THE FRESHWATER ICHTHYOFAUNA OF NIGERIA, WEST AFRICA, AND ITS ECONOMIC VALUES

by

Nicholas M. Inyang

AN ABSTRACT OF A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE

Department of Fisheries and Wildlife

1966

ABSTRACT

THE FRESHWATER ICHTHYOFAUNA OF NIGERIA, WEST AFRICA, AND ITS ECONOMIC VALUES

by Nicholas M. Inyang

Nigeria has a large number and a great variety of freshwater fishes, the study of which is useful and interesting not only for the sake of scientific knowledge, but for the economic value of these fishes to the nation.

Previous work on the freshwater fishes of Nigeria consists mainly of descriptive accounts of the various species and new forms which occur in Nigeria. These accounts are scattered in the works of Gunther (1859-70), Boulenger (1901-16) and in various journals, publications, and magazines. Little or nothing is known about their ecology and biology.

Despite the economic opportunities offered by Lake Chad, and by many rivers, streams, and creeks and the unquestionable need for freshwater fisheries study in Nigeria, this important aspect of the country's economic development, at the moment, seems to be receiving but little attention.

The purpose of this project was to attempt a literature survey of the freshwater fishes of Nigeria, compile and classify all the recorded species in a phylogenetic

sequence and also group together all the available information on different species. In addition to the checklist of the Nigerian freshwater species included in appendix 2, 75 species representing the important families and genera are discussed in detail to cover their distribution, characteristics, ecology, biology, economic value and size.

Though lack of capital, technical and biological knowledge of the life history, behavior and whereabouts of the Nigerian species contribute to the slow progress of freshwater fisheries development in the country, there are great possibilities and prospects for this development in the near future.

The freshwater fisheries of Nigeria have a potential economic value to the nation in terms of providing fish food for the nation, providing markets for fishing equipment and supplies, and also offering opportunities for sports and recreation.

THE FRESHWATER ICHTHYOFAUNA OF NIGERIA, WEST AFRICA, AND ITS ECONOMIC VALUE

By

Nicholas M. Inyang

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE

Department of Fisheries and Wildlife

1966

ACKNOWLEDGMENT

The author wishes to express his sincere gratitude and appreciation to Professor P. I. Tack, Chairman of Department of Fisheries and Wildlife, under whose direction and guidance the project was carried out. His advice and suggestions have been very helpful.

I also wish to thank Professors E. W. Roelofs, and E. C. Martin of Departments of Fisheries and Wildlife and Entomology, respectively, for their various suggestions and cooperation. I am also indebted to Dr. E. A. Lachner of the Division of Fishes, U.S. National Museum who made it possible for me to examine the collections of the freshwater fishes from Africa in the museum.

Finally, my gratitude goes to all the graduate students in the Department of Fisheries and Wildlife and others who contributed in various ways towards the completion of this project. Their cooperation and readiness to help have been greatly appreciated.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDIX

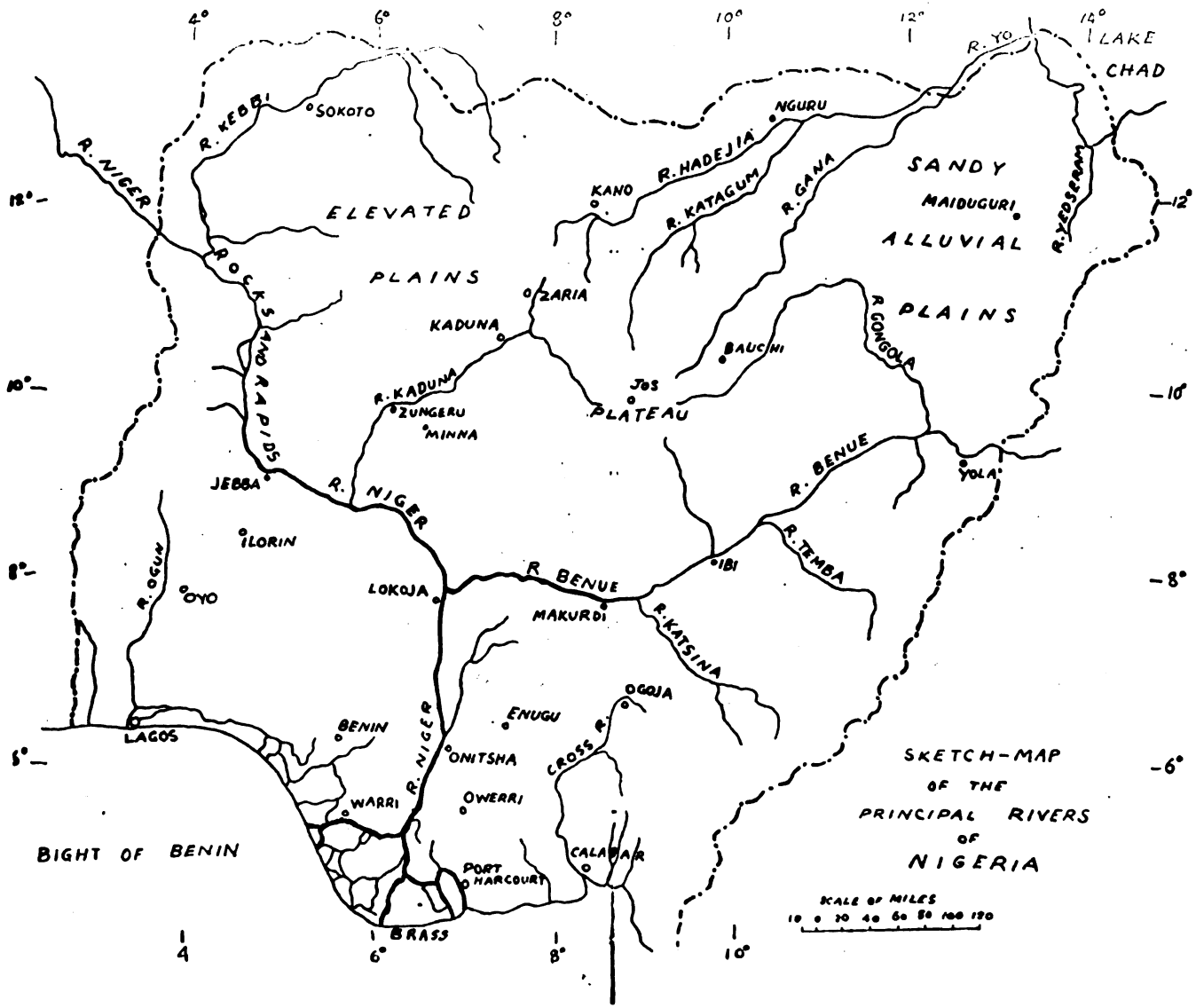
4°
6°
8°
10°
12°
14°
LAKE CHAD
R. YO
R. NIGER
R. KEBBI
SOKOTO
NGURU
R. HADEJIA
KANO
R. KATAGUM
R. GANA
SANDY
MAIDUGURI
ALLUVIAL
PLAINS
R. YEDSERAM
ELEVATED
PLAINS
ROCKS AND RAPIDS
ZARIA
KADUNA
R. KADUNA
ZUNGERU
MINNA
JOS
PLATEAU
BAUCHI
R. GONGOLA
PLAINS
JEBBA
R. NIGER
R. BENUE
YOLA
ILORIN
R. OGUN
OYO
LOKOJA
IBI
R. TEMBA
MAKURDI
R. KATSINA
OGOJA
ENUGU
BENIN
LAGOS
ONITSHA
CROSS R.
R. NIGER
OWERRI
WARRI
CALABAR
PORT HARCOURT
BIGHT OF BENIN
BRASS
SKETCH-MAP
OF THE
PRINCIPAL RIVERS
OF
NIGERIA
SCALE OF MILES
10 0 20 40 60 80 100 120
12°
10°
8°
6°
4°

Figure 1

I. INTRODUCTION

Previous work on freshwater fish fauna of Nigeria

The fish fauna of Nigeria presents an interesting study, not only from the biological point of view, but also from its economic value to the nation. Nigeria has a large number and a great variety of fishes which few places in the world can equal. Though not all the freshwater fishes in the Nigerian waters are known, some taxonomic and descriptive work has been done mainly on the collection of foreign visitors or expatriate residents. Descriptions of many species of fishes found in Nigeria are scattered in the works of Gunther (1859-70, 1896), Boulenger (1901-16) and in various journals, publications, and magazines. Boulenger's "Catalogue of freshwater fishes of Africa" is an indespensable piece of work to the study of African ichthyofauna as a whole, though his classification of some families such as the Cyprinodontidae has been largely revised.

Welman (1948) conducted a partial survey of the freshwater fishes of Nigeria and conjectured on future developments. Copley (1952) described some of the species which occur in Nigeria, and Maclaren (1953) stated that Copley first wrote of his fishing experience in Lagos, Lokoja and Ibi on the Benue River between 1910-14, the original work of which was not accessible to the author.

Maclaren (1950, 1953, 1954, 1955) while in Nigeria as a fisheries officer, contributed to the knowledge of the freshwater fishes and fisheries of the country.

Clausen (1956, 1963) described new species of Syngnathidae and Cyprinodontidae.

Kahsbauer (1962) brought together what is specifically known about the fish fauna of Nigeria, but because his work is in German it has not made much impact in Nigeria to date. Other workers have contributed in various ways to the knowledge of the fish fauna of Nigeria, but so far most authors have been concerned largely with collection, identification and classification. Though much of this task still remains to be done, there is need to greatly enlarge the scope of the work particularly to the development of artificial keys to genera and species, and the study of ecology and general biology of the freshwater fishes. These problem areas are now crying for investigation.

Sources of freshwater fisheries in Nigeria

Though fish, particularly fresh fish are not commonly eaten in Nigeria, they are used in many homes in certain dishes and as a delicacy. Many Nigerians enjoy fish, but locally produced fish is scarce and imported fish and fishery products are so expensive that few homes can afford them.

Nigeria has many rivers which under proper fisheries management could supply extensive fisheries resources to the nation. It is also apparent that the country's position on the west coast of the Atlantic makes possible extensive marine fisheries development, so that with adequate scientific, economic and technological development Nigeria has the potential to be more than self-sufficient in fish production. Unlike some of the countries in the central and east Africa, Nigeria lacks big lakes except for Lake Chad which lies partly within its territory. The Nigerian sector of the lake, at the moment, is offering extensive fishery resources to the country. However, a good number of the freshwater fishes in Nigeria come from the rivers. The two principal river systems, the Niger and Benue (Fig. 1) offer great possibilities for fisheries development. Apart from these two important river systems, there are many other rivers, streams, creeks and small bodies of water distributed throughout the country, whose resources have not been fully tapped, and these too provide an abundance and a great variety of fishes.

The aim and scope of this work

The aim of this work was to survey literature on the freshwater fishes of Nigeria. My aim was also to compile and classify the known freshwater species in a phylogenetic sequence

and to assemble available information relating to different species.

Poll (1957) lists 38 families and about 180 genera of African freshwater fishes, of which 32 families, 67 genera and at least 209 species have been recorded from the Nigerian freshwaters. In this work, apart from compiling as complete a list as possible of the known freshwater species, I have selected 75 important species representing all the families and some of the genera to discuss in some detail. Some corollary hypotheses were made from information available from adjacent countries and water systems to apply to the Nigerian species.

The importance of this study in relation to the development of fisheries in Nigeria

At the present stage of fisheries development in Nigeria, a study of this nature is a desirable first step toward further research. This study may stimulate and help collectors, particularly students of ichthyology, to learn and collect Nigerian species. It is hoped that it may provide incentive for further work on those species about which little is known. Throughout the discussion of each species, I have attempted to incorporate the economic value in terms of its food and sports value to stimulate interest in more rapid development and utilization of the country's fisheries.

Problems

There are many problems facing a person who attempts a project of this nature. It must be admitted that the fresh-water fishes of Nigeria, per se, have not been studied intensively, and our present knowledge about them is in its infancy. The information in literature is discouragingly scarce and scattered. Some of the old books from which information could be obtained have either been out of print or are difficult to obtain, and recent works and publications, most of which are published in foreign countries, are equally limited and inaccessible. It was discovered that very little is known about many species and, in fact, certain information is completely lacking about some, either because nothing is known about them or if such information is in existence it has not been accessible to me.

In a study of this nature one has to accept with caution certain information on some species because most authors were inclined to generalize their information on the same species from separate water systems and from different parts of the continent; besides, some conclusions seemed to have been based on speculation, tales, or on few and unconfirmed observations. Such generalizations and conclusions are at times misleading. In fact, Svensson (1933) realized the problem of generalization by the ichthyologists on African fish fauna when he remarked

that "the fish fauna of Africa gets a more uniform appearance than it really has, because races, and sub-species and perhaps species become neglected" in an attempt to unite one or two forms of a fish from separate water systems without taking into consideration the constant differences which they show, even though such differences may be regarded as relatively small. This situation makes it difficult to decide whether certain information should be regarded as correct with reference to a particular species from a particular water system.

Nigeria, with an area of 356,000 square miles, exhibits some differences in climate and topography from one part to another and its fish fauna, being affected by different ecological and topographic factors, might show slight variation in character, behavior and distribution. In order to see the relationship between the species, the fishes in separate water systems should be studied in their own perspectives. Already it has been noted that some species, particularly the brackish water species, occur in the southern parts of the country and not in the north. The coastal position of the southern provinces is, of course, the reason for this; though Clausen (1964) asserts that different geological factors also determine the distribution of freshwater fishes in Nigeria.

Method and organization

In the brief description and identification of most of the species I have followed Boulenger (1901-16),Daget (1954), and Sterba (1963). In the identification of many species in the museum, the artificial keys of Welman (1948) and Boulenger (1901-16) were very useful. The list of species included in appendix 2 and the information on each of the species discussed came from various journals, publications and magazines.

The families of freshwater fishes in this work are arranged in phylogenetic sequence and each family and representative species are discussed with reference to their distribution, morphological characters, habits and habitats, spawning and economic value. The economic potentials of the freshwater fisheries and some of the problems of developing Nigeria's fisheries are discussed in the last chapter.

II. SYNOPSIS OF CLASSIFICATION OF FRESHWATER FISHES OF NIGERIA

Class Osteichthyes

Subclass Brachiopterygii

Order Polypteriformes

Family Polypteridae (polypterids or bichirs)

Subclass Sarcopterygii

Order Dipteriformes

Family Lepidosirenidae (lung fishes)

Subclass Actinopterygii

Order Clupeiformes

Family Clupeidae (herrings)

Suborder Phractolaemoidei

Family Phractolaemidae

Suborder Pantodonoidei (Osteoglossoidea)

Family Pantodontidae (butterfly-fishes)

Family Osteoglossidae (osteoglossids)

Suborder Notopteroidei

Family Notopteridae (featherbacks)

Order Mormyriformes

Family Mormyridae (mormyrids)

Family Gymnarchidae (gymnarchids)

Order Cypriniformes

Suborder Cyprinoidei

Family Characidae (characins)

Family Citharinidae (moonfishes)

Family Ichthyoboridae

Family Cyprinidae (carps, barbels, etc.)

Suborder Siluroidei

Family Ariidae (sea catfishes)

Family Clariidae (labyrinthic catfishes)

Family Schilbeidae

Family Bagridae (bagrid catfishes)

Family Mochocidae

Family Amphiliidae

Family Malapteruridae (electric catfish)

Order Synbranchiformes

Family Synbranchidae (swamp eels)

Order Syngnathiformes

Family Syngnathidae (pipefishes and sea horses)

Order Perciformes (Percomorphi)

Suborder Percoidei

Family Centropomidae (Nile perches)

Family Nandidae

Family Cichlidae (cichlids)

Suborder Goboidei

Family Eleotridae (eleotrids)

Family Gobiidae (gobies)

Suborder Anabantoidei

Family Anabantidae (climbing perches)

Suborder Ophiocephaloidei

Family Ophiocephalidae (snake-heads)

Order Mastacembeliformes

Family Mastacembelidae (spiny eels)

Order Tetraodontiformes

Family Tetraodontidae (puffers)

III. THE IMPORTANT FRESHWATER FISHES

Order Polypteriformes

Family Polypteridae (polypterids or bichirs)

The curious looking creatures in this family have for a long time attracted the attention of the biologists. They are confined to the continent of Africa.

Their bodies are elongate, sub-cylindrical or slightly compressed and they are easily recognized by the presence of a series of dorsal spiny finlets attached to one another or several rays supporting a membrane. The pectoral fin has a fleshy lobe at its base. The fish retain a number of archaic characters and Copley (1958) regards them as relicts of Crossopterygi. Their heads are covered with bony plates and the bodies with rhombic bony scales (ganoid scales). There are also vestigial valves in the large intestine, and the large air bladder "lungs", functioning as an accessory respiratory organ, opens into the gut from the side. This enables them to live in slow moving and muddy waters. They spawn between the months of July and September during which period the anterior anal rays of the male become enlarged. Harrington (1899) believed that the enlarged anal fin of the male was a copulatory organ. Polypteridae are known to

be oviparous, but in Gambia Budgett (1901) expressed his difficulty in obtaining the eggs of Polypteridae because of the fact that they probably make no nests for spawning. Young Polypterus have external gills which disappear after metamorphosis.

Polypteridae are of biological interest but they are of no economic importance. They are not found in great numbers in Nigerian waters and are difficult to catch. Members of this family live in shoals along the bottom of rivers near the banks and are often seen in shady areas rising to the surface of water from time to time for air.

The genera, Polypterus and Calamoichthys, are present in Nigeria.

Polpyterus bichir

Distribution: Lake Chad, Lake Rudolf and Nile River. Not very common in Nigeria.

Morphology: Body elongate, slightly compressed; head strongly depressed; lower jaw projects beyond upper jaw; interorbital surface slightly convex.

Dorsal fin, XIV-XVIII, overlapping on being folded down.

Anal fin, 11-15 rays.

Color: Greyish or green above, yellow beneath. Young specimens with 10-13 cross bars on the back and 2 or 3 bands along the side disappearing or becoming indistinct in adults.

Habits: The fish lives in quiet streams, preferring shallow areas. It is predatory in habit, feeding on frogs, worms and other small fishes mainly during the night.

Spawning: Spawns during the months of July and August. The eggs are deposited among the weeds. The fish (sex not known) is believed to guard the eggs and the young.

Remarks: The species is not of much importance though the flesh is eaten by local people. It reaches 720 millimeters in length.

Polypterus senegalus

Distribution: The Niger and Benue river systems, Lake Chad, Lake Rudolf, Nile river, Senegal and Gambia.

Morphology: Body elongate and slightly compressed. Dorsal fin, VIII-XI spines which do not overlap when folded down. Anal fin, 14-17 rays; pectoral fin widely separated from the first dorsal finlet.

Color: Adult specimens are uniformly greyish-olive above and lighter beneath. Young larvae with longitudinal bands disappearing with external gills early in life.

Habits: Lives in quiet, shallow waters and is often seen among dense vegetation. They feed mainly on aquatic insects.

Spawning: Spawning takes place between the months of August and October, and it is believed that it has a prolonged spawning period.

Remarks: The species is edible. It grows to 420 millimeters in length.

Calamoichthys calabaricus (Fig. 2a)

Distribution: Niger Delta, Old Calabar, Cameroun.

Morphology: Body much elongate and serpent-like, cylindrical to the middle of its length and slightly compressed psteriorly; head small, depressed on top, round in front. Upper jaw slightly projecting beyond the lower. Dorsal fin-lets, VII-XIII spines, widely separated, originating immediately behind anal opening, and very narrowly separated from the caudal fin. Body covered with ganoid scales, 104-114 in longitudinal series.

Color: Olive-green above, fading to yellowish white beneath.

Habits: The fish is common during the rainy season in muddy areas of rivers, streams, creeks and in pools in marshy lands. But during the dry season it occurs in deep muddy pools and is difficult to catch. The species is carnivorous, feeding on fish and insects (both adult and larvae).

Spawning: Spawns during the rainy season when it is found in shallow waters in rivers and streamlets.

Remarks: The sexes are distinguished by their appearance and by the number of anal fin rays. The male is more uniform in depth throughout its whole length with a distinct and well developed anal fin consisting of 12-14 rays. The female has a more tapering form of body posteriorly with the small anal fin consisting of 9-11 rays.

The fish is of no commercial importance, but its flesh is edible. Smith (1867) remarked that the fish was not eaten by the most refined people in Calabar. Grows to 370 millimeters in length.

Order Dipteriformes

Family Lepidosirenidae (the lung fishes)

This family is characteristic of the African and South American freshwaters and is another representative of an old race of fishes.

The body is elongate, slightly compressed and covered with small cycloid scales sunk right into the skin. Members of this family are readily recognizable by their possession of long and slender paired limbs which may or may not have a unilateral fringed membrane. The nostrils are located under the upper lips and their paired lungs function as true respiratory organs. The African genus is Protopterus and only one species Protopterus annectens is present in Nigeria.

Protopterus annectens (mud fish, juju fish)

Distribution: Niger river system, Lake Chad, Senegal, Gambia and Ghana.

Morphology: Body elongate, slightly compressed; body depth 6-8 1/2 times in total length. Dorsal and anal fins confluent, terminating in a small pointed tail fin. Pectoral fin longer than pelvic fin, with a more developed fringe.

Color: Greyish brown above, lighter beneath. Body very often tinted with black spots.

Habits: A sluggish animal living in slow moving and muddy areas in rivers and lakes. During the dry season when the mud dries it aestivates in a cocoon in the hardened earth for about three or four months. During this period it lives on the reserve fats which it stored during the wet season. The natives of Idah in northern Nigeria believed that the fish eats itself during the period of aestivation and regenerates again from the remains of the head when the rain comes. There is no evidence for this belief; but Boulenger (1891) reports on a regenerated left pectoral limb of this species when it was bitten off by its companion in the London Zoological garden. The fish feeds on crustaceans, worms and small fishes. If they are crowded in an aquarium they show cannibalistic tendencies.

Spawning: Spawning takes place during the wet season between July and August in a nest constructed by digging an oval-shaped hole in the ground near the edge of the water. The male fertilizes the eggs and thereafter guards both the eggs and the larvae until the young leave the nest. The larvae have four pairs of external gills and they grow very rapidly.

Remarks: This species is not valued as food fish. It grows to a length of about 650 millimeters.

Order Clupeiformes

Family Clupeidae (herrings)

This family has a wide distribution throughout the world. The members of the family are characterized by saw-toothed appearance of the ventral scutes along the entire midline of the belly. The lateral line is indistinct or absent.

The majority of the species in this family are marine, some are restricted to freshwater and lagoons while still others live in the sea but enter freshwater for spawning and feeding purposes.

Only one species, Pellonula vorax, is considered to be a freshwater species in Nigeria. Though the Clupeidae, particularly the marine species, are of great commercial

value, the freshwater species are of little or no importance as food fish.

Pellonula vorax

Distribution: Niger river, Lagos area, Senegal, Gambia and Angola.

Morphology: Body moderately elongate and strongly compressed; body depth 3-4 times in total length; mouth wide, extends to the anterior border of the eye; lower jaw projects beyond the upper; gill rakers long, closely set, 26-30 on the lower part of the anterior arch. Dorsal fin 15-17 rays, equidistant from the end of the snout and the base of the caudal fin. Anal fin, 17-19 rays.

Color: Bluish with a silvery lateral bands. Fry, colorless and transluscent; the pigmentation commencing to appear at a length of 30 millimeters (Svensson, 1933).

Habits: The fish is found in open water near the surface. It feeds on zooplankton, copepods and insects.

Daget's (1954) studies indicated that Pellonula vorax was not strictly a freshwater species but marine and that it only entered the freshwater to spawn.

Spawning: The spawning habits are not known.

Remarks: The species is not of much economic importance as food, but it serves as food for predatory species. It grows to a length of 120 millimeters.

Family Phractolaemidae

This family occurs only in the Niger and Congo rivers. It contains a single species, Phractolaemus ansorgi.

Phractolaemus ansorgi

Distribution: Lower Niger and upper Congo rivers.
Morphology: Body elongate, sub-cylindrical and slightly compressed posteriorly; head depressed, with conspicuous nasal barbels; mouth small, highly protrusible almost as a tube, no teeth. Dorsal fin, 6 rays equdistant from the head and the caudal fin. Anal fin, 6 rays reaching or almost reaching the base of the caudal fin.
Color: Greyish above, fading to pale brown beneath.
Habits: Phractolaemus ansorgi lives in muddy, weedy areas in rivers. It feeds on minute organisms from the mud.
Spawning: The spawning habits of this species are not known.
Remarks: The fish is of no economic importance. It grows to a length of 150 millimeters.

Family Pantodontidae (butterfly-fishes)

This family is confined to west and south west Africa, and consists of only one species, Pantodon buchholzi.

Pantodon buchholzi (Butterfly-fish)

Distribution: Lower Niger river, Cameroun and Congo Basin.

Morphology: Body moderately elongate and compressed, rounded below; snout short; mouth wide, extending beyond the posterior border of the eye and directed upwards. Dorsal fin, 6 rays, inserted above the base of the anal fin. Anal fin, 9-14 rays; pectoral fins, large and wing-like; Ventral fins, first 4 rays produced into filaments.

Color: Greyish above and silvery beneath with dark streaks and spots on the body.

Habits: These fish are found on the surface of slow-moving rivers and creeks. Frequently they leap from the water in shoals. They feed on insects and beetles that fall onto the surface of water.

Spawning: Before spawning, the male rides on the back of the female for some time and eventually it twists itself around the female. Fertilization is believed to be internal and the elongated ventral rays are apparently an adaptation for copulation. The eggs float on the surface and are not protected by the parents. The young hatch in three days.

Remarks: This species is of no importance economically, but it is an interesting aquarium fish.

Family Osteoglossidae (osteoglossids)

This family is represented in Africa, South America and Australia. Members of the family are archaic in appearance. The body is elongate, slightly compressed and covered with stout bony scales. They are capable of aerial respiration probably due to the cellular structure of their air bladder. Only one species is present in Nigeria and in Africa as a whole.

Heterotis niloticus (Fig. 3)

Distribution: Niger and Benue rivers, Nile river, Gambia.

Morphology: Body elongate and compressed, tapering to a small caudal peduncle, and covered with large bony scales; head naked; mouth equipped with small conical teeth; gill rakers long, closely set. Dorsal fin, 32-37 rays, originating a little behind the anal fin. Anal fin, 34-39 rays. Both dorsal and anal fins narrowly separated from the caudal fin.

Color: Olive-brown above, whitish beneath.

Habits: The fish is predaceous. It feeds on fish, frogs and insects.

Spawning: Spawning takes place during the rainy season in shallow waters. In Gambia, Budgett (1901) reported that the nest was about four feet in diameter, formed of matted grass

in the swamp in which the female deposited the eggs. The parents defend the eggs until they hatch in two days. The larvae have long gill filaments which project onto the outside through the opercular opening. These become shortened or absorbed as the fish grow.

Remarks: The species is not common in rivers but its large size makes it important as food fish where it occurs. It grows to a length of 800 millimeters.

Family Notopteridae (featherbacks)

Members of this family are found in West Africa and South East Asia.

They are characterized by long and strongly compressed bodies. The dorsal and ventral fins are either absent or reduced while the anal fin extends to nearly the whole length of the body. The fish inhabit both rivers and lakes preferring quiet stretches of rivers and stagnant pools.

The fish are good to eat but are too scarce to be of economic importance. Two genera, each with one species, are present in Nigeria.

Notopterus afer

Distribution: Lower Niger, Calabar, Congo rivers, Gambia, Sierra Leon, Liberia and Cameroun.

Morphology: Body elongate and compressed; dorsal fin at the middle of the body or a little nearer the snout than the caudal fin. Anal fin, 2/3 of the body, uniting with the short caudal fin. Ventral fin absent.

Color: Olive-brown above, whitish beneath.

Habits: Often found in quiet pools in rivers, rising to the surface from time to time. This action is believed to be associated with air breathing and Johnel (1954) feels that the large air bladder in this species can possibly function as an accessory breathing organ. Specimens in an aquarium have been observed to take a quantity of air in their mouths from the surface. The fish is carnivorous, feeding on small fishes and insects.

Spawning: Spawning takes place during the rains, but the details of its breeding habits are not known, though Nikolski (1961) reported that all species of Notopterus apparently care for their offspring.

Remarks: The fish is important as food fish. The taste of its flesh is excellent. It grows to 570 millimeters in length.

Xenomystus nigri

Distribution: Niger river, Chad Basin, Liberia, Gaboon and Congo river.

Morphology: Body elongate and strongly compressed; body depth 4.3-5 times in total length. Dorsal fin absent; ventral fin reduced to short spines. Anal fin, 108-130 rays, extends nearly the whole length of the ventral surface, unites with the small caudal fin.

Color: Uniformly grey to dark brown above, paler beneath.

Habits: The fish is found is deep quiet pools in rivers and creeks. It stays right at the bottom, becoming active at night. It feeds on insect larvae and worms.

Spawning: The spawning habits are not known.

Remarks: This fish is edible and its flesh tastes good, but because of its scarcity it is not economically important as a food fish in Nigeria. It grows to 200 millimeters in length.

Order Mormyriformes

Family Mormyridae (mormyrids)

Members of this family are confined to Africa and are found in no other parts of the world.

The interest of the zoologist in this family lies in their possession of electric organs on either side of the tail, and in their possession of a very large human-like brain. Sanders (1882) remarked on the large and peculiar brain of the Mormyridae. Another interesting feature of the fishes

in this family is the communication of the air bladder with the ear, though this is not as developed as in the Cypriniformes. The shape of the snout varies from tubular to a finger-like projection which acts as a feeler for the fish. Most of the species in this family are bottom dwellers feeding on insect larvae, crustaceans and on stems and roots of water weeds. The family has a large number of species and individuals distributed throughout the country. They are found both in rivers, streams and lakes and are important as food fish in the country; though the flesh tends to be fatty and oily.

There are seven genera of this family in Nigeria, Mormyrops, Petrocephalus, Marcusenius, Gnathonemus, Mormyrus Isichthys, and Hyperopisus.

Mormyrops deliciosus (Fig. 4b)

Distribution: Niger river system, Congo and Zambezi rivers, Lake Chad and Senegal.

Morphology: Body elongate and compressed; snout long and rounded, used for stirring up the mud for its food. Dorsal fin, 26-27 rays, nearer the base of the caudal fin than the end of the snout. Anal fin, 41-43 rays, originating behind the dorsal fin. In the male the anterior part of the anal fin is higher than in the female.

Color: Brownish above, silvery beneath. Color much affected by the copious gelatinous slime giving a yellowish or purplish tint to the real color of the fish. Nichols and Griscom (1917) quoting from Mr. Chapin's notes say that the slime is yellow and that there is no metallic lustre save in the iris.

Habits: The fish stays in deep, muddy pools in rivers and lakes. It feeds on small fishes, worms and insect larvae. In East Africa, Worthington (1936) reported that it also feeds on weeds and debris.

Spawning: The spawning behavior of this species is not known with certainty, but it is believed to spawn during the rainy season.

Remarks: The fish is edible and it grows to a length of 1500 millimeters.

Mormyrops engystoma

Distribution: Lower Congo river, Lake Chad.

Morphology: Body moderately elongate and compressed; body depth 7-7.5 times in total length; snout rounded, projecting a little beyond the mouth. Dorsal fin, 19-20 rays; anal fin, 35-37 rays, originating anterior to the dorsal fin.

Color: Brown, dotted with black spots.

Habits: The species lives in deep, muddy pools in rivers and lakes. It feeds on small fishes, worms and insect larvae.

Spawning: The spawning habits are not known.

Remarks: The species is important as food fish; its flesh tastes good.

Petrocephalus simus

Distribution: Lower Niger and Congo rivers, Liberia.

Morphology: Body short and compressed, tapers to a long slender caudal peduncle; body depth, 2.75-3.5 times in total length; snout short and rounded; mouth inferior, located below the anterior border of the eye. Dorsal fin, 23-27 rays, originating slightly behind the anal fin. Anal fin, 27-33 rays.

Color: Olive-brown above, silvery beneath with a vertical band along the anterior border of the dorsal fin.

Habits: The fish is often found in small shoals in open water. It feeds on insect larvae and mud.

Spawning: The spawning habits are not known.

Remarks: The species is common and edible. It grows to 120 millimeters in length.

Marcusenius longianalis

Distribution: Lower Niger river and Cameroun.

Morphology: Body elongate and slightly compressed; snout short and rounded; mouth small and inferior. Dorsal fin, 15-16 rays. Anal fin, 23-33 rays, its base 2-2.5 times that of the dorsal fin.

Color: Purplish-brown with black specks over the body.

Habits: The species feeds on algae and bottom debris.

Spawning: The spawning habits are not known.

Remarks: The fish is used for food. It grows to 145 millimeters in length.

Marcusenius kingsleyae

Distribution: Calabar and Cross rivers, and Cameroun.

Morphology: Body moderately elongate and compressed; snout short and rounded; mouth inferior. Dorsal fin, 16-20 rays, inserted above the 9th ray of the anal fin. Anal fin, 21-26 rays, its base slightly longer than that of the dorsal fin.

Color: Brown with pale brownish fins.

Habits: Not known.

Spawning: The spawning habits of this species are not known.

Remarks: The species is used as food fish. It grows to a length of 145 millimeters.

Gnathonemus niger

Distribution: Niger and Benue river systems, Nile river and Gambia.

Morphology: Body moderately elongate and compressed; body depth 3-4 times in total length; snout very short; mouth terminal, no appendage on the lower jaw. Dorsal fin, 17-20 rays. Anal fin, 25-28 rays; pectoral fin large and pointed, reaching or nearly reaching to the end of the ventral fin.

Color: Dark brown above fading to silvery on the sides and below. Body dotted with brown specks.

Habits: The habits of this species are not known.

Spawning: The spawning habits are not known.

Remarks: The species is used for food; it grows to a length of 140 millimeters.

Gnathonemus tamandua (Fig. 5a)

Distribution: Niger and Benus river systems, Cross and Congo rivers.

Morphology: Body elongate and strongly compressed, tapering sharply towards the caudal peduncle; snout long and curved, with a small appendage on the lower jaw. Dorsal fin, 26-30 rays, inserted slightly behind the anal fin. Anal fin, 29-30 rays. Caudal fin deeply forked, pointed lobes.

Color: Brown above, lighter beneath.

Habits: The species is found in muddy areas of the rivers, and creeks. It feeds on insect larvae (chironomids), vegetable matter and mud.

Spawning: The spawning habits are not known.

Remarks: The fish is important as food fish. It grows to 360 millimeters in length.

Mormyrus macrophthalmus

Distribution: Lower Niger river, Chana.

Morphology: Body elongate and compressed, tapering toward the caudal peduncle; head curved downwards; mouth terminal. Dorsal fin, 61-68 rays, inserted above the base of the ventral fin. Anal fin, 19-21 rays. Scales 21 round the caudal peduncle.

Color: Brown above, silvery beneath.

Habits: The fish is a bottom feeder; it feeds on insect larvae, mud and vegetable debris.

Spawning: The spawning habits of this species are not known.

Remarks: The fish is common in rivers and is used for food. It grows to a length of 290 millimeters.

Family Gymnarchidae (gymnarchids)

This family is closely related to the Mormyridae, but for the absence of the anal, ventral and caudal fins.

The family contains one genus and one species, Gymnarchus niloticus.

Gymnarchus niloticus

Distribution: Niger and Benue river systems, Nile river, Lake Chad, Lake Rudolf, Senegal and Gambia.

Morphology: Body eel-like, covered with small scales; snout long and blunt in front; mouth terminal Dorsal fin extends the whole length of the body, attenuating to a pointed tail. Anal and caudal fins absent. Pectoral fin just behind the operculum.

Color: Olive-brown above, whitish beneath.

Habits: The fish lives in still deep waters and is more active at night than by day. During the day it hides in holes and among the water weeds. Like theMormyridae, this species possesses electric organs along the posterior part of the body on either side. The organs are apparently for navigation.

Spawning: The fish spawns during the rainy season. According to Budgett (1901) the fish constructs a large floating nest in shallow water in dense grass. Budgett described in detail the structure of the nest and its method of construction. The female deposits about 1,000 large eggs in the whole area of the nest. The larvae hatch

out in five days. The larvae have long external gill filaments which are absorbed along with the yolk sac as the fish grow, and before they leave the nest.

Remarks: The fish is highly rated and esteemed as food. It grows to 1500 millimeters in length.

Order Cypriniformes (Ostariophysi)

Family Characidae (characins)

Members of this family occur in Africa, Central and South America.

They resemble the Barbus but for the absence of the barbels. Their bodies are elongate or moderately elongate and compressed. They have protractile mouths which are toothed. Some parts of the dentition are strongly developed. Invariably all the members of this family have adipose fins. The majority of the African species are voracious and carnivorous though a few of them are herbivorous or ominivorous. Their bodies are covered with cycloid scales. They have Weberian ossicles, a characteristic of the order in which they belong.

In Nigeria, they occur in freshwaters, some of them are found in lagoons. The family contains a large number of genera and species, but five genera are listed in Nigeria, namely, Hepsetus, Hydrocynus, Micralestes, Alestes, and

Arnoldichthys. Many of the species are not valued as food fish because of the bones in their flesh. The tiger fish are famous as sport fishes.

Hepsetus odoe (Pikelet, Fig. 8)

The genus Hepsetus replaces Sarcodeces (Hubbs, 1939)
Distribution: Niger and Benue river systems, Lake Chad, Congo and Zambezi rivers, Senegal, Gambia and Congo.
Morphology: Body elongate and compressed, covered with large cycloid scales; snout elongate; mouth equipped with numerous pointed and canine-like teeth in two series; lower jaw with a triangular dermal fold on each side. Svensson (1933) found that these folds start to grow out when the young fish is 40 millimeters in length and reach full size at the length of 150-200 millimeters. Dorsal fin, II, 7 rays, situated behind the ventral fin. Anal fin, 12 rays.
Color: Dark brown above and silvery below.
Habits: Solitary, preferring fast running streams and rivers. It also occurs in lagoons. The species is voracious, feeding mainly on fish.
Spawning: As with most African species, Hepsetus odoe spawns during the wet season when the rivers are flooded. The female makes a floating nest of white foam on the water surface in which she lays her numerous eggs. The male fertilizes the mass of eggs which hatch out in few days.

Remarks: The species is not of much economic importance, though it is eaten. It grows to a length of 400 millimeters.

Hydrocynus forskahlii (small tiger-fish)

Distribution: Niger and Benue river systems, Nile river, Senegal, Liberia, Lake Albert and Lake Rudolf.

Morphology: Body elongate and compressed. Dorsal fin, II,8 rays, originating in front of the ventral fin. Anal fin, III, 11-13 rays. Gill rakers shorter than gill filaments.

Color: Silvery-yellow with dark longitudinal streaks along the body. Dorsal and adipose fins greyish yellow.

Habits: The fish are found in and off the shore and they tend to go in shoals always. They are primarily carnivorous, feeding on small fishes especially the young of Alestes and Tilapia species. They also feed on insects and crustaceans.

Spawning: The spawning habits of this species are not known with certainty, but it is believed to spawn during the rainy season or at the beginning of rains.

Remarks: The generic name Hydrocynus replaces Hydrocyon (Myers, 1950); though some recent authors on African ichthyo-fauna continue to use the generic name Hydrocyon as snyonymous with Hydrocynus.

Hydrocynus forskahlii is famous as a sport fish. The flesh is edible but it is rather full of small bones. The fish grows to 450 millimeters in length.

Hydrocynus lineatus (the tiger-fish)

Distribution: Niger and Benue river systems, and Nile river.

Morphology: Body elongate and compressed; body depth 3-4.5 times in total length; mouth equipped with strong canine-like teeth. Dorsal fin, II,8 rays, inserted above the ventral fin. Anal fin, III, 11-13 rays. Caudal fin deeply forked, pointed lobes.

Color: Olive-green above, whitish beneath with distinct longitudinal dark stripes above and below the lateral line. Adipose fin marked with a black spot.

Habits: The species is solitary. It is found in fast clean waters frequenting quiet pools. The young specimens feed on insects and fish fry. The adult is carnivorous, feeding on fish, preferring the young of Alestes and its own young as well.

Spawning: The fish migrate to bributaries during the rainy season for spawning.

Remarks: Although noted as a sport fish, it is not a good food fish; its flesh is fibrous and tasteless. It grows to a length of 420 millimeters and may weigh 30 pounds.

Alestes macrolepidotus (yellow-fin characin)

Distribution: Niger and Benue river systems, Cross river.

Morphology: Body moderately elongate and compressed; body depth 3.5-4.5 times in total length. Dorsal fin, II,8 rays, equidistant from the end of snout and the caudal fin. Anal fin, III, 17-20 rays.

Color: Silvery, brownish-olive above. Anal fin with a stripe of orange-red in the center, hence its common name, yellow-fin characin.

Habits: These fish move in shoals along the inshore of rivers and lakes. They feed on surface insects (beetles and winged termites) that fall on to the water surface at the beginning of rain. Welman (1948) reported that their food also include water weeds and filamentous algae. In Uganda they feed equally well on small fishes (Greenwood, 1956).

Remarks: The species is used as food fish. It grows to a length of 470 millimeters.

Alestes dentex (Fig. 6)

Distribution: Niger and Benue river systems, Lake Chad, lower Nile river, Senegal and Gambia.

Morphology: Body elongate and compressed; snout rounded; gill rakers 20-26 on the lower part of the anterior arch, long and slender. Dorsal fin, II, 8 rays, originating behind the base of the ventral fin. Anal fin, III, 19-22 rays.

Color: Dark grey above, silvery beneath, with a dark band extending along each side of the back. Caudal fin black-edged, lower lobe reddish.

Habits: Not known.

Spawning: Alestes dentex spawns during the rainy season.

Remarks: The species is important as a food fish. It grows to 400 millimeters in length.

Alestes baramose

Distribution: Niger river system, Lake Chad, Nile river, Senegal, and Gambia.

Morphology: Body elongate and compressed; body depth 3.6-5.3 times in total length; gill rakers 30-38 on the lower part of the anterior arch, long and slender. Dorsal fin, II,8 rays, equidistant from the eye and the root of the caudal fin. Anal fin, III,22-27. Caudal fin deeply forked, pointed lobes.

Color: Dark grey above, silvery below.

Habits: Pelagic, but often found in shoals along the inshore region of rivers, jumping a lot into the air. Greenwood (1956) quoting from Uganda Government (1953) states that the number of this fish is inversely related to the number of Hydrocynus species in the area. Since the tiger fish feeds upon this species, it is reasonable to assume that this characteristic jumping at the water surface is an attempt to keep out of the way of the tiger fish which are their greatest predator. The species itself is carnivorous, feeding on crustaceans, insects and fishes.

Spawning: The spawning behavior of this species in Nigeria has not been observed, but in Gambia this species spawns during the flood period in swamps. The species has a high fecundity. Females examined in Nile river during the spawning season by Nawar and Yoakim (1963) showed a minimum fecundity of 43,954 ova and a maximum of 343,700 ova with an average of about 139,000 ova. The fecundity may be influenced by the environmental factors and population in an area.

Remarks: The fish is used as food. It grows to 310 millimeters in length.

Micralestes acutidens

Distribution: Lower Niger, Nile, Congo and Zambezi rivers.

Morphology: Body depth 3-4 times in total length; maxillary extends to nearly below the anterior border of the eye; teeth in two rows of upper jaw, compressed. Dorsal fin, 11,8 rays originating above the base of the ventral fin. Anal fin, 17-19 rays. Caudal fin deeply forked.

Color: Light brown above with a broad greyish lateral band running from the gill cover to the base of the caudal fin. Fins whitish to light green. Dorsal fin tipped with a black stripe.

Habits: The fish prefers to live along the shore; it feeds on filamentous algae and phytoplankton. It also feeds on insects.

Spawning: The spawning habits are not fully known.

Remarks: The species is of no economic importance, partly because of its small size. It grows to 65 millimeters in length.

Family Citharinidae (moonfishes)

Members of this family were formerly grouped with the Characidae but recent classification groups them under a separate family. This family is present only in Africa. The body form varies among different species, being short

and highly compressed in some and elongate in others. They are characterized by straight lateral lines. Some species live both in freshwater and in lagoons.

Three genera occur in Nigeria - Citharidium, Citharinus and Distichodus. They are important as food fish and are liked by many.

Citharidium ansorgi

Distribution: Lower Niger river.

Morphology: Body short and highly compressed; head flattened above. Dorsal fin, 17 rays; adipose fin scaly. Anal fin, 21 rays, anterior rays at least five times the length of the psterior. Caudal fin deeply forked, pointed lobes. Scales ctenoid, 51 in longitudinal series.

Color: Brown above, yellow beneath, with a black stripe crossing the body from the front of the dorsal to the base of the ventral fins. Dorsal, anal and caudal fins edged with black and greyish behind.

Habits: This species lives both in rivers and lagoons, and was recently introduced into ponds.

Spawning: The spawning behavior of this species is not fully known.

Remarks: The fish are important as food fish. They reach a length of 130 millimeters.

Citharinus citharus (Fig. 9)

Distribution: Niger and Benue river systems, Lake Chad, Senegal and Gambia

Morphology: Body short and strongly compressed. Dorsal fin, 17-20 rays, directly above the ventral fin. Adipose fin moderately long, covered with scales. Anal fin, 28-30 rays. Caudal fin deeply forked.

Color: Greenish or purplish grey above with silvery reflections. Young specimens with longitudinal lines between the series of scales.

Habits: The species is found in still portions of shallow inshore waters and is rarely found in the deep waters. It feeds on macroplankton - mainly crustaceans and diatoms. The fact that this species is often found on the surface may be associated with breathing behavior rather than their feeding on the surface scum as suggested by Worthington (1929) since Citharinus are known to possess accessory breathing organs (Greenwood, 1956).

Spawning: Spawns during the months of July and August. The female deposits eggs among the water weeds to which they become attached. The eggs hatch out in a few days and the fry grow very fast. The young move in shoals in shallow waters. No parental care is known.

Remarks: The species is an important food fish in Nigeria. It grows to a length of 500 millimeters.

Distichodus engycephalus

Distribution: Niger and Benue river systems. Cross and Nile rivers.

Morphology: Body short and compressed; body depth 2.4-3 times in total length; snout projects beyond the mouth; gill rakers short. Dorsal fin, 23-25 rays, equidistant from the occiput and the caudal fin. Anal fin, 13-14 rays, base shorter than that of the dorsal fin.

Color: Brownish on the back and whitish below with numerous dark spots scattered on the sides.

Habits: This species prefers gravelly bottomed areas and it lives on or near the bottom.

Spawning: The spawning habits are not known.

Remarks: The species is important as a food fish and its flesh tastes good. It grows to a length of 270 millimeters.

Distichodus brevipinnis

Distribution: Niger river, Lake Chad, Senegal and Gambia.

Morphology: Body elongate and compressed; body depth 2.4-3 times in total length; snout rounded, projecting slightly beyond the mouth; gill rakers short, 14-16 on the

lower part of the anterior arch. Dorsal fin, 20-22 rays. Anal fin, 13-15 rays. Caudal fin deeply forked, pointed lobes.

Color: Dark grey above, whitish below with 4-5 indistinct irregular longitudinal series of round spots on the sides, being more distinct in young specimens.

Habits: The habits of this species are not fully known.

Spawning: The spawning habits are not known.

Remarks: This species is used as food in Nigeria. It grows to 220 millimeters in length.

Family Ichthyoboridae

The members of this family are confined to Africa. They are characterized by the long and narrow snout with beak-like jaws equipped with teeth. The body is elongate, compressed or very slightly compressed. They are scaled with ctenoid scales. They have a small adipose fin.

The fish are precaceous and are of little economic importance as food fish.

Phago loricatus

Distribution: Niger river basin.

Morphology: Body extraordinarily long and very slightly compressed, covered with large scales; body depth 9 times in total length; snout elongate; mouth armed with teeth. Dorsal fin, III,9 rays, originating above the last ray of the ventral fin. Anal fin, III,8 rays. Scales 47 in longitudinal series.

Color: Dark brown on the back, reddish brown on the sides with two or more longitudinal streaks. Dorsal and anal fins marked with brownish to blackish bands. Caudal fin with three oblique dark streaks across each lobe.

Habits: This species is predaceous and feeds on small fishes and insect larvae.

Spawning: The spawning habits are not known.

Remarks: The fish is of little commercial importance but it is edible. It reaches 150 millimeters in length.

Phago maculatus (pike)

Distribution: Niger river system

Morphology: Body elongate and slightly compressed; snout very long and slender; mouth equipped with strong teeth. Dorsal fin, III,8-9 rays, originating slightly behind the ventral fin. Anal fin, III,7-8 rays.

Color: Marble to blackish-brown above, yellowish with numerous transverse stripes on the side, yellowish to silvery beneath. Dorsal and caudal fins with 2-3 dark bands.
Habits: The fish is predaceous, feeding on small fishes.
Spawning: The spawning behavior of this species is not known.
Remarks: This species is of little economic importance. It grows to a length of 140 millimeters.

Ichthyoborus besse

Distribution: Lake Chad, Lower Nile River.
Morphology: Body elongate and compressed; scales small, 91-112 in longitudinal series; snout long; mouth equipped with 17-20 teeth on each side in the upper jaw, 14-16 in the lower jaw; head flattened on top; gill rakers very short or rudimentary. Dorsal fin, III, 12-14 rays, originating just behind the base of the ventral fin. Anal fin, III, 11-14 rays.
Color: Pale olive with silvery reflections and a greenish streak running longitudinally above the lateral line. Caudal fin with numerous black spots; other fins more or less colorless.
Habits: The habits of this species are not known.
Spawning: The spawning behavior is not known.
Remarks: Grows to a length of 190 millimeters.

Family Cyprinidae (carps and barbels)

The carp family - Cyprinidae - are freshwater fishes of Europe, Asia, Africa, North and Central America.

Members of this family occur in all kinds of freshwaters, in rivers, streams, lakes and ponds. Many species occuring in Nigeria are introduced and cultured in ponds for food. The bodies are compressed lacking adipose fins and the mouths are toothless, except the pharyngeal teeth. Barbels are either absent or one to two pairs may be present. Generally the Cyprinidae feed on vegetable matter. Some feed on insects and molluscs and larger ones also feed on other fishes. The carp family exhibits a number of spawning habits - some scatter their eggs in patches over weeds, while others spawn in riffles or cast their eggs over the sandy banks of rivers and lakes.

Some species of this family form important food fish in Nigeria and are of economic importance. Other small-sized members are important in the food chains of most predaceous fishes. Some are also used as bait by fishermen.

Many members of this family have not yet been identified in Nigeria, and out of tne 14 genera present in Africa (Poll, 1957), only about 5 genera are represented in Nigeria -

Labeo, Barbus, Barilius, Chelaethiops, and Garra. There may be more than this number of genera in Nigeria, but since the members of this family are so numerous and closely resemble one another the correct taxonomy of this group is always difficult.

Labeo coubie (Fig. 10b)

Distribution: Niger and Benue river systems, Cross and Nile rivers, Lake Chad, Lake Albert, Senegal and Gambia.

Morphology: Body moderately elongate and compressed; snout often swollen or rounded with tubercles on it; barbel small, usually hidden by folds of skin at the end of the mouth. Svensson (1933) noticed that the young specimens in Gambia have two barbels on each side but the anterior ones become rudimentary in old specimens. Dorsal fin, III,12-13 rays, equidistant from the anterior border of the eye and the caudal fin. Anal fin, III,5 rays. Scales moderately large, 36-40 along the longitudinal series.

Color: Brownish green with an indistinct band along the side.

Habits: This species is found along the inshore shallow waters. During the dry season when the river breaks into pools, it occurs in isolated pools. Holden (1963) found

that this species formed 8% of the population in the dry pools in Sokoto river from 1955-57. The fish feeds on mud and diatoms. In East Africa, it feeds on ooze, algae and the underwater vegetable matter (Copley, 1958).

Spawning: This species spawns during the flood season.

Remarks: The fish is an important food fish in Nigeria. It grows to 340 millimeters in length.

Labeo senegalensis

Distribution: Niger river system, Lake Chad, Senegal, Ghana and Gambia.

Morphology: Body strongly compressed; snout broad and rounded; barbel one on each side of the mouth. Dorsal fin, III,12-14 rays. Anal fin, III,5 rays.

Color: Olive-green above, silvery beneath with dark longitudinal bands (usually 7) between the series of scales on the dorsal part of the body.

Habits: This species occurs both in rivers and in lagoons and is often seen on the surface going in shoals in shallow waters.

Spawning: The fish spawns during the wet season and the fry grow fast.

Remarks: The species is common in Nigeria. It is much valued as food. It grows to a length of 500 millimeters.

Barbus occidentalis

Distribution: Upper and lower Niger and Benue rivers, Ogun river.

Morphology: Body compressed; mouth subinferior; barbels two on each side of the mouth. Dorsal fin, IV,8 rays, equidistant from the eye and the root of the caudal fin. Anal fin, III,5 rays.

Color: Dark green above, silvery beneath. Anal and caudal fins, yellowish; other fins whitish.

Habits: The fish feeds on filamentous algae and on the minute organisms contained therein (Welman, 1948).

Spawning: This species spawns during the rainy season.

Remarks: The fish is used as bait by fishermen. It reaches 50 millimeters in length.

Barbus niloticus

Distribution: Niger and Benue river systems, Nile river.

Morphology: Body elongate and compressed; snout pointed; mouth terminal, extending to below the center of the eye; barbels absent; gill rakers short. Dorsal fin, III,7-8 rays, advance of the anal fin. Anal fin, III,10-12 rays.

Color: Silvery, darker on the back.

Habits: Lives in shallow areas of rivers and lakes. Moves in shoals, feeding on zooplankton and other organisms.

Spawning: The spawning habits of this species are not known.

Remarks: Because of their small size they are of no economic importance as food fish, but they are used as bait by fishermen. They are also important food for tiger fish which prey upon them. They grow to a length of 95 millimeters.

Barilius loati

Distribution: Ogun river, Lagos areas, Omo and Blue Nile rivers.

Morphology: Body elongate and slightly compressed; snout projects beyond the mouth; barbels absent. Dorsal fin, III,7-9 rays, opposite the anal fin. Anal fin, III,12-15 rays.

Color: Silvery white with 10 or more distinct blue-black vertical bars on each side, darker on the back.

Habits: This species lives in shallow waters and moves in shoals.

Spawning: The spawning behavior of this species is not known.

Remarks: The fish forms food for tiger fish and is excellent bait because of its small size. It grows to a length of 185 millimeters.

Suborder Siluroidei (the catfishes)

The former family Siluridae has been elevated to the rank of suborder siluroidei by recent classification.

The catfishes are well distributed throughout the world. Some species are restricted to a marine environment and others live in fresh as well as brackish waters. The catfishes are scaleless and have non-protractile mouths surrounded by the premaxillaries and maxillaries or by the premaxillaries only. They have long barbels which act as sensory receptors. They have adipose fins and most species develop sharp spines either on the dorsal or pectoral fins which serve as weapons of offense and defense. They have Weberian ossicles which connect the air bladder with the internal ear. Catfishes feed on many things ranging from vegetable, animal and dead organic matter, and as Copley (1958) puts it "nobody knows what catfish will not eat." Some African catfishes are believed to be poisonous, but most species are important as food.

Family Clariidae (labyrinthic catfishes)

Members of this family are easily recognized by their eel-shaped body. They have four pairs of barbels (1 nasal, 1 maxillary and 2 mandibular). They live in all kinds of

freshwaters, in rivers, streams, lakes and ponds. They also live in swamps. They have accessory breathing organs which are paired blind sacs extending backwards from the gill chamber on either side of the vertebral column. By virtue of this organ they can live for a long time out of water. Welman (1948) observed the mass migration of Clarias over dry land as they moved from a drying pool to permanent water. The fish are important as food and their flesh is of excellent quality.

Clarias lazera

Distribution: Niger and Benue river systems, Lake Chad, Congo and Nile rivers, Senegal and Syria.

Morphology: Body elongate and slightly compressed; head 1.5-2 times as long as broad; vomerine teeth granular band, 1.3-2.5 times the width of the premaxillary band; gill rakers long and closely set. Dorsal fin, 62-82 rays, extending almost to the base of the caudal fin. Anal fin, 50-56 rays, narrowly separated from the caudal fin. Pectoral spine serrated on outer border.

Color: Greyish-olive to brown above, greyish white beneath. Vertical fins often black-edged, with a yellow tint. Fins in young specimens marked with a dark bar, edged with yellow in front and behind across the caudal fin.

Habits: This species is often found in pools and in deep slow flowing parts of rivers, though young ones may be found in riffles. In lakes, they lie in deep holes near the shore particularly during the day. They are most active at night than by day. They can live out of water for some time by virtue of their accessory breathing organ. During the dry season, they migrate from drying pools to permanent waters, but are also believed to bury themselves in mud during the drought. Their food consists of frogs, molluscs, insects, worms, weeds and dead organic matter.

Spawning: This species spawns during the wet season or at the beginning of the rains.

Remarks: The fish is very important as food fish and is most sought after by African people. It grows to 1170 millimeters in length, and may weigh up to 50 pounds.

Clarias angolensis

Distribution: Lagos, Niger Delta areas, Congo river, Ghana, Cameroun and Angola.

Morphology: Body elongate and slightly compressed; vomerine teeth conical in shape; gill rakers closely set, 20-25 on the first anterior arch. Dorsal fin, 70-82 rays, narrowly separated from the caudal fin. Anal fin, 55-63 rays, narrowly separated from the caudal fin. Pelvic fin nearer the snout than the base of the tail fin.

Color: Dark-brown to black with light dots on the body.

Habits: The habits of this species are not known.

Spawning: The spawning behavior is not known.

Remarks: The fish is used as food. It reaches 380 millimeters in length.

Heterobranchus longifilis

Distribution: Niger river system, Nile, Congo and Zambezi rivers, Gambia, Sierra Leon, Ghana and Uganda.

Morphology: Body elongate and compressed; body depth 6-8 times in total length; head slightly depressed; barbels 4 pairs. Dorsal fin, 29-34 rays; adipose fin large, extending immediately from the base of the dorsal fin to the base of the caudal fin, its base, as long or a little longer than that of the dorsal fin. Anal fin, 44-54 rays, narrowly separated from the caudal fin. Pectoral spine feebly serrated on the outer border.

Color: Olive above, whitish beneath. Caudal fin - yellowish at the base with a well defined crescentic band across the middle, fading off to yellowish behind.

Habits: The species is found in lagoons, rivers and streams. It is more active at night than by day. During the day it hides under weeds and in swamps, and becomes active at night. It feeds on nearly everything.

Spawning: This species spawns during the rainy season.

Remarks: This is an important food fish. It reaches 720 millimeters in length.

Heterobranchus bidorsalis

Distribution: Niger and Benue river systems, Nile river, Lake Chad and Senegal.

Morphology: Body elongate and compressed; body depth 6-9 times in total length; head strongly depressed; vomerine teeth villiform; gill rakers short, 20-30 on the anterior arch. Dorsal fin, 38-45 rays, Adipose fin 2/5-2/3 as long as the dorsal fin. Anal fin, 50-57 rays, reaching the caudal fin.

Color: Dark olive above, whitish beneath.

Habits: This species is found both in lakes and rivers. It feeds on nearly everything.

Spawning: The spawning habits are not specifically known.

Remarks: The fish is important as a food fish and it grows to a length of 770 millimeters and may weigh up to 50 pounds.

Gymnallabes typus

Distribution: Lower Niger river, Old Calabar province.

Morphology: Body eel-shaped; body depth 14-15 times in total length; premaxillary teeth 3-3.5 times as long as

broad; vomerine teeth pointed; barbels 4 pairs; gill rakers moderately long, 10 on the anterior arch. Dorsal and anal fins completely fused with the caudal fin. Ventral fins small.

Color: Blackish brown above, lighter on the ventral side.

Habits: The habits of this species are not known.

Spawning: The spawning behavior is not known.

Remarks: The species is edible. It reaches a length of 230 millimeters.

Family Schilbeidae (Butterfishes)

Members of this family occur in Africa and Asia. They resemble many of the catfishes and are found in rivers, streams and lakes. Their bodies are elongate and compressed. The dorsal fin is generally short and the adipose fin may be present or absent. The majority of the species are carnivorous and they have a wide variety of food. They are economically important as food fish.

The family has five genera represented in Nigeria, but few species.

Schilbe Mystus

Distribution: Niger and Benue river systems, Cross river, Lake Chad, Congo and Nile rivers, Senegal and East Africa.

Morphology: Body moderately elongate and strongly compressed; snout rounded; lower jaw projects slightly beyond the upper. Dorsal fin, I,5-6 rays. Adipose fin absent. Anal fin, 53-67 rays. Pectoral spine feebly serrated on the inside. Caudal fin deeply forked.

Color: Silvery, darker on the back with an indistinct blotch above the pectoral fin.

Habits: This species is found in all kinds of freshwaters. It is often found in deep pools in fast rivers. These fish are common in the Niger River system and they are believed to be non-migratory, though Welman (1948) states that all Schilbe are migratory. They feed on insects and molluscs (Irvine, 1947).

Spawning: This species spawns during the flood season, though Holden (1963) noticed specimens with ripe gonads during the dry season in pools, a point which seems to indicate that they spawn during the dry season in the pools as well.

Remarks: The fish is edible. It reaches 340 millimeters in length.

Physaila pellucida

Distribution: Lagos, Niger river, and Calabar.

Morphology: Body strongly compressed; body depth 4-4.5 times in total length; snout broad and rounded. Dorsal fin absent. Adipose fin short and small. Anal fin, 67-72 rays, narrowly separated from the caudal fin. Pectoral fin large and rounded with spine serrated on the inside border. Caudal fin deeply forked, pointed lobes.

Color: Colorless. Air bladded seen through the translucent body. Minute black spots along the back and near the anal fin.

Habits: The habits of this species are not fully known.

Spawning: The spawning behavior is not known.

Remarks: The species is of no economic importance.

Eutropius niloticus

Distribution: Lagos, Niger and Benue river systems, Lake Chad and rivers across West Africa.

Morphology: Body elongate and compressed; body depth 3-4.6 times in total length; snout broad, projecting beyond the lower jaw; barbels 4 pairs. Dorsal fin, I,5-6 rays, spine feebly serrated behind. Anal fin, III-V,48-61 rays. Adipose fin small. Pectoral spine barbed on the inner surface. Caudal fin deeply forked, pointed lobes.

Color: Brownish or olive-green above, silvery below with a black blotch above the pectoral fin.

Habits: This species prefers fast rivers though it is also found in lakes. They move in small shoals. These fish are carnivorous, feeding on small fishes, worms and crustaceans. Copley (1958) reports that they also feed on insects and snails.

Spawning: This species spawns during the rainy season.

Remarks: The fish is important as food fish and is a first-class eating fish. It grows to a length of 320 millimeters and may weigh up to 3 pounds.

Family Bargridae (bagrid catfishes)

Members of this family are widely distributed throughout Africa, Asia Minor, Japan and Malaya.

The body is moderately long and slightly compressed. They are naked catfishes. The dorsal and anal fins are comparatively short and the adipose fin is large. The dorsal spine is invariably stout. They have 3-4 pairs of barbels. They are found in rivers, streams, lakes and ponds. The majority of this group are voracious feeders, and are more active at night than during the day.

They are economically important as food fish and various species of Chrysichtys are reputably excellent food fishes (Maclaren, 1954).

Four genera of this family are present in Nigeria, Bagrus, Chrysichthys, Auchenoglanis and Clarotes.

Bargrus domac

Distribution: Niger Delta, Ghana, lakes in East Africa.

Morphology: Body elongate and compressed; body depth 4-5 times in total length; head flat on top; snout projects beyond the lower jaw; barbels 4 pairs, maxillary barbels reaching or almost reaching the ventral fins. Dorsal fin, I,8-9 rays, anterior rays produced into filaments. Anal fin, IV-V,8-9 rays. Caudal fin deeply forked, upper lobe prolonged in adults.

Color: Dark olive above, whitish beneath. Yellow shading on the sides of some specimens in certain localities believed to be spawning colors (Copley, 1958).

Habits: This species is found in shallow waters and in deep pools during the dry season. It feeds mainly on fish and on prawns as well as insects and mud. Irvine (1947) reports their main food in Ghana to be fish eggs, fry and adult fish; Graham (1929) asserts that it feeds on prawns

in the deeper waters and on fish in shallow areas. This is interesting because it indicates that the species is not restricted to shallow waters only, but occurs in deep waters.

Spawning: Spawning takes place at the beginning of the rains and the eggs are deposited among rocks in rivers or in the head pool in lakes.

Remarks: The fish is economically important as food fish. It grows to 600 millimeters in length.

Bagrus bayad

Distribution: Niger River, Lake Chad, Nile River and Senegal.

Morphology: Body moderately elongate and compressed; head depressed; snout projects beyond the lower jaw; barbels 4 pairs, the maxillary reaching or passing the base of the ventral fin. Dorsal fin,I,9-11 rays. Adipose fin twice as long as the dorsal fin. Anal fin, IV-V, 9-10 rays. Caudal fin forked, upper and lower lobes produced into filaments.

Color: Dark brown above, whitish beneath, with dark spots scattered on the body and fins.

Habits: This species is found in deeper waters and also along the shore. It feeds on small fishes and insect larvae, prawns and frogs.

Spawning: The spawning behavior of this species is not known.

Remarks: The fish is important as food fish. It reaches a length of 650 millimeters, and may weigh up to 200 pounds.

Chrysichthys nigrodigitatus

Distribution: Niger and Benue River systems, Cross River.

Morphology: Body moderately elongate and compressed; head slightly depressed and rugose on top; snout obtusely rounded; barbels 4 pairs. Dorsal fin, I,6 rays, spine feebly serrated behind. Anal fin, IV-V,7-9 rays. Caudal fin deeply forked, upper lobe produced into filament.

Color: Dark grey above, silvery beneath.

Habits: This species lives in freshwater and in lagoons. It is a bottom feeder, feeding on prawns and insect larvae.

Spawning: The spawning habits are not fully known. In Gambia it is believed to have a prolonged spawning period from the end of the dry season to the rainy season.

Remarks: The fish is used as food. It grows to a length of 370 millimeters.

Clarotes laticeps

Distribution: Niger and Nile Rivers, Lake Chad, Senegal and Ghana.

Morphology: Body elongate and s ightly compressed; head depressed and rugose on upper surface; mouth inferior. Dorsal fin, I,6 rays, spine serrated in the young. Adipose fin short. Anal fin, 12-14 rays.

Color: Brownish above, silvery beneath.

Habits: The species does not confine itself to one particular habitat. It spreads all over the river, except in the fast rapids. It migrates during the dry season to larger bodies of water. It is a great predator, feeding on fish and prawns.

Spawning: Spawning takes place during the flood season, but the details of its spawning habits are not known.

Auchenoglanis occidentalis

Distribution: Niger and Benue river systems, Lake Chad, Nile River, Senegal and East Africa.

Morphology: Body moderately elongate and compressed; head slightly depressed; snout pointed. Dorsal fin, I,7 rays. Anal fin, 10-14 rays.

Color: Olive or brown sometimes spotted with large dark brown or blackish on the back and on the cuadal fin.
Habits: This species is found in quiet stretches of waters both in river and lakes along inshore areas. Daget (1954) records that the species is common in the swamps of the flood plains in the upper Niger river. It feeds on insect larvae, crustaceans and worms.
Spawning: Spawning takes place during the flood season.
Remarks: The fish is of no economic importance. In East Africa the local people refuse to eat it as it is believed to be poisonous. There is no evidence for this belief; it might be that the ugly appearance of the fish scares the people from tasting the flesh. It reaches 510 millimeters in length.

Family Mochocidae

This is another group of catfish family confined to Africa. The body is short or moderately elongate. The dorsal and pectoral fins have stout spines often serrated. The adipose fin is always present. There are 3 pairs of barbels, the mandibularies being always branched or feathered.

They inhabit rivers, lakes and lagoons, and are often found in slow flowing areas. They gather in shoals, and some

species of this family swim with their bellies upwards, feeding on the air borne insects that fall in the water.

Their large numbers in the Nigerian waters make them important food fish for the local people.

Only one genus, Synodontis, is present in Nigeria.

Synodontis schall

Distribution: Niger river system, Lake Chad, Nile River, Senegal, Ghana and lakes in East Africa.

Morphology: Body short and moderately compressed; body depth 3-4 times in total length; snout rounded; barbels 3 pairs, the mandibular and the mental branched, the maxillary plain with narrow marginal membrane at the base. Dorsal fin, I,7 rays. Anal fin, IV-V,8-9 rays. Pectoral spine as long or a little longer or shorter than the dorsal, inner border strongly serrated. Caudal fin deeply forked, upper lobe sometimes produced into filament.

Color: Brownish or olive-green above, silvery beneath. Paired and anal fins sometimes blackish.

Habits: This species occurs in deep as well as in shallow waters. It feeds on insects, small fishes and vegetable matter.

Spawning: The spawning behavior is not known.

Remarks: The fish is not valued as food fish because of many bones in its flesh. Irvine (1947) reports that its flesh is tasteless and of little value. Boulenger (1911) separated this species from Synodontis gambiensis, but Daget (1954) feels strongly that they are the same species.

Synodontis nigrita

Distribution: Lower Niger River, Nile River, Senegal and Gambia.

Morphology: Body moderately compressed; skull bones project out into finger-like process; snout rounded. Dorsal fin, 1,7 rays, spine serrated behind. Anal fin, IV-V,8-9 rays. Pectoral spine strongly serrated on the inner edge.

Color: Brown or olive to blackish, marked with round black spots and transverse series black spots across the caudal fin. Young specimens characterized by 2-3 irregular transverse bars on the caudal peduncle.

Habits: This specis is often found on the surface, sometimes with its lips just breaking the water surface. It feeds on insects and vegetable matter.

Spawning: Synodontis nigrita spawns during the rains.

Remarks: The species is used as food. It grows to a length of 170 millimeters.

Synodontis membranaceus

Distribution: Niger and Benus river systems, Lake Chad, Nile River, Senegal and Gambia.

Morphology: Body strongly compressed; body depth 2.6-3.5 times in total length; head granular above; snout obtusely blunt; barbels 3 pairs, the maxillary with a large membrane on its border, the mandibular with long branches on its basal half and a membrane on the other half. Dorsal fin, I,7 rays, spine feebly serrated behind. Adipose fin, large and narrowly separated from the caudal fin. Anal fin, VI,7-9 rays. Pectoral spine as long as the caudal spine. Caudal fin forked, with pointed lobes.

Color: Silvery grey or whitish above, dark brown below. Barbels whitish. Young specimens with round spots on the rayed fins.

Habits: This species is found on the surface swimming with its belly upwards, but taking the normal position at the approach of any danger. It feeds on insects.

Spawning: The spawning habits of this species are not known.

Remarks: This fish is used as food. It grows to a length of 450 millimeters.

Family Amphiliidae

Members of this family occur in Africa.

The body is elongate and slightly compressed with a long and slender caudal peduncle. The mouth is more or less inferior, with 3 pairs of short and simple barbels (a maxillary and 2 mandibular) on each side. The fins are not provided with strong spines, and both the dorsal and adipose fins are short. The fishes live in hard bottomed areas in rivers and many species prefer the riffles.

Only one species occurs in Nigeria.

Phractura ansorgi

Distribution: Lower Niger River

Morphology: Body depth 10 times in total length; head flat on top; snout obtusely pointed. Dorsal fin, 1,6 rays, originating in advance of the ventral fin. Adipose fin small. Anal fin, 1,10 rays. Scutes, 26 on each side of the back and 22 on the ventral side characterize this species. Caudal peduncle, 1/3 of total length.

Color: Pale brown above spotted with black, whitish beneath. Dorsal fin marked with two black spots; caudal fin with two black streaks across it.

Habits: The fish is found in shallow creeks and in flooded lands during the rains.

Spawning: The spawning behavior of this species is not known.

Remarks: This species is of no economic importance. It grows to a length of 50 millimeters.

Family Malapteruridae (electric catfish)

The electric catfish is confined to Africa and consists of one genus Malapterurus in West Africa.

The body is moderately elongate and very slightly compressed, lacking the dorsal fin except the small adipose fin. The pectoral fin is without spines. There are three pairs of barbels, the nasal barbels are absent. The electric catfish is of interest to the biologists on account of its electric organ which extends over the whole body from the head to the origin of the adipose fin. The organ gives a very powerful shock and is an organ of offese and defense.

There is only one species in Nigeria.

Malapterurus electricus (electric catfish)

Distribution: Lagos, Calabar, Ogun River, lower Niger River, Nile River, Gambia, Ghana, Gaboon and Cameroun.

Morphology: Body moderately elongate and sub-cylindrical; snout rounded. Dorsal fin absent. Adipose fin low and narrowly separtaed from the caudal fin. Anal fin, III,8-10 rays. Pectoral fin rounded, without spine.

Color: Greyish to blue above and whitish beneath. Body usually marked with dark dots or blotches. Caudal fin darker behind.

Habits: This species is found in quiet pools of waters. It feeds on fish, prawns and occasionally on vegetable debris.

Spawning: The spawning behavior of this species has not been observed in Nigeria.

Remarks: Murray (1854) described the species from Old Calabar, Nigeria, as a new species Malapterurus beninensis as distinct from the Nile species Malapterurus electricus, but the two species are now known to be one and the same species.

The electric catfish is well known to the fishermen because of its electric shock. It is of little or no economic value because it is rarely caught in large numbers. Copley (1952) remarks that the natives of Congo do not eat this fish for fear that it might be detrimental to their virility. In Ghana, Irvine (1947) reports that the fish is edible. It is also eaten in Nigeria.

Order Cyprinodontiformes

Family Cyprinodontidae (cyprinodonts)

This family is represented in nearly every continent except Australia, but it is more or less confined to Africa,

the whole of Central and South America.

The classification of these fishes, particularly the oviparous forms, presents the most difficult problem to the ichthyologists because of their small size and close resemblance (Myers, 1933). They are generally small fishes with head flattened on top. The mouth is protractile, terminal or slightly directed upwards, without barbels. There is no adipose fin, and the only dorsal fin is usually inserted well backwards, more or less opposite the anal fin. Lateral line is absent, the cycloid scales cover both the body and the head.

The sexes are distinguished by coloration and the shape of the fins and these vary from one genus to another. The African cyprinodonts are oviparous and they occur both in fresh and in brackish waters. Some species deposit their eggs on plants and others lay them in small holes in the ground. They feed on small crustaceans and insect larvae.

The fish are of insignificant economic importance as food fish; but certain species are useful in controlling malarial mosquito larvae, and they are also valued as aquarium fishes on account of their bright colorations.

Several genera in this family have been mixed up in classification, and if there is any group of African fish that needs review of classification, it is the group of cyprinodonts. Five genera are present in Nigeria, Aphyosemion, Aplocheilichthys, Micropanchax, Epiplatys, and Procatopus.

Aphyosemion gularis

Distribution: Lower Niger River, rivers in southern Nigeria and Cameroun.

Morphology: Body depth 3.5-4 times in total length; head flat on topl snout short and broad; mouth slightly directed upwards. Dorsal fin, 15-16 rays, equidistant from the head and the base of the caudal fin. Anal fin, 16-18 rays, opposed to the dorsal fin. Caudal fin rounded in the female, upper rays produced in the male.

Color: Pale olive-brown above, whitish below in males. Uniform white with few reddish-brown dots on the dorsal and anal fins in the females. Bluish with red vertical bars in the male sub-species, Aphyosemion gularis caerulea. Caudal fin makred with yellow in the middle between blue bands above and below (Boulenger, 1915).

Habits: The species lives in shallow creeks and in small pools during the flood season. It feeds on small animal life, insect larvae and crustaceans.

Spawning: During spawning, the female bores small holes in the ground by means of its anal fin, and into each of these holes it lays 1-3 eggs which are fertilized by the male, and thereafter takes no charge of them any longer.
Remarks: The fish is of no economic importance as food but is valued as an aquarium fish. It grows to a length of 105 millimeters.

Aphyosemion arnoldi

Distribution: Niger Delta areas
Morphology: Body depth 4.5-5.5 times in total length; head flat on top; lower jaw projects beyond the upper; mouth directed upwards. Dorsal fin, 15-16 rays, originating slightly in front of the anal fin. Anal fin, 15-17 rays. Caudal fin round in the female, upper and lower rays produced in the males forming pointed lobes.
Color: Variable. Brownish-red on the back fading to olive green on the sides with carmine blotches on the head and body. Upper parts of the dorsal and the anal fins marked with a dark band. Female, brownish olive to greyish brown with red spots or streaks on the body.
Habits: This species is found on the bottom of small creeks, and in floods during the rainy season.

Spawning: The spawning habits are not known.

Remarks: The fish is of no importance. It grows to 60 millimeters in length.

Aplocheilichthys spilauchena

Distribution: Lagos, Senegal and Congo.

Morphology: Head flat on top; mouth terminal. Dorsal fin, 7-8 rays originating at about the sixth ray of the anal fin. Anal fin, 13-14 rays. Caudal fin rounded.

Color: Yellowish-green above and lighter beneath.

Habits: This species lives both in fresh and brackish waters, preferring the latter. It is often found on the surface feeding on mosquito larvae.

Spawning: The fish spawns on plant substrate, the eggs hatch in 12-14 days.

Remarks: This species is useful in controlling malarial mosquito larvae. It is used as an aquarium fish. Several species of the genus Micropanchax were formerly assigned to the genus Aplocheilichthys on the assumption that the two genera were synonymous; but Schultz (1942) and Sterba (1963) separate the genus Micropanchax on the basis of their small size from Aplocheichthys which has one species, spilauchena, in Nigeria.

Micropanchax macrophthalmus

Distribution: Lagos

Morphology: Head flat on top; mouth directed upwards; lower jaw projects beyond the upper jaw. Dorsal fin, 7 rays. Anal fin, 11 rays. Dorsal and anal fins produced to a point in the males, rounded in the females.

Color: Slightly transluscent with a blue green band running from behind the operculum to the root of the caudal fin in the males.

Habits: This species is often found both in freshwater and in lagoons. It prefers shallow reedy areas. It feeds on mosquito larvae and other small insects.

Spawning: This species spawns in shallow places. The female extrudes clusters of 10-15 eggs hanging onto her vent while the male fertilizes them. The eggs are then brushed onto the plants nearby.

Remarks: This species is good for the aquarium. It reaches a length of 35 millimeters.

Epiplatys grahami

The genus Epiplatys replaces Boulengers' Haplochilus.

Distribution: Lagos, Old Calabar province, southern Nigeria.

Morphology: Body small, spindle-shaped; body depth 4-4.5 times in total length; head flat on top; mouth directed upwards. Dorsal fin, 7-8 rays, inserted above the posterior fourth ray of the anal fin. Anal fin, 15-16 rays. Ventral fin small. Caudal fin pointed.

Color: Pale brown with 5-7 black vertical bars across the body, and a dark spot at the base of the caudal fin.

Habits: This species lives in sluggish and standing waters and is often seen on the surface. It feeds on other fishes and on insect larvae.

Spawning: The spawning behavior of this species is not known.

Epiplatys sexfasciatus (Fig. 12a)

Distribution: Lower Niger River, Old Calabar province, Congo River and Senegal.

Morphology: Body elongate and slightly compressed; head flat on top; snout rounded; mouth directed upwards. Dorsal fin, 10-12 rays inserted above the middle of the anal fin. Anal fin, 15-17 rays. Caudal fin pointed.

Color: Brown above, yellow beneath with 5-7 vertical black bars on each side of the body.

Habits: The fish is often found on the surface of small slow moving bodies of waters. It feeds on insects and other small fishes.

Spawning: The spawning habits are not known.

Remarks: The species is used as aquarium fish. It grows to a length of 100 millimeters.

Procatopus nototaenia

Distribution: Lower Niger river and Cameroun.

Morphology: Body strongly compressed; head depressed on top; mouth directed upwards. Dorsal fin, 9-11 rays. Anal fin, 14-17 rays. Ventral fin inserted below the pectoral fin, outer rays produced into a filament.

Color: Yellowish olive above, whitish below with a longitudinal yellow streak on each side of the body.

Habits: The habits of this species are not known.

Spawning: The spawning behavior is not known.

Order Perciformes (Percomorphi)

Family Centropomidae (Nile perches)

This family is closely related to the marine family Serranidae. The family Centropomidae occurs only in Africa.

The body is elongate and moderately compressed. The mouth is protractile and is equipped with villiform teeth. The fish as with other perch families have two portions of dorsal fins, the spinous and the soft rayed portions which

are either continuous or separated. The anal fin usually has three spines.

There are two genera, Lates and Luciolates, of this family in Africa of which only the former is present in Nigeria.

Lates niloticus (the Nile or Niger perch)

Distribution: Niger and Benue river systems, Nile and Congo Rivers and Senegal.

Morphology: Body elongate and moderately compressed; body depth 2.5-4 times in total length. Dorsal fin, VII to VIII - I to II,10-14 rays, spinous and soft rayed portions narrowly separated, and connected at the base. Anal fin, III,7-9 rays. Caudal rounded.

Color: Olive-brown above, silvery beneath.

Habits: This species lives in deep pools preferably immediately below the rapids during the day. But at night it may be found in shallow areas. It is a predaceous fish of the first order, feeding on fish (Alestes, Hydrocynus and cichlids).

Spawning: Very little is known about the spawning behavior and life history of this species.

Remarks: This species is well known for its size and sporting qualities. It is important as food fish. McCormick (1949) remarks that the flesh of the fish is very delicious. The species is most sought after in the northern part of Nigeria for food. The fish grows to a length of 1800 millimeters, and may weigh up to 280 pounds. Gudger (1944) remarks that the Nile perch is not only the largest freshwater fish in Africa but also the largest freshwater percoid in the world.

Family Nandidae

This is relatively a small family occurring in West Africa, South America and Southern Asia.

The body is short and compressed. The mouth is protractile. The spinous and soft portions of the dorsal fin are united, the former being well developed. The anal fin has three or more spines. The Nandidae are predaceous, feeding on fish.

They are of no economic importance and are represented by only one species in Nigeria.

Polycentropsis abbreviata

Distribution: Lagos, Lower Niger and Ogowe rivers.

Morphology: Body short and compressed; snout pointed with slightly projecting chin. Dorsal fin XV-XVII,9-11 rays, narrowly separated from the caudal fin. Anal fin, IX-XI, 8-9 rays. Ventral fin, I,5 rays anterior rays produced into filament. Caudal peduncle short.

Color: Pinkish brown with base of soft dorsal, anal and caudal fins blackish and edged with pink.

Habits: This species is predaceous. It stays in wait for its prey, and feeds mainly on fish and crustaceans.

Spawning: During spawning, the male makes sticky bubbles around the under side of a leaf and the female then lays her eggs about the bubbles attached to the leaf.

Remarks: This species is of no economic importance. It grows to 65 millimeters in length.

Family Cichlidae (cichlids)

Members of this family are confined to Africa, South and Central America.

The cichlids are distinguished from the perches by their possession of only one nostril on each side of the head. The body is robust to disc-shaped and strongly compressed.

The mouth is protractile. The lateral line is broken into two parts; and the spinous and soft portions of the dosal fin are united with the spinous portion well developed.

The cichlids are found in all kinds of freshwaters, in rivers, streams, lakes and ponds. Certain species are also found in lagoons and brackish water. They prefer standing or sluggish waters and they like to hide under the banks, rocks and stones and among the fallen branches in the water. The majority of the species are predaceous, feeding on other small fishes, insect larvae. Others, like the Tilapia spp. and few specialized forms are herbivorous. The cichlids are oviparous, but are noted for their parental care. Some carry their eggs and brood in the mouth, while others guard and defend the eggs and young till when they can fend for themselves. Many species of Tilapia breed throughout the year and so can easily over-populate an area.

The cichlids are of extreme economic importance as food fish. They form a group of excellent food fishes in Nigeria. Welman(1948) remarks that Tilapia spp. are the best flavoured of all the African fishes. Many species are widely cultured in ponds in many parts of the country and they have proven to be the most suitable species for culture,

not only on account of their size, and fast growth rate, but their adaptability to many ponds without adequate management. The majority of Tilapia grow wild in rivers and creeks. Holden (1963) noticed the dominance of Tilapia spp. in River Sokoto forming an average of 61% by weight of the total population and 81% by weight of total herbivores in the pools he studied. From this we would expect that these species constitute the highest proportion by weight of the catch in each season particularly as they are non-migratory.

In Florida, Tilapia heudeloti has entered the commercial catch in Hillsborough Bay (Springer and John, 1963), and in Malii Tilapia mosambica is reared commercially to supplement the naturally occurring bait fishes for the tuna (Hida, et al. 1962).

Certail species are also useful in controlling mosquito larvae as they feed on them.

There are several genera of this family in Africa, but only three are represented in Nigeria, Tilapia, Pelmatochromis and Hemichromis. The majority of the African genera and species are endemic to the great lakes of East Africa.

Tilapia nilotica (Fig. 13)

Distribution: Niger and Benue river systems, Lake Chad, Senegal, Gambia and East African lakes.

Morphology: Body long and robust; mouth large extending to below the anterior border of the eye. Dorsal fin, XVI-XVII,11-15 rays. Anal fin, III,8-11 rays. Pectoral fin pointed, reaching the anal fin. Caudal fin rounded at its upper and lower margins.

Color: Greyish to dark olive or silvery with dark spots at the base of the scales. Young specimens marked with 8-9 vertical dark bars. Caudal fin with dark bars; dorsal and anal fins spotted with dark and light dots in oblique series.

Habits: The fish frequents quiet stretches of rivers and shallow shores. The food of Tilapia nilotica is variable. It feeds on water weeds and minute animals. In East Africa, the food consists of plankton, aquatic plants and diatoms with green and blue algae. It has been shown that the fish digests the diatoms and passes out other algae through the alimentary canal unharmed (Fish, 1955). Hickling (1961) reports that Tilapia nilotica in Lake Kivu feeds directly on the free floating bacteria.

Spawning: This species spawns during the rainy season, and during the breeding period the color of the male becomes intensified. Boulenger (1908) observed that the brighter colors and the large size of the males render them easily distinguishable from the females. Before spawning, the male excavates a depression near the shore in shallow waters and later goes out to look for a mate which he courts to the nest. The female lays about 150-270 eggs which are fertilized by the male. After fertilization, the female takes the eggs into her mouth; the developing fry are also brooded in the mouth during which period the female stops feeding.

Remarks: This species is of economic importance as an excellent food fish. It grows to a length of 460 millimeters and may weigh up to 12 pounds.

Tilapia heudeloti

Distribution: Lagos, Cross River, Lower Niger River, Lake Chad, Senegal, Ghana, Gaboon and Cameroun.

Morphology: Body moderately elongate and compressed; head convex in upper profile; mouth small; gill rakers short. Dorsal fin, XV-XVI,11-13 rays. Anal fin, III,8-11 rays. Pectoral fin pointed reaching the origin of the anal fin.

Color: Olive brown above, golden yellow beneath with a black spot at the operculum. Soft part of dorsal fin marked with dark and light spots in oblique series.

Habits: This species lives in rivers, lakes and lagoons, frequenting shallow places along the shore.

Spawning: During spawning, both the male and female construct a nest by scooping out depressions in the sand near the shore. The female then deposits eggs in the depressions and they are fertilized by the male, who later takes the fertilized eggs into the mouth for incubation.

Remarks: This species is important as food and is useful in controlling mosquito larvae. It was used in the Lagos Medical department to control mosquito larvae in 1948 (Rept. Fish. Invest., 1948). The fish grows to a length of 300 millimeters.

Pelmatochromis guntheri

Distribution: Lower Niger River, Rivers in southern Nigeria, Ghana, Gaboon and Cameroun.

Morphology: Body short and compressed; snout slightly pointed; mouth large, extending beyond the nostril; gill rakers short, 12-15 on the lower part of the anterior arch. Dorsal fin, XV-XVII,9-12 rays. Anal fin, III,7-8 rays, reaching beyond the base of the caudal fin. Daudal fin rounded.

Color: Olive brown above, yellowish beneath with a dark opercular spot.

Habits: Common in small bodies of waters along the coastal region of Nigeria. They inhabit brackish water as well as freshwater. They are usually found in shallow areas hiding among the weeds and tangled roots of trees.

Spawning: This species spawns at the beginning of the rains. Both parents take part in excavating a small pit in which the female lays her eggs. After the eggs are fertilized by the male, one parent picks up the eggs in the mouth and the two parents take turns in the mouth brooding till the yolk sacs are all absorbed. This method of mouth breeding seems to be peculiar to the species among the members of the genus Pelmatochromis, which generally are not mouth breeders.

Remarks: The fish is important and highly prized as a food fish. It reaches a length of 130 millimeters.

Hemichromis fasciatus

Distribution: Lagos, Lower Niger and Cross Rivers, and other creeks in southern Nigeria.

Morphology: Body short and compressed; snout longer than the diameter of the eye; gill rakers short. Dorsal fin,

XIII-XV,11-13 rays with increasing length in spine to the last. Anal fin, III,8-10 rays.

Color: Olive-brown above and whitish beneath with five dark bars or blotches on each side of the body, and a large opercular spot. Edge of soft dorsal fin and upper caudal fin reddish in live specimens but whitish in preserved specimens.

Habits: This species occurs in small rivers, creeks, lagoons and in brackish waters. It feeds on mosquito larvae, and fish fry at the early stage but when it grows older it preys on fishes and crustaceans.

Spawning: Spawning takes place between June and July during the rains. Eggs are not incubated in the mouth, but laid in depressions in the ground.

Remarks: The fish is an important food fish. It grows to a length of 230 millimeters.

Family Eleotridae (eleotrids)

Members of this family are world-wide in distribution and are closely related to the gobies, but for their ventral fins which are completely separated and show no sign of union as in the gobies.

The body is elongate and slightly compressed. The lateral line is absent. The dorsal fin consists of two portions, the first is composed entirely of simple flexible spines, and the second is the soft rayed portion with one simple spine. The mouth is protractile.

Certain species of this family live in the sea or brackish water. Others are confined to freshwaters while some can stay both in fresh and brackish waters. They prefer to live on the bottom hiding between stones and among roots of water trees. The majority of the species are predatory, feeding on the young and fry of other fishes.

The freshwater eleotrids spawn onto water plants and the parents, particularly the male, takes care of the eggs by fanning them with his fins till they hatch. It also cares for the fry.

The freshwater species are of no economic importance but certain species are used as aquarium fish.

The family is represented by one genus, Eleotris, in Africa and in Nigeria.

Eleotris labretoni

Distribution: Lower Niger River, Lagos, Senegal, Gambia and Angola.

Morphology: Body elongate and strongly compressed posteriorly; head flat on top and covered with scales. Dorsal fins, VII-VIII - 1,8-9 rays. Anal fin, 1,9-10 rays, below the soft rayed portion of the dorsal fin. Caudal fin large and rounded.

Color: Olive brown above, dirty yellow below with a bluish blotch behind the operculum. Scales marked with dark brown spots in longitudinal series. Fins spotted with numerous dark spots.

Habits: This species is found both in rivers, lakes and lagoons.

Spawning: The fish spawns on the leaves of water plants. The male initially endeavours to keep the fry together in a group till they are able to care for themselves.

Remarks: This species is not economically important as food fish but it is used as aquarium fish. It grows to a length of 120 millimeters.

Family Gobiidae (gobies)

The Gobiidae have world-wide distribution and are found mostly in marine or brackish water. Only very few species are represented in freshwaters. They are bottom dwellers and they feed on the small bottom organisms.

Members of this family are characterized by the partial or complete fusion of the ventral fins not adherent to the belly.

The body is elongate, deep and compressed, with two distinct dorsal fins.

Gobius guineensis

Distribution: Lower Niger River, Sierra Leon and Angola.

Morphology: Body elongate and cylindrical; snout convex on upper profile, rounded in front; mouth sub-inferior, equipped with two or three rows of teeth on each jaw. Dorsal fins, VI--I,10 rays, widely separated from each other. Anal fin, I,10 rays opposed to the second dorsal fin. Ventral fin below or slightly in advance of the pectoral fins. Caudal fin rounded.

Color: Greyish-yellow with spots forming either longitudinal or transverse bands on the body. Dorsal and caudal fins spotted with transverse red-brown bars.

Habits: This species is often found on the bottom of shallow rivers and lagoons. It feeds on bottom invertebrates.

Spawning: Spawning takes place during the rainy season. It spawns on stones.

Remarks: The species is of no economic importance as food fish. It grows to 155 millimeters in length.

Family Anabantidae (labyrinth fishes)

The labyrinth fishes occur in Africa, South East Asia, China and Philippine Islands.

The Anabantidae in Africa are represented by a single genus, Ctenopoma, the climbing perches. Their body is deep and compressed with well developed dorsal and anal fins containing numerous spines. The mouth is protrusible. The suprabranchial respiratory organ is poorly developed and so the aerial respiration does not play an important role in the lives of the fishes.

The fish are found in all kinds of freshwaters, rivers, streams, ponds and swamps. They are carnivorous, feeding on fishes, insects and small organisms.

Certain species are known to build bubble nests for spawning while others spawn in the water without nests.

Three species are present in Nigeria.

Ctenopoma Kingsleyae

Distribution: Lagos, Lower Niger and Congo Rivers, Senegal and Gambia.

Morphology: Body elongate, deep and compressed; body depth 2-2.6 times in total length; snouth rounded; mouth large, obliquely directed extending beyond the anterior border of the eye; opercular notch indented above and below. Dorsal fin, XVII-XIX,9-11 rays, narrowly separated from the caudal fin. Anal fin, IX-X,9-10 rays, originating slightly behind the end of the pectoral fin.

Color: Brownish to olive brown with a dark blotch in front of the caudal root. Borders of dorsal, anal and caudal fins colorless.

Habits: The species is found in weedy areas of quiet streams and rivers. It is highly predaceous, feeding on fish and large insect larvae.

Spawning: This species spawns during the flood season. Details of its spawning are not known.

Remarks: The fish is edible. It grows to a length of 200 millimeters.

Family Ophiocephalidae (Channidae) - the snake-heads

Members of this family are found in Africa, and South East Asia.

Their body is very elongate, almost cylindrical and slightly compressed posteriorly. The head is large and flat on top with a wide cleft mouth. The dorsal and anal fins are very elongate without spines. The air bladder is elongate and bifid. The snake-heads have a simple diverticulum structure in the gill chamber which functions as an accessory respiratory organ so that the fish can augment its respiration in muddy places.

The fish are predaceous, feeding on fish, frogs, insects and worms. They are important as food fish and their flesh is of high quality.

There are only two species of this family in Nigeria.

Ophiocephalus africanus

Distribution: Lagos, Calabar and Cameroun.

Morphology: Body elongate and slightly compressed posteriorly; body depth 6.5-7.5 times in total length; snout rounded; lower jaw projects slightly beyond the upper jaw; nasal barbels conspicuously long. Dorsal fin, 42-49 rays. Anal fin, 30-34 rays, inserted below the 14th dorsal ray.

Color: Greenish brown above, greyish beneath with a black band extending from the end of the snout across the eye to the posterior border of the operculum. Body marked with oblique vertical bands. Fin spotted dark brownish.
Habits: This species lives in quiet, sluggish waters in rivers and lagoons. It feeds on fish, frogs and worms.
Spawning: The spawning habits of this species are not known.
Remarks: The fish is important as food fish. It reaches a length of 320 millimeters.

Order Mastacembeliformes

Family Mastacembelidae (spiny eels)

Members of this family are found in Africa and South East Asia.

The body is eel-shaped with a series of free isolated spines on the back followed by soft rayed portion of the dorsal fin which may or may not be confluent with the caudal fin. The African species are characterized by the fusion of both the dorsal and the anal fins with the small caudal fin. The snout is produced into a proboscis-like process which is more or less fleshy and mobile and used for feeling

the prey. The mouth is small and inferior and the body is covered with small scales.

The fish are found both in fresh and brackish waters. They are more active at night than by day. Their food consists of worms, insect larvae and small crustaceans which are simply sipped into the mouth.

Two species of this family are present in Nigeria and they are not economically important as food fish.

Mastacembelus loennbergi

Distribution: Lower Niger river, Lake Chad, Sierra Leon and Cameroun.

Morphology: Body long and cylindrical; body depth 14-17 times in total length; snout produced into a pointed appendage. Dorsal fin, XXVIII-XXXII,110-130 rays. Anal fin, II,100-130 rays. Dorsal and anal fins fused with the caudal fin. Vent located midway between the end of the snout and the caudal fin.

Color: Variable. Brownish with an indistinct dark lateral band or with dark or lighter spots.

Habits: The species is found in weedy, quiet waters on muddy bottom. It feeds on worms and insect larvae.

Spawning: The spawning behavior of this species is not known.

Remarks: The fish is edible. It grows to a length of 190 millimeters.

Order Tetraodontiformes

Family Tetraodontidae (puffers)

Members of this family are found in Africa, Asia, Australia and South America. They occur both in brackish and freshwaters.

The fish have a peculiar globular or club-shaped body with a sac-like diverticulum extending under the skin and the belly. This diverticulum is capable of being inflated either with water or air often to assume the usual globular shape. This action is thought to be a means of defense which scares away its aggressor with the impression of its being unswallowable. The snout is produced into a bleak with more or less a coalescent dentition which is united in the middle.

The body is either naked or often covered with prickly spines. The fish lack the ventral fins but the pectoral fins are well developed for locomotion. The dorsal and the anal fins are without spines.

The nature of the teeth in these fishes make them excellent crushers of shells and so their main food is molluscs. They also feed on eathworms and midge larvae. The spawning habits of the tetraodonts in Nigeria are not fully known. The majority of species in this family are toxic and they are not economically important as food fish.

Only one genus Tetraodon is present in Nigeria.

Tetraodon fahaka (Fig. 15)

Distribution: Niger and Nile Rivers, and Senegal.

Morphology: Body global with rounded belly; snout produced into a beak, rounded in front; nasal barbels 2 pairs, no apparent nostrils. Dorsal fin, 12-14 rays, inserted nearer the caudal fin than the head. Anal fin, 10-11 rays, originating below the middle of the dorsal fin. Ventral fins absent. Caudal fin rounded. Body covered with small pricklets.

Color: Dark olive-grey above, lighter beneath with black stripes along the sides and caudal peduncle. Sides of the head marked with dark vertical bars. Young specimens with ill-defined stripes or rounded spots.

Habits: This species is found along the shallow shores of rivers. It feeds on molluscs and midge-larvae.

Spawning: The spawning habits are not known.

Remarks: This species is believed to be toxic. It is not edible. It reaches a length of 420 millimeters.

IV. THE ECONOMIC POTENTIALS OF THE FRESHWATER FISHERIES IN NIGERIA

From the account of the families and species given above, one may get the impression that all species which are considered useful as food fish or sport fish, are also economically important. This is not so. Though a number of species are eaten as food because of the limited fish food supply, only few families such as the catfish families, mormyrids, characins, citharinids, cichlids, carps and barbels, osteoglossids, and centropomids, can be considered economically important on account of their number, size and availability.

Nigerians are in great need of animal protein in their diet, and the rivers, lakes and swamps are the first immediate sources of their fish food from which they get some of the proteins. The problem in Nigeria is not who will consume the locally produced fish, but how to get enough for the growing population (55 million people in the country, according to 1963 census). The locally produced fish from the freshwaters, coastal waters and open sea is not sufficient, so that fresh, frozen and dried fish of all sorts must be imported annually to supplement the quantity produced locally in the country. Longhurst (1961) estimates

that out of the 203,000 tons of fish consumed in Nigeria annually, about 145,000 tons of fish are imported. The most significant item of the import is the stock-fish, which has a large market in the country. Stock-fish is simply any dried fish, cured by being split and dried in the open air. Different kinds of fish mostly the cod family are used.

Table 1 shows the quantity and value of stock-fish imported annually. Table 2 also shows that a significant sum of money is spent for the import of fresh, chilled or frozen as well as dried, salted or smoked fish to meet the demand of the consumers.

The figures in these tables indicate the great demand for fish and fishery products in Nigeria, and the need for fisheries development in the country in order to reduce the quantity of imported fish.

The Nigerian waters have potential fisheries resources that have not yet been fully tapped. Though accurate fishery statistics are not kept at the moment in Nigeria, partly because of lack of funds and personnel and partly because of the unorganized fishery structure, an intensive fishery survey would indicate that the catch and landings of the inland fishes are often underestimated. In 1960

Table 1. The quantity and value of stock-fish imported into Nigeria

Year	Quantity (thousand tons)	Value (₦1,000,000)
1952	12.7	2.9
1953	14.8	4.0
1954	22.8	5.2
1955	21.2	4.8
1956	29.1	6.3
1957	34.9	7.7
1958	29.0	6.8
1959	34.0	7.9
1960	33.8	7.9
1961	30.7*	7.6
1962	29.03*	5.9
1963	32.2**	4.8
1964	17.5**	4.4

* Quantity in thousand metric tons

** Quantity from January to September

Sources: Comm. Fish. Rev. 1963

Nigeria Trade Jour. 1959, 1961, 1965.

Table 2. The quantity and value of fresh and dried fish improved into Nigeria

	Fresh, chilled and frozen fish		Dried, salted or smoked fish	
Year	Quantity (thousand metric tons)	Value (£1,000)	Quantity (thousand metric tons)	Value (£1,000,000
1957	1.2	133.9	35.7	7.3
1958	1.6	158.5	29.9	7.0
1959	1.8	188.9	34.7	7.9
1960	1.9	214.3	34.5	8.0
1961	2.2	235.0	31.4	7.6
1962	1.3*	200.0	35.6	7.2
1963	na	na	36.6	6.4

* Quantity from January to October in metric tons

na Not available

Sources: Comm. Fish. Rev. 1963

Year book of fishery statistics, 1965.

the quantity of freshwater fishes landed was about 30,000 metric tons, and this exceeded the marine landings of 28,000 metric tons for the same year. A fishery survey conducted by the Federal Fisheries Research Service, Lagos, indicated that 15,000 tons (wet) or 6,000 tons (dry) of fish leave the coast of Lake Chad annually for markets within the Federation (Nig. Trade Jour., 1963). In 1962 the annaul catch from the Nigerian sector of Lake Chad was 10,000 metric tons. When this quantity was marketed to the southern provinces, it yielded a retail value of £4.5 million. These figures are indicative of the potential freshwater fishery resources in Nigeria which need proper management for more production. The figures also show the importance of the freshwater fishes in the national economy.

Now, the question that is often asked is this: why import fish and fishery products from abroad while there are supplies from the rivers, lakes and seaboards in Nigeria. The problem of effective exploitation of Nigerian waters consists in dearth of certain factors:

a) Lack of capital for the cost of improvement by way of introducing better boats, fishing gear and other equipment which can operate beyond the narrow continental shelf along the Nigerian coasts.

b) Lack of technical knowledge for handling and operating the modern scientific gear and trawlers.

c) The problem of handling, processing, storage and marketing facilities in the country.

d) Lack of biological knowledge of the life history, whereabouts and behavior of most of the Nigerian species. This problem makes it difficult for efficient management; and regulations based on scientific research cannot be made.

However, steps are being taken toward solving some of the problems. Both the government and interested bodies are concerned about the development of fisheries in Nigeria. In the national 'six-year development plan: 1962-68', the country's off-shore fishery resources are to be developed by a "systematic hydrological and hydro-biological survey of its coastal waters"[1/]; research and development of inland fisheries with particular reference to Lake Chad and the Kainji Dam Reservoir are also emphasized. Each regional government is also concerned about its own fishery development

---

1/ National development plan: 1962-68. Fisheries.

project. In the western region, the Ministry of Agriculture and Natural Resources has undertaken a "Grow Your Own Fish" campaign, the result of which has made fish ponds and farms a common sight in many towns and villages there. In the eastern region, the government has built fish ponds in different localities to serve as demonstration ponds with a view to stimulating the people to be more interested in fish ponds of their own.

At the momen, the tidal fish pond at Opobo is producing 1,150 lbs. of fish per acre per annum, and it is hoped that its production will increase to between 1,750 and 2,000 lbs. per acre with supplementary feeds and with the application of fertilizer (Nat. Dev.Plan Prog. Rept. 1964).

Longhurst (1961) is of the opinion that the best prospect of increasing the locally produced fish in Nigeria is to exploit the distant water fisheries for both the pelagis and demersal forms. The possibilities of this depend on the availability of finances and personnel with scientific knowledge of the local fisheries as discussed above.

With the present economic revolution in Nigeria and the good opportunities and possibilities of developing the

country's fisheries, it is hoped that a time will come in the future when the imported stock-fish and smoked fish in Nigerian markets will probably be replaced by the locally produced fish; and also that sufficient quantity will be made available not only to the people of Nigeria but also to other African countries.

Apart from increasing the country's production of fish for consumption, fisheries development might ensure surplus for export, provide markets for fishing equipment and supplies, and as well offer sports and recreational facilities both for visitors and the Nigerians themselves. All these form the potential economic role of the freshwater fisheries in Nigeria, which call for greater attention than is given to them today.

LITERATURE CITED

Axelrod, H.R. and L.P. Schultz. 1955. Handbook of Tropical Aquarium fishes. McGraw Hill Book Company Inc., New York, 718 pp.

Boulenger, Charles L. 1908. On the breeding habits of a cichlid (Tilapia nilotica). Proc. Zool. Soc. London. 405-407.

Boulenger, G.A. 1891. On a regenerated left pectoral limb of Protopterus annectens. Proc. Zool. Soc. London. 147-148.

_____ 1901-16. Catalogue of the freshwater fishes of Africa. British Museum (Natural History), London. Vols. I-IV.

_____ 1911. Catalogue of the freshwater fishes of Africa. British museum (Natural History), London. Vol. III:404

Ibid. Vol. III:31

Budgett, J.S. 1901. On the breeding habits of some West African fishes, with an account of the external features in development of Protopterus annectens, and a description of the larva of Polypterus lapradei. Trans. Zool. Soc. London. 16:115-136.

Clausen, H.S. 1956. Biological and taxonomic notes on Nigerian freshwater Sygnathus (Linn. 1758) Kaup 1886, with remarks on the taxonomic value of Crista media trunci and Crista sup. sudae. Vidensk. Meddel. Kopenhagen. Vol. 118:225-234.

_____ 1963. Description of three new species of Aphyosemion Myers from Nigeria and Cameroun. Vidensk. Meddel. Kopenhagen. 125:195-205.

_____ 1964. Correlation of ichthyofaunal distribution with distribution of geological deposits and chemical composition of freshwater in Nigeria. Vidensk. Meddel. Kopenhagen. 126:317-322.

Commercial Fish. Review 1963. Nigeria: Imports of certain fishery products 1961 and Jan.-October 1962. Bureau of Comm. Fish. U.S. Dept. of Interior, Washington, 25(6):83-84.

Copley, Hugh. 1952. The game fishes of Africa. H.F. and G. Witherly Ltd., London. 276 pp.

_____ 1958. Common freshwater fishes of East Africa. H.F. and G. Witherly Ltd., London. 172 pp.

Daget, J. 1954. Les poissons du Niger supérieur. IFAN. Dakar. 391 pp.

Fish, G. R. 1955. The food of Tilapia in East Africa. Uganda Journal. 19(1):85-89.

Fowler, H. W. 1920. The fishes of U.S. Eclipse expedition to West Africa. Proc. U.S. Nat. Mus. Vol. 56:195-292.

Graham, M. 1929. The Victoria Nyasa and its fisheries. Crown Agents for the Colonies.

Greenwood, P. H. 1956. The fishes of Uganda - II. Uganda Jour. 20(2):129-165.

Gudger, E.W. 1944. The giant freshwater perch of Africa. Scientific monthly, New York. Vol. 58:269-272.

Gunther, A. 1859-70. Catalogue of fishes in the British Museum (Natural History) London. Vols. I-VIII.

_____ 1896. Report on a collection of reptiles and fishes made by Miss M.H. Kingsley during her travels on the Ogowe River and in Old Calabar. Ann. Mag. Nat. Hist. 6(17):261-285.

Harrington, N. R. 1899. The life habits of Polypterus. American Naturalist, Vol. 33:721-728.

Hickling, C.F. 1961. Tropical inland fisheries. John Wiley & Sons, New York. 287 pp.

Hida, Thomas, Joseph R. Harada and Joseph E. King. 1962. Rearing Tilapia for tuna bait. U.S. Fish. & Wildlife Service., Fish. Bul. 198(61):1-20.

Holden, M.J. 1963. The population of fish in dry season pools of the River Sokoto. Colonial Fish. Pub. No. 19: 1-58.

Hubbs, Carl L. 1939. Hepsetus to replace Hydrocyonoides and Sarcodaces for a genus of African fishes. Copeia. 3:168.

Irvine, F.R. 1947. Fishes and fisheries of the Gold Coast. Crown Agents for the Colonies. 352 pp.

Johnel, A.G. 1954. Notes on fishes from Gambia River. Ark. Zool. 6(17):327-411.

Kahsbauer, Paul. 1962. Beitrag zur kenntnis der fischfauna von Nigeria. Ann. Naturhist. Mus. Wein. 65:139-165.

Longhurst, A.R. 1961. Report on the fisheries of Nigeria. Fed. Fish.Serv. Mins. of Econ. Dev. Lagos, 53 pp.

Maclaren, P.I.R. 1950. Fish and fisheries of lower Ogun River. Nigerian Field. 15(4):177-181.

_____ 1953. Game fishing in Nigeria. Nigerian field. XVIII(3):110-129.

_____ 1954. Nigerian fishes and their palatability. Nigerian field XIX(1):4-15.

_____ 1955. Nigerian fishing gear. Nigerian field. 10(4):148-159.

McCormick, L.J. 1949. Niles perch. In game fishes of the world. Harper and Brothers., New York, 366-372.

Murray, A. 1854. On electric fishes, with description of a new species from Old Calabar. Proc. Phys. Soc. Edinb. Vol. 1:20-21.

Myers, G.S. 1933. The genera of Indo-Malayan and African cyprinodont fishes. Cpoeia. No. 3:180-185.

_____ 1950. On the characid fishes called Hydrocynus and Hydrocyon by Cuvier. Proc. Calif. Zool. Club. 1(9):45-47.

National Development Plan: 1962-68. Fed. Mins. of Econ. Dev., Lagos. 352 pp.

_____ Progress Report, 1964. Fed. Mins. Econ. Dev. Lagos, 149-150.

Nawar, G. and E.G. Yoakim. 1963. A study of the fecundity of the Nile characid, Alestes baramose (Joanis, 1835). Ann. Mag. Nat. Hist. 13(6):157-159.

Nichols, John T. and Ludlow Griscom. 1917. Freshwater fishes of the Congo Basin obtained by the American Museum Congo expedition 1909-1915. Bul. Amer. Mus. Nat. Hist., Vol. 37:653-756.

Nigeria Trade Jour. 1959. Stock-fish - Review of Trade. Federal Mins. of Econ. Dev. Lagos. 7(3):98-99.

_____ 1961. Trade statistics - Imports by commodities. Federal Mins. of Econ. Dev. Lagos 9(2):74.

_____ 1963. Developing Nigeria's fisheries. Federal Mins. of Econ. Dev. Lagos. 11(2):53-58.

_____ 1965. Trade statistics - Imports by commodities. Fed. Mins. of Econ. Dev. Lagos. 13(2):84.

Nikil'ski, G.V. 1961. Special ichthyology. National Science Foundation. Washington, D.C., 538 pp.

Poll, Max. 1957. Les genres des poissons d'eau douce de L'Afrique. Bruxelles. 191 pp.

Report on fishery investigation 1942-48: Nigeria. Government Printer, Lagos. 63 pp.

Sanders, Afred. 1882. Contributions to the anatomy of the central nervous system in vertebrate animals. Trans. Phil. Roy. Soc. London, 173(3):927-960.

Schultz, L.P. 1942. The freshwater fishes of Liberia. Proc. U.S. Nat. Mus. 92(3152):301-348.

Smith, J.A. 1867. Description of Calamoichthys, a new genus of ganoid fish from Old Calabar, West Africa. Trans. Roy. Soc. London. Vol. 24:457-479.

Springer, Victor G. and John Finucane. 1963. The African cichlid fish Tilapia heudeloti Dumeril, in commercial fish catch of Florida. Trans. Am. Fish. Soc. 92(3): 317-318.

Sterba, Gunther. 1963. Freshwater fishes of the world. The Viking Press, New York, 877 pp.

Svensson, G. 1933. Freshwater fishes from the Gambia River. K. Svenska Vet. Akad. Handl. 12(3):1-102.

Welman, J.B. 1948. Preliminary survey of the freshwater fisheries of Nigeria. Govt. Printer, Lagos. 71 pp.

Worthington, E.B. 1929. A report on the fishery survey of Lakes Albert and Kyoga. Crown agents for the Colonies.

_____ 1936. The fishes of Lake Tankanyika. Proc. Zool. Soc. London, Part 3-4:1061-1112.

Year book of fishery statistics 1963, Vol. 17: Imports and exports by countries, F.A.O. Fish. Statistics, b-16.

APPENDIX 1

Distribution of families and genera for freshwater fishes in Africa and Nigeria

Family & Genus	World range distribution	Number of species in Africa	Number of species in Nigeria
Polypteridae	Tropical Africa		
Polypterus		12	4
Calamoichthys		1	1
Lepidosirenidae	Africa & S.America		
Protopterus	Africa	3	1
Clupeidae	World wide		
Pellonula	Trop. Africa	6	1
Microthrissa		2	-
Phractolaemidae	West Africa		
Phractolaemus		1	1
Pantodontidae	Trop. W. Africa		
Pantodon		1	1
Osteoglossidae	Africa, S.America & Australia		
Heterotis		1	1
Notopteridae	Trop. Africa, and S.E. Asia		
Notopterus		1	1
Xenomystus		1	1
Mormyridae	Tropical Africa		
Mormyrops		19	2
Petrocephalus		13	5
Marcusenius		30	6
Gnathonemus		33	9

Family & Genus	World range distribution	Number of species in Africa	Number of species in Nigeria
Mormyrus		16	4
Isichthys		1	1
Hyperopisus		1	1
Stomatorhinus		6	-
Gymnarchidae	Trop. Africa		
Gymnarchus		1	1
Characidae	Trop. Africa, Cent. & S. America		
Alestes		31	9
Arnoldichthys		1	1
Hepsetus		1	1
Hydrocynus		5	3
Micralestes		7	1
Petersius		15	-
Citharinidae	Tropical Africa		
Citharidium		1	1
Citharinus		5	2
Distichodus		19	3
Nannaethiops		3	1
Nannocharax		11	1
Ichthyoboridae	Tropical Africa		
Phago		3	2
Ichthyoborus		1	1

Family & Genus	World range distribution	Number of species in Africa	Number of species in Nigeria
Cyprinidae	World wide		
Labeo	Africa & E.Asia	51	6
Barbus	Africa, Asia & Europe	149	9
Barilius	Africa, China & S.E. Asia	22	2
Garra			2
Chelaethiops		2	1
Discognathus	Africa & S.Asia	8	-
Ariidae			
Arius		6	1
Clariidae	Africa & S. Asia		
Clarias		39	6
Heterobranchus		3	3
Gymnallabes		2	1
Schilbeidae	Africa & Asia		
Schilbe		4	1
Eutropius		16	4
Parailia		2	1
Physailia		3	1
Ansorgi		1	-

Family & Genus	World range distribution	Number of species in Africa	Number of species in Nigeria
Bagridae	Africa, Asia, Japan & Malaya		
Bagrus		7	3
Chrysichthys		26	4
Clarotes		3	1
Auchenoglanis		10	2
Mochocidae	Africa		
Synodontis		63	21
Microsynodontis		2	-
Mochocus		4	-
Amphiliidae			
Phractura		7	1
Amphilius		14	-
Paraphractura		1	-
Malapteruridae	West Africa		
Malapterurus		1	1
Synbranchidae	Africa, S.America, S. Asia		
Synbranchus		1	1
Syngnathidae	World wide		
Syngnathus			1

Family & Genus	World range distribution	Number of species in Africa	Number of species in Nigeria
Cyprinodontidae	World wide except Australia		
Aphyosemion		19	10
Aplocheilichthys		1	1
Michropanchax			4
Epiplatys			11
Procatopus		1	1
Centropomidae	Africa		
Lates		3	1
Luciolates		2	-
Nandidae	Africa, S. & Central America		
Polycentropsis		1	1
Cichlidae	Africa, S. & Central America		
Tilapia		96	7
Pelmatochromis		39	9
Hemichromis		2	2
Gobiocichla		1	-
Eleotridae	World wide		
Eleotris		14	5
Kribia			-

Family & Genus	World range distribution	Number of species in Africa	Number of species in Nigeria
Gobiidae	World wide		
Gobius		21	6
Anabantidae	Africa, South East Asia		
Ctenopoma		16	4
Ophiocephalidae	Africa, S. and S.E. Asia		
Ophiocephalus		3	2
Mastacembelidae	Africa & South Asia		
Mastacembelus		34	2
Tetraodontidae	Africa, Australia and Asia		
Tetraodon		4	3

APPENDIX 2

Check list of freshwater species of Nigeria

Check List of Freshwater Species of Nigeria

Order Polypterifomes

Family - Polypteridae (polypterids or bichirs)

Polypterus bichir Geoff.

Polypterus senegalus Cuvier

Polypterus endlicheri Heckel

Polypterus lapradii Stdr.

Calamoichthys calabaricus Smith

Order Dipteriformes

Family - Lepidosirenidae (lung fishes)

Protopterus annectens Owen

Order Clupeiformes (Isospondyli)

Family - Clupeidae (herrings)

Pellonula vorax Gunther

Family - Phractolaemidae

Phractolaemus ansorgi Blgr.

Family - Pantodontidae (butterfly fishes)

Pantodon buchholzi Peters

Family - Osteoglossidae (osteoglossids)

Heterotis niloticus Cuvier

Family - Notopteridae (featherbacks)

Notopterus afer Gunther

Xenomystus nigri Gunther

Order Mormyriformes

Family Mormyridae (mormyrids)

Mormyrops deliciosus Leach

Mormyrops engystoma Blgr.

Petrocephalus bane Lacep.

Petrocephalus bovei C & V.

Petrocephalus sauvagi Blgr.

Petrocephalus simus Sauvage

Marcusenius kingsleyae Gunther

Marcusenius brachystius Gill

Marcusenius longianalis Blgr.

Marcusenius psittacus Blgr.

Marcusenius adspersus Gunther

Marcusenius budgetti Blgr.

Gnathonemus petersii Gunther

Gnathonemus stanleyanus Blgr.

Gnathonemus niger Gunther

Gnathonemus cyprinoides Linn.

Gnathonemus senegalensis Blgr.

Ganthonemus gilli Blgr.

Gnathonemus pictus Marcus

Gnathonemus tamandua Gunther

Gnathonemus abadii Blgr.

Mormyrus hasselquistii C & V.

Mormyrus macrophthalmus Gunther

Mormyrus anchiete Guimaraes

Mormyrus rume C & V.

Isichthys henryi Blgr.

Hyperopisus bebe Gunther

Hyperopisus tenuicauda Pellegr

Family - Gymnarchidae

Gymnarchus niloticus Cuvier

Order Cypriniformes (Ostariophysi)

Family - Characidae (characins)

Alestes chaperi Sauvage

Alestes macrolepidotus C & V.

Alestes leuciscus Gunther

Alestes longipinnis Stdr.

Alestes grandisquamis Blgr.

Alestes dentex C & V.

Alestes nurse Ruppell

Alestes brevis Blgr.

Alestes baremose Joann.

Arnoldichthys spilopterus Blgr.

Hepsetus odoe Bloch

Hydrocynus lineatus Bleeker

Hydrocynus forskahlii Cuvier

Hydrocynus brevis Gunther

Micralestes acutidens Peters

Family - Citharidae (moon fishes)

Citharidium ansorgi Blgr.

Citharinus latus M & T

Citharinus citharus Geoff.

Distichodus brevipinnis Gunther

Distichodus rostratus Gunther

Distichodus engycephalus Gunther

Nannaethiops unitaeniatus Gunther

Nannocharax ansorgi Blgr.

Family - Ichthyoboridae

Phago loricatus Gunther

Phago maculatus Ahl.

Ichthyoborus besse Gunther

Family - Cyprinidae (carps and barbels)

Labeo senegalensis C & V.

Labeo coubie Rupell

Labeo chariensis Pellegr.

Labeo brachypoma Gunther

Labeo ogunensis

Barbus negeriensis Blgr.

Barbus occidentalis Blgr.

Barbus lagoensis Guther

Barbus chlorotaenia Blgr.

Barbus callipterus Blgr.

Barbus oboinensis

Barbus ablabes Bleeker

Barbus trispilus Bleeker

Barbus camptacanthus Bleeker

Barbus franciscis Blgr.

Barilius niloticus Joann.

Barilius loati Blgr.

Chelaethiops bibie

Garra trewawasi Monod

Garra waterloti Pellegr.

Family - Ariidae (sea catfishes)

Arius gigas Blgr.

Family - Clariidae (labyrinthic catfishes)

Clarias lazera C & V.

Clarias laticeps Rupell

Clarias angolensis Stdr.

Clarias anguilaris Linn.

Clarias dumerilii Stdr.

Clarias senegalensis C & V.

Heterobranchus longifillis C & V.

Heterobranchus bidorsalis Geoff.

Heterobranchus isotopterus Bleeker

Gymnallabes typus Gunther

Family - Schilbeidae (butterfishes)

Schilbe mystus Linn.

Eutropius congolensis Leach

Eutropius niloticus Ruppell

Eutropius adansoni C & V.

Eutropius mentalis Blgr.

Parailia congica Blgr.

Physailia pellucida Blgr.

Family - Bagridae (Bagrid catfishes)

Bagrus bayad Forskal

Bagrus domac Forskal

Bagrus filamentosus Pellegr.

Chrysichthys furcatus Gunther

Chrysichthys auratus Geoff.

Chrysichthys nigrodititatus Lacep.

Chrysichthys walkeri Gunther

Clarotes laticeps Gunther

Auchenoglanis occidentalis C & V.

Auchenoglanis biscutatus Geoff.

Family - Mochocidae

Synodontis serratus Ruppell

Synodontis robianus Smith

Synodontis melanopterus Blgr.

Synodontis membranaceous Geoff.

Synodontis filamentosus Blgr.

Synodontis sorex Gunther

Synodontis budgetti Blgr.

Synodontis obesus Blgr.

Synodontis violacea

Synodontis omias Gunther

Synodontis schall Bloch

Synodontis ocelifer Blgr.

Synodotis guttatus Gunther

Syndontis labeo Gunther

Synodontis xiphias Gunther

Synodontis batensoda Ruppell

Synodontis resupinatus Blgr.

Synodontis clarias Linn.

Synodontis courteti Pellegr.

Synodontis nigrita C & V.

Synodontis gambiensis Gunther*

---

*Boulenger (1911) described this species as separate from Synodontis schall, but Daget (1954) feels that the two species are the same.

Family - Amphiliidae

Phractura ansorgi Blgr.

Family - Malapteruridae (electric catfish)

Malapterurus electricus Gmelin

Order Synbranchiformes

Family - Synbranchidae (swamp eels)

Synbranchus afer Bloch

Order Syngnathiformes

Family - Syngnathidae (pipefishes and sea horses)

Syngnathus pulchellus

Order Cyprinodontiformes (Michrocyprini)

Family - Cyprinodontidae (cyprinidonts)

Aphyosemion filamentosum Meinken

Aphyosemion gardneri Blgr.

Aphyosemion gularis Blgr.

Aphyosemion sjoestedti Lonnb.

Aphyosemion loennbergii Blgr.

Aphyosemion multicolor Meinken

Aphyosemion oeseri Ahl.

Aphyosemion arnoldi Blgr.

Aphyosemion bivittatum Lonnb.

Aphyosemion calabaricus Ahl.

Aphyosemion nigerianum Myers

Micropanchax flavipannis Meinken

Micropanchax macrurus Blgr.

Micropanchax loati Blgr.

Micropanchax macrophthalmus Meiken

Aplocheilichthys spilauchena Dumeril

Epiplatys dorsali Ahl.

Epiplatys fasciolatus Gunther

Epiplatys grahami Blgr.

Epiplatys cameronensis Blgr.

Epiplatys marmoi Stdr.

Epiplatys longiventralis Blgr.

Epiplatys sexfasciatus Gill

Epiplatys macrostigma Blgr.

Epiplatys spilauchen Dumeril

Epiplatys senegalensis Stdr.

Procatopus nototaenia Blgr.

Order Perciformes (Percomorphi)

Family - Centropomidae (Nile perches)

Lates niloticus (Niger perch)

Family - Nandidae

Polycentropsis abbreviata Blgr.

Family - Cichlidae (cichlids)

Tilapia nilotica Linn.

Tilapia galilaea Artedi

Tilapia mariae Blgr.

Tilapia malanopleura Dumeril

Tilapia zillii Gervais

Tilapia heudeloti Dumeril

Tilapia macrocephala Bleeker

Pelmatochromis guntheri Sauvage

Pelmatochromis kingsleyae Blgr.

Pelmatochromis kribensis Blgr.

Pelmatochromis taeniatus Blgr.

Pelmatochromis pulcher Blgr.

Pelmatochromis arnoldi Blgr.

Pelmatochromis annectens Blgr.

Pelmatochromis intermedius Blgr.

Pelmatochromis ansorgi Blgr.

Hemichromis fasciatus Peters

Hemichromis bimaculatus Gill

Family - Eleotridae (eleotrids)

Eleotris lebretoni Stdr.

Eleotris pleurops Blgr.

Eleotris africana Stdr.

Eleotris vittata Dumeril

Eleotris nana Blgr.

Family - Gobiidae (gobies)

Gobius maindroni Sauvage

Gobius guineensis Peters Var. aenofuscus Blgr.

Gobius soporator C & V.

Gobius nigri Gunther

Gobius schlegelii Gunther

Gobius occidentalis Blgr.

Family - Anabantidae (climbing perches)

Ctenopoma kingsleyae Gunther

Ctenopoma nigropannosus Reichen

Ctenopoma argentoventer Schreitmuller

Ctenopoma petherici Gunther

Family - Ohiocephalidae (snake-heads) = Channidae

Ophiocephalus africanus Stdr.

Ophiocephalus obscurus Gunther

Order Mastacembeliformes

Family - Mastacembelidae = (Opisthomi) - spiny eels

Mastacembelus longicauda Blgr.

Mastacembelus loennbergii Blgr.

Order Tetraodontiformes

Family - Tetraodontidae (puffers)

Tetraodon fahaka Bennett

Tetraodon pustulatus Murray

Tetraodon lineatus Linn.

FIGURES

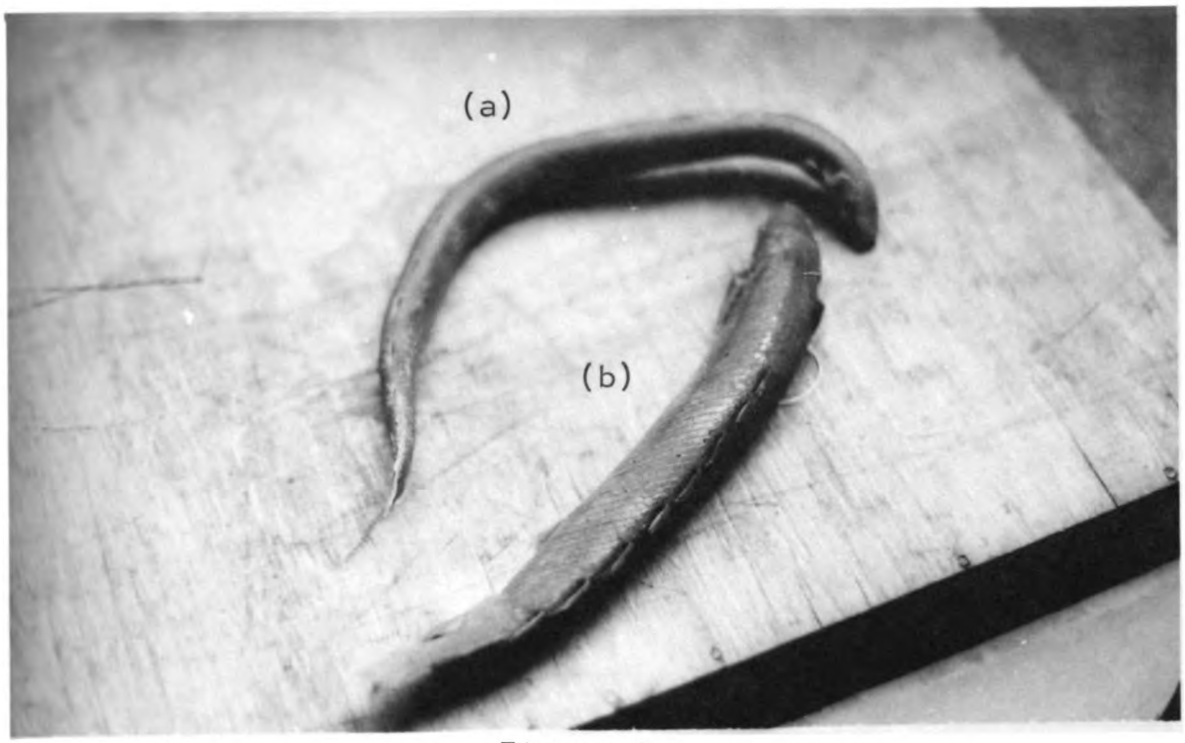

Figure 2.

a. Calamoichthys calabaricus
b. Polypterus senegalus

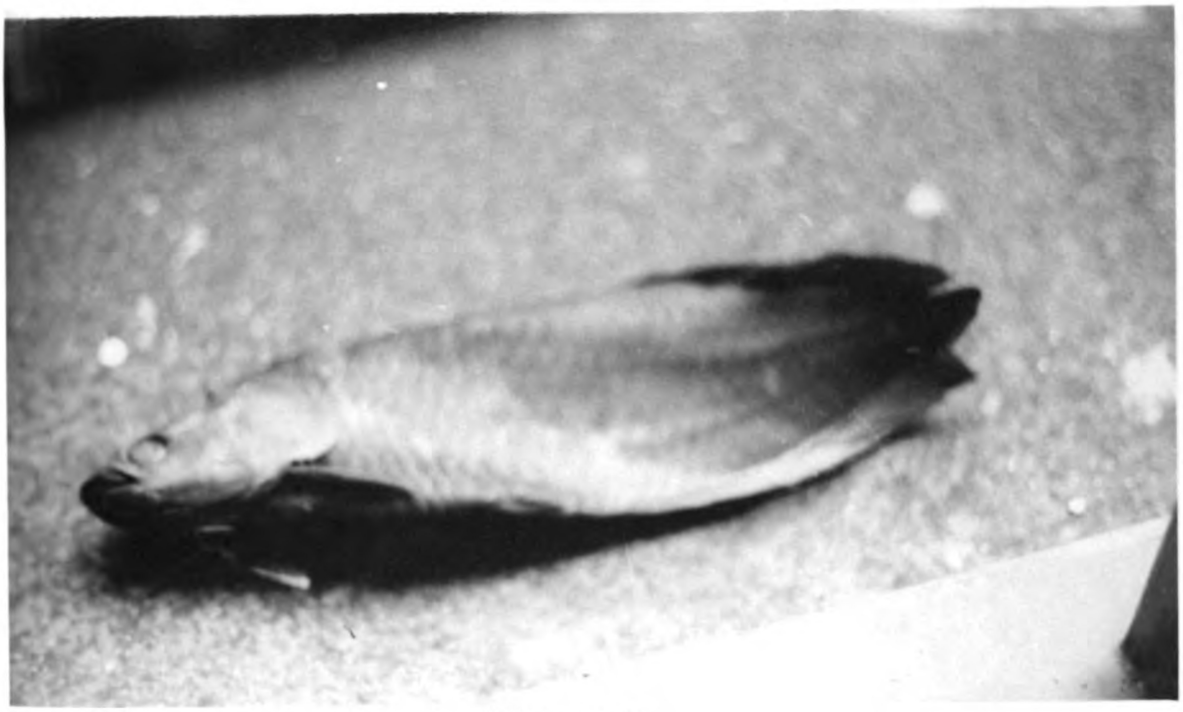

Figure 3.

Heterotis niloticus

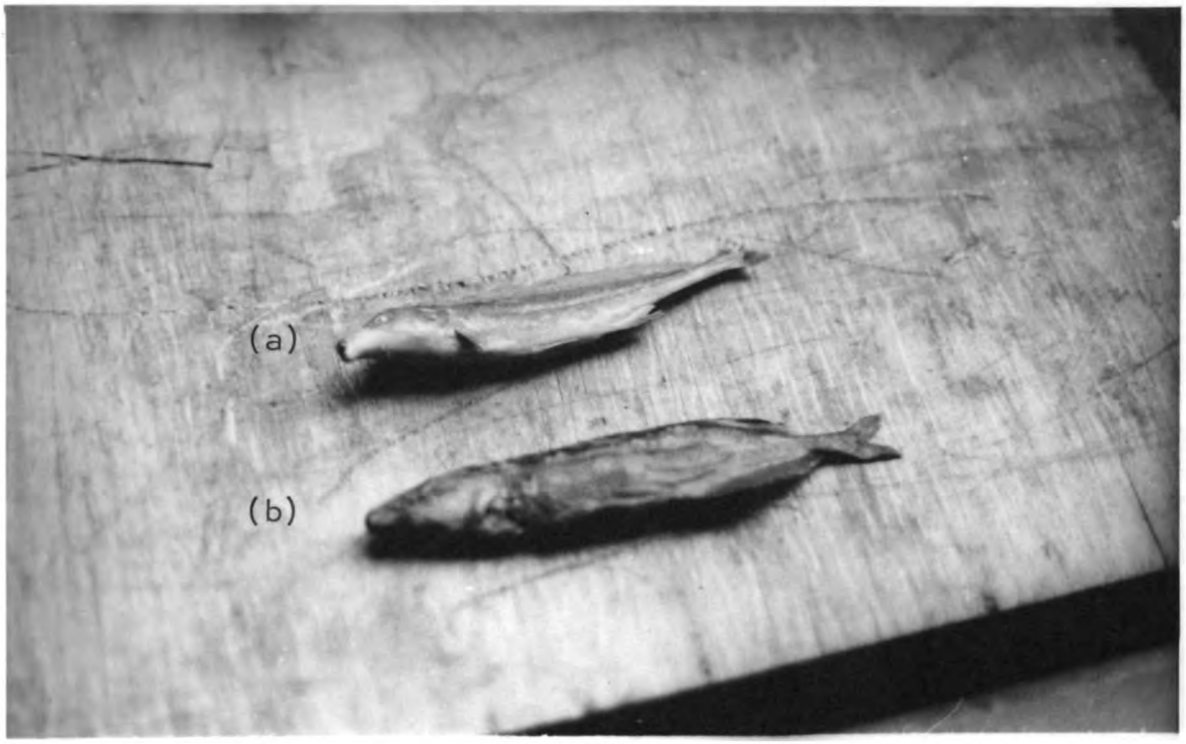

Figure 4.

a. Mormyrus rume
b. Mormyrops deliciosus

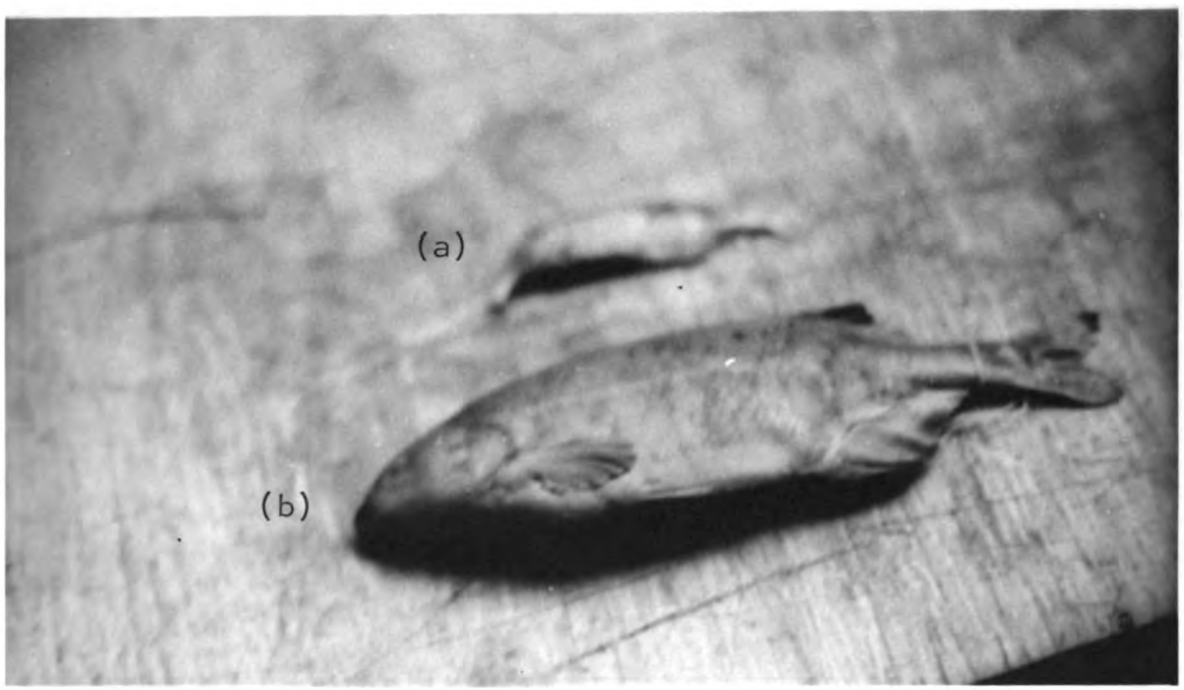

Figure 5.

a. Gnathonemus tamandua
b. Gnathonemus macrolepidotus

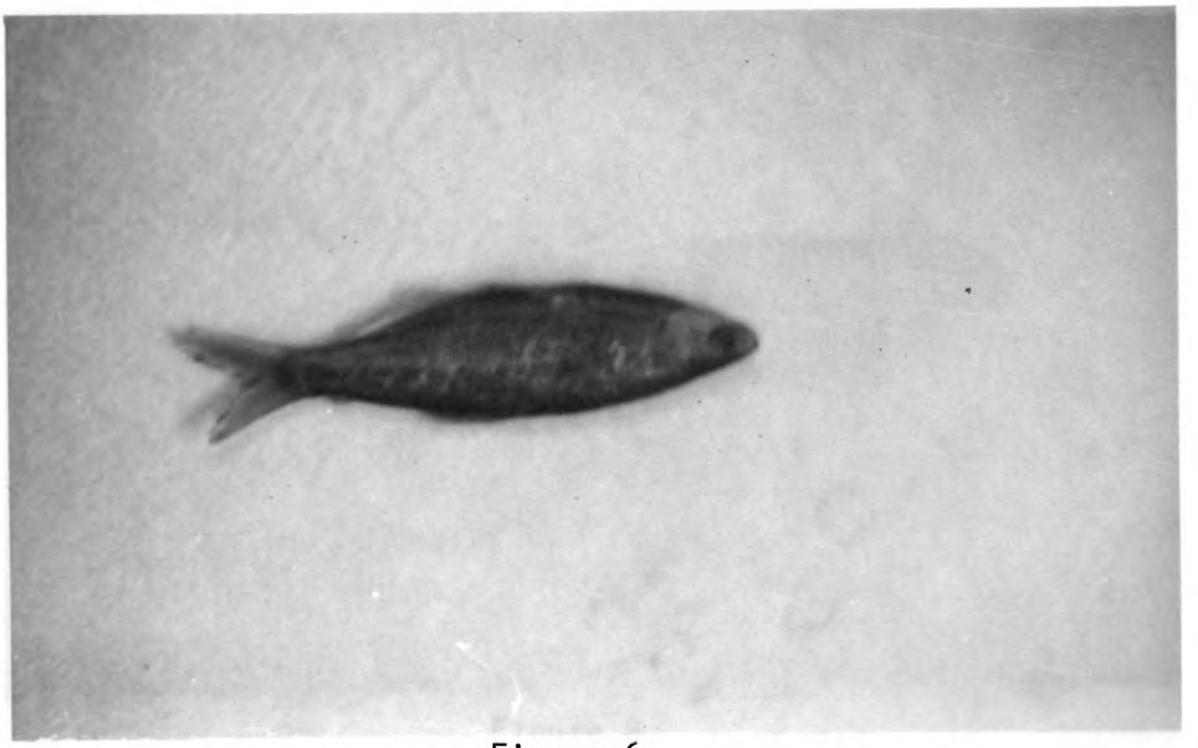

Figure 6.

Alestes dentex

Figure 7.

Alestes nurse

Figure 8.

Hepsetus odoe

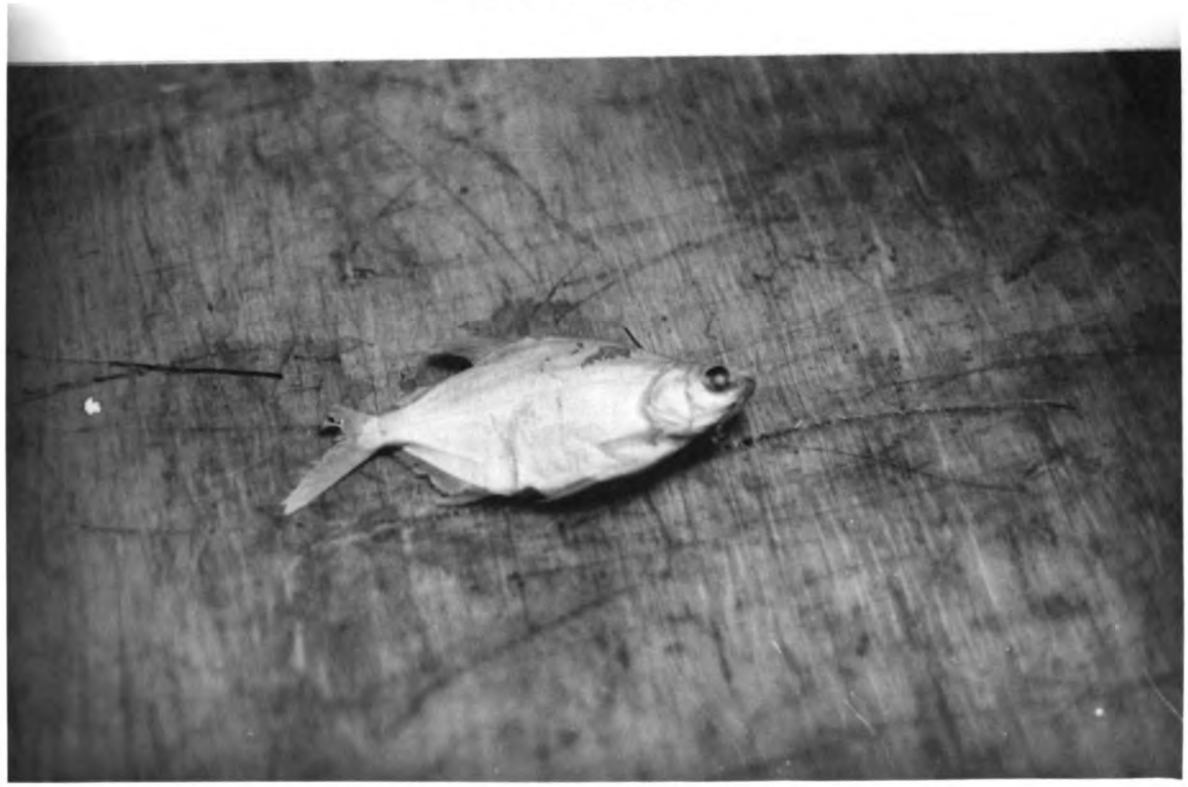

Figure 9.

Citharinus citharus

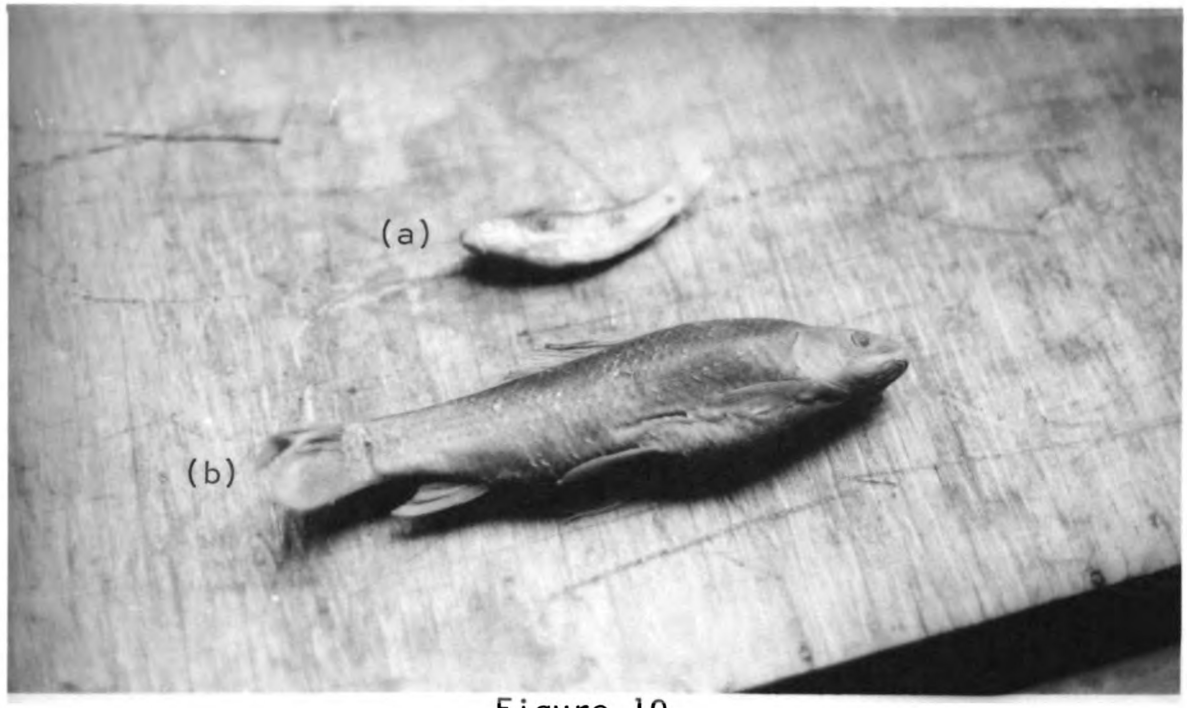

Figure 10.

a. Barbus trispilus
b. Labeo coubie

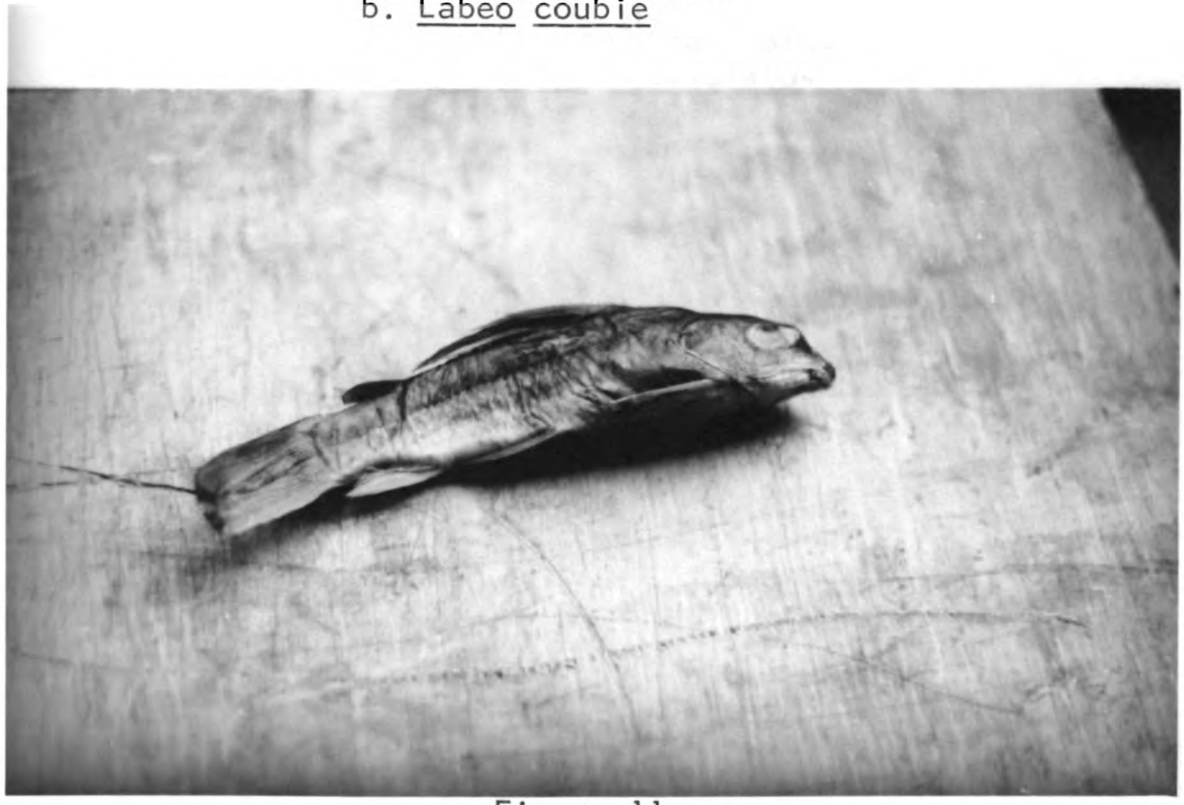

Figure 11.

Chrysichthys nigrodigitatus

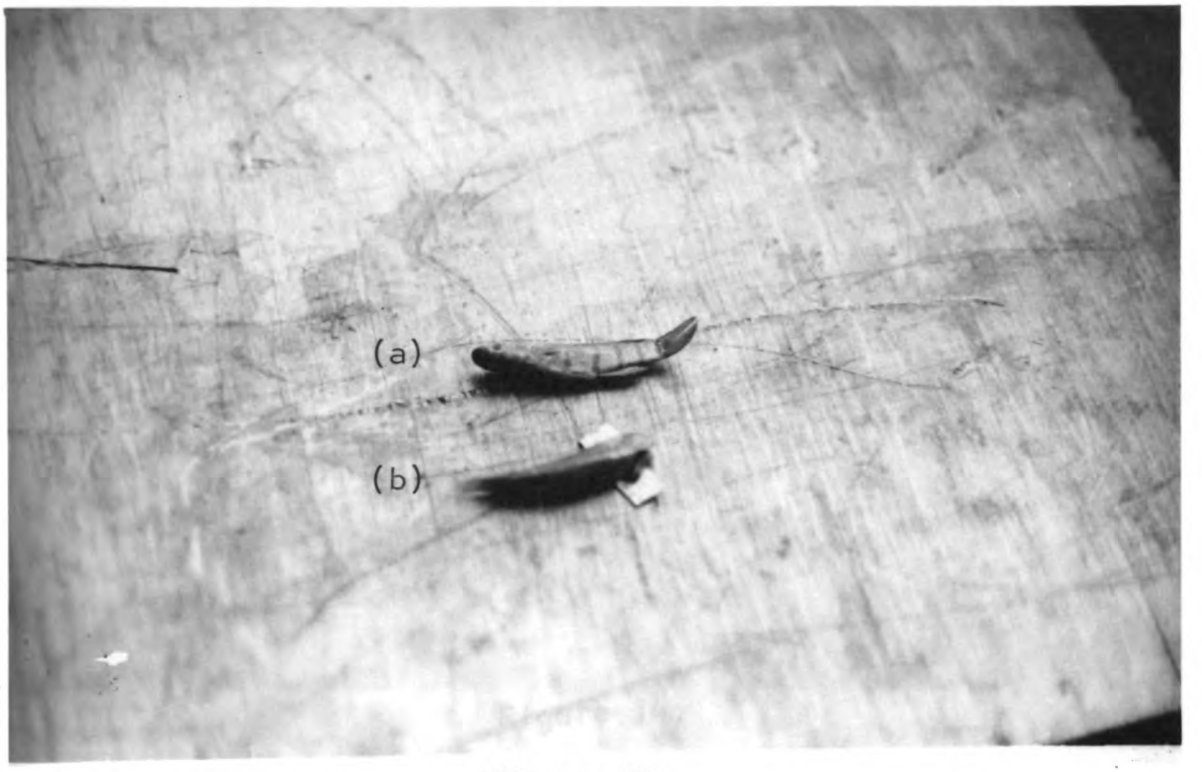

Figure 12.

a. Epiplatys sexfasciatus
b. Epiplatys fasciolatus

Figure 13.

Tilapia nilotica

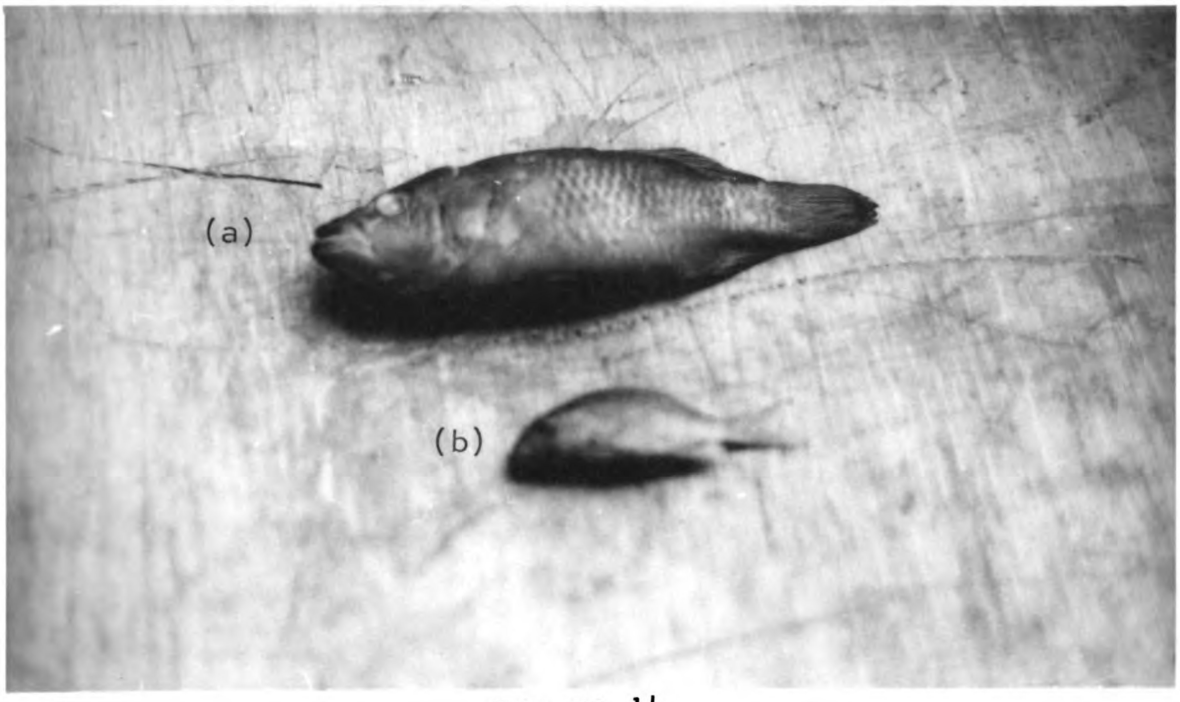

Figure 14.

a. Pelmatochromis intermedius
b. Hemichromis bimaculatus

Figure 15.

Tetraodon fahaka