABLE 23: SEX RATIO OF SOME FISHES IN SHIRORO LAKE

FISH SPECIES	NUMBER OF FISH EXAMINED	NUMBER OF MALES	NUMBER OF FEMALES	SEX RATIO (ADJUSTED) M:F
Polypterus senegalus	18	7	11	1:2
Brycinus nurse	61	22	39	1:2
Hepsetus odoe	23	9	14	1:2
Labeo senegalensis	88	54	34	2:1
Auchenoglanis occidentalis	49	38	11	3:1
Chrysichthys nigrodigitatus	25	13	12	1:1
Schilbe mystus	16	7	9	1:1
Schilbe uranoscopus	43	9	34	1:4
Clarias gariepinus	83	29	54	1:2
Malapterurus electricus	75	40	35	1:1
Lates niloticus	271	100	171	1:2
Synodontis schall	26	10	16	1:2
Sarotherodon galilaeus	248	101	147	1:2
Oreochromis niloticus	78	36	42	1:1
Tilapia zilli	204	102	102	1:1
Hemichromis fasciatus	24	8	16	1:2
H. bimaculatus	12	1	11	1:11

TABLE 24: MONTHLY VARIATIONS IN THE SEX RATIO OF SOME FISH IN SHIRORO LAKE

FISH SPECIES	M O N T H											
	A(1987) M:F	M M:F	J M:F	JL M:F	A M:F	S M:F	O M:F	N M:F	D M:F	J(1988) M:F	F M:F	M M:F
Brycinus nurse	2:-	3:1	-:1	-:4	-:1	1:1	1:4	1:1	1:1	1:2	-:1	1:2
Hepsetus odoe	-:2	1:-	1:1	-	1:-	-:1	1:2	-	1:4	2:-	1:-	-:2
Labeo senegalensis	-:2	1:6	1:1	6:-	3:1	1:1	1:1	2:-	3:1	1:3	2:1	1:1
Auchenoglanis occidentalis	-:2	2:-	-:2	1:-	2:-	1:-	3:1	-:1	4:-	4:1	5:1	2:-
Chrysichthys nigrodigitatus	3:-	-:1	3:-	3:1	-:2	-	-	-	-	1:3	1:2	1:2
Schilbe uranoscopus	-:5	1:1	-:2	1:1	-:1	1:-	-:4	-:3	-:2	1:-	-:4	1:2
Clarias gariepinus	-	-	2:1	1:-	1:3	-:2	1:1	1:1	1:13	1:1	-:3	-
Malapterurus electricus	1:-	1:2	1:2	3:1	1:1	1:1	2:1	1:3	1:2	1:2	1:4	2:1
Lates niloticus	1:1	1:1	1:6	2:1	1:3	1:1	7:1	1:1	1:1	1:1	1:1	-:5
Sarotherodon galilaeus	1:2	1:2	1:1	1:1	1:6	1:1	1:1	1:1	1:2	1:1	1:2	1:1
Oreochromis niloticus	-:4	2:1	1:1	1:1	2:1	5:1	1:1	1:5	3:1	-:6	1:1	1:1
Tilapia zilli	1:2	1:1	1:1	2:1	1:1	1:1	2:1	1:1	5:1	1:2	1:1	1:1

Chrysichthys nigrodigitatus: The sex ratio was approximately 1:1. There was no much variation in the number of males and of females rpresent in the monthly samples studied. 4.6.5 Schilbidae

Schilbe uranoscopus: The females of this species predominanted in the sample (Table 25). The male to female ratio was 1:4. There was high fluctuation in the numbers of the two sexes throughout the period of study.

S. mystus: This had 1:1 sex ratio.

4.6.6 Clariidae

Clarias gariepinus: C. gariepinus had a sex ratio of 1:2 in favour of the females.

4.6.7 Malapteruridae

Malapterurus electricus: The sex ratio was approximately 1:1. The species had little variation in the sex ratio recorded for the period of study.

4.6.8 Centropomidae

Lates niloticus: There were more females of L. niloticus in the sample studied but there was no any significant difference in the sex ratio. Throughout the period of study, except for the months of June and October, the sex ratios were approximately 1:1.

4.6.9 Cichlidae

Sarotherodon galilaeus: No much variation in the sex ratio of S. galilaeus was observed during the period of study.

TABLE 25: STATISTICAL ANALYSIS FOR SIGNIFICANCE DIFFERENCE BETWEEN EXPECTED AND OBSERVED SEX RATIO OF SOME FISHES IN SHIRORO LAKE

Fish species	No. of males in sample	No. of females in sample	Ratio of M/F	Analysis of Frequency X^2	P <0.05
Polypterus senegalus	7	11	1:1.57	0.32	
Brycinus nurse	22	39	1:1.77	0.59	
Hepsetus odoe	9	14	1:1.56	0.31	
Labeo senegalensis	54	34	1:0.63	0.14	
Auchenoglanis occidentalis	38	11	1:0.29	0.50	
Chrysichthys nigrodigitatus	13	12	1:0.92	0.006	
Schille uranoscopus	9	34	1:3.78	7.73	Significant differen.
S. mystus	7	9	1:1.29	0.08	
Clarias gariepinus	29	54	1:1.86	0.74	
Malapterurus electricus	40	35	1:0.88	1.01	
Lates niloticus	100	171	1:1.71	0.50	
Sarotherodon galilaeus	101	147	1:1.46	0.21	
Oreochromis niloticus	36	42	1:1.17	0.03	
Tilapia zilli	102	102	1:1	1.70	
Hemichromis fasciatus	8	16	1:2	10	
H. bimaculatus	1	11	1:11	100	Significant differen.

Oreochromis nilotious and Tilapia zilli had sex ratio 1:1. The sex ratio of H. bimaculatus was 1:11. This was found to be significantly different (p=0.05) from the 1:1 ratio.

4.7 Reproduction Cycle and Fecundity

Scanty data were obtained on reproduction cycle and fecundity. The data could not permit any meaningful ecological analysis therefore, were disc arded.

CHAPTER FIVE

D I S C U S S I O N

A total of 1,384 specimens of fish from 13 families comprising 22 genera and 31 species from Shiroro Lake were studied. A large number of species were encountered during the rainy season. At this period a lot of food items were usually washed into the lake for the fish to feed upon in addition to already increased primary production. The length and weight frequency curves of most of the fishes revealed that smaller ones were caught. Ita et al. (1985b) reported same observation and attributed it to the use of small mesh nets by the fishermen and the age of the lake which was one year then. Although in this study fish were collected at first landing to prevent chances of bias, it was only possible to eliminate intermediate losses, as commercial landings are always to some extent biased. The limitation could be responsible for the presence in large number the small size group.

The equations obtained of the length-weight relationships for Oreochromis niloticus and Sarothorodon galilaeus compare favourably with those of Abdullahi (1987). Factors such as maturity level, season, time of capture and factors that influence weight are known to have effect on 'b'-values (Lagler, 1952).

The tendency for almost all the species to increase in plumpness with size, as revealed by the equations for the length-weight relationship (Table 5) was confirmed by better

condition. The mean condition factor (Appendix 2) indicated that most of the fishes were in good condition throughout the period of investigation. Good condition observed in fish during the dry season could mean that even though at this period there was reduction in the primary production and inflow of fish food into the lake, fishes were not starved. There was significant difference in condition factor of males and females of Labeo senegalensis, Lates niloticus and Tilapia zilli. Condition factor can be influenced by age, changes in season, gonad maturity, length-weight of the fish and stomach fullness (Lagler, 1952).

During the period of study a high proportion of the fish were observed to have empty stomachs. This may be due to regurgitation of stomach contents after capture (Lagler, 1952; Olatunde, 1978a). It could also be that the fish had not fed or the food had already been digested before they were caught or removed from gill nets. Incidences of high percentage of empty stomachs have also been reported for some fish by Munro (1967), Arawomo (1976), Sagua (1978) and Olatunde (1978a).

Holden and Reed (1978) reported Brycinus macrolepidotus to feed on insects and small fish, while Lewis (1974b) and Reed et al. (1967) gave its food as plant materials and insects. In this study it was predominantly herbivorous. The result of the analysis of food of Hepsetus odoe shows that fish dominated the food followed by plant debris and insects. This observation seems to agree with the record of Jubb (1961) and Holden and Reed (1978) that H. odoe fed on small fishes especially Brycinus sp.

and insects. Molluscs and Crustaceans were observed in addition to fish in the stomach of Porcus docmac. This observation agrees with the result of Copley (1952), Corbet (1961), Imevbore and Bakare (1970) and Fryer and Iles (1972). However, Welman (1948) gave the food of this fish in Nigeria as prawn, insects larvae and mud. In the blue Nile they have been reported to feed on odonata nymphs, insects, fish, sorghum, plant debris and seeds (Sandon and Tayib, 1953). Jubb (1961), Petr (1969a) and Fryer and Iles (1972) have reported Schilbe mystus to be piscivorous in Lake Kariba, Volta and the great lakes of Africa respectively. In Nigeria, Imevbore and Bakare (1970) and Olatunde (1979b) have observed S. mystus in Kainji lake to feed mainly on fish. Mok (1974) observed the juveniles in Lake Chad to feed on insects and the adults on fishes. This study revealed S. mystus to feed mainly on fish with insects, gastropods and plant debris being secondary diets.

The dietary composition of Lates niloticus showed that it is piscivorous, feeding mainly on fish and arthropods. Hopson (1964) and Reed et al. (1967) worked on the food and feeding habits of L. niloticus. They reported the fish to be piscivorous with the juveniles feeding on insects nymphs and larvae, Cladocerans and prawns. Although most of the specimens of L. niloticus studied from Shiroro Lake were juveniles, they did not include much arthropod in their diets.

On the food and feeding habits of Malapterurus electricus, this study suggest that there is piscivorous. Sagua (1978), Coates (1984), Olatunde (1984) and Ogbe (1985) also arrived at the same conclusion.

The analysis of the stomach contents of Clarias gariepinus showed that the fish is piscivorous eating in addition to fish a large variety of food items which included insects, frogs and weeds. This observation seems to agree with the report of Imevbore and Bakare (1970) and Lewis (1974b) On river Niger and Lake Kainji respectively that C. gariepinus is piscivorous. However, Olatunde (1983) reported the fish in Zaria to be an Omnivore. He found the fish to feed on insects fish, molluscs, Crustaceans, plant debris and bottom deposits. Welman (1948) had also given the food of C. gariepinus to consist of fish, molluscs, insects frogs and weeds.

A great proportion of the total fish population examined from Shiroro lake was found to depend on fish as food. This observation could be attributed to the abundance of their prey. For example, most of the predators fed on Cichlids that dominated the lake.

The feeding habits of Brycinus nurse are known to be very diversed (Copley, 1952; Jubb, 1961; Imevbore and Bakare, 1970; Lewis, 1974b; Holden and Red, 1978). Moss (1980) reported it to feed on [illegible] seeds and Zooplankton. In this study it was found to feed on plant material, insects, crustaceans molluscs annelids, frogs and fish scales.

Tilapia zilli was found to feed on diatoms, algae, insects, Crustaceans and plant materials Fagade (1971, 1978) and Moriarty (1973) had observed that many Tilapia species include algae in their diet.

Coates (1984) has reported Synodontis schall in the irrigation waters of Sudan to feed on algae, annelids, insects and detritus. Abdullahi (1987) found those in [illegible]

reservoir, Nigeria to feed on insects larvae and molluscs. In this study they were found to feed on Crustaceans,molluscs fish and detritus. Mormyrops deliciosus were found to have the same food habits in Lake Kariba (Jubb, 1961). They fed on fish insects, detritus and annelids.

Sarotherodon galilaeus was found to feed mainly on desmids, diatoms, algae and crustaceans. Abdullahi (1987) found this species in Kangimi reservoir to feed on diatoms desmids, protozoans and corn husks which were used as bait by the fishermen. Bailey (1978) reported the species in Nyumba ya Mungu reservoir, Tanzania to feed on diatom, Chironomous larvae and fish. In Kainji Lake, Nigeria, Akintunde and Imevbore (1979) observed that S. galilaeus fed mainly on phytoplankton. It was also found to feed on submerged macrophytes, detritus, algae and periphyton (Bon, 1979; Moss, 1980). Oreochromis niloticus fed almost exclusively upon diatoms desmids and Daphia species.

SUMMARY AND CONCLUSION

Work done on Shiroro lake with a view to obtaining some knowledge of the fish fauna is described. Thirty-one species of fish from 13 families were collected during the work, the majority of them previously unrecorded from that locality. The 31 species are listed and notes on aspect of the biology of each given.

Data on feeding, length-weight relationship, sex ratio and condition factor are given in greater detail for common species. Growth was found to be isometric in Brycinus nurse. Others had allometric growth pattern.

The condition factor indicated that most of the fishes were in good condition throughout the period of investigation. Most of the fishes in the lake were found to be predators. High incidence of empty stomachs was recorded.

The sex ratio was approximately 1:1 for most of the species. However, the females of Schilbe uranoscopus and Hemichromis bimaculatus predominated in the sample.

In conclusion, the information obtained from this work provides base data of the biology of the fishes of the lake. These may be of use to other future workers.

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APPENDIX: 1 LENGTH AND WEIGHT MEASUREMENT OF SOME FISHES IN SHIRORO LAKE

FISH SPCIES	PHYSICAL PARAMETER	SEX	NUMBER EXAMINED	RANGE	MEAN	S.E.	C.V.	95% C.I.	KURTOSIS	SKEWNESS
	SL	M	22	8.00-15.50	11.80	0.49	19.44	10.78-12.81	-0.96	0.27
Brycinunurse	(cm)	F	39	9.20-15.50	11.75	0.27	14.13	11.21-12.29	-0.49	0.74
	WT	M	22	4.00-81.35	35.43	4.03	53.30	27.06-43.80	1.13	1.07
B	(gm)	F	39	15.87-75.18	36.31	2.30	39.52	31.66-40.96	0.12	0.99
	SL	M	54	15.00-32.00	22.09	0.66	21.87	20.73-23.42	-0.41	0.74
Labeo senegalensis	(cm)	F	34	13.00-29.50	20.56	0.63	17.88	19.28-21.84	0.33	0.52
	WT	M	54	50.94-872.55	261.67	28.61	79.59	204.27-319.07	1.73	1.67
	(gm)	F	34	46.84-	175.45	19.83	65.91	135.10-215.80	2.83	1.62
	SL	M	38	12.00-28.00	17.03	0.61	22.08	15.79-18.26	0.77	0.95
Auchenoglanis occidentalis	(cm)	F	11	13.50-29.00	19.36	1.64	28.05	15.71-23.01	-0.99	0.48
	WT	M	38	27.00-407.07	117.36	15.12	79.43	86.72-148.00	2.44	1.70
	(gm)	F	11	46.60-398.55	186.00	42.62	75.99	91.05-280-95	-1.18	0.65
	SL	M	9	12.50-17.00	15.00	0.40	7.99	14.08-15.92	0.82	-0.52
Schilbe uranoscopus	(cm)	F	34	9.60-20.00	13.94	0.49	20.32	12.95-14.93	-0.01	-0.07
	WT	M	9	15.51-71.25	38.45	5.35	41.71	26.12-50.77	0.19	0.67
	(gm)	F	34	10.31-98.78	36.53	4.11	65.66	28.16-44.90	-0.32	0.60
	SL	M	29	12.10-39.00	22.90	1.10	25.84	20.65-25.15	0.46	0.24
Clarias lazera	(cm)	F	54	9.80-39.00	21.12	0.82	28.52	19.48-22.77	-0.09	0.17
	WT	M	29	21.09-420.09	136.59	15.68	61.81	104.47-168.71	2.42	1.03
	(gm)	F	54	12.51-420.09	124.63	11.65	68.77	101.24-148.03	0.78	0.65

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APPENDIX: 1 CONT'D. LENGTH AND WEIGHT MEASUREMENT OF SOME FISHES IN SHIRORO LAKE

FISH SPECIES	PHYSICAL PARAMETER	SEX	NUMBER EXAMINED	RANGE	MEAN	S.E.	C.V.	95% C.I.	KURTOSIS	SKEWNESS
	S.L	M	40	9.00-27.00	17.19	0.65	23.85	15.88-18.50	0.30	0.31
Malapterurus	(cm)	F	35	11.00-29.00	17.04	0.83	28.63	15.37-18.72	0.33	1.02
electricus	WT	M	40	23.35-354.00	125.24	12.50	63.12	99.96-150.52	1.46	1.40
	(gm)	F	35	35.91-346.56	117.57	11.56	58.19	94.07-141.07	2.16	1.34
	S.L.	M	100	9.00-24.00	15.76	0.38	23.99	14.99-16.52	0.55	0.42
Lates niloticus	(cm)	F	171	9.90-26.00	14.65	0.25	21.66	14.17-15.14	0.51	0.86
	WT	M	100	18.99-301.37	78.63	5.88	73.70	66.95-90.31	5.64	2.37
	(gm)	F	171	22.19-276.86	70.26	3.38	62.18	63.75-77.09	4.14	1.88
	SL	M	101	7.00-29.00	12.63	0.45	36.02	11.74-13.52	3.89	2.05
Sarotherodon	(cm)	F	147	7.50-31.00	12.50	0.40	24.44	11.70-13.31	3.32	-0.25
Galilaeus	WT	M	101	4.50-259.88	72.16	5.19	72.63	61.87-82.46	3.86	2.06
	(gm)	F	147	17.04-288.30	107.93	4.62	51.60	58.92-77.42	24.79	4.25
	SL	M	36	7.80-18.00	12.27	0.47	23.14	11.31-13.23	-0.70	0.44
Oreochromis	(cm)	F	42	7.51-18.00	11.41	0.42	24.02	10.56-12.26	-0.53	0.27
niloticus	Wt	M	36	11.67-159.58	66.42	7.50	67.70	51.21-81.63	-0.28	0.98
	(gm)	F	42	16.35-150.60	57.67	5.51	61.87	46.58-68.79	-0.35	0.77
	SL	M	102	7.00-16.00	11.14	0.20	18.06	10.75-11.54	-0.61	0.15
Tilapia zilli	(cm)	F	102	6.70-18.00	12.11	0.22	17.92	11.68-12.54	0.30	-0.04
	WT	M	102	13.70-157.60	53.96	2.48	46.38	49.05-58.88	2.52	1.36
	(gm)	F	102	51.20-173.90	62.27	3.08	47.61	59.17-71.38	1.93	1.32

Keys:

SL = Standard length
WT = Weight
SE = Standard error
CV = coefficient of variation
95%CI = 95% confidence interval

APPENDIX 2: MEAN CONDITION FACTOR (K) OF FISH IN SHIRORO LAKE

FISH SPECIES	NO. OF SPECIMENS EXAMINED	SEX	RANGE OF K	MEAN K	STANDARD DEVIATION	STANDARD ERROR
Polypterus senegalus	7	M	0.73-0.87	0.78	0.05	0.02
	11	F	0.26-0.96	0.74	0.18	0.05
Mormyrus rume	3	M	0.81-1.25	1.04	0.22	0.13
	4	F	1.04-1.50	1.22	0.21	0.10
Mormyrops deliciosus	3	M	0,71-.095	0.84	0.12	0.07
Brycinus nurse	22	M	0.78-3.18	2.04	0.57	0.12
	39	F	1.47-2.99	2.15	0.32	0.05
B. macrolepidotus	2	M	1.69-1.82	1.76	0.09	0.06
	1	F	2.48-	2.48	-	-
Hepsetus odoe	9	M	0.41-1.75	1.18	0.49	0.16
	14	F	0.27-2.15	1.51	0.45	0.12
Labeo senegalensis	54	M	1.16-4.48	2.10	0.48	0.07
	34	F	0.54-3.16	1.86	0.53	0.09
L. coubie	1	F	2.60-	2.60		
L. parvus	4	M	1.67-2.51	2.06	0.35	0.17
	2	F	1.59-2.16	1.88	0.40	0.28
Barbus occidentalis	1	M	2.20-	2.20	-	-
Barilius senegalensis	2	M	2.76-3.05	2.91	0.21	0.14
Porcus docmac	1	M	0.14-	0.14	-	-
	1	F	0.71-	0.71	-	-
Auchenoglanis occidentalis	38	M	0.99- .48	2.03	0.53	0.09
	11	F	1.63-3.14	2.14	0.39	0.12
Chrysichthys nigrodigitatus	13	M	1.74-3.15	2.25	0.41	0.11
	12	F	1.32-2.99	2.17	0.51	0.15

Appendix 2 (cont'd.) MEAN CONDITION FACTOR (K) OF FISH IN SHIRORO LAKE

FISH SPECIES	NO. OF SPECIMENS EXAMINED	SEX	RANGE OF K	MEAN K	STANDARD DEVIATION	STANDARD ERROR
C. furcatus	1	M	1.75-	1.75	-	-
	1	F	2.05-	2.05	-	-
Schilbe uranoscopus	9	M	0.76-1.47	1.08	0.26	0.09
	34	F	0.07-1.59	1.13	0.31	0.05
S. mystus	7	M	1.12-1.69	1.42	0.26	0.10
	9	F	1.14-1.58	1.43	0.15	0.05
Clarias gariepinus	29	M	0.63-1.24	1.01	0.14	0.03
	54	F	0.70-2.10	1.10	0.23	0.03
Heterobranchus longifilis	1	M	0.86-	0.86	-	-
Malapterurus electricus	40	M	0.69-3.76	2.32	0.55	0.09
	35	F	0.41-3.54	2.43	0.68	0.11
Lates niloticus	100	M	0.62-3.30	1.96	0.63	0.86
	171	F	0.50-3.70	2.15	0.04	0.54
Synodontis violaceus	1	F	1.68-	1.68	-	-
S. nigrita	3	F	1.72-2.56	2.23	0.45	0.26
S. schall	10	F	1.84-4.40	2.49	0.49	0.15
	6	M	1.83-2.82	2.56	0.61	0.15
S. gambiensis	1	F	1.99-			
Ctenopoma kingsleyae	4	M	3.89-4.98	4.37	0.45	0.23
	3	F	2.73-4.66	3.71	0.47	0.56
Sarotherodon galilaeus	101	M	1.06-7.08	3.69	1.09	0.11
	147	F	0.50-6.30	3.85	2.86	0.38

Appendix 2 (cont'd.) MEAN CONDITION FACTOR (K) OF FISH IN SHIRORO LAKE

FISH SPECIES	NO. OF SPECIMENS EXAMINED	SEX	RANGE OF K	MEAN K	STANDARD DEVIATION	STANDARD ERROR
Oreochromis niloticus	36	M	1.19-6.12	3.32	1.18	0.20
	42	F	1.60-4.94	3.54	0.74	0.11
Tilapia zilli	102	M	2.04-8.73	3.83	0.92	0.09
	102	F	2.04-5.39	3.57	0.87	0.09
Hemichromis fasciatus	8	M	2.98-3.07	3.23	0.43	0.15
	16	F	2.49-4.10	3.11	0.42	0.10
H. bimaculatus	1	M	4.86-	4.86	-	-
	11	F	3.69-4.85	4.26	0.34	0.10