MADRAS GOVERNMENT MUSEUM

GUIDE

TO THE

FISH GALLERY

BY

S.T. SATYAMURTI, M.A., D.SC., F.Z.S.

Director of Museums, Government Museum, Madras.

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S. RANGAMANI, I.A.S.
Principal Commissioner of Museums

Government Museum,
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PREFACE

The Government Museum, Chennai, had started acquiring zoological specimens from 1856 onwards. At present, as the fish gallery consists of South Indian fauna of fishes, a student or a layman gets a complete picture of South Indian fauna of fishes. Apart from collection, preservation, display arrangement and interpretation of the exhibits in the galleries, a great deal of efforts had been concentrated on various other fields of museum activity, such as the building up of reserve collection for faunistic surveys for research and reference purposes, the publication of the results of these researches in a valuable series of guide books and bulletins. It is believed that this guide book will meet all the needs of students and other visitors and prove to be useful to them.

Chennai - 8.
11.02.1999

(S. Rangamani, I.A.S.)

GUIDE TO THE FISH GALLERY

INTRODUCTION

The Fish Gallery of the Madras Government Museum is accommodated in a large, spacious hall on the first floor of the Zoological Galleries in the rear building, immediately adjoining the Invertebrate Gallery and directly above the Mammal Gallery. It can be reached either through the central or the two side passages leading from the Invertebrate Gallery. On entering the Fish Gallery, the huge specimen of the Whale Shark, suspended from the ceiling in the centre, the two large mural paintings on the walls depicting some of the oceanic fishes in their native haunts and the other large specimens of sharks, swordfish, etc., mounted on the wall will arrest the attention of the visitors.

The specimens exhibited in the Fish Gallery consist mainly of stuffed, dry-preserved ones, a few of which are coloured as far as possible to resemble the natural colours of the living fishes, a few specimens of plaster or wax casts and a few original specimens preserved in spirit as wet mounts in jars in a vertical show case in the right hand corner at the farther end of the Gallery. However, since most of the stuffed specimens as well as the spirit-preserved specimens of fishes have lost their natural colour, brief notes on their real colours during their living condition are included wherever possible in the present Guide book to help the visitors to have some idea of the original colours of these fishes.

The exhibited collection in this Gallery also includes a number of fully articulated skeletons of selected species of fishes (both cartilaginous and bony fishes), a few commercial by-products derived from fishes, such as fish oils, isinglass and fish manure, a selected series of the common edible fishes of the Madras Coast, some introductory exhibits to illustrate the external and internal structure of bony and cartilaginous fishes and a few miscellaneous exhibits such as a walking stick made of shark vertebrae, a log of wood pierced and split into two by the "sword" of a sword fish, etc., pertaining to fishes in general.

The majority of the specimens are arranged in their strict systematic sequence (as followed by Day in his latest edition of the monumental work on Fishes of India) and displayed in table-like glass cases with sloping tops and represent in a fairly complete manner the fish fauna of the South Indian seas, especially of the Madras Coast. Some specimens, which, on account of their large and unweildy size, could not be fitted in their proper positions into the regular systematic series, are exhibited as isolated specimens on the walls or in separate, specially large show cases as in the case of the Giant Perch, the Mahseer, the Eagle Ray, etc., or suspended from the ceiling, as in the case of the Whale Shark. Specimens preserved in alcohol are also exhibited separately in a vertical case

in the corner, for the sake of convenience, as there are practical difficulties in displaying them in their proper systematic locations in the sloping show cases among the general series of stuffed and dry-mounted specimens of fishes, which, however, form the bulk of the exhibited collections in this gallery, and which, by themselves, help to present a fairly complete picture of the piscine fauna of the South Indian waters.

In the present Guide book an attempt has been made to give a concise account of the salient features of the various main groups of fishes met with on our shores, together with brief notes on their living colours, habits and economic importance, if any, and incidentally, it is hoped that the present hand-book will serve as a useful, concise, popular introduction to a study of South Indian fishes.

Fishes constitute a large and important class of vertebrate animals. Their most characteristic feature is that they are almost exclusively adapted to a life in water, the majority of them being elongated and " streamlined " for rapid progression in water. They have their extremities modified into specialized appendages known as fins. They breathe by means of gills which are specialized respiratory organs adapted for breathing air dissolved in the water. They are cold-blooded animals with a heart consisting of only two chambers. The bodies of most fishes are covered by scales which may sometimes be modified to form hard, osseous plates.

Fishes mostly live in the sea, but a considerable number of species inhabit freshwaters, estuaries and stretches of brackish water, and a few have accessory respiratory organs which enable them to survive out of water for short periods. Marine fishes may be classified according to their habitat into shore fishes, pelagic fishes and deep sea fishes. Shore fishes usually inhabit coastal waters and live near the surface, while pelagic fishes inhabit the surface waters of the ocean, even far away from the coasts. Deep sea fishes live in the depths of the ocean and possess various peculiar adaptations including luminous organs, to suit the unusual conditions that prevail in the deep sea.

Fishes are divided into two main groups or sub-classes, namely, (1) the Chondropterygii (or Elasmobranchii) which includes the cartilaginous fishes such as the Sharks, Rays and Skates, characterized by the presence of a cartilaginous skeleton, and (2) the Teleostei, which include by far the great majority of living fishes, known as the bony fishes, characterized by the presence of an osseous or bony skeleton.

Besides the nature of the skeleton, the Chondropterygii (Elasmobranchs) may be distinguished from the Teleostei (Bony fishes) by the following characteristic features:—

(1) The gill slits behind the head on the sides are exposed. In bony fishes, they are covered by a gill cover or operculum.

(2) The mouth opens downwards, whereas in a bony fish, it is usually terminal.

(3) The skin is tough and numerous small scales with denticle-like sharp points (placoid scales) are embedded in the skin. These scales become modified into teeth in the mouth. The placoid scales are very different in structure from the flat, overlapping scales of a bony fish.

(4) In the tail of sharks, the backbone is bent upwards and is continued into the upper lobe of the fin (which is much longer than the lower lobe of the fin), while the lower lobe of the fin arises from the lower side of the upturned backbone (heterocercal).

In the case of the bony fishes the tail fin is symmetrical and divided into two equal upper and lower lobes, but the vertebral column stops short at the base of the tail fin, without entering either of the lobes (homocercal).

In the Rays and Skates, the tail degenerates into a whip-like structure in which the backbone tapers to a fine point (leptocercal or leaf-tail).

Typical examples of the above characteristic types of tail fins are exhibited in the case containing introductory exhibits in this Gallery.

(5) The cartilaginous fishes also differ from the bony fishes in their breeding habits. While bony fishes lay small eggs which hatch outside the body of the mother, elasmobranchs generally bring forth their young ones alive or their eggs hatch within the body of the mother. Some elasmobranchs (e.g., some species of sharks) enclose their eggs within horny capsules popularly known as "Mermaid's Purse". Specimens of the horny egg capsules of sharks are also exhibited in one of the Introductory show cases.

INTRODUCTORY EXHIBITS

Two centrally placed sloping show cases right in front of the central passage leading into the Fish Gallery from the Invertebrate Gallery, contain a series of selected introductory exhibits intended to illustrtate the salient feaures in the external and internal structure of the bony and cartilaginous fishes.

The exhibits relating to the first great division of fishes, namely, the cartilagious fishes in these Introductory cases consist, among others, of a stuffed specimen of a shark (Fig. 1) to show the exposed

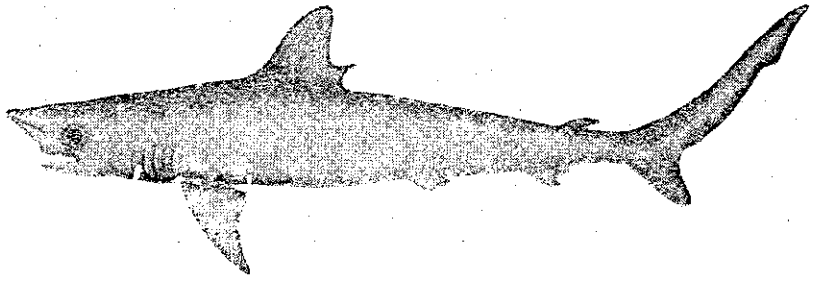

FIG. 1—CARCHARIAS SORRAH : THE COMMON SHARK SHOWING THE EXPOSED GILL SLITS AND HETEROCERCAL TAIL.

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gill slits (which is one of the main features that distinguish cartilaginous fishes from bony fishes), specimens of the vertebrae and jaws of a shark (Fig. 2) showing the formidable rows of strong, recurved

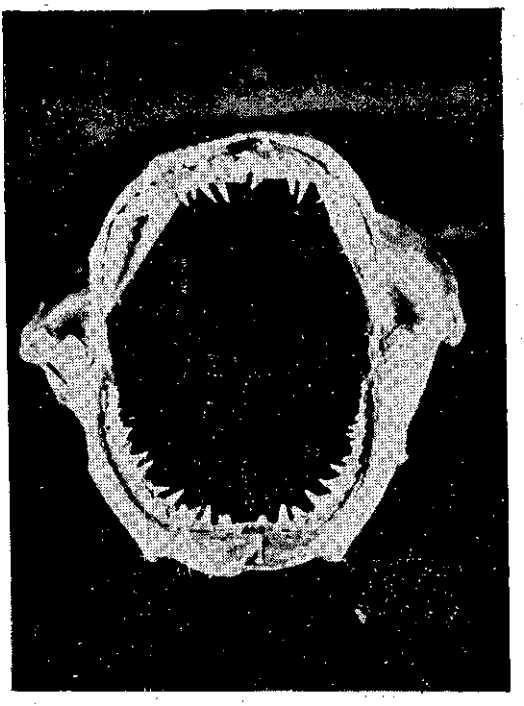

FIG. 2—SKELETON OF THE JAW OF A SHARK SHOWING ROWS OF SHARP, RECURVED TEETH.

teeth which are actually modifications of the placoid scales, the heterocercal caudal fin of sharks, a specimen of the sting ray in which the tail is long and whip-like (leptocercal), the jaw of a Ray fish in which the dentition is in the form of flattened grinding plates (" molars "), the horny egg capsules of sharks, (Fig. 3) and certain

FIG. 3—HORNY EGG CASE OF A SHARK (ELASMOBRANCH FISH).

interesting specimens of elasmobranchs in which the front part of the fish is curiously modified, such as, for instance, the Hammer-headed Shark, *Sphyrna*, in which the head is horizontally expanded

into two lateral lobes so that the outline of the fish resembles a hammer, and a plaster cast of a young specimen of the saw fish (*Pristis*) in which the head is prolonged in front into a rostrum or "saw", bearing a series of processes on either side, which is used as a weapon of offence and defence. An isolated specimen of the "saw" of a saw fish is also exhibited.

The specimens illustrating the general structure of bony fishes, exhibited in these Introductory cases, include an entire mounted and articulated skeleton of a typical bony fish with the principal bones individually labelled, the vertebra, the homocercal tail fin, the otoliths or ear bones and the air bladder of a bony fish and some selected examples of bony fishes in which the fins or the shape and external structure of the body of the fish is peculiarly modified.

Among these exhibits of a general nature relating to the structure of bony fishes, the following are of interest, and deserves special mention:

Air bladder.—In many species of bony fishes there arises a long, cylindrical bag or bladder which lies along the middle of the body, between the backbone and the gut. This is known as the Air Bladder or the Air Vessel (Fig. 4). During development it arises as a small

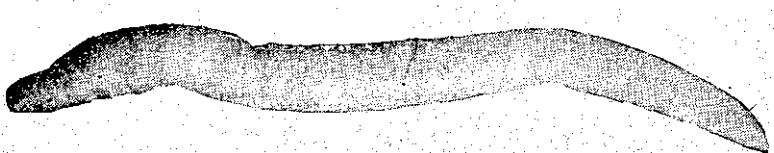

FIG. 4—AIR BLADDER OF A BONY FISH (TELEOST).

bag or pouch from the gullet. It becomes larger and larger, but retains its connection with the gullet by a narrow tube known as the pneumatic duct. In some fishes even this duct disappears, the air bladder thus becoming a separate, closed bag. In the Lung fishes (not represented in India) the air bladder even becomes divided into two bags which function as a pair of lungs.

The air bladder of bony fishes is filled with a mixture of gases. The fish can regulate the quantity of gas according to the depth in which it moves. The bony fishes living at the bottom of the sea have generally a small air bladder, while those which swim in the upper layers of water have a larger air bladder.

The function of the air bladder in general among bony fishes is to regulate the floating capacity of the fish by increasing the size or decreasing it according to the depth, that is to say, it has a hydrostatic function. The gases contained in the air bladder consist of oxygen, nitrogen and a small trace of carbon-dioxide, the same constituents of atmospheric air.

Fins of fishes.—Typical stuffed specimens of a bony fish and a shark are exhibited with all their fins individually labelled to illustrate the terminology of the fins (Fig. 5). Fins are external

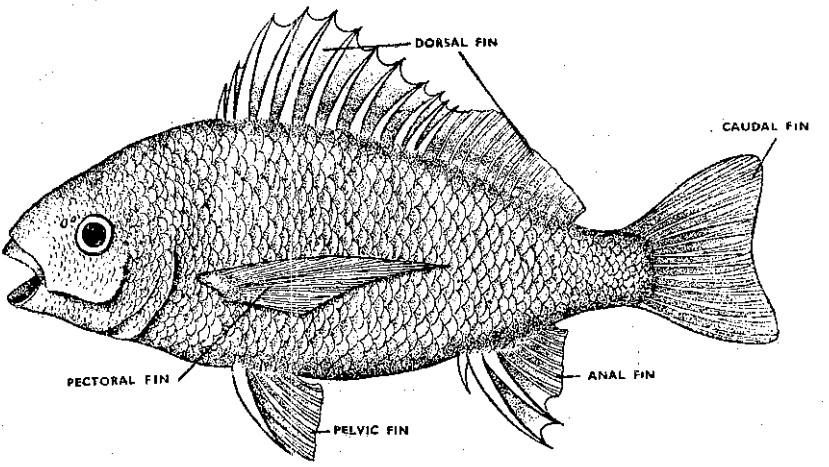

FIG. 5—A TYPICAL BONY FISH WITH THE VARIOUS FINS NAMED.

appendages of fishes which assist them in locomotion. They are of two kinds: median and paired. The median fins include the dorsal, the anal and the tail fins; the paired fins include the pectoral and pelvic fins. The dorsal and anal fins act as balancers while the tail fin, in addition to helping in maintaining stability, also acts as a rudder. The paired fins correspond to the fore and hind limbs of the land vertebrates, but structurally they are different, as they are supported only by a number of spines and rays (fin rays) instead of an actual skeleton of articulated bones as in the limbs of higher vertebrates. The number of spines and rays in each fin are of classificatory value.

Anal fin.—This is a median fin situated on the under side of the fish just behind the vent. In some species, as in the soles, they may be very long, occupying the whole of the under side, or they may be short, as in some of the sardines. The anal fin is mainly used as a keel or balancer.

Dorsal fin.—The dorsal fin is the median fin on the upper side of the body of a fish and is often divided into two portions—the anterior dorsal and the posterior dorsal. In the anterior portion, the rays of the fins are spinous in many fishes such as the perches and the horse-mackerels. The dorsal fin may also sometimes be a long, continuous one from the head to the tail as in the soles, or may be broken up into numerous finlets as in the seer fishes. They mainly serve as balancers preventing the fish from toppling over to one side. In the sole fishes, it serves for locomotion as well, along with the long anal fin.

Caudal fin.—This is the third of the median fins and is situated at the end of the tail. It is made up of only soft rays. The tail fin may be of various shapes. In fast swimmers like the mackerel, the tail fin is deeply forked or crescent-shaped. In the slow-moving Rays and Skates, the tail degenerates into a long, whip-like structure (leptocercal tail).

Three different forms of tail fin are recognized, namely:—

Diphycercal tail.—In this, the supporting part of the backbone is straight and this divides the tail fin into two equal lobes. This type of tail is found at present only in the embryonic stages of fishes and in the Lung fishes (Dipnoi). The vertebral column is continued right up to the tip of the tail in this type of tail fin which was present also in some extinct fishes.

Heterocercal tail fin.—This type is found in the Sharks, in which the backbone is bent upwards and the two lobes of the tail fin are unequal, there being a small lower lobe and a larger and more elongated upper lobe (Fig. 6A).

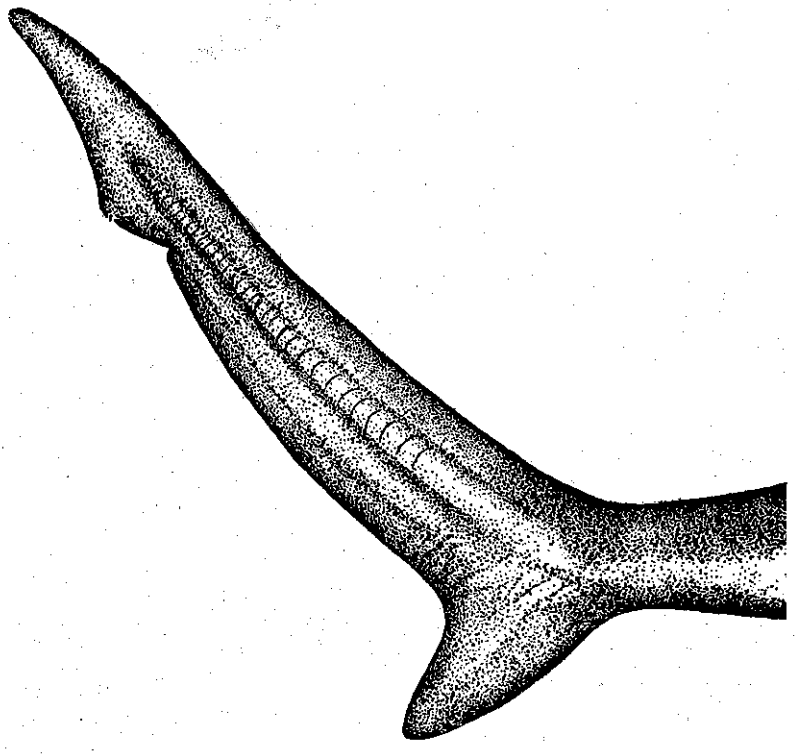

FIG. 6-A—HETEROCERCAL CAUDAL FIN OF A SHARK.

Homocercal tail fin.—This type of tail is found in most bony fishes where the two lobes of the tail fin are equal and symmetrical and the vertebral column stops short at the base of the caudal fin

where it is slightly bent upwards, without actually entering into the structure of the fin (Fig. 6B).

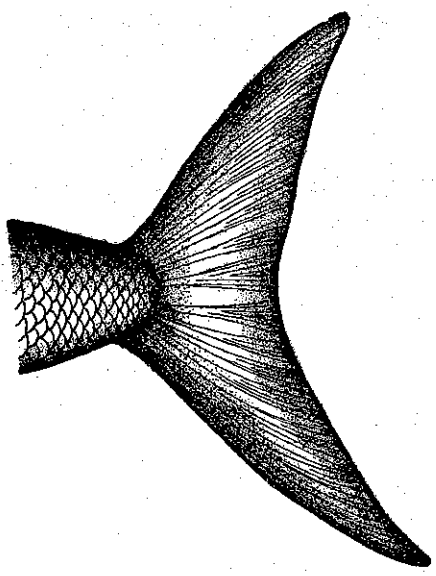

FIG. 6-B—HOMOCERCAL CAUDAL FIN OF A BONY FISH.

Specimens and diagrams to illustrate the different types of tail fin described above are exhibited in these Introductory cases.

Pectoral fins.—These are paired fins situated usually just behind the gill openings. In the cartilaginous fishes (Sharks, etc.), these fins are very large, conspicuous structures, used entirely for steering purposes, while among the bony fishes, these fins are smaller and serve for both steering and propulsion. Forward movements of the body are produced in bony fishes by flapping of the pectoral fins.

In the Skates and Rays, the pectoral fins are much enlarged and are fused in front of the head. The Ray is able to move forwards by the up and down undulating movements of these pectoral fins. These fins are practically the sole organs of locomotion in the Rays and Skates, the attenuated tail being useless for this purpose. The pectoral fins as well as the other fins of a shark are thick structures with plenty of flesh; the fins of the bony fishes, on the other hand, are comparatively thin, with the fin rays clearly visible.

Pelvic fins.—These are paired fins, also known as the ventral fins, and are placed on the under side on either side of the vent. They correspond to the hind limbs of the vertebrates. They seldom serve as organs of propulsion, but they may assist the dorsal and anal fins in balancing the body. In the male Sharks and Rays, paired enlarged appendages known as claspers are usually found associated with the pelvic fins; these probably assist in the transference of milt to the female. The function of the pelvic fins is connected with the maintenance of the fish's equilibrium. They may be compared to the centre board of a yacht. The pelvic fins in some cases form sucking discs which enable the fish to adhere to the rocks and stones.

Scales of fishes.—The integument of fishes is covered by hard, protective structures known as scales. These scales are of various kinds—placoid scales, cycloid scales, ctenoid scales (Fig. 7) and ganoid scales.

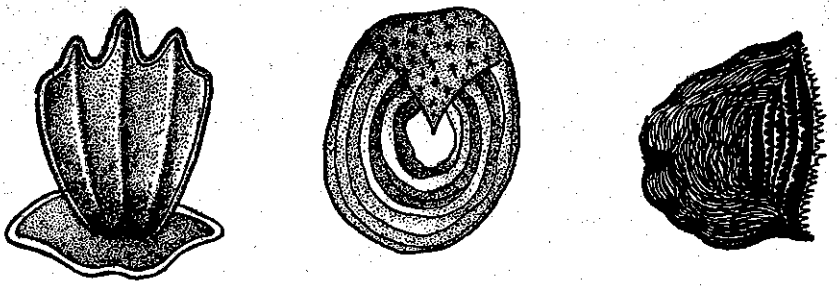

FIG. 7—SCALES OF FISHES :

a. PLACOID SCALE OF A SHARK ;
b. CYCLOID SCALE OF A BONY FISH ;
c. CTENOID SCALE OF A BONY FISH.

Placoid scales are found only in cartilaginous fishes (Sharks and Rays). These scales are in the form of numerous, small, pointed denticles or tooth-like structures turned backwards and arranged in rows. These give the characteristic roughness to the surface of the skins of sharks.

Cycloid and ctenoid scales are rounded, flat, plate-like scales found in bony fishes. In cycloid scales the edges are smooth, whereas ctenoid scales have comb-like, spiny edges.

Ganoid scales are found only in Ganoid fishes (such as the Sturgeon, *Accipenser* sp., which are not represented in India). These scales are thick and covered with bony enamel containing a substance known as *ganoin.*

The arrangement and number of rows of scales on the body of a fish are of great classificatory value. Some selected specimens of the various types of scales and their modifications commonly found in fishes are exhibited in the show case illustrating the integumentary structures of fishes in the Skeleton Gallery downstairs.

Sense organs in fishes.—The senses of smell, taste, touch, sight and hearing are developed to varying degrees in fishes.

In addition to these usual senses, fishes have a peculiar sense organ known as the lateral line sense organ. The lateral line, which usually runs along the middle line of the side, actually consists of a linear series of pores. These pores are situated each on a scale and these communicate with a canal or tube sunk into the skin. There is a group of sensory cells beneath or near each pore and these serve to help the fish in perceiving the minute differences in the pressure of the currents of water. The real function of the lateral line sense organ is still uncertain. Some suppose that it has two or three sensory functions such as feeling and hearing. The canal also appears to be glandular in function and secretes mucus.

The organ of " hearing " in fishes is a more complicated development of the glandular sense organs of the skin. The ear of the typical fish consists of the labyrinth which dilates into three sac-like semi-circular canals which contain one or more large, loose bones, the " ear-stones " or " otoliths ". Like the lateral line system, the hearing organ of fishes serves mainly for balancing and orientating the fish. The " ear-stones " probably serve as dampers on the waves set up in the secretions of the ear by disturbances from outside. By means of these otoliths, it is possible in many cases to determine the age of fishes, if they are not too old. A few specimens of otoliths of a bony fish are exhibited.

Besides the above dry-preserved exhibits in these two sloping cases, illustrating some of the main features in the general external structure of fishes, a spirit-preserved specimen of a dissection of the common European bony fish popularly known as the Pike (*Esox lusciu*s) is also exhibited in a jar in an adjoining bracket to illustrate the internal structure of the anterior part of the body of a typical bony fish.

SUBCLASS CHONDROPTERYGII

(= ELASMOBRANCHII).

(Sharks, Rays and Skates.)

This subclass includes the cartilaginous fishes such as sharks, rays and skates. Besides possessing a cartilaginous skeleton, they are distinguished from the bony fishes by the presence of placoid scales on the skin, exposed gill slits and a heterocercal caudal fin. They also bring forth their young ones alive, or in some of them the eggs undergo their development in the special protective capsules (" Mermaid's purse ").

Sharks and rays are mostly marine, but a few enter into large rivers (e.g., the Gangetic Shark). Most sharks live in the open water, while rays usually live on the sea bottom, but some large species of rays swim at or near the surface of the sea. Some species of sharks and rays in the tropics live habitually in freshwater.

Sharks are active swimmers and are carnivorous (except perhaps, the Whale Shark, which feeds on plankton). They follow shoals of bony fishes such as sardines and mackerels and are highly predaceous. Certain species of sharks seem to prefer feeding on sea snakes. Skates and rays live mostly on crabs and molluscs. Unlike the sharks, they are gregarious and may cause extesive damage to pearl oyster beds if they arrive in large numbers. The largest predaceous sharks may capture animals as large as seals or sea lions.

Sharks are found all along the coasts of India, and some species of sharks such as the Gangetic shark, *Carcharius gangeticus* and the Rayner's Shark (*Galeocerdo rayneri*) are notorious as man-eaters and prove to be a menace to bathers and divers in coastal regions.

Fatalities among bathers in the sea are not uncommon where one or other of these man-eating sharks are known to haunt the area. During the pearl-fisheries in the Gulf of Manaar, pearl divers are frequently attacked by them. Sharks also feed voraciously on corpses of human beings.

The breeding season of sharks and rays extends from September to April when gravid female sharks occur in large numbers in the catches along the coastal areas. They generally seek the shelter of coastal regions, backwaters and estuaries when giving birth to the young ones as these areas are more sheltered and secure than the open sea.

Sharks and rays are of great economic importance. Besides constituting a favourite article of food among all classes of people, especially on the west coast, they are valuable for the shark liver oil which they yield. Their fins are likewise used for soups and are exported in large quantities to China. The skins of some species are used as shagreen and for making sheaths for swords, etc.

Cartilaginous fishes are divided into two main groups or suborders, namely, (1) Selachoidei, comprising sharks, hammer-heads, etc., and (2) Batoidei, including the saw-fishes, plough fishes (or guitar fishes) skates, rays, sting rays, etc.

Sharks belonging to the Selachoidei are distinguished from those of the second group by possessing gill openings at the sides of the neck and in having free pectoral fins not fused with the head, while in several members of the second group (Batoidei), the gill openings are placed on the under side of the disc-like, flattened body, and the pectorals are extensive and joined in front with the head.

A few typical representatives of each of these suborders are exhibited as stuffed specimens in this Gallery, some of the very large ones being mounted exposed on the walls and the others in sloping, glass-topped show cases arranged in their systematic order. Some of the more important among these species are briefly described below, grouped under their respective families.

ORDER PLAGIOSTOMATA

Suborder SELACHOIDEI.

In this group, which includes the sharks, the body is more or less cylindrical, tapering at both ends, and merging behind, gradually into the tail. The gill openings are lateral. Sharks are found in the seas and estuaries of temperate and tropical regions and some species even ascend rivers to considerable distances.

Family CARCHARIIDAE.

The exhibited specimens of this family belong to three species, namely, *Carcharias sorrah, Galeocerdo rayneri* (the Rayner's Shark) and *Sphyrna tudes* (the Hammer-headed Shark).

Carcharias sorrah is one of the common sharks frequenting the shores of the Madras Coast, attaining a length of about 18 inches. It belongs to the large and widely distributed genus of sharks, *Carcharias*, which is distinguished by the longitudinally produced snout and a crescent-shaped mouth placed ventrally. It is closely allied to *Carcharias gangeticus*, the Long-tailed Shark, *C. melanopterus*, the Black-finned Shark and *C. laticaudatus*—a shark commonly seen in the fish markets ("*Pal sorrah*" in Tamil)—all of which are commercially valuable and yield shark liver oil. A wet-preserved specimen of *C. laticaudatus* is exhibited in the vertical show case in the right extreme corner at the farther end of this Gallery, containing spirit-preserved specimens of fishes.

Galeocerdo rayneri is popularly known as Rayner's Shark and attains a considerable size (more than 12 feet in length) in the Indian seas. But around Indian shores it does not occur plentifully. It is one of the man-eating sharks and extremely fierce in its disposition. It is said that this shark is very deceptive and swells itself out so as to appear like a floating mass of animal matter, and having thus lured its prey within its reach, it immediately attacks it. It feeds practically on everything available in the sea, including sea snakes. This shark is dark grey above, becoming dull white beneath; the cheeks and lower surface of the snout are yellowish. The body bears numerous large, black spots and vertical bars. One large specimen, 12 feet long, is mounted on the wall, while another, much smaller one, is exhibited in the sloping show case directly beneath the specimen on the wall.

Zygaena tudes (formerly known as *Sphyrna tudes*) (Fig. 8) is the Hammer-headed shark, readily distinguished by the curious shape of its head. As its popular name indicates, the outline of the

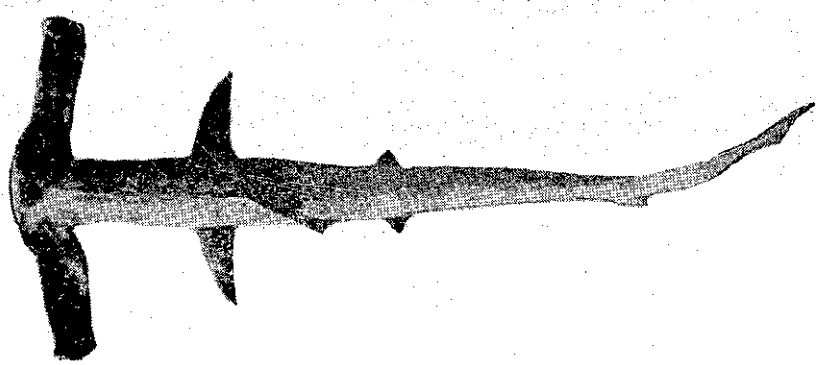

FIG. 8—ZYGAENA TUDES: THE HAMMER-HEADED SHARK.

front part of the body of this shark resembles that of a hammer, the head being markedly hammer-like and produced sideways into two lateral lobes. The eyes are placed at the lateral extremities of these lobes and the nostrils are placed on its front border. The Tamil name, "*Komban sorrah*", meaning "Horned Shark" alludes to the resemblance of the lateral lobes of the head to a pair of horns.

This species sometimes reaches a length of six feet. It is commonly seen in fish markets, and its liver oil has great market value as it is very rich in its Vitamin A content.

Family RHINODONTIDAE.

This family includes the huge Whale Shark *Rhineodon typus*, a medium-sized specimen of which, 22 feet long, is exhibited in the centre of the Fish Gallery, suspended from the ceiling (Fig. 9). The

FIG. 9—RHINEODON TYPUS: THE WHALE SHARK (22 FEET LONG).

Whale Shark is probably the largest of existing sharks and is said to attain a length of 50 feet or more. It is cosmopolitan in distribution, being found all over the tropical parts of the Atlantic, Indian and Pacific Oceans. There have been several records of the Whale Shark on the Indian coastal waters, both on the east and on the west coast. The home of the Whale Sharks, however, seems to be the various archipelagoes in the Pacific, Indian and Atlantic Oceans, from where they migrate to other areas. Their movements are seasonal, depending on the occurrence of plankton on which they feed. They visit the coastal waters of India between January and April, attracted by the abundance of zoo-plankton in these waters during this time of the year. Whale Sharks, unlike the other sharks, feed on minute planktonic organisms, the enormous gill rays serving to strain off the sea water just as the baleen plates of Whale-bone whales which feed in a similar manner. Although the mouth of the Whale Shark is wide enough to engulf a man, the teeth are minute, almost microscopic in size, the largest in a full-sized specimen being only one-tenth of an inch in length. The teeth, 250 to a row, are arranged in about 15 rows.

The colour of the Whale Shark is rather variable, but the Indian Ocean specimens are generally deep bluish grey or lavender purple above, and dead white beneath. The dorsal surface of the head and body are marked by a pattern of numerous white spots. On the head, these are just scattered, but on the body, these spots are arranged in a regular series of transverse rows. In each alternative row, the spots are fainter, and tend to coalesce into linear white bands. The presence of these markings indicate the shore-hunting habits of this Shark, for, as a rule, such markings are absent from species which live in the open sea.

Family SCYLLIDAE.

This family includes the Dog fishes, Tiger sharks, etc. The mouth is placed on the under side and the eyes are without any nictitating membrane. The teeth are small and are arranged in several rows. The first dorsal fin is spineless.

The exhibited specimens of this family include several specimens of the Tiger Shark (*Stegostoma tigrinum*) and one specimen of the familiar Indian Dog fish, *Chiloscyllium indicum*.

Stegostoma tigrinum (Tamil: *Valluvan sura*) is the familiar Tiger Shark of the Indian waters (Fig. 10). It is common at

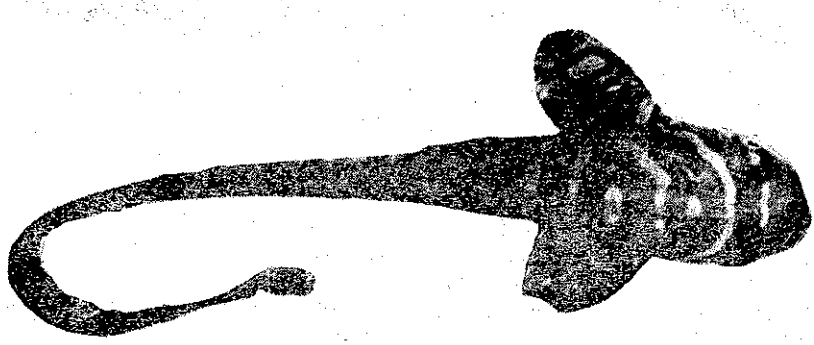

FIG. 10—STEGOSTOMA TIGRINUM : THE TIGER SHARK. (YOUNG SPECIMEN).

Madras, and reaches a length of about seven feet. The peculiar feature of this shark is that the young are black with narrow white lines or bands across the head and body, between which are white spots, but the adults are tawny brown, uniformly coloured, or with more or less irregular transverse bands of rounded white spots. The favourite food of the Tiger shark consists of molluses and crustaceans. One full grown specimen, seven and half feet in length, is mounted on the wall, exposed. The other three specimens are younger ones. In the very young ones, the linear bands are distinct, but in the older specimens these have broken up into rows of spots.

In *Chilosyllium indicum*, the head is rather depressed and much flatter below than above. The colour is extremely variable. They are usually grey, with dark or even black cross bands, or they may be uniformly of a reddish brown colour.

Suborder BATOIDEI.

This suborder includes the Saw fishes, Skates and Rays. The body is not cylindrical, but is either depressed and elongated (e.g., the saw fishes and the plough fishes) or discoidal and broadly ovate or almost circular in outline, with a whip-like tail, (e.g., sting rays and eagle rays). In saw fishes, the body, though somewhat depressed, is still long and shark-like with a well developed tail terminating in a heterocercal caudal fin. The form of the body in these fishes is adapted for living on the sea bottom. The pectoral fins are enlarged, and their front edges extend round the sides of the head. The tail and the median fins are rather reduced in size, although in the plough fishes, guitar fishes and the saw fishes these characters are less pronounced. In the more specialized forms (rays and skates), the trunk, surrounded by the enormously enlarged pectoral fins, forms a broad, flat disc from which the tail projects as a slender appendage. The eyes and spiracles are on the upper surface of the body while the gill clefts and the mouth are on the lower surface. The upper surface is also more darkly coloured, while the lower surface is, as a rule, pale.

Rays and skates occur in large numbers in Indian waters, where they often reach a very large size. Many are dreaded by fishermen because of the wounds inflicted by the poisonous spines on the tails, while others cause great damage to oysters. Skates are gregarious and may prove very destructive to oyster beds when they arrive in large numbers. Rays usually lie hidden in the sand and are noted for the way in which they suddenly encircle fish or other prey swimming above them, with their long tails and then injure them with their serrated tail spine.

The eggs of rays and skates generally undergo their development in thin, horny, egg capsules which are more squarish in form and smaller than those of sharks. They have horn-like protuberances at the corners.

Rays and skates are of considerable economic value. Their skins yield valuable shagreen and are sometimes used as a substitute for sand paper. Their fins are exported to China for use in making soups, along with the fins of sharks, and their livers yield large quantities of oil which is very rich in Vitamin A content.

Family PRISTIDAE.

This family includes the remarkable saw fishes which reach an immense size. They are large, shark-like rays, with a long, saw-shaped prolongation of the snout (rostrum) bearing a series of strong, enamelled, tooth-like projections on each side, embedded in sockets. The "saw" of the saw fish, in very large specimens, may reach a length of six feet and may be as broad as one foot at its base. Saw fishes grow to a considerable size and may reach a length of ten to twenty feet or even longer.

There are only four species of saw fishes in the Indian seas of which only two appear to be common on South Indian coasts, namely, *Pristis perrotteti* and *Pristis cuspidatus* (Fig. 11) and both

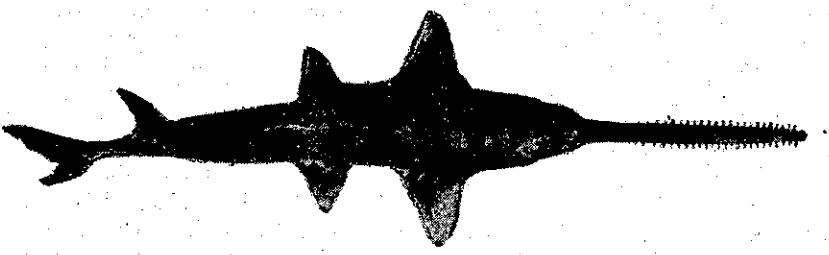

FIG. 11—PRISTIS CUSPIDATUS : THE SAW-FISH. (YOUNG SPECIMEN).

these species are represented by exhibited specimens in this gallery. A large specimen of *Pristis perrotteti,* over 12 feet in length, and the isolated rostrum (or " saw "), about 6 feet long, (of another much larger specimen) are exhibited on the wall. A plaster cast of a young one of the same species, and a stuffed specimen of the other species, *Pristis cuspidatus,* are also exhibited.

Saw fish enter large estuaries and may even migrate beyond tidal influence. They may cause considerable havoc with their " saws " among the shoals of mullets and sardines on which they mainly feed. The " saw " appears to be a weapon of great use in obtaining food. When a saw fish gets into a shoal of fish, it moves its saw rapidly from side to side, killing a number of fish. Large victims are attacked with the " saw " whose teeth tear off lumps of flesh from the body of the victim and the detached pieces are eaten by the saw fish. The " saw " also appears to be used for grubbing in the mud.

Saw fish, like many true sharks, are born alive, the infant " saws " being encased in gelatinous sheaths while still within the parent. The skeletal structure of this " saw " as washed ashore on the beach puzzled the earlier naturalists, and as late as the year 1864 they were described as being dismembered arms of an unknown species of starfish. The liver oil of the saw fish is valuable on account of its large quantity yielded by the fish as well as its high vitamin potency.

Family RHINOBATIDAE.

This family comprises the Rays popularly known as the plough fishes, guitar fishes or the shovel-nosed rays. Most of the members of this family are of small or moderate size, but two of the species common around South Indian coasts, namely, *Rhynchobatus ancylostomus* and *Rhynchobatus djeddensis* (specimens of both of which are exhibited in this gallery) reach a large size, the former species even growing to a length of nearly ten feet. The body is long and depressed with an elongated and pointed snout. The anterior portion of the body is slightly expanded laterally and the tail is thickened and moderately elongated. The spiracles are large and

placed close to the eyes. The teeth are small, numerous and arranged in pavements. The skin is rough and coarse, covered uniformly with the pointed denticles of the placoid scales.

Rhynchobatus djeddensis (Fig. 12) is greyish brown above and dull white below. There is generally a large dark spot at the root of the pectoral fin, surrounded by a ring of small, white spots. This

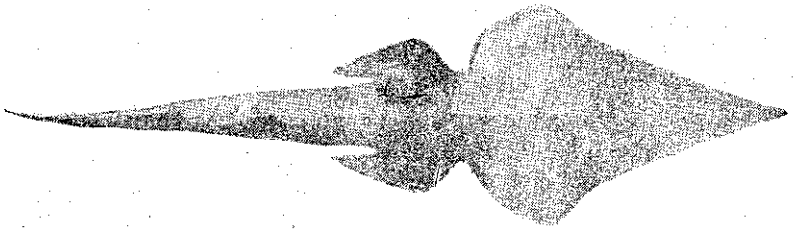

FIG. 12—RHYNCHOBATUS DJEDDENSIS: THE PLOUGH FISH OR GUITAR FISH.

fish grows to a length of six feet, and the oil from its liver is much esteemed.

Plough fishes feed on burrowing molluscs living on the floor of the ocean. The narrow, pointed snout helps them to shovel the sand and get at the molluscs. This habit of digging in the floor of the sea and causing furrows has been responsible for the popular names "shovel-nosed fish" and "plough fish". The alternative names "guitar fish" and "fiddler fish" allude to the peculiar shape of the fish.

These fishes are very destructive to marine molluscs and crustaceans. They are said to be gregarious and live in large droves. Sometimes they do great damage to the pearl oyster beds in Ceylon.

Economically, these fishes are only of limited importance. Large specimens are salted and consumed while smaller ones are eaten fresh. On the east coast, this fishery attains its maximum development in March.

Rhinobatus granulatus is another species with groups of tubercles on the back and a row of compressed spines along its middle, which become obsolete with age. These fishes are extremely numerous along the coasts of India, and prefer a sandy to a muddy bottom. They attain a length of at least seven feet, and are reddish grey above and dull white beneath.

Family TORPEDINIDAE.

This family includes the fishes popularly known as the **Torpedoes** or Electric Rays. They have a soft, perfectly smooth skin. The trunk is broad and the tail stout, with a rayed dorsal and caudal fin and a longitudinal fold along either side. An elaborate electric organ, muscular in its structure and composed of many hexagonal

cells, each filled with soft fluid is present between the pectoral fin and the head. These cells are capable of producing a severe electric shock. The Electric Rays are peculiarly soft to the touch and rather limp. They are found in all warm seas and are not much valued as food. It is said that the exercise of the power to give an electric shock soon exhausts the fish and some rest is essential before it can recoup its energy and be ready for inflicting another shock.

Two species occur in Indian waters, namely, *Narcine timlei* (Fig. 13) and *Astrape dipterygia*, and both these species are represented in this gallery, each by a single specimen. In *Narcine timlei*

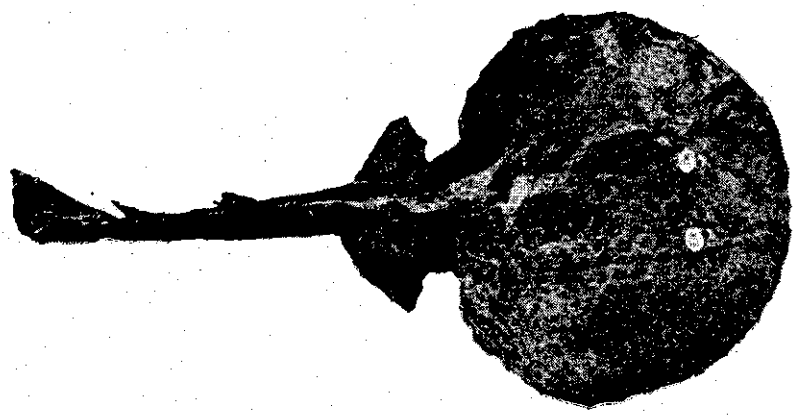

FIG. 13—NARCINE TIMLEI : THE ELECTRIC RAY.

the body and fins are reddish brown above, with numerous irregularly sized, chocolate-coloured spots while the lower surface is white. It attains a length of about eighteen inches.

In *Astrape dipterygia*, the body is dull reddish brown above, and whitish below. It is much smaller than *Narcine timlei*, and reaches a length of at least ten inches.

Family TRYGONIDAE.

The Sting Rays are included in this family. These are characrized by a very wide, broadly ovoid or almost circular, disc-like body and are more specialized than the rays referred to above. The pectoral fins are continued to the extremity of the snout where they become continuous with each other. The dorsal fin is absent altogether, or there is a single small fin, near the root of the tail. The caudal fin may be present or absent. The tail is long and slender without any lateral folds. There is often a strong, serrated spine on the tail, behind the dorsal fin, if this is present. The spine or " sting " is shed from time to time and is replaced by a younger one which develops behind it. In some specimens two or even more spines may be in use at the same time.

Sting Rays are mostly inhabitants of tropical seas, some of them entering into rivers. The skin may be smooth, or more usually rough and beset with sharp, spinuous tubercles. These fishes lie flat on the sandy bottom of the sea and feed mostly on crabs and shell-fish. They are all ovo-viviparous, the eggs hatching within the body. The Sting Rays which are armed with serrated spines on the tail are capable of inflicting severe wounds, not only due to their serrated structure, but also apparently due to the presence of some poisonous substance which seems to be carried into the wound.

The exhibited specimens belong to the genera *Urogymnus* and *Trygon*. In *Urogymnus*, the tail is long and spineless and the body is densely covered with tubercles. Two large specimens belonging to this genus are mounted on the wall.

In *Trygon*, the tail is long and armed with a serrated spine, the teeth are flattened and the body is either smooth or with tubercles. The exhibited specimens of *Trygon* belong to three species, *Trygon imbricata*, *Trygon kuhli* and *Trygon sephen*. Of these, *Trygon sephen* appears to be better known for its economic value.

The String Ray (*Trygon sephen*) (Fig. 14) haunts the bottom of the sea like other rays and skates. It generally prefers shallow water with a sandy or muddy bottom. Its food consists of small

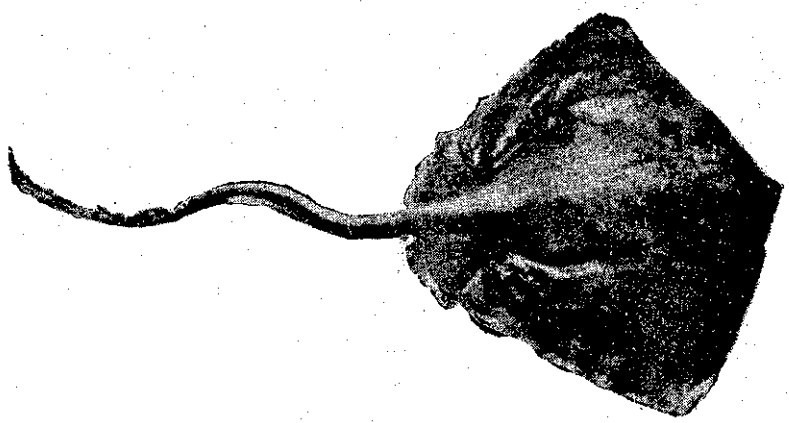

FIG. 14—TRYGON SEPHEN : THE STING RAY.

fishes, prawns, crabs and molluscs, its flattened teeth being well adapted for crushing this type of food. When a fish or suitable prey is within its reach, it darts above, encircles the victim with its long, whip-like tail, wounds it with the serrated tail-spines and overpowers it. These tail spines cause wounds which do not easily heal, and such wounds are considered to be dangerous.

The Sting Ray is said to migrate towards the shore during the south-west monsoon as these skates are common then in the inshore catches.

Economically, Sting Rays are of some importance. Large numbers of Sting Rays are cured by sun-drying as the flavour of the sun-dried product is preferable to that of the salted skate. A fairly important by-product of the Sting Ray is the liver oil which has considerable Vitamin-A potency. The skin of its back is said to yield valuable shagreen.

Family MYLIOBATIDAE.

The Eagle Rays are included in this family. In the Eagle Rays, the tail is long, slender and whip-like, without a caudal fin, and there is a single, small, dorsal fin near its base. The pectoral fins are large, spreading along the sides of the body, thus making it appear very broad. These fins are not present on the sides of the head but appear again at the end of the broad, truncated snout as a pair of horn-like processes which represent the detached fins. This pair of rostral fins in front of the snout unite to form a sort of a rayed pad. The body is smooth or tuberculated on the upper surface. The teeth are arranged in the form of a mosaic-work or pavement. The eagle-like appearance of these fishes is suggested by the form of the skull. The eyes are on the sides of the head, with heavy eye-brows above them.

Eagle Rays are found in most warm seas in the Tropical and Temperate zones. They are generally very destructive to clams and oysters, which they crush with their flattened teeth.

Specimens belonging to a few species of *Myliobatis, Aetobatis, Rhinoptera* and *Dicerobatis* are exhibited. In *Myliobatis,* the fins on the head meet in the form of a soft appendage in front and teeth are disposed in several rows. *Aetobatis* has only one series of very broad teeth and in *Rhinoptera,* the fins on either side of the snout form a lobe. In *Dicerobatis* (Fig. 15), of which specimens of two species are exhibited, there are numerous small teeth in both jaws and the cephalic fins form an appendage on either side of the snout.

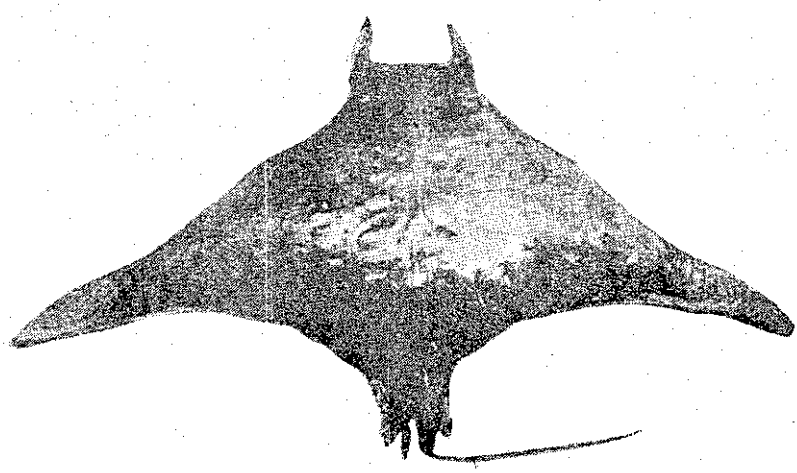

FIG. 15—DICEROBATES THURSTONI : THE EAGLE RAY.

Aetobatis narinari is the Spotted Eagle Ray, rather showily coloured. It is greyish olive, greenish olive or leaden grey above, usually covered all over the back with numerous, dirty white or bluish spots edged with black. In the immature form the back is of a deep leaden colour and the spots are practically absent. It attains a width of six feet. The strength of its jaws is enormous, and very hard-shelled; clams are often cracked and eaten by these Rays. This species has a wide range of distribution, being found all over in tropical and sub-tropical seas.

Dicerobatis eregoodoo inhabits the seas of India eastwards up to the Malay Archipelago and attains a much larger size. Specimens measuring sixteen feet and eighteen feet in width have been recorded. The tail in these Rays is liable to be frequently injured and is therefore seldom found in a perfect condition in adult specimens.

SUBCLASS TELEOSTEI

This subclass includes the bony fishes which comprise the majority of living fishes. The form of the body is extremely variable; normally it is typically fish-like, but it may be elongated and snake-like as in the eels, or laterally compressed and ribbon-like as in the Ribbon fishes (*Trichiurus*) and the Flat fishes (*Pleuronectidae*), or the body may be peculiarly shaped as in the Sea horses (*Hippocampus*) and the Coffer fishes (*Ostracionidae*).

These fishes are characterized by the presence of a bony skeleton, an operculum or gill cover covering the gill openings, and frequently an air bladder is also present. The body of a bony fish is covered by a layer of thin, flexible bony plates or scales overlapping one another like the tiles of a roof. The scales vary greatly in shape and size. They may be either cycloid (with concentric grooves and smooth edges) or ctenoid (with serrated edges). Some fishes, such as the Mahsheer, have very large scales, each sometimes measuring over two inches square, while those of the Mackerel and the Tunny (*Thynnus macropterus*) are minute, and in the case of eels, the scales are buried in the skin and are almost microscopic.

On either side of the fish's body, there runs a streak of a dull colour which consists of a series of minute pores pierced on the scales of a single longitudinal row. This line is often curved in the anterior portion, but is straight in the hinder region. This constitutes what is known as the "lateral line sense organ", characteristic of bony fishes, and is believed to be sensory in function, being connected with the senses of both feeling and hearing.

True bone occurs for the first time among the bony fishes in the evolutionary ladder of Vertebrates. In most bony fishes an air bladder is present. It has already been described above in detail in connection with the Introductory exhibits.

Many bony fishes undergo remarkable changes of form in their growth. In fact, the differences between the young and the adult of the same species are so great that it is difficult to recognize them as belonging to the same species. This is particularly so in the case of Flatfishes, Eels, Sword fishes and Coffer fishes, etc. Bony fishes are also extremely variable under the influence of different climatic and other environmental conditions. The variation is specially evident in the colour of the skin, changes in the colour being mainly due to the changes in the chromatophores or pigment cells. The Sole fishes, for instance, afford remarkable examples of protective colouration.

Marine fishes are usually extremely sensitive to changes of temperature, but fresh-water fishes are less liable to such changes. A few fishes have been domesticated and introduced into different parts of the world (e.g., the Carp, the Gourami, etc.) and certain species of Trout and Salmon have been acclimatized in countries which are not their native homes.

The flesh of many bony fishes (e.g., the Globe fishes or Puffer fishes and Trigger fishes) is poisonous, and wounds caused by the spines of many fishes are poisonous. This is generally due to the poisonous nature of the mucus that is secreted by the skin or by special poison glands.

Many species of bony fishes live at great depths in the sea and most of these deep-sea fishes possess special luminescent organs and other peculiar adaptations.

Many fishes, like birds, perform seasonal migrations. Those which travel from the sea to fresh-water, ascending rivers, etc., for spawning are termed *anadromous* (e.g., Salmon, Shad, Striped Bass and some species of Trout), while those which travel from the fresh-waters to the sea are known as *catadromous* (e.g., the fresh-water Eel). Some deep-water fishes undertake a daily vertical migration.

The exhibited specimens of bony fishes in this Gallery belong mostly to species found around the coasts of South India, especially the east coast, and are arranged in their systematic order grouped under their respective families which in their turn are classified under a few major groups or orders which possess certain distinctive characters.

The chief characteristics of the more important and familiar types of bony fishes exhibited, especially those with peculiar and interesting features, are briefly outlined below, the various species being grouped under their respective families and the families arranged in their systematic sequence under the various orders. Since there are a very large number of species represented among the exhibits, it has been possible to make specific mention of only the more outstanding ones in the following account.

The classification and sequence of arrangement adopted in the present Guide is that followed by Day in his latest edition of his monumental work, "Fishes of India", which is the most up-to-date and standard reference work available on Indian fishes at present.

ORDER ACANTHOPTERYGII

This large and important Order includes by far the vast majority of bony fishes found in Indian waters. They are popularly known as the "Spiny Rayed Fishes". The most characteristic feature of this group is that a portion of the dorsal, anal and ventral fins are unarticulated, forming spines. The air bladder, when present, is completely closed, and typically without a pneumatic duct in the adult state. The gill openings are placed in front of the pectoral fins. The great majority of marine fishes belong to this group. This Order includes the Perches, Mullets, Whitings, Gobiids, Scorpion fishes or Lion fishes, Seer fishes and fresh-water fishes such as Ophiocephalids, etc.

Family PERCIDAE.

This family includes the Perches and Perch-like fishes. The body is rather oblong-ovate and not markedly elongate. The mouth in front of the snout bears a lateral cleft, occasionally on the lower side. The anterior portion of the dorsal fin is spinuous. The scales are either cycloid or ctenoid. The air bladder is usually present and more or less simple.

This is a large and extensive family, and the species of fishes belonging to it fall into several natural groups. The Indian species of the family Percidae are almost entirely marine fishes and although a few genera, such as *Serranus, Lutianus, Therapon, Lobotes,* etc., ascend the mouths of rivers they are never found any considerable distance away from tidal influences. The Percidae is one of the most generalised families of bony fishes, comprising numerous genera and species, all of them being carnivorous fishes living at the bottom and near the coasts in tropical and sub-tropical seas.

The colours of the Perches in the living condition are variable and differ according to the colour of the waters they occupy. In muddy or opaque water these fishes usually are darker, while in clear water they are brighter and generally more lightly coloured. Colour also varies according to the age and season. The colour of the fresh specimen is often very ephemeral and disappears rapidly in stuffed specimens and those preserved in alcohol.

Several specimens belonging to the genera *Lates, Serranus* (= *Epinephelus*), *Lutianus* (= *Lutjanus*), *Therapon, Diagramma, Lobotes, Gerres,* etc., are exhibited.

Lates calcarifer (Fig. 16) is popularly known as the "Cock-up" (Tamil: "*Koduva*"). It is highly esteemed as a food fish, especially when captured from the vicinity of large rivers. It inhabits the

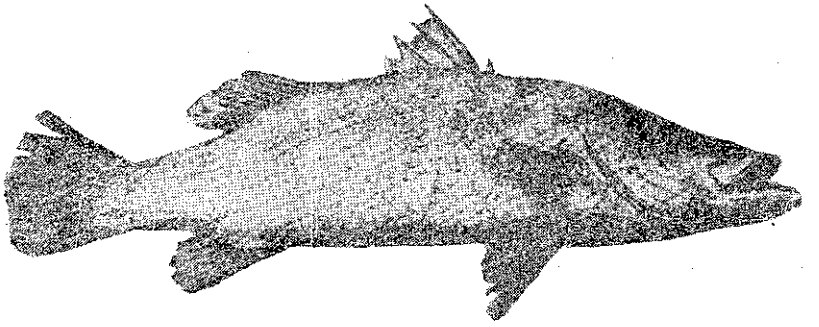

FIG. 16—LATES CALCARIFER: THE COCK-UP

seas, backwaters and mouths of tidal rivers in the East. *Lates calcarifer* is a large Perch reaching a maximum length of over five feet and attaining a weight of about 200 lb. The body is oblong, with fairly large scales. The mouth is terminal, very wide and protrusible. The tail fin is broad and rounded. The body is dark silvery grey above, but paler and almost whitish below.

This is one of the Indian marine Perches which enter estuaries and backwaters. It is carnivorous and feeds mainly on prawns. The presence of a large Cock-up in a backwater is indicated by the occasional sudden disturbance it creates in the water when attacking and seizing prawns or fishes. This fish is common in the Pulicat backwaters, Ganjam, Pamban and Beypore in Malabar.

This fish is highly esteemed as food on account of the excellent flavour of its flesh. Large specimens are cut and sold as fillets. The air bladders are dried and made into rough isinglass, much of which is exported to China and some to Europe. It is also a favourite among anglers in backwaters.

Several species of *Serranus* (formerly known by the synonymous name *Epinephelus*) are exhibited in this Gallery. They are popularly known as the Rock Cods (Tamil: "*Kalava*"). These species are almost entirely marine and their colour is extraordinarily variable. Almost all species of *Serranus* are esteemed as good food fishes, but the following species are particularly common in South Indian Seas and figure prominently among the food fishes of the Madras State: *S. erranus pantherinus, S. undulosus, S. maculatus, S. boenack,* and *S. lanceolatus.* The flesh of very large specimens tends to be rather coarse.

The Rock Cods are mainly distinguished by the presence of two or three flat spines at the sides of the head. The dorsal fin is continuous, the hard (spinuous) part being broadly united with the soft (rayed) part. The Rock Cods grow to a considerable size. *Serranus pantherinus,* for instance, reaches a length of about seven feet and

attains a weight of 300 lbs. *Serranus lanceolatus* (Fig. 17) also attains a very large size; a giant specimen of this Rock Perch is exhibited in a large show-case placed along the wall centrally at the

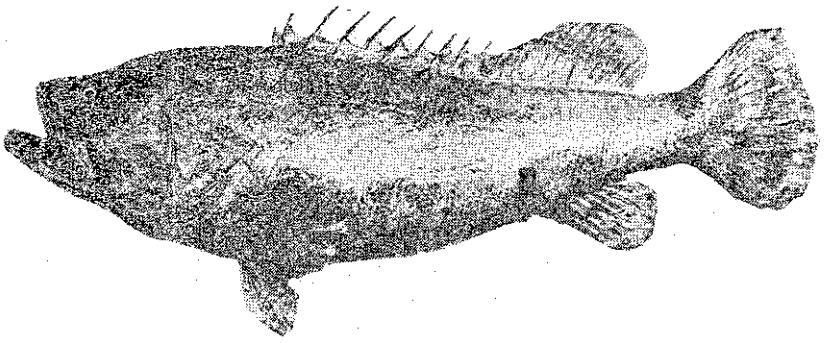

FIG. 17—SERRANUS LANCEOLATUS : THE GIANT PERCH.

rear end of this Gallery. The colour patterns in this group are striking and very variable, and they are therefore favourites as acquarium specimens.

Rock Cods are predaceous fishes living on crabs, prawns, bristle worms and fishes. Specimens of the giant Rock Cod reared in captivity in marine aquaria are noted for their unusually long span of life, some specimens surviving even for twenty years. In their natural haunts, they may even live longer. These fishes are quite commonly seen in the fish markets of Madras City and are esteemed as good food fishes. Isinglass is obtained from the air bladders of some of these fishes.

The genus *Lutianus* (= *Lutjanus*) includes perches commonly known as the "Snappers". Several species are exhibited and of these, the following are particularly common around Madras shores. *Lutianus marginatus, L. annularis, L. johnii* and *L. fulviflamma.* The body is rather deep, with a pointed head. The mouth bears well developed, sharp teeth. The dorsal fin is single and continuous, with from nine to thirteen, rather strong spines. The tail is generally square, but the caudal fin may sometimes be rounded, truncated or emarginate. The scales are ctenoid (i.e., with the free edges of the scales serrated and broken up like the edge of a comb). Parts of the gill covers (operculum) have spines and saw-like edges. The colour patterns of most of these species are quite attractive and varied. As a rule, there is a black blotch on each side of the tail; this spot is more prominent in the young.

These are carnivorous fish, feeding on other smaller fishes (*Caranx* spp., *Clupea* spp. etc.), prawns, crabs, cuttlefish, bristle worms and other soft-bodied marine invertebrates. Occasionally they may feed on sea weeds also. These fishes are gregarious and are frequently found among rocks and coral reefs. Some of the species have extraordinarily beautiful colour patterns which harmonize with their immediate surroundings in the coral reefs. Since this type of

colouration helps the fish to conceal themselves amidst their surroundings and attack the unwary prey that may come within their reach, it is described as " cryptic colouration ". The brilliant and attractive colours and colour patterns of these fishes have made them very popular in aquaria.

These fishes owe their popular name " Snappers " to their peculiar habit of moving their jaws when landed ashore, as though they were going to snap at some object. This may possibly be an expression of anger.

As a rule all these fishes belonging to species of *Lutianus* are highly edible, though the flavour of some species is insipid. All species attain a large size and most of them are extensively salted and dried in many localities. As already mentioned, these fishes make excellent exhibits in marine aquaria on account of their brilliant colour. *Lutianus sebae* (Fig. 18) for instance, is particularly striking with its prominent red bands and is a common exhibit in aquaria.

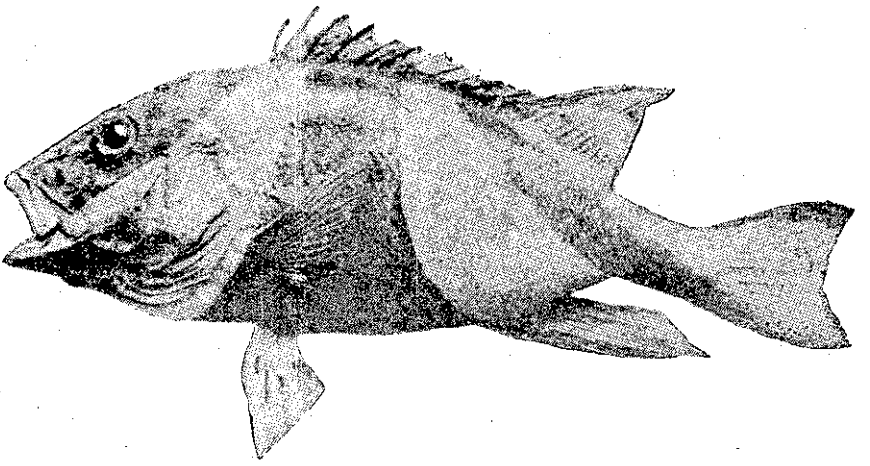

FIG. 18.—LUTIANUS SEBAE : THE SNAPPER.

Therapon jarbua and *Therapon quadrilineatus* belong to the group popularly known as the " Squeaking Perches ". They have a mouth which is protrusible, with thick lips. The gill cover has one or two sharp spines and the edge of its first half (preopercle) is serrated like the edge of a saw. The jaws bear numerous sharp teeth. The colour is generally silvery grey with a series of dark longitudinal bands. These small perches are almost entirely marine, but some are occasionally found in brackish water, within tidal influence. *Therapon jarbua* has been frequently captured in the River Hooghly as far up as Calcutta. These fishes are essentially shallow water forms entering estuaries within tidal influence. These fishes are not generally esteemed as food, as they are usually regarded as feeding on dead fishes and carrion. But recent researches at the Krusadai Biological Station have proved that it is not all the common species of *Therapon* that feed on carrion, and that they eat a considerable amount of wholesome food, such as prawns, crabs, sea weeds, sand

hoppers, worms and small fishes. They also feed on *Balanoglossus*—the worm-like Hemichordate which is a very primitive Chordate. These fishes shovel in the sand with their pointed snouts and pull out these worm-like creatures and eat them. Specimens found in brackish water are also known to feed on the larvae of may flies, dragon flies and mosquitos. As they are active larvicidal fish, they may be useful in the biological control of mosquito larvae.

Therapon jarbua is popularly known as the Zoned Perch on account of the linear dark bands. It is common in marine aquaria and appears to spawn during October in the backwaters at Adyar and the Cooum in Madras City. When they attain a length of about four inches they return to the sea.

These fishes owe their popular name " Squeaking Perches " to the fact that they produce a pleasant queaking sound in the sea. They sometimes approach a boat moored in the sea, in small groups and produce this squeaking noise to which the fishermen listen by dipping one end of the oar in the water and applying the other end to their ear. The exact way in which the perch produces this noise is not clearly understood.

Economically, species of *Therapon* are valued as larvicidal fish and are employed in the biological control of mosquito-borne diseases in coastal areas. As food, these fishes are not esteemed as they are reputed to feed on carrion, although they may take other wholesome prey as living fish, prawns, etc.

Species of *Pristipoma* (of which three are exhibited), are popularly known as " Grunters '. The palate in these fishes is toothless. The spines of the dorsal fin are strong and elongated. The tail fin is truncated and the scales are large. They are more or less stout perches of a silvery grey colour, sometimes with black blotches or spots and greyish or blackish lines on the sides of the body. The scales are ctenoid, and are of small or moderate size.

These fishes are found in all tropical seas and even in the Mediterranean. The young of the Indian species are often taken in backwaters. They grow to a maximum length of two and a half feet. Specimens about a foot long are quite common. They abound where the bottom of the sea is rocky and overgrown with corals. They feed mainly on crabs, prawns, bristle-worms, small fishes, molluscs and starfishes. When the fish are landed, the produce a peculiar sound quite similar to the grunting of pigs; hence the popular name " Grunters ". All the three species exhibited (*Pristipoma furcatum, P. maculatum* and *P. guoraca*) are of economic importance on the East Coast. Being of large size and usually occurring in large shoals, they are fairly good as food fishes, but not much esteemed. The air bladder is collected in some places for making isinglass.

Species of *Diagramma* (Tamil: " *Madanam* " or " *Kalmadanam* " or " *Tholan*") are generally known as the Rock Perches. Two species, *Diagramma crassipinum* and *Diagramma punctatum* are exhibited. The lips in these fishes are thick and folded back. The

gill cover has saw-like edges. These are rather stout perches, of a silvery yellow or grey colour, growing to a fairly large size, some species attaining a length of even two feet or more.

These fishes are common in areas where the bottom of the sea is rocky. They are very common in the sea off the coast of Pamban in the Gulf of Manaar. Their food consists chiefly of prawns, crabs, bristle-worms and small fishes. These rank among the important food fishes of the Madras Coast and are highly esteemed as food.

Lobotes surinamensis, of which two specimens are exhibited, is another perch widely distributed from the East Coast of Africa through the seas of India eastwards to the Malay Archipelago and beyond. It is brassy brown when alive, blotched with darker brown and the ends of the caudal and pectoral fins are of a dirty yellowish white colour. It attains a length of at least two and a half feet, and is highly esteemed as a food fish.

The genus *Scolopsis* is represented among the exhibited series by a single species, *Scolposis vosmeri*. The adult is of a pale dull red colour, usually bearing a whitish band round the opercula, from the upper edge of which a longitudinal white line of the same colour passes backwards below the lateral line. Species of *Scolposis* reach their maximum abundance off the coasts of Sind and Bombay and also around Andamans and Nicobars.

Synagris japonicus and *Synagris striatus* are small perches rarely exceeding a length of nine inches, and popularly known as the Pink Perches. The ground colour, which is pink, is very characteristic of these Perches. Longitudinal reddish or yellowish lines may be present. Fresh specimens exhibit a faint but striking blue iridescent sheen on the head.

The Pink Perches are good shoaling fishes, feeding mainly on other small fishes, but they also appear to feed on carrion. These fishes are of moderate value as food fishes and are frequently brought to the local fish markets.

Caesio cuning is another handsome species, bluish green above and rosy beneath, along the abdomen. It attains a length of about eighteen inches. The caudal fin is deeply forked. The spines of the dorsal fin are slender and flexible.

The genus *Gerres* is distinguished by an oblong, elevated, rather compressed body and a highly protractile mouth. The eyes are comparatively large and the caudal fin is forked. Three species, *Gerres oblongus*, *Gerres filamentosus* and *Gerres oyena* are exhibited. As food, these fishes are eaten mostly by the poorer classes of people, and they are, as a rule, little esteemed as food on account of the numerous bones and insipid flavour. Large numbers are, however, salted and dried, and utilized for export.

The size of the eye generally increases with age in these fishes, and young specimens are usually vertically banded, while in the adults these bands may be indistinct or even entirely absent.

Family SQUAMIPINNES.

Fishes belonging to this family possess, as a rule, a very broad and strongly laterally compressed body. The eyes are lateral and are of moderate size. The mouth is generally small, with a lateral cleft and situated in front of the snout. In most Indian genera of this family, there are no teeth on the palate. The soft portion of the dorsal fin is more extensive than the spinuous portion. The ventral fins are thoracic in position, with one spine and five rays. Scales are either cycloid or very finely serrated at the edges. An air bladder is present and is usually simple

The name " Squamipinnes " refers to the scaly fins, the typical species usually having the soft rays of the dorsal, anal and caudal and sometimes of the other fins densely covered with small scales. In some species, a prolongation of the dorsal fin may be present.

These fishes are almost entirely marine, and although a few species have been recorded from rivers and estuaries, they are rarely found beyond the tidal limits.

This family includes some of the most attractive and brilliantly coloured tropical fishes, such as the Angel fishes (*Holacanthus* spp.), and the Butterfly fishes (*Chaetodon* spp.).

The Indian genera of of this family fall into two main groups—(1) the Chaetodontina, in which there are no vomerine and palatine teeth and (2) the Toxotina, in which vomerine and palatine teeth are present.

All the genera except one, fall under the first group. The specimens of Squamipinnes exhibited in this Gallery belong to the genera *Chaetodon, Molacanthus, Scatophagus, Ephippus* and *Drepane,* all of which are included in the first group, Chaetodontina, which lack the palatine and vomerine teeth.

Chaetodon vagabundus is a particularly bright and attractive fish, with a black ocular band, and numerous dark bands which pass downwards and forwards to the centre of the body from where other bands radiate backwards. Two black vertical bands are present on the caudal fin. This is popularly known as the Butterfly fish and is common in rock pools and among coral reefs in clear water, where their colour harmonizes well with the coral growths. They are also extremely quick in their movements. Many species of Butterfly fishes are often fantastically coloured. The body is deep and compressed and the mouth is armed with small, bristle-like teeth.

Three species of *Holacanthus* are exhibited. The body is highly compressed and, as a rule, much elevated. A single dorsal fin is present, with about twelve to fifteen spines. Scales of moderate or small size more or less completely cover the vertical fins. The air bladder possesses two horns posteriorly. These are popularly known as the Angel fishes on account of their elegant colour patterns.

Holacanthus imperator is bluish white, with three narrow blue bands on the head and about nineteen narrow, oblique, canary-coloured bands on the body, and the caudal fin is yellow.

Holacanthus annularis is brown, with a blue ring on the shoulder and six or seven blue bands radiatnig from the eye and *Holacanthus xanthurus* (Fig. 19) is greyish, with a light opercular band and a yellow spot on the shoulder.

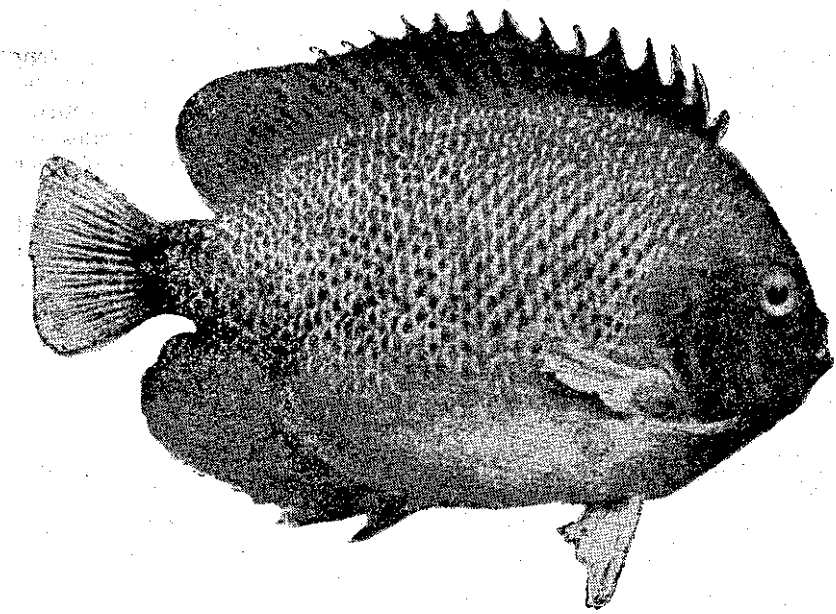

FIG. 19—HOLACANTHUS XANTHURUS : THE ANGEL FISH.

Scatophagus argus (Fig. 20) is a large, purplish fish with large, round, blackish or greenish spots on the body; these spots are most numerous along the back. This fish attains a length of about one foot

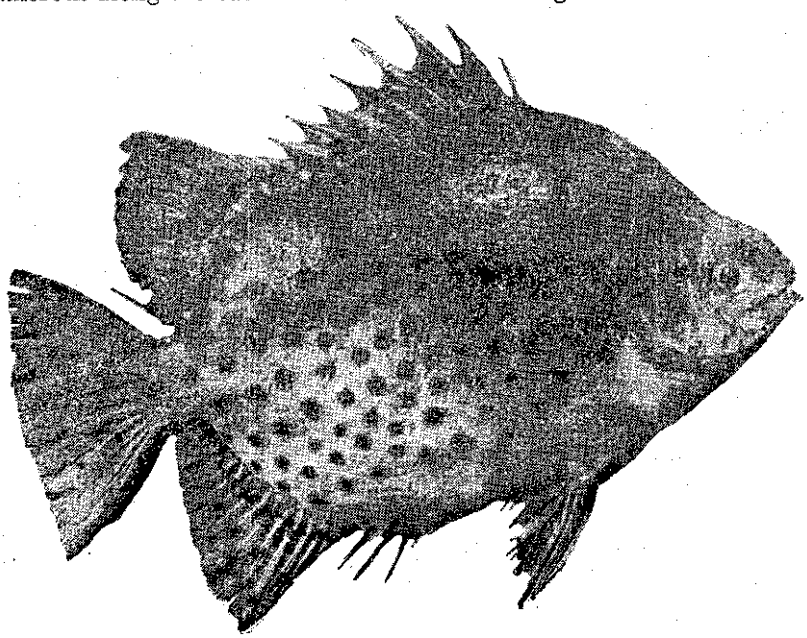

FIG. 20—SCATOPHAGUS ARGUS.

and enters backwaters and rivers. Since this is reported to feed on carrion and other filthy matter, it is not much esteemed as a food fish, although when freshly captured, its flesh is said to have an excellent flavour.

Ephippus orbis is a smaller fish of similar shape, attaining a length of at least six inches. The back and head are greyish brown, while the sides and abdomen are silvery, suffused with pink. The fin membranes are rather transparent and finely dotted with black.

Drepane punctata is another elegant species attaining a length of at least fifteen inches. The fin rays of the dorsal fin are strong. The colour is silvery, with a golden gloss and tinged with purple, and the body may or may not be marked with vertical bands and black spots. This fish is widely distributed from the Red Sea eastwards to Australia, and in most places it is highly esteemed as food.

Family MULLIDAE.

This family includes the fishes popularly known as the Goat fishes or Red mullets. The body is rather elongated, with moderately large eyes placed laterally. The mouth is rather small, placed in front of the snout with a lateral cleft. The most outstanding feature of this family is the presence of a pair of stiff barbels below the chin. The ground colour is generally bright red or golden, often with longitudinal bands. The barbels are usually bright yellow. A common colour pattern in these fishes consists of long, yellow stripes on the body, with the belly coloured sulphur-yellow and the fins barred with cross bands. The scales are large, slightly ctenoid and tending to drop away easily. The air bladder, when present, is simple.

The Goat fishes are carnivorous, feeding on prawns and small fishes. When they swim along the bottom the barbels are carried forwards in order to feel their way through the water. They have the habit of creeping over the bottom of the sea floor in shallow waters, testing the bottom with their barbels for any available food.

These fishes have been recorded from several localities along the East Coast, and from Kozhikode along the West Coast. They are highly esteemed as food fishes as their flesh has an excellent flavour. They were originally termed *Mullus* by the Romans in allusion to the scarlet colour of the Roman sandals which were known as *Mullus*. Their rich colouration has rendered them favourite as exhibits in many aquaria.

Specimens of two species of the genus *Upeneus*, common on the Madras Coast, are exhibited in this Gallery, namely, *Upeneus indicus*

(Fig. 21) and *Upeneus luteus*. The former which is purplish red, attains a length of sixteen inches, while the latter, which is reddish, reaches a length of about one foot.

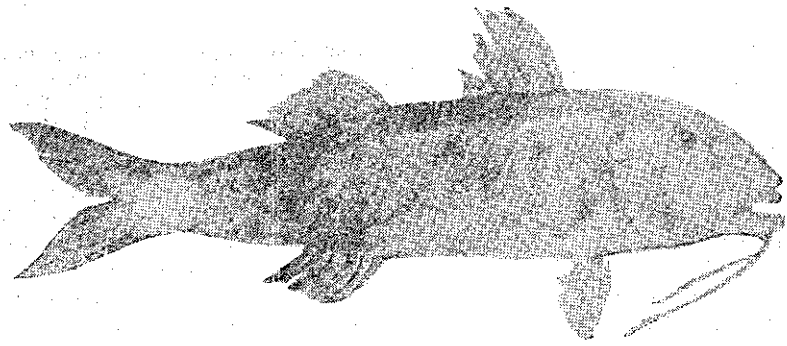

FIG. 21—UPENEUS INDICUS : THE GOAT FISH.

Family SPARIDAE.

This family comprises the fishes popularly known as the Sea Breams or Porgies. The Sea Breams constitute a large and important family including many species of commercial importance. The body is rather oblong and compressed, with moderate-sized eyes, and the mouth is placed in front of the snout, with a lateral cleft. The jaws are armed with strong teeth, some of which along the sides are large and blunt (molar teeth) and adapted for crushing and grinding small crabs and molluscan shells. There are no teeth in the palate, except in the genus *Pimelepterus*. Some species, with incisor-like teeth are herbivorous. A single dorsal fin is formed of spinuous and soft portions which are nearly equal in extent. The scales are cycloid.

The ground colour of these fishes is generally brown; sometimes longitudinal lines may be present, and in some species, the inside of the mouth is orange.

These fishes inhabit the seas of temperate and tropical regions, and some of them enter freshwaters. These are fairly stout fishes, some of which attain a length of two and a half feet. They usually inhabit the sections of the sea where the bottom of the sea is hard and beset with coral rocks. They feed on crabs, prawns and molluscs.

Specimens belonging to four species (of different genera), namely, *Lethrinus karwa, Pagrus spinifer, Chrysophrys berda* and *Pimelepterus cinerascens* are exhibited. Of these, *Lethrinus karwa* (Tamil: "*Velamin*", or "*Koronguvala*") is perhaps the most highly esteemed as a food fish, and this, along with *Lethrinus nebulosus* contribute chiefly to the Sea bream fishery of the Madras Coast. These form one of the first-class edible fishes caught by the "Lady Goschen" expedition. The Sea bream fishery is one of the chief fisheries off the Coast of Tuticorin in the Gulf of Manaar.

Chrysophrys berda (Fig. 22) is popularly known as the Black Rock Cod of the Madras Coast. It is silvery grey, with the scales darkest at their base, and usually a black spot behind the opercle on

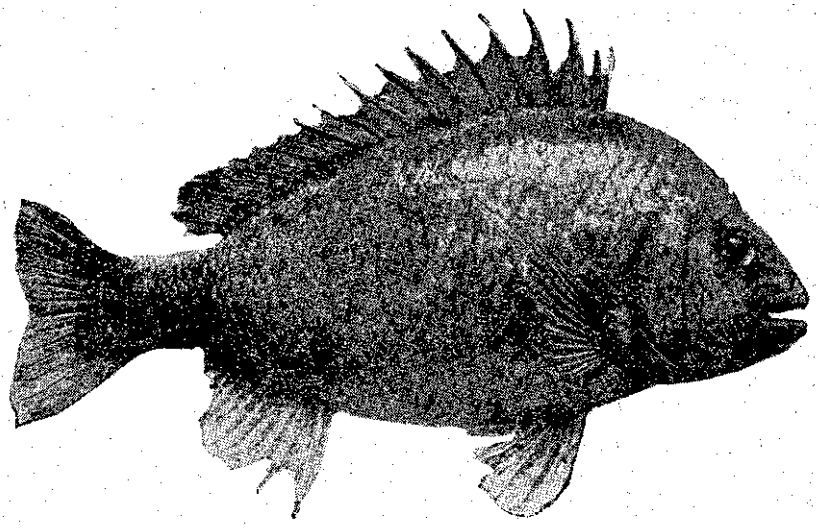

FIG. 22—CHRYSOPHRYS BERDA : THE BLACK ROCK COD.

the shoulder. It is common in Malabar in July and is an excellent food fish.

Pagrus spinifer is whitish, with pinkish vertical bands, which become indistinct below the middle of the body. In small specimens there are about five vertical bands on the body. A closely allied European species, *Pagrus auratus,* popularly known as the Gilt-head, was a great favourite with the ancient Romans. Its head is iridescent green in colour with a crescentic golden band between the eyes.

In the genus *Pimelepterus,* fine teeth are present on the vomer, palatines, and on the tongue. The air bladder is divided posteriorly, one branch passing along either side of the caudal vertebra. A specimen of *Pimelepterus cinerascens* which is silvery grey during life, with a dark band between each row of scales, and with black fins, is exhibited.

Family SCORPAENIDAE.

This large family comprises the fishes popularly known as the Scorpion fishes or Lion fishes. The body is oblong laterally compressed or subcylindrical. The dorsal fin is single, but disposed in two distinct portions, a spiny anterior, and a soft, posterior portion. The spines of the dorsal fin are numerous and strongly developed. Some of the bones of the head are armed. The body is either scaleless, or covered with ctenoid scales. An air bladder is generally present. In extreme forms, the head may besome greatly distorted, with ridges, and grooves; the anal spines may be absent, and the dorsal spines variously modified.

About three hundred species of Scorpion fishes are known from tropical and temperate seas. They are especially abundant in the North Pacific. The Scorpion fishes are carnivorous and live more or less at the sea bottom. Some species have a mottled colour pattern which harmonizes well with the rocks and weeds among which they lurk, whilst others from deeper waters are reddish in colour. The long, dorsal spines of *Pterois* sometimes known as the Lion fishes or Fire fishes, inflict poisonous wounds, and these fishes are therefore dreaded by fishermen. They lurk in crevices in coral reefs and are brilliantly coloured. These fishes are remarkable for their long pectoral fins, elongate dorsal fin spines and the zebra-like striped and spotted colour patterns.

Specimens of one species of *Scorpaenopsis rosea* and two of *Pterois*, namely, *Pterois russellii* and *Pterois miles*, are exhibited.

Scorpaenopsis rosea is rose-coloured, marbled with grey and with one or two irregular vertical grey bands on the caudal fin. The dorsal, anal and ventral fins are also banded and the pectoral fins bear numerous dark spots.

Pterois russellii and *Pterois miles* (Fig. 23) are both common species of Lion fishes found on the Madras Coast. Both are reddish, with several dark vertical bands forming a complicated pattern. The

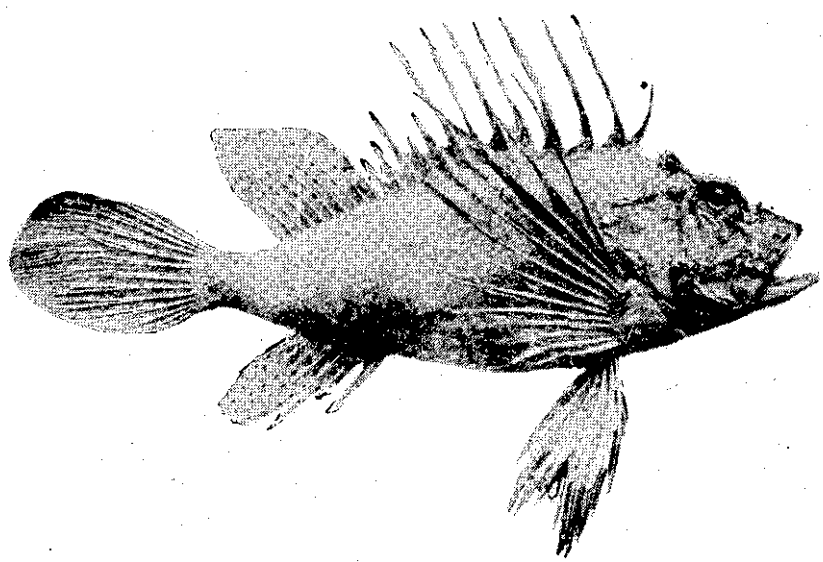

FIG. 23—PTEROIS MILES : THE LION FISH OR SCORPION FISH.

former attains a length of eleven inches and the largest specimen of the latter species recorded from the Madras Coast is about fourteen inches.

Family TEUTHIDIDAE.

This family consists of the fishes popularly known as the Surgeon fishes and Unicorn fishes. The body is oval and strongly laterally compressed. The eyes are of moderate size and laterally placed. The mouth is only slightly protrusible. Each jaw bears a single row of cutting teeth (incisors) but the palate is without teeth. The scales are minute. An air bladder is present, large and forked both anteriorly and posteriorly. Fishes of this family are characterized by the presence on each side of the tail, of a sharp, knife-like, movable spine with the point turned forwards and fitting into a sheath in the skin. This lancet-like spine accounts for the popular name of these fishes, namely, Surgeon fishes or Doctor fishes, and it forms a very effective weapon against their enemies. When not required, this spine is retracted into a sheath in the skin, but can be quickly turned outwards.

These fishes are herbivorous and are found in most tropical seas. This family includes a single genus, *Teuthis*. Specimens of three of the common Indian species of *Teuthis*, namely, *Teuthis java*, *Teuthis marmorata* and *Teuthis oramin* are exhibited. In *Teuthis java*, the head is black and the sides of the body dark brownish. The head and back bear several pale grey rounded spots. *Teuthis marmorata* (Fig. 24) is brownish, covered all over the back with blue vermiculated

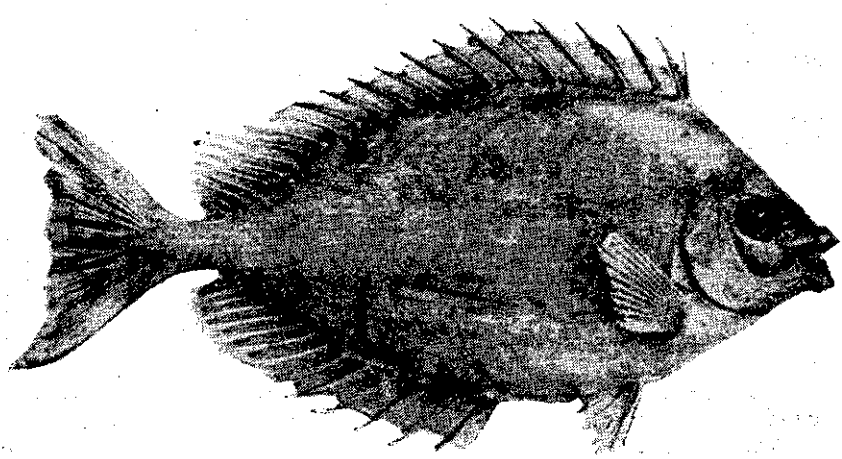

FIG. 24—TEUTHIS MARMORATA : THE SURGEON FISH

lines which become sinuous and elongate at the sides. *Teuthis oramin* is olivaceous, with distinct, longitudinal stripes on the upper half of the body. A round, black shoulder spot and a black spot at the top of the eye are characteristic. There are also numerous pearl white spots on the upper half of the body. *Teuthis oramin* is common along the coasts of India, attaining a length of at least nine inches.

Family BERYCIDAE.

The family Berycidae, along with about eight other families constituted the large group of bony fishes called the Berycoids which formed the Order Berycomorphi of the earlier systems of classification. The Berycidae, among others, includes the fishes popularly known as the Soldier fishes or Squirrel fishes (Genus *Holocentrum*).

The form of the body is oblong, rather high, and laterally compressed. The head bears large, mucus-secreting cavities. The eyes are large and lateral and the cleft of the mouth is more or less oblique. Teeth are present in both jaws and also on the palate. The scales are ctenoid, occasionally bony or even absent. The dorsal fin may be single and continuous, or in two portions, or there may be a few isolated spines in front of the dorsal fin.

These fishes are usually bright scarlet, rosy or black in colour. They are all marine, tropical fishes, and with the exception of fishes belonging to the genus *Holocentrum*, live in rather deep water. Species of *Holocentrum* are particularly abundant among and around coral reefs.

Specimens of only two species (belonging to two different genera), *Myripristis murdjan* and *Holocentrum rubrum*, are exhibited. The former is rose-coloured with the gill openings deep brownish black and with a dark mark on the axilla and a dark vertical band through the eye. This species attains a length of at most about eleven inches and is very common on the Madras Coast especially during February.

Holocentrum rubrum is silvery white, with longitudinal dull rosy bands extending from opercles when young, but the adult is red with seven or eight silvery bands. Both these species are widely distributed and occur from the Red Sea and East Coast of Africa, through the seas of India, eastwards to the Malay Archipelago.

Family KURTIDAE.

This family comprises rather small, deep-bodied fishes, some of which are popularly known as the "deep water Catalufas" or "magifi". The body is oblong and laterally compressed. The eyes are large and the cleft of the mouth is oblique. Teeth are present in both the jaws, vomer and palatines. The dorsal fin is rather short and single, the spinuous portion being shorter than the soft portion. The anal fin is greatly elongated with two or three spines. The scales are small or moderate-sized. An air bladder is present.

These fishes inhabit the tropical seas and are found at moderate depths. A specimen of only one species, *Pempheris russellii*, is exhibited. *Pempheris* bears a superficial resemblance to some of the fishes of the previous family, Berycidae. In *Pempheris*, the air bladder is divided into an anterior and posterior portion.

Family POLYNEMIDAE.

The Polynemidae include marine fishes popularly known as the Threadfins. In these fishes, the pectoral fin is divided into two parts, the lower portion being detached from the remaining part and made up of filamentous rays. These are very slender and thread-like, and are provided with sensory organs and are used as feelers. The body is oblong and somewhat compressed and the eyes are large, lateral and more or less covered by an adipose membrane. The mouth is on the lower side of a prominent snout and bears a lateral cleft. The dorsal fin is disposed in two portions. The scales are finely serrated at the edges (ctenoid) or cycloid. The air bladder, when present, varies in form and structure.

The Threadfins swim in shoals and frequent sandy bays and estuaries in the tropics. They are carnivorous fishes, abounding on the sandy shores in warm, tropical seas. They are not very active, and are not voracious feeders. Their food consists of prawns, crabs, small fishes, such as sardines, and marine eels. The colours are generally golden, silvery green, or purplish black or bluish and silvery. These fishes are all excellent as food fishes and the air bladder of many species yields isinglass of superior quality.

Specimens of two common species, *Polynemus plebius* and *Polynemus indicus* are exhibited. *Polynemus plebius* is golden coloured, with a greyish tinge along the back and dark lines along each row of scales. It is extremely common in the seas and estuaries of India and has been recorded from the Sind on the West Coast, and in the seas of India eastwards up to Malay Archipelago and even beyond.

Polynemus indicus (Fig. 25) is a very large fish, attaining a length of about four feet and a weight of about 20 lb. The back is

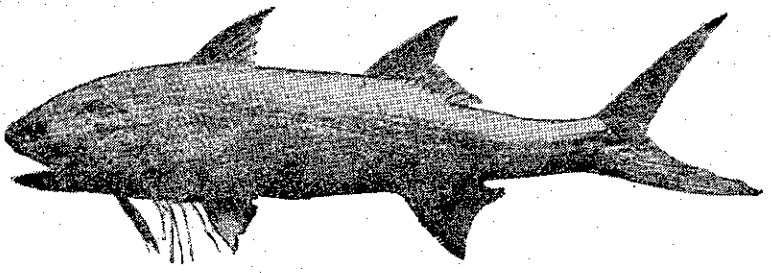

FIG. 25—POLYNEMUS INDICUS : THE THREAD FINS.

purplish black, while the abdomen is silvery white, tinged with golden colour. A large specimen of this fish is said to yield about two ounces of rough isinglass.

Family SCIAENIDAE.

This is a large and varied family of marine fishes, commonly known as the Meagres or Croakers (Tamil: "*Kathalai*", "*Panna*", "*Vellaikathalai*"). The body is rather elongated and somewhat compressed. The eyes are lateral and the mouth is in front of the snout or below it. The mouth is armed with well developed sharp teeth in several rows, but the palate is devoid of teeth. The nature of the teeth indicates their carnivorous habits. In some genera (e.g., *Otolithus*) there are prominent teeth one on either side of the upper jaw and lower jaw, longer and stouter than the rest, and known as "canines". Two dorsal fins are present. The scales are ctenoid or cycloid, covering the head and the snout. The air bladder, when present, usually bears branched, elongated appendages. A remarkable feature of these fishes is the presence of a pair of unusually large ear-stones (otoliths). The colours are usually silvery grey and dull, bright colours being generally absent.

Most of these fishes are marine and coastal in their distribution; a few, however, enter freshwater. The names Drum, Croaker, Roncador, etc., applied to some of these species, refer to the drumming noise produced by the vibration of the air bladder, which often bears a series of hollow, branched appendages. These noises are variously described by listeners as drumming, humming, purring, whistling, etc. The drumming takes place especially at the breeding season and may serve as a signal for the assembling of the shoals. The sounds are quite loud enough to be audible to a person standing on the deck of a ship, and in the Malay Peninsula and other tropical countries, the native fishermen make use of them to locate shoals of fish, one of their party "listening-in", and instructing his companions where to cast their nets.

These fishes are generally found in large shoals on both the East and West coasts of India. They are caught usually in association with the "Grunter", *Pristipoma* and the "Big-jawed Jumper", *Lactarius*. They follow the shoals of the White Bait (*Stolephorus* spp.) on which they feed.. They also feed on other small fishes, prawns, shrimps, crabs and molluscs. Some species attain a large size, e.g., *Sciaena diacanthus*, specimens of which often reach a length of over five feet.

The Sciaenidae constitute an important group of food fishes of the Indian shores, and they often fetch a good price in the Madras fish markets. The air bladders of many of these fishes are extensively collected along the coasts of India for the manufacture of isinglass. Marketable fishes belonging to the species of *Sciaena* and *Otolithus* are particularly abundant at Tanur on the West Coast and at Uppada along the coast of East Godavari district on the East Coast.

Specimens belonging to three species of *Sciaena*, namely, *Sciaena maculata*, *S. albida* and *S. belangeri* and one of *Otolithus*, *Otolithus argenteus* are exhibited. These fishes are mostly silvery grey during life. *Sciaena belangeri* alone is dark grey. *Otolithus argenteus*

(Fig. 26) is a large fish, attaining a length of more than two and half feet. All these are excellent food fishes.

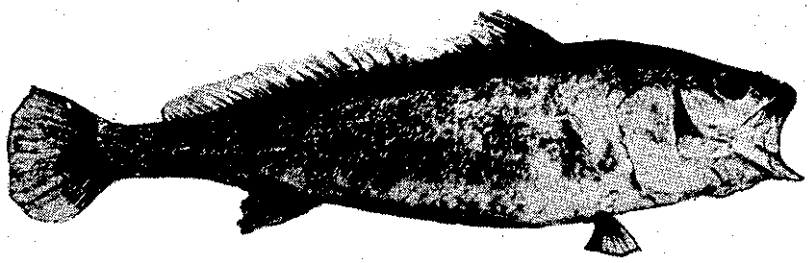

FIG 26—OTOLITHUS ARGENTEUS : THE CROAKER.

Family XIPHIIDAE.

The well known sword fishes or "sail fishes", as they are sometimes called, are included in this family. The most characteristic feature of these fishes is that the upper jaw is produced into a long, pointed, sword-like process or rostrum. The cleft of the mouth is deep and teeth are almost always absent, or, when present, rudimentary. Scales are absent, or they may be in the form of rudimentary dermal plates. The huge dorsal fin of the sword fish is said to be projected above from the surface of the sea on calm days and used by the fish as a sail; hence the popular name, "Sail fish" sometimes applied to these fishes. When swimming at any considerable speed, the dorsal, anal and pelvic fins are folded away into deep grooves. Ventral fins are usually absent, or, when present, it is thoracic in position and rudimentary. An air bladder is present.

An interesting feature of these fishes is the modification undergone by the vertebral column, in which the neural and haemal spines of the individual vertebrae are expanded into long, flat, overlapping processes. These are designed to give added strength and rigidity to the backbone which is subjected to considerable strain when the fish is travelling at great speed.

Sword fishes may attain a length of fifteen feet and are regarded as the swiftest fish. Sword fishes and spear fishes are believed to occasionally attack even whales, but it is doubtful if they really do so. It is, however, true that they often attack ships and are even capable of splitting the ship's timber by the powerful thrust of their "swords". When moving fast through the water, they sometimes come into collision with ships and in the days of wooden vessels, the "spear" was often driven into the timber and broken off short.

A log of wood, probably of a catamaran, broken into two pieces by the "sword" of a sword fish, is exhibited in this Gallery.

Sword fishes are said to strike with the accumulated force of fifteen double-handed hammers. Their velocity is comparable to that of a swivel-shot and is as dangerous in its effects as an

artillery projectile. Serious accidents were caused in olden days to wooden ships by the sword fishes which split the ship's timber and made holes in it, thus letting in water.

Two species are represented in this Gallery, *Histiophorus gladius* and *Histiophorus brevirostris*. Of these, *H. gladius* is by far the best known species of sword fish, and is widely distributed in all warm seas and grows to a length of fifteen to twenty feet. In this fish the "sword" is flattened, instead of being rounded in cross section, and the pelvic fins are absent. In some parts of the world, it constitutes the basis of an important fishery, the method of fishing being to single out and harpoon individual fishes. In life this fish is bluish grey, becoming dull white beneath, and the sail-like dorsal fin is of a bright Prussian blue colour with black spots. A fair-sized specimen of this species, with the extensive, sail-like dorsal fin well spread out, and an entire articulated skeleton of another specimen of the same species are exhibited high up on the wall, in flat wall cases.

Histiophorus brevirostris (Fig. 27) is a much smaller species, with a comparatively shorter rostrum or "sword"; the colour is greyish above, becoming dull beneath. A specimen of this species,

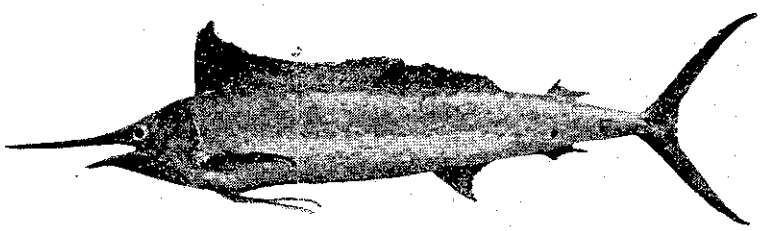

FIG. 27—HISTIOPHORUS BREVIROSTRIS : THE SWORD FISH.

about four feet in length, is exhibited in this Gallery in a sloping case directly below the wall cases containing the other species of sword fish and its skeleton.

Family TRICHIURIDAE.

This family includes flat and elongated, ribbon-like fishes, known appropriately as the Ribbon fishes. The body is flat and long, like a ribbon and terminates behind in a slender, pointed tail, without a tail fin. The mouth is armed with several small, sharp, strong, well developed teeth for seizing their prey. The gill openings are wide and the eyes laterally placed. The cleft of the mouth is deep. The single dorsal fin is long and extends along the entire length of the back. The dorsal and anal fins are many-rayed. The ventrals, when present, are thoracic in position, but sometimes they are rudimentary. The pelvic fins, if present, are reduced to a pair of scale-like structures. Scales are, as a rule, absent, but when present, they may be rudimentary. An air bladder is present. The colour of these fishes is generally bright silvery during life. These fishes are also sometimes popularly known as the Hair-tails.

These are shoaling fishes coming inshore, and one of the species, *Trichiurus savala* (which is also the only one exhibited in this Gallery) enters the inshore waters of Malabar for spawning purposes.

The eggs of this ribbon-fish were often found in the plankton collections during September and October in 1939. These fishes are mainly fish-eating in their habits, feeding on quite a wide variety of fishes such as sardines, big-jawed jumpers, grunters, horse-mackerels, croakers and even on fish larvae and prawns. Species of *Trichiurus* are often voracious in their habits, sometimes devouring members of their own species. They are also pugnacious in their disposition and bite severely when handled. They grow to a length of from three to five feet.

These fishes are esteemed as food fishes to a varying degree in different places and in many localities they are dried and eaten even without being salted because their bodies are thin and ribbon-shaped and not liable to decompose readily. In former times they are said to have been highly esteemed for the table by European soldiers. Large shoals numbering from 3,000 to 5,000 are often caught in Tranquebar in the Thanjavur district on the East Coast, and also off Mukkur in the Ramanathapuram district during the season from June to February. On the West Coast much larger shoals occur from July to November.

A single specimen of *Trichiurus savala*, a common species on the Madras Coast, is exhibited. It is bright silvery, with yellowish white fins.

Family ACANTHURIDAE.

This family comprises marine fishes popularly known as the Surgeon fishes and their relatives. The body is oblong or elevated and laterally compressed. The eyes are lateral and the cleft of the mouth is very shallow. Teeth are present in both jaws, but the palate is devoid of teeth. A single dorsal fin is present, with only a few spines. The ventral fins are reduced, having only three soft rays and are thoracic in position. The scales are disproportionately small and almost minute. The side of the free portion of the tail is usually armed with one or more bony plates or spines. The most characteristic feature of this group is the presence of a sharp, knife-like, movable spine lying in a sheath on each side of the tail with the point turned forwards. This accounts for the popular name "Surgeon fish" as the spine simulates a surgeon's lancet. An air bladder is present, branched into two posteriorly. The ground colour is generally dull brown, but some species have brilliant colour patterns in which yellow and blue lines predominate.

In the allied genus *Naseus* (which is not represented in this Gallery), and in some other related species of this family, a long, bony horn grows forward from the cranium above the eyes. Hence the name Unicorn fishes applied to some members of this family. In the young, this horn appears to be absent. In some species of *Acanthurus*, the caudal spines are bright scarlet and in others blue. The young of the genus *Acanthurus* have no scales, but the skin is vertically striated, sometimes with small, rough prominences. Some of the fishes belonging to this family are said to have a highly convoluted intestines and are herbivorous.

These fishes generally inhabit coral reefs and feed mainly on vegetable matter, cuttlefish and prawns. The tail spines serve as weapons of offence and defence and are capable of inflicting severe

wounds. When a live Surgeon fish is handled carelessly, the tail spines can cut and lacerate the fingers badly. These fishes sometimes attain a large size reaching a length of three feet. Economically, they are not much esteemed as food; however, they seem to form the basis for considerable commercial fisheries at certain ports on the East Coast.

A single specimen of *Acanthurus mata* (*Acanthurus bleekeri*) alone is exhibited to represent this family. It is blackish brown, with the lips and fins entirely black, and attains a length of about eighteen inches.

Family CARANGIDAE.

This is a large and varied family of marine fishes including different genera of laterally compressed fishes popularly known as the Pampanos, Amber fishes or Crevallies, the Horse Mackerels, the Gogglers, the Silver bellies, etc. They are found in all warm seas. In the Horse Mackerels and in several other genera, the scales along the hind portion of the lateral line are modified into enlarged, keeled, bony plates or scutes and this constitutes one of the chief characteristic features of the Horse Mackerels.

The body is oblong, rather elevated, or sub-cylindrical and laterally compressed. The gill openings are wide and the eyes laterally placed. The dorsal fin is rather varied in structure. The spinuous portion of the dorsal fin may be very short and is sometimes formed of isolated spines. The posterior portion of both the dorsal and anal fin sometimes consists of a series of short, detached finlets. The ventrals, when present, are thoracic in position and may sometimes be rudimentary. The scales are usually small and sometimes absent. An air bladder is present. The tail fin is deeply forked. The ground colour of most of these fishes is silvery, often with a metallic blue shade on the back.

Most of the species of *Caranx* occurring in the Indian waters are known popularly as the Horse Mackerels. They have a mixed diet consisting of algae and animal food such as prawns, crabs, shrimps, small fishes such as the Silver bellies, and molluscs. These fishes grow to a large size, some of them, as for instance, *Caranx rottleri* (Fig. 28) and *Caranx kurra*, attaining a length of more than three or four feet. They are highly esteemed as food fishes and

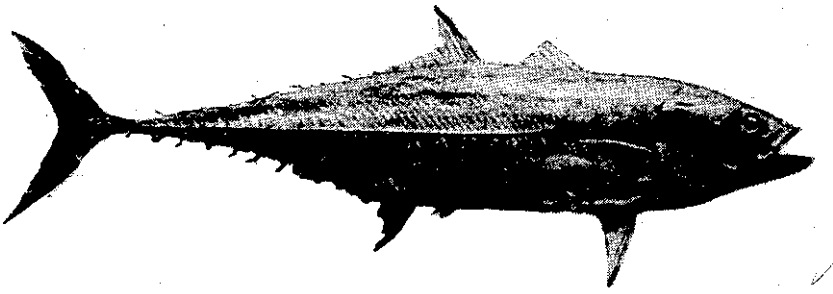

FIG. 28—CARANX ROTTLERI : THE HORSE MACKEREL.

constitute an important fishery off the coast of Madras City. Large specimens are often cut and sold as fillets. As many as twenty-three species of food fishes belonging to the genera *Caranx*, *Alectis*,

etc., are represented in the catches off the coast of South India. Of these, the following contribute to the bulk of the catches on both the East and West Coasts: *Caranx rottleri, C. nigrescens, C. hippus, C. sansum, C. djedaba, C. affinis, C. kalla* and *C. speciosa.*

Several species of *Caranx* including some of the above mentioned species which are highly esteemed edible fishes, are exhibited in this Gallery. Some of these species (e.g., *Caranx crumenophthalmus* and *C. kurra*) are popularly known as the Gogglers. In these forms, the eye is prominent, and disproportionately large and teeth are present on the tongue. The tail is deeply forked. These fishes are silvery on the back and golden below. Gogglers shoal in abundance on the West Coast in September and October and feed mainly on plankton, prawns, crabs, small fishes and molluscs.

Trachynotus ovatus (Tamil: "*Vavval Parai*") is popularly known as the Pampano. This is a Spanish word meaning a "vine leaf", employed by American writers to denote the relatively broad and flattened body of the fish. The fish resembles partly the Pomfret in having a swollen snout and a similar head and partly the Horse Mackerel in having a proportionately long body; hence its Tamil name, "*Vavval Parai*" which means "Pomfret plus Horse Mackerel". The body is compressed and covered with small scales. There is a single dorsal fin, far in front. The ground colour of this species is yellow, with whitish abdomen. The Pampano grows to about two feet in length. They shoal in small numbers near rocky coasts, feeding on shells, crustaceans and planktonic organisms. This is one of the finest of Indian food fishes, with an excellent flavour. Unfortunately it does not occur in the catches abundantly enough to be of commercial importance, but the little quantity that is caught occasionally fetches a considerably high price. It attains a length of at least twenty inches.

Chorinemus lysan (Tamil: "*Thol-parai*") (Fig. 29) and *Chorinemus sancti-petri* are popularly known as the Leather Jackets (or the butterfish or the queenfish). They are closely related to the

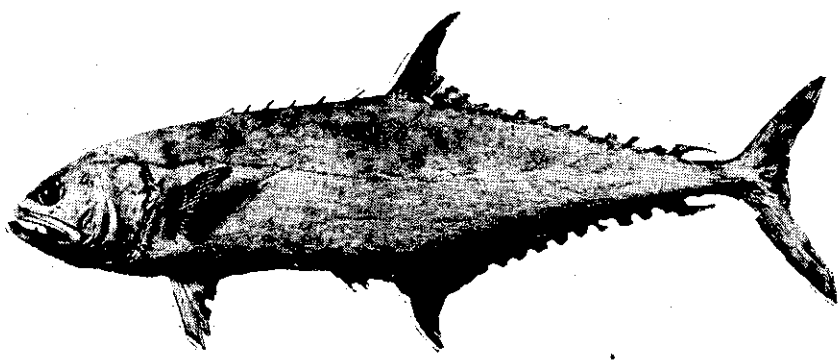

FIG. 29—CHORINEMUS LYSAN : THE LEATHER JACKET.

Pomfret and the Horse Mackerel. The body is compressed and clothed with moderate-sized scales. The anterior dorsal fin is composed of a few free isolated spines. The teeth are well-developed. As the skin is thick and can be easily peeled off, these fishes are known as Leather Jackets. The colour during life is silvery on the

sides, with a row of circular blotches above the lateral line. The median fins are dark. These fishes follow shoals of the White bait and other small fishes and prawns on which they feed. *Chorinemus lysan* especially attains a large size reaching a length of four feet sometimes. The flesh is not so tasty as that of the seer fish. It is very common in the Madras fish markets where it is often cut up and sold as fillets.

Equula edentula is a small fish, popularly known as the Silver belly, with the body oblong and strongly compressed. It is silvery, greyish along the lateral line and with fine, vertical lines from the back down the sides. It attains a length of ten inches or more and ascends rivers far beyond the limits of tidal influence. These fishes are extensively sun-dried, salted and eaten. Fishes of the genus *Equula* are termed "*Caraputty*" in Madras and are eaten salted by natives who suffer from malarial fever.

These are small fishes generally attaining a length of four to eight inches. The mouth is protrusible and the lower portion of the gill cover is serrated. There are spines above the eyes.

Silver bellies prefer to live in-shore in sandy or muddy areas. They are found in abundance at depths of about two and a half to three and half fathoms. They feed on worms and crustaceans found in the mud and also on planktonic organisms. Their protractile mouth is well adapted for feeding in muddy regions.

Platax tiera (Fig. 30) is another common Carangid fish of the Madras Coast with a very broad, oblong body, strongly laterally

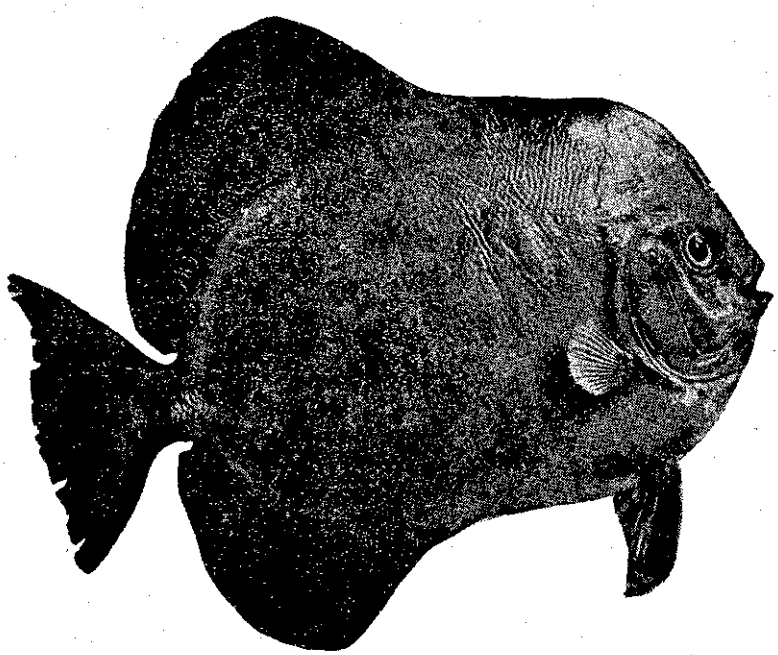

FIG. 30—PLATAX TIERA : THE SEA BAT OR BAT FISH.

compressed. These fishes appear to alter considerably with age, the outline of the front part of the body becoming more obtuse and the

fins being comparatively shorter. The young are greyish, with an ocular band passing downwards from the eye to the ventral fin and other broad bands behind. But these bands disappear with age. This fish is popularly known as the Sea Bat or Bat fish and attains a length of at least twenty inches. The flesh of this species is highly esteemed as food. Two adult specimens and one young are exhibited.

Other species of this family exhibited in this Gallery include *Seriola nigrofasciata, Seriolychthys bipinnulatus, Psettus argenteus* and *Lactarius delicatulus*. Of these, *Psettus argentius* is silvery, with purplish iridescence, especially around the anal fin. The back is yellowish green during life. The body is also broadly banded with black. It attains a length of at least seven inches and is most common in Malabar during the monsoon season.

Lactarius delicatulus is popularly known as the Big-jawed jumper. The body is oblong and compressed and the lower jaw is prominent. The teeth are small with one or two pairs of strong, canine teeth. The upper portion of the body is of a lead colour. A black spot is present behind the gill cover. This is a shoaling fish feeding on prawns, sardines and other small fishes, such as Soles, Silver bellies, White bait, etc. It is said that at times these fishes leap over and escape from the fishermen's nets; hence the popular name "Jumper", and the Tamil name "*Guthipu*" (leaping) also alludes to this habit. This fish is economically important and caught in fairly large quantities both on the East and West Coasts from June to December and extensively salted in fish-curing yards. The flesh of this fish has an excellent flavour and is considered beneficial during convalescence.

Family STROMATEIDAE.

This family includes the highly esteemed food fishes popularly known as the Pomfrets. The body is very broad, oblong and strongly compressed. The eyes are lateral. The head is small and the mouth is also small and terminal. The scales are small, smooth and firmly adherent to the skin. The gill openings are wide. There are numerous small teeth in the jaws and some of the barbed teeth extend also into the gullet, but the palate is devoid of teeth. There is a single, long, continuous dorsal fin without any distinct spinuous portion. Ventral fins, when present, are thoracic in position; in large specimens, the ventral fins are absent. The caudal fin is deeply forked. The ground colour of the fishes is generally grey, or deep brown or greyish brown, usually with metallic reflections. The air bladder, when present, is small.

Pomfrets are found in most tropical and temperate seas. They are moderately shoaling fishes and generally come in-shore. They are mainly surface feeders, feeding on planktonic organisms which are supplemented by small prawns and algae. They also feed on molluscs occasionally. Ingenious methods are employed in trapping large shoals of these fishes by means of huge nets spread out in between catamarans.

Pomfrets are commercially very important and form the basis for a flourishing fishery both on the East and West Coasts. They are

highly valued as food fishes as their flesh has an excellent flavour and is free from fine bones. They are also salted in fish-curing yards and marketed as salt-fish.

Three species of Pomfrets are recognized on Indian shores, namely, *Stromateus sinensis*, the White Promfret (Fig. 31), *S. cinereus*, the Grey Pomfret or Silver Pomfret and *S. niger*, the Black Pomfret.

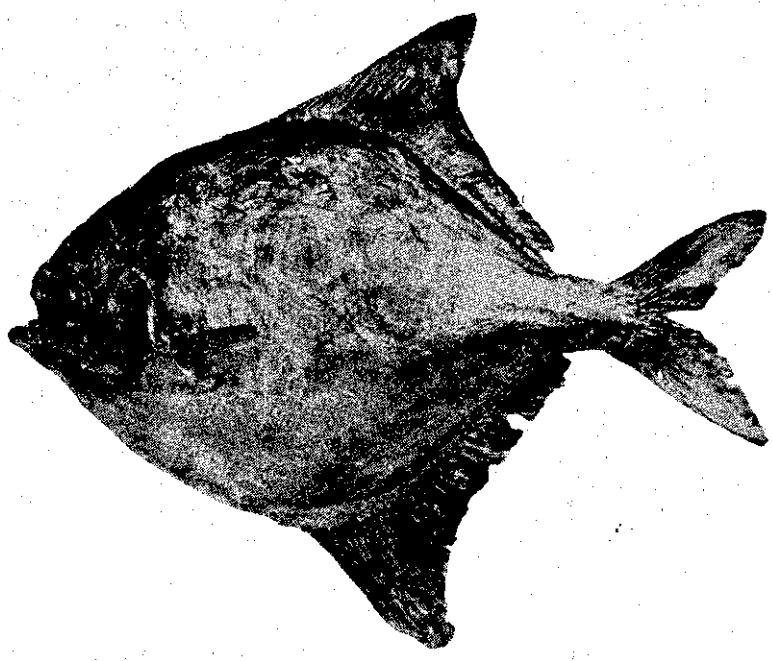

FIG. 31—STROMATEUS SINENSIS : THE WHITE POMFRET

The last two species are commercially more important. The White Pomfret is light silvery and almost whitish, the Grey Pomfret silvery grey, fading into white on the abdomen and the Black Pomfret deep brown, or greyish brown with blue reflections. In the case of *S. cinereus*, the larger specimens (known as Grey Pomfrets) are considered more tasty than the immature ones (known as Silver Pomfrets). The Black Pomfret (*S. niger*) is said to be exceptionally good eating and attains a length of about two feet. Specimens of all these three species are exhibited in the show cases containing the edible fishes of Madras in this Gallery, to which reference will be made later. In the present systematic series, however, only specimens of the Black Pomfret and the Grey Pomfret are exhibited as representatives of this family.

Family CORYPHAENIDAE.

This family comprises marine, mostly pelagic fishes popularly known as the Dolphins; (these are not to be confused with the real Dolphins which are not fishes at all, but aquatic mammals allied to the Whales and included in the Order Cetacea). These fishes have a broad, oblong, compressed body, with wide gill openings and laterally

placed eyes. Teeth are present on the jaws but may be present or absent on the palate. There is a single, long, dorsal fin, without a distinct spinuous section. The ventral fins are usually thoracic in position. The caudal fin is deeply forked. The air bladder may be present or absent.

The Dolphins or Dorados, as they are sometimes called, are found in the seas of the tropical and temperate regions. They are large, swift, mostly pelagic fishes, with elongate, strongly compressed bodies. The high forehead characteristic of the Dolphin is developed only in the adult male. The flesh of the Dolphin is highly esteemed as food.

Only two species of this family are recorded from Indian shores, namely, *Coryphaena hippurus* and *Mene maculata*, and specimens of both these species are exhibited in this Gallery

Coryphaena hippurus is the Common Dolphin which is widely distributed in tropical and temperate seas. It attains a length of more than five feet and sometimes even six feet. It is a swift pelagic fish found in all warm seas, swimming near the surface, and is predatory in habits. During life, this fish is brilliantly coloured with golden blue tints and deep blue spots, but these bright colours fade rapidly after death, the spots becoming black. These Dolphins are not uncommon at Madras, and their flesh is eaten by the natives. Dolphins are considered excellent as food; there is a curious custom of testing their flesh before eating, by putting a piece of silver into the vessel in which they have been cooked; if the flesh is poisonous, the silver is believed to turn black.

Mene maculata is popularly known as the Moon fish. It is much broader and more oblong and ovoid in outline than the preceding species. It is a comparatively small fish attaining at most a length of about one foot. The body is strongly compressed, the belly being sharp-edged and much more deeply curved and prominent than the slightly arched back. This fish is deep blue along the back, becoming silvery white on the sides and abdomen, and bearing two or three rows of large, blue spots along the back. The ventral fins are thoracic, with one spine and five rays, the first of which is very much elongated. This fish inhabits the seas of India and eastwards to the Malay Archipelago and even to Japan and the East Indies. This fish is termed "*Amatti-katti*" in Tamil, meaning a "razor" on account of its peculiar shape.

Family SCOMBRIDAE.

This is a large and varied family comprising a wide range of marine fishes, most of which are economically important and highly esteemed as food fishes. It includes the Mackerels, Seer fishes, the Tunny fishes or Bonitos and the Sucker fishes or Remoras. The last of these (the Sucker fishes), which are not ranked as edible fishes, are sometimes separated into a distinct family, the Echeneoidei.

The body is oblong or moderately elongated and compressed, with wide gill openings and laterally placed eyes. Teeth are present in the jaws, but may be present or absent on the palate. The dorsal fin is in two portions, the first being spiny and distinct from the soft-rayed hinder part. A series of distinct dorsal and anal finlets may be

present or absent. The side of the tail is sometimes keeled. The scales, if present, are small or minute. An air bladder may be present or absent.

All the species of this family are carnivorous, pelagic fishes, usually silvery and blue-backed, and are especially abundant in warm seas. They are very swift swimmers, the pointed head and the fusiform, streamlined body being very efficiently adapted for rapid progress. The spinous dorsal fin is formed of slender spines and can be depressed into a groove on the back. The soft dorsal and anal fins are composed of short, pointed portions in front, followed by a series of detached and much branched rays or finlets.

Specimens of some of the more common South Indian species of almost all the important genera of this family are exhibited in this Gallery and the main characters of these species are briefly outlined below.

Scomber microlepidotus is popularly known as the Mackerel ("*Kanangeluthi*," in Tamil). There is a series of detached finlets on the back behind the dorsal fin and another corresponding series below, behind the anal fin. The tail is rather slender and the caudal fin is deeply forked. The ground colour of the back is greenish, with a row of sixteen spots along the summit of the back and about five to eight dark, longtitudinal bands on the back. The sides and abdomen have a metallic lustre. These fishes are swift swimmers. They feed on minute planktonic organisms, chiefly Copepods; arrow-worms, young polychaet worms, etc., are also occasionally eaten. Diatoms also form a good proportion of their diet. Mackerels also feed on fish eggs. The young Mackerels are carnivorous. The Mackerel is one of the chief food fishes of the South Indian shores and is especially abundant on the West Coast where it is second in importance only to the oil sardine. As the flesh of the Mackerel does not keep fresh for long, the great bulk of the catches on the West Coast is salted and exported to Ceylon and Singapore.

Thynnus macropterus and *Thynnus thunnia* are commonly known as the Tunny fishes or Bonitos; they bear a strong resemblance to the Mackerels and Seer fishes. Of these, the specimen of *Thynnus macropterus* (Fig. 32) is particularly large, and exhibited in a separate show

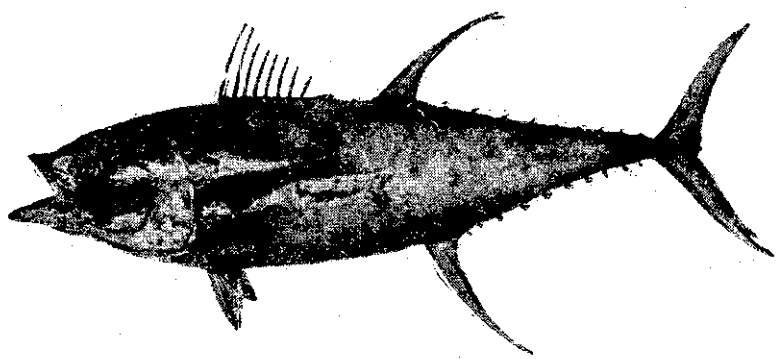

FIG. 32. THYNNUS MACROPTERUS : THE TUNNY FISH.

case near the centre of this Gallery, opposite the case containing the Mahseer. In these Tunny fishes, the spines in the dorsal fin are weak. The hinder portion of the body has no scales. The teeth are small, and there is a longitudinal ridge on either side of the tail. The flesh of these fishes is red: hence the Tamil name, "*Rathachurai*", which means "Blood-coloured fish". The back is blue during life, with oblique dark bands and the abdomen is silvery. Tunny fishes are favourite game fishes. These fishes are well-known for their speed in water and for their fighting qualities. They generally feed on sardines, flying fishes and other small fishes which they follow. They also feed on planktonic organisms. They are usually caught by hook and line, using a small fish as bait. The Tunny is not very popular as a food fish on the Madras Coast, but it is occasionally cut up into fillets and sold in the fish markets. Its economic importance is due mostly to a special product known as "mass-meen" prepared from its cured flesh. Large quantities of this product are exported to Ceylon, Straits Settlement and Japan.

Cybium solandri and *Cybium commersonii* (Fig. 33) are two of the common species of Seer fishes occurring in the Indian seas, (Tamil "*Vanjiram*"). The scales are very small and sometimes they

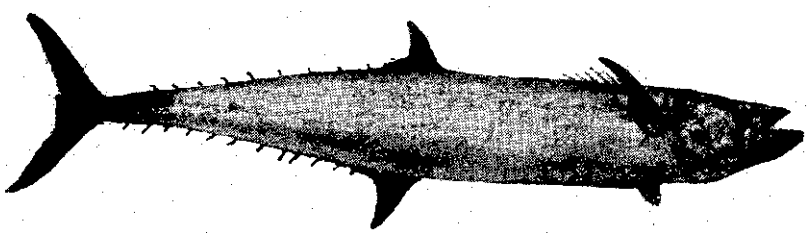

FIG. 33—CYBIUM COMMERSONII: THE SEER FISH.

are absent altogether. The teeth are large, strong and well-developed in both the jaws. There are seven or more detached finlets behind the posterior dorsal and anal fins. The caudal fin is deeply forked and a slight keel or ridge is present on each side of the tail. The upper portion of the body is steel blue while the abdomen is white and silvery. The sides of the body bear indistinct bands or dots. The Seer fishes are swift swimmers and sometimes leap fairly high out of the water. They attain a length of about four to five feet. They usually follow shoals of small fishes such as sardines, etc., on which they feed. The Seer fishes are among the most highly esteemed food fishes of the Indian shores. Specimens from one and half to two and half feet in length are considered to be the ideal for eating. Larger specimens tend to be coarse. Large specimens are generally cut up into fillets and sold, while smaller ones are generally sold entire.

Elacate nigra (*Rachicentrum nigra*) is another Seer-like fish, olivaceous brown with a dark band along the back below the base of the dorsal fin and another along the centre of the side. The fins are brownish, with dark or black edges. This is a widely distributed species, ranging from the seas of India eastwards up to Japan. The specimen exhibited in this Gallery is an exceptionally large one, reaching a length of four feet, ten inches.

Echeneis naucrates [Figs. 34 (A), (B) & (C)] is one of the well-known species of Sucking fishes. These fishes are also variously known as the Shark-suckers or Remoras. In these fishes, the anterior or spinuous dorsal fin is transformed into an oval, transversely

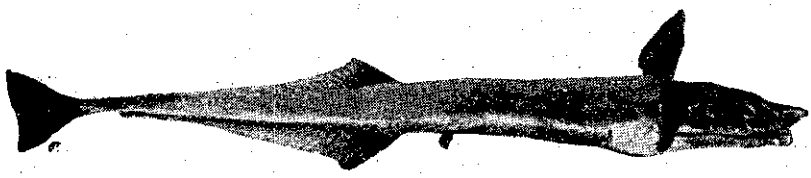

FIG. 34-A—ECHENEIS NAUCRATES : THE SUCKER FISH (LATERAL VIEW).

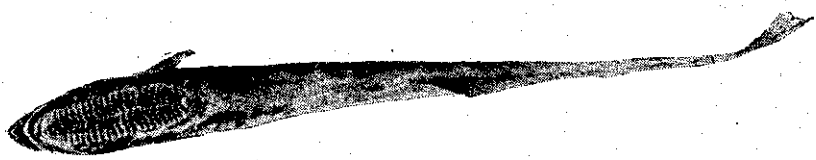

FIG. 34-B—ECHENEIS NAUCRATES : THE SUCKER FISH (DORSAL VIEW).

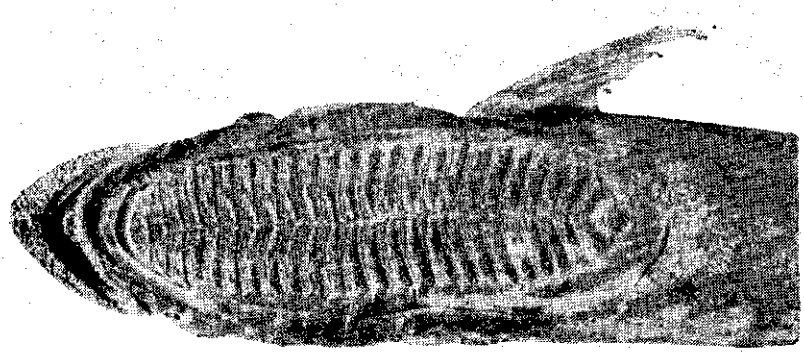

FIG. 34-C—ENLARGED VIEW OF THE ADHESIVE APPARATUS ON TOP OF THE HEAD OF THE SUCKER FISH.

laminated, adhesive disc which extends forwards on the upper side of the head. This sucking apparatus consists of a double series of transverse plates surrounded by a fleshy fringe, and the erection of the plates results in a series of vacuum chambers by means of which this fish attaches itself firmly to the bodies of other large fishes such as sharks or to the sides of boats and sailing vessels or to other floating objects. Natives in various parts of the world make use of these fishes to catch turtles. There is a very strong ancient belief that these fishes are able to impede the progress of sailing vessels, or even to stop them altogether, but such instances are, of course, not authenticated. The Sucking fishes are carnivorous fishes of the warmer seas and some of the larger species attain a length of about three feet.

Family URANOSCOPIDAE.

Fishes of this family are popularly known as the Star Gazers. The body is low, elongated and more or less cylindrical. The gill openings are wide and the eyes are placed on the top of the head. The mouth is vertical and the head is usually well armoured with bony plates. The scales, when present, are rudimentary. An air bladder is absent. The dorsal fin may be single and continuous (as in the genus *Ichthyoscopus*) or in two portions (as in the genus *Uranoscopus*).

The Star Gazers are found in the warm seas and some of the larger species are food fishes of considerable importance. They have the habit of burrowing in the sand with only the eyes projecting and attract small fishes within reach of their jaws by the play of a membranous flap or filament which is generally brightly coloured and which is protruded from the mouth. Some species of Star Gazers are provided with electric organs.

Only two species of this family are recorded in the Indian seas, namely, *Uranoscopus guttatus* and *Ichthyscopus inermis*, and specimens of both these species are exhibited. *Uranoscopus guttatus* is chestnut or slaty brown, with two or three rows of bluish white spots along the back and up to the middle of the sides; the dorsal fin is in two portions. In *Ichthyscopus inermis* the dorsal fin is single, and the body is canary-yellow with buff coloured markings along the back and sides, enclosing white rounded or oval spots.

Family TRACHINIDAE.

This family includes the marine fishes commonly known as the Whiting and related forms. The body is more or less elongated and compressed posteriorly. The head is often large, with laterally placed large eyes. Some of the bones of the head are usually armed. The dorsal fin is sometimes in two portions, but more or less connected or slightly separated. Scales may be present or absent. An air bladder may be either present or obsent.

This family is represented in this Gallery by only a single species, *Sillago sihama*, the Whiting of the South Indian shores (Fig. 35), The body is long and cylindrical. The upper jaw projects well

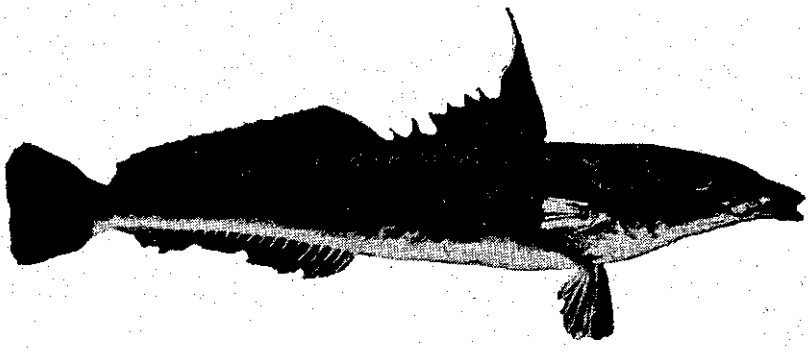

FIG. 35—SILLAGO SIHAMA : THE WHITING.

beyond the mouth. The gill cover bears a small spine. During life, the fish is greenish, but the colour very soon fades after death into a light brown. The abdomen is whitish, with a purple iridescence.

The Whiting is found both in the open sea and in estuaries and often enters very shallow waters. They are said to burrow in sand when frightened. They feed on sea weeds, bristle-worms, prawns, crabs, sand-hoppers and small fishes. Recently, it has been found to feed also on *Balanoglossus* (a worm-like primitive Chordate burrowing in sand and abundant in the Pamban area). As the Balanoglossids live in burrows in the sand, it is probable that the Whitings search for them by digging with their snouts into the sand and pull them out. This fish is known to attain a maximum length of about one foot.

This is one of the esteemed food fishes of the Madras Coast and its flesh has an excellent flavour and is free from fine bones. They are captured in moderate quantities along the East Coast from May to December. The flesh is recommended as being good for invalids as it is easily digestible, and since it is extremely nutritious, native women who are nursing mothers with young babies are advised to eat it.

Family PEDICULATI.

This family comprises the fishes popularly known as the Angler fishes, Sea toads and Frog fishes. The head and front part of the body are large, the head being often broad and depressed. The gill opening is reduced to a small aperture. The teeth are minute. The eyes are either placed on top of the head or laterally. The spinous portion of the dorsal fin, when present, is composed of a few isolated spines. The skin is smooth or with small spines or tubercles. The air bladder may be present or absent.

The Angler fishes are distinguished by the peculiar structure of the spinous dorsal fin. This is composed of a few flexible rays, the first of which (the *illicium*) is placed on the head and usually terminates in a fluffy flap, tassel or bulb, and is used as a line or bait. The head is usually large and flat and the wide mouth is armed with rows of long, sharply pointed teeth. The angler fishes live on the bottom of the sea down to depths of 200 fathoms and lure their prey within easy reach by waving the line and tassel-like bait in front of the mouth. The membranous tassels on the head and body serve to break up the fish's outline and make the fish appear very much like a weed-covered piece of stone. They feed mainly on small fishes, but the larger species are sometimes known to leave the bottom and drag down sea birds floating at the surface. The pectoral fins in these fishes are provided with a sort of peduncle formed by the prolongation of the bones inside, and their pediculated pectoral fins enable them to walk or hop over moist ground or slimy rock in search of their prey. As a result of this peculiar mode of progression, they have become very widely distributed. Although they are bad swimmers, they sometimes inflate themselves and float on the water like a globe fish. Angler fishes also frequently conceal themselves in

the mud; displaying only the foremost filamentous process on the head carrying the bait-like tassel to which the unsuspecting prey are easily attracted. Numerous species of Angler fishes inhabit the tropical seas, frequenting coral reefs and crawling about or hanging on by the pectoral fins.

Specimens of three species of *Antennarius* (Fig. 36), (*Antennarius hispidus, A. mummifer* and *A. commersonii*), and one of *Halieutaea* (*H. stellata*) are exhibited. In *Antennarius* the head and body are

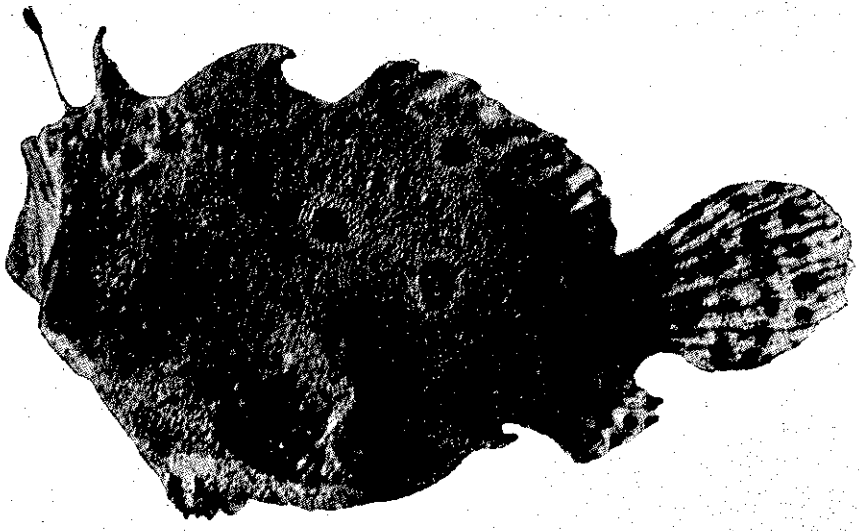

FIG. 36—ANTENNARIUS COMMERSONII: THE ANGLER FISH.

moderately compressed and an air bladder is present, while in *Halieutaea* the head and body are strongly compressed and an air bladder is absent. *Halieutaea* is pinkish while species of *Antennarius* are yellowish, greyish brown or reddish yellow, with spots and markings.

Family COTTIDAE.

Fishes of this family are commonly known as the Flat heads or Crocodile fishes. The body is oblong, more or less spindle-shaped, compressed or subcylindrical with flattened heads. Some of the bones of the head are armed. The eyes are lateral or partly directed upwards. The dorsal fin is in two distinct portions. An air bladder is generally present.

The Flat heads include about fifty species inhabiting the warm seas of the Indo-Pacific Region. Many of them grow to a fairly large size and are valued as food. The most abundant species and usually the largest in size is *Platycephalus insidiator*, the "Kochi" of the Japanese, which is represented among the exhibited specimens in this Gallery. These fishes are popularly known as the "Crocodile fishes" in Malabar, and are capable of inflicting severe wounds when

handled alive, causing violent irritation. These fishes are therefore killed by knocking on the head immediately they are captured. The eyes of these fishes are peculiar in having two semi-circular flaps over the iris which can be brought close together in response to the stimulus of light. The head becomes much broader in proportion to its length as age advances, in these fishes. They are eaten by the poorer classes of people in many localities.

Specimens of three species of *Platycephalus*, namely, *P. scaber*, *P. insidiator* and *P. punctatus* are exhibited. These fishes are all brownish in life, becoming paler or whiter beneath. Of these three species, *P. scaber* is the commonest one on the Madras Coast, but *P. insidiator* reaches the largest size, attaining a length of at least a foot and a half in length.

Family GOBIIDAE.

This family includes mostly fishes of small size known as the Gobies. The body is generally elongated and more or less cylindrical. The eyes are lateral and sometimes very prominent. The dorsal fin may be either single or sometimes very prominent. The dorsal fin may be either single or sometimes divided into two portions, the spines in the spinous portion being flexible. The pectoral fins are large, with broad bases and the pelvic fins are sometimes united to form a sucker like disc or cup or they may arise close together. Scales may either be present or absent and the air bladder is generally absent.

Fishes of this family are nearly all of small size, some living on sandy or muddy bottoms close to the shore while others inhabit rock-pools between tide marks. Some small species of Gobies habitually live in the crevices of coral rock. These fishes are usually found in fairly large numbers along the shores and estuaries of India. In some species, such as the Mud skipper or Walking Goby (*Periophthalmus* spp.), the eyes are very prominent and the pectoral fins are modified into limb-like organs which enable the fish to venture out of water and walk for considerable distances on land in damp and marshy localities.

Although numerous species of this family (belonging to different genera) both marine and freshwater, are recorded from Indian shores, specimens of only two species, namely, *Gobius giurus* and *G. acutipinnis* are exhibited. In *G. giurus*, which is exhibited as a dry-mounted specimen, the colour is very variable, but it is generally fawn coloured with cloudy markings on the head and irregular spots on the body. This fish attains a length of about a foot and a half and numerous subspecies are recognized based on differences in colour and colour markings. This is one of the common fresh water Gobies of South India that is largely bred in tanks and ponds and shows considerable variation, not only in its colour, but also in the proportions of the body. The specimen of the other species, *G. acutipinnis*, is a wet-mounted one and is exhibited separately in the corner vertical case containing spirit preserved specimens. It is a very common species attaining a length of three and a half inches and in life, it is greyish brown above, becoming dull white beneath.

Family CALLIONYMIDAE.

This family comprises small, generally scaleless fishes, popularly known as the Dragonets. The body is usually elongated. There are two dorsal fins, the anterior dorsal bearing flexible spinous rays. The pelvic fins are placed widely separated from each other. An air bladder is absent.

These fishes are widely distributed and are found in temperate seas as well as throughout the seas of the tropical regions from India to the Malay Archipelago. They appear to live mostly at the bottom of the sea, but not far from the shore. The width of the gill opening varies widely in this family, and based on the size and position of the gill opening, this family has been divided into a number of sub-groups. Many of the species are remarkable for the sexual differences they exhibit and for their interesting courtship displays. The vivid colours of the male often become intensified at the breeding season. They are small, naked fishes, with a flattened head and a small mouth. There is a strong spine on the gill cover. They are found in moderately deep water mostly at the sea bottom in tropical and temperate seas.

A specimen of a single species, *Callionymis lineolatus,* is exhibited. It is a small fish attaining a length of about four inches, with the mouth and lower surface of the head coloured scarlet and bearing five or six greyish bands across the back and sides of the body.

Family RHYNCHOBDELLIDAE.

This family includes elongated, eel-like fishes, commonly known as the Spiny Eels and their allies. The body is elongated and somewhat snake-like or eel-shaped. The gill opening is reduced to a slit on the side of the head. A single, long continuous dorsal fin is present with a series of free spines in its anterior part. The ventral fins are absent. An air bladder is present.

These fishes are carnivorous freshwater fishes found in Africa and Southern Asia. They prefer to live in ponds or other stretches of freshwater in which mud abounds. They are found in the deltas of most of the large rivers in India. They are often found far inland and also sometimes at great elevations. The lower jaw, although long, is incapable of much free movement. The peculiarities of the nostrils and the olfactory organs in these fishes indicate that they depend much on their sense of smell and it is probable that they burrow in mud during the day and search for food at night.

These fishes are reputed to be excellent as food, although owing to their superficial resemblance to eels and snakes, they are not favoured by many classes of people. However, they have a less disgusting appearance than the real eels and are much esteemed as food by some of the natives.

One species of *Rhynchobdella,* namely, *R. aculeata* and two of *Mastacembelus, M. armatus* and *M. pancalus,* are exhibited. The colour in life of these fishes is mostly brownish or greenish or greenish olive, becoming yellowish or lighter brown on the abdomen.

Family SPHYRAENIDAE.

Fishes included in this family usually attain a large size and are commonly known as Barracudas. The body is elongate and more or less subcylindrical. The eyes are fairly large and lateral in position. The jaws are armed with large and powerful cutting teeth; teeth are also present on the palate. Two short dorsal fins are present, widely separated from each other. The scales are small and cycloid and the air bladder is branched into two posteriorly.

The Barracudas are large, pike-like carnivorous fishes found widely distributed in tropical and temperate seas. Their powerful jaws armed with strong, acute, sharp-edged teeth enable them to attack and capture their prey quite efficiently. The larger species may be dangerous to man and are often more dreaded than the sharks in the seas inhabited by them. Large species may attain a length of eight feet. Normally they feed on other fishes and have voracious appetite. They are swift and extremely powerful swimmers. Their long, knife-like teeth render them very destructive to fishing nets. These fishes are not much esteemed as food fishes.

Two species are common on Indian shores, namely *Sphyraena jello* and *Sphyraena commersonii* and specimens of both these species are exhibited. The former is grey, becoming white beneath and attains a length of at least five feet. The latter is bluish above and silvery beneath and reaches a length of about four and half feet.

Family MUGILIDAE.

This family includes commercially valuable fishes commonly known as the Mullets; they are also called Grey Mullets or the Mugils. The body is oblong, rather stout, somewhat compressed and with the head and anterior part of the body rather broad and generally depressed. The eyes are lateral and sometimes have fleshy lids known as adipose lids. The teeth are very fine and sometimes may be absent altogether. Two dorsal fins are present. The scales are usually cycloid and are large and conspicuous. The body is generally silvery.

Mullets inhabit coastal waters and are extensively distributed in the seas of India, entering tidal portions of rivers and estuaries. Some species, e.g., *Mugil oeur* go even beyond the tidal limits and enter freshwater. It is this remarkable power of adaptation that has renederd this fish suitable for freshwater pisciculture. Mullets generally feed on planktonic organisms, larvae of bristle worms, larval molluscs and sea weeds, and often their food consists mainly of the decomposed animal and vegetable matter contained in the mud. Their very small teeth, often reduced to mere bristles, are adapted to this type of feeding habit. The hinder portion of their stomach is muscular like the gizzard of a fowl.

The Mullets, being stout fishes, without fine bones, are very fleshy and are highly esteemed as food fishes in the fresh state. They are mostly consumed fresh, but are also extensively salted and sun-dried.

The freshwater species are mostly confined to the larger rivers. As Mullets decompose rapidly in hot climates, they should be adequately preserved in cold storage if they cannot be consumed immediately in the fresh state. Their bodies often become distended with gases as a result of rapid putrefaction. The roes of Mullets are also highly esteemed as food, both in the fresh and salted condition.

Several species of food fishes belonging to the genus *Mugil* are common on the Madras Coast. Of these, specimens of only two species, *Mugil borneensis* and *Mugil oeur* (Fig. 37) are exhibited in

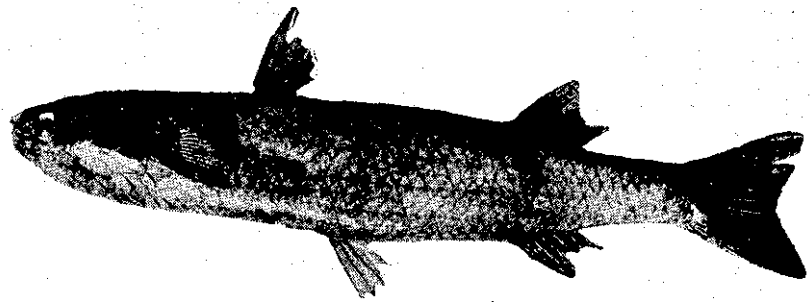

FIG. 37—MUGIL OEUR : THE MULLET.

this Gallery. *Mugil oeur* appears to be particularly suited for freshwater pisciculture. It is greyish along the back and silvery on the sides and lower surface. A dark line is present along each row of scales in the upper half of the body. The sides of the head are golden-coloured. *Mugil borneensis* is more or less uniformly silvery, the dorsal and caudal fins being edged with black.

Family OPHIOCEPHALIDAE.

These are freshwater fishes, known popularly as the Murrels or Snake-heads (Tamil: "*Veral*" or "*Korava*"), inhabiting both ponds and rivers. The body is elongated, more or less cylindrical, and the head is flat and depressed bearing, enlarged plate-like, thickened scales, resembling somewhat the shields on the head of a snake (hence the name *Ophiocephalus*, meaning snake-headed fish). The eyes are lateral. The lower jaw bears enlarged and pointed teeth. These fishes have hollow cavities in the head, and in addition to breathing dissolved air by gills, the Murrel has certain accessory respiratory organs which enable the fish to breathe free air. The fins are spineless. An air bladder is present. The colour is variable and ranges from olive green to dark brown. These fishes possess to some extent the power of changing their colouration to suit the colour scheme of their surroundings.

Murrels are confined to freshwater ponds and rivers and are found especially in weedy ponds and swamps. They come up to the surface frequently for breathing free air. The presence of an accessory cavity to the gills enables them to respire free air and they are therefore able to travel over moist ground for considerable distances. They are able to tide over adverse conditions either by

travelling from a drying pond to another with better conditions or by aestivation when the pond becomes dry and is no longer suitable for the fish to live in. The Murrel enters into a state of suspended animation by burying itself in the drying mud, the accessory air-breathing organs alone functioning. These fishes are predaceous, feeding on worms, insects, small fishes, tadpoles and frogs and they also sometimes eat their own young ones. They build nests for laying their eggs, the nest being a shallow depression cleared in the weed-covered margins of the ponds. These fishes are valued as food fishes, but those living in rivers and streams are preferred to those found in ponds and stagnant water. Murrels are well suited for pisciculture on account of their hardy constitution and the ease with which they can be thansported. Most species attain a length of about one foot.

Specimens of four of the common South Indian species, namely, *Ophiocephalus micropeltes* (Fig. 38) *O. striatus, O. punctatus* and *O. gachua* are exhibited. The colours of these species in life are

FIG. 38—OPHIOCEPHALUS MICROPELTES : THE MURREL OR SNAKE HEAD.

mostly dark greyish, greyish brown or olive greenish above, but they vary considerably according to the colour of the water which they inhabit. Most of these are favourite as food fishes, especially in interior localities where marine fishes are difficult to secure. *O. gachua* is often found thriving at the bottom of wells; *O. striatus* abounds especially in tanks and grassy swamps and may attain a length of about three feet. *O. punctatus* prefers stagnant to running water and grows to a length of about one foot.

Family LABYRINTHICI.

This family comprises freshwater and estuarine fishes with an elaborate accessory air-breathing apparatus and includes the well known Climbing Perch and the Gourami. The body is compressed and more or less broadly oblong. The eyes are lateral. A well developed accessory breathing organ is present in the form of a pair of relatively large air chambers or lungs, each developed as an outgrowth from the gill cavity. In addition, each chamber contains a complicated, shell-like, "labyrinthine organ" which is richly supplied with blood vessels and bears complex folds which increase the respiratory surface. The anterior portions of the dorsal and anal fins are provided with very strong and stiff spines. The scales are moderately large and ctenoid. An air bladder is present.

These fishes inhabit freshwaters and estuaries. They are capable of living for considerable periods out of water and are able to breathe atmospheric air directly by means of their accessory respiratory organ. They feed both on vegetable and animal matter and often get easily introduced and acclimatized in other countries. All fishes of this family are regarded as good for eating and some species are even considered valuable for their medicinal and invigorating properties.

Specimens of two of the best known species of this family are exhibited, namely, the Climbing Perch. *Anabas scandens* and the Gourami (*Osphronemus alfaff* = *Osphronemus gourami*).

The Climbing Perch (*Anabas scandens*) (Fig. 39) rarely exceeds a length of about eight inches. It is capable of making extensive overland journeys from one pond to another, progression being

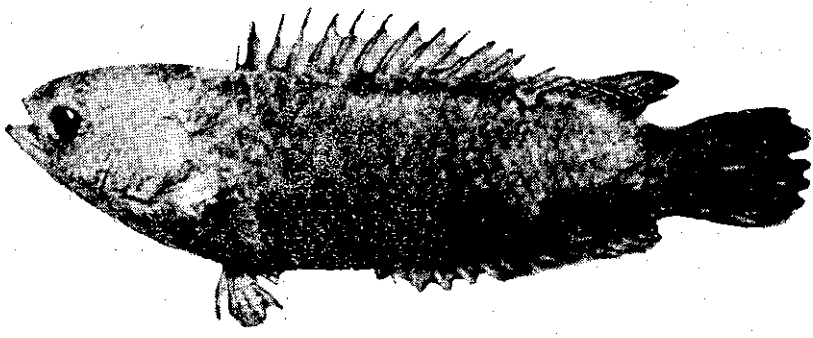

FIG. 39—ANABAS SCANDENS : THE CLIMBING PERCH.

effected by the pectoral fins and the tail, aided by the spines on the gill covers. The air breathing is carried on even when the fish is in the water, the fish frequently coming to the surface for this purpose and it has been shown that it will suffocate and get drowned in water saturated with oxygen if it is deprived of access to free air. These fishes are reputed to climb trees, specially the trunks of palmyrah trees (hence the Tamil name, "*Panai-eri-kendai*"), and there is a record of a specimen having been captured five feet from the ground in the cleft of a palmyrah tree. During the rainy season they migrate from pond to pond and during the hot weather they are known to aestivate, burying themselves in the dry mud in a torpid condition. The Climbing Perch is extensively used for food in India and the Malay Peninsula.

The Gourami (*Osphronemus olfax* = *O. gourami*) (Fig. 40) is a much larger fish attaining a length of eighteen to twenty inches and a weight of more than twenty pounds. It is valued as a food fish and is also a favourite specimen in tropical aquaria. It is greenish brown above and lighter below, with a broad and compressed body. The mouth is protractile. The outer ray of the ventral fin is long and filamentous. The male has a knob on the head. In young specimens there are four or five vertical bands. The Gourami is noted for its nest-building habits. The nest, usually six inches in diameter and seven inches in depth, has a striking

resemblance to a bird's nest; the mouth of the nest, however, faces downwards. Numerous species of water weed are used in the

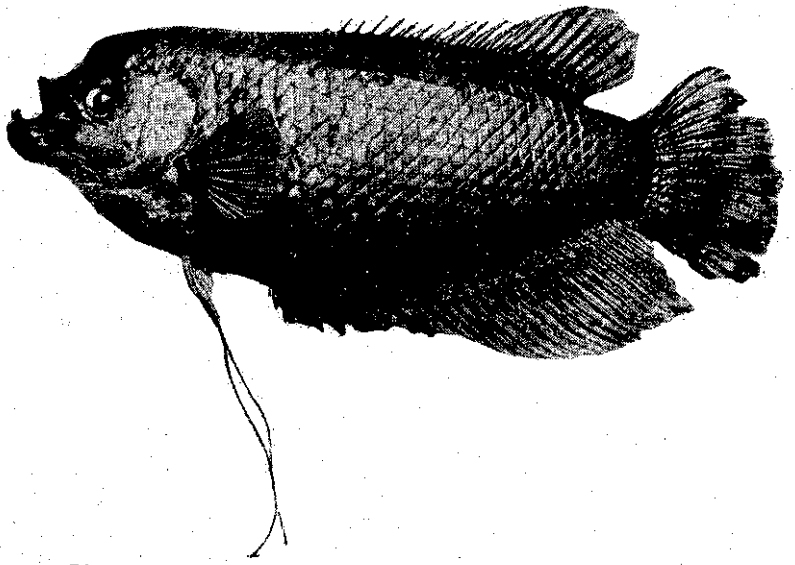

FIG. 40—OSPHRONEMUS GOURAMI: THE GOURAMI.

construction of the nest. After the eggs are laid in the nest, the male keeps a watch over the embryos. Hatching takes place in about three weeks. The original home of the Gourami is Java, and it has been extensively used for freshwater pisciculture in shallow ponds containing water weeds. This fish is an excellent freshwater food fish when reared in clean water.

Family GLYPHIODONTIDAE.

Fishes belonging to this family, popularly known as the Damsel fishes are typically inhabitants of coral reefs and are often brilliantly coloured. The body is short and more or less laterally compressed. The teeth are rather feebly developed. There is only a single nostril on each side. The dorsal fin is single, with the spines more or less equal in number to the soft rays. The scales are ctenoid; an air bladder is present.

Damsel fishes are noted for their very vivid and brilliant colouration and many species bear white vertical bands on a bright ground colour. Some species of *Amphiprion*, for instance, are brilliant orange, red or yellow, usually marked by white or creamy blue vertical bands. Most of these fishes are carnivorous, feeding on shrimps, worms and other small marine organisms. Certain species of the genus *Amphiprion* have the habit of associating with large sea anemones, and live in the interior of the bodies of the aliemones apparently without suffering any harm from the stinging cells with which their tentacles are armed. It is suggested that the brilliantly coloured fish serves the anemone as a decoy, attracting small fishes within its reach to the mutual advantage of both partners. This is therefore a good example of commensalism.

Specimens of two species, namely, *Amphiprion bifasciatum* and *Glyphiodon caelestinus* are exhibited. The former is brownish back, with two milk-white cross bands, while the latter is olive brown, with five vertical dark cross bands.

Family LABRIDAE.

The Labridae constitute a large and rather varied family of almost entirely marine fishes, commonly known as the Wrasses. The body is oblong or elongated. Teeth are present in the jaws, but not on the palate. The dorsal fin is single and continuous, usually with as many spines as the soft rays or even more. The scales are cycloid and an air bladder is present.

This large family of marine fishes includes nearly 500 species, mostly confined to the seas of tropical and temperate regions, and living in shallow water among rocks and weeds. Many species are brilliantly coloured and are generally found in the vicinity of coral reefs and rocks. They feed mainly on crabs and shells and many species are provided with extremely strong and powerful teeth to enable them to crush the shells of crabs and molluscs, and a few have an additional pointed tooth at the angle of the mouth for pressing the shells against the crushing teeth while feeding. The tropical forms especially include a number of brightly coloured species. The lips in these fishes are generally thick—a feature from which these fishes derive their alternative name, "Lip-fishes". The lower pharyngeal bones on the floor of the gullet are united to form a broad, triangular or T-shaped plate bearing conical or rounded teeth that help in crushing the hard shells of molluscs and crabs on which they feed.

Specimens of five species, belonging to five different genera are exhibited to represent this family. *Cossyphus axillaris* is orange-red in colour, but the colour is somewhat variable. *Platyglossus bimaculatus* is yellowish, with the lower edge of the eye tinted greenish and with violet coloured bands radiating from it. It attains a length of eight inches. *Novacula rufa* is rosy, becoming yellowish on the abdomen and with yellowish fins. In *Julis lunaris*, in which the body is oblong and compressed, the head is violet, with several oblique reddish bands while the body is greenish with red banks. *Pseudoscarus rivulatus* attains a length of about eighteen inches and is greenish in colour, each scale bearing a reddish base and with numerous undulating green lines on the snout and cheeks.

Family CHROMIDES.

This family includes freshwater and brackish water fishes commonly known as the Pearl Spots and their allies. The body is rather broad and oblong and more or less laterally compressed. The teeth are small, and absent on the palate. The dorsal fin is single and continuous, the spines being more numerous than the rays. The ventrals are thoracic in position and bear one spine and five rays. The scales are generally ctenoid, and an air bladder is present.

Although this family contains many genera, only one, namely, *Etroplus*, is represented in the Indian seas. The fishes of this genus are found along the Malabar Coast south of South Canara and along the Coromandel Coast as far up as Orissa. Among the three recorded species of this genus, *Etroplus suratensis* (Fig. 41), popularly

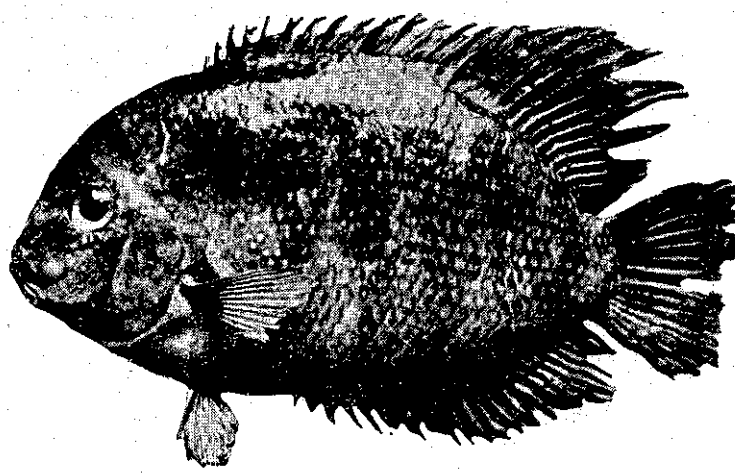

FIG. 41—ETROPLUS SURATENSIS : THE PEARL SPOT.

known as the Pearl Spot is the commonest on the Madras Coast, and this, and another species, *Etroplus maculatus*, mounted as a wet specimen in the vertical case in the corner, are the only species of this family that are exhibited in this Gallery. In *Etroplus suratensis*, the ground colour is light green. There are eight dark transverse bands. The scales above the lateral line have a central white pearly spot.

The Pearl Spot is very common in backwaters, estuaries and freshwater lakes and rivers wherever there is a luxuriant growth of acquatic vegetation. Its food consists mainly of the alga *Spirogyra* as well as worms and shirmps. It becomes sexually mature in the second year of its life and breeding takes place twice a year. The mother watches over the larvae for over two months. This fish is well adapted for pond culture. The fish is free from bones, and as its flesh has a delicate flavour, it is one of the highly esteemed fresh water food fishes of the Madras Coast. It is also very common in fresh water ponds and estuaries on the Malabar Coast and attains a length of more than one foot. It is attracted to a bait easily, but is not so readily captured in a net, as it has a tendency to bury itself in the mud, diving under the net. Even if a fish farm is infested with predaceous fishes such as he Murrel, etc., the young Pearl Spots are able to live and thrive there on account of the well developed spinous dorsal fin which prevents an enemy from attempting to swallow them

ORDER ANACANTHINI

In this Order, all the rays of the dorsal, anal and ventral fins are soft, i.e., there are no spines in the fins as in the preceding Order (Acanthopterygii). The ventral fins are thoracic or jugular in position. The air bladder, when present, is *not* connected with the gullet by a pneumatic duct. These spineless fishes are dividd into two groups or Suborders, namely, (i) Anacanthini gadoidei, in which the two sides of the head are symmetrical and (ii) Anacanthini pluronectoidei, in which the two sides of the head are apparently asymmetrical in the adult. The single family of this Order represented by exhibited specimens in this Gallery, namely, Family Pleuronectidae, comprising the Soles and Flat fishes, belongs to the latter group or Suborder.

Family PLEURONECTIDAE.

The Flat fishes and Soles belong to this family. The head and body are strongly flattened and compressed, with one of its sides coloured, the other side being pale or whitish. These fishes are unique in being asymmetrical with both eyes placed on one side (i.e., the coloured side which is normally uppermost when the fish lives flat) of the head. The two sides of the head are asymmetrically developed, one side remaining almost rudimentary. The dorsal and anal fins are long and continuous, supported by numerous soft rays. The jaws and teeth may be almost equally well developed on both the sides or even slightly more developed on the blind side. Scales may be present or absent. There is no air bladder. There are three lateral lines, one on the blind side and two on the eyed (ocular) side.

The Flat fishes and Soles are widely distributed, being found in almost all the seas of the world, and live mostly at the sea bottom with the eyed (ocular) side which is coloured, uppermost, and with the blind side, which is generally white, underneath. Unlike the ordinary fishes which cleave the water vertically with their body, the sole fishes float horizontally in the water and move by undulating motions of the body with the coloured side uppermost. These sole fishes also spend most of their time on the sea bottom half buried or creeping over the sand and feeding on the organisms there. They feed mainly on unicellular plants, Copepods, larval prawns larval molluscs, bristle worms and on ossicles of sea slugs, dead fish, etc. Many species are highly esteemed as food fishes and the group as a whole is therefore of considerable commercial importance. They possess remarkable powers of changing their colouration to harmonize with the colour scheme of their surroundings. They also undergo a remarkable metamorphosis. When the young sole hatches out it has a symmetrical body and both sides are alike. As the young fish develops, it begins to stop and rest from time to time lying on one side for a little while. The side on which the fish lies is usually the right side and this gradually loses its colour while the left side (the uppermost side) becomes darker. The mouth gets twisted and gradually the right eye begins to travel slowly towards the margin and it crosses over the top and comes to rest on the left side of the

body so that now both eyes are on the uppermost side. The body also becomes flattened and strongly compressed from side to side. In South India, the Malabar Sole (*Cynoglossus semifasciatus*, Tamil: "*Nakkumeen*") is particularly valued as a food fish, and is perhaps the only sole of commercial importance because it is the only species of sole fish which occurs in large shoals, although it is of small size, measuring only 16 centimeters in length.

Specimens of *Psettodes erumei* (Fig. 42) (Tamil: "*Erumai-nakku*"), *Synaptura commersoniana*, two species of *Pseudorhombus*, and two of *Cynoglossus* are exhibited. *Psettodes erumei* is brownish,

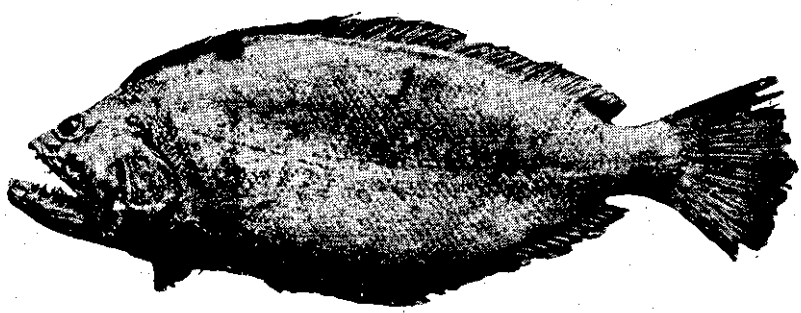

FIG. 42—PSETTODES ERUMEI : THE SOLE FISH OR FLAT FISH.

while *Synaptura commersoniana* is leaden grey. Species of *Pseudorhombus* are rich brownish or reddish brown. *Cynoglossus lingua* is also reddish brown sometimes with cloudy markings, while *Cynoglossus microlepidotus* is brownish with an ill-defined bluish band along the bases of the dorsal and anal fins. All these colours are seen only on the coloured or uppermost (ocular) side, the other side being pale whitish and colourless. In *Psettodes* the dorsal fin does not extend forward on to the head and its anterior rays are spinous, but in all other genera, the dorsal fin extends forwards on to the head at least above the eye and all the fin rays are flexible and articulated.

ORDER PHYSOSTOMI

In this Order, which comprises various families such as those including the Cat fishes, Flying fishes, Carps, Herrings, Milk fish, Eels, etc., all the fin rays are soft and articulated, with the exception of the first in the dorsal and pectoral fins, which are frequently more or less ossified. The ventral fins, when present, are abdominal in position and spineless. The air bladder, when present, has a pneumatic duct, except in the family of Flying fishes.

Family SILURIDAE.

The Siluroid fishes are popularly known as the Cat fishes on account of the presence of a number of long feelers or barbels around the mouth. They form a large and varied group, including

several hundreds of species, the vast majority of which occur in fresh water. The skin is scaleless, and is either smooth or covered with bony plates or scattered tubercles. The dorsal fin is rayed, and either this, or an adipose dorsal fin (i.e., a fleshy fin-like lobe) may be present or absent. The air bladder, when present, is either free in the abdominal cavity, or more or less enclosed in bone. It is connected with the hearing organ by means of the auditory bones. The jaws carry large and sharp teeth often disposed in two or more bands.

Cat fishes are mostly fresh water fishes which generally prefer muddy to clear water. The larger forms usually inhabit the large and wide rivers such as the Ganges, Indus, etc., and hence they are comparatively rare in South India. These fishes make use of their feelers or barbels in finding their way about in muddy places and consequently the eye gets partly atrophied in the adult. Most Cat fishes have bands of pointed teeth and are omnivorous, but some with smaller mouths and incisor-like cutting teeth are herbivorous or feed on organic debris. Many of these fishes are known to cause poisonous wounds. Some species, such as those of *Glarias*, have a dendritic accessory air breathing apparatus which enables them to survive out of water, breathing direct atmospheric air. Parental care is noticed in the genus *Arius* and some allied forms where the males carry the eggs in their mouths until they are hatched.

Although most members of this family are fresh water forms, yet some species such as those of *Arius* are essentially marine, inhabiting the seas and estuaries of tropical regions and ascending the mouths of rivers within tidal limits. There are five marine Cat fishes of economic importance on the coasts of South India, namely, *Arius thalassinus* and *A. dussumieri* on the West Coast, and *Arius falcarius, A. jella* and *Osteogeniosus militaris* on the East Coast. Of these, specimens of the two common species occurring on the Madras Coast, namely *Arius falcarius* and *A. jella* (Fig. 43) are exhibited.

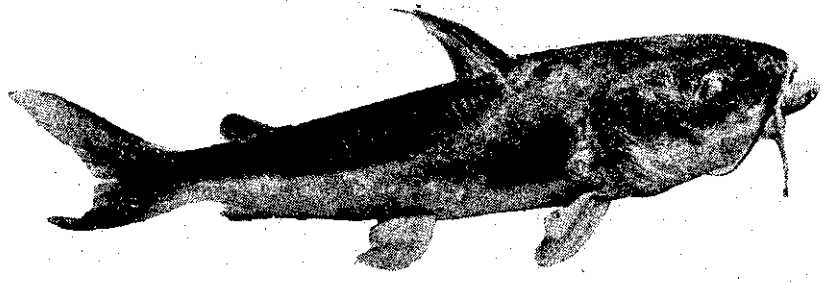

FIG. 43.—ARIUS JELLA : THE WHITE CAT FISH (WITH YOUNG IN ITS MOUTH).

These Cat fishes shoal in large numbers on the West Coast, but on the East Coast they do not appear in shoals. They feed mainly on sea cucumbers, cuttlefishes, small crustaceans, prawns, crabs, worms, molluscs and small fishes. *Arius jella* is the White Cat fish, greyish silvery above and whitish on the sides and lower surface. This Cat fish is found in estuaries and backwaters, and around Madras it is common in the Adyar and Ennur backwaters, especially during the

breeding seasons, i.e., from August to January. After fertilizing the eggs, the male transfers them to its mouth and incubates them there till they hatch out after about a month. Even after the young ones are hatched, the male carries them in its mouth for a further period of about a month till the yolk sac is completely absorbed. Throughout this period, the male does not take any food. This is an extraordinarily striking instance of parental care among fishes.

Specimens belonging to two species of *Macrones,* three of *Arius* and other species such as *Callichrous bimaculatus, Wallago attu, Plotosus canius, Clarias batrachus* and *Saccobranchus fossilis* are exhibited. In the vertical show case in the corner, containing spirit-preserved specimens, stages in the development of *Arius falcarius* and a male adult specimen of *Arius jella* carrying eggs in its mouth, illustrating a remarkable instance of parental care in fishes, are exhibited. The male does not feed throughout the period the eggs remain in its mouth, until they are hatched.

Plotosus canius is a chestnut brown fish, with two bluish white longitudinal bands and very long barbels. The wounds from the pectoral spines of this fish are said to be dangerous. *Saccobranchus fossilis,* a leaden-coloured fish, sometimes with two yellow bands, also causes poisonous wounds by means of its pectoral spines. *Clarias magur* has a well developed accessory respiratory organ and is able to survive long after removal from water. Its flesh is considered highly nourishing. *Wallago attu* (Fig. 44) is sometimes known

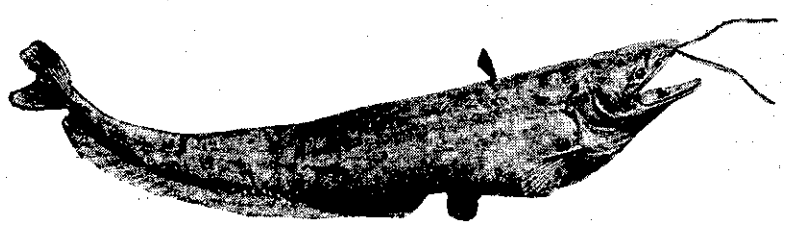

FIG. 44—WALLAGO ATTU : THE CAT FISH OR "FRESHWATER SHARK".

erroneously as the "fresh water shark". It is a large and powerful Cat fish attaining a length of nearly six feet and is predaceous in its habits. It devours other fishes in the pond. Generally it flourishes in muddy tanks and is slow in its movements, living at the bottom of the tank for the most part. It is one of the better known fresh water food fishes of Madras, but although eminently suited for fresh water pisciculture, it cannot be recommended for cultivation on a large scale on account of its predaceous habits.

Family SCOPELIDAE.

This family comprises marine fishes some of which are known as lantern-fishes on account of the numerous luminous spots on the body (Genus *Scopelus*). It also includes the well known edible fish, *Harpodon nehereus,* which, in the salted form is known popularly

as "Bombay Duck". The body is elongated, more or less subcylindrical or sometimes compressed. The gill openings are very wide. Two dorsal fins are present, the posterior being fleshy (adipose). The scales are either present or absent. The air bladder is small or absent.

These fishes are more or less closely allied to the Cat fishes and are widely distributed throughout the tropical and temperate seas. Some of these forms are deep sea fishes (e.g., *Scopelus*) and carry rows of luminous spots. Many fishes of this family lie close to the bottom of the sea and are coloured brownish or brownish grey and sometimes mottled with irregular blotches to harmonize with the surrounding coral sand. This family includes also the well known edible fish, *Harpodon nehereus* which is most common at Bombay, inhabiting the seas and estuaries on the Coast. It is a fish with a large mouth and arrow-shaped teeth and is highly esteemed as food, both in the fresh and salted condition. When salted and dried it is known as the "Bombay Duck" and is extensively used as relish. It is, however, not very common at Madras and is not represented among the exhibits in this Gallery.

A specimen of only a single species belonging to this family, namely, *Saurida tumbil*, is exhibited. It is brownish grey along the back, becoming white beneath, the entire body showing a yellowish iridescence. It is widely distributed, ranging from the Red Sea eastwards to Malay Archipelago, China and Japan. It is not much esteemed as food as its flesh is rather dry and insipid This fish attains a length of about eight inches.

Family SCOMBRESOCIDAE.

This family includes the Gar fishes (*Belone*), Half Beaks (*Hemiramphus*) and Flying fishes (*Exocoetus*). In the Gar fishes and Half Beaks, the body is slender and elongated but in the Flying fishes it is stouter. The dorsal fin is rayed and placed far back in the caudal portion of the vertebral column opposite the anal fin. The pectorals and pelvics are enlarged in the Flying fishes. Scales are present, and usually there is a keeled row of scales along either side of the free portion of the tail. An air bladder is usually present and sometimes without a pneumatic duct.

The Gar fishes (*Belone* spp.) (Fig. 46) are coastal fishes inhabiting the warmer seas and are generally found swimming near the surface and feeding on small fishes. The colour is usually green, the

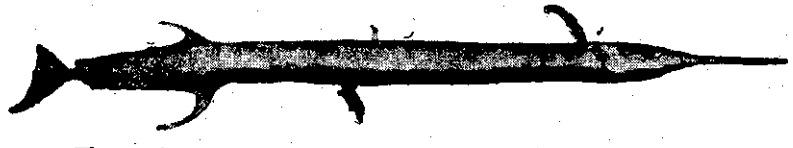

FIG. 46.—BELONE MELANOSTIGMA : THE GAR FISH.

scales being silvery. The body is long and slender. They are related to the Half Beaks but are readily distinguished from them in having both the upper and lower jaw prolonged into a long, beak-like

structure. Sharp, rather unequal teeth are present in both the jaws. Some of the larger species grow to a length of about five or six feet and may even prove dangerous to man. They appear in small shoals in coastal waters and are omnivorous, feeding on small prawns, young crabs, small fish and algae. They are very destructive to young and small fishes. They swim near the surface with great speed, and when disturbed, jump into the air in groups of two or three. They enter estuaries during the breeding season (September to December). The flesh of Gar fishes is firm and is much esteemed as food. The bones in these fishes are green.

In the Half Beaks (*Hemiramphus* spp.), only the lower jaw is prolonged, forming a long, pointed beak. In appearance it almost resembles the beak of a bird, but because only one jaw is prolonged, these fishes are called " Half Beaks ". In the newly hatched young ones, the jaws are normal. The adult condition is reached gradually during development. The colour is usually bluish or greenish blue along the back and with a silvery lateral band. The bones have also a greenish colour in the fresh condition. These are coastal fishes of the warm seas and feed mainly on plankton and green algae. Occasionally they also feed on small crustaceans and fish fry. These fishes are peculiar in that they foresake the water when pursued by enemies such as sharks, etc., and solitary specimens may be seen skipping over the surface of the sea trying to avoid boats or launches. The spawning season extends from March to April. They are highly esteemed as food and their fishery is of great economic importance especially in the Palk Bay.

The Flying fishes, which are quite different in appearance from the above fishes are in fact derived from them and are closely related to them. In the Flying fishes (*Exocoetus* spp.) (Fig. 45) the

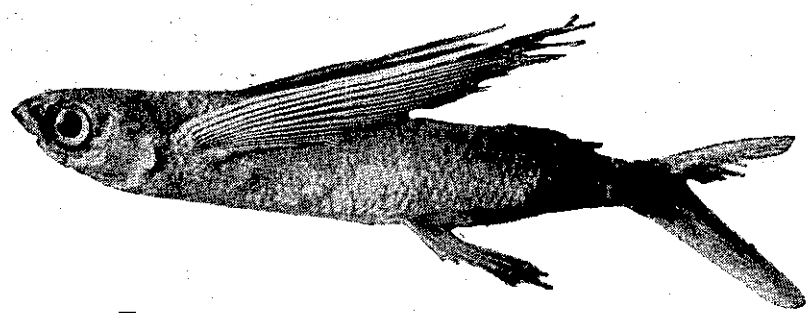

FIG. 45.—EXOCOETUS SP. : THE FLYING FISH.

pectoral fins are much enlarged and help the fish in sailing in the air and gliding for long distances when it leaps out of the water. Though allied to the Half Beaks, they have both the jaws normally developed and short. The back of the fish is blue while the sides and abdomen are silvery. The Flying fish is noted for its remarkable power of leaving the water and gliding long distances through the air, supported by the enlarged pectoral fins which act after the manner of the planes of a " glider ". They can leap as high as thirty feet above the surface of the water and can cover a distance of 100 to 200 yards in a single leap. The initial " take-off " is

achieved by the propelling side-to-side strokes of the strongly muscular caudal fin. Such leaping flying fishes are often seen in small groups and may occasionally get stranded on the decks of ocean-going steamers. Flying fishes feed on young fish, fish eggs and prawns. They attach their eggs to floating objects. The Flying fish is highly esteemed as a food fish and is common on the Madras Coast. The range of the fishery on a commercial basis ranges from Point Calimere to Madras on the East Coast.

Specimens of four species of *Belone* (*Belone melenostigma, B. liura, B. cancila* and *B. strongylurus,* one species of *Hemiramphus,* namely, *H. limbatus,* and one of the Flying fish, *Exocoetus* (probably *Exocoetus poecilopterus,* which is one of the common Madras species), are exhibited. Of these, specimens of *Belone concila, B. strongylurus* and *Hemiramphus limbatus* are exhibited as spirit-preserved specimens in the vertical show-case containing wet specimens in the corner, while the rest are displayed as dry-preserved stuffed specimens in their appropriate systematic positions. A group of Flying fish leaping in the air over the surface of the sea is also exhibited in the general Zoological Gallery downstairs in the series illustrating " Flight in Animals".

Family CYPRINODONTIDAE.

These are small fishes commonly known as " Toothed carps " occurring in fresh and brackish waters. The body is elongated and subcylindrical, with the eyes laterally placed. Scales are present, both on the head and on the body. Teeth are present in both jaws. A single spineless dorsal fin is present in the hinder half of the body. An air bladder is present, but devoid of a pneumatic duct.

These are small fishes, inhabiting the freshwaters and brackish waters, and are widely distributed, being found in America, Africa, Southern Europe and Southern Asia. Many of the species exhibit remarkable sexual differences, the males being usually smaller and more brightly coloured. This family also includes the familiar little fishes known as " Top minnows " in America, and the handsome little fishes commonly known as the Molly, Guppy and Sword Tail, so popular with aquarists. Many of these small fishes breed quite freely in captivity. The teeth are small and of various forms according to the nature of the food. In most of the herbivorous forms, they are pointed and incisor-like, serrate and loosely inserted in the lips. In species which feed on insects, worms or insect larvae, they are more firmly fixed. In places where rice is grown they are found abundantly in the rice swamps and ditches. In South India, these fishes (belonging mostly to the genus *Haplochilus*) feed extensively on mosquito larvae and are hence largely reared in freshwater ponds and tanks as a larvicidal fish. They are small fishes, usually about one and a half inches in length.

This family is not represented by any stuffed, dry-mounted specimens in this Gallery, but only by wet-preserved specimens of two species, namely, *Haplochilus melastigma* and *H. parrus,* exhibited in the vertical show-case in the corner containing spirit-preserved specimens.

Family CYPRINDAE.

This family, comprising the Carps and their allies, is a very large and widely distributed group of freshwater and estuarine fishes including more than a thousand species. The body is oblong or elongated, usually with a rounded abdomen. The mouth is devoid of teeth, but one to three rows of teeth are present in the lower pharyngeal bones. A single, soft-rayed dorsal fin is present. The head is scaleless, but the body may be either scaled or scaleless. The air bladder is large and may be divided either into a front and hind portion by a constriction or into two lateral portions.

The Carps perhaps constitute the largest single family of fishes and are well represented in the freshwaters and estuaries of India. In fact, these fishes and the Siluridae (Cat fishes) form the vast majority of freshwater fishes of the world. But while Cat fishes prefer muddy water and are on the whole very unclean feeders, Carps appear to thrive mostly in clear water and seem to be more wholesome feeders. Hence Carps are much better esteemed as food fishes than Cat fishes in spite of the numerous bones present in their bodies. As Carps are abundant in many places they are popular as food fishes with the natives in most localities where they occur. Most of the Cyprinids feed on insects, worms, etc., or subsist on an entirely herbivorous diet, but some have powerful jaws and feed on smaller fishes. The original home of the Carp family appears to be probably Southern Asia, from where they have been introduced into Europe and other parts of the world. Carps are often prolific breeders and they sometimes check the spread of predatory fishes by feeding on their eggs. Many species, such as, for instance, the Mahseer (*Barbus tor*) are popular as game fishes and have large, plate-like scales. The Mirror Carp (not represented in this Gallery) also has very large, bright, silvery scales along the sides of the body, and large, dull scales on the back. In many species of Carps, the males develop hard, wart-like structures on the head, fin rays and other parts of the body during the breeding season, and occasionally they are retained throughout adult life. They are often used as offensive weapons in their fight against rival males, in nest building and other activities during the breeding season.

In India, Bengal is the home of pisciculture of freshwater Carps on account of the perennial water supply from the Ganges that is available there. In the Madras State, continuity in freshwater pisiculture is rendered impossible by the fact that the rivers and river-fed tanks are practically dry for almost six months in the year. However, the Carps are well represented in the freshwaters and estuaries of the Madras State. Some of the large species that are esteemed as food fishes are *Laheo calbasus, Labea fimbriatus, Cirrhina cirrosa, Cirrhina reba, Catla buchanani* and *Barbus tor* (the Mahseer). Though most of them have numerous small bones, they are held in much esteem because of their good flavour.

Specimens of *Discognathus jerdoni* (an olivaceous fish becoming yellow on the sides and below), *Cirrhina cirrhosa,* a silvery species with each scale having a red centre, *Barilius gatensis,* which is silvery

grey with about fifteen vertical bars, which get broken up in the adult, *Chela argentea*, a small silvery fish with a lateral band which fades after death, and several species of *Barbus*, including the well known sporting fish of India, the Mahseer (*Barbus tor*), and several species of *Labeo* are exhibited in the systematic series of stuffed and dry-mounted specimens in this Gallery. In *Discognathus*, a suctorial disc is present on the chin, formed on the lower lip. In addition to these, a few more spirit-preserved specimens of other species of *Barbus*, and of species of *Amblypharyngodon*, *Nuria*, *Perilampus*, *Rasbora* and *Lepidocephalychthys*, and of *Chela clupeoides* and *Cirrhina reba* are exhibited in the vertical show-case containing wet-mounted specimens in the corner.

Special mention may be made here of the Mahseer, *Barbus tor*, a large specimen of which, from the Bhavani River, is exhibited in a separate central show-case somewhere in the centre of this Gallery. This is a well known game fish of India inhabiting the upper reaches of the rivers in the hills and has been very popular with the anglers and sportsmen in India. Apart from its popularity as a sporting fish, it is also valued as a food fish, and specimens normally weigh from fourteen to fifty pounds. This gigantic Carp has a characteristically large head and the body is stout, clothed with unusually large scales, each scale sometimes being as large as the palm of a man's hand. In the South Indian Mahseer, which is the one that is exhibited in this Gallery, the lips are prominent with protruding fleshy lobes. The upper half of the body during life is greenish or silvery, while the sides and abdomen are silvery, shot with gold. The pectoral, pelvic and anal fins are reddish yellow. It is purely a freshwater Carp ascending hill streams up to an altitude of 2,500 feet for purposes of spawning. It is common in the upper reaches of the Cauvery and the Bhavani Rivers. It feeds on aquatic weeds of all sorts, seeds of trees, paddy washed from the fields, freshwater crabs, earthworms, snails, insects and small fishes. Its thick lips help the fish in detaching freshwater snails from the rocks. This Carp is important both as a food fish and as a game fish. Specimens weighing from two pounds to about ten pounds are considered ideal for the table, as larger specimens tend to be coarse and oily. This fish is also suitable for use in a dried and salted condition. This is the most highly esteemed among the Indian sporting fishes and grows to a weight of 250 pounds.

Other species of *Barbus* exhibited in this Gallery in their regular systematic position, include, among others, *Barbus chrysopoma*, *B. carnaticus*, *B. thomassi* and *B. machecola*. Most of these are fairly small fishes, less than ten inches long, and are dark or pale silvery with various markings during life. Among species of *Labeo* exhibited, *Labeo calbasu*, blackish, stout fish growing to three feet in length, with numerous small bones, *Labeo kontius* with a reddish or fleshy tinge growing to two feet in length and found in the Cauvery, rivers of the Nilgiris, etc., and *Labeo nigrescens*, a deep brownish fish about eighteen inches in length found in the rivers of Mangalore and South Kanara deserve special mention.

Family CLUPEIDAE.

This is a large and important family comprising the Herrings and their allies such as the Sprats, Sardines, Anchovies, Shads, etc., including some two hundred and odd species. The body is elongated with the gill openings very wide and the abdomen mostly compressed, generally into a sharp edge and often serrated. The eyes are lateral and the mouth may have a deep cleft. A single dorsal fin is present with a few or a moderate number of soft rays. Scales are present on the body, but not on the head. The air bladder is present and more or less simple.

Most of these fishes are marine, generally swimming in shoals near the surface, not far from the Coast. They feed on minute marine organisms known as plankton collectively. Some species ascend rivers to breed while a few others are permanently resident in freshwater. The Herrings and Herring-like fishes are well represented in the Indian seas and, as a rule, they appear to be more abundant on the Malabar Coast than on the East Coast. This group consists mostly of small fishes with degenerate teeth and noted for their great fecundity. The various species shoal in great abundance, thus affording ample opportunities for a flourishing commercial fishery. The Herring-like fishes are particularly prolific on the West Coast where they shoal in vast numbers. Another interesting feature of these fishes is their migratory movements and seasonal abundance. For instance, the Oil Sardine of Malabar (*Clupea lile*) shoals from August to February, when it yields a valuable fishery. But after this, the shoals disperse and are scarcely in evidence. The Herrings and Herring-like fishes also play an important role in the food cycle of the oceans, since they feed on minute planktonic organisms (diatoms, Copepods, etc.), and other larger fishes feed on the Herrings and Herring-like fishes. So, wherever plankton abounds there will also be a correspondingly large population of these Herring-like fishes. The occurrence of marine plankton therefore appears to govern, to a great extent, the seasonal migration of these fishes. In the Coastal waters of the Madras State, the fisheries of Herring-like fishes are of great importance and include those of the Oil Sardine of Malabar and other species such as the Anchovies (*Engraulis* spp.), the White Bait (*Stolephorus* spp.), and the Gizzard Shad (*Chatoessus* spp.). Shoals of other Sardines such as *Kowala thoracta, Dussumiera* spp., etc., also occur on the Madras shores, but these catches are utilized mainly in the manufacture of fish manure as they are not much esteemed as food. Anchovies (*Engraulis* spp.) which are food fishes of considerable commercial importance also belong to this family.

Specimens of the Gizzard Shad, *Chatoessus chacunda* and *Chatoessus nasus,* several species of *Clupea,* including the well known Hilsa or the Indian Shad, *Clupea ilisha,* and the Indian Sprat, *Clupea brachysoma,* one species of *Pellona,* namely. *Pellona elangata,* the Indian Herring, two species of *Elops, Elops indicus* and *E. machinata, Megalops cyprinoides,* the Ox-eye Herring and a specimen of *Chanos chanos,* now more correctly termed *Chanos salmoneus,* the Milk fish or White Mullet are exhibited.

Brief notes on a few of the more important species of food fishes of this family, exhibited in this Gallery, are appended below:

Clupea brachysoma is one of the small Indian Sardines, or the fish, shot with purple, attaining a length of about eight inches. It is one of the important food fishes of the Madras Coast.

Clupea brachysoma is one of the small Indian Sardines, or the Indian Sprat as it is usually called, and is generally greenish above and silvery at the sides and over the abdomen. These are shoaling fishes feeding on planktonic organisms, and apart from being used as food, they are also largely used in the manufacture or fish manure.

Pellona elongata is popularly known as the Indian Herring (Tamil: "*Vengannu*"), although it differs considerably from the more well known European Herring. It has a long anal fin. The body is oblong, much compressed and the abdomen is strongly serrated. The eyes are fairly large and prominent and the caudal fin is deeply forked. This fish is silvery along the sides and dark above. It is a shoaling fish, feeding on small sardines and other fishes. It is particularly abundant during October, and is much esteemed as a food fish.

Clupea ilisha (Fig. 47) is the well known Hilsa or the Indian Shad and is one of the important food fishes of the Madras Coast, partly freshwater in its habitat. The body is oblong and compressed.

FIG. 47—CLUPEA ILISHA: THE HILSA OR INDIAN SHAD.

The abdomen bears a saw-like edge with sharply pointed scutes. The jaws have no teeth. This fish is silvery with gold and purplish iridescence. In the young there is a row of spots which disappear in the adult. Its migrations have formed the subject of an interesting study. The fry of this fish, after hatching in the rivers, spend a greater part of their early life in estuaries, later enter the sea in search of food and finally return to the rivers periodically for spawning purposes after growing into the adult. The Hilsa is therefore an anadromous fish. It is highly esteemed as a food fish and has formed the basis of an important fishery in India. In South Indian rivers it can be fished only during two or three months in a year when the rivers are full. It occurs plentifully along with other fresh-water food fishes, seasonally in Cauvery, Kistna and Godavari Rivers.

Megalops cyprinoides is popularly known as the Ox-eye Herring. In this fish, the body is covered with large scales and the eyes and the lower jaw are prominent. The back of the fish is bluish green while the abdomen is silvery, with bluish reflections. This fish occurs in the seas, estuaries and fresh-waters of South India and is commonly found in tanks where it is able to adapt itself to adverse conditions. It feeds on prawns and small fishes and grows to a length of nearly two feet. The flesh of this fish has a delicate flavour and it is therefore esteemed as a good food fish. It is also a favourite game fish, popular with anglers.

Chanos salmoneus (formerly more familiarly known as *Chanos chanos*) (Fig. 48) is the Milk fish or White Mullet. It is a brilliant shiny silvery white fish and in specimens fresh from the sea, the back

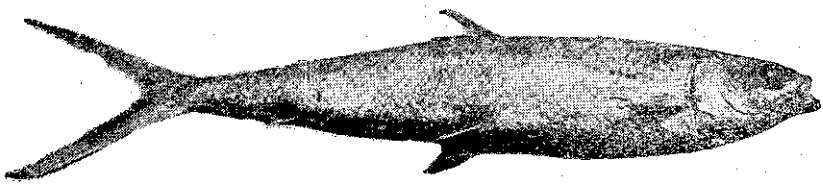

FIG. 48—CHANOS SALMONEUS.

has a bright glossy blue colour which, however, fades rapidly after death. The body is covered with small, smooth scales and the mouth is small and toothless. The snout and the region of the eye are covered by a thick, gelatinous substance. The tail is deeply forked. The Milk fish feeds mainly on plankton and sea weeds. Fresh-water lakes in coastal areas abound in young Milk fish. The adults live in the open sea and are powerful swimmers. This is a fish that has been successfully acclimatized to life in fresh-water. This fish has the habit of leaping up into the air and a full grown Milk fish can leap forward into the air for a distance of forty feet and to a height of ten feet above the surface of the water. The Milk fish is very common in the Pulicat Lake where it is caught by taking advantage of its leaping habit. It is not a shoaling fish and does not occur in abundance, but it is much esteemed as a food fish on account of its excellent flavour, in spite of the many fine bones it possesses.

Family CHIROCENTRIDAE.

This family includes only a single species, the Sabre fish (*Chirocentrus dorab*). The body is much elongated and compressed. A single rayed dorsal fin is placed over the caudal portion of the vertebral column. The body bears thin scales which easily drop away (deciduous). An air bladder is present.

A specimen of the single representative of the family, namely, *Chirocentrus dorab*, popularly known as the Sabre fish, is exhibited. The body is flat and elongated, and laterally compressed, with the abdomen bearing a sharp edge. The margin of the abdomen bears a row of filaments. The ventral fins are reduced. The jaws bear strong, well developed teeth. As indicated by its Tamil name, "*Mulluvalai*", it has numerous fine bones. During life, the back is

metallic steel blue or bluish green, while the flanks and abdomen are silvery. It is stated by Day to attain a length of at least twelve feet, but from all available fishery records, the maximum length reached by this fish appears to be only four feet.

These fishes are pelagic, feeding on other small pelagic fishes such as Sardines, young Ribbon fishes, prawns and young eels (*Leptocephali*). They usually get caught in the net by their sharp teeth getting entangled in the meshes of the net. They are pugnacious in disposition and when captured, bite at everything near them. These fishes, in spite of the numerous fine bones in their flesh, are valued as food fishes and constitute an important commercial fishery both on the East and West Coasts.

Family NOTOPTERIDAE.

This is a small family of fresh-water and brackish water fishes in which the body is rather peculiarly shaped like the blade of a curved knife. Hence the popular Tamil name, "*Ambattan Katti*" applied to these fishes. The body is oblong or more or less elongated, and compressed. The body ends in a long and tapering fin. The dorsal fin is single and present on the caudal portion of the vertebral column. As usual in fishes which swim by undulations of the body, the ventral fins are lost or rudimentary. The head and body bear small scales. The edge of the abdomen is serrated in the portion lying in front of the ventral fins. The anal fin is contiguous with the caudal fin. An air bladder is present; it is highly complex in structure, being subdivided into several compartments and terminating in two horns anteriorly and posteriorly. These fishes are found in the fresh and brackish waters of West Africa, India and eastwards up to the Malay Archipelago.

Only two species are recorded in India, and of these, only one, namely, *Notopterus kapirat* (= *Notopterus notopterus*) (Fig. 49) commonly occurs in the fresh and brackish waters of South India.

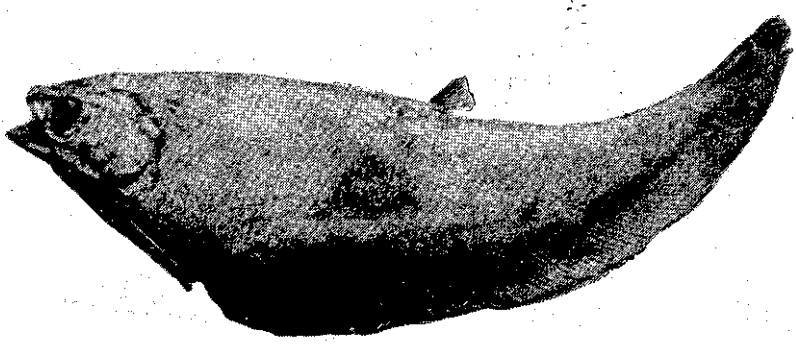

FIG. 49—NOTOPTERUS KAPIRAT.

A specimen of this species alone is exhibited in this Gallery. During life, it is silvery, darkest on the back and with a glossy yellow tint about the head. It attains a length of two feet or more. These

fishes are not much esteemed as food, as they are reputed to feed on human carcases sometimes.

Family MURAENIDAE.

This family comprises the Eels. They are long, snake-like fishes, often growing to a large size. The body is elongated, cylindrical or compressed and band-shaped. One of the most characteristic features of this group is that the shoulder girdle is not attached to the skull. The median fins (dorsal and anal), when present, may be confluent, or may be separated by a distinct, projecting tail. Scales may be absent, or when present, they may be rudimentary. The jaws are furnished with small, but sharp teeth arranged in bands.

Eels are voracous fishes occurring in the tropical and sub-tropical seas and are especially abundant in the crevices of coral rock on reefs. Some of them attain a length of eight to ten feet and are capable of inflicting severe wounds with their sharp, pointed, knife-like teeth. In many species, the jaws are so curved and the mouth so amply filled with the knife-like teeth that the jaws cannot be closed. The teeth are well adapted for holding their slippery prey. Eels mostly feed on worms, small fish, crayfishes, etc. Many species of Eels have bright and striking colour patterns. The Common European Eel or the Common Moray as it is sometimes called (*Muraena helena*) found in the Mediterranean and the neighbouring parts of the Atlantic, grows to a length of four feet and was greatly esteemed as a delicacy by the ancient Romans who reared them in specially constructed reservoirs near the sea.

Eels are catadromous fishes, i.e., they return to the sea to breed. The larvae of Eels are transparent, strongly flattened creatures known as *Leptocephali*. They live in the upper surface layers of the ocean, feeding on plankton. They grow in course of time into cylindrical elvers or " glass eels " about two and half inches in length. These elvers migrate in enormous numbers into the rivers where they grow into adults which again return to the sea to breed. They also migrate overland from one river to another when they need a change.

Eels attain a large size in India, but are seldom eaten except by the poorer classes of people. They are considered by the natives to be serpents and are generally known as "*Velangoo*" or "*Pamboo Meen*" in Tamil (meaning, quite appropriately, " Snake fish ").

Specimens of a few common species of South Indian Eels (Fig. 50) are exhibited in this Gallery, mostly as stuffed, dry-preserved

FIG. 50—GYMNOTHORAX FAVIGENUS : THE EEL.

specimens, but one or two are mounted as spirit-preserved specimens in the vertical show-case in the corner.

Anguilla bengalensis (= *Anguilla elphinstonei*) is brownish above, becoming yellowish on the sides and over the abdomen. In some specimens the entire upper surface of the body is covered with black spots. It is pugnacious in disposition and inflates its head when angered. It reaches a length of over four feet and is common on the Andaman Islands. It has been introduced into the rivers of the Nilgiri Hills in South India. Besides the stuffed specimen, there is a spirit-preserved specimen of this species in the vertical show-case in the corner.

Muraenosox talaban is a large-sized Eel, attaining a length of ten feet or more. The upper surface of the back and head are olive, becoming brownish posteriorly, while the abdomen is dull white and silvery beneath.

Muraenosox cinereus is the commonest species of the genus in the Indian waters. It is silvery, becoming white on the abdomen, with the median fins coloured yellowish.

Muraena tessellata is common especially on coral reefs, with a very striking pattern of dark purplish black polygonal or rounded spots on the head, body and fins, which are separated by a net work of narrow white lines or interspaces. This species has often been collected on the reefs at Pamban and Krusadai Island in the Gulf of Manaar.

Muraena macrura is another large species attaining a length of ten feet or more. It is uniformly brown, with the fins tinged black.

Muraena pseudothyrsoidea is brownish, marked with fine, dark spots on the head and the body, and five reticulated yellow lines.

Among the spirit-preserved specimens of fishes in the vertical show-case in the corner of this Gallery, are exhibited a specimen of *Anguilla bengalensis* (already described above) and a fairly young specimen of the beautifully marked species. *Muraena nebulosa*, with its very striking pattern of colour and colour markings. It is brownish or olive brownish, darkest along the back, and bears a row of 20 to 25 black blotches along the upper surface of the head and the back, and a similar row of blotches along the abdominal surface. It is said to grow to a length of five feet.

ORDER LOPHOBRANCHII

This Order is also sometimes known as Solenichthyes. It includes the Sea horses and the Pipe fishes. These fishes are rather varied in shape and appearance and possess a rigid integumentary

segmented skeleton, with the opercular shields reduced to a single plate. All of them have a small mouth placed at the end of a narrow, tube-like snout. Teeth are absent and the muscles are rather feebly developed. An air bladder is present, but without a pneumatic duct.

These fishes normally swim in a vertical position, the movement being chiefly effected by the undulating motion of the dorsal fin.

This Order is represented in the Indian Ocean by only a single family, the Syngnathidae, which includes both the Sea horses and the Pipe fishes.

Family SYNGNATHIDAE.

In this family the gill openings are small and there is a single dorsal fin. It is divided into two distinct groups, namely, (1) the Syngnatha, including the Pipe fishes, in which the tail is not prehensile and a caudal fin is usually present, and (2) the Hippocampa, including the Sea horses in which the tail is prehensile and the caudal fin is absent.

In the Pipe fishes, the body is narrow, cylindrical and elongated, encased in a rigid dermal skeleton. The body bears more or less distinct transverse ridges. The dorsal and pectoral fins are small, but are supported by many rays, and the fishes swim largely by means of the undulating or vibratory movements of these fins. Sometimes the fishes move by lashing their thin, pipe-like bodies into curves. The males carry the eggs in a brood pouch or groove on the abdomen or under the tail. These fishes occur in all tropical and temperate seas, generally among weeds, and some of them enter freshwater. Specimens belonging to two species, *Dorychthys brachyura* and *Doryichthys cunculus* are exhibited as spirit-preserved specimens in the vertical show-case in the corner.

The Sea horses (belonging to the genus *Hippocampus*) are closely related to the Pipe fishes, with their peculiarly shaped head and neck presenting a strikingly horse-like appearance. They are unique in having a prehensile tail. They generally swim upright, locomotion being effected by rapid vibratory movements of the dorsal and pectoral fins. The head is set at an angle to the curved neck and is capable of being moved up and down. Sea horses generally live among sea weeds to which they firmly anchor themselves in a vertical position by means of their prehensile tail. They feed mainly on small crustaceans, and in feeding, the tube-like snout acts like a sort of an inhalent siphon, the prey being drawn in rapidly when the fish inflates its cheeks. The male sea horse carries the eggs in a brood pouch below its abdomen and affords a good example of parental care in fishes.

Two specimens of Sea horses, a large, dry-preserved one belonging to the species *Hippocampus guttulatus* and a smaller, wet-preserved one of *Hippocampus trimaculatus* (Fig. 51) are exhibited. The

FIG. 51—HIPPOCAMPUS TRIMACULATUS : THE SEA HORSE.

latter specimen, which is faded almost completely white, is exhibited in the vertical show-case containing spirit-preserved specimens of fishes, in the corner. These are the only two common species of Sea horses recorded from the Indian seas.

ORDER PLECTOGNATHI

The Order Plectognathi comprises two families of bony fishes with a rather peculiar shape, appearance and structure. It includes the fishes popularly known as the Trigger fishes, Horn fishes or Coffer fishes, Sun fishes Globe fishes and Puffer fishes. They have an incompletely ossified skeleton and a reduced number of vertebrae. The head is often large, but the mouth is rather narrow, with the bones of the upper jaw mostly united and sometimes produced in the form of a beak-like projection. Teeth may either be absent or distinctly present. There is a single, soft-rayed dorsal fin placed over the caudal portion of the vertebral column, and in some species, a reduced spinous dorsal fin may also be present in front. The

skin is either smooth, or covered with rough scales or bony plates or spines. An air bladder is present, devoid of a pneumatic duct.

This Order includes two families, the Sclerodermi, comprising the Trigger fishes, Horn fishes and Trunk fishes or Coffer fishes in which the teeth are distinct in the jaws and the Gymnodontes, comprising the Globe fishes or Puffer fishes in which the teeth are absent, but the jaws are modified into a beak. Several specimens, belonging to both the families are exhibited.

Family SCLERODERMI.

This family includes the Trigger fishes, Horn fishes and Coffer fishes or Trunk fishes. In the Trigger fishes and Horn fishes, the body is compressed, while in the Coffer fishes it is angular and box-like with the integument forming a rigid carapace. The snout is somewhat produced. The jaws bear a few small, but distinct teeth. The skin is rough or spinose, or the scales may be in the form of scutes joined firmly to form the carapace.

The Horn fishes (*Triacanthus* spp.) represent the most generalized members of the group and differ from all other members of the family in having a protractile upper jaw. Teeth are disposed in two rows in the jaws. Most of them live on sandy stretches at the bottom of the sea and feed chiefly upon shellfish. Two species, *Triacanthus brevirostris* and *Triacanthus strigilifer*, the only two recorded Indian species, are exhibited.

Monacanthus scriptus (= *Aleuteres scriptus*) is a species of File fish or Leather Jacket. It has the body covered with close-set spinules, which give the skin the appearance of velvet. Its flesh is bitter and unfit for eating.

The Trigger fishes (*Balistes* spp.) (Fig. 52) have the body covered with numerous close-fitting bony plates. The body is laterally compressed. The integumentary covering is rough, or with

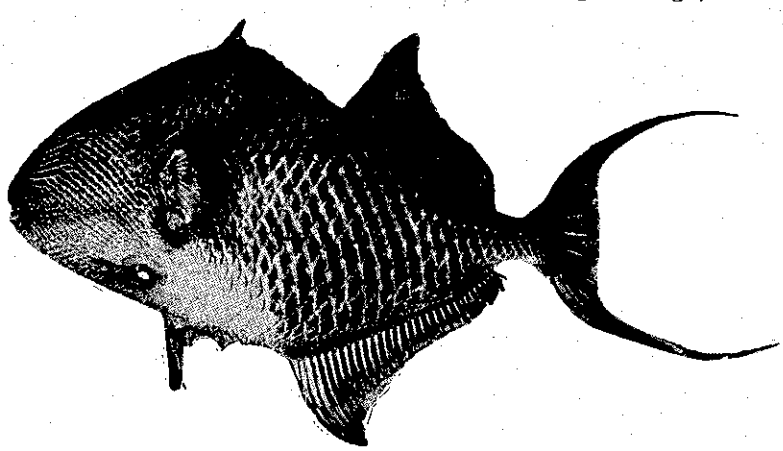

FIG. 52—BALISTES ERYTHRODON : THE TRIGGER FISH.

movable scutes. They derive their popular name " Trigger fishes " from the peculiar structure of their spinous dorsal fin, this being supported by three spines, the first being very strong and hollowed

out behind to receive a bony knob at the base of the second. By this ingenious mechanism, the first spine remains immovably erect until the second, which acts more or less like a trigger, is pressed down. The Trigger fishes are large, coarse fishes found in the tropical seas, many of them being brilliantly coloured. But the flesh of the Trigger fishes is poisonous and hence dangerous as food. The colours of the Indian Trigger fishes in life are generally brownish, greyish, bluish black, olive or sometimes bluish or yellowish. Several species of *Balistes* are recorded in the Indian seas, and specimens of as many as seven of these species, mostly common ones found in the Madras Coast, are exhibited.

The Trunk fishes or Coffer fishes belong to the genus *Ostracion* and are remarkable for their hard, box-like, angular outer covering formed by a number of closely fitting bony plates. These bony plates are six-sided and are united firmly to form a box that encloses the head and the body, except the small mouth and the short, naked tail. The spinous dorsal fin and the ventral fin are absent, but their positions are represented by bony protuberences. Some species have a pair of horn-like projections in front of the carapace.

These are sluggish fishes, living in shallow coastal waters of the warm tropical seas. They are of no economic value. There is a legendary belief that these fishes represent metamorphosed cows which were once condemned to the bottom of the sea by a curse. Hence the popular Tamil name "*Madumeen*" (meaning cow fishes) sometimes applied to these fishes. The popular name "Cow fish" is appropriate for these fishes on account of the peculiar shape of the head, the bovine appearance of which is accentuated by the presence of two prominent, horn-like spines over the eye on each side.

Specimens of three species of Coffer fishes, *Ostracion turritus* (= *Ostracion gibbosus*) (Fig. 53), *Ostracion nasus* and *Ostracion cornutus*, all of them common on the Madras Coast, are exhibited. In

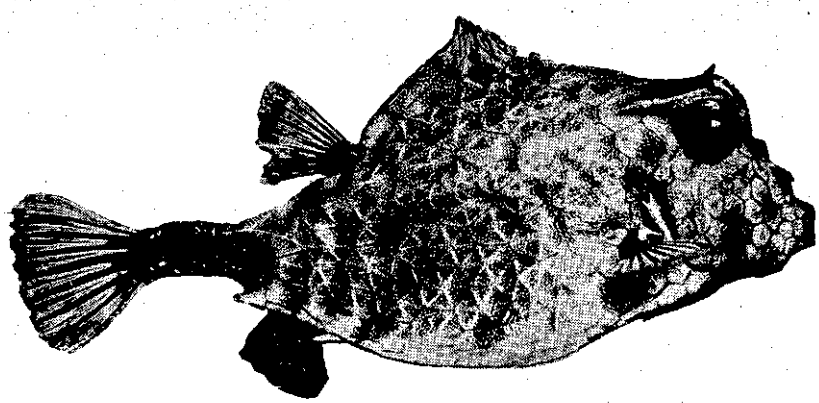

FIG. 53—OSTRACION GIBBOSUS : THE COFFER FISH OR TRUNK FISH.

O. turritus the carapace is three-ridged, in *O. nasus* it is five-ridged, and in *O. cornutus* it is four-ridged, with a long, anteriorly directed, conical, horn-like spine on each side.

Family GYMNODONTES.

This family comprises the Puffer fishes, Globe fishes, Porcupine fishes and Sun fishes. The body is more or less short and stout. Some species possess the power of inflating themselves by dilating an elastic portion of the oesophagus or an abdominal sac with air. All these fishes have the bones of the upper and lower jaw produced to form a parrot-like beak with a cutting edge. This beak is covered with an ivory-like substance which may or may not bear a median suture. The dorsal, anal and caudal fins are spineless and the ventral fins are absent. The integument is often covered with small or large spines. An air bladder may be present or absent.

In the Puffer fishes or Globe fishes (*Tetrodon* spp.) (Fig. 54) the body is naked, but there are generally small, movable spines in the skin. They are able to inflate themselves into a rounded globe-like body by drawing in either air or water into the large abdominal

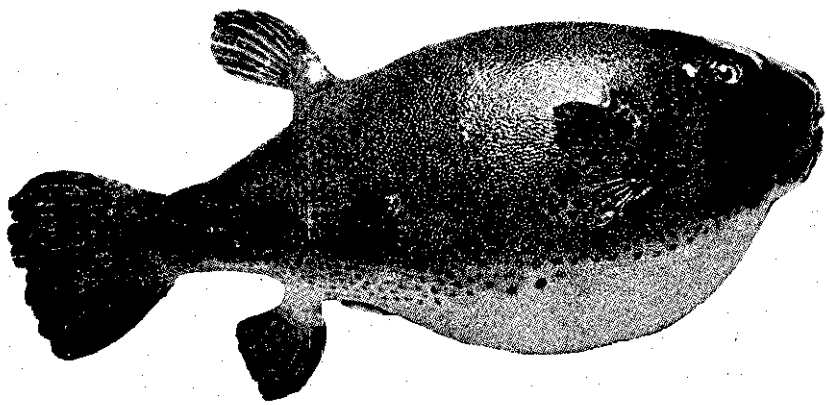

FIG. 54—TETRODON STELLATUS : THE GLOBE FISH.

sac, until the spines stand out erect. Most of these are marine and are found in tropical waters, but a few are confined to freshwater. All Puffer fishes are more or less poisonous and are therefore never eaten. These fishes are sometimes termed " Sea frogs " by the natives of Malabar, on account of the noise they make when captured.

Specimens of about nine species of the Globe fishes belonging to the genus *Tetrodan*, all of them occurring on the Madras shores, some of them being brightly coloured and variously ornamented with rounded spots and other markings are exhibited. Some of them reach a large size, attaining a length of more than one foot.

In the Porcupine fishes or Burr fishes as they are sometimes called (*Diodon*) the spines are longer and stronger, being two-rooted and movable in some species, or three-rooted and fixed in others. These are also distinguished from the Globe fishes (*Tetrodon*) by the undivided " beak " in front of the jaws whereas in *Tetrodon* the " beak " in each jaw is divided by a median suture, thus making it

appear as though there are four " teeth " in front. A large specimen of *Diodon hystrix* (Fig. 55), the only species of Porcupine fish found in Indian waters, is exhibited. This fish is of a light brown colour,

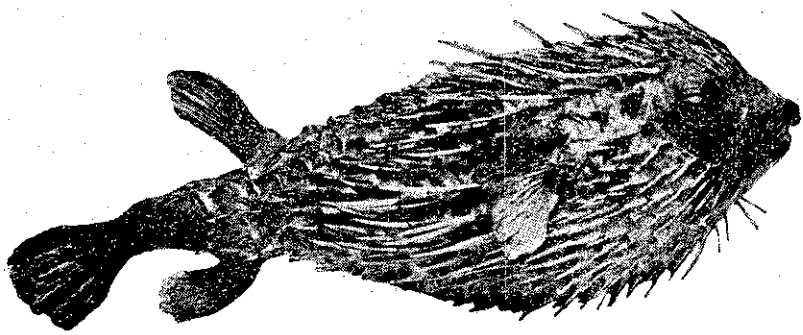

FIG. 55—DIODON HYSTRIX : THE PORCUPINE FISH.

marked all over with round blue or brown spots. It attains a large size, sometimes as much as two and half feet in length.

Lastly mention may be made of a large specimen of the remarkable Sun fish, *Ranzania makna* (Fig. 56) which is also exhibited along with the Globe fishes, etc., as a representative of this family. However,

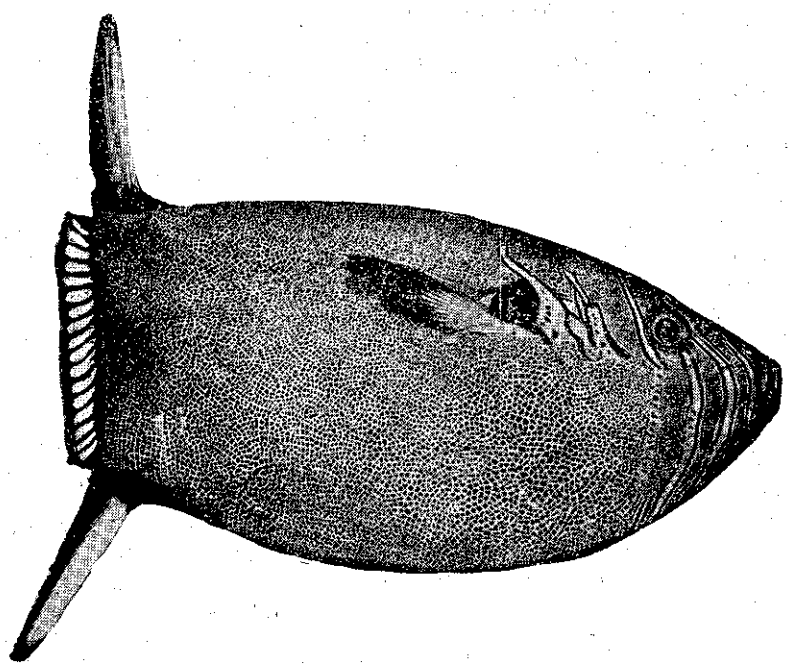

FIG. 56—RANZANIA MAKNA : THE SUN FISH.

it is not strictly an Indian species. It is closely related to the Puffer fishes and Trunk fishes. In the Sun fish, the leathery body is strongly laterally compressed, broad and oblong, and so abruptly truncated

immediately behind the high dorsal and anal fins that it looks as though the body has been amputated, and there is a deep, straight, caudal fin, extending along the entire width of the broad, truncated posterior end. These are oceanic fishes found in all the warmer seas, and often seen basking at the surface, sometimes lying on one side. The shape of the body of this fish is well adapted to drifting on the surface, but as certain deep sea fishes have been found on the stomachs of captured specimens, it is probable that the Sun fish periodically descends to great depths. The body of the Sun fish is beautifully silvery grey, ornamented profusely with black spots and undulating markings.

ECONOMIC IMPORTANCE OF FISHES

Many species of fishes, both cartilaginous fishes (Elasmobranchs) and bony fishes (Teleosts) are highly esteemed as food fishes and constitute the basis for important commercial fisheries all over the world. In the course of the foregoing systematic descriptions of the various species of fishes inhabiting the South Indian shores and the Madras Coast in particular, mention has been made of the most familiar and commonly occurring species of edible fishes and their economic importance, and it is therefore perhaps needless to repeat this here. Apart from the specimens of certain edible species of fishes exhibited in their regular systematic positions, selected specimens of some specially well known and esteemed species of food fishes of the Madras Coast are isolated and exhibited separately in a series of three sloping show-cases towards the end of the systematic series of fishes in this Gallery in order to focus special attention on some of these important food fishes and their economic utility. The specimens exhibited in these show cases include such well known species of edible fishes, such as the Pomfret, Seer fish, Flying fish, Ba-min, Perches, Sole fishes, Mullets, Whiting, the Cock-up and the Mackerel. The commercial importance of these fishes and their edible qualities have already been discussed in detail above, in the context of their respective descriptions in their proper systematic sequence.

Apart from the above exhibits, there is a separate show case in which are displayed some select examples of important by-products derived from fishes. These include many commercially valuable products, such as fish-oil, isinglass and fish-meal and fish-manure and were procured from the Madras Fisheries Department. Brief mention may be made below of the nature of these fishery by-products and their economic importance.

Fish-oil.—The most important by-product yielded by fishes is the oil that is obtained in two ways, namely, (1) small fishes like the Oil Sardine are boiled whole and the oil which floats is skimmed off—this is known as body oil, and (2) only the large liver of sharks is boiled and the oil thus extracted is known as shark-liver oil. Shark-liver oil is rich in vitamin A content and has great nutritive value.

Shark-livers are boiled in a number of fish-curing yards and the crude oil thus extracted is then sent to the oil factory where it is filtered and the oil blended and diluted with sufficient refined groundnut oil in order to reduce it to 1,500 international units of Vitamin A per gramme which is double the potency of ordinary Cod-liver oil. The processing of the oil is carried out under hygenic conditions.

Fish Isinglass.—Isinglass is one of the purest and finest of the animal glues and is the cured product of the air bladder or fish sound of bony fishes. The air bladders of Cat fishes, Cock-up (*Lates calcarifer*), Thread fins (*Polynemus* spp.), Croakers (*Sciaena* spp.) and other big fishes are utilized in the manufacture of isinglass. The air bladders, after they are removed from the fish, are slit open, washed well in sea-water and dried in the open air. The cured product does not dissolve in cold water, but swells up when soaked in water. It possesses a fishy odour. The most important use of isinglass is in the clarification of wine and beer. It is also used in the preparation of food jelly, confectionery, and in the manufacture of court-plaster and special cements. It has taken the place of gelatine in many instances. It is brought to the market in different forms, sometimes in the form of plates, or lumps, or in the form of a bag or purse. When of good quality, isinglass is of a white colour, thin and semi-transparent, but tough and flexible, without any taste or smell. But the inferior kinds are thicker, yellowish coloured, opaque and sometimes have a fishy smell and taste. Pure isinglass dissolves entirely in boiling water.

Fish-meal and fish-manure.—Certain food fishes yield a surplus after meeting the demands of local consumption as fresh fish. Even after transporting fish to long distances in cold storage, a substantial surplus remains in the case of certain species of food fishes. This surplus is therefore turned into fish-meal (fish guano) and fish-manure.

The fish by-product which the Oil Sardine yields is the body oil. After the oil is extracted what remains is the fish-meal. On account of the high percentage of albuminoids, proteins and calcium phosphate present in fish-meal, it serves as a nutritious diet for cattle and poultry.

Fish-manure is prepared only on the West Coast by simply drying the whole fish, mostly Sardines, on the sandy beach. No salt is used in this method of curing. The oil that comes out of the body causes the sand particles to adhere to the fish. The fish-manure thus produced is used as a fertilizer. Improved methods of producing fish-manure consist in introducing artificial drying and a method of light and brief salting followed by sun-drying. This enhances the value of the fish-manure as a fertilizer which can be used effectively for special crops, such as tobacco. Large quantities of fish-manure are exported to Colombo where it is largely used for the rubber and tea plantations.

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