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AND
THE ADJACENT COUNTRIES

EDITED BY DR. M. L. ROONWAL
Director, Zoological Survey of India

PISCES
(SECOND EDITION)
VOL. 1
ELASMOBRANCHII AND HOLOCEPHALI

BY
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सत्यमेव जयते

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EDITOR'S PREFACE

As Dr. F. Day's two volumes on the Fishes of India, Burma and Ceylon in the *Fauna of British India* series (1889), edited by Dr. W. T. Blanford, were long out of print and also out of date from the nomenclative point of view, it was decided long ago to revise the volumes, and the work was assigned, in 1930, to the late Dr. S. L. Hora, Assistant Superintendent, and subsequently (1947-55) Director, Zoological Survey of India. It was then anticipated that the new edition will extend to at least five volumes. Dr. Hora, however did not leave any manuscript. On his demise in December, 1955, the question of assignment was reconsidered, and in August, 1958, the work was assigned to Dr. K. S. Misra, Assistant Superintendent, Zoological Survey of India and then in charge of the Fish Section of the Survey. It is anticipated that the group will occupy at least six volumes.

Dr. Misra is a well known ichthyologist who has done life-long work on fish taxonomy, mainly of the Oriental Region, and there is hardly any one who is more qualified than him for the assignment. I am sure that the second edition of the volumes, as they appear one by one, will become authoritative works of references.

The present volume deals with the classes Elasmobranchii and Holocephali. Out of a total of 114 species and 2 subspecies included here three species belong to the class Holocephali, two of which have been recorded only from egg-cases.

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ZOOLOGICAL SURVEY OF INDIA

Calcutta, 21st January, 1962

INTRODUCTION

THE first edition of the "*Fauna of British India*" series on fishes written by Dr. F. Day and edited by Dr. W. T. Blanford was published in two volumes in 1889, under the authority of the Secretary of State for India in Council. The present volume, being the second edition of the *Fauna of British India* series on Fishes by Dr. F. Day, is the first under the *Fauna of India* Series on Pisces.

The revision of the Day's volumes has been imperative mainly due to the extensive work done especially on the deep-sea fishes collected by the R.I.M.S. "Investigator" during 1884–1926, and discoveries made in the systematics of the fishes of India and the neighbouring countries since 1889, and the changes effected in taxonomy due to the Rules of the International Commission of Zoological Nomenclature.

In this and the following volumes all the species excluding fossils so far known to inhabit the "Indian region" will be dealt with. The "Indian region" as meant here does not connote any subfaunal zoogeographical area. This region is demarcated by dotted line in the accompanying map (Plate 1).

The limits of the "Indian region" adopted for this series are as follows :

- (a) *For marine species* : The sea area bounded by an imaginary line starting from Ras Pishkan on the Gwadar Coast of Pakistan (ca 62° 30' E., 25° N.) to Ras el Haad (ca 60° E., 22° 18' N.), thence southwards along Long. 60° E. where it meets Lat. 1° S.; thence along Lat. 1° S. eastwards where it meets Long. 88° E.; thence on the east through the Great Channel to Victoria Point (ca 98° 24' E., 10° N.) on the Southernmost end of the Burma Coast.
- (b) *For fresh and brackish water species* : The water area (ponds, lakes, rivers and estuaries) within the political boundaries of India, Pakistan, Burma, Ceylon and Nepal.

It may be pointed out here that the western limit for marine species along 60° E. is also the western limit of the Oriental region; the southern limit fixed a degree below the Equator is to include the Addu Atoll, the Bay of Bengal and a part of the Indian Ocean to the south of it; on the east the Andaman Sea is included but not the Strait of Malacca and the Malayan region.

In Day's volumes, under the Class Elasmobranchii, there are 1 order, 11 families, 29 genera and 69 species. This volume on the Classes Elasmobranchii and Holocephali deals with 6 orders, 18 families, 48 genera and 114 species and 2 subspecies. The increase in the number of species as compared to Day's work, is attributable to the extensive work done on the collections made during their cruises by R.I.M.S. "Investigator" (Marine Survey: 1884-1926), "Valdivia" (1898-1899) and H.E.M.S. "Mabahiss" (John Murray Expedition: 1933-1934) in the "Indian region" in deep waters to a maximum depth of 4,454 metres, and by the "Golden Crown" (1908-1909) in surface waters within the 100 fathom line.

During the years 1884-1914 and 1921-1926, the R.I.M.S. "Investigator" surveyed 711 stations in the Indian Ocean covering the range 5° — 29° N., 46° — 98° E., and made collections in depths varying from surface to 3652 metres. Of the 711 stations, 37 were out of the limits of the "Indian region" in the area 13° — 29° N., 46° — 59° E., including the Gulf of Aden, Persian Gulf and the Gulf of Oman, and the collections made were from depths ranging from 23--2375 metres. Thus the 674 stations surveyed in the "Indian region" covered the area 5° — 24° N., 60° — 98° E. in depths varying from surface to 3652 metres and in bottom temperatures ranging from 1.5° C. to 23.9° C., 1.5° C. in 2907 metres at $5^{\circ} 56' 30''$ N., $91^{\circ} 5' E.$ and 23.9° C. in 40 metres off the Indus Delta. In the year 1898-1899 the "Valdivia" expedition covered 271 stations in the Atlantic and the Indian Oceans in the range 60° N.— 63° S., 22° W.— 101° E. in sounding depths varying from 70—5834 metres and collection depths ranging from 500—4000 metres in bottom temperatures— 0.5° C. to 23.5° C.— 0.5° C. in 4636 metres at $63^{\circ}16'5''$ S., $57^{\circ}51'E.$ and 23.5° C. at $0^{\circ}32'2''$ N., $97^{\circ}59'7''$ E. Out of 271 stations only 12 stations, covering the area $0^{\circ}2'S.$ — 6° N., 73° — 93° E. in the Bay of Bengal, were from the "Indian region" in sounding depths varying from 296—4454 metres and collection depths ranging from 296-2,500 metres, in bottom temperatures 1.2° C to 11.4° C.; 1.2° C. in 2000 metres at $7^{\circ} 57' 9''$ N., $91^{\circ} 47' 2''$ E. and 11.4° C. in 296 metres at $6^{\circ} 54'$ N., $93^{\circ} 8' 8''$ E. The John Murray expedition during the years 1933-1934, surveyed 212 stations in the Indian Ocean within the range 29° N.— 7° S., 32° — 73° E. in sounding depths 11—5106 metres and collection depths from surface to 4793 metres. Out of the 212 stations, 60 were in the "Indian region" covered by the area 24° N.— $0^{\circ}36'S.$, 60° — 73° E. in the Arabian Sea,

in sounding depths 27—4793 metres and collection depths from surface to 4793 metres, in bottom and subsurface temperature 1.41°C. to 29.05°C.; 1.41°C. in 4200 metres at 1°25'N., 47°37'48"E. and 29.05°C. in 40 metres at 7° 11'48" N., 60° 38'42"E. The trawler "Golden Crown", being of the type commonly used in commercial fishing, made many trips in 1908-1909, confined mainly to the northern parts of the Bay of Bengal in depths between 20—30 fms., along the coast of Gopalpur to Oyster I., off the Burmese coast, but mostly in Balasore Bay, off Konarak and Puri in Orissa, off the entrance to Eastern Channel of river Hooghly, off the Mutlah Lightship at the entrance of Mutlah river and in the vicinity of Cox's Bazar, Chittagong. The collections obtained by this vessel are complimentary to those made by the R.I.M.S. "Investigator" in shallow waters.

The general classification adopted in this series is mainly according to Dr. L. S. Berg's "Classification of fishes both recent and fossil", *Trav. Inst. Zool. Acad. Sci. U.R.S.S.*, Leningrad, 5, liv, 2, pp. 1—517, 1940; Russian pp. 1—345, 190 figs.; English pp. 346—517 (lithoprint in 1947, Ann Arbor, Michigan).

The keys are artificial and not strictly phylogenetical. They are purely regional in application and deal only with species, genera, families and other higher taxonomic categories treated in this work. A running field key for the identification of the 114 species of Elasmobranchii and Holocephali is also given towards the end.

Most of the references to genera and species have been checked with the original publications. In a few cases where this was not possible, reliance was placed on D.S. Jordan's *The Genera of fishes*, S. A. Neave's *Nomenclator Zoologicus*, and F. E. Schulze, W. Kukenthal and K. Heider's *Nomenclator animalium generum et subgenerum*.

Genera, species and subspecies are serially numbered in Arabic numerals; classes, superorders, orders, superfamilies and families in capital Roman numerals; subclasses, suborders, subfamilies and subgenera in small Roman numerals; their numbers are to be serially continued in the succeeding volumes on class Teleostomi.

Classes, superorders and orders are in All Caps Roman; subclasses and suborders in All Caps Italics; superfamilies and families in Caps and Small Caps Roman; subfamilies in Caps and Small Caps Italics; genera, subgenera, species

and subspecies in Pica or Antique while occurring above synonymies and genera and subgenera in Pica or Antique while occurring in keys.

The species under each genus have been arranged alphabetically. In the synonymies the first is the original reference with the type locality, and as far as possible the name of the institution where the type is deposited; others are with respect to the confines of our and other regions. Where several localities are given in the original reference, all have been included, but only the first mentioned is taken as the type locality. A selection of other references which are important is also given.

Descriptions of the species are based mostly on those by Day, and wherever necessary either after original authors or on specimens available in the collections of the Zoological Survey of India. As regards illustrations those copied from other works are duly acknowledged in the legends of the figures.

Vernacular names of the species are given along with standardised Indian names, just after the specific synonymy, wherever available. Much reliance, however, cannot be placed on these names for the correct identification of the species.

Out of the 114 species and two subspecies dealt with in this volume, 24 species and one subspecies, viz., *Rhinochimaera* sp., *Isurus güntheri* (Murray), *Scyliorhinus (Halaelurus) alcokii* Garman, *Scyliorhinus (Halaelurus) quagga* (Alcock), *Proscyllium alcocki* Misra, *Pentanchus (Parapristurus) investigatoris* Misra, *Chaenogaleus balfouri* (Day), *Centroscymnus rossi* (Alcock), *Centroscyllium ornatum* (Alcock), *Rhinobatos lionotus* (Norman), *Pristis annandalei* Chaudhuri, *Zanobatus schoenleinii* (M. & H.), *Raja andamanica* Lloyd, *Raja mamillidens* Alcock, *Raja reversa* Lloyd, *Dasyatis (Himantura) alcockii* (Annandale), *Dasyatis (Himantura) favus* (Annandale), *Dasyatis (Himantura) jenkinsii* (Annandale), *Dasyatis (Himantura) marginatus* (Blyth), *Dasyatis (Himantura) microps* (Annandale), *Aetomylus nichofii cornifera* (Annandale), *Rhinoptera sewelli* Misra, *Mobula thurstoni* (Lloyd), *Narcine brunnea* Annandale and *Bengalichthys impennis* Annandale, are in the mean annual isotherm of 20°C. and endemic in the range 4°-25°N., 60°—97°E. being restricted to the north of the Equator.

Of the remaining 90 species and one subspecies, 17 species, viz., *Rhincodon typus* Smith, *Alopias vulpinus*

(Bonn.), *Isurus glauca* (M. & H.), *Carcharhinus commersonii* (Blainv.), *Carcharhinus limbatus* (M. & H.), *Galeocerdo cuvier* (Le Sueur), *Sphyrna mokarran* (Rüpp.), *Sphyrna tudes* (V.), *Sphyrna zygaena* (L.), *Pristis microdon* Latham, *Pristis pectinatus* Latham, *Dasyatis (Dasyatis) pastinaca* (L.), *Dasyatis (Pastinachus) bennetti* (M. & H.), *Urogymnus africana* (Schn.), *Gymnura (Gymnura) micrura* (Schn.), *Mobula mobular* (Bonn.), and *Chimaera monstrosa* L., are found in the Indo-Pacific,¹ Mediterranean, Atlantic and the Arctic Oceans in the areas of 35° N.—35° S., 18° E.—111° W. 36°—43° N., 7°—14° E., 62° N.—33° S., 18° E.—80° W., and 65° N., 16° E.—20° W. respectively, in the isotherms of 20°C., 12°C., 6°C. and beyond 6°C. isotherm in the Arctic zone. Of these 17 species, 4 species, viz., *Sphyrna mokarran*, *Dasyatis (Pastinachus) bennetti*, *Gymnura (Gymnura) micrura* and *Mobula mobular* are restricted to the north of the Equator with a range of 0°—25° N., 39°—118° E. in the Indo-Pacific 5°—26° N., 55°—92° W. in the Atlantic and 37° N., 14° E. in the Mediterranean. Out of the remaining 13 species, 5 species, viz., *Rhincodon typus*, *Alopias vulpinus*, *Carcharhinus commersonii*, *Galeocerdo cuvier* and *Sphyrna tudes*, extend their range from Africa eastwards to the Californian coast, the distributional range being 35° N.—35° S., 18° E.—111° W. in the Indo-Pacific, 0°—25° N., 50°—90° W. in the Atlantic and 37° N., 14° E. in the Mediterranean. Of the remaining 8 species, 3 species viz., *Isurus glauca*, *Carcharhinus limbatus*, and *Sphyrna zygaena*, have been recorded eastwards beyond 180° E., but not reaching the Californian coast, their range being 35° N.—35° S., 18° E.—155° W. in the Indo-Pacific and 26° N.—18° S., 61°—92° W. in the Atlantic. Of the remaining five species, 4 species viz., *Pristis microdon*, *Pristis pectinatus*, *Dasyatis (Dasyatis) pastinaca* and *Urogymnus africana* restrict their range as 25° N.—35° S., 18°—142° E. in the Indo-Pacific, 3°—26° N., 2°—92° W. in the Atlantic and 36° N., 14° E. in the Mediterranean. One species *Chimaera monstrosa* has been recorded besides from the Arctic zone from the Indo-Pacific, Atlantic and Mediterranean with the distributional range 35° N.—35° S., 18°—130° E. in the Indo-Pacific, 62° N.—33° S., 18° E.—80° W. in the Atlantic, 36°—43° N., 7°—15° E. in the Mediterranean and 65° N., 20° W. in the Arctic zone.

Of these 17 species, 7 species, *Rhincodon typus*, *Carcharhinus commersonii*, *Carcharhinus limbatus*, *Galeo-*

¹ In the "Distribution" of the species their latitudinal and longitudinal range in the Indo-Pacific has also been demarcated separately for the Indian and Pacific Oceans.

cerdo cuvier, *Sphyrna zygaena*, *Pristis microdon* and *Urogymnus africana*, have been recorded only from the north and south of the Equator in the Indo-Pacific and north of the Equator in the Atlantic; 2 species, viz., *Alopias vulpinus* and *Sphyrna tudes*, are restricted to the Mediterranean and north and south of the Equator in the Indo-Pacific; *Dasyatis (Dasyatis) pastinaca* has been recorded from the Mediterranean and the north and south of the Equator in the Indian Ocean. While another species, *Mobula mobular* is restricted to the north of the Equator in the Indian Ocean and the Mediterranean; *Isurus glauca* is distributed to the north and south of the Equator in the Indo-Pacific, but only south of the Equator in the Atlantic; 3 species, viz.; *Sphyrna mokarran* and *Dasyatis (Pastinachus) bennetti*, and *Gymnura (Gymnura) micrura*, have been recorded only from the north of the Equator in the Indo-Pacific and north of the Equator in the Atlantic; *Pristis pectinatus* is distributed to the north and south of the Equator in the Indian Ocean and north of the Equator in the Atlantic, while *Chimaera monstrosa* is widely distributed in the north and south of the Equator in the Indo-Pacific and north and south of the Atlantic, in the Mediterranean and the Arctic Ocean.

Out of the 73 species and one subspecies, 12 species viz., *Carcharhinus ellioti* (Day), *Hemipristis elongatus* (Klunz.), *Rhinobatos annandalei* (Norman), *Raja johannisdavisi* Alcock, *Raja powelli* Alcock, *Dasyatis (Amphotistius) imbricata* (Schn.), *Dasyatis (Himantura) bleekeri* (Blyth), *Gymnura (Aetoplatea) tentaculata* M. & H., *Rhinoptera adspersa* M. & H., *Benthobatis moresbyi* Alcock, *Narke dipterygia* (Schn.) and *Harriotta indica* (Garman), are restricted to the north of the Equator, their range of distribution being 1°—34°N., 39°—132°E., in the Indo-Pacific.

Out of the 61 species and one subspecies, 32 species, viz., *Heptranchias indicus* (Agassiz), *Chiloscyllium griseum* M. & H., *Chiloscyllium indicus* (Gmel.). *Chiloscyllium plagiosum* (Benn.), *Nebrius concolor* Rüpp., *Nebrius ferrugineum* (Lesson), *Stegostoma varius* Seba), *Carcharius tricuspidatus* Day, *Scyliorhinus (Scyliorhinus) capense* (Smith), *Scoliodon palasorrah* (C.), *Scoliodon walbeehmi* Blkr., *Carcharhinus dussumieri* (M. & H.), *Carcharhinus sorrah* (M. & H.), *Carcharhinus spallanzani* (Le Sueur) *Mustelus manazo* Blkr., *Triaenodon obesus* (Rüpp.), *Rhinobatos obtusus* (M. & H.), *Rhina ancylostomus* Scha., *Rhynchobatus djiddensis* (Forsk.), *Pristis zysnon* Blkr., *Dasyatis (Himantura) uarnak* (Forsk.),

Taeniura lymma (Forsk.), *Taeniura melanospilos* Blkr., *Taeniura meyeri* M. & H., *Dasyatis (Amphotistius) kuhlii* (M. & H.), *Aetobatus flagellum* (Schn.), *Aetobatus ocellatus* (Kuhl), *Mobula diabolus* (Shaw), *Mobula kuhlii* (M. & H.), *Manta ehrenbergii* (M. & H.), *Torpedo panthera* Olfers and *Torpedo sinus persici* Olfers, extend their range up to 20°S. or beyond 20°S., having been recorded also from the north of the Equator, with the distributional range 35°N.—35°S., 18°E.—111°W. Out of these 32 species, 4 species, viz., *Scyliorhinus capense*, *Taeniura meyeri*, *Dasyatis (Amphotistius) kuhlii* and *Torpedo sinus persici*, are restricted to the Indian Ocean within the range 27°N.—35°S., 18°—85°E. while the remaining 28 species extend their range into Indo-Pacific with a distributional range of 35°N.—35°S., 18°—158°E.

Out of the remaining 29 species and one subspecies, 6 species, viz., *Atelomycterus marmoratum* (Benn.), *Physodon mülleri* M. & H., *Aprionodon acutidens* (Rüpp.), *Hypoprion hemiodon* M. & H., *Rhinobatos typus* (Benn.), and *Dasyatis (Himantura) gerrardi* (Gray) occur between 10°S. and 12°S. of the Equator with the distributional range 34°N.—12°S., 38°E.—170°W. The remaining 23 species and one subspecies, viz., *Scyliorhinus (Halaelurus) bürgeri* (M. & H.), *Scyliorhinus (Halaelurus) hispidum* (Alcock), *Scoliodon sorrakowah* (C.), *Hypoprion macloti* M. & H., *Carcharhinus bleekeri* (Dumeril), *Carcharhinus gangeticus* (M. & H.), *Carcharhinus menisorrah* (M. & H.), *Carcharhinus pleurotaenia* (Blkr.), *Carcharhinus remminckii* (M.&H.), *Sphyrna blöchii* (C.), *Rhinobatos granulatus* (C.), *Rhinobatos thouin* (Anon.), *Pristis cuspidatus* Latham, *Dasyatis (Amphotistius) zugei* (M.&H.), *Dasyatis (Himantura) walga* (M.&H.), *Dasyatis (Pastinachus) sephen* (Forsk.), *Gymnura (Aetoplatea) zonurus* Blkr., *Gymnura (Gymnura) poecilura* (Shaw), *Aetomylus milvus* (M.&H.), *Aetomylus maculatus* (Gray), *Aetomylus nichofii nichofii* (Schn.), *Rhinoptera javanica* M.&H., *Narcine maculata* (Shaw) and *Narcine timlei* (Schn.), extend their range only to 1°—7°S., their distributional range being 35°N.—7°S., 39°—155°E. Of these 24 species, *Scyliorhinus (Halaelurus) hispidum* and *Carcharhinus bleekeri*, are restricted to the Indian Ocean, not extending beyond the Bay of Bengal and within the distributional range 14°—20°N., 39°—93°E.

Of the total 114 species and two subspecies of Elasmobranchii and Holocephali, the distributional pattern of

96 species of Elasmobranchs shows that they are pelagic¹ or littoral in the "Indian region," being restricted only within the range of the 20°C. mean annual isotherm, (Plate II) (excepting 4 species mentioned below which also occur in 12°C., 2°C. annual isotherm and some other species in the Pacific even to the western coasts of tropical, North and South Americas, but not so far westwards into the Atlantic beyond the Cape of Good Hope. This is due to the fact that the 12°C. isotherm bordering the southwest coast of Africa beyond west of the Cape of Good Hope and extending up to the 22°S. latitude forms a physical barrier for the free intermingling of the Indian and Atlantic species. The Cape of Good Hope is, therefore, a well-defined line of division between the Indo-Pacific and Atlantic species. The occurrence of 4 species out of the 96, viz., *Alopias vulpinus*, *Sphyrna tudes*, *Dasyatis (Dasyatis) pastinaca*, and *Mobula mobular* in the Mediterranean within the range of the 12°C. annual isotherm and some other species in the tropical Atlantic within the range of the mean annual isotherm of 20°C., may be explained by the configuration of the land masses during the Eocene period when the Great Inland Sea extended eastwards from the present Gulf of Mexico, through the present Mediterranean to the present Arabian Sea, and the isthmus of Panama was submerged under the sea connecting the Atlantic and the Pacific Oceans (Plate III), and thus making it possible for a free dispersal of the species. It is also probable, as suggested by Smith² "that these are relics of earlier intermingling, for not very long ago in geological time, conditions were different, and there was almost certainly a warm water connection between the Indian and Atlantic Oceans" Besides, the recent and artificially connected Panama Canal³ and Suez Canal may have, to a certain degree, served as a connecting passage for the migration of these species. The remaining 18 species, viz., *Scyliorhinus (Scyliorhinus) capense*, *Scyliorhinus (Halaelurus) alcockii*, *Scyliorhinus (Halaelurus) bürgeri*, *Scyliorhinus (Halaelurus) hispidum*, *Scyliorhinus (Halaelurus) quagga*, *Proscyllium alcocki*, *Pentanchus (Parapristurus) investigatoris*, *Centroscymnus rossi*, *Centroscyllium ornatum*, *Raja andamanica*, *Raja johannis-davisi*, *Raja mamillidens*, *Raja powelli*, *Raja*

1. Pelagic species occur in waters beyond the continental shelf in depth less than 200 metres ; and littoral species inhabit depths less than 200 metres within the continental shelf.

2. Smith, J. L. B., *The Sea Fishes of Southern Africa*, p. 7 (1949).

3. The Panama Canal, though mostly freshwater, may not be a real barrier for the intermingling of at least a few marine species that are euryhaline.

reversa, *Benthobatis moresbyi*, *Chimaera monstrosa*, *Hurriotta indica* and *Rhinochimaera* sp. being bathypelagic are not affected by such physical barriers as temperature from the distributional point of view. These species, therefore, may occur in the 20°C., 12°C. and 6°C. mean annual isotherms, though all of them, except *Chimaera monstrosa*, have been recorded from the Indian Ocean in 20°C. mean annual isotherm. *Chimaera monstrosa*, has, however, been recorded in 20°C., 12°C., 6°C. mean, annual isotherms and beyond 6°C. isotherm in the Arctic Zone where the air, surface and subsurface temperatures as recorded by R.R.S. "Discovery" (1925-1927) at 12.00—14.00 hrs. on 27—iii—1927, off C. Kaiser, Brabant I., Palmer Archipelago, 64° 14'S., 61° 49'W., are: air—0.6°C., at surface—0.15°C., in 10 metres—0.32°C., in 20 metres—0.33°C., in 30 metres—0.31°C., in 40 metres—0.30°C., in 50 metres—0.30°C., in 60 metres—0.29°C., in 80 metres—0.22°C., in 100 metres—0.21°C., in 150 metres—0.00°C., in 200 metres—0.00°C., in 300 metres—0.02°C., in 400 metres—0.06°C., in 600 metres—0.28°C., and in 780 metres—0.49°C. Similar data collected by the R.R.S. "Discovery" (which cruised the Mid-Atlantic and South Atlantic in the range 13° 1'45"N.—64° 56'S., 17° 48'15"E.—65° 35'W., covering 299 stations in sounding depths 7—5,700 metres and collecting depths from surface to 3,500 metres in subsurface temperatures ranging from 23.62°C. to 0.92°C. for 3 stations occurring respectively in 6°C., 12°C., and 20°C. mean annual isotherms are given below to show the homogeneity of temperatures of bathypelagic regions and the heterogeneity of temperatures of surface regions: as 3.93°C. in 620 m. at 53° 33' S., 61° 49' 30" W with air temperature 7.2°C. and surface temperature 6.31°C. at 08.00 hrs. on 24-viii-1927; 4.22°C. in 600 m. at 33° 6'S., 16° 55'E., with air temperature 15°C. and surface temperature 15.24°C. at 23.30—00.00 hrs. on 19/20 vii-1927; 6.30°C. in 600 m. at 4° 18' 15" N., 16° 51' W with air temperature 25°C. and surface temperature 26.01°C. at 20.00—00.00 hrs. on 24-vii-1927.

It can be seen from the above data that bathymetric temperatures of the temperate and tropical zones tend to be more or less uniform, while the surface temperatures are fluctuating. In the frigid zones, however, conditions are quite different, surface and bathymetric temperatures being —0°C. with minimum fluctuations between them. These differences in temperature conditions of the frigid

¹. Bathypelagic species inhabit waters beyond the continental shelf in depths below 200 m. up to 2000 m.

zone is bound to have some influence on the species inhabiting the region as to expect some raiation¹ from their congeners of the temperate zones. Thus the isotherms may serve as an indicator to the taxonomist in dealing with the relationships of the species and subspecies from the zoogeographical point of view. To study the distributional pattern of the species and to verify their nomenclatorial validity, it will be necessary to conduct taxonomic investigations on an international basis as suggested by Horacio Rossa Jr.²

In the preparation of this volume considerable use has been made of the vast literature on the group of Elasmobranchii, reference to which may be made from the generic and specific synonymies and from the "References" given towards the end.

It may be useful to those reading the volumes in this series to consult such references as *Cambridge Natural History*, Vol. VII, and *Procedure in Taxonomy* by E. T. Schenk and J. H. Mc Masters, regarding some of the scientific terms used in this work. A few explanations which seem necessary for certain terms used here are given below :—

1. *Trunk* is measured from the tip of snout to the vent.
2. *Length of disc* (in ray-like forms) is measured from the tip of the snout to the hind edges of the expanded pectorals.
3. *Length of head* is measured from the tip of snout to the anterior edge of the first gill-opening.
4. *Preoral length* is measured from the tip of snout to the mouth.
5. *Internarial width* is measured from the inner edge of one nostril to that of the corresponding one on the opposite side.
6. *Orthotype* is the type of a genus as indicated or distinctly implied by the original author.
7. *Logotype* is the type of a genus selected by the "first reviser".
8. *Haplotype* or *Monotype* is the sole species mentioned under a genus and so is an orthotype as well.
9. *Tautotype* is a name of a genus identical with the specific name of the species.
10. *Co-type* or *syntype* is a specimen of the original series when there is no holotype.

1. Misra, K.S. & Menon, M.A.S. 1958.—*Rec. Indian Mus.*, 53 (1955), p. 76.

2. Rossa H., 1951.—*Trans. Amer., Fish. Soc.*, 70, pp. 110-118.

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PISCES

Cold blooded vertebrates (except Order Thunniformes), with jaws and fins, exclusively aquatic and breathing by gills throughout life. Skull well developed with or without sutures. Jaws hyostylic, amphistylic or autostylic. Endoskeleton cartilaginous, often calcified or bony. Exoskeleton of scales of dermal denticles either structurally identical with teeth or non-identical with teeth, or sometimes entirely wanting. Paired nasal organs each with one or 2 external openings. Gills persistent throughout life; gill openings as one or 5 to 7 lateral or 5 ventral apertures; with or without operculum. Branchial arches either 5 to 7 or 5 to 2. Paired limbs as fins, not of pentadactylus type, rarely atrophied. Myxopterygia (claspers) in males present or absent. Heart with auricle, ventricle and arterial bulb; atrium undivided or partially divided. Air-bladder either present or absent. Fertilization internal or external; oviparous, viviparous or ovo-viviparous; amnion and allantois absent.

Upper Silurian to Recent.

The series PISCES is divided into 4 classes: ELASMOBRANCHII, HOLOCEPHALI, TELEOSTOMI and DIPNOI.

Key to classes of series PISCES

- | | | |
|--|------|--|
| 1. Skeleton cartilaginous | 3 | |
| 2. Skeleton bony (except order Ateleopiformes; where the endocranium is mainly cartilaginous). | .. 5 | |
| 3. Single pair of lateral gill openings: operculum present | | Class HOLOCEPHALI |
| 4. 5—7 pairs of lateral or ventral gill openings: operculum absent | | Class ELASMOBRANCHII |
| 5. Atrium partially divided, with development of lungs | | Class DIPNOI (not represented in the Indian region). |
| 6. Atrium not divided, without lungs | | Class TELEOSTOMI |

I. Class ELASMOBRANCHII

Sharks, Skates and Rays

Endoskeleton cartilaginous, often calcified, membrane bones of head undeveloped. Endocranium not ossified but

superficially calcified. Skull amphistylitic or hyostylitic without sutures. Ribs of the pleural (ventral) type. Five to seven gill arches and gill openings, either lateral or ventral; gills not free, attached to skin by outer margins; gill openings between mandibular and hyoid arches reduced; no gill cover. Skin naked or with placoid scales. Paired olfactory organs, each with one external opening. Pectoral and pelvic fins uniserial. Pelvics abdominal. Males with myxopterygia. Intestine with spiral valves. Cloaca present. Arterial bulb with 3 series of valves. Cerebral hemisphere united. Optic nerve united by chiasma. Tail heterocercal. No air-bladder. Internal fertilization, oviparous, viviparous or ovo-viviparous.

Upper Silurian to Recent.

Class ELASMOBRANCHII has only one subclass, *SELACHII*.

i. Subclass *SELACHII*

Sharks and Rays

Skull amphistylitic. Body more or less cylindrical or depressed. Trunk either passing gradually to the tail or not. Five to 7 gill openings, either lateral or ventral. Anterior margin of pectoral fin free or fused with sides of body or head. Olfactory capsule with or without a pair of preorbital cartilage. Hyomandibular with or without branchial rays. Two halves of pectoral girdle either separate from each other or from vertebral column, or united with each other or to the vertebral column. Vertebral centra either asterospondylic or cyclospondylic. Anal fin present or absent.

Silurian to Recent.

The subclass *SELACHII* is divided into 2 superorders : *SELACHOIDEI* and *BATOIDEI*.

Key to superorders of subclass SELACHII

- | | |
|----------------------------------|------------------------|
| 1. Gill openings on ventral side | Superorder BATOIDEI |
| 2. Gill openings on lateral side | Superorder SELACHOIDEI |

I. Superorder SELACHOIDEI

Sharks

Body more or less cylindrical. Trunk gradually passing into tail. Five to 7 lateral gill openings. Anterior margin of pectoral fin, free. Olfactory capsule without a free pair of preorbital cartilages. Two halves of pectoral girdle separated from each other and from the vertebral column.

Hyomandibular with branchial arches. Anal fin present or absent.

Carboniferous to Recent.

Superorder SELACHOIDEI is divided into 3 orders : HEXANCHIFORMES, SQUALIFORMES and LAMNIFORMES.

Key to orders of superorder SELACHOIDEI

- | | |
|---------------------|----------------------|
| 1. One dorsal fin | Order HEXANCHIFORMES |
| 2. Two dorsal fins | 3 |
| 3. Anal fin absent | Order SQUALIFORMES |
| 4. Anal fin present | Order LAMNIFORMES |

I. Order HEXANCHIFORMES

Skull amphistylic. Vertebral column imperfectly segmented, each segment consisting of 2 vertebral and 2 neural arches. Six to 7 gill arches and 6—7 lateral gill openings. A single spineless dorsal fin. Anal fin present. Mesopterygium of pectoral fin reaching its anterior margin. No radials on propterygium.

Middle Jurassic to Recent.

HEXANCHIFORMES is the most primitive of the existing sharks with only one living family, HEPTRANCHIDAE.

I. Family HEPTRANCHIDAE

Cow Sharks

Body elongate. Head long, depressed. Snout long, protruding. Eyes without nictitating membrane. Mouth inferior, with labial folds at angles of lower jaw. Teeth dimorphic, jagged and cusped in the upper and comb-like in the lower. Nostrils inferior. Oronasal grooves and cirri absent. Gill openings lateral, 6 or 7. Small spiracle on neck. A single spineless dorsal opposite and like anal. Caudal long, without pits. Subcaudal well developed. Viviparous.

Middle Jurassic to Recent.

The family Heptranchidae is represented by only one genus and one species.

1. Genus **Heptranchias**¹ Rafinesque

1810. *Heptranchias* Rafinesque, *Caratt. Animal Piante Sicilia*, p. 13 (type, *Squalus cinereus* Gmelin, monotypic).

¹ Often spelt as **Heptanchus** by some authors.

1841. *Heptanchus* Müller & Henle, *Syst. Besch. Plagiost.*, p. 81 (type, *Squalus cinereus* Gmelin).
 1855. *Notorhynchus* Ayres, *Proc. California Acad. Sci.*, 1, p. 72 (type, *N. maculatus* Ayres, monotypic).
 1864. *Notorhynchus* Gill, *Proc. Acad. nat. Sci. Philad.*, p. 149 (type, *N. maculatus* Ayres).

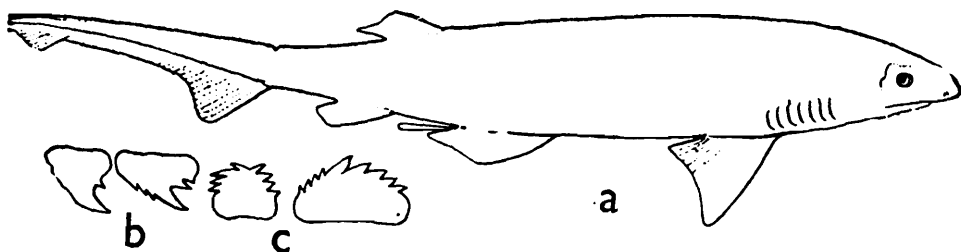
Body elongate. Snout rounded and obtuse. Eyes without nictitating membrane. Mouth large. Labial folds at angles of mouth. Spiracles small. 7 pairs of gill-openings. A single spineless dorsal fin opposite the anal. Lower caudal lobe well developed. No caudal pit. Teeth dimorphic, jagged and cusped in the upper and comb-like in the lower.

Distribution—Atlantic, Indian and Pacific Oceans.

1. *Heptranchias indicus* (Agassiz)

(Text-fig. 1)

1835. *Notidanus indicus* Agassiz, *Poiss. Fossil*, pl. e, fig. 1, *Feuilleton*, pp. 71, 92, pl. e, figs. 1—4 (teeth) (type locality: Indes Orientales).
 1841. *Heptanchus indicus* Müller & Henle, *Syst. Besch. Plagiost.*, p. 82, pl. 32 (teeth) (Indian Ocean).
 1850. *Heptanchus indicus* Schlegel, *Siebold's Fauna Japonica Poiss.*, Pt. 15, p. 303 (Japan).
 1855. *Notorhynchus maculatus* Ayres, *Proc. California Acad. Sci.*, 1, p. 72 (type locality: California).
 1864. *Notidanus indicus* Günther, *Cat. Fish. Brit. Mus.*, 8, p. 398 (from Cape of Good Hope to California).
 1878. *Notidanus indicus* Day, *Fish. India*, p. 723, pl. 189, fig. 4 (Madras and Cape seas example).



TEXT-FIG. 1.—*Heptranchias indicus* (Agassiz).

(a) Lateral view : $\times ca \frac{1}{15}$. (b) Upper teeth. (c) Lower teeth. (After F. Day)

1880. *Notidanus* (*Heptranchus*) *indicus* Peters, *Monatsb. Akad. Wiss. Berlin*, p. 926 (Ningpo).
 1889. *Notidanus indicus* Day, *Fauna Brit. India*, Fish., 1, p. 80, fig. 10.
 1929. *Notidanus indicus* Tirant, *Serv. Ocenogr. Peches Indo-Chine*, 6° note p. 64 (Cochin-China).
 1949. *Heptranchias platycephalus* (*nec* Tenore) Misra, *Rec. Indian Mus.*, 45 (1947), p. 7.
 1953. *Heptranchias pectorosus* Smith, *Sea Fish. S. Africa*, p. 39 (Algoa Bay).
 1958. *Heptranchias platycephalus* (*nec* Tenore) Misra & Menon, *Rec. Indian Mus.*, 53, p. 81.

The suborder *LAMNOIDEI* is represented by 3 families: *ORECTOLOBIDAE*, *ODONTASPIDAE* and *LAMNIDAE*.

Key to families of suborder LAMNOIDEI

- | | |
|---|-----------------------------|
| 1. Nasoral grooves present | Family <i>ORECTOLOBIDAE</i> |
| 2. Nasoral grooves absent | 3 |
| 3. Second dorsal and anal fins large:
lateral keel absent | Family <i>ODONTASPIDAE</i> |
| 4. Second dorsal and anal fins small:
lateral keel present or absent | Family <i>LAMNIDAE</i> |

II. Family *ORECTOLOBIDAE*

Cat sharks, Whale sharks

Body short to moderately elongate, depressed, sub-cylindrical. Tail slender, longer than or equal to trunk, with long or short caudal. Head broad, depressed or not depressed. Snout short, obtuse or pointed. Eyes small, without nictitating membrane. Mouth transverse, labial folds in both jaws. Oronasal grooves present; cirri present or absent. Teeth compressed, with or without lateral cusps. Small spiracle behind or below eye. Five pairs of gill openings and gill arches, last 1 or 2 above pectorals. First dorsal origin opposite or behind pelvic origin. Second dorsal origin in front of anal origin. Anal nearer to sub-caudal than to pelvics. Back with or without dermal ridges. Lateral keel on tail present or absent. Caudal pits present or absent. Subcaudal very long or short, lobed or not lobed. Viviparous or oviparous.

The family *ORECTOLOBIDAE* is divided into 2 subfamilies: *ORECTOLOBINI* and *RHINEODONTINI*.

Key to subfamilies of family ORECTOLOBIDAE

- | | |
|--|----------------------|
| 1. Nasoral grooves and cirri present: tail
without lateral keels and pits | <i>ORECTOLOBINI</i> |
| 2. Only nasoral grooves present: tail
with lateral keels and pits | <i>RHINEODONTINI</i> |

i. Subfamily *ORECTOLOBINI*

Body not massive, without lateral caudal keels and caudal pits. Teeth small, with or without cusps. Nasal cirri present. Gill rakers short.

Key to genera of subfamily ORECTOLOBINI

- | | |
|---|------------------------------------|
| 1. First dorsal fin behind
pelvics: 1-3 dermal ridges on
back | Genus <i>Chiloscyllium</i> M. & H. |
|---|------------------------------------|

- | | |
|--|---------------------------------|
| 2. First dorsal fin opposite
pelvics : without dermal ridges
on back | 3 |
| 3. Caudal fin short | Genus <i>Nebrius</i> Rüpp. |
| 4. Caudal fin long | Genus <i>Stegostoma</i> M. & H. |

2. Genus *Chiloscyllium* Müller & Henle

1837. *Chiloscyllium* Müller & Henle, *Sitz. Ber. preuss. Akad. Wiss. Berlin*, p. 112 (type, *Scyllium plagiosum* Bennett, logotypic).
1838. *Hemiscyllium* Andrew Smith, *Proc. zool. Soc. Lond.*, p. 86 (type, *Squalus ocellatus* Bon., monotypic).
1862. *Synchismus* Gill, *Ann. Lyc. nat. Hist. New York*, 7, pp. 407, 408 (type, *Squalus tuberculatus* Schneider, orthotypic).

Body elongate. Trunk shorter than tail. Eyes without nictitating membrane. Nasoral grooves and cirri present. Spiracles below eyes. Five pairs of lateral gill openings. Two spineless dorsal fins; first dorsal behind pelvics. Anal fin present. One to 3 dermal ridges on back. Teeth small, triangular, with or without lateral cusps.

Distribution.—S. Africa, Red Sea, India, Ceylon, Singapore, Indonesia, "Indo-China", Formosa, Japan, Philippines, Australia, Melanesia.

Key to species

- | | |
|--|-----------------------------|
| 1. With one dermal ridge on back | 3 |
| 2. With 3 dermal ridges on back | <i>C. indicus</i> (Gmelin) |
| 3. Origin of first dorsal above middle
of pelvic bases: body with white spots | <i>C. plagiosum</i> (Benn.) |
| 4. Origin of first dorsal above ends of
pelvic bases: body with dark spots | <i>C. griseum</i> M. & H. |

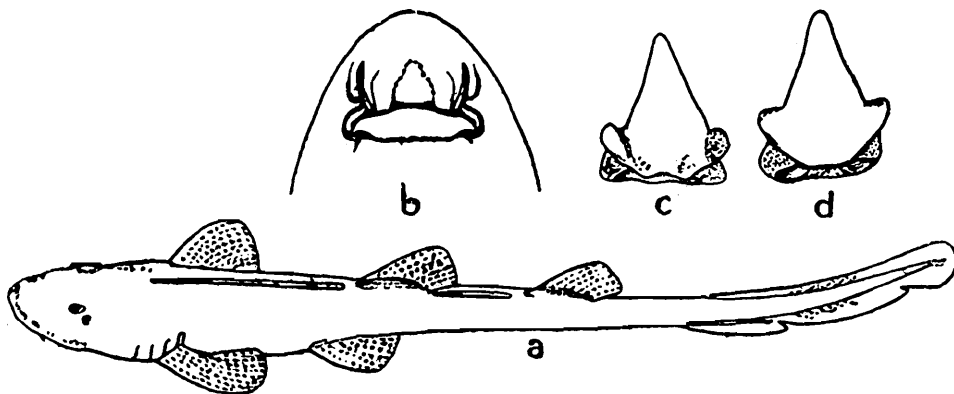
2. *Chiloscyllium griseum* M. & H.

(Text-fig. 2)

1841. *Chiloscyllium griseum* Müller & Henle, *Syst. Besch. Plagiost.*, p. 19 (type locality: India, Japan).
1851. *Chiloscyllium obscurum* Gray, *List Fish. Brit. Mus.*, p. 25 (type locality: Moluccas).
1852. *Chiloscyllium hasseltii* Bleeker, *Verh. Bat. Gen. (Plagiost.)*, 24, p. 8 (Moluccas, Batavia, Vizagapatam).
1878. *Chiloscyllium indicum* (nec Gmelin) Day, *Fish India*, p. 726, pl. 188, fig. 3 (India, Malay Archipelago).
1888. *Chiloscyllium indicum* var. *obscurum*, Ogilby, *Cat. Fish. Austral. Mus.*, pt. 1, p. 8 (Malabar).
1889. *Chiloscyllium indicum* (nec Gmelin) Day, *Fauna Brit. India, Fish.*, 1, p. 34 fig. 14 (Seas of India to Malay Archipelago and beyond).
1908. *Chiloscyllium griseum* Regan, *Proc. zool. Soc. Lond.*, pl. 11, fig. 1, pl. 13, fig. 1 (young) (India, Malay Archipelago).

1913. *Chiloscyllium griseum* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 64 (South Africa, India, Japan).
1914. *Chiloscyllium griseum* Raj, *Rec. Indian Mus.*, 10, pp. 318, 319 (Madras).
1919. *Chiloscyllium griseum* Southwell & Prashad, *Rec. Indian Mus.*, 16, p. 222, pl. 19, fig. 5 (Port Canning, Bengal).
1928. *Chiloscyllium griseum* Fowler, *J. Bombay nat. Hist Soc.*, 33, p. 100 (Bombay).
1929. *Chiloscyllium griseum* Pillay, *J. Bombay nat. Hist. Soc.*, 33, p. 350 (Travancore).
1938. *Chiloscyllium griseum* Aiyar & Nalini, *Proc. Indian Acad. Sci.*, 7, Sec. B, p. 252 (Madras).
1941. *Hemiscyllium griseum* Fowler, *Bull. U.S. nat. Mus.*, (100), 13, p. 88.
1949. *Chiloscyllium griseum* Misra, *Rec. Indian Mus.*, 45 (1951), p. 8.
1952. *Chiloscyllium griseum* Misra, *Rec. Indian Mus.* 49 (1951), p. 98.
1953. *Chiloscyllium griseum* Herre, *Check List Philippine Fish.*, p. 9 (Philippines).
1953. *Chiloscyllium griseum*, Smith, *Sea Fish. South Africa*, p. 51.
1955. *Chiloscyllium indicum* (*nec* Gmelin) Anonymous, *Mar. Fish. Karachi, Sind & Makran*, p. 4, fig. 8 (Coasts of Sind and Makran).
1955. *Chiloscyllium griseum* Munro, *Mar. Freshwater Fish. Ceylon*, p. 3 (Ceylon).
1958. *Chiloscyllium griseum* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 81.

Head depressed, 4.5; depth 9.0 to subcaudal origin. Snout obtuse, 2.1 in head to first gill opening. Eyes without



TEXT-FIG. 2.—*Chiloscyllium griseum* M. & H.

- (a) Dorso-lateral view : $\times ca\frac{1}{2}$. (b) Ventral view of head
 $\times ca\frac{1}{4}$. (c) Upper tooth : $\times ca14$. (d) Lower tooth : $\times ca14$.
 (After K. S. Misra)

nictitating membrane, 8.0 in head, in middle of head. Preoral 1.4 in mouth. Short labial folds on both jaws.

Oronasal grooves and cirri present. Nostrils midway between snout end and mouth. Teeth in $\frac{32-33}{30-32}$ rows, triangular, edges entire. Spiracle below eye and equal to an eye diameter. Gill openings narrow, 4th and 5th very close together, last 3 above pectoral base. First dorsal origin above ends of pelvic base. Second dorsal origin nearer anal origin than to first dorsal origin. Pelvic origin much nearer to pectoral base than to anal base. Anal very close to subcaudal. Subcaudal equal to head to first gill opening, without lobe. One dermal ridge on back. No caudal pits.

Pale brown with about 12 transverse bands on back all broader than pale interspace; 2 large, dark blotches on dorsals.

It attains 609 mm. (2ft.) in length; littoral, very sluggish in movement.

Distribution—India, Pakistan, Ceylon.—S. Africa, Red Sea, Malay Peninsula, China, Japan; in the mean, annual isotherm of 20°C. with the latitudinal and longitudinal range of 35°N.—35°S., 18°—130° E. in the Indo-Pacific (=25°—35°S., 18°—100°E. in the Indian Ocean+35°N.—7°S., 110°—130°E. in the Pacific Ocean).

3. *Chiloscyllium indicus* (Gmel.)

1789. *Squalus indicus* Gmelin, *Syst. Nat. Linn.*, 1, p. 1503 (type locality: Indian Ocean).
1801. *Squalus tuberculatus* Schneider, *Syst. Ichth. Bloch*, p. 137 (on *Le Squale dentele* Lacépède, *Hist. nat. Poiss.*, 1, p. 281, pl. 11, fig. 1, 1798 (type locality : not given).
1804. *Squalus gronovianus* Shaw, *General Zoology*, 5, p. 353 (type locality: Indian Seas).
1852. *Chiloscyllium phymatodes* Bleeker, *Verh. Bat. Gen. (Plagiost.)*, 24, pp. 14, 21 (type locality: Samarang).
1878. *Chiloscyllium indicum* Day (*partim*), *Fish. India*, p. 726, *nec* pl. 188, fig. 3 (Seas of India to the Malay Archipelago and beyond).
1889. *Chiloscyllium indicum* Day (*partim*), *Fauna Brit. India*, *Fish.*, 1, p. 34, *nec* fig. 14 (Seas of India to the Malay Archipelago and beyond).
1913. *Chiloscyllium indicum* Zugmayer, *Abh. kon. Bayer. Akad. Wiss. math.—phys. Kl.*, 26, p. 8 (Makran).
- 1915-18. *Chiloscyllium indicum* Pearson, *Ceylon Administr. Rep.*, p. F 12.

1919. *Chiloscyllium indicum* Southwell & Prashad, *Rec. Indian Mus.*, **16**, p. 222 (reference only).
1931. *Chiloscyllium indicum* Chu, *Biol. Bull. St. John's Univ.*, No. 1, p. 2 (China).
1933. *Chiloscyllium indicum* Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
1933. *Chiloscyllium indicum*, Deraniyagala, *Ceylon J. Sci. (C)*, **5**, p. 80 (Ceylon).
1934. *Chiloscyllium indicum*, Deraniyagala, *Spol. Zeyl.*, **18**, p. 249 (Ceylon).
1936. *Chiloscyllium indicum*, Suvatti, *Index Fish. Siam*, p. 1 (Siam).
1941. *Hemiscyllium colax* Fowler, *Bull. U.S. nat. Mus.*, (100) **13**, p. 89.
1949. *Chiloscyllium indicus* Misra, *Rec. Indian Mus.*, **45** (1947), p. 8.
1952. *Chiloscyllium indicus* Misra, *Rec. Indian Mus.*, **49** (1951), p. 98.
1952. *Chiloscyllium indicus* Mori, *Mem. Hyogo Univ. Agric.*, **1**, No. 3, p. 16 (Fusan, Korea).
1953. *Chiloscyllium indicum* Herre, *Check List Philippine Fish.*, p. 9 (Philippines).
1953. *Chiloscyllium indicum* Smith, *Sea Fish. South Africa*, p. 52 (S. Africa).
1955. *Chiloscyllium indicum* Munro, *Mar. Freshwater Fish. Ceylon*, p. 3 (Ceylon).
1958. *Chiloscyllium indicus* Misra & Menon, *Rec. Indian Mus.*, **53** (1955), p. 81.

Vernacular names.—INDIA : *Balavala*, Marathi; *Corungun sorrah*, Tamil; *Bokee sorrah* or *Ra sorrah*, Telegu. PAKISTAN : *Poos-hee*, Beloch. BURMA : *Nga man ingmyoung*. CEYLON : *Corungan schura* or *Karikkan schura*, Tamil.

Head 5.7; depth 10 to subcaudal origin. Snout obtusely pointed, 2.3 in head to first gill opening. Eyes without nictitating membrane, 7.5 in head, nearer to snout end than to first gill opening. Width of mouth 1.3 in preoral. Short labial folds in both jaws. Oronasal groove and cirri present. Nostrils nearer to snout end than to mouth. Teeth in $\frac{30}{30}$ rows, triangular, edge entire. Spiracles below eye and equal to eye diameter. Gill openings narrow, 4th and 5th close together; last 4 gill openings above pectoral base. First dorsal origin nearly opposite to pelvic ends. Second dorsal origin midway between first dorsal and anal origins. Pelvic origin much nearer to pectoral base than to anal base.

Anal very close to subcaudal. Subcaudal smaller than head to first gill opening, without lobe. Three dermal ridges on back. No caudal pits.

Pale brown with 11–12 transverse dark brown bands on body, each dark band with a few pale spots and obscure darker ones.

It attains 508 mm. in length; littoral.

Distribution.—India, Pakistan, Burma, Ceylon.—Cape of Good Hope, Red Sea, Arabian Sea, Penang, Singapore, Malay Peninsula, Indonesia, Thailand, “Indo-China”, Formosa, China, Melanesia (Solomon Islands); in the mean annual isotherm of 20° C. with the latitudinal and longitudinal range of 35°S.—25°N., 18°—158°E. in the Indo-Pacific = (25°N.—35°S., 18°—100°E. in the Indian Ocean +22°N.—8°S., 103°—158°E. in the Pacific Ocean).

4. *Chiloscyllium plagiosum* (Benn.)

1830. *Scyllium plagiosum* Bennett, *Life of Raffles*, p. 694 (type locality : Sumatra).
1849. *Chiloscyllium plagiosum* Cantor, *J. Asiat. Soc. Bengal*, 18, p. 1374 (Penang, Singapore).
1865. *Chiloscyllium plagiosum* Day, *Fish. Malabar*, p. 267 (Malabar).
1913. *Chiloscyllium plagiosum* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 62 (Hong Kong, Siam, Singapore, Penang).
1914. *Chiloscyllium caeruleo-punctatum* Pellegrin, *Bull. Soc. Zool. France*, 39, p. 230 (type locality : Port Dauphin, Madagascar).
1931. *Chiloscyllium plagiosum* Chu, *Biol. Bull. St. John's Univ.*, p. 2 (China).
1936. *Chiloscyllium plagiosum* Suvatti, *Index Fish. Siam*, p. 1 (Gulf of Siam).
1939. *Chiloscyllium plagiosum* Herre, *Rec. Indian Mus.*, 41, p. 111 (Maungamagan, Burma).
1941. *Hemiscyllium plagiosum* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 86.
1949. *Chiloscyllium plagiosum* Misra, *Rec. Indian Mus.*, 45 (1947), p. 8.
1952. *Chiloscyllium plagiosum* Misra, *Rec. Indian Mus.*, 49 (1951), p. 8.
1953. *Hemiscyllium plagiosum* Herre *Check List Philippine Fish.*, p. 10.
1953. *Chiloscyllium plagiosum* Smith, *Sea Fish. S. Africa*, p. 51.
1958. *Chiloscyllium plagiosum* Misra & Mcnon, *Rec. Indian Mus.*, 53 (1955), p. 81.

Head 5.6; depth 8.1 to subcaudal origin. Snout 2.0 in head. Eyes without nictitating membrane, 6.5 in head, in middle of head. Mouth broad. Oronasal grooves and cirri present. Teeth numerous, pointed, small, tricuspid. Spiracles below eye. Gill openings narrow, 4th and 5th close together; last 3 gill openings above pectoral base. First dorsal origin above middle of pelvic base. Second dorsal origin nearer to anal origin than to first dorsal origin. Pelvics origin much nearer to pectoral base than to anal base. Anal very close to subcaudal. Subcaudal equal to head to second gill opening, without lobe. A low median ridge on back. No caudal pits.

Pale brown above with 10—13, broad, deep brown, cross bars on body; distinct white spots some invading dark cross bars.

It attains 711 mm. in length; littoral.

Distribution.—India, Burma.—Cape Colony, Madagascar, Indonesia, Thailand, China, Japan; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 35°N.—35°S., 18°—130°E. in the Indo-Pacific = (16°N.—35°S., 18°—100°E. in the Indian Ocean + 0°—35° N., 101°—130°E. in the Pacific Ocean).

3. Genus *Nebrius* Rüppell

1837. *Nebrius* Rüppell, *Neue Wirbelth. Fische*, p. 62 (type, *N. concolor* Rüpp., monotypic (*Nebria* Latrelle & *Nebriis* C. not involved).
1837. *Ginglymostoma* Müller & Henle, *Sitz. Ber. preuss. Akad. Wiss. Berlin*, p. 113 (type, *Squalus cirratus* Gmelin; logotypic).
1913. *Nebrodes* Garman, *Mem. Harv. Mus. Comp. Zool.*, **36**, p. 36 (type, *Nebrius concolor* Rüpp.).

Body elongate with the trunk region spindle-shaped. Snout short. Eyes small, without nictitating membrane. Nasal grooves and cirri present. Spiracles minute, behind eyes. 5 pairs of lateral gill openings. Two spineless dorsal fins; the first dorsal opposite the pelvics. Anal fin present. Teeth multicuspid.

Distribution.—Madagascar, Red Sea, India, Ceylon, Malay Peninsula, Indonesia, "Indo-China", Melanesia, Polynesia.

Key to species

1. Teeth in 3 rows : second dorsal fin longer than the anal *N. concolor* Rüpp.
2. Teeth in more than 3 rows : second dorsal fin smaller than the anal *N. ferrugineum* (Lesson).

5. *Nebrius concolor* Rüpp.

1837. *Nebrius concolor* Rüppell, *Neue Wirbelth. Fische*, p. 62, pl. 17, fig. 2 (type locality: Massaua, Red Sea).
1852. *Ginglymostoma rüppellii* Bleeker, *Verh. Bat. Gen. (Plagiost.)*, 24, p. 91 (type locality: Singapore).
1870. *Ginglymostoma concolor* Günther, *Cat. Fish. Brit. Mus.*, 8, p. 409 (Java, Penang).
1878. *Ginglymostoma concolor* Day, *Fish. India. Suppl.*, p. 811, fig. (Red Sea through the Seas of India to Malay Archipelago).
1889. *Ginglymostoma concolor* Day, *Fauna Brit. India, Fish.*, 1, p. 32, fig. 12 (Red Sea through the Seas of India to Malay Archipelago).
- 1912-13. *Ginglymostoma concolor* Southwell, *Ceylon Administr. Rep.*, p. E 49.
1913. *Nebrodes concolor* Garman, *Mem. Harv. Mus. Comp. Zool.*, 26, p. 57 (Red Sea to India).
1941. *Nebrius concolor* Fowler, *Bull. U. S. nat. Mus.*, (100) 13, p. 70.
1949. *Nebrius concolor* Misra, *Rec. Indian Mus.*, 45 (1947), p. 9.
1952. *Nebrius concolor* Misra, *Rec. Indian Mus.*, 49 (1951), p. 98.
1955. *Nebrius concolor* Munro, *Mar. Freshwater Fish. Ceylon*, p. 3 (Ceylon).
1958. *Nebrius concolor* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 81.

Head 5.2; depth 6.3 to subcaudal origin. Snout short, 2.2 in head. Eyes without nictitating membrane, 11.0 in head, in middle of head. Preoral more than half of mouth width, 4.5 in head. Oronasal grooves and cirri present. cirri reaching lower lip. Labial folds well developed in both jaws. Teeth in 3 transverse rows, only one row functional; each tooth with one central and 4-5 lateral cusps having serrated edges. Spiracle behind eye. Gill openings narrow, 4th and 5th close together; last 2 gill openings above pectoral base. Pectorals equal to head to first gill opening. First dorsal origin opposite pelvic origin. Second dorsal longer than anal; origin before anal, nearer to anal origin than to first dorsal origin. Pelvic origin nearer to anal origin than to pectoral origin. Anal and subcaudal separated by a wide interspace; and origin below middle of second dorsal base. Subcaudal lobed, longer than head to last gill opening. No caudal pits.

Brownish above, lighter below; littoral.

It attains 609 mm. in length.

Distribution.—India, Pakistan, Ceylon.—Red Sea, Madagascar, Malay Peninsula, Java, Philippines, Solomon Islands; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 20°N.—20°S., 39°—158°E. in the Indo-Pacific=(20°N.—20°S., 39°—100°E. in the Indian Ocean+14°N.—8°S., 103°—158°E. in the Pacific Ocean).

6. *Nebrius ferrugineum* (Lesson)

1830. *Scyllium ferrugineum* Lesson, *Voy. "Coquille", Zool.*, **2**, pt. 1, fig. 95 (type locality: Port Praslin; Offack Bay, Waigiu).
1870. *Ginglymostoma mülleri* Günther, *Cat. Fish. Brit. Mus.*, **8**, p. 408 (type locality: India).
1871. *Ginglymostoma mülleri* Klunzinger, *Verh. Zool.-bot. Ges. Wien.*, **21**, p. 670 (Red Sea).
1878. *Ginglymostoma mülleri* Day, *Fish. India*, p. 725 (India)
1889. *Ginglymostoma mülleri* Day, *Fauna Brit. India, Fish.*, **1**, p. 33. (Red Sea, Indian Ocean).
- 1912-13. *Ginglymostoma mülleri* Pearson, *Ceylon Administr. Rep.*, p. E 7.
1913. *Ginglymostoma ferrugineum* Garman, *Mem. Harv. Mus. Comp. Zool.*, **36**, p. 36 (India, East Indies).
1933. *Ginglymostoma ferrugineum* Deraniyagala, *Ceylon J. Sci. (c)*, **5**, p. 8J.
1941. *Nebrius ferrugineum* Fowler, *Bull. U. S. nat. Mus.*, (100) **13**, p. 69.
1942. *Nebrius ferrugineus* Sarangdhar, *Ind. J. med. Res.*, **30**, p. 558 (Bombay).
1949. *Nebrius ferrugineum* Misra, *Rec. Indian Mus.*, **45** (1947), p. 9.
1952. *Nebrius ferrugineum* Misra, *Rec. Indian Mus.*, **49** (1951), p. 98.
1955. *Ginglymostoma ferrugineum* Munro, *Mar. Freshwater Fish. Ceylon*, p. 3 (Ceylon).
1958. *Nebrius ferrugineum* Misra & Menon, *Rec. Indian Mus.*, **53** (1955), p. 80.

Vernacular names.—CEYLON: *Be kal mora*, Sinhalese.

Head 5.3; depth 7.4 to subcaudal origin. Snout short, 2.1 in head. Eyes without nictitating membrane, 11.5 in head, in middle of head. Preoral half of mouth width, 4.0 in head to first gill opening. Oronasal grooves and cirri present, cirri not reaching lower lip. Labial folds

well developed in both jaws. Teeth small, in several rows, many rows functional; each tooth with a median and 3—5 lateral cusps having serrated edges. Spiracle behind eye. Gill openings narrow, last 2 close together, above pectoral base. First dorsal origin opposite pelvic origin. Second dorsal and anal subequal; origin slightly before anal origin. Pelvic origin nearer to anal base than to pectoral base. Anal and subcaudal separated by a wide interspace; anal origin a little behind second dorsal origin. Pectorals equal to head to 3rd gill opening. Subcaudal lobed, reaching beyond head to inner end of pectoral. No caudal pits.

Uniform rusty brown above, lighter below; littoral. It grows to 2,436—2,593 mm. in length; valued for its liver oil.

Distribution.—India, Ceylon.—Red Sea, Madagascar, Singapore, Malay Peninsula, Indonesia, “Indo-China”, Melanesia, Polynesia (Samoa); in the mean annual isotherm of 20°C. with latitudinal and longitudinal range of 20°N.—20°S., 39°E.—170°W. in the Indo-Pacific=(20°N.—20°S., 39°—80°E. in the Indian Ocean+15°N.—12°S., 103°E.—170°W. in the Pacific Ocean).

4. Genus *Stegostoma* Müller & Henle

1837. *Stegostoma* Müller & Henle, *Sitz. Ber. preuss. Akad. Wiss. Berlin*, p. 112 (type, *Squalus fasciatus* Hermann, orthotypic).

Body slender, elongate. Tail longer than trunk. Snout obtuse. Eyes small, without nictitating membrane. Nasoral grooves and cirri present. Labial folds well developed. Spiracles behind eyes. Five pairs of lateral gill openings. Two spineless dorsal fins. Anal fin present. Caudal fin very elongate. Teeth trilobed.

Distribution.—Indian and western Pacific Oceans.

7. *Stegostoma varius* (Seba)

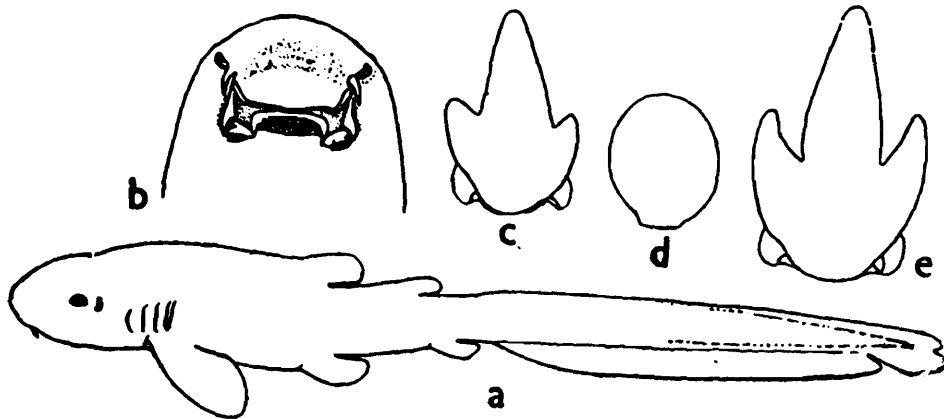
(Text-fig. 3)

1758. *Squalus varius* Seba, *Thesauri*, 3, pl. 34, fig. 1, p. 105 (type locality: not given).
 1783. *Squalus fasciatus* Hermann, *Tab. Affln.*, p. 302 (on *Squalus varius* Seba; type locality: not given).
 1785. *Squalus fasciatus* Bloch, *Naturg. Ausland. Fische*, 1, p. 19, pl. 113 (Tranquebar).
 1788. *Squalus tigrinus* Bonnaterre, *Tab. Encyclop. Ichth.*, p. 8, pl. 8, fig. 23 (type locality: La Mer des Indes).

1789. *Squalus longicaudus* Gmelin, *Syst. Nat. Linn.*, **1**, p. 1496 (type locality: not given).
1823. *Scyllium quinquecarinatum* v. Hasselt, *Alg. Konst. Letterbode*, May (type locality: Java).
1837. *Scyllium heptagonum* Rüppell, *Neue Wirbelth. Fische*, p. 61, pl. 17, fig. 1 (type locality: Djedda, Red Sea).
1847. *Stegostoma carinatum* Blyth, *J. Asiat. Soc. Bengal*, **16**, p. 725, pl. 25, fig. 1 (type locality: India).
1849. *Stegostoma fasciatum* Cantor, *J. Asiat. Soc. Bengal*, **18**, p. 1378 (Penang).
1860. *Stegostoma fasciatum* Bleeker, *Nat. Tijds. Ned. Indie*, **22**, p. 101 (Singapore).
1870. *Stegostoma tigrinum* Günther, *Cat. Fish. Brit. Mus.*, **8**, p. 409 (India, Zanzibar, Ceylon, Formosa).
1889. *Stegostoma tigrinum* Day, *Fauna Brit. India, Fish.*, **1**, p. 33, fig. 13 (Madras).
1908. *Stegostoma tigrinum* Regan, *Proc. zool. Soc. Lond.*, p. 363 (Zanzibar, India, Ceylon, Sarawak, Formosa, North West Australia).
1911. *Stegostoma tigrinum* Tanaka, *Fish. Japan*, **4**, p. 65, pl. 16, figs. 55-58 (Tokyo market).
- 1912-13. *Stegostoma tigrinum* Southwell, *Ceylon Administr. Rep.*, pp. E 41, E 49.
1913. *Stegostoma varium* Garman, *Mem. Harv. Mus. Comp. Zool.*, **36**, p. 59 (India and East Indies to Africa).
1928. *Stegostoma tigrinum* Fowler, *J. Bombay nat. Hist. Soc.*, **33**, p. 100 (Bombay).
1929. *Stegostoma tigrinum* Pillay, *J. Bombay nat. Hist. Soc.*, **33**, p. 350 (Travancore).
1931. *Stegostoma tigrinum* Chu, *Biol. Bull. St. John's Univ.*, No. 1, p. 3 (China).
1933. *Stegostoma tigrinum* Sorely, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
1936. *Stegostoma tigrinum* Suvatti, *Index Fish. Siam*, p. 1 (Gulf of Siam).
1941. *Stegostoma fasciatum* Fowler, *Bull. U. S. nat. Mus.*, (100) **13**, p. 100.
1949. *Stegostoma varium* Misra, *Rec. Indian Mus.*, **45** (1947), pp. 1, 10.
1952. *Stegostoma varium* Misra, *Rec. Indian Mus.*, **49** (1951), p. 98.
1953. *Stegostoma varium* Herre, *Check List Philippine Fish*, p. 13.
1953. *Stegostoma fasciatum* Smith, *Sea Fish. South Africa*, p. 51 (from Algoa Bay eastwards).

1955. *Stegostoma tigrinum* Anonymous, *Mar. Fish. Karachi, Sind & Makran*, p. 3 (Coasts of Sind and Makran).

1955. *Stegostoma fasciatum* Munro, *Mar. Freshwater Fish. Ceylon*, p. 3 (Ceylon).



TEXT-FIG. 3.—*Stegostoma varius* (Seba).

(a) Lateral view : $\times \frac{1}{2}$. (b) Ventral view of head : $\times \frac{1}{2}$.
 (c) Upper tooth : $\times 25$. (d) Scale : $\times 25$. (e) Lower tooth : $\times 25$. (After K. S. Misra)

Vernacular names.—INDIA : *Shinavala*, Marathi; *Corungun sorrah*, Tamil; Standardised names : *Shinvala*, *Zebra sura*. PAKISTAN : *Mangra*, Sind.

Head broad, long, 4; depth 4.3 to subcaudal origin. Snout 1.8 in head. Eyes small, without nictitating membrane, 8.0 in head. Width of mouth 1.2 in preoral. Oronasal grooves and cirri present. Upper lip very thick. Short labial folds at angles of mouth. Teeth in $\frac{20-23}{20-23}$ rows, small, tricuspid. Spiracles behind eyes. Gill openings narrow, last 2 close together and last 3 above pectoral. First dorsal origin opposite pelvic origin. Second dorsal smaller than first dorsal; origin before anal origin and at a short distance behind first dorsal. Pelvic origin equidistant between pectoral and anal origins. Anal origin behind second dorsal; anal separated from subcaudal by a short interspace. Pectorals equal to head to 1st gill opening. Subcaudal not lobed, 3 times in head to first gill opening. An indistinct, median, tubercular dorsal ridge and often another on either side of it. No caudal pits.

In young white or buff with narrow white cross bands on head and body between which are white spots; adults tawny or with transverse bands of rounded spots.

It attains a length of 3,349 mm.; sluggish in movements and lives on crustaceans and molluscs. Oviparous; egg-cases when fresh, have bunches of byssus for attachment; littoral.

Distribution.—India, Pakistan, Ceylon.—Red Sea, Zanzibar, S. and E. Africa, Madagascar, Malay Peninsula, Indonesia, Thailand, "Indo-China", Formosa, China, Japan, N.W. Australia; in the mean annual isotherm of 20°C. with the longitudinal and latitudinal range of 35°N.—30°S., 33°—130°E. in the Indo-Pacific=(25°N.—30°S., 33°—130°E. in the Indian Ocean +35°N.—7°S., 101°—130°E. in the Pacific Ocean).

ii. Subfamily *RHINEODONTINI*

Whale Sharks

Body massive, with lateral caudal keels and caudal pits. Teeth very minute, pointed, numerous, conical. Nasal cirri absent. Gill rakers very long, slender.

5. Genus *Rhincodon* Smith

1829. *Rhincodon* Smith, *Zool.*, 4, p. 443 (type, *R. typus* Smith, monotypic).
 1838. *Rhineodon* Müller & Henle, *Mag. Nat. Hist. Charlesworth*, 2, p. 37 (type, *Rhincodon typus* Smith).
 1839. *Rhiniodon* Swainson, *Nat. Hist. Animal.*, 2, p. 317 (type, *Rhincodon typus* Smith).
 1841. *Rhinodon* Müller & Henle, *Syst. Besch. Plagiost.*, p. 77 (type, *Rhincodon typus* Smith).
 1865. *Micristodus* Gill, *Proc. Acad. nat. Sci. Philad.*, p. 17 (type, *M. punctatus* Gill, monotypic).

Body fusiform, massive. Snout broad, flat and short. Eyes very small, without nictitating membrane and just behind the mouth. Nasoral grooves; cirri absent. Spiracles small. Five pairs of lateral gill openings. Two spineless dorsal fins. Anal fin present. Subcaudal lobe well developed. Several keels along sides. Caudal pit present. Teeth very small, pointed, numerous.

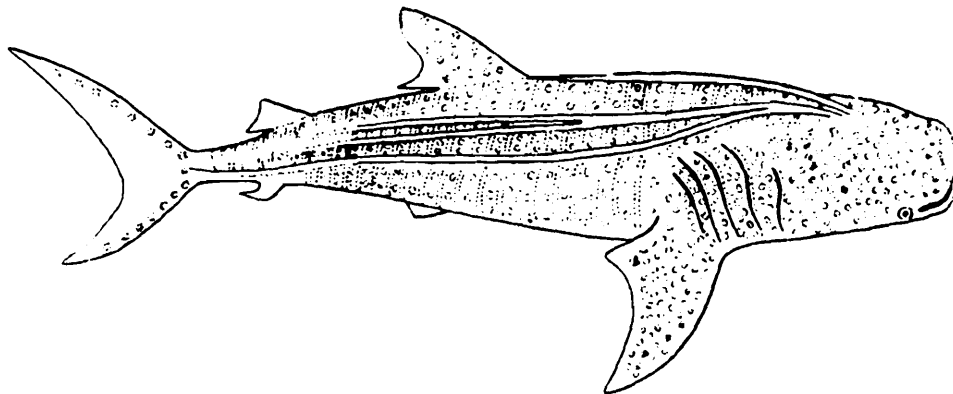
Distribution.—Tropical Atlantic, S. Africa, Seychelles, India, Ceylon, Indonesia, Philippines, Japan, Australia, East Pacific Ocean.

8. *Rhincodon typus* Smith

(Text-fig. 4)

1829. *Rhincodon typus* Smith, *Zool.*, 4, p. 443 (type locality: Table Bay, South Africa; according to Bertin the holotype is in the Paris Museum).
1865. *Micristodus punctatus* Gill, *Proc. Acad. nat. Sci. Philad.*, 17, p. 117 (type locality: Gulf of California).
1887. *Setache maxima* (nec Gunner) Thomas, *Cannibals & Convicts Experience Western Pacific*, p. 380 (type locality: Red-Scar Bay, S. Coast of New Guinea).
1888. *Rhinodon typicus* Day, *Fish. India, Suppl.*, p. 811 (Ceylon).
1889. *Rhinodon typicus* Day, *Fauna Brit. India, Fish.* 1, p. 29 (Ceylon).
1891. *Rhinodon pentalineatus* Kishinouye, *Zool. Anz.*, 24, p. 694, figs. (type locality: Cape Inul, Japan).
1908. *Rhinodon typicus* Regan, *Proc. zool. Soc. Lond.*, p. 353 (Seychelles).
1908. *Rhinodon typicus* van Kampen, *Nat. Tijds. Ned. Indie*, 67, p. 124 (N. Coast of Java).
1908. *Rhinodon typicus* Lloyd, *Rec. Indian Mus.*, 2, p. 306 (Bay of Bengal).
- 1912-13. *Rhinodon typicus* Southwell, *Ceylon Administr. Rep.*, pp. E 44, E 49.
1913. *Rhincodon typus* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 42 (Cape of Good Hope, Japan, Florida).
1929. *Rhinodon typicus* Pillay, *J. Bombay nat. Hist. Soc.*, 33, p. 35 (Travancore).
1936. *Rhincodon typus* Suvatti, *Index Fish. Siam.*, p. 2 (Gulf of Siam).
1940. *Rhincodon typus* Whitley, *Fish. Australia*, 1, pp. 87, 88 (S. Australia; as this shark is peculiarly a warm-water fish its occurrence so far south is of great interest. This specimen was most probably a stray which had drifted down on the warm notonectian current which washes the New South Wales coast and which appears to have been somewhat stronger this year than usual).
1941. *Rhincodon typus* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 116.
1949. *Rhincodon typus* Misra, *Rec. Indian Mus.*, 45 (1947), p. 9.
1952. *Rhincodon typus* Misra, *Rec. Indian Mus.*, 49 (1951), p. 99.
1952. *Rhincodon typicus* Mori, *Mem. Hyogo Univ. Agric.*, No. 3, p. 16 (Quelpart I., Korea).
1953. *Rhincodon typus* Smith, *Sea Fish. S. Africa*, p. 50.
1953. *Rhincodon typus* Herre, *Check List Philippine Fish.*, p. 14.

1955. *Rhinodon typicus* Anonymous, *Mar. Fish. Karachi, Sind & Makran*, p. 4 (Karachi, Iranian coast).
1955. *Rhincodon typus* Munro, *Mar. Freshwater Fish. Ceylon*, p. 3 (Ceylon).
1958. *Rhincodon typus* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 79.



TEXT-FIG. 4.—Dorso-lateral view of *Rhincodon typus* Smith. After Andrew Smith)

Vernacular names.—INDIA : *Pulli-udoombu*, *Thimingal sura*, Tamil; Standardised name : *Thimingal sura*, Karunj. PAKISTAN : *Mohr*. CEYLON : *Pulli udumbu schura*, *Usmon schura* or *Makara schura*, Tamil.

Head broad 5.0; depth 5.0 to caudal pit. Snout broad, short, 2.2 in head. Eyes small, without nictitating membrane, 13.0 in head. Mouth transverse, large, near snout end, 3.2 in head. Upper labial folds longer than lower. Oronasal grooves; cirri absent. Teeth in $\frac{250-300}{250-300}$ rows in jaws, 12–15 in transverse rows, very small, conical, curved. Spiracles behind eyes. Gill openings very large, largest last 2 in young and last one only in adult above pectoral base. First dorsal nearer to caudal pit than to snout end; origin before pelvic origin. Second dorsal larger than anal; origin before anal. Pelvic origin nearer to caudal pit than to pectoral origin. Pectorals equal to head to 2nd gill opening. Caudal pits present. Caudal peduncle keeled. A pair of ridges or keels on each side of body beginning from above gill openings, upper extending to interdorsal and the lower meeting the caudal keel.

Sandy brown with numerous pale spots on head and a series of pale spots alternating with pale vertical stripes on sides.

It grows to a length of 21,336 mm. (70 ft.) in length and is esteemed for the large quantity of oil it yields; feeds generally on smaller organisms of the sea; pelagic.

Distribution.—India, Pakistan, Ceylon.—Seychelles, S. Africa, Java, Thailand, Philippines, Korea, Japan, Queensland, Australia, California, Florida, Brazil, tropical Atlantic; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 35°N.—35°S., 18°E.—111°W. in the Indo-Pacific=(25°N.—35°S., 18°—140°E. in the Indian Ocean+35°N.—7°S., 101°E.—111°W. in the Pacific Ocean); 0°—25°N., 50°—88°W. in the Atlantic Ocean.

III. Family ODONTASPIDAE

Sand Sharks

Body elongate, compressed. Tail compressed, smaller than trunk. Head depressed, tapering. Snout short or long. Eyes small, without nictitating membrane. Mouth wide, large, arched, somewhat or greatly protractile. No groove at angles of mouth. Oronasal grooves and cirri absent. Teeth very large, awl-shaped, smooth, with serrated base and a small basal cusp on either side. Small spiracles behind eyes. Five pairs of lateral gill openings and gill arches; all gill openings before pectoral base. First dorsal origin before pelvic origin, midway between pelvics and pectorals. Second dorsal nearly as large as first dorsal; origin before anal origin. Caudal pits present, upper one distinct or indistinct. Subcaudal moderate or long, lobed. Anal nearer to subcaudal than to pelvics.

Upper Cretaceous to Recent.

The family ODONTASPIDAE is represented by a single subfamily *ODONTASPINI* consisting of a single genus and species, in the Indian region.

iii. Subfamily *ODONTASPINI*

Snout short; mouth not highly protractile. Dorsals, pelvics and anal subequal. A distinct upper caudal pit. Subcaudal produced.

6. Genus *Carcharias* Rafinesque

1810. *Carcharias* Rafinesque, *Caratt. Animal. Piante Sicilia*, p. 10 (type, *C. taurus* Raf., monotypic).
 1835. *Odontaspis* Agassiz, *Poiss. Foss.*, 3, p. 55 (type, *Squalus ferox* Risso, monotypic).

1837. *Triglochis* Müller & Henle, *Sitz. Ber. Acad. preuss. Wiss. Berlin*, p. 113 (atypic; type, *Carcharias taurus* Raf., *Arch. Naturg.*, p. 396, 1837 monotypic).
1847. *Oxytes* Giebel, *Fauna Vorwelt. Fische*, p. 364 (type, *O. obliqua* Giebel, monotypic) (fossil).
1861. *Eugomphodus* Gill, *Proc. Acad. nat. Sci. Philad.*, p. 60 (type, *Squalus littoralis* Mitchill = *Carcharias taurus* Raf., monotypic).
1931. *Synodontaspis* White, *Vertebrate Fauna English Eocene*, p. 51 (type, *Carcharias taurus* Raf.).
1931. *Parodontaspis* White, *Vertebrate Fauna English Eocene*, p. 63 (type, *Odontaspis platensis* Lahille).

Body fusiform. Trunk about more than twice the tail. Eyes small, without nictitating membrane. Nasoral grooves and cirri absent. Spiracles small, behind eyes. Five pairs of lateral gill openings. Two spineless dorsal fins. Anal fin present. Caudal pit present. Teeth very large, awl-shaped, smooth except at base where there exists a basal cusp on either side.

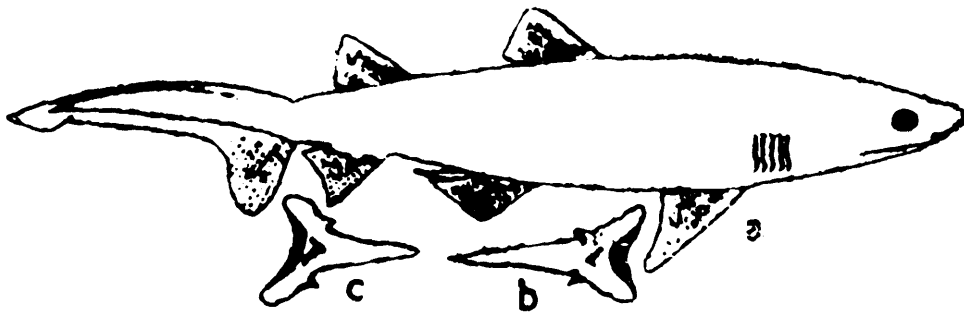
Distribution.—Atlantic Ocean, S. Africa, India, Indonesia, "Indo-China", Japan, Australia, Tasmania.

9. *Carcharias tricuspidatus* Day

(Text-fig. 5)

1878. *Carcharias tricuspidatus* Day, *Fish. India*, p. 713, pl. 180 fig. 1 (type locality: Karachi and Baluchistan).
1888. *Odontaspis tricuspidatus* Day, *Fish. India, Suppl.*, p. 810 (Sind).
1889. *Odontaspis tricuspidatus* Day, *Fauna Brit. India*, 1, Fish., p. 27, fig. 8 (Seas of Sind).
1913. *Carcharias tricuspidatus* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 26 (Cape of Good Hope; India).
1941. *Carcharias tricuspidatus* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 121.
1942. *Carcharias tricuspidatus* Sarangdhar, *Ind. J. med. Res.*, 30, p. 558 (Bombay).
1949. *Carcharias tricuspidatus* Misra, *Rec. Indian Mus.*, 45 (1947), pp. 1, 10.
1952. *Carcharias tricuspidatus* Misra, *Rec. Indian Mus.*, 49 (1951), p. 99.
1953. *Carcharias tricuspidatus* Smith, *Sea Fish. South Africa*, p. 48.
1955. *Odontaspis tricuspidatus* Anonymous, *Mar. Fish. Karachi, Sind & Makran*, p. 3 (Coasts of Sind and Makran).

1958. *Carcharias tricuspidatus* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 82.



TEXT-FIG. 5.—*Carcharias tricuspidatus* Day

(a) Lateral view: $\times ca \frac{1}{68}$. (b) Upper tooth. (c) Lower tooth.
(After F. Day)

Vernacular names.—INDIA: *Khondecha*, Kanarese; *Tambus*, Marathi; Standardised name: *Wagir*. PAKISTAN: *Dandanee*, *Gussi*.

Head 3.7; depth 5 to subcaudal origin. Snout 3.6 in head. Eyes without nictitating membrane, 9.0 in head. Preoral nearly half of mouth width, 2.5 in distance between eye and first gill opening. No groove at angles of mouth. Oronasal grooves and cirri absent. Nostrils nearer to mouth than to snout end. Teeth in $\frac{32-34}{30-34}$ rows, very large, awl-shaped, entire, serrated at base, each with a basal cusp on either side; 4th tooth on either side of the symphysis of upper jaw, much smaller than those next to it; the central tooth on each side of the symphysis of the mandibles slender; the last few lateral rows in both jaws small. Small spiracle behind eye. Five pairs of lateral gill openings, all before pectoral base. First dorsal origin before pelvics. Second and first dorsal subequal; second dorsal origin before anal origin. Caudal pits present. Subcaudal longer than head to last gill opening. Anal nearer to subcaudal than to pelvics.

Brown above, dull white below.

Viviparous; attains 6,096 mm. (20 ft.) in length; pelagic. Its fins are valued and the liver oil extracted for burning purposes.

Distribution.—India, Pakistan.—S. Africa, “Cochin-China”; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 25°N.—35°S., 18°—108°E. in the Indo-Pacific=(25°N.—35°S., 18°—72°E. in the Indian Ocean+10°N., 108°E. in the Pacific Ocean).

IV. Family LAMNIDAE

Thresher Sharks, Man-eating Sharks, Mackerel Sharks

Body fusiform. Tail longer or shorter than trunk. Head subconical, long or rounded or short. Snout short, rounded or pointed. Eyes small, without nictitating membrane. Mouth arched. Labial folds in jaws present. Nasoral grooves and cirri present or absent. Spiracles minute, behind eyes, or above mouth angle. Teeth simple, long, awl-shaped, lanceolate, sharp, smooth, without basal cusps. Five pairs of gill openings, last one or last 2 over pectoral base. First dorsal origin before pelvic origin. Second dorsal much smaller than first dorsal, more or less equal to anal, opposite or before anal origin. Caudal pits present. Anal nearer to subcaudal than to pelvic origin. Subcaudal lobed, upper lobe very long or normal. Caudal keel present or absent.

Cretaceous to Recent.

The family LAMNIDAE is represented by two subfamilies *ALOPINI* and *LAMNINI*, each consisting of a single genus and species.

Key to subfamilies of family LAMNIDAE

1. Lateral keel on tail absent: caudal fin nearly $\frac{1}{2}$ the total length Subfamily *ALOPINI*
2. Lateral keel on tail present: caudal fin much less than $\frac{1}{2}$ the total length Subfamily *LAMNINI*

iv. Subfamily *ALOPINI*

Fox or Thresher Sharks

Tail longer than trunk. Caudal keel absent.

7. Genus *Alopias* Rafinesque

1768. *Vulpecula* Valmont, *Dict. Hist. Nat. Paris*, 3, p. 740 (type, *Squalus vulpes* Gmelin; inadmissible according to Opinion 89 of the International Commission of Zoological Nomenclature).
1810. *Alopias* Rafinesque, *Caratt. Animal. Piante Sicilia*, p. 12 (type, *A. macrourus* Raf., monotypic).
1837. *Alopecias* Müller & Henle, *Sitz. Ber. preuss. Akad. Wiss. Berlin*, p. 114 (type, *Alopias macrourus* Raf.).
1838. *Alopius* Swainson, *Nat. Hist. Animal.*, 1, p. 91 (type, *Alopias macrourus* Raf.).

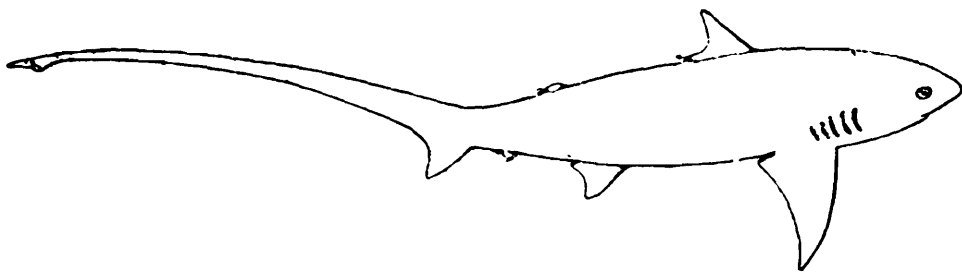
Body fusiform. Trunk equal to the extraordinarily elongated upper lobe of the caudal fin. Eyes large, without nictitating membrane. Nasoral grooves and cirri absent. Spiracles minute, behind eyes. 5 pairs of gill openings. Two spineless dorsal fins; second dorsal very small, equal to anal fin. Caudal pit present. Lateral keel on tail absent. Teeth simple, smooth, sharp-edged.

Distribution.—Atlantic Ocean, Arabia, S. Africa, India, Ceylon, China, Korea, Japan, Australia, New Zealand, Hawaii, Eastern Pacific Ocean.

10. *Alopias vulpinus* (Bonn.)

(Text-fig. 6)

1788. *Squalus vulpinus* Bonnaterre, *Tabl. Ichth.*, pl. 85, fig. 349 (type locality : Mediterranean).
 1810. *Alopias macrourus* Rafinesque, *Caratt. Animal. Piante Sicilia*, p. 12 (type locality : Sicily).
 1888. *Alopias vulpes* Day, *Fish. India, Suppl.*, p. 810 (Ceylon).
 1889. *Alopias vulpes* Day, *Fauna Brit. India, Fish.*, 1, p. 28, fig. 9 (Ceylon).
 1901. *Alopias vulpes* Jordan & Snyder, *Annot. Zool. Japan*, 7, p. 127 (Tokyo).
 1931. *Alopias vulpinus* Chu, *Biol. Bull. St. John's Univ.*, No. 1, p. 3 (Hongkong).
 1941. *Alopias vulpinus* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 125.
 1949. *Alopias vulpinus* Misra, *Rec. Indian Mus.*, 45 (1947), p. 11.
 1952. *Alopias vulpinus* Misra, *Rec. Indian Mus.*, 49 (1951), p. 100.
 1953. *Alopias vulpinus* Smith, *Sea Fish. South Africa*, p. 47.
 1955. *Alopias vulpinus* Munro, *Mar. Freshwater Fish. Ceylon*, p. 4 (Ceylon).
 1958. *Alopias vulpinus* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 79.



TEXT-FIG. 6.—Lateral view of *Alopias vulpinus* (Bonn.) : $\times ca \frac{1}{29}$.
 (After F. Day)

Head 4.7; depth 5 to subcaudal origin. Snout 4 in head. Eyes moderately large, without nictitating

membrane, 7.2 in head, nearer to snout end than to 1st gill opening. Mouth crescentic. Length of gape 1.3 in its width. Preoral 3.6 in head. Nostrils small, nearer to mouth than to snout end. Oronasal grooves and cirri absent. Labial folds present in both jaws. Teeth in $\frac{44}{38}$ rows; the third or fourth tooth on either side of the centre of upper jaw, smaller than others. Gill openings of medium size, the last 2 above pectoral base. First dorsal origin opposite inner end of pectoral, nearer to snout end than to subcaudal origin. Second dorsal very small, more or less equal to anal, entirely before anal. Pelvic origin nearer to subcaudal origin than to pectoral origin. Anal nearer to subcaudal origin than to pelvic origin. Subcaudal lobed. Upper caudal lobe much elongated, nearly half the total length. Caudal pits present. No lateral keels on tail.

Dark slaty brown above to level of spiracle, contrasted with white below.

It attains at least 4,572 mm. in length; pelagic. It leaps high out of water and is a fine game fish fighting well when hooked.

Distribution.—India, Ceylon,—S. Africa, Natal, Arabia, Philippines, China, Korea, Japan, Mediterranean, California; in the mean annual isotherms of 12°C. and 20°C. with latitudinal and longitudinal range of 35°N.—29°S., 32°E.—111°W in the Indo-Pacific=(25°N.—35°S., 18°—140°E. in the Indian Ocean+35°N.—7°S., 110°E.—111°W. in the Pacific Ocean); 37°N., 14°E. in the Mediterranean.

v. Subfamily *LAMNINI*

Man-eating Sharks

Tail shorter than trunk. Caudal keel present.

8. Genus *Isurus* Rafinesque

- 1810. *Isurus* Rafinesque, *Caratt. Animal. Piante Sicilia*, p. 11 (type, *I. oxyrinchus* Raf., monotypic).
- 1836. *Oxyrhina* Agassiz, *Poiss. Fossil.*, 3, pp. 87, 276 (type, *Lamna oxyrhina* V., monotypic).
- 1848. *Plectrostoma* Gistel, *Naturg. Thierreichs.*, p. x (type, *Oxyrhina mantelli* Ag., orthotypic).
- 1862. *Isuropsis* Gill, *Ann. Lyc. nat. Hist. New York*, 7, pp. 398, 408 (type, *Oxyrhina glauca* M. & H., orthotypic).

Body fusiform. Snout pointed. Eyes without nictitating membrane. Nasoral grooves and cirri absent. Spiracles minute, above mouth angle. 5 pairs of gill openings. Two spineless dorsals; second dorsal very small, equal to anal fin. Caudal pit present. Lateral keel on tail present. Teeth long, awl-like, lanceolate, smooth, without basal cusps.

Distribution.—St. Helena, Cape of Good Hope, Red Sea, Arabia, India, Indonesia, "Indo-China", Japan, Queensland, Australia, Hawaii, New Zealand, Chile, Tasmania, Atlantic.

Key to species

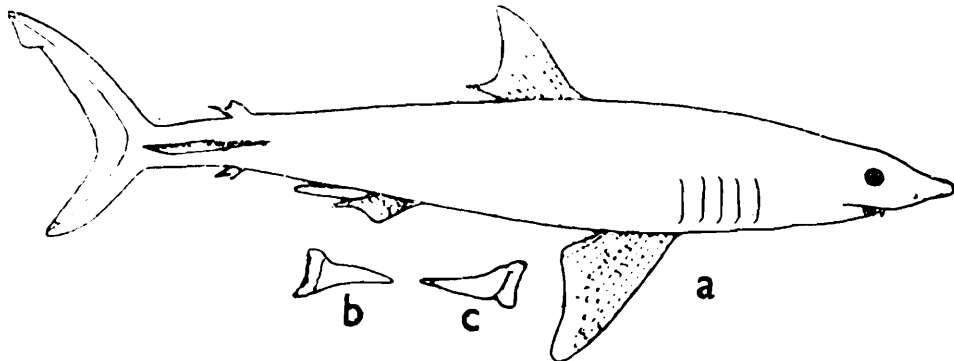
- | | |
|--|-----------------------------|
| 1. Teeth in 24 rows above, 22 below:
lateral line keeled only along the
side of tail | <i>I. glauca</i> (M. & H.) |
| 3. Teeth in 44 rows above, 56
below: lateral line keeled from
behind eye over gill openings to
side of tail | <i>I. güntneri</i> (Murray) |

11. *Isurus glauca* (M. & H.)

(Text-fig. 7)

1841. *Oxyrhina glauca* Müller & Henle, *Syst. Besch. Plagiost.*, p. 69, pl. 29 (typelocality: Java).
1850. *Oxyrhina glauca* Schlegel, *Siebold's Fauna Japonica*, pt. 15, p. 302 (Japan).
1878. *Lamna spallanzanii* Day, *Fish. India*, p. 722, pl. 186, fig. 2 (Madras).
1887. *Lamna huidobrii* Philippi, *Anal. Univ. Chile*, 71, p. 548, pl. 3, fig. 1 (type locality: Santiago).
1931. *Isurus glaucus* Chu, *Biol. Bull. St. John's Univ.*, No. 1, p. 3 (China).
1933. *Lamna spallanzanii* Deraniyagala, *Ceylon J. Sci.* (c), 5, p. 8 (Ceylon).
1941. *Isurus glauca* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 104.
1949. *Isurus glauca* Misra, *Rec. Indian Mus.*, 45 (1947), p. 11.
1952. *Isurus glauca* Misra, *Rec. Indian Mus.*, 49 (1951), p. 101.
1953. *Isurus glaucus* Smith, *Sea Fish. S. Africa*, p. 50.

1958. *Isurus glauca* Misra & Menon, *Rec. Indian Mus.*, **53** (1955), p. 79.



TEXT-FIG. 7.—*Isurus glauca* (M. & H.) (a) Lateral view. (b) Upper tooth. (c) Lower tooth. (After F. Day)

Vernacular name—INDIA: *Ganumu sorrah*, Tamil.

Head attenuated in profile, 4.2; depth 6.5 to subcaudal origin. Snout pointed, 2.8 in head. Eyes without nictitating membrane, 10.2 in head, nearer to snout end than to 1st gill opening. Labial folds in both jaws. Oronasal grooves and cirri absent. Mouth as long as wide. Preoral 3.2 in head. Nostrils small, nearer to mouth than to snout end. Teeth in $\frac{24}{22}$ rows, long, slender, unequal, sharp-edged, entire, without basal cusp. Gill openings very wide, none above pectoral. First dorsal origin a little behind inner angle of pectoral, nearer snout end than to subcaudal origin. Second dorsal very small; origin before anal origin. Pelvic origin nearer to anal origin than to pectoral origin. Anal nearer to subcaudal base than to pelvic origin. Subcaudal lobed. Pectorals equal to head to 1st gill opening. Caudal pits present. Lateral keel on tail.

Grey above, lighter below.

It grows to 4,560 mm. (15 ft.) in length; a fierce and dangerous species; pelagic.

Distribution.—India, Ceylon.—Red Sea, Gulf of Oman, S. Africa, Arabia, Java, Indo-China, China, Japan, Queensland, Hawaii, St. Helena; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 35°N.—35°S., 18° E.—155°W in the Indo-Pacific = (23°N.—35°S., 18°E.—140°E., in the Indian Ocean +35°N.—7°S., 110°E.—155°W. in the Pacific): 16°N., 5° 38'W. in the Atlantic.

12. *Isurus güntheri* (Murray)

1884. *Lamna güntheri* Murray, *Ann. Mag. nat. Hist.*, (5) **13**, p. 349 (type locality: Karachi, India).

1888. *Lamna güntheri* Day, *Fish. India, Suppl.*, p. 810.
 1889. *Lamna güntheri* Day, *Fauna Brit. India, Fish.*, 1 p. 26 (Karachi).
 1913. *Isurus güntheri* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 39 (Karachi).
 1941. *Isurus güntheri* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 106.
 1949. *Isurus güntheri* Misra, *Rec. Indian Mus.*, 45 (1947), p. 11.
 1952. *Isurus güntheri* Misra, *Rec. Indian Mus.*, 49 (1951), p. 101.
 1958. *Isurus güntheri* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 77.

Snout much produced, more or less triangular. Oronasal grooves and cirri present. Labial folds present. Angle of mouth midway between nostril and 1st gill opening. Nostril conspicuous, nearer to eye than to tip of snout. Minute spiracle present. Teeth in $\frac{44}{56}$ rows, smooth-edged, sharp, without basal cusps. Gill openings subequal. A strongly-ridged, lateral line from behind eye over gill openings to side of tail. First dorsal origin behind base of pectoral fin, nearer to pectoral origin than to pelvic origin. Caudal pits present.

Dark plumbeous above, greyish below; under side of snout yellowish; pelagic.

It attains 2,220 mm. in length.

Distribution.—Karachi, W. Pakistan; in the annual isotherm of 20°C. in 24°N., 67°E.

ii. Suborder *SCYLIORHINOIDEI*

Vertebral centra with calcified rays extending into each of the four main uncalcified areas. Nictitating membrane present or vestigial.

Jurassic to Recent.

The suborder *SCYLIORHINOIDEI* is represented by 3 families: SPHYRNIDAE, SCYLIORHINIDAE and CARCHARHINIDAE.

Key to families of suborder SCYLIORHINOIDEI

1. Head with lateral (oculonarial) expansions Family SPHYRNIDAE
2. Head without lateral (oculonarial) expansions 3
3. Anal fin before second dorsal fin Family SCYLIORHINIDAE
4. Anal fin opposite second dorsal fin Family CARCHARHINIDAE

V Family SCYLIORHINIDAE

Lazy Sharks

Body elongate, more or less subcylindrical. Tail not much compressed, not much bent upward. Head depressed, with numerous mucous pores. Eyes with or without nictitating membrane. Mouth inferior, arched. Teeth small or moderate, in several series, functional, with a median cusp and one or two on each side. Oronasal grooves present or absent. Spiracles present. Five small gill openings, last 2 or 3 above pectoral base. Two spineless dorsals. First dorsal before, above or behind pelvics. Second dorsal equal to or smaller than anal. Caudal pit present or absent. Subcaudal lobe not produced. Egg cases large, quadrate, with prehensile tubes at the angles.

Upper Jurassic to Recent.

The family SCYLIORHINIDAE is represented by four genera.

Key to genera of family SCYLIORHINIDAE

- | | | |
|----|---|---|
| 1 | Anal and subcaudal close together | Genus Pentanchus Smith & Radcliffe |
| 2. | Anal and subcaudal wide apart | 3 |
| 3. | Origin of first dorsal fin before pelvics | Genus Proscyllium Hilgendorf |
| 4. | Origin of first dorsal fin above or behind pelvics | 5 |
| 5. | Head depressed: teeth tri-pentacuspoid: base of anal distinctly longer than base of second dorsal | Genus Scyliorhinus Blainville |
| 6. | Head subcylindrically compressed: teeth tricuspoid: base of anal equal to base of second dorsal | Genus Atelomycterus Garman |

9. Genus **Scyliorhinus** Blainville

1769. *Catulus* (nec Kniphof, 1759) Valmont, *Dict. Hist. nat. Paris*, **10**, p. 114; **12**, p. 421, 1769 (type, *C. vulgaris* Valmont = *Squalus canicula* L., monotypic; inadmissible, according to opinion 89 of the International Commission of Zoological Nomenclature).
1816. *Scyliorhinus* Blainville, *Bull. Soc. philom. Paris*, p. 121 (type, *Squalus canicula* L., logotypic).
1817. *Scyllium* Cuvier, *Régne Animal.*, **2**, p. 124 (type, *Squalus canicula* L., logotypic).

1825. *Scylliorhinus* Blainville, *Faun. Francaise. Poiss.*, p. 68 (type, *Squalus canicula* L.).
1843. *Scylliodus* Agassiz, *Poiss. Fossil.*, 3, p. 377 (type, *S. antiquus* Agassiz, monotypic).
1862. *Halaelurus* Gill, *Ann. Lyc. nat. Hist. New York*, 7, p. 407 (type, *Scyllium bürgeri* M. & H., orthotypic).
1934. *Holohalaelurus* Fowler, *Proc. Acad. nat. Sci. Philad.*, 85, p. 235 (type, *S. regani* Gilchrist, orthotypic).

Body elongate. Head depressed. Trunk slightly shorter than tail. Snout obtuse, short or elongate. Eyes large, with nictitating membrane. Nasoral grooves absent or rudimentary. Nasal cirri absent or present. Mouth wide. Labial folds on both jaws or on lower jaw only. Spiracles present. 5 pairs of gill openings, narrow, not so wide as the orbit. Two spineless dorsal fins; first dorsal fin behind or above the pelvics. Base of anal fin equal to or distinctly longer than base of second dorsal. Caudal pit absent. Teeth in numerous rows, tri-pentacuspoid.

Distribution.—Atlantic Ocean: Canary Is., 946–975 m., New York, 1,491 m., Indian Ocean: Coast of East Africa, 463–1,840 m., Coast of South Africa, 36–457 m., Cape of Good Hope; Gulf of Aden, OT, 37–200 m., AT, 1,061–1,080; 1,289–1,840 m., Zanzibar area, OT, 640–658 m., 238–293 m., Gulf of Oman, Arabian Sea, 186–1,261 m., Andaman Sea, 338–766 m., Pacific Ocean: Indonesia; China; Formosa; Japan; Sandwich Is., 570–1,463 m., Australia, 159–172 m., South-west Coast of South America, 731 m.; California, 335–841 m.

The genus *Scylliorhinus* is divided into 2 subgenera.

Key to subgenera of genus Scylliorhinus

1. Base of anal fin longer than base of second dorsal fin: labial fold on lower jaw only Subgenus *Scylliorhinus* Blainville
2. Base of anal fin equal to base of second dorsal fin: labial folds on both jaws Subgenus *Halaelurus* Gill

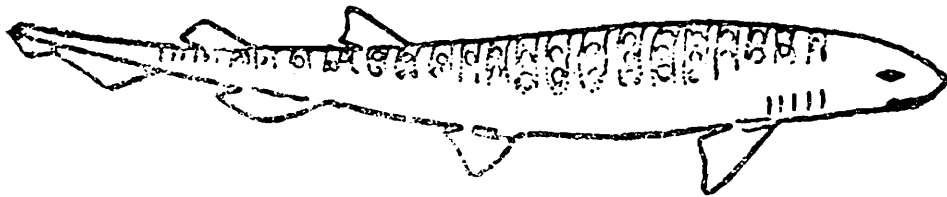
i. Subgenus *Scylliorhinus* Blainville

Labial folds in lower jaw only. Base of anal longer than base of second dorsal.

Scylliorhinus (*Scylliorhinus*) *capense* Smith, is the only species of the subgenus found in India.

13. *Scyliorhinus (Scyliorhinus) capense* (Smith) (Text-fig. 8)

1837. *Scyllium capense* Smith, *Proc. zool. Soc. Lond.*, p. 85 (type-locality: Cape of Good Hope; name only).
 1841. *Scyllium capense* Müller & Henle, *Syst. Besch. Plagiost.*, p. 11 (Cape of Good Hope).
 1878. *Scyllium capense* Day, *Fish. India*, p. 724, pl. 190, fig. 1 (India).
 1889. *Scyllium capense* Day, *Fauna Brit. India*, Fish., 1, p. 31 (India).
 1941. *Scyliorhinus capensis* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 35.
 1949. *Scyliorhinus (Scyliorhinus) capensis* Misra, *Rec. Indian Mus.*, 45 (1947), p. 12.
 1952. *Scyliorhinus (Scyliorhinus) capensis* Misra, *Rec. Indian Mus.*, 49 (1951), p. 102.
 1953. *Scyliorhinus capensis* J.L.B. Smith, *Sea Fish. S. Africa*, p. 54 (20-150 fms., from Port Nolloth round the Cape).
 1958. *Scyliorhinus (Scyliorhinus) capensis* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 81.



TEXT-FIG. 8.—Lateral view of *Scyliorhinus (Scyliorhinus) capense* (Smith): $\times ca \frac{1}{11}$ (After F. Day)

Head 6.2, depth 7.3 to subcaudal origin. Snout obtuse, 2.8 in head. Eyes 4.5 in head, 1.2 in snout. Preoral half of snout. Mouth wide. Teeth minute, with one or 2 lateral cusps. No labial fold in upper jaw, short one in lower jaw. Nasal valves distinct, separated from each other by wide interspace. No nasal cirri. Gill openings equidistant, last 2 above pectoral base. First dorsal origin nearer to anal origin than to pelvic origin and entirely behind pelvic base. Second dorsal entirely behind anal. Subcaudal equal to head to 1st gill opening.

Brown above, light beneath, with light vertical bands and some white blotches. Bottom dwelling species.

It grows to 1,219 mm. in length; found in depths 36—274 metres.

Distribution.—India.—S. Africa (36–274 m.); in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 35°S.—10°N., 18°—70°E. in the Indian Ocean.

ii. Subgenus **Halaelurus** Gill

Labial folds in both jaws. Base of anal equal to base of second dorsal.

Key to species

- | | |
|--|--|
| 1. First dorsal larger than second dorsal | <i>Scyliorhinus (Halaelurus) hispidum</i> (Alc.) |
| 2. First dorsal not larger than second dorsal | 3 |
| 3. First dorsal smaller than second dorsal : nasal cirri well developed | <i>Scyliorhinus (Halaelurus) alcockii</i> Garman |
| 4. First dorsal and second dorsal subequal: nasal cirri absent or rudimentary | 5 |
| 5. Origin of first dorsal above middle of pelvic bases: transverse bands spotted with black | <i>Scyliorhinus (Halaelurus) bürgeri</i> (M. & H.) |
| 6. Origin of first dorsal a little in advance of hind ends of pelvic bases: transverse bands 20 or more not spotted with black | <i>Scyliorhinus (Halaelurus) quagga</i> (Alc.) |

14. *Scyliorhinus (Halaelurus) alcockii* Garman

1896. *Scyllium canescens* (nec Günther) Alcock, *J. Asiat. Soc. Bengal*, **66**, p. 310 (type locality: Arabian Sea 23° N., 60° 8' E. in 609—620 fms., 8° C.).
1899. *Scyllium canescens* (nec Günther) Alcock, *Cat. Ind. Deep. Sea Fish.*, p. 16.
1913. *Halaelurus alcockii* Garman, *Mem. Harv. Mus. Comp. Zool.*, **36**, p. 87.

This species resembles *S. (Halaelurus) hispidum* (Alc.) in all important characters. The points of difference as noted by Alcock are—

1. Snout slightly longer.
2. Eyes slightly smaller.
3. Labial folds at angles of mouth slightly longer.
4. Teeth tricuspid, cusps subequal.
5. Body covered with simple stiff prickles.
6. Second dorsal slightly larger than first dorsal.

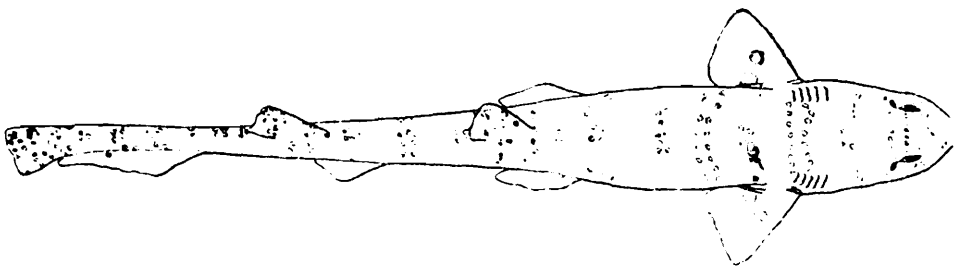
7. Base of anal not so extensive.
8. Blackish with a hoary grey surface.

Distribution.—Arabian Sea, 23°N., 60°8'E., 1,133—1,261 m., in the mean annual isotherm of 20° C.

15. *Scyliorhinus (Halaelurus) Ügeri* (M. & H.)

(Text-fig. 9)

1841. *Scyllium bürgeri* Müller & Henle, *Syst. Besch. Plagiost.*, p. 8, pl. 2 (type locality: Japan).
 1865. *Scyllium bürgeri* Kner, *Reise Novara Fische*, p. 412 (Madras).
 1870. *Scyllium bürgeri* Günther, *Cat. Fish. Brit. Mus.*, 8, p. 404 (Japan, Formosa, Amboyna).
 1913. *Halaelurus bürgeri* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 83 (Japan, East Indies).
 1941. *Halaelurus bürgeri* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 44.
 1949. *Scyliorhinus (Halaelurus) bürgeri* Misra, *Rec. Indian Mus.*, 45 (1947), p. 12.
 1952. *Scyliorhinus (Halaelurus) bürgeri* Misra, *Rec. Indian Mus.*, 49 (1951), p. 102.
 1952. *Scyliorhinus (Halaelurus) bürgeri* Mori, *Mem. Hyogo Univ. Agric.*, No. 3, p. 19 (Mokpo).
 1958. *Scyliorhinus (Halaelurus) bürgeri* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 81.



TEXT-FIG. 9.—Dorsal view of *Scyliorhinus (Halaelurus) bürgeri* (M. & H.).
 (After J. Müller & F. Henle)

Head 5·8 to subcaudal origin. Snout broad, obtuse, 3.0 in head. Eyes 5 in head. Width of mouth 1·8 in head. Teeth with a narrow, irregular, median cusp and one or two small lateral cusps basally; edges all entire. Short labial folds in both jaws. Nostrils midway between mouth and snout end; anterior nasal valves widely separate, not reaching mouth. Gill openings small, more or less equidistant, last 3 above pectoral base. First dorsal equal to second dorsal; origin behind pelvic base. Second dorsal origin above hind end of anal base. Subcaudal equal to head to third gill opening.

Brown becoming white below, with dark brown bands and scattered spots.

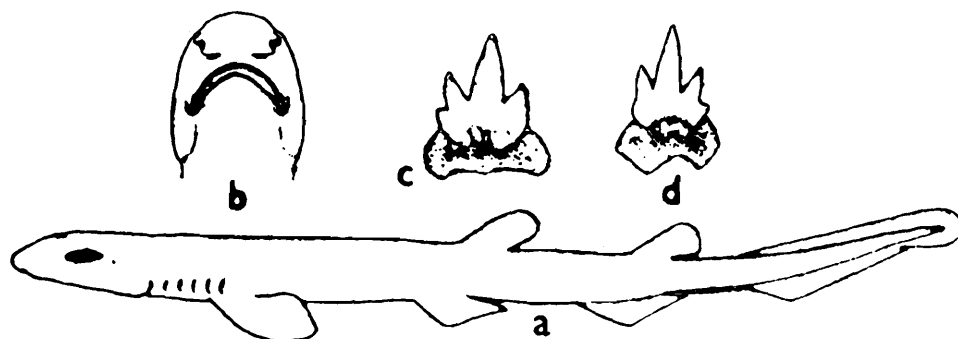
It attains a length of 350 mm.

Distribution.—India, Indonesia, China, Japan; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 35°N.—4°S., 80°—130°E. in the Indo-Pacific=(13°C., 80°E., in the Indian Ocean+35° N.—7°S., 111°—130°E. in the Pacific).

16. *Scyliorhinus (Halaelurus) hispidum* (Alc.)

(Text-fig. 10)

1891. *Scyllium hispidum* Alcock, *Ann. Mag. nat. Hist.*, (6) 8, p. 21 (type locality: Andaman islands, 11° 31' 40" N., 92° 46' 6" E., 188 to 200 fms., surface temp. 28.3° C.; type is in the Zoological Survey of India).
1894. *Scyllium hispidum* Alcock, *Ill zool. Investig. Fish.*, pl. 8, fig. 3, 3a (Andaman Islands).
1899. *Scyllium hispidum* Alcock, *Cat. Ind. Deep Sea Fish.*, p. 15 (Andaman Sea, 11° 31' 40"N., 92° 46' 6"E., 188-220 fms., surface temp. 28.3°C., 11° 25' 5", N., 92° 47' 6"E., 405 fms., 8.3° C., surface temp. 27.8° C., 14° 13' N., 93°40' E., 370-419 fms.).
1906. *Scyliorhinus hispidus* Brauer, "*Valdivia*" *Tiefsee Fische*, 15, p. 7 (E. African Coast, 6° N.—5° S., 39°—49° E., 463—628m.).
1908. *Scyliorhinus hispidus* Regan, *Ann. Mag. nat. Hist.*, (8) 1, p. 460 (Indian Ocean).
1913. *Halaelurus hispidus* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 85 (Andaman Sea).
1941. *Scyllium hispidum* Herre, *Mem. Indian Mus.*, 13, p. 332 (Andamans).
1949. *Scyliorhinus (Halaelurus) hispidum* Misra, *Rec. Indian Mus.*, 45 (1947), p. 12.
1952. *Scyliorhinus (Halaelurus) hispidum* Misra, *Rec. Indian Mus.*, 49 (1951), p. 102.
1958. *Scyliorhinus (Halaelurus) hispidum* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 81.



TEXT-FIG. 10.—*Scyliorhinus (Halaelurus) hispidum* (Alc.).

(a) Lateral view : $\times \frac{3}{4}$. (b) Ventral view of head: $\times \frac{9}{20}$.
 (c) Upper tooth: $\times ca 28$. (d) Lower tooth: $\times ca 24$.
 (After K. S. Misra)

Head broad, depressed, 4.5; depth 8.5 to subcaudal origin. Snout flat, semicircular in outline, 2.2 in head.

Eyes 4 in head, 1·8 in snout. Mouth large, crescentic. Short labial folds in both jaws. Teeth in broad bands in both jaws, small, mostly tricuspid and rarely pentacuspoid, the middle cusp being the longest. Nasal valves separated by an interspace nearly equal to the diameter of the mouth. Nasal cirri present. Gill openings equidistant, last 2 above pectoral base. First dorsal larger than second dorsal, origin behind pelvic base. Second dorsal origin nearly opposite middle of anal base. Subcaudal as deep as anal, equal to head to 2nd gill opening.

Dull stony grey, lighter beneath.

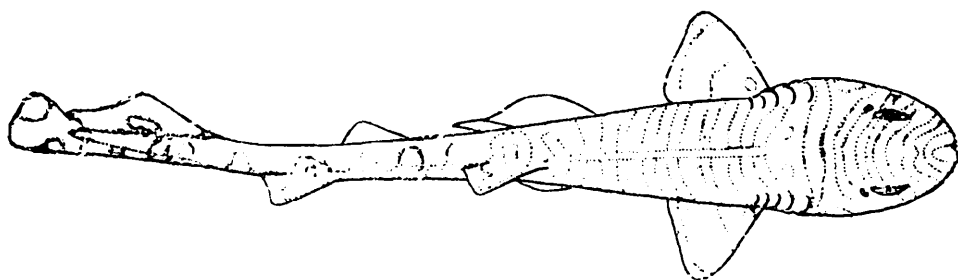
It grows to a length of 280 mm., found in depths 343—628 metres.

Distribution.—Andamans, 343—365 m., India.—Off E. Africa (463—628 m.), in the mean annual isotherm of 20° C. with the latitudinal and longitudinal range of 14° N.—5° S., 39° —93°E. in the Indian Ocean.

17 *Scyliorhinus (Halaelurus) quagga* (Alc.)

(Text-fig. 11)

1899. *Scyllium quagga* Alcock, *Cat. Ind. Deep Sea Fish.*, p. 17 (type locality : Off Malabar Coast, 102 fms., type is in the Zoological Survey of India).
 1900. *Scyllium quagga* Alcock, *Ill. Zool. Investig. Fish.*, pl. 27, figs. 1, 1a (off Malabar Coast).



TEXT-FIG. 11.—Dorsal view of *Scyliorhinus (Halaelurus) quagga* (Alc.) : $\times \frac{1}{3}$. (After A. Alcock)

1908. *Scyliorhinus quagga* Regan, *Ann. Mag. nat. Hist.*, (7) 1, p. 461 (Malabar).
 1913. *Halaelurus quagga* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 84 (Malabar).
 1941. *Halaelurus quagga* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 46.
 1949. *Scyliorhinus (Halaelurus) quagga* Misra, *Rec. Indian Mus.*, 45 (1947), p. 13.
 1952. *Scyliorhinus (Halaelurus) quagga* Misra, *Rec. Indian Mus.*, 49 (1951), p. 102.
 1958. *Scyliorhinus (Halaelurus) quagga* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 78.

Head broad, depressed, 4.5 to subcaudal origin. Snout flat, elliptical in outline with a bluntly acuminate tip, 2.6 in head. Preoral half of snout. Eyes 4 in head, 1.5 in snout. Mouth large, crescentic. Short labial folds in both jaws. Teeth tricuspid to pentacuspoid, middle cusp the longest. Nasal valves separated by an interspace more than $\frac{2}{3}$ the length of snout. Minute nasal cirri present. Gill openings graduated to the last, last 2 above pectoral. First and second dorsals more or less equal. First dorsal origin just after end of pelvic base. Second dorsal origin after end of anal base. Anal base a little longer than either of the dorsal. Subcaudal equal to head to 1st or 2nd gill opening.

Dull grey with numerous well defined alternate cross bands of light and very dark brown at sides from snout to tip of tail.

It attains 280 mm. in length; found in depths 186 metres. Bottom dwelling species.

Distribution.—Malabar Coast 186 m., India; in the mean annual isotherm of 20°C. in 11°N., 76°E., in the Arabian Sea.

10. Genus *Proscyllium* Hilgendorf

1904. *Proscyllium* Hilgendorf, *Sitz. Ber. Naturf. Freunde Berlin*, p. 39 (type, *Scyllium habereri* Hilgendorf).

Body slender, elongate. Trunk shorter than tail. Snout rounded. Eyes large with rudimentary nictitating membrane. Nasoral grooves and cirri absent. Labial folds rudimentary. Spiracles small, close behind eyes. 5 pairs of gill openings. Two spineless dorsal fins; first dorsal fin before the pelvics. Anal fin long. Caudal pit absent. Teeth dimorphous on the upper jaw; tetramorphous on the lower jaw.

Distribution.—India, 238—766 m.—Formosa, Japan.

Proscyllium alcocki Misra, is the only species of the genus found in India.

18 *Proscyllium alcocki* Misra

(Pl. IV)

1950. *Proscyllium alcocki* Misra, *J. zool. Soc. India*, 2, No. 2, p. 87, pl. 1 (type locality: Andaman Sea, 13° 17' 15" N., 93° 10' 25" E.; 185 fathoms; nature of bottom: sand; bottom temperature: 11.9° C.; surface temperature, 25.6° C.; Andaman Sea, 14° 13' N., 93° 4' E.; 370-419 fms.; nature of bottom: grey mud; type is in the Zoological Survey of India).

1952. *Proscyllium alcocki* Misra, *Rec. Indian Mus.*, **49** (1951), p. 104.

1958. *Proscyllium alcocki* Misra & Menon, *Rec. Indian Mus.*, **53** (1955), p. 78.

Head elongate, depressed, 6.1–6.2; depth 12.7 in total length (4.7–4.8 and 10.1–10.5 in standard length). Pre-oral 2.6–2.8 in head. Snout 2.6–2.9 in head. Eyes 1.1–1.2 in snout, 3.2–3.3 in head. Nictitating membrane absent. Nostrils slightly oblique, outer narial about double the hind border of each valve. Oronasal groove absent. Width of mouth 2.8 in head, its length 1.4 in its width. Labial folds short, rudimentary, upper fold slightly larger than lower one. Teeth in upper jaws dimorphic, in lower jaw tetramorphic; front and hind teeth in upper jaw smooth, those in front tricuspid, hind teeth pentacuspoid; front teeth in lower jaw triangular, posterior teeth bilobed, trilobed and tetralobed. Nasal cirri absent. Gill openings moderate, equidistant, last 2 above pectoral base. First dorsal smaller than second dorsal; origin entirely before pelvics. Second dorsal origin slightly in front of anal origin. Subcaudal long, equal to head to 4th gill opening.

Dull brownish yellow becoming white below; tips of dorsal and caudal tinted grey.

It grows to a length of 204 mm., found in depths 238–766 metres, bathypelagic.

Distribution.—Andaman Sea 238–766 m., India; in the mean annual isotherm of 20° C. in 13° N., 93° E.

11. Genus *Pentanchus* Smith & Radcliffe

1912. *Pentanchus* Smith & Radcliffe, *Proc. U.S. nat. Mus.*, **41**, p. 490 (type, *P. profundicolus* Smith & Radcliffe, monotypic).

1913. *Apristurus* Garman, *Mem. Harv. Mus. Comp. Zool.*, **36**, p. 96 (type, *Scyliorhinus indicus* Br., orthotypic).

1934. *Parapristurus* Fowler, *Proc. Acad. nat. Sci. Philad.*, **85**, p. 237 (type, *Catulus spongiceps* Gilbert, orthotypic).

Body robust, moderately elongate. Trunk about half of total length. Snout flattened, obtuse. Eyes large, with labial folds on both sides. Spiracle small, near eye. Five pairs of small gill openings, last 2 above pectoral base. Two small, spineless dorsal fins. First dorsal above pelvics. Base of anal fin much longer than base of 2nd dorsal. Pectorals, pelvics, anal and subcaudal large and close

together. Caudal pit absent. Teeth moderately large, tricuspid.

Distribution.—Atlantic Ocean: 34°8' S., 17°17' 33'' W., 402–548 m.; Saldanha Bay, 914 m.; Indian Ocean: Off East Africa, 1,289 m.; Off Table Bay, 1,444 m.; Gulf of Aden, 1,840 m., Gulf of Oman, 1,104 m.; Andaman Sea, 1,040 m.; Pacific Ocean: Sibuko Bay, Borneo; Banda Sea; Jolo Sea; Mindanao Sea; Makassar Strait, 655 m.; Misaki Sea; Sagami Sea; Bird Is., Hawaii; 572–1,463 m.

iii. Subgenus **Parapristurus** Fowler

Nasal valves entire, without cirri

19. **Pentanchus (Parapristurus) investigatoris** Misra

(Pl. V)

1959. *Pentanchus (Parapristurus) investigatoris* Misra, *Proc. First All India Zool. Congr.*, 1959, 1, p. 636, pl.1, figs. 1–6c type locality: Andaman Sea, 11°46'30"N., 93°16'E., 569 fms. (1040 meters); nature of bottom: green mud and globigerina ooze; bottom temperature: 4.4°C.; surface temperature: 26.1°C., type is in the Zoological Survey of India).

Head elongate, depressed, 4.6 in total length, 3.1 to subcaudal origin. Depth of body 10.2 in total length, 7.2 to subcaudal origin. Width of head 1.4 in its length, depth 1.8 in its width. Snout broadly rounded, depressed, 1.7 in head. Eyes without nictitating membrane, 4.0 in snout, 7.0 in head and 2.0 in interorbital. Nostrils oblique, 2.0 in head. Oronasal grooves absent. Width of mouth 2.2 in head. Dentary width 2.5 in head. Labial folds in both upper and lower jaws. Preoral length 2.1 in head, nearly equal to width of mouth. Teeth monomorphic, 42 in upper jaw and 43 in lower jaw; each tooth large, erect, slender, with a pointed, large median cusp, a small basal cusp on one side and two smaller basal cusps on other side. Spiracle small, 5.3 in eye, close behind it. Five pairs of lateral, subequal gill openings, equidistant from one another, the last two above pectoral base; the first gill opening 2.6 in eye. Two spineless dorsal fins. First dorsal origin about 1.5 eye diameters behind pelvic origin; base 4.3 in head. Second dorsal origin above middle of anal base; base 3.2 in head. Pectorals not reaching pelvic base; length 1.6 in head, base 2.8 in head. Pelvic origin 1.5 eye diameters before first dorsal origin; length 1.6 in head. Anal origin just behind posterior end of first dorsal base; base 1.2 in head. Subcaudal well developed, 1.2 times head length. Caudal long, 1.5 times head length. Skin rough.

Uniform sandy brown.

It attains a length of 260 mm.; found in depth 1,040 metres, bathypelagic.

Distribution.—Andaman Sea, 1,040 m., India, in the mean annual isotherm of 20°C. in 11°N., 92°E. in the Indian Ocean.

12. Genus *Atelomycterus* Garman

1913. *Atelomycterus* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 100 (type, *Scyllium marmoratum* Bennett, orthotypic).

Body elongate, slender. Trunk shorter than tail. Eyes large, orbit oblong, nictitating membrane present. Nasoral grooves present; cirri absent. Spiracles small, close behind eyes. Labial folds well developed. 5 pairs of gill openings. Two spineless dorsal fins; first dorsal fin behind the ventrals. Base of anal fin equal to the base of second dorsal. Caudal pit absent. Teeth small, tricuspid, median cusp the longest.

Distribution.—Ceylon, India, Malay Peninsula, Indonesia, Thailand, "Indo-China", Philippines.

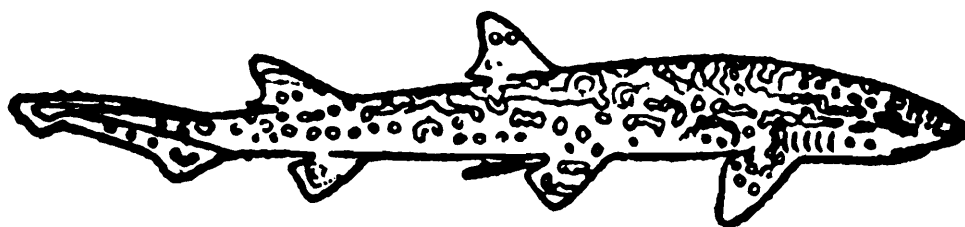
Atelomycterus marmoratum (Benn.) is the only species of the genus found in India and Ceylon.

20. *Atelomycterus marmoratum* (Benn.)

(Text-fig. 12)

1830. *Scyllium marmoratum* Bennett, *Life of Raffles*, p. 693 (type locality: Sumatra).
- 1830-32. *Scyllium maculatum* (*nec* Schneider) Gray, *Ill. Ind. Zool. Hardwicke*, 1, pl. 98, fig. 1 (India).
1832. *Scyllium ornatum* Gray, *Ill. Ind. Zool. Hardwicke*, 1, pl. 98, fig. 2 (type locality: China).
1870. *Scyllium marmoratum* Günther, *Cat. Fish. Brit. Mus.*, 8, p. 400 (Singapore; East Indies; India).
1878. *Scyllium marmoratum* Day, *Fish. India*, p. 724, pl. 190, fig. 2 (the figure is taken from Hardwicke's type of *Scyllium maculatum*, 18 inches in length).
1889. *Scyllium marmoratum* Day, *Fauna Brit. India, Fish.*, 1, p. 31, fig. 11 (Seas of India to the Malay Archipelago).
1896. *Scylliorhinus marmoratus* Steindachner, *Ann. Hofmus. Wien*, 2, p. 227 (Bangkok).
1908. *Scylliorhinus marmoratus* Regan, *Ann. Mag. nat. Hist.*, (8) 1, p. 462 (India; Malay Archipelago).
1913. *Atelomycterus marmoratus* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 100 (India; Malay Archipelago).

1931. *Atelomycterus marmoratus* Chu, *Biol. Bull. St. John's Univ.*, No. 1, p. 3 (China).
 1941. *Atelomycterus marmoratus* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 62, fig. 6.
 1949. *Atelomycterus marmoratum* Misra, *Rec. Indian Mus.*, 45 (1947), p. 13.
 1952. *Atelomycterus marmoratum* Misra, *Rec. Indian Mus.*, 49 (1951), p. 104.
 1953. *Atelomycterus marmoratus* Herre, *Check List Philippine Fish.*, p. 8 (Philippines).
 1955. *Atelomycterus marmoratus* Munro, *Mar. Freshwater Fish. Ceylon*, p. 4 (Ceylon).
 1958. *Atelomycterus marmoratus* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 81.



TEXT-FIG. 12.—Lateral view of *Atelomycterus marmoratum* (Benn.)
 : $\times \frac{1}{5}$. (After F. Day)

Vernacular names.—INDIA: *Kurangan sura*, *Udamban sura*, Tamil; Standardised name: *Udamban sura*.

Head 5.7; depth 7.5 to subcaudal origin. Snout 2.5 in head. Eyes 4 in head, 1.3 in snout. Mouth wide, with long labial folds around its angles. Teeth small, tricuspid, median cusp the longest. Nostril midway in preoral length. Nasoral grooves present, cirri absent. Anterior nasal valves separate. No posterior valve. Gill opening moderate, the last 2 above pectoral base. First and second dorsals more or less subequal. First dorsal origin about middle of pelvic base. Second dorsal origin behind anal origin. Anal smaller than second dorsal. Subcaudal equal to head to 3rd gill opening.

Colour variable, light brownish becoming whitish below; young with 12 cross bands of brown on back separated by pairs of light spots or blotches; fins spotted with white tips. Adult more irregularly spotted with brown, less banded, white spots retained as brown edged ocelli.

It grows to a length of 503 mm. Oviparous; littoral.

Distribution.—India, Pakistan, Ceylon.—Malay Peninsula, Singapore, Java, Sumatra, Amboina, Thailand, “Indo-China”, China, Canton, Philippines, Port Darwin, N. Australia, in the mean annual isotherm of 20° C. with the

latitudinal and longitudinal range of 25° N.—12° S., 62°—131° E. in the Indo-Pacific=(25° N.—12° S., 62°—131° E. in the Indian Ocean+23° N.—7° S., 62°—100° E. in the Pacific Ocean).

VI. Family CARCHARHINIDAE

Grey Sharks

Body elongate, subcylindrical. Tail compressed; caudal bent up from caudal base, without lateral keel; caudal pit present or absent. Head depressed. Eyes with nictitating membrane. Mouth inferior, arched. Teeth monomorphous or dimorphous, monoserial or polyserial, erect or oblique, smooth or serrated, cuspidate, flat or pavement-like. Oronasal groove and cirri absent. Spiracles present or absent. Five pairs of gill openings, last 1 or 2 above pectoral base. Two spineless dorsals, first dorsal large, elevated, entirely before pelvics. Second dorsal small, opposite anal. Subcaudal lobe moderately produced.

Eocene to Recent.

The family CARCHARHINIDAE is represented by 10 genera in the Indian region.

Key to genera of family CARCHARHINIDAE

- | | | |
|--|-----|----------------------------------|
| 1. Spiracle present | 3 | |
| 2. Spiracle absent | 9 | |
| 3. Caudal pit absent | | Genus <i>Mustelus</i> Linck |
| 4. Caudal pit present | 5 | |
| 5. Teeth dimorphous: lower smooth or finely serrated | 7 | |
| 6. Teeth monomorphous : lower serrated on both edges | | Genus <i>Galeocerdo</i> M. & H. |
| 7. Lower teeth erect, not curved inwards, smooth | | Genus <i>Chaenogaleus</i> Gill |
| 8. Lower teeth curved inwards, finely serrated | | Genus <i>Hemipristis</i> Agassiz |
| 9. Teeth polyserial, in bands .. | | Genus <i>Triaenodon</i> M. & H. |
| 10. Teeth monoserial, not in bands .. | 11 | |
| 11. Teeth with smooth edges | 13 | |
| 12. Teeth with roughened edges | 17 | |
| 13. Teeth with swollen bases | | Genus <i>Physodon</i> M. & H. |
| 14. Teeth without swollen bases | .15 | |
| 15. Teeth with oblique cusps | | Genus <i>Scoliodon</i> M. & H. |
| 16. Teeth with erect cusps | | Genus <i>Aprionodon</i> Gill |

17. Teeth serrated both on bases
and cusps in the upper jaw Genus *Carcharhinus* Blainville
18. Teeth serrated at their bases
only in the upper jaw Genus *Hypoprion* M. & H.

13. Genus *Physodon* Müller & Henle

1841. *Physodon* Müller & Henle, *Syst. Besch. Plagiost.*, p. 30
(type, *Carcharias (Physodon) mülleri* M. & H., monotypic).

Body elongate, slender. Trunk nearly equal to tail. Snout elongate, pointed. Eyes small, with nictitating membrane. Labial folds only on the lower jaw. Nasoral grooves and cirri absent. Spiracles absent. 5 pairs of gill-openings. Two spineless dorsal fins. Anal fin present. Caudal pit present. Teeth smooth, the central ones smaller than those at the side, which bear swollen bases with oblique and narrow cusps.

Distribution.—India, China, Australia.

Physodon mülleri M. & H. is the only species of the genus found in India.

21. *Physodon mülleri* M. & H.

1841. *Carcharias (Physodon) mülleri* Müller & Henle, *Syst. Besch. Plagiost.*, p. 30, pl. 19, fig. 1 (type locality : Bengal : according to Bertin holotype figure is in the Paris Museum).
1870. *Carcharias mülleri* Günther, *Cat. Fish. Brit. Mus.*, 8, p. 360 (Bengal).
1878. *Carcharias mülleri* Day, *Fish. India*, p. 714 (Bengal).
1888. *Carcharias muelleri* Ogilby, *Proc. Linn. Soc. New South Wales*, 3 (2), p. 1767 (Cape York, North Australia).
1889. *Carcharias mülleri* Day, *Fauna Brit. India*, Fish., 1, p. 11 (Bengal).
1913. *Carcharias mülleri* Zugmayer, *Abh. Kon. Bayer. Akad. Wiss. math.-phys. Kl.*, 26, p. 8 (Mekran).
1922. *Physodon mülleri* Hora, *Mem. Indian Mus.*, 5, p. 763 (Chilka Lake).
1930. *Physodon mülleri* Fowler, *Hong Kong Nat.*, 1, p. 85 (China).
1931. *Physodon mülleri* Chu, *Biol. Bull. St. John's Univ.* No. 1, p. 4 (China).
1941. *Physodon mülleri* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 129.
1949. *Physodon mülleri* Misra, *Rec. Indian Mus.*, 45 (1947), p. 13 (typographical error for *Physodon*).

1952. *Physodon mülleri* Misra, *Rec. Indian Mus.*, **49** (1951), p. 105.
 1958. *Physodon mülleri* Misra & Menon, *Rec. Indian Mus.*, **53** (1955), p. 81.

Body elongate, cylindrical. Head broader than deep. Snout long, pointed. Eyes small, lateral, with nictitating membrane, above middle of mouth. Nostrils nearer to angle of mouth than to snout end. Mouth wider than long. Short labial folds at angles of lower jaws. Teeth smooth, in $\frac{27}{28}$ rows; one median upper, 2 median lower; central ones in lower jaws smaller than those at sides, the latter swollen at bases with an oblique, narrow cusp; upper flat, oblique. Last gill openings above pectoral base. First dorsal origin midway between pectoral and pelvic bases. Second dorsal very small, above the last third of anal base. Pectorals extend to below dorsal origin.

Brownish, becoming lighter beneath; fins a little darker.

It attains a length of 500 mm.; pelagic.

Distribution.—India, Pakistan.—China, Hongkong, Cape York, Queensland; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 25°N.—10°S., 62°—142°E. in the Indo-Pacific=(25°—20°N., 62°—92°E. in the Indian Ocean+22°N.—10°S., 114°—142°E. in the Pacific Ocean).

14. Genus *Scoliodon* Müller & Henle

1837. *Scoliodon* Müller & Henle, *Mag. Hist.*, **2**, p. 114 (atypic; type, *Carcharias (Scoliodon) laticaudus* M. & H., logotypic).
 1865. *Alopiopsis* Lioy, *Atti. Soc. Ital. Sci. nat. Milano*, **8**, p. 398 (type, *A. plejodon* Lioy, monotypic) (fossil).
 1915. *Rhizoprion* (*nec* Jourdain, 1861) Ogilby, *Mem. Queensland Mus.*, **3**, p. 132 (type, *Carcharias (Scoliodon) crenidens* Klunzinger, orthotypic); (inadmissible as homonym of *Rhizoprion* Jourdain, according to rules under article 34 of the International Commission of Zoological Nomenclature).
 1929. *Rhizoprionodon* Whitley, *Austral. Zool.*, **5**, p. 354 (type, *Carcharias (Scoliodon) crenidens* Klunzinger, orthotypic).

Body elongate, slender. Trunk nearly equal to tail, snout elongate, pointed. Eyes moderate, with nictitating membrane. Nasoral grooves and cirri absent. Labial folds on both the jaws. Spiracles absent. 5 pairs of gill openings. Two spineless dorsal fins. Anal fin present. Caudal pit present. Teeth with smooth edges; all oblique and without swollen bases.

Distribution.—South Africa, Red Sea, Arabia, Makran, India, Ceylon, Burma, Malay Peninsula, Java, "Indo-China", Formosa, Japan, Philippines.

Key to species

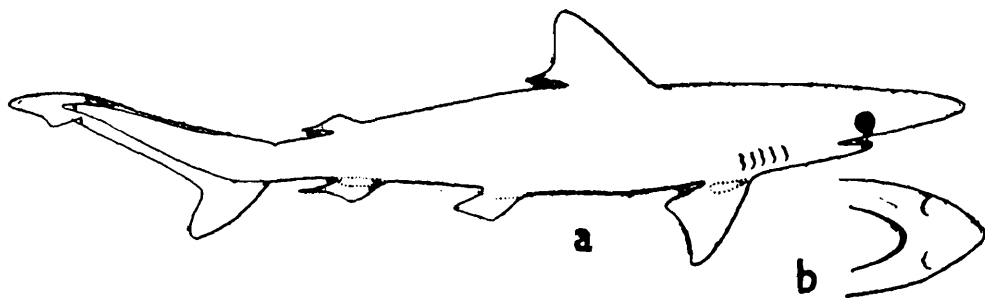
1. Labial fold extending to the upper jaw : D.F. 25/24 *S. walbeehmi* Blkr.
2. Labial fold not extending to the upper jaw : D.F. 23-31/22-30 3
3. Second dorsal fin posterior to base of anal : D.F. 31/28-30 *S. sorrakowah* (C)
4. Second dorsal fin over end of base of anal : D.F. $\frac{23-25}{22-26}$ *S. palasorra* (C.)

22. *Scoliodon palasorra* (C.)

(Text-fig. 13)

1829. *Carcharias palasorra* Cuvier, *Règne Animal.*, ed. 2, p. 388 (on *Palasorra* Russell, *Fish. Coromandel.*, 1, p. 9, pl. 14, 1803 ; type locality : Vizagapatnam ; Madras).
1841. *Carcharias (Scoliodon) acutus* Müller & Henle, *Syst. Besch. Plagiost.*, p. 29 (Red Sea ; India ; Java).
1851. *Squalus (Scoliodon) acutus* Gray, *List Fish. Brit. Mus.*, p. 41 (China and Bengal).
1870. *Carcharias acutus* Günther, *Cat. Fish. Brit. Mus.*, 8, p. 358 (Cape of Good Hope ; East Indies ; Penang ; Singapore ; Vizagapatam ; Japan).
1878. *Carcharias acutus* Day, *Fish. India*, p. 712, pl. 184, fig. 3 (Madras).
1889. *Carcharias acutus* Day, *Fauna Brit. India*, Fish., 1, p. 10 (India).
1913. *Scoliodon palasorra* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 111 (India, East Indies.)
1913. *Carcharias acutus* Zugmayer, *Abh. Kon. Bayer. Akad. Wiss. math.-phys. Kl.*, 26, p. 8 (Mekran, Oman).
1926. *Scoliodon lalandei* (nec Müller & Henle) Chabanaud, *Service Oceanogr. Pêches. Indo-Chine*, 10 note, p. 5 (Gulf of Siam).
1926. *Scoliodon acutus* Fowler, *J. Bombay nat. Hist. Soc.*, 31, p. 2 (Bombay).
1927. *Scoliodon acutus* Fowler, *J. Bombay nat. Hist. Soc.*, 32, p. 253 (Bombay).
1928. *Scoliodon palasorra* Thillayampalam, *Ind. zool. Mem.*, 2, p. 8 (Madras).
1931. *Scoliodon palasorra* Chu, *Biol. Bull. St. John's Univ.*, No. 1, p. 4 (China).
1933. *Scoliodon palasorra* Deraniyagala, *Ceylon J. Sci. (c)*, 5, p. 80 (Ceylon).
1933. *Carcharias acutus* Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
1936. *Scoliodon palasorra* Suvatti, *Index Fish. Siam*, p. 2 (Gulf of Siam).
1938. *Scoliodon palasorra* Fowler, *List Fish. Malaya*, p. 11 (Penang), Singapore).
1940. *Scoliodon palasorra* Mahadevan, *Proc. Indian Acad. Sci.*, 11, Sec. B, p. 19 (Madras).
1941. *Scoliodon palasorra* Fowler, *Bull. U. S. nat. Mus.*, (100) 13, p. 137.

1946. *Scoliodon ceylonensis* Setna & Sarangdhar, *Proc. nat. Inst. Sci. India*, 12, p. 252.
1949. *Scoliodon palasorrah* Misra, *Rec. Indian Mus.*, 45 (1947), p. 14.
1950. *Scoliodon acutus* Setna & Sarangdhar, *Rec. Indian Mus.*, 47 (1949), p. 125, text-figs. 1, 2.
1952. *Scoliodon acutus* Mori, *Mem. Hyogo Univ. Agric.*, 1, No. 3, p. 21 (Fusan).
1952. *Scoliodon palasorrah* Misra, *Rec. Indian Mus.*, 49 (1951), p. 106.
1953. *Scoliodon palasorrah* Herre, *Check List Philippine Fish.*, p. 24.
1953. *Scoliodon palasorrah* Smith, *Sea Fish. S. Africa*, p. 43 (as far south as Durban).
1955. *Scoliodon palasorrah* Munro, *Mar. Freshwater Fish. Ceylon*, p. 6.
1958. *Scoliodon palasorrah* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 81.



TEXT-FIG. 13.—*Scoliodon palasorrah* (C.)

(a) Lateral view : $\times ca\frac{1}{3}$. (b) Ventral view of head : $\times ca\frac{1}{3}$. (After F. Day)

Vernacular names.—INDIA : *Pal sorrah*, Malayalam; *Sem sorrah*, Telegu; Standardised name : *Pal sura*. CEYLON : *Kiri mora*, Sinhalese; *Pal schura*, Tamil.

Head 3.8; depth 6.2 to subcaudal origin. Snout elongate, 2.0 in head. Eyes with nictitating membrane, 8.0 in head. Width of mouth almost equal to its length. Labial folds at angles of mouth, and slightly along the lower jaw. Preoral less than distance between eye and first gill opening, exceeding width of mouth by one third. Nostrils nearer to mouth than to snout end. Distance between outer edges of nostrils more than distance between nostrils and snout end. Nasoral grooves and cirri absent. Teeth in $\frac{23-25}{22-26}$ rows, oblique, entire in both jaws. First dorsal origin above depressed inner end of pectoral. Second dorsal slightly smaller than anal; origin about middle of anal base. Pelvic origin behind end of first dorsal base. Pectorals much

shorter than head to first gill opening, with the last 2 gill openings above their base. Anal origin nearer to subcaudal origin than to pelvic origin. Subcaudal equal to head to 3rd gill opening. Caudal pits present.

Grey or bronze above, white below; pectorals, pelvics, anal and upper edge of caudal white-edged.

It grows to a length of 1,216 mm. (4 ft.); pelagic.

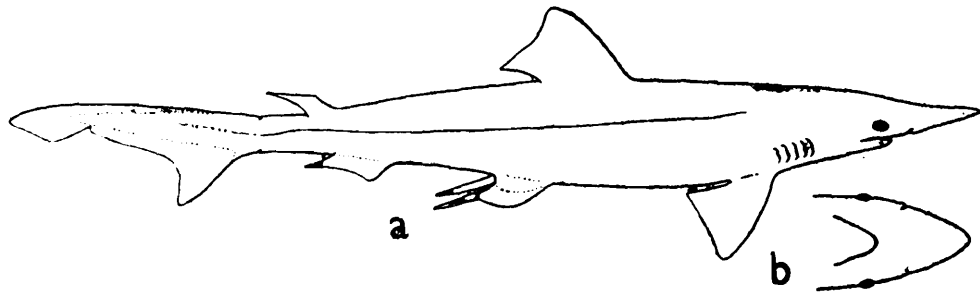
Distribution.—India, Pakistan, Ceylon.—Red Sea, S. Africa, Arabia, Malay Peninsula, Java, Thailand, "Indo-China", China, Japan, Philippines; in the mean annual isotherm of 20° C. with the latitudinal and longitudinal range of 35°N.—29°S., 32°—125° E. in the Indo-Pacific=(25°N.—29°S., 32°—100°E. in the Indian Ocean +35°N.—7°S., 101°—125°E. in the Pacific Ocean).

23. *Scoliodon sorrakowah* (C.)

(Text-fig. 14)

1829. *Carcharias sorrakowah* Cuvier, *Régne Animal.*, ed. 2, p. 388 (on *Sorrakowah* Russell, *Fish. Coromandel*, 1, p. 9, pl. 15, 1803; type locality: Vizagapatnam).
1841. *Carcharias (Scoliodon) laticaudus* Müller & Henle, *Syst. Besch. Plagiost.*, p. 28, pl. 8 (type locality: India; according to Bertin the paratypes from Malabar and Bombay are in the Paris Museum).
1852. *Carcharias (Scoliodon) macrorhynchus* Bleeker, *Verh. Bat. Gen. (Plagiost.)*, 24, pp. 27, 31, fig. 1 (teeth and head) (type locality: Batavia).
1860. *Squalus (Scoliodon) laticaudus* Blyth, *J. Asiat. Soc. Bengal*, 39, p. 35 (Calcutta).
1865. *Scoliodon laticaudus* Kner, *Reise Novara Fische*, p. 414 (Madras).
1870. *Carcharias laticaudus* Günther, *Cat. Fish. Brit. Mus.*, 8, p. 358 (Bengal; Batavia; China; Amoy; Japan).
1878. *Carcharias laticaudus* Day, *Fish. India*, p. 712, pl. 188, fig. 1 (Seas of India to the Malay Archipelago and beyond).
1888. *Carcharias laticaudus* Ogilby, *Cat. Fish. Austral. Mus.*, pt. 1, p. 1 (Bombay).
1889. *Carcharias laticaudus* Day, *Fauna Brit. India, Fish.*, 1, p. 9 (Seas of India to the Malay Archipelago and beyond).
1907. *Carcharias laticaudatus* Lloyd, *Rec. Indian Mus.*, 1, p. 220 (Akyab).
- 1912-13. *Carcharias laticaudus* Pearson, *Ceylon Administr. Rep.*, p. E 6.
1913. *Carcharias (Scoliodon) macrorhynchus* Weber, "*Siboga*" *Exped., Fische*, 57, p. 589 (Makassar).
1913. *Carcharias laticaudus* Zugmayer, *Abh. Kon. Bayer. Akad. Wiss. math.-phys. Kl.*, 26, p. 8 (Makran).
1928. *Scoliodon sorrakowah* Thillayampalam, *Ind. zool. Mem.*, 2, p. 8 (Tuticorin; Ennur).

1929. *Carcharias laticaudatus* Pillay, *J. Bombay nat. Hist. Soc.*, 33, p. 350 (Travancore).
 1931. *Scoliodon sorrakowah* Chu, *Biol. Bull. St. John's. Univ.*, No. 1, p. 4 (China).
 1933. *Carcharias laticaudus* Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
 1936. *Scoliodon sorrakowah* Suvatti, *Index Fish. Siam*, p. 2, (Siam).
 1938. *Scoliodon sorrakowah* Fowler, *List Fish. Malaya*, p. 10 (Straits of Malacca, Singapore).
 1940. *Scoliodon sorrakowah* Mahadevan, *Proc. Indian Acad. Sci.*, 11, Sec. B, p. 7 (Madras).
 1941. *Scoliodon sorrakowah* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 140.
 1949. *Scoliodon sorrakowah* Misra, *Rec. Indian Mus.*, 45 (1947), p. 14.
 1952. *Scoliodon sorrakowah* Misra, *Rec. Indian Mus.*, 49 (1951), p. 106.
 1955. *Scoliodon sorrakowah* Munro, *Mar. Freshwater Fish. Ceylon*, p. 8 (Ceylon).
 1958. *Scoliodon sorrakowah* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 82.



TEXT-FIG. 14.—*Scoliodon sorrakowah* (C.)

(a) Lateral view : $\times ca \frac{1}{7}$ (b) Ventral view of head : $\times ca \frac{1}{7}$. (After F. Day)

Vernacular names.—INDIA: *Mushi*, Marathi; *Nullian sorrah* or *Palah sorrah*, Telegu; Standardised name: *Ko sura*, *Son mushi*. CEYLON: *Hakuru mora*, Sinhalese; *Karnpathi schura*, Tamil.

Head 3.7; depth 6.8 to subcaudal origin. Snout elongate, 1.8 in head. Eyes with nictitating membrane, 8 in head, nearer to first gill-opening than to snout end. Width of mouth more or less equal to its length. Labial folds present in lower jaw. Preoral equal to distance between eye and last gill opening, twice width of mouth. Nostrils very much nearer to mouth than to snout end. Distance between outer edges of nostrils equals distance between nostrils and snout end. Nasoral grooves and cirri absent. Teeth in $\frac{31}{28-30}$ rows, entire, oblique in both jaws. First

dorsal origin nearer to pelvic base than to pectoral base. Second dorsal much smaller than anal; origin behind last half of anal base. Anal origin nearer to subcaudal origin than to pelvic origin. Pelvic origin opposite end of first dorsal base. Pectorals about half of head to last gill opening. Subcaudal less than head to 1st gill opening. Caudal pits present.

Uniform grey above, white beneath; pectorals deep grey, edged white; pelvic and anal white-edged; posterior part of caudal almost black.

It attains 457 mm. in length; pelagic.

Distribution.—India, Pakistan, Burma, Ceylon.—Malay Peninsula, Java, Thailand, “Indo-China”, China, Wenchow, Japan, Philippines; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 35°N.—7°S., 62°—130°E. in the Indo-Pacific=(2°—25°N., 62°—102°E. in the Indian Ocean+35°N.—7°S., 101°—130°E. in the Pacific Ocean).

24. *Scoliodon walbeehmi* Bleeker

Milk Shark

1856. *Carcharias (Scoliodon) walbeehmi* Bleeker, *Nat. Tijds. Ned.-Ind.*, 10, p. 353 (type locality : Rio., Bintang Island).
1878. *Carcharias walbeehmi* Day, *Fish. India*, p. 712, pl. 185, fig. 2 (Malabar).
1889. *Carcharias walbeehmi* Day, *Fauna Brit. India*, Fish., 1, p. 10 (India, Malay Archipelago, Japan).
- 1912-13. *Carcharias walbeehmi* Southwell, *Ceylon Administr. Rep.*, p. E 49.
1913. *Scoliodon walbeehmi* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 112 (Singapore, Colombo, Penang).
1919. *Scoliodon walbeehmi* Southwell & Prashad, *Rec. Indian Mus.*, 16, p. 223, pl. 17, figs. 1, 2, 4, 7, 8 (Ceylon).
1928. *Scoliodon walbeehmi* Thillayampalam, *Ind. Zool. Mem.*, 2, p. 8 (Tuticorin, Ennur).
1929. *Carcharias walbeehmi* Pillay, *J. Bombay nat. Hist. Soc.*, 33, p. 350 (Travancore).
1931. *Scoliodon walbeehmi* Chu, *Biol. Bull. St. John's Univ.*, No. 1, p. 4 (Amoy; China).
1936. *Scoliodon walbeehmi* Suvatti, *Index Fish. Siam*, p. 3 (Phatallung).
1938. *Scoliodon walbeehmi* Fowler, *List Fish. Malaya*, p. 11 (Penang, Singapore).
1940. *Scoliodon walbeehmi* Mahadevan, *Proc. Indian Acad. Sci.*, 11, Sec. B, p. 6 (Madras).
1941. *Scoliodon walbeehmi* Herre, *Mem. Indian Mus.*, 13, p. 332 (Andamans).
1946. *Scoliodon walbeehmi* Setna & Sarangdhar, *Proc. nat. Inst. Sci. India*, 12, No. 5, p. 252 (Bombay).

1949. *Scoliodon walbeehmi* Misra, *Rec. Indian Mus.*, **45** (1947), p. 15.
1952. *Scoliodon walbeehmi* Misra, *Rec. Indian Mus.*, **49** (1951), p. 106.
1952. *Scoliodon walbeehmi* Mori, *Mem. Hyogo Univ. Agric.*, No. 3, p. 21 (Fusan).
1953. *Scoliodon walbeehmi* Herre, *Check List Philippine Fish.*, p. 25.
1953. *Scoliodon walbeehmi* Smith, *Sea Fish. S. Africa*, p. 43 (Natal).
1955. *Scoliodon walbeehmi* Munro, *Mar. Freshwater Fish. Ceylon*, p. 6.
1958. *Scoliodon walbeehmi* Misra & Menon, *Rec. Indian Mus.* **53** (1955), p. 82.

Vernacular names.—INDIA: *Eidah*, Andamanese; Standardised name: *Wal mushi*.

Head 4.1; depth 4.9 to subcaudal origin. Snout elongate, 2.0 in head. Eyes with nictitating membrane, nearly in the middle of head, 8 in head. Width of mouth 1.2 times as broad as its length. Labial folds on both jaws, upper one longer. Preoral equal to distance between eye and 2nd gill opening, exceeding width of mouth by one third. Nostrils nearer to mouth than to snout end. Distance between outer edge of nostrils equals distance between nostrils and snout end. Nasoral grooves and cirri absent. Teeth in $\frac{25}{24}$ rows, oblique, flat, entire in both jaws. First dorsal origin opposite depressed inner ends of pectorals. Second dorsal smaller than anal; origin above last half of anal base. Anal origin much nearer to subcaudal origin than to pelvic origin. Pelvic with the last 2 gill openings above their base. Subcaudal equal to head to the 4th gill opening. Caudal pits present.

Light brown above, dull white beneath; fins grey with light outer edges.

It grows to 457 mm. (1½ ft.) in length; according to Smith it attains 1,216 mm. (4 ft.) in length; flesh palatable.

Distribution.—India, Ceylon.—S. Africa, Natal, Malay Peninsula, Java, Thailand, "Indo-China", China, Formosa, Japan, Philippines; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 35°N.—29°S., 30°—130°E. in the Indo-Pacific=(18°N.—29°S., 30°—100°E. in the Indian Ocean+35°N.—7°S., 100°—130°E. in the Pacific Ocean).

15. Genus *Aprionodon* Gill

1841. *Aprion* (*nec* Valenciennes, 1830) Müller & Henle, *Syst. Besch. Plagiost.*, p. 31 (type, *Carcharias (Aprion) brevipinna* M. & H., inadmissible).
1862. *Aprionodon* Gill, *Ann. Lyc. Nat. Hist. New York*, 7, pp. 400,401, 411 (type, *Carcharias (Aprion) isodon* M. & H., orthotypic).

Body fusiform. Trunk slightly longer than tail. Snout pointed. Eyes moderate with nictitating membrane. Nasoral grooves and cirri absent. Short labial fold at the corner of the mouth in the lower jaw. Spiracles absent. 5 pairs of gill openings. Two spineless dorsal fins. Anal fin present. Caudal pit present. Teeth small, narrow, with broad bases; the lower erect, the upper erect or slightly oblique.

Distribution.—Western Atlantic, Red Sea, Seychelles, Arabia, India, "Indo-China", Japan, Australia, Micronesia.

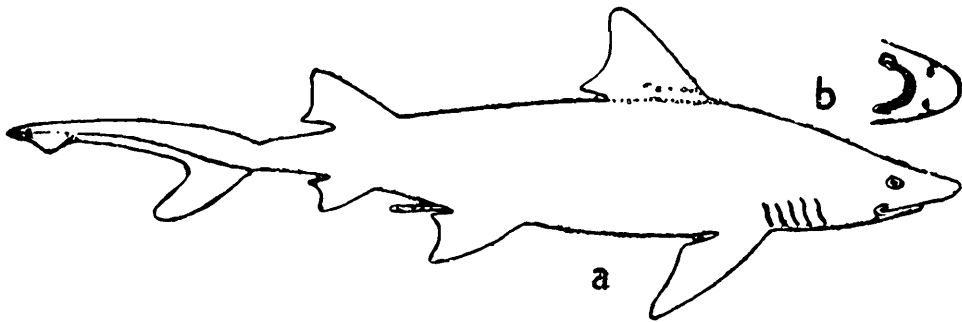
Aprionodon acutidens (Rüpp.), is the only species of the genus found in India.

25. *Aprionodon acutidens* (Rüpp.)

(Text-fig. 15)

1837. *Carcharias acutidens* Rüppell, *Neue Wirbelth. Fische*, p. 65, pl. 18, fig. 3 (type locality : Djedda, Red Sea).
1878. *Carcharias acutidens* Day, *Fish. India*, p. 713, pl. 189, fig. 1 (Red Sea, Sind, Indian Ocean).
1888. *Carcharias acutidens* Ogilby, *Proc. Linn. Soc. South Wales*, 3 (2) p. 1767 (Torres Strait).
1889. *Carcharias acutidens* Day, *Fauna Brit. India*, Fish., 1, p. 11 (Red Sea, Indian Ocean).
1899. *Carcharias forskalii* Hilgendorf, *Symbol. Phys. Hemprich-Ehrenberg*, p. 8, pl. 5, fig. 2 (type locality : Red Sea).
1913. *Carcharias acutidens* Zugmayer, *Abh. Kon. Bayer. Akad. Wiss. math-phys. Kl.*, 26, p. 8 (Mekran and Oman), p. 17 (Gwadar).
1928. *Aprionodon acutidens* Fowler, *Mem. Bishop Mus.*, 10, p. 22 (Apiang).
1929. *Carcharias acutidens* Tirant, *Serv. Oceanogr. Pêches Indo-Chine*, 6° note, p. 61 (Cochin-China).
1941. *Aprionodon acutidens* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 141.
1949. *Aprionodon acutidens* Misra, *Rec. Indian Mus.*, 45 (1947), p. 15.
1952. *Aprionodon acutidens* Misra, *Rec. Indian Mus.*, 49 (1951), p. 106.
1953. *Aprionodon acutidens* Herre, *Check List Philippine Fish.*, p. 16.

1955. *Carcharias acutidens* Anonymous, *Mar. Fish. Karachi, Sind & Makran*, p. 3 (Coast of Sind and Makran).
1958. *Aprionodon acutidens* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 82.



TEXT-FIG. 15.—*Aprionodon acutidens* (Rüpp.) (a) Lateral view : $\times \frac{1}{14}$. (b) Ventral view of head: $\times \frac{1}{14}$. (After F. Day)

Vernacular name.—PAKISTAN : *Dandan*, Sind & Makran.

Body elongate, spindle-shaped. Head broad, depressed, 5; depth 5 to subcaudal. Snout obtuse, rounded, 2.5 in head. Eyes small, nearer to snout end than to first gill opening, 7.5 in head, 2.5 in snout. Mouth nearly twice wider than long. Preoral equal to $\frac{2}{3}$ the width of mouth, much less than the distance between eye and first gill opening. Nostrils nearer to mouth than to snout end. Labial fold short, both in upper and lower jaws. Teeth in $\frac{27-29}{30-29}$ rows, slender, erect or oblique, entire, with bases rather swollen. Last gill opening above pectoral base. First dorsal origin opposite hind inner angle of pectoral. Second dorsal larger than anal; origin slightly before anal origin. Caudal 4.0 in total length. Subcaudal equal to head to 4th gill opening.

Dull reddish brown, becoming lighter at sides and below.

Rüppell's type measured 763 mm.; pelagic.

Distribution.—India, Pakistan, Ceylon.—Red Sea, Seychelles, Arabia, "Indo-China", Philippines, Micronesia, Apiang, Caroline, Kingsmills Is., N. Australia (Torres Strait); in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 25°N.—10°S., 39°—150°E. in the Indo-Pacific=(25°N.—10°S., 39°—142°E. in the Indian Ocean+5°—15°N., 105°—150°E. in the Pacific Ocean).

16. Genus *Hypoprion* Müller & Henle

1841. *Hypoprion* Müller & Henle, *Syst. Besch. Plagiost.*, p. 34 (type, *Carcharias (Hypoprion) macloiti* M. & H., designated by Jordan & Gilbert, *Bull. U.S. nat. Mus.*, 16, p. 61, 1883).
1862. *Hypoprionodon* Gill, *Ann. Lyc. nat. Hist. New York*, 7, p. 399 (type, *Carcharias (Hypoprion) hemiodon* M. & H., orthotypic).

Body elongate, fusiform. Trunk slightly longer than tail. Snout acutely pointed or rounded. Eyes moderate with nictitating membrane. Nasoral grooves and cirri absent. Short labial fold at the corner of the mouth present or absent. Spiracles absent. 5 pairs of gill openings. Two spineless dorsal fins. Anal fin present. Caudal pit present. Teeth smooth except at the bases of the upper ones which are serrated.

Distribution.—Atlantic, Indo-Pacific.

Key to species

1. Snout pointed : labial folds present : both sides of bases of upper teeth serrated : D. F. $\frac{27}{27}$ *H. macloiti* M. & H.
2. Snout rounded: labial folds absent : only outer sides of bases of upper teeth serrated : D.F. $\frac{29-32}{27-29}$ *H. hemiodon* M. & H.

26. *Hypoprion hemiodon* M. & H.

Long nosed Shark

1841. *Carcharias (Hypoprion) hemiodon* Müller & Henle, *Syst. Besch. Plagiost.*, p. 35, pl. 19, fig. 2 (teeth) (type locality : Pondicherry ; according to Bertin the holotype *measure et figure*, is in the Paris Museum).
1851. *Squalus (Hypoprion) hemiodon* Gray, *List Fish. Brit. Mus.*, p. 43 (Pondicherry).
1870. *Carcharias hemiodon* Günther. *Cat. Fish. Brit. Mus.*, 8, p. 362 (Calcutta, India).
1878. *Carcharias hemiodon* Day, *Fish. India*, p. 714 (India, Hooghly at Calcutta).
1878. *Carcharias hemiodon* Macleay, *Proc. Linn. Soc. New South Wales*, 2, p. 366 (Port Darwin).
1885. *Carcharias (Hypoprion) hemiodon* Meyer, *Ann. Soc. Espan. Hist. nat. Madrid*, 14, p. 48 (North Celebes, Manila Bay, Luzon).
1889. *Carcharias hemiodon* Boulenger, *Proc. zool. Soc. Lond.*, p. 243 (Muscat).
1889. *Carcharias hemiodon* Day, *Fauna Brit. India, Fish.*, 1, p. 12 (Hooghly at Calcutta).
1913. *Carcharias hemiodon* Weber, "*Siboga*" *Exped., Fische*, 57, p. 590 (Dama, N. W. Waigiu).

1913. *Hypoprion hemiodon* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 122 (Pondicherry ; Calcutta).
1929. *Carcharias hemiodon* Tirant, *Serv. Oceanogr. Peches Indo-Chine*, 6^e note, p. 79 (Saigon river).
1941. *Hypoprion hemiodon* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 146.
1949. *Hypoprion hemiodon* Misra, *Rec. Indian Mus.*, 45 (1947), p. 15.
1952. *Hypoprion hemiodon* Misra, *Rec. Indian Mus.*, 49 (1951), p. 106.
1953. *Hypoprion hemiodon* Herre, *Check List Philippine Fish.*, p. 33 (Philippines).
1958. *Hypoprion hemiodon* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 82.

Vernacular name.—BURMA : *Nga man ngheppyan*.

Snout obtuse, rounded, shorter than, in *H. macloti*. Nostrils midway between mouth and snout end. Internarial between outer nasal angles equals preoral. Eyes with nictitating membrane. Nasoral grooves and cirri absent. Labial folds absent. Spiracle absent. Teeth in $\frac{29-32}{27-29}$ rows; only the outer sides of the bases of the upper teeth serrated; lower teeth erect, smooth, or serrated on outer basal portions, with narrow cusps and broad bases. Last one or 2 gill openings above pectoral base. First dorsal origin just behind pectoral. Second dorsal origin a little behind anal. Caudal pits present.

Blackish grey, lighter below.

It grows to 609 mm. (2 ft.) in length; pelagic.

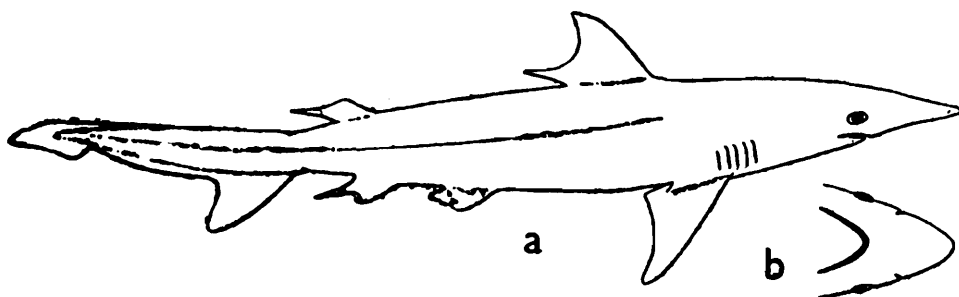
Distribution.—India.—Arabia, Muscat, “Indo-China”, Saigon, Philippines, Waigui, N. Australia; in the mean annual isotherm of 20°C. with latitudinal and longitudinal range of 23°N.—12°S., 58°—131°E. in the Indo-Pacific= (23°N., 12°S., 58°—131°E. in the Indian Ocean+16°N.—2°S., 105°—130°E. in the Pacific Ocean).

27. *Hypoprion macloti* M. & H.

(Text-fig. 16)

1841. *Carcharias (Hypoprion) macloti* Müller & Henle, *Syst. Besch. Plagiost.*, p. 34, pl. 10 (type locality : New Guinea).
1870. *Carcharias macloti* Günther *Cat. Fish Brit. Mus.*, 8, p. 362 (Indian Ocean ; New Guinea).
1878. *Carcharias macloti* Day, *Fish India.*, p. 713, pl. 187, fig. 2 (Malabar).

1889. *Carcharias macloti* Day, *Fauna Brit. India*, Fish., 1, p. 12 (Seas of India to New Guinea).
 1913. *Hypoprion macloti* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 121 (New Guinea ; Indian Ocean).
 1913. *Carcharias macloti* Zugmayer, *Abh. Bayer. Akad. Wiss., math-phys. Kl.*, 26, p. 8 (Makran).
 1933. *Carcharias macloti* Deraniyagala, *Ceylon J. Sci. (c)*, 5, p. 80 (Ceylon).
 1938. *Hypoprion macloti* Fowler, *List Fish. Malaya*, p. 10 (Malay Peninsula).
 1940. *Hypoprion macloti* Whitley, *Fish. Australia*, 1, p. 107, figs. 88.
 1941. *Hypoprion macloti* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 145.
 1949. *Hypoprion macloti* Misra, *Rec. Indian Mus.*, 45 (1947), p. 16.
 1952. *Hypoprion macloti* Misra, *Rec. Indian Mus.*, 49 (1951), p. 106.
 1955. *Hypoprion macloti* Munro, *Mar. Freshwater Fish. Ceylon*, p. 8 (Ceylon).
 1958. *Hypoprion macloti* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 82.



TEXT-FIG. 16.—*Hypoprion macloti* M. & H.
 (a) Lateral view : $\times \frac{1}{4}$. (b) Ventral view of head : $\times \frac{1}{8}$.
 (After F. Day)

Vernacular names.—INDIA: *Pala sorrah* or *Sorrah kowah*, Telegu. CEYLON: *Hudja mora*, Sinhalese; *Muthra schura*, Tamil.

Head 3.2; depth 5.8 to subcaudal origin. Snout acutely pointed, 2.3 in head. Eyes with nictitating membrane, nearer to snout than to first gill opening, 8.0 in head. Width of mouth 1.5 times as broad as long. Preoral exceeds width of mouth by one third and equal distance between eye and second gill opening. Nasoral grooves and cirri absent. A short labial groove at corner of mouth not extending to jaws. Nostrils with small pointed lobes, nearer to mouth than to snout end. Spiracles absent. Teeth in $\frac{27}{27}$ rows; bases of teeth in upper jaw serrated on both sides, lower teeth entire, narrower than upper. Last 2 gill openings above pectoral base. First dorsal origin above inner pectoral angle. Second dorsal smaller than anal; origin nearly

about last third of anal base. Pectorals smaller than head. Subcaudal equal to head to the gill opening. Caudal pits present.

Grey or brown becoming dull white beneath; fins grey, caudal nearly black in its posterior half; outer half of first dorsal dark, pectorals and pelvics with a light edge.

It attains a length of 609 mm. (2 ft.); according to Dumeril the type is 660 mm. in length; pelagic.

Distribution.—India, Pakistan, Ceylon.—Malay Peninsula, Indonesia, Melanesia; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 25°N.—5°S., 62°—142°E. in the Indo-Pacific=(2°—25°N., 62°N.—100°E. in the Indian Ocean+1°N.—5°S., 103°—142°E. in the Pacific Ocean).

17. Genus *Carcharhinus* Blainville

1816. *Carcharhinus* Blainville, *Bull. Soc. philom. Paris.* p. 121; *J. Phys.*, 83, p. 264 (type, *Squalus commersonii* Blainv., logotypic).
1862. *Eulamia* Gill, *Ann. Lyc. nat. Hist. New York*, 7, p. 401 (type, *Carcharias lamia* Risso=*Squalus commersonii* Blainv.).
1862. *Platypodon* Gill, *Ann. Lyc. nat. Hist. New York*, 7, p. 401 (type, *Carcharias (Prionodon) menisorrah* M. & H., orthotypic).
1862. *Isogomphodon* Gill, *Ann. Lyc. nat. Hist. New York*, 7, p. 401 (type, *Carcharias oxyrhynchus* M. & H., orthotypic).
1862. *Lamiopsis* Gill, *Ann. Lyc. nat. Hist. New York*, 7, p. 401 (type, *Carcharias (Prionodon) temminckii* M. & H., orthotypic).
1862. *Isoplagiodon* Gill, *Ann. Lyc. nat. Hist. New York*, 7, p. 401 (type, *Carcharias (Prionodon) sorrah* M. & H., orthotypic).
1899. *Gymnorhinus* (nec Maximillian, 1841) Hilgendorf, *Symbol. Phys. Hemprich-Ehrenberg*, p. 8 (type, *Carcharias (Prionodon) menisorrah* M. & H.).
1934. *Mapolamia* Whitley, *Mem. Queensland Mus.*, 10, pt. 4, pp. 185, 188 (type, *Carcharias melanopterus* Q. & G., orthotypic).
1934. *Gillisqualus* Whitley, *Mem. Queensland Mus.*, 10, pt. 4, pp. 185, 189 (type, *Carcharhinus amblyrhynchus* Blkr., monotypic).
1934. *Galeolamnoides* Whitley, *Mem. Queensland Mus.*, 10, pt. 4, pp. 185, 191 (type, *Carcharias macrurus* Ramsay & Ogliby, orthotypic).

Body elongate, fusiform. Trunk shorter or longer than tail. Snout pointed or rounded. Eyes moderate with well developed nictitating membrane. Nasoral grooves and cirri absent. Teeth serrated at both bases and cusps; teeth in lower jaw non-serrated in some. Labial folds rudimentary or short. Spiracles absent. 5 pairs of gill openings. Two spineless dorsal fins. Anal fin present. Caudal pit present. Viviparous; infested with Remoras and often accompanied by Pilot-fish.

Distribution.—Tropical Atlantic, Red Sea, Natal, Seychelles, Madagascar, India, Ceylon, Singapore, East Indies, Philippines, "Indo-China", Australia, Micronesia, China, Melanesia, Hawaii.

Key to species

1. Second dorsal fin larger than anal fin 3
2. Second dorsal fin not larger than anal fin .. 9
3. Teeth in lower jaw distinctly non-serrated : D.F. $\frac{29-38}{27-40}$.. *C. temminckii* (M. & H.)
4. Teeth in lower jaw serrated : D.F. $\frac{24-34}{23-31}$.. 5
5. Teeth distinctly awl-shaped : only the outer edge of cusp serrated *C. ellioti* (Day)
6. Teeth though narrow not awl-shaped: serrated entirely 7
7. Snout very short: eye 8 in snout: depth of body 6.0 in length from snout to subcaudal origin *C. gangeticus* (M. & H.)
8. Snout moderate : eye $4\frac{1}{2}$ to $4\frac{2}{3}$ in snout : depth of body $4\frac{4}{5}$ —5.0 in length from snout to subcaudal origin *C. commersonii* (Blainville)
9. Teeth in lower jaw serrated: D.F. $\frac{24-34}{23-31}$. 11
10. Teeth in lower jaw not serrated: D.F. $\frac{24-28}{24-27}$.. *C. menisorrhah* (M. & H.)
11. Second dorsal distinctly smaller than anal 13
12. Second dorsal and anal subequal 15
13. Second dorsal and anal origins opposite: D.F. $\frac{34}{31}$ *C. limbatus* (M. & H.)
14. Second dorsal origin behind anal origin: D.F. $\frac{25}{25}$.. *C. sorrah* (M. & H.)
15. Preoral length distinctly less than width of mouth 17
16. Preoral length more than or equal to width of mouth 19
17. All fins tipped with black : tail shorter than trunk : D.F. $\frac{25}{25}$ *C. spallanzani* (Le Sueur)
18. All fins not tipped with black : tail longer than trunk : D.F. $\frac{24-26}{24-26}$ *C. pleurotaenia* (Blkr.)

19. Preoral length more than width
of mouth : D.F. $\frac{24-25}{24-25}$ *C. dussumieri* (M. & H.)
20. Preoral length equal to width of
mouth : D.F. $\frac{25-31}{23-28}$ *C. bleekeri* (Dumeril)

28. *Carcharhinus bleekeri* (Dumeril)

(Pl. VI)

1865. *Carcharias (Prionodon) bleekeri* Dumeril, *Hist. nat. Poiss.*, **1**, p. 367 (type locality : Pondicherry ; the holotype is in the Paris Museum).
1878. *Carcharias bleekeri* Day, *Fish. India*, p. 715 (East coast of Africa ; Seas of India).
1889. *Carcharias bleekeri* Day, *Fauna Brit. India*, *Fish.*, **1**, p. 15 (East Coast of Africa ; Indian Seas).
1946. *Carcharhinus watu* Sarangdhar & Setna, *Proc. nat. Inst. Sci. India*, **12**, p. 252 (type locality: Bombay).
1949. *Carcharhinus bleekeri* Misra, *Rec. Indian Mus.*, **45** (1947), p.16.
1952. *Carcharhinus bleekeri* Misra, *Rec. Indian Mus.*, **49** (1951), p. 108.
1958. *Carcharhinus bleekeri* Misra & Menon, *Rec. Indian Mus.*, **53** (1955), p. 82.

Vernacular name.—INDIA : Standardised name : *Balda*.

Snout moderately produced, nostrils midway between mouth and snout end. Preoral equal to width of mouth. Nasoral grooves and cirri absent. Teeth in $\frac{25-31}{23-28}$ rows, serrated; in upper jaw triangular, slightly notched externally; in lower jaw nearly erect, narrow, on broad base. First dorsal origin at a short distance behind inner angle of pectoral. Second dorsal and anal subequal; origin opposite to anal origin. Inner margin of pectoral 5 in its outer margin. Caudal one fourth the total length. Subcaudal equal to distance between snout end and inner angle of pectoral. Caudal pits present.

A deep black spot at the lower edge of the end of pectoral; a second at the end of the inferior lobe of caudal; no black spot on first dorsal.

It attains 762—1,220 mm. in length; pelagic.

Distribution.—India, Pakistan.—Red Sea, Seychelles; in the mean annual isotherm of 20° C. with the latitudinal and longitudinal range of 20°N.—4°S., 55°—79°E. in the Indian Ocean.

29. *Carcharhinus commersonii* (Blainv.)

1816. *Squalus commersonii* Blainville, *Bull. Soc. philom. Paris* p. 121.
1820. *Squalus lamia* Blainville, *Faune Francaise, Poiss.*, p. 88, pl. 22, fig. C (type locality : "Nos mers").
1820. *Squalus commersonii* Blainville, *Faune Francaise, Poiss.*, p. 90.
1841. *Carcharias (Prionodon) maou* Lesson, *Voy. "Coquille", Zool.*, 2, pt. 1, p. 91, pl. 1 (type locality : Society Is.).
1841. *Carcharias (Prionodon) amboinensis* Müller & Henle, *Syst. Besch. Plagiost.*, p. 40, pl. 19 (dentition) (type locality : Amboina).
1851. *Squalus (Carcharinus) milberti (nec Müller & Henle)* Gray, *List. Fish. Brit. Mus.*, p. 45 (India).
1852. *Carcharias (Prionodon) fasciatus* Bleeker, *Verh. Bat. Gen. (Plagiost.)*, 24, p. 37 (type locality : Batavia, Java).
1858. *Squalus longimanus* Poey, *Mem. Hist. nat. Cuba*, 2, 61 p. 338, pl. 19, figs. 9-10 (type locality : Cuba).
1860. *Squalus (Carcharinus) milberti (nec Müller & Henle)* Blyth, *J. Asiatic Soc. Bengal*, 29, p. 35 (Calcutta).
1865. *Prionodon lamia* Day, *Fish. Malabar*, p. 270 (Malabar).
1865. *Carcharias (Prionodon) lamia* Dumeril, *Hist. nat. Elasmobr.*, 1, p. 356 (Malabar, Cape of Good Hope, Sharks Bay, W. Australia).
1891. *Eulamia (Platypodon) platyrhynchus* Gilbert, *Proc. U.S. nat. Mus.*, 14, p. 543 (type locality : Revillagigedo Is., Lower California).
1896. *Carcharias (Prionodon) siamensis* Steindachner, *Ann. Hofmus. Wien.*, 11, p. 229 (type locality : Mouth of Irrawaddy, Rangoon).
1913. *Carcharinus commersonii* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 140.
1928. *Eulamia commersonii*, Fowler, *Mem. Bishop Mus.*, 10, p. 20 (Hawaii, Fiji).
1931. *Carcharinus commersonii* Chu, *Biol. Bull. St. John's Univ.*, No. 1, p. 5 (Shanghai).
1941. *Eulamia lamia*, Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 169.
1949. *Carcharhinus lamia* Misra, *Rec. Indian Mus.*, 45 (1947), p. 18.
1952. *Carcharhinus lamia* Misra, *Rec. Indian Mus.*, 49 (1951), p. 108.
1953. *Carcharias commersonii* Herre, *Check List Philippine Fish.*, p. 17.
1958. *Carcharhinus lamia* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 79.

Head 4.8 ; depth 5.7 to subcaudal origin. Snout broad, obtusely rounded, 2.3 in head. Eyes with nictitating membrane, 13.0 in head, nearer to snout end than to mouth. Width of mouth 1.8 in head to first gill opening. Short labial folds at angles of mouth. Preoral 2.0 in head. Nostrils midway between mouth and snout end. Nasoral

grooves and cirri absent. Teeth in $\frac{28-30}{28-30}$ rows, subtriangular, serrated; in upper jaw nearly erect, in lower jaw, more erect, concave. First dorsal origin opposite inner angle of pectoral. Second dorsal larger than anal; origin before anal origin. Pectorals large, long, extending beyond first dorsal in young and nearly to its end in adult; inner margin of pectoral 4.2 in its outer margin. Subcaudal 1.3 times head to first gill opening. Caudal pits present.

Grey above, lighter below.

Specimens measuring 1,488 mm. have been recorded; pelagic.

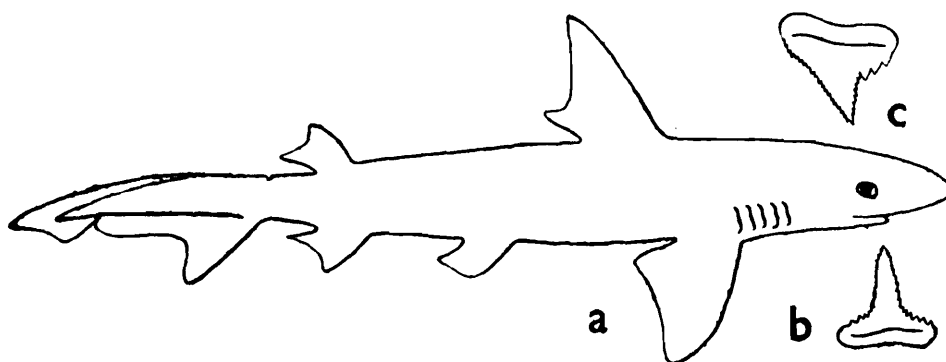
Distribution.—India, Burma.—Arabia, Indonesia, China, Philippines, Melanesia, Hawaii, Sharks Bay, W. Australia, also in California, tropical Atlantic; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 35°S.—35°N., 18°E.—111°W. in the Indo-Pacific = (24°N.—35°S., 18°E.—113°E. in the Indian Ocean +35°N.—7°S., 110°E.—111°W. in the Pacific Ocean); 22°N., 80°W. in the Atlantic Ocean.

30. *Carcharhinus dussumieri* (M. & H.)

(Text-fig. 17)

1841. *Carcharias (Prionodon) dussumieri* Müller & Henle, *Syst. Besch. Plagiost.*, p. 47, pl. 19, fig. 8 (type locality: China; Bombay; Pondicherry; the paratopotypes from Bombay and Pondicherry are in the Paris Museum).
1852. *Carcharias (Prionodon) javanicus* Bleeker, *Verh. Bat. Gen. (Plagiost.)*, 24, pp. 28, 38, pl. 2, fig. 5 (Batavia).
1878. *Carcharias dussumieri* Day, *Fish. India*, p. 714, pl. 187, fig. 2 (India, Malabar, Malay Archipelago).
1889. *Carcharias dussumieri* Day, *Fauna Brit. India, Fish.*, 1, p. 13 (Seas of India to the Malay Archipelago).
- 1912-13. *Carcharias dussumieri* Southwell, *Ceylon Adminstr. Rep.*, p. E 49.
1913. *Carcharias dussumieri* Zugmayer, *Abh. Bayer Akad. Wiss. math.-phys. Kl.*, 26, p. 8 (Mekran).
1913. *Carcharhinus dussumieri* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 137 (India, East Indies, China).
1931. *Carcharhinus dussumieri* Chu, *Biol. Bull. St. John's Univ.*, No. 1, p. 5 (China).
1933. *Carcharias dussumieri* Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
1938. *Eulamia dussumieri* Fowler, *List Fish. Malaya*, p. 9 (Selangor, Singapore).
1940. *Carcharias dussumieri* Mahadevan, *Proc. Indian Acad. Sci.*, 11, Sec. B, p. 6 (Madras).
1941. *Eulamia dussumieri* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 164.

1949. *Carcharhinus dussumieri* Misra, *Rec. Indian Mus.*, 45 (1947), p. 16.
 1952. *Carcharhinus dussumieri* Misra, *Rec. Indian Mus.*, 49 (1951), p. 108.
 1953. *Carcharias dussumieri* Herre, *Check List Philippine Fish.*, p. 17 (Philippines).
 1953. *Carcharhinus dussumieri* Smith, *Sea Fish. S. Africa*, p. 42, (Delagoa Bay).
 1955. *Eulamia dussumieri* Munro, *Mar. Freshwater Fish. Ceylon*, p. 7.
 1958. *Carcharhinus dussumieri* Misra & Menon, *Rec. Indian Mus.*, 53 (1951), p. 82.



TEXT-FIG. 17.—*Carcharhinus dussumieri* (M. & H.)

(a) Lateral view. (b) Lower tooth. (c) Upper tooth.
 (After F. Day)

Vernacular names.—INDIA: *Shivra*, Kanarese; *Chotimushi*, Marathi; Standardised name : *Karamuthu sura*.

Head 4.1; depth 6.0 to subcaudal origin. Snout 2.3 in head. Eyes with nictitating membrane, 8.0 in head, nearly in the middle of head. Preoral slightly exceeding width of mouth, and equals the distance between eye and first gill opening. Short labial folds in jaws, slightly extending in the upper. Nostrils nearer to mouth than to snout end. Oronasal grooves and cirri absent. Teeth in $\frac{24-25}{24-25}$ rows; in upper jaw oblique, serrated, externally notched; in lower jaw smaller, oblique, narrow, serrated, with a broad base. First dorsal origin just behind inner angle of pectoral. Second dorsal smaller than anal: origin opposite anal origin. Pelvic origin nearer to pectoral origin than to subcaudal origin. Pectoral a little smaller than head to first gill opening; inner margin of pectoral 2.5–3.0 in its outer margin. Last 2 gill openings above pectoral base. Subcaudal equal to head to 2nd gill opening. Caudal pits present.

Grey or dull brown above, whitish beneath; upper two-thirds of second dorsal black; fins gray, white-edged externally.

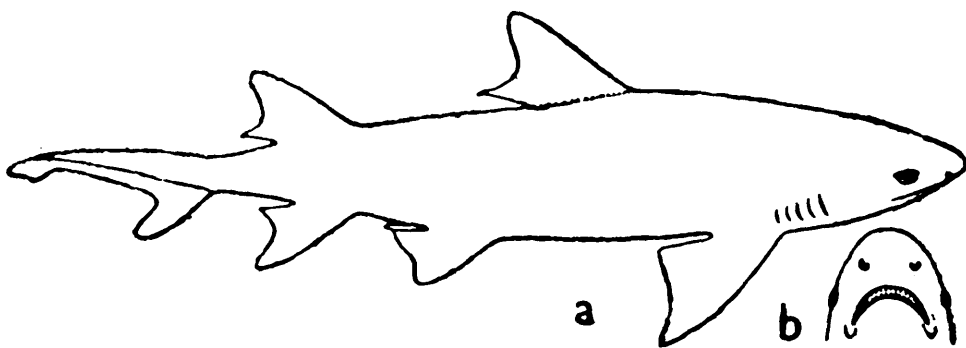
It attains 2,218 mm. (7 ft.) in length; not dangerous; pelagic.

Distribution.—India, Pakistan, Ceylon.—E. & S. Africa, Arabian Sea, Malay Peninsula, Indonesia, Hongkong, "Indo-China", China, Philippines; in the mean annual isotherm of 20° C. with the latitudinal and longitudinal range of 25°N.—25°S., 32°—123°E. in the Indo-Pacific—(25°N.—25°S., 32°—100°E. in the Indian Ocean + 22°N.—7°S., 103°—123°E. in the Pacific Ocean).

31 *Carcharhinus ellioti* (Day)

(Text-fig. 18)

1878. *Carcharias ellioti* Day, *Fish. India*, p. 716, pl. 189, fig. 2 (type locality : Kurrachee).
 1883. *Carcharias murrayi* Günther, *Ann. Mag. nat. Hist.*, (5) 11, p. 137 (type locality : Kurrachee).
 1888. *Carcharias murrayi* Day, *Fish. India, Suppl.*, p. 808 (Kurrachee).
 1889. *Carcharias murrayi* Day, *Fauna Brit. India, Fish.*, 1, p. 16 (Kurrachee).
 1913. *Carcharhinus ellioti* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 142 (India).
 1913. *Carcharias ellioti* Zugmayer, *Abh. Bayer. Akad. Wiss. math-phys. Kl.*, 26, p. 8 (Mekran and Oman).
 1933. *Carcharias ellioti* Deraniyagala, *Ceylon J. Sci. (c)*, 5, p. 79 (Ceylon).
 1941. *Eulamia ellioti* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 175.



TEXT-FIG. 18.—*Carcharhinus ellioti* (Day)

(a) Lateral view : $\times ca \frac{1}{20}$. (b) Ventral view of head : $\times ca \frac{1}{20}$. (After F. Day)

1949. *Carcharhinus ellioti* Misra, *Rec. Indian Mus.*, 45 (1947), p. 17.
 1952. *Carcharhinus ellioti* Misra, *Rec. Indian Mus.*, 49 (1951), p. 108.
 1955. *Carcharias ellioti* Anonymous, *Mar. Fish. Karachi, Sind & Makran*, p. 3 (Coast of Sind and Makran).
 1955. *Eulamia ellioti* Munro, *Mar. Freshwater Fish. Ceylon*, p. 6 (Ceylon).
 1958. *Carcharhinus ellioti* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 82.

Vernacular names.—INDIA : *Puducan* or *Adugupal sorrah*, Tamil; *Pal sorrah*, Telegu. PAKISTAN : *Dandan*, Sind. CEYLON : *Kachipudangia* or *Patchepadan-guva*, Sinhalese; *Adukupal schura*, *Padancan* or *Puducan*, Tamil.

Head 5.2; depth 5.0 to subcaudal origin. Snout 3.0 in head. Eyes with nictitating membrane, nearer to snout end than to first gill opening, 3 in head. Width of mouth twice its length. Preoral equals width of mouth, less than distance between eye and first gill opening. Labial folds well developed in both jaws, longer in upper jaw. Nostrils nearer to mouth than to snout end. Nasoral grooves and cirri absent. Teeth in $\frac{24-26}{30-34}$ rows; in upper jaw triangular, without notch or basal enlargement, coarsely serrated on both edges; in lower jaw obliquely erect, awl-shaped, smaller and more triangular at angle of mouth; the awl-shaped ones with cusp on either side of base below which outer edge with a few serrations; external triangular ones serrated externally. First dorsal origin behind inner end of pectoral. Second dorsal longer than anal; origin slightly in front of anal. Pectorals equal to head to 3rd gill opening; inner margin of pectoral 3.0 in its outer margin. Pelvic origin equidistant between subcaudal and pectoral origins, a little before inner end of dorsal. Last 2 gill openings above pectoral base. Subcaudal equal to head to 2nd gill opening. Caudal pits present.

Grey above, white beneath.

It grows to 1,830 mm. in length; pelagic.

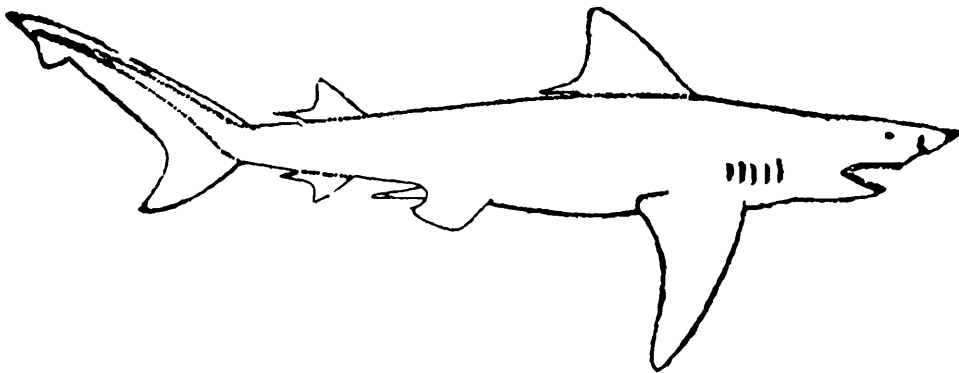
Distribution.—India, Pakistan, Ceylon.—Arabia; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 4°—23°N., 57°—80°E. in the Indian Ocean.

32. *Carcharhinus gangeticus* (M. & H.)

(Text-fig. 19)

1822. *Squalus carcharias* (*nec* Linn.), Hamilton, *Fish. Ganges*, p. 4 (Ganges R.).
1841. *Carcharias* (*Prionodon*) *gangeticus* Müller & Henle, *Syst. Besch. Plagiost.*, p. 39, pl. 13 (type locality : 60 hours above the Sea at Hooghly : the paratype from the Ganges is in the Paris Museum).
1850. *Carcharias* (*Prionodon*) *japonicus* Schlegel, *Fauna Japonica*, Poiss., p. 302, pl. 133 (type locality : Japan).
1851. *Squalus* (*Carcharhinus*) *gangeticus* Gray, *List Fish. Brit. Mus.*, p. 45 (Calcutta).

1860. *Squalus (Carcharinus) gangeticus* Blyth, *J. Asiat. Soc. Bengal*, 29, p. 36 (Calcutta).
1870. *Carcharias gangeticus* Günther, *Cat. Fish. Brit. Mus.*, 8, p. 168 (Calcutta ; Freshwater of Viti Levu; Fiji).
1878. *Carcharias gangeticus* Day, *Fish. India*, p. 715, pl. 187, fig. 1 (India ; Japan ; the example figured 18 inches long, was from Bombay).
1889. *Carcharias gangeticus* Day, *Fauna Brit. India*, Fish., 1, p. 13 (Hooghly at Calcutta ; the Burmese Coast).
1907. *Carcharias gangeticus* Lloyd, *Rec. Indian Mus.*, 1, p. 220 (Akyab).
1910. *Carcharias gangeticus* De, *Rep. Fish. Eastern Bengal and Assam*, p. 17 (Goalundo).
1913. *Carcharinus gangeticus* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 139 (India, Fiji, Japan).
1918. *Carcharhinus gangeticus* Southwell & Prashad, *Rec. Indian Mus.*, 16, p. 76 (Bengal).
1922. *Carcharinus gangeticus* Hora, *Mem. Indian Mus.*, 5, p. 76 (Chilka Lake).
1931. *Carcharinus gangeticus* Chu, *Biol. Bull. St. John's Univ.*, No. 1, p. 5 (Ningpo).
1933. *Carcharias gangeticus* Sorley, *Marine Fish. Bombay Presidency*, p. 156 (Bombay).
1939. *Carcharhinus gangeticus* Bertin, *Bull. Mus. nat. Hist. Paris*, (2) 11, p. 71.
1941. *Eulamia gangetica* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 168.
1949. *Carcharhinus gangeticus* Misra, *Rec. Indian Mus.*, 45 (1947), p. 17.
1952. *Carcharhinus gangeticus* Misra, *Rec. Indian Mus.*, 49 (1951), p. 108.
1953. *Carcharias gangeticus* Herre, *Check List Philippine Fish.*, p. 18.
1958. *Carcharhinus gangeticus* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 80.



TEXT-FIG. 19.—Lateral view of *Carcharhinus gangeticus* (M. & H.).
(After J. Müller & F. Henle)

Vernacular names.—INDIA : *Tamasi*, Kanarese; *Wagh-sheer*, Marathi; *Mundah magur*, Ooriah; Standardised name: *Magar Sura*. BURMA : *Nga man gOUNG WYN*.

Head 4.0; depth 6.0 to subcaudal origin. Snout 2.9 in head. Eyes with nictitating membrane, nearer to snout end than to first gill opening, 22.0 in head. Width of mouth 1.6 in head, length $\frac{1}{2}$ width. Preoral 3.8 in head, 2.5 in width of mouth, equals half of interspace between eye and the 3rd gill opening. Short labial grooves at angle of mouth. Nostrils in front half of the distance between snout end and mouth. Nasoral grooves and cirri absent. Teeth in $\frac{27-30}{27-30}$ rows, serrated in both jaws; in upper jaw almost subtriangular, notched (in immature only); in lower jaw narrow, erect, with broad bases. First dorsal origin between last gill opening and inner angle of pectoral. Second dorsal larger than anal; origin before anal origin. Pectorals equal to head to 3rd gill opening; inner margin of pectoral 4.5 in its outer margin. Pelvic origin equidistant between pectoral and subcaudal origin, but much behind inner end of dorsal. Last 2 gill openings above pectoral base. Subcaudal equal to head to 2nd gill opening. Caudal pits present.

Grey above, dull white below; pectorals, pelvics and anal edged white; posterior portion of caudal black.

It attains at least 2,743 mm. in length; ascends tidal rivers; pelagic.

Distribution.—India, Pakistan, Burma, Ceylon.—Arabia, Tigris R. to Baghdad, Java, "Indo-China", China, Japan, Philippines, Fiji, Laysan, Hawaii; in the mean annual isotherm of 20° C. with the latitudinal and longitudinal range of 35°N.—7°S., 57°E.—155°W in the Indo-Pacific = (4°—35°N., 57°—92°E. in the Indian Ocean + 35°N.—7°S., 105°E.—155°W. in the Pacific Ocean).

33. *Carcharhinus limbatus* (M. & H.)

1841. *Carcharias (Prionodon) limbatus* Müller & Henle, *Syst. Besch. Plagiost.*, p. 49, pl. 19, fig. 9 (type locality: Martinique; according to Bertin the paratype is in the Paris Museum).
1866. *Isogomphodon maculipinnis* Poey, *Rep. Hist. nat. Cuba*, 1, pp. 191, 450, pl. 4, figs. 3-4 (type locality: Cuba).
1871. *Carcharias ehrenbergi* Klunzinger, *Verh. Zool. bot. Ges. Wien*, 21, p. 661 (type locality: Kosier, Red Sea).
1878. *Carcharias limbatus* Day, *Fish. India*, p. 716, nec pl. 184, fig. 2.
1889. *Carcharias limbatus* Day, *Fauna Brit. India*, Fish., 1, 17 (Coasts of India).
1906. *Carcharias (Prionodon) limbatus* Steindachner, *Sitz. Akad. Wiss. Wien. math.-nat. Kl.*, 115, pt. 1, p. 1425 (Opolu).

1913. *Carcharinus limbatus* Garman, *Mem. Harv. Mus. Comp. Zool.*, **36**, p. 127.
1933. *Carcharias limbatus* Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
1941. *Eulamia limbata* Fowler, *Bull. U.S. nat. Mus.*, (100) **13**, p. 150.
1942. *Carcharinus limbatus* Sarangdhar, *Ind. J. med. Res.*, **30**, p. 558 (Bombay).
1949. *Carcharhinus limbatus* Misra, *Rec. Indian Mus.*, **45** (1947), p. 18.
1952. *Carcharhinus limbatus* Misra, *Rec. Indian Mus.*, **49** (1951), p. 108.
1953. *Carcharias limbatus* Herre, *Check List Philippine Fish.*, p. 18.
1953. *Carcharinus limbatus* Smith, *Sea Fish. South Africa*, p. 40 (east coast as far as Mossel Bay).
1955. *Carcharias limbatus* Anonymous, *Mar. Fish. Karachi, Sind & Makran*, p. 3 (Coasts of Sind and Makran).
1958. *Carcharhinus limbatus* Misra & Menon, *Rec. Indian Mus.*, **53** (1955), p. 80.

Vernacular names.—INDIA: *Khaksi*, Kanarese; *Walu*, Marathi; Standardised names: *Pettian sura*, *Pisori*. PAKISTAN: *Muiyyach*, Sind.

Head 3.7; depth 5.5 to subcaudal origin. Snout 2.5 in head. Eyes with nictitating membrane, 10 in head. Width of mouth 1.3 times as broad as long. Preoral a little less than width of mouth, slightly less than distance between eye and first gill opening. Short labial folds at angles of mouth. Nostrils nearer to mouth than to snout end. Nasoral grooves and cirri absent. Teeth in $\frac{34}{31}$ rows; in upper jaw serrated on bases and sides of cusps; in lower jaw not serrated on cusps but serrated on bases. First dorsal origin opposite inner end of depressed pectoral. Second dorsal smaller than anal; origin opposite to anal origin. Pectoral smaller than head to first gill opening; inner edge of pectoral 4.0 in its outer edge. Pelvic origin nearer to subcaudal origin than to pectoral origin, far behind inner end of first dorsal. Last 2 gill openings above pectoral base. Subcaudal equal to head to last gill opening. Caudal pits present.

Brownish grey above becoming white beneath, dorsals, pectorals, anal and subcaudal each with a black spot.

It grows to a length of 1,983 mm. and yields plenty of liver oil; pelagic.

Distribution.—India, Pakistan.—Red Sea, Seychelles, Natal, Arabia, Philippines, Opolu, Samoa, Polynesia, and also in the tropical Atlantic (Mexico, Cuba, West Indies);

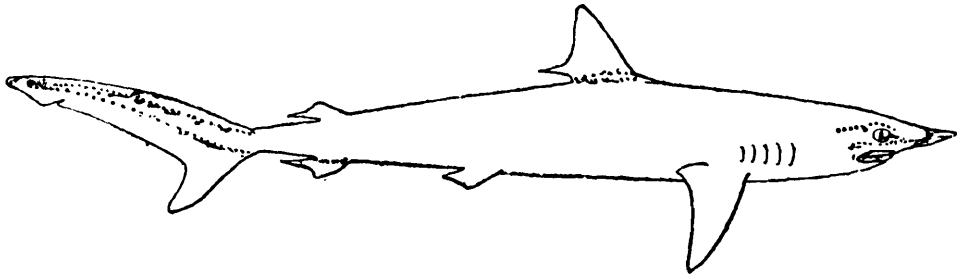
in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 25°N.—34°S., 22°E.—170°W. in the Indo-Pacific=(25°N.—34°S., 22°—72°E. in the Indian Ocean+15°N.—12°S., 105°E.—170°W. in the Pacific Ocean); 14°—22°N., 61°—80°W. in the Atlantic Ocean.

34. *Carcharhinus menisorrah* (M. & H.)

(Text-fig. 20)

1841. *Carcharias* (*Prionodon*) *menisorrah* Müller & Henle, *Syst. Besch. Plagiost.*, p. 46, pls. 17, 19, fig. 7 (type locality: Java; Australia; Red Sea, the paratopotype from Mer des Indes is in the Paris Museum).
1852. *Carcharias* (*Prionodon*) *tjutjot* Bleeker, *Verh. Bat. Gen. (Plagiost.)*, 24, pp. 28, 36, pl. 1, fig. 4 (head) (type locality: Batavia).
1873. *Carcharias malabaricus* Day, *J. Linn. Soc. Lond. Zool.*, 10, p. 529 (type locality: Palliport near Cochin and Calicut, on Malabar Coast, India).
1878. *Carcharias menisorrah* Day, *Fish. India*, p. 716, pl. 184, fig. 1 (Calicut; Red Sea, Malay Archipelago; the example figured, 19 inches long, was from Calicut).
1889. *Carcharias menisorrah* Day, *Fauna Brit. India, Fish.*, 1, p. 16 (Red Sea to the Malay Archipelago).
1898. *Carcharhinus cerdale* Jordan & Evermann, *Bull. U.S. nat. Mus.*, (47) 3, p. 2746 (type locality: Panama).
1899. *Gymnorhinus pharaonis* Hilgendorf, *Symbol. Physic. Hemprich-Ehrenberg*, p. 8, pl. 7, fig. 1 (type locality: Red Sea).
1912. *Carcharias menisorrah* Jenkins, *Rec. Indian Mus.*, 7, p. 57 (Akyab).
1923. *Carcharhinus natator* Meek & Hilderbrand, *Field Mus. Publ.*, No. 215, *Zool. Ser.*, 15, pt. 1, p. 40, pl. 1, fig. 1 (type locality: Panama City).
1933. *Carcharias menisorrah* Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
1938. *Eulamia menisorrah* Fowler, *List Fish. Malaya*, p. 9 (Penang, Singapore).
1941. *Eulamia menisorrah* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 161.
1949. *Carcharhinus menisorrah* Misra, *Rec. Indian Mus.*, 45 (1947), p. 19.
1952. *Carcharhinus menisorrah* Misra, *Rec. Indian Mus.*, 49 (1951), p. 108.
1953. *Carcharias menisorrah* Herre, *Check List Philippine Fish.*, p. 20.

1955. *Carcharias menisorrah* Anonymous, *Mar. Fish. Karachi, Sind & Makran*, p. 3 (Coasts of Sind and Makran).
 1958. *Carcharhinus menisorrah* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 79.



TEXT-FIG. 20.—Lateral view of *Carcharhinus menisorrah* (M. & H.).
 (After J. Müller & F. Henle)

Vernacular names.—INDIA : *Tharvat*, Kanarese; *Mushi*, Marathi; *Karimuthu sura* or *Suga sura*, Telegu; Standardised name : *Mandi sura*. PAKISTAN : *Gussi*, Sind & Makran. BURMA : *Nga man nee*, Arrakan.

Head 4.0; depth 6.0 to subcaudal origin. Snout 2.5 in head. Eyes with nictitating membrane, 7.0 in head. Width of mouth 2.5 in head. Preoral equals width of mouth. Short labial folds in both jaws, extending in the upper jaw. Nostrils nearer to mouth than to snout end. Nasoral grooves and cirri absent. Teeth in $\frac{24-28}{24-27}$ rows; in upper jaw oblique, triangular, notched, externally serrated along the whole extent of the cusp; in lower jaw erect, slender, lanceolate, entire, with broad bases. First dorsal origin a little behind inner angle of pectoral. Second dorsal subequal with anal; origin opposite anal origin. Pectorals smaller than head to first gill opening; inner margin of pectoral 3.0 in its outer margin. Last 2 gill openings above pectoral base. Subcaudal equal to head to 4th gill opening. Caudal pits present.

Grey above, white below; upper half of second dorsal often deep black.

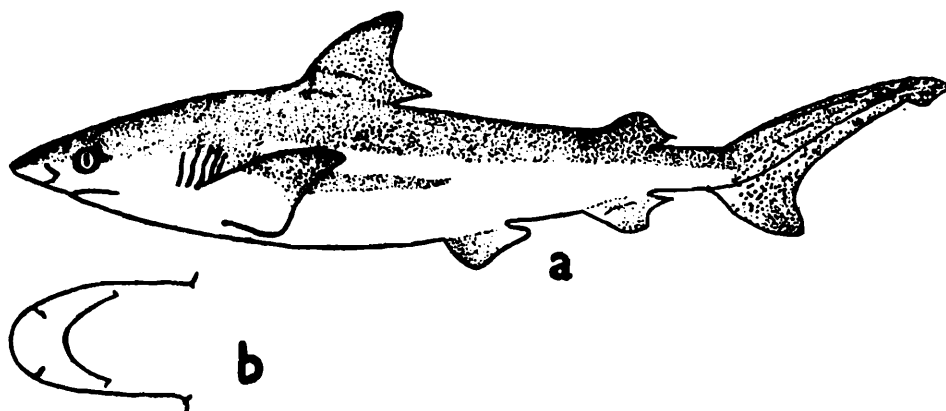
It attains 3,657 mm. or more in length. Viviparous; pelagic.

Distribution.—India, Pakistan, Burma.—Red Sea, Arabia, Malay Peninsula, Java, “Indo-China”, Philippines, Panama; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 25°N.—7°S., 39°E.—79°W. in the Indo-Pacific Ocean=(5°—25°N., 39°—100°E. in the Indian Ocean+15°N.—7°S., 103°E.—79°W in the Pacific Ocean).

35. *Carcharhinus pleurotaenia* (Blkr.)

(Text-fig. 21)

1852. *Carcharias* (*Prionodon*) *pleurotaenia* Bleeker. *Verh. Bat. Gen. (Plagiost.)*, 24, pp. 28, 40, pl. 2, fig. 6 (type locality : Batavia).
1913. *Carcharhinus pleurotaenia* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 137.
1938. *Eulamia pleurotaenia* Fowler, *List Fish. Malaya*, p. 9 (Singapore).
1941. *Eulamia pleurotaenia* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 166.
1942. *Carcharhinus pleurotaenia* Sarangdhar, *Ind. J. med. Res.*, 30, p. 558 (Bombay).
1949. *Carcharhinus pleurotaenia* Misra, *Rec. Indian Mus.*, 45 (1947), p. 19.
1952. *Carcharhinus pleurotaenia* Misra, *Rec. Indian Mus.*, 49 (1951), p. 108.
1953. *Carcharias pleurotaenia* Herre, *Check List Philippine Fish.*, p. 20 (Philippines).
1958. *Carcharhinus pleurotaenia* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 82.



TEXT-FIG. 21.—*Carcharhinus pleurotaenia* (Blkr.)

(a) Lateral view : $\times \frac{1}{6}$. (b) Ventral view of head : $\times \frac{1}{6}$.
(After H. W. Fowler)

Head 4.2; depth 4.4 to subcaudal origin. Snout broadly rounded, 2.6 in head. Eyes with nictitating membrane, 10.0 in head, nearer to snout end than to first gill opening. Mouth 1.4 times as wide as long and equal to distance between eye and first gill opening. Preoral 1.3 times in width of mouth. Short labial folds in upper jaw. Nostrils nearer to mouth than to snout end. Oronasal grooves and cirri absent. Teeth in $\frac{24-26}{24-26}$ rows; in upper with subtriangular cusps; in lower jaw more erect, lanceolate; all serrated. First dorsal origin opposite inner end of depressed

pectoral. Second dorsal and anal subequal; origin opposite anal origin. Pelvic origin nearer to pectoral origin than to subcaudal origin. Pectorals a little shorter than head to first gill opening; inner margin of pectoral 3.0–3.5 in its outer margin. Last 2 gill openings above pectoral base. Subcaudal a little more than head to last gill opening. Caudal pits present.

Brown above, pale below; indistinct, pale longitudinal band along sides of body from pectoral to above pelvics; tips of dorsals, pectorals and subcaudal dark to black.

It grows to a length of 1,520 mm. (5 ft.) and yields good quality liver oil; pelagic.

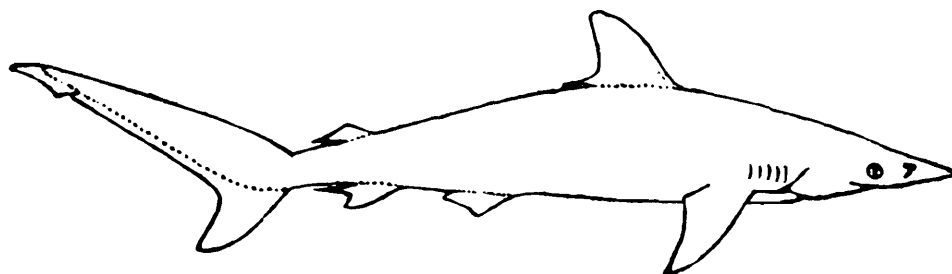
Distribution.—India.—Singapore, Java, Philippines; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 18°N.—7°S., 72°—123°E. in the Indo-Pacific = (18°N., 72°E. in the Indian Ocean + 14°N.—7°S., 103°—123°E. in the Pacific Ocean).

36. *Carcharhinus sorrah* (M. & H.)

(Text-fig. 22)

- 1841. *Carcharias (Prionodon) sorrah* Müller & Henle, *Syst. Besch. Plagiost.*, p. 45. pl. 16 (type locality: India; Java; Madagascar; according to Bertin the paratopotypes from Pondicherry and Madagascar are in the Paris Museum).
- 1878. *Carcharias sorrah* Day, *Fish. India*, p. 714, pl. 185, fig. 1 (India, Mangalore ; Malay Archipelago).
- 1889. *Carcharias sorrah* Day, *Fauna Brit. India*, Fish., 1, p. 12 (Seas of India to the Malay Archipelago).
- 1889. *Carcharias sorrah* Perugia, *Ann. Mus. Civ. Stor. nat. Genova*, (2) 7, p. 269 (Padang, Sumatra).
- 1912. *Carcharias marianensis* Engelhardt, *Zool. Anz.*, 39, p. 647 (type locality : Guam, Marianes).
- 1913. *Carcharhinus sorrah* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 132 (Indian Seas; Madagascar; Borneo ; Java).
- 1928. *Eulamia sorrah* Fowler, *Mem. Bishop Mus.*, 10, p.19 (Hawaii).
- 1930. *Eulamia sorrah* Fowler, *Proc. Acad. nat. Sci. Philad Philad*, (1929), p. 597 (Hong Kong).
- 1933. *Carcharias sorrah* Sorley, *Marine Fish. Bombay Presidency*, p. 159.
- 1938. *Eulamia sorrah* Fowler, *List Fish. Malaya*, p. 9 (Singapore).
- 1939. *Carcharhinus sorrah* Bertin, *Bull. Mus. nat. Hist. Paris*, (2) 11, p. 71.
- 1941. *Eulamia sorrah* Fowler, *Bull. U. S. nat. Mus.*, (100) 13, p. 156.
- 1949. *Carcharhinus sorrah* Misra, *Rec. Indian Mus.*, 45 (1947), p. 20.
- 1952. *Carcharhinus sorrah* Misra, *Rec. Indian Mus.*, 49 (1951), p. 109.

1953. *Carcharias sorrah* Herre, *Check List Philippine Fish.*, p. 2 (Philippines).
 1958. *Carcharhinus sorrah* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 82.



TEXT-FIG. 22.—Lateral view of *Carcharhinus sorrah* (M. & H.).
 (After J. Müller & F. Henle)

Vernacular name.—INDIA : *Shirat*, Kanarese.

Head 3.9; depth 5.4 to subcaudal origin. Snout 2.3 in head. Eyes with nictitating membrane, 9.2 in head, midway between snout end and first gill opening. Preoral 1.2 in width of mouth, equal to distance between eye and first gill opening. Nostrils midway between mouth and snout end. Mouth 1.4 times as wide as long. Nasoral groove and cirri absent. Labial folds rudimentary or absent. Teeth in $\frac{25}{25}$ rows; oblique, broad, flat, serrated, externally notched in both jaws; lower ones narrower, erect. First dorsal origin opposite inner end of pectoral. Second dorsal smaller than anal: origin nearly above first half of anal base. Pectorals much smaller than head to first gill opening; inner margin of pectoral 3–4 in its outer margin. Subcaudal equal to distance between snout end and inner angle of pectoral. Caudal pits present. Pelvic origin nearer to subcaudal origin than to pectoral origin and further behind inner end of first dorsal. Last 2 gill openings above pectoral base.

Dull brown above, whitish beneath; fins grey; lower caudal lobe and pectorals tipped black.

Specimens measuring about 762 mm. have been recorded; pelagic.

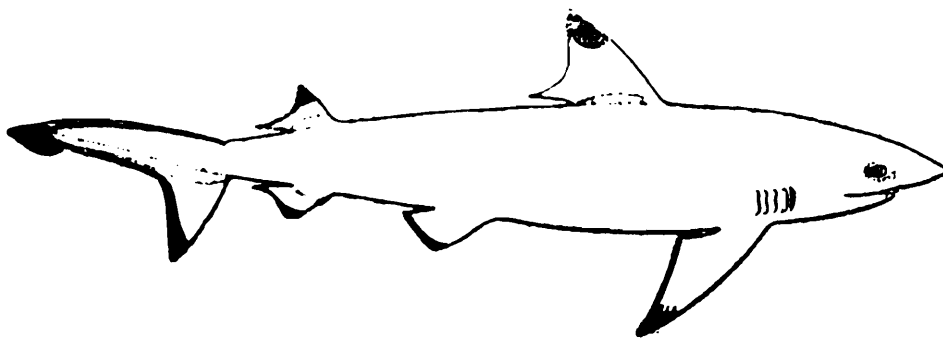
Distribution.—India, Pakistan.—Red Sea, Madagascar, Malay Peninsula, Indonesia, “Indo-China”, China, Philippines, Melanesia, Hawaii; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 25°N.—20°S., 46°E.—155°W in the Indo-Pacific=(25°N.—20°S., 39°—100°E. in the Indian Ocean+ 22°N.—7°S., 103°E.—155°W. in the Pacific Ocean).

37. *Carcharhinus spallanzani* (Le Sueur)

(Text-fig. 23)

1822. *Squalus spallanzani* Le Sueur, *J. Acad. nat. Sci. Philadphilad*, 2, pt. 2, p. 351 (type locality : Terre de Witt, New Holland).
1824. *Carcharias melanopterus* Quoy & Gaimard, *Voy. "Uranie," Zool.*, pts. 5-6, p. 194, pl. 42, figs. 1-2 (type locality : Ile Vaigion (Oceania); the holotype and the paratopotypes from Ile Vaigior, Nouvelle Guinee and Ile Vanicoro respectively are in the Paris Museum).
1860. *Squalus (Carcharinus) melanopterus* Blyth, *J. Asiat. Soc. Bengal*, 29, p. 36 (Calcutta).
1865. *Prionodon melanopterus* Day, *Fish. Malabar*, p. 269 (Malabar).
1878. *Carcharias melanopterus* Day, *Fish. India*, p. 715, pl. 185, fig. 3 (the example figured, a female 42 inches long, was from the Andamans),
1889. *Carcharias melanopterus* Day, *Fauna Brit. India, Fish.*, 1, p. 14 (Calicut).
1899. *Carcharias elegans* Hilgendorf, *Symbol. Physic. Hemprich-Ehrenberg*, p. 7, pl. 4, fig. 2 (type locality : Red Sea).
1901. *Carcharhinus melanopterus* Jordan & Snyder, *Annot. Zool. Japan*, 3, p. 38 (Nagasaki).
1910. *Carcharias melanopterus* De, *Rep. Fish. Eastern Bengal & Assam*, p. 17 (Chittagong).
1913. *Carcharias (Prionodon) melanopterus* Weber, "*Siboga*" *Exped. Fische*, 57, p. 590 (Makassar Strait : Aru Is.).
1922. *Carcharinus melanopterus* Hora, *Mem. Indian Mus.*, 5, p. 763 (Chilka Lake).
1929. *Carcharias melanopterus* Pillay, *J. Bombay nat. Hist. Soc.*, 33, p. 350 (Travancore).
1931. *Carcharias melanopterus* Chu, *Biol. Bull. St. John's Univ.*, No 1, p. 5 (China).
1933. *Eulamia melanoptera* Deraniyagala, *Ceylon J. Sci. (c)*, 5, p. 80 (Ceylon).
1936. *Carcharinus (Prionodon) melanopterus* Suvatti, *Index Fish. Siam*, p. 2 (Gulf of Siam).
1938. *Eulamia melanopterus* Fowler, *List Fish. Malaya*, p. 9 (Straits of Malacca, Singapore).
1940. *Mapolamia spallanzani* Whitley, *Fish. Australia*, 1, p. 94.
1941. *Eulamia melanoptera* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 158.
1941. *Carcharinus melanopterus* Herre, *Mem. Indian Mus.*, 13, p. 332 (Andamans).
1942. *Carcharinus melanopterus* Sarangdhar, *Ind. J. med. Rés.*, p. 556 (Bombay).
1949. *Carcharhinus melanopterus* Misra, *Rec. Indian Mus.*, 45 (1947), p. 18.

1952. *Carcharhinus melanopterus* Misra, *Rec. Indian Mus.*, 49 (1951), p. 108.
1953. *Carcharias melanopterus* Herre, *Check List Philippine Fish.* p. 19.
1953. *Carcharhinus melanopterus* Smith, *Sea Fish. S. Africa*, p. 41 (Natal).
1955. *Eulamia melanopterus* Munro, *Mar. Freshwater Fish. Ceylon*, p. 9.
1955. *Eulamia spallanzani* Munro, *Mar. Freshwater Fish. Ceylon*, p. 9.
1958. *Carcharhinus melanopterus* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 80.



TEXT-FIG. 23.—Lateral view of *Carcharhinus spallanzani* (Le Sueur)
 $1 \times \frac{1}{12}$ (After F. Day)

Vernacular names.—INDIA: *Caval sorrah*, *Nella vekal sorrah*, *Raman sorrah*, *Mukhan sorrah*, *Boka sorrah* or *Ran sorrah*, Telegu; Standardised name: *Mokkan sura*. PAKISTAN: *Hungur*, Chittagong; *Kanatyān*, Sind & Makran. BURMA: *Nga man toungme*, Arrakan. CEYLON: *Kundu mora* or *Perunthalaya*, Sinhalese; *Perunthalai schura*, Tamil.

Head 4.5; depth 5.3 to subcaudal origin. Snout rounded, very obtuse, 2.6 in head. Eyes with nictitating membrane, 8.0 in head, nearer to snout end than to first gill opening. Preoral $\frac{2}{3}$ the width of mouth and much less than the distance between eye and the first gill opening. Nostrils nearer to snout end than to mouth. Nasoral grooves and cirri absent. Short labial folds at corners of mouth. Teeth in $\frac{25}{25}$ rows; erect, narrow, flat, distinctly serrated in upper, minutely serrated in lower. First dorsal origin behind inner end of depressed pectoral. Second dorsal subequal with anal; origin opposite to anal origin. Pelvic origin a little nearer to subcaudal origin than to pectoral origin and behind inner end of first dorsal. Pectorals equal to head to last gill opening; inner margin of pectoral 4.0 in its outer margin. Subcaudal equal to head to 3rd gill

opening. Last 2 gill openings above pectoral base. Caudal pits present.

Brown or bluish grey above becoming dull white below; ends of all fins deep black.

It attains a length of 3,048 mm.; its liver oil is exceedingly rich in vitamin contents. Viviparous; fights well when hooked; pelagic.

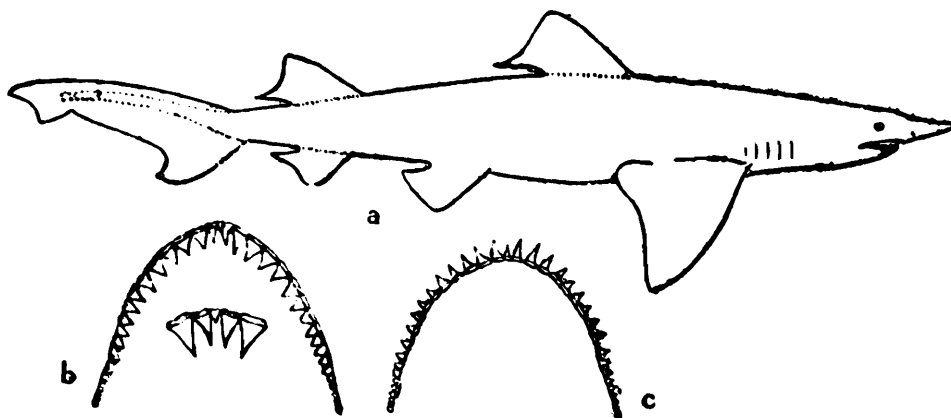
Distribution.—India, Pakistan, Burma, Ceylon.—Red Sea, S. Africa, Arabia, Malay Peninsula, Java, Amboina, Thailand, “Indo-China”, China, Japan, Philippines, Melanesia, Micronesia, Polynesia, Hawaii; in the mean annual isotherm of 20° C. with the latitudinal and the longitudinal range of 35°N.—29°S., 30°E.—155°W. in the Indo-Pacific=(25°N.—29°S., 30°—102°E. in the Indian Ocean+35°N.—12°S., 101°E.—155°W in the Pacific Ocean.)

38. *Carcharhinus temminckii* (M. & H.)

(Text-fig. 24)

1841. *Carcharias* (*Prionodon*) *temminckii* Müller & Henle, *Syst. Besch. Plagiost.*, p. 48, pl. 18 (type locality : Pondicherry).
1860. *Squalus* (*Carcharinus*) *temminckii* Blyth, *J. Asiat. Soc. Bengal*, **29**, p. 36 (Calcutta).
1870. *Carcharias temminckii* Günther, *Cat. Fish. Brit. Mus.*, **8**, p. 374 (Calcutta).
1876. *Carcharias* (*Prionodon*) *temminckii* Martens, *Preuss. Exped. Ost-Asien*, **1**, p. 409 (Makassar Straits).
1878. *Carcharias temminckii* Day, *Fish. India*, p. 717 (India).
1889. *Carcharias temminckii* Day, *Fauna Brit. India, Fish.*, **1**, p. 17 (India).
- 1889-90. *Carcharias temminckii* Vinciguerra, *Ann. Mus. Civ. Stor. nat. Genova*, **29**, p. 160 (Rangoon).
1913. *Carcharinus temminckii* Garman, *Mem. Harv. Mus. Comp. Zool.*, **36**, p. 142 (Indian Seas).
1941. *Eulamia temminckii* Fowler, *Bull. U.S. nat. Mus.*, (100) **13**, p. 176.
1946. *Carcharinus* sp. ?, Setna & Sarangdhar, *Proc. nat. Inst. Sci. India*, **12**, p. 253 (Bombay).
1949. *Carcharhinus temminckii* Misra, *Rec. Indian Mus.*, **45** (1947), p. 20.

1952. *Carcharhinus temminckii* Misra, *Rec. Indian Mus.*, 49 (1951), p. 107.
 1958. *Carcharhinus temminckii* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 82.



TEXT-FIG. 24.—*Carcharhinus temminckii* (M. & H.)
 (a) Lateral view. (b) Upper jaw. (c) Lower jaw.
 (After J. Müller & F. Henle)

Vernacular names.—INDIA : *Tekkan sravu* or *Nedunthala*, Malayalam; *Koora sura* or *Neeti sura*, Tamil; Standardised name : *Neeti sura*.

Head 4.4; depth 6.6 to subcaudal origin. Snout 2.4 in head. Eyes with well developed nictitating membrane, 13.5 in head, nearer to snout end than to first gill opening. Preoral equals $\frac{4}{5}$ width of mouth. Labial folds short, around angles of mouth and in upper jaw. Nostrils nearer to mouth than to snout end. Nasoral grooves and cirri absent. Teeth in $\frac{29-38}{27-40}$ rows; in upper jaw broad, flat, triangular, serrated; in lower jaw awl-shaped, entire. First dorsal origin behind inner angle of depressed pectoral. Second dorsal larger than anal; origin slightly before anal origin. Pectorals equal to head to first gill opening; inner margin of pectoral 3.5 in its outer margin. Pelvic origin midway between subcaudal and pectoral origins, opposite lower (inner) end of dorsal. Last 2 gill openings above pectoral base. Subcaudal equal to head to 2nd gill opening. Caudal pits present.

Fawn above, whitish below.

Specimens up to 609 mm. in length have been recorded; pelagic.

Distribution.—India, Burma.—Macassar Strait, Celebes; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 18°N.—5°S., 72°—119°E. in the Indo-Pacific = (16°—18°N., 72°—96°E. in the Indian Ocean + 5°S., 119°E. in the Pacific Ocean).

18. Genus *Chaenogaleus* Gill

1852. *Hemigaleus* (*nec* Jourdain, 1837) Bleeker, *Verh. Bat. Gen. (Plagiost.)*, **24**, p. 45 (type, *Hemigaleus microstoma* Blkr., designated by Jordan, *Gen. Fish.*, pt. 2, 250, 1919).
1862. *Chaenogaleus* Gill, *Ann. Lyc. nat. Hist. New York*, **7**, p. 411 (type, *Hemigaleus microstoma* Blkr.).
1931. *Negogaleus* Whitley, *Austral. Zool.*, **6**, p. 334 (type, *Hemigaleus microstoma* Blkr., orthotypic).

Body slender; elongate. Trunk shorter than tail. Snout pointed. Eyes moderate with nictitating membrane. Nasoral grooves and cirri absent. Labial folds present. Spiracles minute, behind eyes. 5 pairs of gill openings. Two spineless dorsal fins. Anal fin present. Caudal pits present. Teeth dimorphous; upper inclined, with denticles on basal part of outer edge, lower erect and smooth.

Chaenogaleus balfouri (Day), is the only species of the genus found in India.

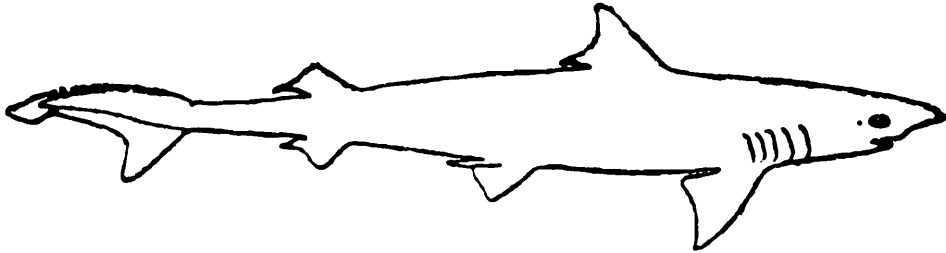
Distribution.—Tropical, Indian and Western Pacific Oceans.

39. *Chaenogaleus balfouri* (Day)

(Text-fig. 25)

1878. *Hemigaleus balfouri* Day, *Fish. India*, p. 717, pl. 185, fig. 4 (type locality: Waltair, Coromandel Coast).
1889. *Hemigaleus balfouri* Day, *Fauna Brit. India*, *Fish.*, p. 18, fig. 2 (Coromandel Coast).
1913. *Hemigaleus balfouri* Garman, *Mem. Harv. Mus. Comp. Zool.*, **36**, p. 152 (Coromandel Coast).
1941. *Hemigaleus balfouri* Fowler, *Bull. U.S. nat. Mus.*, (100) **13**, p. 184.
1949. *Hemigaleus balfouri* Misra, *Rec. Indian Mus.*, **45** (1947), p. 20.
1952. *Hemigaleus balfouri* Misra, *Rec. Indian Mus.*, **49** (1951), p. 109.
1955. *Hemigaleus balfouri* Anonymous, *Mar. Fish. Karachi, Sind & Makran*, p. 3 (Coasts of Sind and Makran).
1955. *Hemigaleus balfouri* Munro, *Mar. Freshwater Fish. Ceylon*, p. 5 (Ceylon).

1958. *Negogaleus balfouri* Misra & Menon, *Rev. Indian Mus.*, 53 (1955), p. 77.



TEXT-FIG. 25.—Lateral view of *Chaenogaleus balfouri* (Day): $\times ca \frac{1}{9}$.
(After F. Day)

Head 5.5; depth 7.1 to subcaudal origin. Snout 2.5 in head. Eyes closer to snout end than to first gill opening, with nictitating membrane, 5.5 in head. Preoral slightly more than width of mouth. No oronasal groove and cirri. Labial folds in both jaws. Nostrils nearer to mouth than to snout end. Teeth in $\frac{24}{24}$ rows; in upper jaw smooth, notched externally or with 3 denticulations on the outer side of the base; in lower jaw slightly smaller, erect, entire. Last 2 gill openings above pectoral base. First dorsal larger than second dorsal, midway between pelvic origin and end of pectoral base. Second dorsal rather larger than anal; origin a little before anal origin. Caudal pit present. Subcaudal equal to head to the first gill opening. Pectorals shorter than head.

Dark brown; fins grey, second dorsal tipped black.

It attains 826 mm. in length; pelagic.

Distribution.—India, Pakistan; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 4°—25°N., 62°—80°E., in the Indian Ocean.

19. Genus *Hemipristis* Agassiz

1833. *Hemipristis* Agassiz, *Poiss. Fossil.*, 1, p. 8; 3, pp. 237, 302, 1843 (type, *H. serra* Ag., logotypic).

1871. *Dirrhizodon* Klunzinger, *Verh. Zool. bot. Ges. Wien.*, 21, p. 644 (type, *D. elongatus* Klunzinger, orthotypic).

Body elongate, slender. Trunk shorter than tail. Snout rounded. Eyes moderate with nictitating membrane. Nasoral grooves and cirri absent. Labial folds present. Spiracles small, close behind eyes. 5 pairs of gill openings. Two spineless dorsal fins. Anal fin present. Caudal pit

present. Teeth dimorphous; upper teeth large, broad, flat, serrated; the lower smooth, slender, curved inwards.

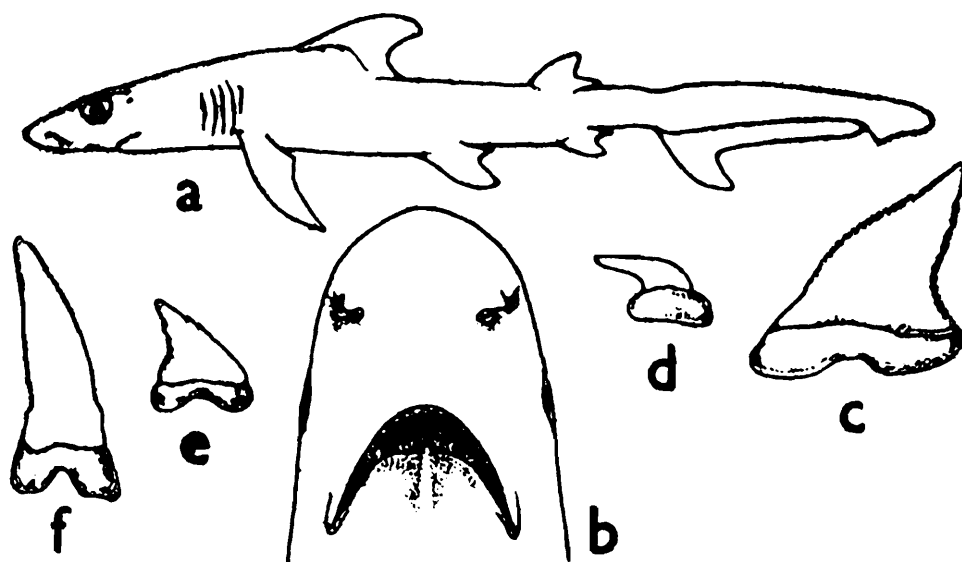
Distribution.—Red Sea, Ceylon, India.

Hemipristis elongatus (Klunzinger) is the only species of the genus found in India.

40. *Hemipristis elongatus* (Klunzinger)

(Text-fig. 26)

1871. *Dirrhizodon elongatus* Klunzinger, *Verh. Zool. bot. Ges. Wein.*, **21**, p. 665 (type locality: Red Sea).
 1938. *Hemipristis elongatus* Leriche, *Mem. Soc. Palae. Suisse*, **61**, pp. 11-18.
 1941. *Hemipristis elongatus* Fowler, *Bull U.S. nat. Mus.*, (100) **13**, p. 193.
 1946. *Hemipristis pingali* Setna & Sarangdhar, *Proc. nat. Inst. Sci. India*, **12**, No. 5, p. 253 (type locality : Bombay waters).
 1950. *Hemipristis elongatus*, Setna & Sarangdhar, *Rec. Indian Mus.*, **47** (1949), p. 128, text-fig. 3, pl. 11, fig. 1 (Bombay).
 1952. *Hemipristis elongatus* Misra, *Rec. Indian Mus.*, **49** (1951), p. 109.
 1957. *Hemipristis elongatus* Smith, *Ann. Mag. nat. Hist.*, (12) **10**, p. 555, fig. 1 (Zanzibar City).



TEXT-FIG. 26.—*Hemipristis elongatus* (Klunzinger)

(a) Lateral view: $\times \frac{1}{6}$. (b) Ventral view of head: $\times \frac{1}{3}$. (c) Lateral tooth of upper jaw: $\times 1\frac{1}{3}$. (d) Median tooth of upper jaw: $\times 1\frac{1}{3}$. (e) Lateral tooth lower jaw: $\times 1\frac{1}{3}$. (f) Median tooth of lower jaw: $\times 1\frac{1}{3}$. (After S. B. Setna & P. N. Sarangdhar)

Head moderately depressed, 5.5—6.0; depth 6.5—7.0 to subcaudal. Snout rounded, little wider than long, 3.5—4.0

in head. Eyes moderate with nictitating membrane, nearer to snout end than to first gill opening, 4.5 in interorbital, 3.7 in preoral. Nostrils midway between the apex of mouth and snout end. Nasoral grooves and cirri absent. Labial folds in both jaws. D.F. $\frac{26-28}{36}$, dimorphic in both jaws; several rows of teeth functional; no median symphyseal teeth in both jaws. In upper jaw, slender, pointed, awl shaped, non-serrated teeth in one or two of the most medial rows; flat, triangular and serrated in lateral rows. In lower jaw elongate, subcylindrical, claw-shaped, non-serrated teeth in the medial rows; teeth flattened out becoming distinctly deflected outwardly and developing more serrations on their outer margins; all teeth of both jaws with swollen and bifid bases. Spiracles very small, $\frac{1}{5}$ the eye diameter and about $\frac{3}{4}$ eye diameter behind eye. 5 pairs of gill openings; gill openings large, about thrice eye diameter, the first four subequal, the last slightly smaller and above pectoral base. First dorsal origin behind inner angle of pectorals. Second dorsal before anal origin. Pectorals equal to head, much nearer to snout end than to pelvic origin. Pelvics moderate, 1.5 in head; origin behind end of dorsal, nearer to pectoral origin than to subcaudal. Anal a little smaller than second dorsal, origin below middle of second dorsal base. Upper lobe of caudal 2.5 times the lower; subcaudal notched posteriorly. Upper caudal pit distinct, lower not so conspicuous. Cloaca midway between snout and caudal ends. Scales with 3—5 keels.

Black slaty grey becoming white beneath; fins grey, anal tipped white.

It attains 2.30 metres in length; viviparous; pelagic.

Distribution.—India.—Red Sea; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 18°—20°N., 39°—72°E.

20. Genus *Galeocerdo* M. & H.

1837. *Galeocerdo* Müller & Henle, *Sitz. Ber. preuss. Akad. Wiss. Berlin*, p. 115 (type, *Squalus arcticus* Faber, monotypic).
 1854. *Galeodes* (*nec* Olivier, 1791 or Bolten, 1798) Heckel, *Sitz. Ber. Akad. Wiss. Wien. math-nat. Kl.*, 11, p. 324 (type, *G. priscus* Heckel, monotypic) (fossil).
 1862. *Boreogaleus* Gill, *Ann. Lyc. nat. Hist. New York*, 7, pp. 402, 411 (type, *Squalus arcticus* Faber, orthotypic).

Body elongate. Head depressed. Trunk more or less equal to tail. Snout wide, short. Eyes moderate with nictitating membrane. Nasoral grooves and cirri absent. Labial

folds present on both jaws. Spiracles small, behind eyes. 5 pairs of gill openings. Two spineless dorsal fins. Anal fin present. Teeth large, flat, triangular, notched, oblique, serrated on both edges.

Distribution.—Arctic, Temperate and Tropical Seas.

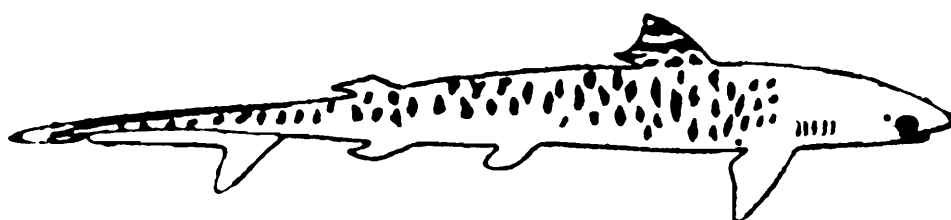
Galeocerdo cuvier (Le Sueur) is the only species of the genus found in India and Ceylon.

41 *Galeocerdo cuvier* (Le Sueur)

(Text-fig. 27)

1822. *Squalus cuvier* Le Sueur, *J. Acad. nat. Sci. Philad.*, 2, p. 351 (type locality : North west coast of New Holland).
1841. *Galeocerdo tigrinus* Müller & Henle, *Syst. Besch. Plagiost.*, p. 59, pl. 23 (type locality : India, Pondicherry).
1871. *Galeocerdo obtusus* Klunzinger, *Verh. Zool. bot. Ges. Wien*, 21, p. 664 (type locality : Kosier, Red Sea).
1878. *Galeocerdo tigrinus* Day, *Fish. India*, p. 718 (Red Sea, India, Japan).
1878. *Galeocerdo rayneri* (nec Mac Donald & Barrow) Day, *Fish. India*, p. 718, pl. 187, fig. 3 (India).
1889. *Galeocerdo tigrinus* Day, *Fauna Brit. India*, Fish., 1, p. 21, fig. 3 (Red Sea, Seas of India to Japan and beyond).
1889. *Galeocerdo rayneri* (nec Mac Donald & Barrow) Day, *Fauna Brit. India*, Fish., 1, p. 20 (Indian Seas; Australian Seas).
1899. *Galeocerdo hemprichii* Hilgendorf, *Symbol. Physic. Hemprich-Ehrenberg*, p. 8, pl. 5, fig. 3 (type locality : Red Sea).
1903. *Galeocerdo tigrinus* Jordan & Fowler, *Proc. U.S. nat. Mus.*, 26, p. 612 (Nagasaki).
- 1912-13. *Galeocerdo tigrinus* Southwell, *Ceylon Administr. Rep.*, pp. E 46, E 49.
1913. *Galeocerdo arcticus* (nec Faber) Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 148, pl. 43, figs. 6-8.
1928. *Galeocerdo arcticus* (nec Faber) Fowler, *Mem. Bishop Mus.*, 10, p. 19, fig. 5 (Honolulu, Laysan, Nihoa).
1929. *Galeocerdo rayneri* (nec Mac Donald & Barrow) Pillay, *J. Bombay nat. Hist. Soc.*, 33, p. 350 (Travancore).
1938. *Galeocerdo arcticus* (nec Faber) Fowler, *List Fish. Malaya*, p. 10 (Malay Peninsula).

1941. *Galeocerdo cuvier* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 186 (Galapagos and California).
1942. *Galeocerdo tigrinus* Sarangdhar, *Ind. J. med. Res.*, 30, p. 556 (Bombay).
1949. *Galeocerdo arcticus* (nec Faber) Misra, *Rec. Indian Mus.*, 45 (1947), p. 21.
1952. *Galeocerdo arcticus* (nec Faber) Misra, *Rec. Indian Mus.*, 49 (1951), p. 111.
1953. *Galeocerdo arcticus* (nec Faber) Herre, *Check List Philippine Fish.*, p. 21.
1953. *Galeocerdo cuvier* Smith, *Sea Fish. S. Africa*, p. 44 (S. Africa).
1955. *Galeocerdo rayneri* (nec Mac Donald & Barrow) Anonymous, *Mar. Fish. Karachi, Sind & Makran*, p. 3 (Coasts of Sind and Makran).
1955. *Galeocerdo cuvieri* Munro, *Mar. Freshwater Fish. Ceylon*, p. 5 (Ceylon).
1958. *Galeocerdo arcticus* (nec Faber) Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 79.
1958. *Galeocerdo cuvieri* Briggs., *Bull. Florida Mus. Biol. Sci.*, 2, No. 8, p. 248 (Gulf of Mexico).



TEXT-FIG. 27.—Lateral view of *Galeocerdo cuvier* (Le Sueur). (After F. Day)

Vernacular names.—INDIA : *Pulliravu*, Malabar; *Wagh-beer*, Marathi; *Wulluven sorrah*, Tamil; *Kethulam*, Telegu; Standardised name: *Pulli sura*. PAKISTAN: *Kori*. CEYLON: *Koti mora* or *Thalagoi mora*, Sinhalese; *Pulli schura*, Tamil.

Head 5.5; depth 7.7 to subcaudal origin. Snout obtuse, depressed, 3.3 in head. Eyes with nictitating membrane, 5.8 in head, nearer to snout end than to first gill opening. Preoral less than width of mouth. Labial folds in both jaws, larger in upper jaw. Nasoral grooves and cirri absent. Nostrils with flaps, nearer to snout end than to mouth, large cockscomb-shaped. Teeth in $\frac{21-23}{23}$ rows; compressed, serrated, notched externally above base, in lower jaw not so large as in upper. First dorsal origin just behind pectoral base or above the angle of pectoral. Second dorsal slightly before and subequal with anal. Pectorals smaller

than head, with the last 2 gill openings above their base. Subcaudal 1.5 times as long as head to first gill opening. No caudal pit.

It attains a length of 4,520 mm. and a weight of about 1,016 k. gms.; it yields good liver oil; pelagic.

Distribution.—India, Pakistan, Ceylon.—Red Sea, Natal, S. Africa, Arabia, Malaya, Java, “Indo-China”, China, Japan, Philippines, Australia, Melanesia, Hawaii, Galapagos, California; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 35°N.—29°S., 30°E.—111°W. in the Indo-Pacific=(25°N.—29°S., 30°—120°E. in the Indian Ocean+35°N.—7°S., 103°E.—111°W. in the Pacific Ocean); 19°N., 90°W. in the Atlantic Ocean.

21. Genus *Mustelus* Linck

1768. *Mustelus* Valmont, *Dict. Hist. nat. Poiss.*, 3, p. 138 (type, *Galeus stellatus* Valmont=*Squalus mustelus* L.; inadmissible according to Opinion 89 of the International Commission of Zoological Nomenclature).
1790. *Mustelus* Linck, *Mag. Phys. Naturg. Gotha*, (3) 6, p. 31 (type, *Squalus mustelus* L., monotypic).
1813. *Mustellus* Fischer-Waldheim, *Zoognosta*, ed. 3, 1, p. 78 (type, *Squalus mustelus* L.).
1848. *Myrnillo* Gistel, *Naturg. Theirreichs*, p. x (type, *Squalus mustelus* L.).
1864. *Pleuracromylon* Gill, *Proc. Acad. nat. Sci. Philad.*, p. 148 (type, *Mustelus laevis* Risso, orthotypic).
1903. *Cynias* Gill, *Proc. U.S. nat. Mus.*, 25, p. 960 (type, *Squalus canis* Mitchill, orthotypic).

Body elongate, fusiform. Trunk more or less equal to tail. Snout produced, pointed. Eyes moderate with nictitating membrane. Nasoral grooves and cirri absent. Well developed labial fold at each angle of mouth. Spiracles small, behind eyes. 5 pairs of gill openings. Two spineless dorsal fins. Anal fin present. Caudal pit absent. Teeth monomorphous, polyserial, pavement-like, smooth, obtuse, devoid of distinct cusps.

Distribution.—Atlantic, S. Africa, Red Sea, India, “Indo-China”, Korea, Japan, Australia, Tasmania, New Zealand.

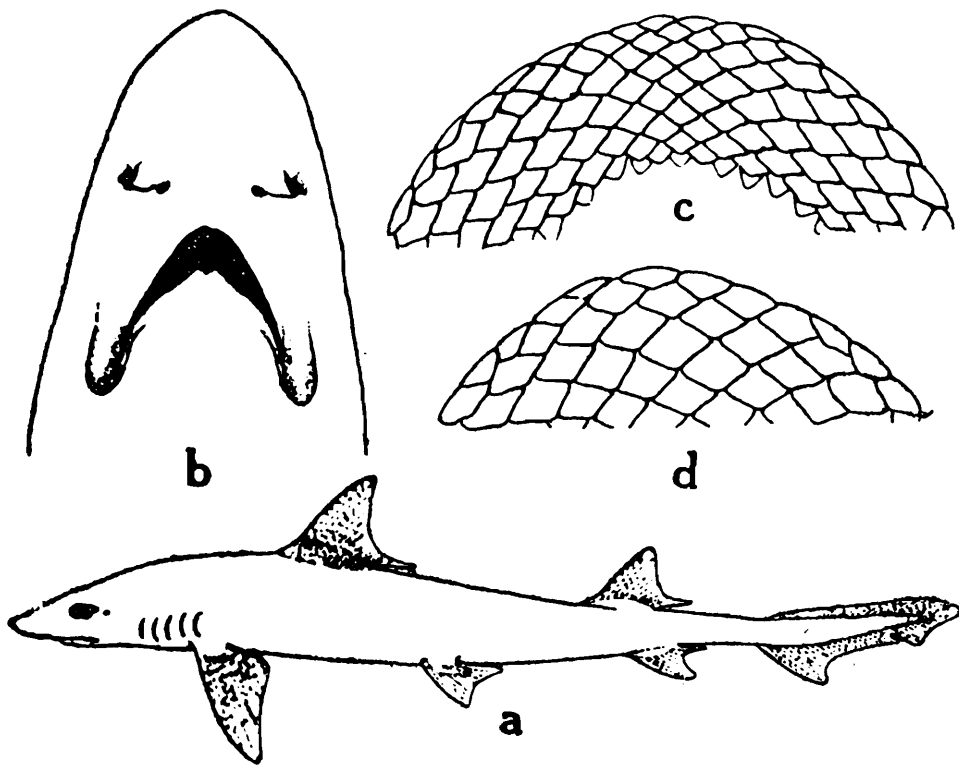
Mustelus manazo Blkr., is the only species of the genus found in India and Ceylon.

42. *Mustelus manazo* Blkr.

(Text-fig. 28)

1857. *Mustelus manazo* Bleeker, *Verh. Bat. Gen. (Japan)*, 26, pp. 42, 126 (type locality : Nagasaki).
1870. *Mustelus manazo* Günther, *Cat. Fish. Brit. Mus.* 8, p. 387 (Japan, Ceylon).

1878. *Mustelus manazo* Day, *Fish. India*, p. 720, pl. 186, fig. 3 (Kurrachee).
 1889. *Mustelus manazo* Day, *Fauna Brit. India, Fish.*, 1, p. 24 (India, Japan).
 1931. *Cynias manazo* Chu, *Biol. Bull. St. John's Univ.*, No. 1, p. 19 (Amoy, Ningpo).
 1933. *Mustelus manazo* Sorley, *Mar. Fish. Bombay Presidency*, p. 159 (Bombay).
 1934. *Mustelus manazo* Fowler, *Proc. Acad. nat. Sci. Philad.*, 86, p. 408 (Natal).
 1938. *Mustelus manazo* Fowler, *List Fish. Malaya*, p. 10 (Malay Peninsula).
 1941. *Mustelus manazo* Fowler, *Bull. U.S. nat. Mus.*, (100) 13 p. 205.



TEXT-FIG. 28.—*Mustelus manazo* Blkr.

(a) Lateral view : $\times ca \frac{1}{2}$. (b) Ventral view of head : $\times ca \frac{1}{2}$.

(c) Upper jaw : $\times ca 6\frac{1}{2}$. (d) Lower Jaw : $\times ca 3\frac{2}{3}$.

(After K. S. Misra)

1949. *Myrmillo manazo* Misra, *Rec. Indian Mus.*, 45 (1947), p. 22.
 1952. *Myrmillo manazo* Misra, *Rec. Indian Mus.*, 49 (1941), p. 111.
 1952. *Cynias manazo* Mori, *Mem. Hyogo Univ. Agric.*, 1, No. 3, p. 19 (Korea).
 1953. *Mustelus manazo* Smith, *Sea Fish. S. Africa*, p. 45.
 1955. *Mustelus manazo* Anonymous, *Mar. Fish. Karachi, Sind & Makran*, p. 3 (Coasts of Sind and Makran).
 1955. *Myrmillo manazo* Munro, *Mar. Freshwater Fish. Ceylon* p. 5 (Ceylon).
 1958. *Mustelus manazo* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 82.

Vernacular names.—INDIA: *Kajari magar*, Marathi; *Pal sorrah*, Telegu. PAKISTAN: *Mangra*, Sind & Makran.

Head 6; depth 7 to subcaudal origin. Snout produced, pointed, 2.1 in head. Eyes with nictitating membrane, 4.1 in head, more or less in the middle of head. Mouth about 1.4 times as broad as long. Labial folds in both jaws. Nasoral grooves and cirri absent. Nostrils nearer to mouth than to snout end. Teeth in $\frac{48}{40}$ rows; similar in jaws, pavement-like, smooth, without any distinct cusps. First dorsal origin opposite posterior end of the base of pectorals. Second dorsal origin before anal origin. Anal smaller than second dorsal. Pectorals equal to or a little smaller than head, with the last gill openings above their base. Subcaudal as long as head to the 3rd gill opening. No caudal pit.

Reddish grey above, dull white below.

It attains 1,520 mm. in length; sluggish; littoral.

Distribution.—India, Pakistan, Ceylon.—Natal, S. Africa, “Indo-China”, China, Korea, Japan; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 35°N.—29°S., 30°—130°E. in the Indo-Pacific=(25°N.—29°S., 30°—100°E. in the Indian Ocean+1°—35°N., 103°—130°E. in the Pacific Ocean).

22. Genus *Triaenodon* M. & H.

1837. *Triaenodon* Müller & Henle, *Sitz. Ber. preuss. Akad. Wiss. Berlin*, p. 117 (atypic; type, *Carcharias obesus* Rüpp., designated by Jordan, *Gen. Fish.*, p. 192, 1919).

Body elongate. Trunk longer than tail. Snout short, rounded. Eyes moderate with nictitating membrane. Nasoral grooves and cirri absent. Labial folds short, not extending along the jaws. Spiracles absent. 5 pairs of gill openings. Two spineless dorsal fins. Anal fin present. Caudal pit present. Subcaudal well developed. Teeth minute, numerous in both jaws, with central and lateral cusps.

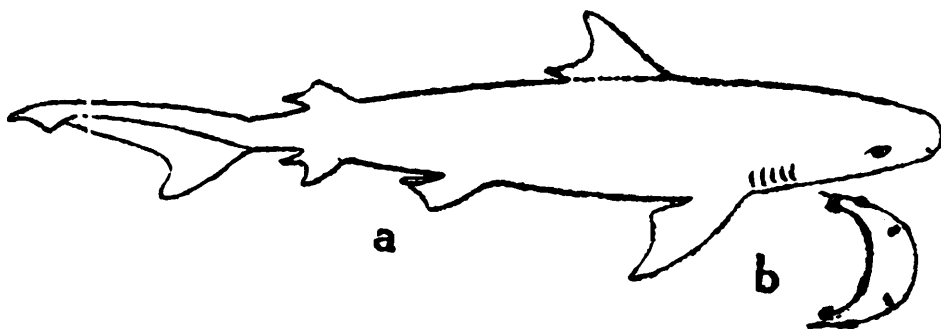
Distribution.—Red Sea, Arabia, India, Ceylon, Indonesia, Philippines, Melanesia, Polynesia, Hawaii.

Triaenodon obesus (Rüpp.), is the only species of the genus found in India and Ceylon.

43. *Triaenodon obesus* (Rüpp.)

(Text-fig. 29)

1837. *Carcharias obesus* Rüppell *Neue Wirbelth. Fische*, p. 64, pl. 18, fig. 2 (type locality : Djedda, Red Sea).
 1841. *Triaenodon obesus* Müller & Henle, *Syst. Besch. Plagiost.*, p. 55, pl. 20 (Indian Ocean, Red Sea).
 1878. *Triaenodon obtusus* Day, *Fish. India*, p. 720, pl. 189, fig. 3 (type locality : Kurrachee).
 1889. *Triaenodon obtusus* Day, *Fauna Brit. India*, Fish., 1, p. 25 (Kurrachee).
 1908. *Eulamia odontaspis* Fowler, *Proc. Acad. nat. Sci. Philad.*, p. 63, fig. 2 (type locality : probably Indian Ocean).
 1910. *Triaenodon obesus* Günther, *J. Mus. Godeffroy*, pt. 17, p. 482 (Macassar).
 1913. *Triaenodon obesus* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 163 (Kurrachee, India).
 1914. *Triaenodon obtusus* Pearson, *Ceylon Administr. Rep.*, p. E 4.
 1925. *Triaenodon obesus* Fowler & Ball, *Bull. Bishop Mus.*, 26, p. 4 (Laysan, Lisiansky, Wake Is.).
 1928. *Triaenodon obesus* Fowler, *Mem. Bishop Mus.*, 10, p. 12, fig. 7 (Laysan).
 1941. *Triaenodon obesus* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 194.
 1949. *Triaenodon obesus* Misra, *Rec. Indian Mus.*, 45 (1947), p. 22.
 1952. *Triaenodon obesus* Misra, *Rec. Indian Mus.*, 49 (1951), p. 111.
 1953. *Triaenodon obesus* Herre, *Check List Philippine Fish.*, p. 2 (Philippines).
 1955. *Triaenodon obesus* Anonymous, *Mar. Fish. Karachi, Sind & Makran*, p. 4 (Coasts of Sind and Makran).
 1955. *Triaenodon obesus* Munro, *Mar. Freshwater Fish. Ceylon*, p. 6 (Ceylon).
 1958. *Triaenodon obesus* Misra & Menon, *Rec. Indian Mus.*, 5 (1955), p. 80.

TEXT-FIG. 29.—*Triaenodon obesus* (Rüpp.)(a) Lateral view: $\times ca \frac{1}{5}$. (b) Ventral view of head: $\times ca \frac{1}{5}$.

(After F. Day)

Vernacular name.—PAKISTAN : *Mangra*, Sind and Makran.

Head depressed; 4.6; depth 5.7 to subcaudal origin. Snout short, rounded, 3.0 in head. Eyes with nictitating

membrane, 5.8 in head, nearer to snout end than to first gill opening. Preoral a little more than twice in width of mouth. Mouth broadly arched, 3 times as broad as long. Labial folds short, not extending along jaws. Nasoral grooves and cirri absent. Nostrils each with flaps nearer snout end than to mouth. Spiracles absent. Teeth minute, numerous rows about 45 in both jaws, each with a central and a small lateral cusp on each side. First dorsal origin behind or opposite inner angle of pectoral. Second dorsal opposite anal. Second dorsal and anal somewhat equal. Pectorals equal to head, with the last gill opening above their base. Subcaudal equal to head to the last gill opening. Caudal pits present.

Dark grey above becoming lighter beneath.

Specimens measuring 286 mm. in length have been recorded; pelagic.

Distribution.—Pakistan, Ceylon.—Red Sea, Seychelles, Madagascar, Indonesia, Philippines, Melanesia, Polynesia, Hawaii; in the mean annual isotherm of 20°C., with the latitudinal and longitudinal range of 25°N.—20°S., 39°E., —155°W. in the Indo-Pacific=(25°N.—20°S., 39°—80°E., in the Indian Ocean+20°N.—12°S., 119°E.—155°W in the Pacific Ocean).

VII. Family SPHYRNIDAE

Hammer-head Sharks

Body elongate, compressed behind head. Head depressed, with oculonarial expansion on either side. Eyes with nictitating membrane. Mouth arched. Oronasal grooves and cirri absent. Teeth similar in both jaws, single cusped, sharp-edged, oblique. Spiracles absent. Last gill opening above or anterior to pectoral base. First dorsal large, in front of pelvics. Second dorsal and anal small. Caudal pit present. Subcaudal slightly produced. Viviparous.

Eocene to Recent.

The family SPHYRNIDAE is represented by a single genus in the Indian region.

23. Genus *Sphyrna* Rafinesque

- 1792. *Cestracion* (Klein) Walbaum, *Artedi pisc.*, 3, p. 580 (type, *Squalus zygaena* L., logotypic; inadmissible according to opinion 21 of the International Commission of the Zoological Nomenclature).
- 1810. *Sphyrna* Rafinesque, *Ind. Itt. Sicilliana*, pp. 46, 60 (type, *Squalus zygaena* L., logotypic).
- 1811. *Sphyrnias* Rafinesque, *Anal. de la nature*, p. 93 (type, *Squalus zygaena* L.).

1816. *Cestrorhinus* Blainville, *Bull. Soc. philom. Paris*, 8, p. 121 (type, *Squalus zygaena* L., logotypic).
 1817. *Zygaena* (*nec* Fabricius, 1775) Cuvier, *Règne Animal.*, 2, p. 27 (type, *Squalus zygaena* L., tautotypic).
 1826. *Zygaena* Risso, *Hist. nat. Europe merid. Poiss*, 3, p. 125 (type, *Squalus zygaena* L.).
 1828. *Sphyrichthys* Thienemann, *Lehrb. Zool.*, p. 408 (type, *Squalus zygaena* L.).
 1839. *Platysqualus* Swainson, *Nat. Hist. Animal.*, 2, p. 318 (type, *Squalus tiburo* L., orthotypic).
 1839. *Zygaena* Swainson, *Nat. Hist. Animal.*, 2, p. 318 (type, *Zygaena laticeps* Cantor, monotypic).
 1862. *Eusphyr*a Gill, *Ann. Lyc. nat. Hist. New York*, 7, pp. 408, 412 (type, *Zygaena blochii* C., orthotypic).
 1862. *Reniceps* Gill, *Ann. Lyc. nat. Hist. New York*, 7, pp. 403, 412 (type, *Squalus tiburo* L., orthotypic).

Body elongate, head T-shaped, forming oculonarial expansions on either side. Trunk behind head compressed. Eyes moderate with nictitating membrane; situated at the oculonarial extremities. Nasoral grooves and cirri absent. Labial folds rudimentary. Spiracles absent. 5 pairs of gill openings. Two spineless dorsal fins. Anal fin present. Caudal pit present. Subcaudal lobe produced. Teeth monomorphic, oblique, notched, serrated or non-serrated. Viviparous.

Distribution.—Atlantic Ocean, Mediterranean Sea, Indian Ocean, Indonesia.

Key to species

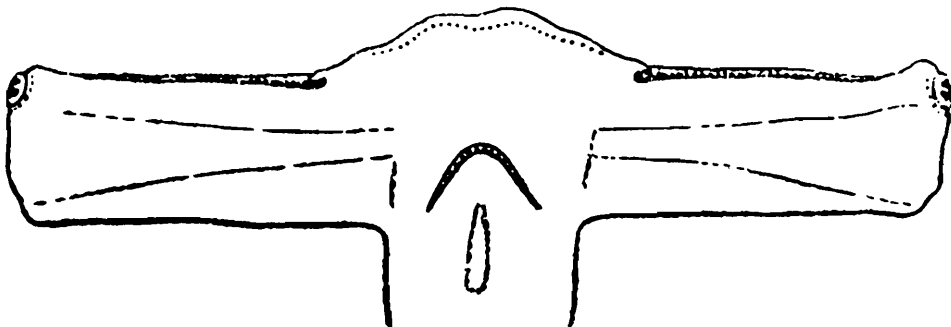
- | | | |
|---|------|-------------------------------|
| 1. A groove along the front edge of head | 3 | |
| 2. No groove along the front edge of head | | <i>S. mokarran</i>
(Rüpp.) |
| 3. Eyes and nostrils not widely separated
(oculonarial expansions short) | .. 5 | |
| 4. Eyes and nostrils widely separated (oculonarial expansions long) | | <i>S. blochii</i> (C.) |
| 5. Anterior edge of oculonarial expansions curved | | <i>S. tudes</i> (V.) |
| 6. Anterior edge of oculonarial expansions straight | | <i>S. zygaena</i> (L.) |

44. *Sphyrna blochii* (C.)

(Text-fig. 30)

1817. *Zygaena blochii* Cuvier, *Règne Animal*, 2, ed. 1, p. 127.
 1837. *Zygaena laticeps* Cantor, *Quart. med. J. Calcutta*, p. 315, pls. 1-3 (type locality : Calcutta).
 1852. *Sphyrna blochii* Bleeker, *Verh. Bat. Gen. (Plagiost.)*, 24, p. 41, pl. 3 fig. 7 (Batavia, Tegal, Samarang, Surabaya, Kammal).
 1860. *Sphyrnias blochii* Blyth, *J. Asiat. Soc. Bengal*, 29, p. 35, (Calcutta).

1870. *Zygaena blochii* Günther, *Cat. Fish. Brit. Mus.*, **8**, p. 380 (Calcutta).
1878. *Zygaena blochii* Day, *Fish. India*, p. 719, pl. 184, fig. 4 (India; Malay Archipelago ; Malabar).
1889. *Zygaena blochii* Day, *Fauna Brit. India*, Fish., **1**, p. 22 (Malabar Coast).
1907. *Zygaena blochii* Gupta, *Extract Preliminary Rep. Fish. Bengal in Collection of papers Fishery Survey of Bengal*, p. 2 (Bengal).
- 1915-18. *Zygaena blochii* Pearson, *Ceylon Administr. Rep.*, p. F 9.
1928. *Sphyrna blochii* Fowler, *J. Bombay. nat. Hist. Soc.*, **33**, p. 101 (Bombay).
1933. *Zygaena blochii* Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
1936. *Cestracion blochi* Suvatti, *Index Fish. Siam*, p. 3 (Gulf of Siam).
1938. *Sphyrna blochii* Fowler, *List Fish. Malaya*, p. 11 (Penang, Singapore).
1941. *Sphyrna blochi* Herre, *Mem. Ind. Mus.*, **13**, p. 333 (Andamans).
1942. *Cestracion blochii* Sarangdhar, *Ind. J. med. Res.*, **30**, p. 557 (Bombay).
1949. *Sphyrna blochii* Misra, *Rec. Indian Mus.*, **45** (1947), p. 22.
1952. *Sphyrna blochii* Misra, *Rec. Indian Mus.*, **49** (1951), p. 112.
1953. *Sphyrna blochi* Herre, *Check List Philippine Fish.*, p. 26.
1955. *Zygaena blochii* Anonymous, *Mar. Fish. Karachi, Sind & Makran*, p. 5 (Coasts of Sind and Makran).
1955. *Sphyrna blochii* Munro, *Mar. Freshwater Fish. Ceylon*, p. 7 (Ceylon).
1958. *Sphyrna blochii* Misra & Menon, *Rec. Indian Mus.*, **53** (1955), p. 82.



TEXT-FIG. 30.—Ventral view of head of *Sphyrna blochii* (C.). : $\times \frac{1}{5}$.
(After F. Day)

Vernacular names.—INDIA: *Khan mushi*, Kanarese; *Zori*, Marathi; *Koman sorrah*, Tamil; *Sappa sorrah*, Telegu;

Standardised name: *Kombu sura*. PAKISTAN: *Doka*, Sind & Makran. BURMA: *Nga man kuey*.

Head 4.3; depth 5.8 to subcaudal origin. Head 1.2 in snout. Oculonarial expansion on each side of head, 2.3 times as long as broad, with a deep groove along the anterior edge. Eyes with nictitating membrane, 6.3 in head, situated at the upper angle of the external edge of the lobe of head. Length of mouth 1.6 in its width. Nostrils nearer to mouth than to eye. Teeth in $\frac{29}{30}$ rows, oblique, externally notched, smooth in their entire extent. Last gill opening above pectoral base. First dorsal origin behind pectoral base. Second dorsal origin above posterior half of anal. Pectorals longer than head to the fourth gill opening. Caudal 2.0 in trunk. Subcaudal 2.4—2.7 in caudal.

Deep grey or brownish grey becoming lighter beneath; fins usually of slightly deeper colour than the body.

It attains 1,524 mm. in length; its liver yields considerable amount of oil; pelagic.

Distribution.—India, Pakistan, Burma, Ceylon.—Malay Peninsula, Indonesia, Thailand, "Indo-China", Philippines; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 25°N.—7°S., 62°—123°E. in the Indo-Pacific=(2°—25°N., 62°—100°E. in the Indian Ocean+15°N.—7°S., 101°—123°E. in the Pacific Ocean).

45. *Sphyrna mokarran* (Rüpp.)

1837. *Zygaena mokarran* Rüppell, *Neue Wirbelth. Fische*, p. 66, pl. 17, fig. 3 (type locality : Massauh, Red Sea).
1870. *Zygaena mokarran* Günther, *Cat. Fish. Brit. Mus.*, 8, p. 383 (Red Sea).
1887. *Zygaena dissimilis* Murray, *J. Bombay nat. Hist. Soc.*, 2, p. 103, pl. (type locality : Kurrachee).
1888. *Zygaena mokarran* Day, *Fish. India, Suppl.*, p. 809 (Red Sea ; Kurrachee).
1889. *Zygaena mokarran* Day, *Fauna Brit. India, Fish.*, 1, p. 23 (Red Sea to Kurrachee).
1913. *Cestracion mokarran* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 160 (Red Sea; India).
1913. *Zygaena mokarran* Zugmayer, *Abh. Bayer. Akad. Wiss. math-phys. Kl.*, 26, p. 8 (Mekran).
1931. *Sphyrna mokarran* Chu, *Biol. Bull. St. John's Univ.*, No. 1, p. 6 (China).
1941. *Sphyrna mokarran* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 214.

1949. *Sphyrna mokarran* Misra, *Rec. Indian Mus.*, **45** (1947), p. 23.
1952. *Sphyrna mokarran* Misra, *Rec. Indian Mus.*, **49** (1951), p. 112.
1958. *Sphyrna mokarran* Misra & Menon, *Rec. Indian Mus.*, **53** (1955), p. 82.
1958. *Sphyrna mokarran* Briggs, *Bull. Florida Mus., Biol. Sci.*, **2**, No. 8, p. 249 (Gulf of Mexico).

Anterior edge of head nearly straight forming more or less a right angle with the lateral margin. Length of hind edge of one of the lobes equal to its width near the eye; no groove running along the anterior edge of the head. Snout 11.0 in head. Eyes with nictitating membrane, 19.0 in head, near nostril. Width of mouth 2.2 in head, length slightly more than half its width. Teeth oblique, as broad as long at their bases with indistinct lateral notch, serrated on both edges. Last gill opening above pectoral base. First dorsal origin behind pectoral base. Anal origin slightly behind second dorsal. Pectorals equal head to second gill opening.

Brownish grey becoming white beneath.

It grows to a length of 3,050 mm.; pelagic.

Distribution.—India, Pakistan.—Red Sea; China; Gulf of Mexico; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 20°—25°N., 39°—114° E. in the Indo-Pacific=(20°—25°N., 39°—67°E. in the Indian Ocean+22°N., 114°E. in the Pacific Ocean); 26°N., 92°W. in the Atlantic.

46. *Sphyrna tudes* (V.)

1822. *Zygaena tudes* Valenciennes, *Mem. Hist. nat. Paris*, **9**, p. 225, pl. 12, figs. 1a,b (type locality: Mediterranean; Cayenne; Coromandel; types from Cayenne and Nice are in the Paris Museum).
1847. *Sphyrna chiereghini* Nardo, *Synon. Moderna Pesc. Chiereghini* p. 111 (type locality: Venice, Italy).
1870. *Zygaena tudes* Günther, *Cat. Fish. Brit. Mus.*, **8**, p. 382 (Zanzibar, Sumatra).
1878. *Zygaena tudes* Day, *Fish. India*, p. 720, pl. 188, fig. 4 (Mediterranean, Indian Ocean, Malay Archipelago, Atlantic).
1888. *Zygaena tudes* Ogilby, *Cat. Fish. Austral. Mus.*, p. 4 (Madras).
1889. *Zygaena tudes* Day, *Fauna Brit. India, Fish.*, **1**, p. 23 (Mediterranean, Indian Ocean, Malay Archipelago, Atlantic).
1908. *Sphyrna tudes* Fowler, *Proc. Acad. nat. Sci. Philad.*, p. 66 (Surinam).

1912. *Sphyrna tudes* Pellegrin, *Ann. Mus. Zool. Univ. Napoli*, new Ser., 3, No. 27, p. 2 (Honolulu).
1913. *Sphyrna tudes* Weber, "*Siboga*" *Exped., Fische*, 57, p. 592 (Makassar and Timor).
1913. *Zygaena tudes* Zugmayer, *Abh. Bayer. Akad. math.-phys. Kl.*, 26, p. 8 (Mekran).
1929. *Zygaena tudes* Pillay, *J. Bombay nat. Hist. Soc.*, 33, p. 351 (Travancore).
1933. *Zygaena tudes* Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
1936. *Sphyrna tudes* Suvatti, *Index Fish. Siam*, p. 3 (Gulf of Siam).
1941. *Sphyrna tudes* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 213.
1949. *Sphyrna tudes* Misra, *Rec. Indian Mus.*, 45 (1947), p. 23.
1952. *Sphyrna tudes* Misra, *Rec. Indian Mus.*, 49 (1951), p. 112.
1953. *Sphyrna tudes* Herre, *Check List Philippine Fish.*, p. 28.
1955. *Zygaena tudes* Anonymous, *Mar. Fish. Karachi, Sind & Makran*, p. 5 (Coasts of Sind and Makran).
1955. *Sphyrna tudes* Munro, *Mar. Freshwater Fish. Ceylon*, p. 8 (Ceylon).
1958. *Sphyrna tudes* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 79.

Vernacular names.—INDIA: *Magala*, Marathi; *Koma sorrah*, Telegu; Standardised name: *Mottu-kombu sura*.

Head 4.7; depth 5.6 to subcaudal origin. Snout 1.7 in head. Oculonarial expansion shorter than its width, with a deep groove along its anterior edge. Eyes 4.2 in head, situated just below the junction of anterior and outer edges of the snout. Width of mouth 3.0 in head, length 1.6 in its width. Nostrils close to eye. Teeth in $\frac{30}{29}$ rows, oblique, with a notched outer edge. Last gill opening above pectoral base. First dorsal origin above hind margin of the inner edge of the pectoral fin. Second dorsal origin over hind half of anal, longer than second dorsal. Pectorals less than head to the first gill opening. Caudal 1.7 in trunk. Subcaudal 1.2 in caudal.

Grey becoming lighter beneath, first fin very dark.

It grows to several feet in length (Day); specimens measuring 1,828 mm. (6 ft.) in length have been recorded.

Distribution.—India, Pakistan, Ceylon.—E. Africa, Arabian Sea, Thailand, "Indo-China", Philippines, Melanesia, Hawaii, Panama, Mediterranean; in the mean annual isotherms of 20°C., and 12°C. with the latitudinal and

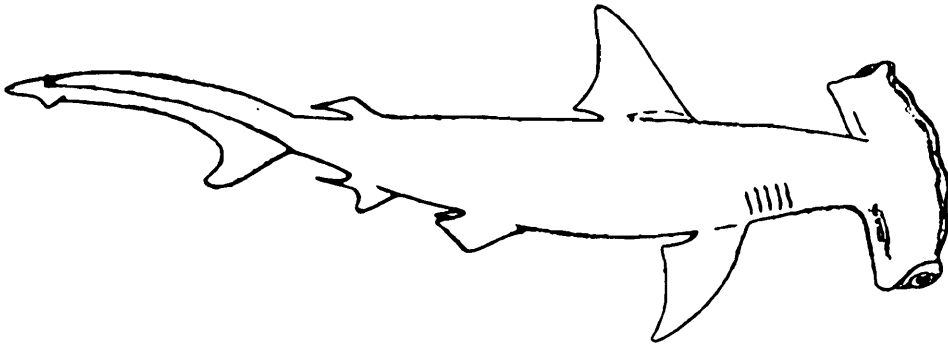
longitudinal range of 25°N.—10°S., 38°E.—79°W. in the Indo-Pacific=(25°N.—10°S., 38°—125°E. in the Indian Ocean+15°N.—5°S., 101°E.—79°W. in the Pacific Ocean); 37°N., 14°E. in the Mediterranean.

47. *Sphyrna zygaena* (L.)

(Text-fig. 31)

1758. *Squalus zygaena* Linnaeus, *Syst. nat.*, 1, ed. 10, p. 234 (type locality : Europe, America).
1810. *Squalus malleus* Risso, *Ichth. Nice*, p. 34 (type locality : Nice).
1824. *Zygaena indica* v. Hasselt, *Bull. Sci. nat. Ferussac*, 2, p. 90 (Java).
1878. *Zygaena malleus* Day, *Fish. India*, p. 719, pl. 186, fig. 4 (tropical and temperate Seas).
1889. *Zygaena malleus* Day, *Fauna Brit. India*, Fish., 1, p. 22 (tropical and temperate Seas).
1899. *Zygaena erythraea* Hilgendorf, *Symbol. Physic. Hemprich—Ehrenberg*, p. 8, pl. 6, fig. 2 (type locality : Red Sea).
1910. *Zygaena zygaena* Günther, *J. Mus. Godeffroy*, pt. 17, p. 434 (Fiji, Samoa, Hawaii).
- 1912-13. *Zygaena malleus* Southwell, *Ceylon Administr. Rep.*, p. E 49.
1929. *Zygaena malleus* Pillay, *J. Bombay nat. Hist. Soc.*, 33, p. 351 (Travancore).
1931. *Sphyrna zygaena* Chu, *Biol. Bull. St. John's Univ.*, No. 1, p. 5 (China).
1933. *Zygaena malleus* Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
1938. *Sphyrna zygaena* Fowler, *List Fish. Malaya*, p. 12 (Penang, Singapore).
1941. *Sphyrna zygaena* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 217.
1942. *Cestracion zygaena* Sarangdhar, *Ind. J. med. Res.*, 30, p. 557 (Bombay).
1949. *Sphyrna zygaena* Misra, *Rec. Indian Mus.*, 45 (1947), p. 23.
1952. *Sphyrna zygaena* Mori, *Mem. Hyogo Univ. Agric.*, 1, No. 3, p. 21 (Fusan, Mokpo, Korea).
1952. *Sphyrna zygaena* Misra, *Rec. Indian Mus.*, 49 (1951), p. 112.
1953. *Sphyrna zygaena* Herre, *Check List Philippine Fish.*, p. 28.
1953. *Sphyrna zygaena* Smith, *Sea Fish. South Africa*, p. 46 (from Cape eastwards).
1955. *Zygaena malleus* Anonymous, *Mar. Fish. Karachi, Sind & Makran*, p. 5 (Coasts of Sind and Makran).
1955. *Sphyrna zygaena* Munro, *Mar. Freshwater Fish. Ceylon*, p. 8.

1958. *Sphyrna zygaena* Misra & Menon, *Rec. Indian Mus*, 53 (1955), p. 80.
 1958. *Sphyrna zygaena* Briggs, *Bull. Florida Mus. Biol. Sci.*, 2, No. 8, p. 249 (Gulf of Mexico).



TEXT-FIG. 31.—Dorso-lateral view of *Sphyrna zygaena* (L.). (After F. Day)

Vernacular names.—INDIA: *Variocha*, Kanarese; Standardised name: *Chota kombu sura*. PAKISTAN: *Bodherbuther*, Sind & Makran. BURMA: *Nga man thanwoot*. CEYLON: *Udhalu mora*, Sinhalese; *Komben schura* or *Mammoti schura*, Tamil.

Head 4.3; depth 3.7 to subcaudal origin. Snout 1.4 in head. Hind edge of oculonarial expansion equals its width near the eye, with a groove along almost its entire anterior margin. Eyes 5.2 in head. Width of mouth 2.5–3.0 in head, length $\frac{1}{2}$ in its width. Nostrils close to eye. Teeth in $\frac{35}{32}$ rows, oblique, with a notched straight outer edge. Last gill opening before pectoral base. First dorsal origin behind hind margin of the inner edge of the pectoral fin. Second dorsal origin over one-third of anal. Anal longer than second dorsal. Pectorals as long as head to the first gill opening. Caudal 1.8 trunk. Subcaudal 1.2 in supracaudal.

Grey to grey brown above, whitish below; fins slatish grey.

It attains 1,828 mm. in length; it yields considerable amount of liver oil. It is known to be ferocious, fearless and voracious; fights vigorously when hooked; pelagic.

Distribution.—India, Pakistan, Ceylon.—Red Sea, Zanzibar, Natal, E. & S. Africa, Seychelles, Madagascar, Arabia, Singapore, Malay Peninsula, Indonesia, “Indo-China”, China, Formosa, Korea, Japan, Philippines, Polynesia, Hawaii, tropical Atlantic; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 35°N.—35°S., 18°E.—155°W. in the Indo-Pacific=(25°N.—35°S., 18°—100°E. in the Indian Ocean+35°N.—16°S., 103°E.—155°W. in the Pacific); 26°N., 92°W. in the Atlantic.

III. Order SQUALIFORMES

Skull hyostylic. Mesopterygium not reaching anterior margin of pectoral fin. Vertebrae cyclospondylic or tectospondylic. Radials on mesopterygium one to several. Anal fin absent. Two dorsals with or without spine. Five pairs of gill openings, lateral or ventral; 5 pairs of gill arches.

Upper Jurassic to Recent.

Order SQUALIFORMES is divided into two suborders *SQUALOIDEI* and *SQUATINOIDEI*, of which the latter is not represented in the Indian region.

Key to the suborders of order SQUALIFORMES

1. Body shark-like; dorsals each with a spine, or spineless Suborder *SQUALOIDEI*
2. Body ray-like; dorsals without spine Suborder *SQUATINOIDEI*

iii. Suborder *SQUALOIDEI*

Body elongate, subcylindrical, shark-like. Head depressed. Eyes without nictitating membrane. Five lateral gill openings; 5 gill arches. Spiracles large. Vertebrae with calcareous lamellae arranged in a ring round central axis.

The *SQUALOIDEI* is represented by a single family SQUALIDAE, in the Indian region.

Upper Jurassic to Recent.

Suborder *SQUALOIDEI* consists of two families SQUALIDAE and PRISTIOPHORIDAE, of which the latter is not found in the Indian region.

Key to the families of suborder SQUALOIDEI

1. Dorsals each with a spine; snout not saw-like Family SQUALIDAE
2. Dorsals without spine; snout saw-like Family PRISTIOPHORIDAE
(Not found in India)

VIII. Family SQUALIDAE

Spiny Sharks or Dog Fishes

Body elongate, subcylindrical. Head depressed. Tail more or less compressed, shorter than trunk. Eyes without nictitating membrane. Mouth inferior, arched. Well

developed labial folds in both jaws. Teeth dimorphic, compressed, in one or 2 series in jaws, unicuspid or multicuspid, oblique or erect. Nasoral grooves and cirri absent. Gill openings moderate or narrow, all before pectorals. Spiracles large. Two spinate dorsals, first dorsal before pelvics. Second dorsal behind pelvic origin. Anal absent. Caudal pit and keel absent. Lower caudal lobe with or without posterior notch.

Family SQUALIDAE is represented by two genera in the Indian region.

Key to genera of family SQUALIDAE

1. Upper teeth as well as the lower with one cusp only; snout spatulate Centroscyrnus Bocage & Capello
2. Upper teeth with 3-7 cusps; snout depressed Centroscyllium M. & H.

24. Genus *Centroscyrnus* Bocage & Capello

1864. *Centroscyrnus* Bocage & Capello, *Proc. zool. Soc. Lond.*, p. 263 (type, *C. coelolepis* Bocage & Capello, orthotypic).
 1913. *Centroselachus* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 206 (type, *Centrophorus crepidater* Bocage & Capello).
 1934. *Proscymnodon* Fowler, *Proc. Acad. nat. Sci. Philad.*, 85, p. 239 (type, *Centrophorus plunketi* Waite, orthotypic).

Snout in front of mouth, not longer than mouth to level of origin of pectoral fins. Lower teeth smooth-edged, the cusps directed strongly outward; upper teeth lancet-shaped, much narrower than lower and more nearly erect. Inner corner of pectoral fins broadly rounded. Dorsal spines either exposed at the tip or entirely enclosed in the skin. Subterminal notch of caudal fin well marked in most species, but indistinct in juveniles, the parentage of which is not yet known. Dermal denticles on sides of body scale-like, tridentate or evenly rounded.

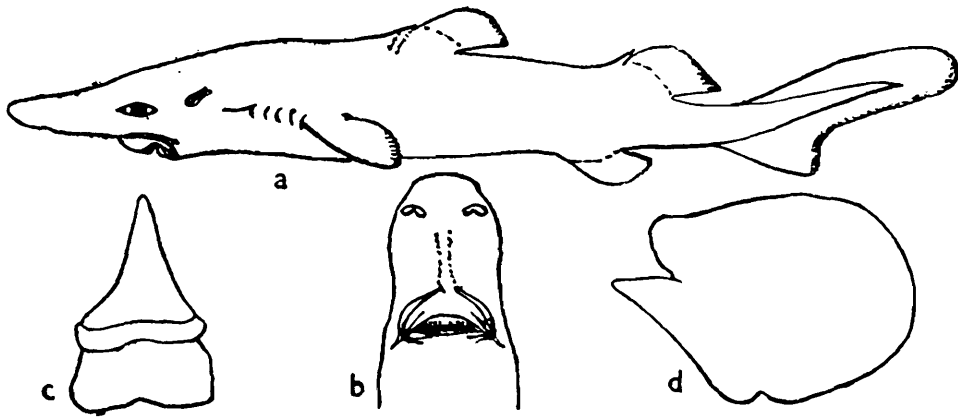
Some of the species of the genus are the deepest living sharks found at depths down to about 2,700 metres.

Distribution.—Atlantic Ocean: Madeira; Faroe Is., 750 m., Portugal, 731—1,097 m.; North Spain; Massachusetts; Indian Ocean: South Africa; Arabian Sea, 786 m.; Pacific Ocean: New Zealand; Japan; Coast of Chile.

48. *Centroscymnus rossi* (Alc.)

(Text-fig. 32)

1898. *Centrophorus rossi* Alcock, *Ann. Mag. nat. Hist.*, (7) 2, p. 143 (type locality; off Travancore Coast, Laccadive Sea, 7°17' 30" N., 76° 54' 30" E., 430 fms. 3.3° C., bottom temperature; 27.8° C., surface temperature; type is in the Zoological Survey of India).
1899. *Centrophorus rossi* Alcock, *Ill. Zool. Investig. Fish.*, pl. 26, figs. 3, 3a, 3b, 3c (Off Travancore Coast).
1899. *Centrophorus rossi* Alcock, *Cat. Ind. Deep Sea Fish.*, p. 13 (Arabian Sea).
1908. *Centroscymnus crepidater* Regan (*partim*), *Ann. Mag. nat. Hist.*, (8) 2, p. 50 (Indian Ocean).
1913. *Lepidorhinus rossi* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 214 (Off Travancore Coast).
1941. *Centrophorus rossi* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 232.
1949. *Centrophorus rossi* Misra, *Rec. Indian Mus.*, 49 (1947), p. 24.
1952. *Centrophorus rossi* Misra, *Rec. Indian Mus.*, 49 (1951), p. 113.
1957. *Centroscymnus rossi* Bigelow & Schroeder, *Bull. Harv. Mus. Comp. Zool.*, 117, No. 1, p. 96.
1958. *Centrophorus rossi* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 77.

TEXT-FIG. 32.—*Centroscymnus rossi* (Alc.)

(a) Lateral view : $\times ca \frac{2}{5}$. (b) Ventral view of head : $\times ca \frac{2}{5}$. (c) Upper tooth : $\times ca 20$. (d) Lower tooth : $\times ca 20$. (After K. S. Misra)

Head 3.1; depth 5.7 to subcaudal origin. Snout spatulate, produced, 2.3 in head. Eyes without nictitating membrane, 4.0 in head, nearer to 1st gill opening than to snout end. Spiracle oblique, superior, half of eye diameter. Mouth crescentic, protractile, its width 1.6 in pre-oral. Labial folds extending more than half way between angle of mouth and middle of lower jaw. Teeth in upper

jaw, acute, triangular, biserial; those in lower jaw oblique, uniserial. Nasoral grooves and cirri absent. Gill openings smaller than eye diameter, last 2 close together, before pectorals. First dorsal origin behind pectoral base, and nearer to it than to pelvic origin. Second dorsal larger than first dorsal; origin opposite midpelvic base. Pelvic origin nearer to subcaudal than to pectoral origin. Dorsal spines about half the greatest height of their fins, but projecting well beyond skin. Anal fin absent. Pectorals equal to postorbital up to 4th gill opening. Posterior borders of all fins fringed.

Uniform jet black.

It attains a length of 254 mm., bathypelagic.

Distribution.—India : Off Travancore Coast : 786 m.; in the mean annual isotherm of 20°C. in 7°17'30"N., 76°54'30"E.

25. Genus *Centroscyllium* Müller & Henle

1841. *Centroscyllium* Müller & Henle, *Syst. Besch. Plagiost.*, p. 191 (type, *Spinax fabricii* Reinh., monotypic).

1889. *Paracentroscyllium* Alcock, *Ann. Mag. nat. Hist.*, (6) 4, p. 379 (type, *P. ornatum* Alc., monotypic).

Body elongate, subcylindrical. Head depressed. Tail depressed. Eyes large, without nictitating membrane; orbit elongate. Nasoral grooves and cirri absent. Labial folds well developed in both jaws. Spiracles large, behind eyes, higher, superior. 5 pairs of gill openings. Two dorsal fins, each with a well developed spine anteriorly. Anal fin absent. Caudal pit absent. Caudal fin truncated or pointed with subterminal notch. Teeth small, raptorial, multicuspid. Dermal denticles on sides of body slender, thorn-like.

Distribution.—Atlantic Ocean: Faroe Is., 750—1,100 m.; Greenland; Northeast America: Northwest Africa, 1,495 m.; Falkland Is., 630 m.; Indian Ocean: Arabian Sea, 1,133—1,261 m.; Bay of Bengal, 521—740 m.; Pacific Ocean: Eastern Pacific off Central America; Gulf of Panama, 998—1,014 m.; Hawaii Is., Japan.

49. *Centroscyllium ornatum* (Alc.)

(Pl. VII, figs. 1, 2; Text-fig. 33)

1889. *Paracentroscyllium ornatum* Alcock, *Ann. Mag. nat. Hist.*, (6) 4, p. 379 (type locality : Bay of Bengal, 13°27'N., 93°14' 30" E., 285-405 fms. ; 8.9°C., bottom temperature ; 26.1°C. surface temperature; type is in the Zoological Survey of India)

1894. *Paracentroscyllium ornatum* Alcock, *Ill. Zool. Investig. Fish.*, pl. 8, fig. 2 (error in delineation as without a distinct posterior notch on the caudal fin) (Bay of Bengal).
1896. *Centroscyllium ornatum* Alcock, *J. Asiat. Soc. Bengal*, **65**, pp. 308, 310 (Arabian Sea 23° N., 66° 8'E., 609–620 fms., 8° C.).
1899. *Centroscyllium ornatum* Alcock, *Cat. Ind. Deep Sea Fish.*, p. 14.
1900. *Centroscyllium ornatum* Alcock, *Ill. Zool. Investig. Fish.*, pl. 35, figs. 1, 1a-b (error in delineation as without a distinct, posterior notch on the caudal fin).
1900. *Paracentroscyllium ornatum* Burckhardt, *Ann. Mag. nat. Hist.*, (7) **6**, p. 567, fig. 8 (correct delineation of type, showing clearly a subterminal notch on the caudal fin).
1908. *Centroscyllium ornatum* Regan, *Ann. Mag. nat. Hist.*, (8) **2**, p. 41 (Bay of Bengal).
1912. *Centroscyllium ornatum* Sewell, *Rec. Indian Mus.*, **7**, p. 2 (Arabian Sea).
1913. *Centroscyllium ornatum* Garman, *Mem. Harv. Mus. Comp. Zool.*, **36**, p. 233 (Bay of Bengal and Arabian Sea).
1941. *Centroscyllium ornatum* Fowler, *Bull. U.S. nat. Mus.*, (100) **13**, p. 254.
1949. *Centroscyllium (Paracentroscyllium) ornatum* Misra, *Rec. Indian Mus.*, **45** (1947), p. 24.
1952. *Centroscyllium (Paracentroscyllium) ornatum* Misra, *Rec. Indian Mus.*, **49** (1951), p. 113.
1957. *Centroscyllium ornatum* Bigelow & Schroeder, *Bull. Harv. Mus. Comp. Zool.*, **117**, No. 1, p. 47.
1958. *Centroscyllium (Paracentroscyllium) ornatum* Misra & Menon, *Rec. Indian Mus.*, **53** (1955), p. 77.



TEXT-FIG. 33.—Lateral view of *Centroscyllium ornatum* (Alc.): $\times \frac{3}{4}$. (After R. Burckhardt, delineated from type series showing caudal notch).

Head large, flat, depressed, branchial region laterally expanded, 3.1 to 4.2 (in young); depth 6.6 (in young) to 7.5 to subcaudal origin. Snout depressed, less than eye, somewhat polygonal in outline, 3.3 (in young) to 4.2 in head to 1st gill opening; under surface with numerous, large, Y-or V-shaped rows of pores between nostrils. Eyes without nictitating membrane, 2 (in young) to 6 in head to 1st gill opening, nearer to spiracle than to snout end. Spiracles superior, behind eye, 4 in eye diameter. Nostrils large, on ventral surface of snout edge. Mouth large, crescentic, its width equal to or slightly longer than preoral.

Labial folds well developed in both jaws. Nasoral grooves and cirri absent. Teeth minute, tricuspid in both jaws. Gill openings subequal, smaller than eye diameter, gradually closer to last, all before pectoral base. First dorsal origin opposite depressed pectoral end. Second dorsal opposite inner angle of pelvics, longer than first dorsal. Second dorsal spine longer than first dorsal spine. Pelvic origin midway between subcaudal and pectoral origins. Anal fin absent. Pectorals less than half of head. Subcaudal long, faintly notched. No caudal pit.

Uniform jet black, or deep violet black, lighter between eyes; head with minute, white spots arranged in the shape of a lute; pelvics with pale tips.

It grows to a length of 290 mm.; bathypelagic.

Distribution.—India : Bay of Bengal 521–740 m.; Arabian Sea, 1,133–1,261 m., in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 13°—23° N., 66°—93° E. in the Indian Ocean.

II. Superorder BATOIDEI

Body depressed, shark-like or disc-like, wide, flat; edges of disc formed by expanded pectorals. Five ventral gill openings. Spiracles present. Anterior margin of pectorals fused with sides of body and head. Olfactory capsule with a free pair of preorbital cartilages. Two halves of pectoral girdle united to each other or to vertebral column. Hyomandibular without branchial arches. Anal absent. Dorsals when present on tail. Caudal present or absent. Tail slender, often whip-like or shark-like.

Upper Jurassic to Recent.

Superorder BATOIDEI consists of two orders RAJIFORMES and TORPEDINIFORMES.

Key to orders of superorder BATOIDEI

- | | |
|----------------------------|-----------------------|
| 1. Electric organs present | Order TORPEDINIFORMES |
| 2. Electric organs absent | Order RAJIFORMES |

IV Order RAJIFORMES

No electric organs between head and pectoral fins. Pre-orbital cartilages not enlarged.

Order RAJIFORMES is represented by seven families in the Indian region.

Key to the families of order RAJIFORMES

- | | | | |
|--|----|----|----------------------|
| 1. Disc narrow and elongate | .. | 3 | |
| 2. Disc broad and expanded | | 7 | |
| 3. Rostrum very much produced, saw-like | | | Family PRISTIDAE] |
| 4. Rostrum very short, not saw-like | | 5 | |
| 5. Pectorals extending to end of snout: disc broad, rounded | | | Family DISCOBATIDAE |
| 6. Pectorals not extending to end of snout: disc narrow, elongated | | | Family RHINOBATIDAE. |
| 7. Tail whip-like, dorsal reduced to spines | | 9 | |
| 8. Tail not whip-like, without spines : 2 small dorsals | | | Family RAJIDAE |
| 9. Head distinct from disc, with a prominent snout | | 11 | |
| 10. Head not distinct from disc, without prominent snout | | | Family DASYATIDAE |
| 11. With horn-like cephalic flippers | | | Family MOBULIDAE |
| 12. Without horn-like cephalic flippers: | | | Family MYLIOBATIDAE |

IX. Family RHINOBATIDAE

Guitar-Fishes

Body depressed, elongate, shark-like. Disc triangular, gradually passing into a long, strong, depressed tail. Snout produced, pointed or short, rounded. Eyes without nictitating membrane, widely placed on either side of median line. Mouth inferior, transverse. Nostrils oblique, wide. Nasoral grooves and cirri absent. Teeth small, numerous, in pavement. Spiracles large, close behind eye or a little behind it, with or without folds on hind edge. Five pairs of ventral gill openings. Two spineless dorsals on tail far behind pelvics, close together. Rayed portion of pectorals continued opposite to the gill openings. Pelvics just behind or far behind pectorals. Anal fin absent. Tail depressed, nearly equal to trunk, without spine. Caudal moderate or small. Subcaudal with or without lobes, smaller than supercaudal. No caudal keels or pits. Ovo-viviparous.

The family RHINOBATIDAE is represented by 3 genera in the Indian region.

Key to genera of family RHINOBATIDAE

- | | | |
|---|---|--------------------------|
| 1. Snout triangularly pointed : spiracles with folds on hind edge | 3 | |
| 2. Snout blunt, broad, rounded : spiracles without folds on hind edge | | Genus <i>Rhina</i> Schn. |

3. Origin of first dorsal distinctly nearer to the tip of snout than to the tip of caudal. Genus **Rhynchobatus** M. & H.
4. Origin of first dorsal distinctly nearer to the tip of caudal than to the tip of snout. Genus **Rhinobatos** Linck

26. Genus **Rhinobatos** Linck

1790. *Rhinobatos* Linck, *Mag. Phys. Naturg. Gotha*, (3) 6, p. 32 (atypic; type, *Raja rhinobatos* L., tautotypic).
1792. *Rhinobatus* (Klein) Walbaum, *Artedi Pisc.*, 3, p. 581 (atypic; type, *Raja rhinobatos* L., tautotypic; inadmissible according to opinion 21 of the International Commission of Zoological Nomenclature).
1801. *Rhinobatus* Schneider, *Syst. Ichth. Bloch*, p. 353 (type, *Raja rhinobatos* L., tautotypic).
1810. *Leiobatus* Rafinesque, *Caratt. Animal. Piante Sicilia*, p.16 (type, *L. panduratus* Raf.).
1824. *Squatinatoraja* Nardo, *Osserv. Agg. Adriaticae Ittiol.*, (type, *S. colonna* = *Rhinobatus columna* M. & H.).
1825. *Leiobatis* Blainville, *Faune Francaise Poiss.*, p. 43 (type, *L. panduratus* Raf.).
1836. *Aellopos* Münster, *Neues Jahrb. Mineral*, p. 58 (type, *A. elongatus* Münster).
1843. *Euryarthra* Agassiz, *Poiss. Fossil.*, 3, p. 382 (*E. münsteri* Agassiz).
1846. *Glaucostegus* Bonaparte, *Cat. Metod. Pesci Europei*, p. 14 (type, *Rhinobatus cemiculus* Geoffroy St. Hilaire = *Raja rhinobatos* L.).
1849. *Spathobatis* Thiolliere, *Ann. Soc. Agric. Hist. nat. Lyon*, (2) 1, p. 63 (type, *S. bugesiacus* Thiolliere).

Body depressed, elongated. Disc triangular, slightly rounded, wider behind. Tail depressed, nearly equal to trunk. Snout triangularly pointed. Nostrils oblique, wide. Spiracles wide, just behind eyes, with folds on hind edge. 5 pairs of gill openings on the ventral side. Two spineless dorsal fins behind pelvics and closer to caudal than to snout end. Pelvics closer to pectorals than to dorsals. The rayed portion of pectoral fins not continued on to snout. Anal fin absent. Teeth obtuse, with indistinct, transverse ridges.

Sluggish, bottom-living rays of shallow water; excellent as food and bait.

Distribution.—W. and S. Africa, Red Sea, Arabia, India, Ceylon, Andamans, Burma, Malay Peninsula, Indonesia, Thailand, Formosa, Philippines, Japan, Australia.

Key to species

1. Snout long, pointed: interspiracle 3·3—3·8 in snout 3
2. Snout short, bluntly or obtusely pointed: interspiracle 2·5—2·9 in snout 7
3. Snout expanded at the tip *R. thouin* (Anonymous)
4. Snout not expanded at the tip .. 5
5. Length of nostril equal to internarial space, twice width of mouth: interspiracle 3·8 in snout .. *R. granulatus* (C.)
6. Length of nostril greater than internarial space, less than twice width of mouth: interspiracle 3·3 in snout *R. typus* (Benn.)
7. Snout obtusely pointed: interspiracle 2·6 in snout; length of nostril equal to internarial space, twice width of mouth *R. obtusus* (M. & H.)
8. Snout not obtusely pointed: interspiracle 2·5—2·9 in snout: length of nostril greater than internarial space, less than twice width of mouth .. 9
9. Base of first dorsal fin $2\frac{1}{4}$ — $2\frac{2}{5}$ in distance between dorsals: space between rostral ridges rather narrow: series of spines in the middle line of back .. *R. annandalei* (Norman)
10. Base of first dorsal $2\frac{4}{5}$ in distance between dorsals: space between rostral ridges broader: minute tubercles in the middle line of back: *R. lionotus* (Norman)

50. *Rhinobatos annandalei* (Norman)

1888. *Rhinobatus columnae* (nec Bonaparte) Day, *Fish. India, Suppl.*, p. 811 (Indian Ocean).
1889. *Rhinobatus columnae* (nec Bonaparte) Day, *Fauna Brit. India, Fish.*, 1, p. 44 (Indian Ocean).
1909. *Rhinobatis columnae* (nec Bonaparte) Annandale, *Mem. Indian Mus.*, 2, p. 14 (off Hugli River mouth).
- 1912-13. *Rhinobatus columnae* (nec Bonaparte) Southwell, *Ceylon Administr. Rep.*, pp. E 43, E 45, E 48, E 49.
1914. *Rhinobatus columnae* (nec Bonaparte) Pearson, *Ceylon Administr. Rep.*, p. E 14.
1926. *Rhinobatus annandalei* Norman, *Proc. zool Soc. Lond.*, p. 960, text-fig. 13 (type locality: East Channel, mouth of River Hugli, in 40 fathoms; according to Fowler type is in the British Museum).

1938. *Rhinobatos rhinobatos* (*nec* Linnaeus) Fowler, *List Fish. Malaya*, p. 13 (Malaya).
 1941. *Rhinobatos annandalei* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 309.
 1949. *Rhinobatos annandalei* Misra, *Rec. Indian Mus.*, 45 (1947), p. 25.
 1952. *Rhinobatos annandalei* Misra, *Rec. Indian Mus.*, 49 (1951), p. 115.
 1955. *Rhinobatos annandalei* Munro, *Mar. Freshwater Fish. Ceylon*, p. 10 (Ceylon).
 1958. *Rhinobatos annandalei* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 83.

Snout moderate, bluntly pointed, margin a little concave, about 6.5 in total length. Eyes 3.7 in snout, equal to interorbital. Width of mouth 2.0 in preoral, more than 2 times longer than internarial. Nostrils moderate, 1.8 times in width of mouth. Internarial 5.7 in preoral. Interspiracle 2.9 in snout. Teeth small, almost flat, ridges across them poorly developed, same size in all parts of jaw. Spiracles nearly equal to eye, close behind eyes, folds both on front and hind edges. Five pairs of ventral gill openings. Two spineless dorsal fins. First dorsal origin not far behind tip of pelvics, at a distance 1.3 times interdorsal. Rayed portion of pectorals continued up to the spiracles. Pelvics large, almost reaching first dorsal origin. Anal fin absent.

Skin covered with minute denticles, rather smooth to touch; series of small, close spines in the median line of back, 2—4 on each shoulder, several around orbits and above spiracles; all spines sharper and stronger in males. Greyish-brown with indistinct marblings of darker shade and with many obscure, round, whitish spots; white below; large specimens darker.

It attains a length of 415 mm.; littoral.

Distribution.—India, Ceylon.—Malaya; in the mean annual isotherm of 20°C., with the latitudinal and longitudinal range of 1°—22°N., 80°—100°E. in the Indian Ocean.

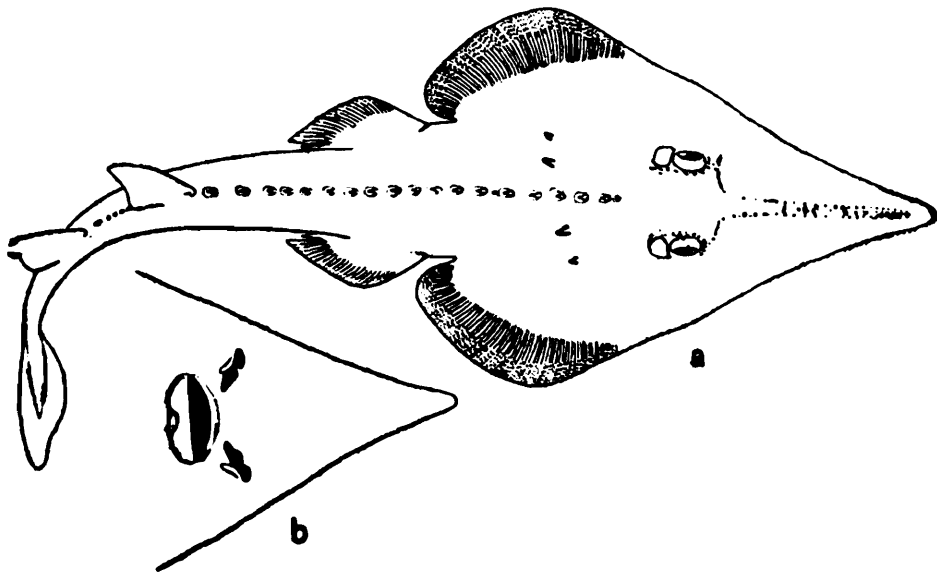
51. *Rhinobatos granulatus* (C.)

(Text-fig. 34)

1829. *Rhinobatus granulatus* Cuvier, *Règne Animal.*, 2, ed. 2, p. 396 (type locality: Pondicherry; type is in the Paris Museum).
 1841. *Rhinobatus* (*Rhinobatus*) *granulatus* Müller & Henle, *Syst. Besch. Plagiost.*, p. 117, pl. 38 (Tranquebar and Pondicherry).
 1851. *Rhinobatus granulatus* Gray, *List Fish. Brit. Mus.*, p. 95 (India).

1853. *Rhinobatus tuberculatus* Bleeker, *Verh. Bat. Gen. (Bengal)*, **25**, p. 9 (on *Suttiwarah* Russell, *Fish. Coromandel*, **1**, p. 7, pl. 11, 1803, type locality : Vizagapatam).
1860. *Rhinobatus granulatus* Blyth, *J. Asiat. Soc. Bengal*, **29**, p. 36 (Calcutta).
1865. *Rhinobatus (Rhinobatus) granulatus* Dumeril, *Hist. nat. Elasmobr.*, **1**, p. 493 (Malabar, Ganges River, Pondicherry).
1870. *Rhinobatus granulatus* Günther (*partim*), *Cat. Fish. Brit. Mus.*, **8**, p. 433 (India; East Indies).
1870. *Rhinobatus spinosus* Günther, *Cat. Fish. Brit. Mus.*, **8**, p. 518.
1878. *Rhinobatus granulatus* Day (*partim*), *Fish. India*, p. 732, pl. 192, fig. 2 (Malabar).
1878. *Rhinobatus thouini* Day, *Fish. India*, p. 732, pl. 190, fig. 4 (Andamans).
1889. *Rhinobatus granulatus* Day (*partim*), *Fauna Brit. India*, *Fish.*, **1**, p. 42, fig. 17 (Seas of India to the Malay Archipelago).
1889. *Rhinobatus thouini* Day, *Fauna Brit. India*, *Fish.*, **1**, p. 44 (Red Sea through India to the Malay Archipelago).
1904. *Rhinobatus granulatus* Volz, *Rev. Suisse Zool.*, **12**, p. 484 (Padang, Sumatra : Kwala).
1907. *Rhinobatus granulatus* Volz, *Nat. Tijds. Ned. Indie*, **66**, p. 240 (Langhat).
1908. *Rhinobatus acutus* Garman, *Bull. Harv. Mus. Comp. Zool.*, **51**, p. 253 (type locality : Ceylon).
1909. *Rhinobatis granulatus* Annandale, *Mem. Indian Mus.*, **2**, p. 14 (off Orissa).
1910. *Rhinobatis granulatus* De, *Rep. Fish. Eastern Bengal & Assam*, p. 17 (Chittagong).
1913. *Rhinobatus granulatus* Garman, *Mem. Harv. Mus. Comp. Zool.*, **36**, p. 272 (India).
1913. *Rhinobatus acutus* Garman, *Mem. Harv. Mus. Comp. Zool.*, **36**, p. 273, pl. 17 b, figs. 1, 2 (Ceylon).
1926. *Rhinobatus granulatus* Norman, *Proc. zool. Soc. Lond.*, p. 949, text-fig. 3 (Madras, India, Shanghai).
1929. *Rhinobatus granulatus* Pillay, *J. Bombay nat. Hist. Soc.*, **33**, p. 352 (Travancore).
1933. *Rhinobatus granulatus* Deraniyagala, *Ceylon, J. Sci. (c)*, **5**, p. 81 (Ceylon).
1933. *Rhinobatus granulatus* Sorley, *Mar. Fish. Bombay Presidency*, p. 159 (Bombay).
1936. *Rhinobatus granulatus* Hora & Mukerji, *Rec. Indian Mus.*, **38**, pp. 18, 21, pl. 2, fig. 1 (Burma).
1938. *Rhinobatos granulatus* Fowler, *List Fish. Malaya*, p. 13 (Singapore, Patani Bay).
1941. *Rhinobatus granulatus* Herre, *Mem. Indian Mus.*, **13**, p. 333 (Andamans).

1941. *Rhinobatos granulatus* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 315.
1949. *Rhinobatos granulatus* Misra, *Rec. Indian Mus.*, 45 (1947), p. 25.
1952. *Rhinobatos granulatus* Misra, *Rec. Indian Mus.*, 49 (1951), p. 115.
1953. *Rhinobatos granulatus* Herre, *Check List Philippine Fish.*, p. 37 (Philippines).
1955. *Rhinobatos granulatus* Anonymous, *Mar. Fish. Karachi, Sind & Makran*, p. 7 (Coasts of Sind and Makran).
1955. *Rhinobatos granulatus* Munro, *Mar. Freshwater Fish. Ceylon*, p. 10.
1958. *Rhinobatos granulatus* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 83.



TEXT-FIG. 34.—*Rhinobatos granulatus* (C.)
 (a) Dorsal view : $\times \frac{2}{3}$. (b) Ventral view of head : $\times \frac{2}{3}$.
 (After K. S. Misra)

Vernacular names.—INDIA : *Fodka*, Kanarese; *Kal-poonthi*, Malayalam; *Lanj*, Marathi; *Suttiwarah*, Telegu; Standardised name : *Purungan*, *tiruke*. PAKISTAN : *Mattla byllia*, Chittagong; *Kair*, *Cundaree* or *Sherol*, Sind. BURMA : *Nga man Kha*. CEYLON : *Bal oliva* or *Gal uluva*, Sinhalese; *Kal uluvai*, Tamil.

Disc triangular, longer than wide; its length about 2.0 in total length. Snout triangularly pointed, long, margins concave, 2.2 in length of disc. Eyes 6.5 in snout, 1.7 in interorbital. Width of mouth 2.8 in preoral, longer than internarial, short upper and lower labial folds at angles of mouth. Nostrils wide, oblique, about half width of mouth. Internarial 4.8 in preoral. Interspiracle 3.8 in

snout. Teeth in 53-60 rows, smooth, rhomboid, Spiracles a little smaller than eye, with folds on hind edge only, close behind eyes. Five pairs of ventral gill openings. Two spineless, subequal, dorsal fins. First dorsal origin far behind pelvic origin at a distance more than 2 times the interdorsal. Second dorsal origin nearly equidistant between dorsal and caudal origins. Rayed portion of pectorals continued to below spiracles. Pelvics large, origin an eye diameter behind pectorals. Caudal small. Supracaudal rounded. No subcaudal lobe. Anal fin absent. Tail depressed, without spine, shorter than trunk.

Tubercles enlarged on back, scapular region and top of head; a series of strong, compressed spines in the median line on back; 2 or more on each shoulder, several around orbit and spiracle. Brown above whitish below.

It attains a length of 2,150 mm.; littoral.

Distribution.—India, Pakistan, Burma, Ceylon.—Red Sea, Singapore, Indonesia, China, Philippines; in the mean annual isotherm of 20°C., with the latitudinal and longitudinal range of 35°N.—1°S., 39°—123°E. in the Indo-Pacific = (25°N.—1°S., 39°—100°E. in the Indian Ocean + 1°—35°N., 103°—123°E. in the Pacific Ocean).

52. *Rhinobatos lionotus* (Norman)

1909. *Rhinobatis schlegeli* (nec Müller & Henle) Annandale, *Mem. Indian Mus.*, 2, p. 15 (off Hughli River mouth and Mutlah River).
1929. *Rhinobatus lionotus* Norman, *Proc. zool. Soc. Lond.*, p. 961, text-fig. 14 (type locality : East Channel, mouth of River Hughli, in 40 fathoms; according to Fowler type is in the British Museum).
1941. *Rhinobatos lionotus* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 310.
1949. *Rhinobatos lionotus* Misra, *Rec. Indian Mus.*, 45 (1947), p. 26.
1952. *Rhinobatos lionotus* Misra, *Rec. Indian Mus.*, 49 (1951), p. 115.
1958. *Rhinobatos lionotus* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 78.

Snout moderate, bluntly pointed, margins scarcely concave. Eyes 3.4 in snout, equal to interorbital. Width

of mouth 2·2 in preoral, 2 times internarial. Nostrils moderate, oblique, half of mouth width. Internarial 5 in preoral. Interspiracle 2·5 in snout. Teeth small, with transverse ridges strongly convex, conical, with flattened base. Spiracles smaller than eye, close behind it, with folds both on front and hind edges. Five pairs of ventral gill openings. Two spineless, dorsal fins. First dorsal origin behind pelvics, at a distance equal to interdorsal.

Skin with minute denticles, smooth to touch; a series of minute tubercles in the median line of back, a single one on each shoulder several around orbits and above spiracles. Uniform brownish grey or olive green above, whitish below.

The type-specimen measured 500 mm. in length; littoral.

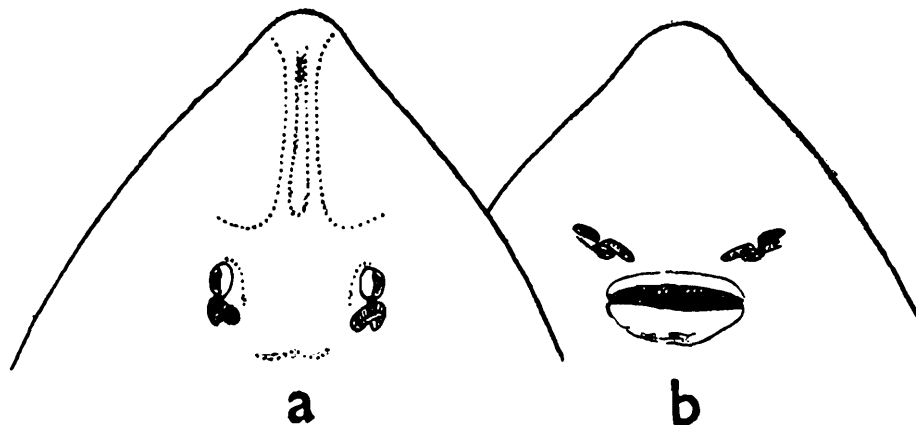
Distribution.—INDIA: mouth of river Hooghly, in 72 metres (40 fms.), Mutlah river; in the mean annual isotherm of 20°C. in 21°N., 88°E.

53. *Rhinobatos obtusus* (M. & H.)

(Text-fig. 35)

1841. *Rhinobatus (Rhinobatus) obtusus* Müller & Henle, *Syst. Besch. Plagiost.*, p. 122, pl. 37, fig. 2 (type locality : India; Pondicherry; Malabar; according to Bertin paratypes from Malabar and Pondicherry are in the Paris Museum).
1860. *Rhinobatus obtusus* Blyth, *J. Asiat. Soc. Bengal*, 29, p. 37 (Calcutta).
1865. *Rhinobatus obtusus* Day., *Fish. Malabar*, p. 274 (Malabar).
1878. *Rhinobatus halavi* (nec Forskal) Day, *Fish. India*, p. 731, pl. 193, fig. 4 (Mangalore).
1889. *Rhinobatus halavi* (nec Forskal) Day, *Fauna Brit. India, Fish.*, 1, p. 43 (South Africa; India; Malay Archipelago).
1926. *Rhinobatus obtusus* Norman, *Proc. zool. Soc. Lond.*, p. 950, text-fig. 4 (rostra) (India; East Indies).
1941. *Rhinobatos obtusus* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 317 (reference).
1949. *Rhinobatos obtusus* Misra, *Rec. Indian Mus.*, 45 (1947), p. 26.
1952. *Rhinobatos obtusus* Misra, *Rec. Indian Mus.*, 49 (1951), p. 115.
1953. *Rhinobatos obtusus* Smith, *Sea Fish. S. Africa*, p. 64 (Natal).

1958. *Rhinobatos obtusus* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 83.



TEXT-FIG. 35.—*Rhinobatos obtusus* (M. & H.)
(a) Dorsal view of head. (b) Ventral view of head.
(After J. R. Norman)

Vernacular names.—INDIA : *Pare* (young), *Padangan* (adult), Tamil.

Disc triangular, longer than broad; its length nearly 2.8 in total length. Snout broad, obtusely pointed, margin not concave, 2.6 in length of disc. Eyes 7.0 in snout, 2.5 in interorbital. Width of mouth 1.8 in preoral, larger than internarial. Nostrils wide, oblique, about half width of mouth. Internarial 3 in preoral. Interspiracle 2.6 in snout. Teeth in $\frac{70}{66}$ rows; 15 vertical rows in the median row in either jaw; each tooth oval, with a slight ridge along the centre. Spiracles equal to eye, only outer folds developed, close behind eye. Five pairs of ventral gill openings. Two spineless dorsal fins. First dorsal origin far behind pelvic origin at a distance 2.0 times interdorsal. Second dorsal slightly smaller than first dorsal; origin nearer to supracaudal origin than to first dorsal origin. Rayed portion of pectorals extends beyond eye. Pelvics large about an eye diameter behind pectorals. Caudal small. No subcaudal lobe. Supracaudal low. Anal fin absent. Tail depressed, without spine, nearly 1.5 times longer than trunk.

Tubercles enlarged in back, scapular region and top of head; some in the median line of back spinous; no distinct series of spines. Reddish grey superiorly, white beneath; fins and snout with a reddish tinge. Large examples have occasionally black blotches over them.

It attains a length of 930 mm.; littoral.

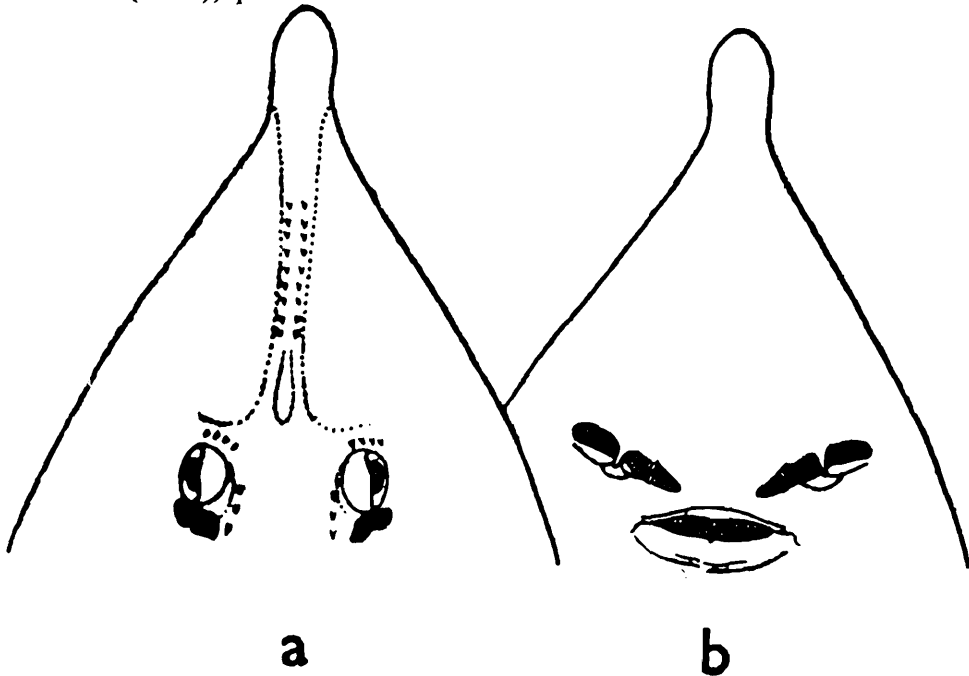
Distribution.—India.—S. Africa, Indonesia; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 22°N.—29°S., 30°—130°E. in the Indo-Pacific = (22°N.—29°S., 30°—88°E. in the Indian Ocean + 5°N.—7°S., 103°—130°E. in the Pacific Ocean).

54. *Rhinobatos thouin* (Anonymous)

(Text-fig. 36)

1798. *Raia thouin* Anonymous, *Allg. Lit.-Zeit.*, 3, pp. 287, 677, 685, pl. 1, figs. 3, 4 (type locality: not known).
1798. *La raie thouin* Lacépède, *Hist. nat. Poiss.*, 1, p. 134, pl. 1, figs. 3-5 (type locality: not known; described from a specimen preserved in the museum of the Prince of Orange, later transferred to Paris and forming a part of the National Museum of France; inadmissible).
1804. *Raja thouiniana* Shaw, *Gen. Zool.*, 5, p. 318, pl. 147, fig. 2 (locality unknown).
1823. *Rhinobatus thouini* v. Hasselt, *Alge. konst. Letterbode*, p.—(Java).
1876. *Rhinobatus thouini* Martens, *Preuss. Exped. Ost-Asien*, 1, p. 409 (Bangkok and Batavia).
1913. *Rhinobatus thouini* Weber, “*Siboga*” *Exped., Fische*, 57, p. 597 (Makassar and Aru Is.).
1926. *Rhinobatus thouiniana* Norman, *Proc. zool. Soc. Lond.*, p. 951, text-fig. 5.
1933. *Rhinobatus thouini* Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
1936. *Rhinobatus thouini* Suvatti, *Index Fish. Siam*, p. 4.
1938. *Rhinobatos thouinianus* Fowler, *List Fish. Malaya*, p. 14 (Penang, Singapore, Malacca Strait).
1941. *Rhinobatos thouin* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 317.
1947. *Rhinobatos thouiniana* Misra, *Rec. Indian Mus.*, 45 (1947), p. 27.
1952. *Rhinobatos thouiniana* Misra, *Rec. Indian Mus.*, 49 (1951), p. 115.
1955. *Rhinobatos thouini* Anonymous, *Mar. Fish. Karachi, Sind & Makran*, p. 7 (Coasts of Sind and Makran).

1958. *Rhinobatos thouiniana* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 83.



TEXT-FIG. 36.—*Rhinobatos thouin* (Anonymous)
(a) Dorsal view of head. (b) Ventral view of head.
(After J. R. Norman)

Vernacular names.—INDIA: *Lanj*, Marathi. PAKISTAN: *Liario*, Sind & Makran.

Disc triangular, longer than broad; its length 2.2 in total length. Snout rather long, expanded at the tip, margins distinctly concave, 2.2 in length of disc. Eyes 5.5—8.7 in snout. Mouth nearly straight, width 2.7 in preoral, 2.1 in internarial. Nostrils wide, oblique, 1.2 in its width, 2.7 in preoral, 2.1 in internarial. Internarial 5.5 in preoral. Interspiracle 3.8 in snout. Teeth obtuse, with indistinct, transverse ridge. Spiracles, nearly equal to eye, close behind it; both folds feebly developed, outer the more prominent. Five pairs of ventral gill openings. Two spineless dorsal fins. First dorsal origin far behind pelvic origin at a distance 1.2—1.8 times interdorsal. Second dorsal nearly equal to first dorsal; origin nearer to supracaudal origin than to first dorsal origin. Rayed portion of pectorals extends beyond eye. Pelvics large, close behind pectorals. Caudal small. No subcaudal lobe. Supracaudal low. Anal fin absent. Tail depressed, without spine, 1.2 times longer than trunk.

Denticles somewhat enlarged on back, scapular region and top of head; a series of strong, compressed spines in the median line of back, 2 on each shoulder and many around orbits and spiracles. Black brown above, with a milk white patch on either side of head; under surface milk white.

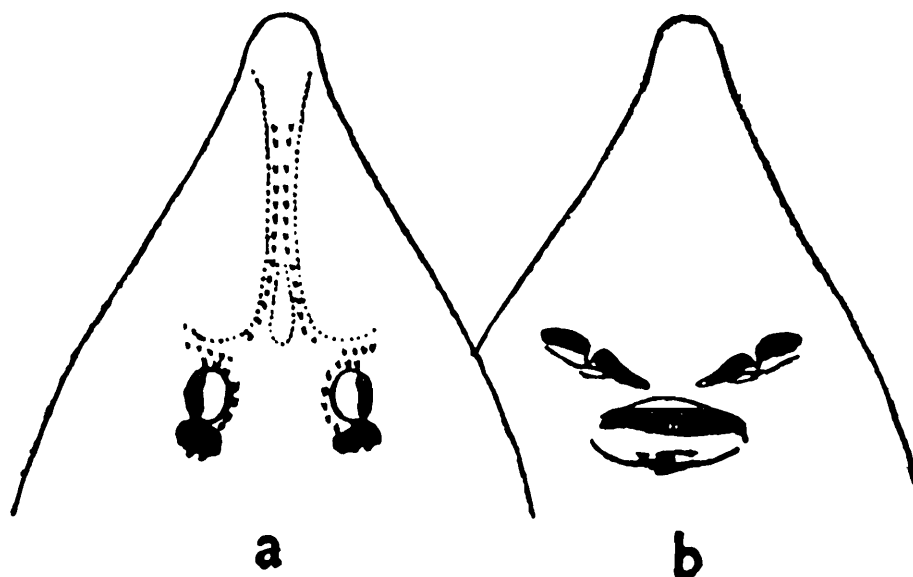
It grows to a length of 405 mm.; littoral.

Distribution.—India, Pakistan.—Malaya, Indonesia; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 25°N.—7°S., 62°—134°E. in the Indo-Pacific=(2°—25°N., 62°—100°E. in the Indian Ocean+13°N.—7°S., 100°—134°E. in the Pacific Ocean).

55. *Rhinobatos typus* (Benn.)

(Text-fig. 37)

1830. *Rhinobatos typus* Bennett, *Life of Raffles*, p. 694 (type locality: Sumatra).
 1833-34. *Rhinobatos armatus* Gray, *Ill. Ind. Zool. Hardwicke*, 2, pl. 99 (type locality: India).
 1841. *Rhinobatos (Rhinobatos) armatus* Müller & Henle, *Syst. Besch. Plagiost.*, p. 119 (India).
 1870. *Rhinobatos granulatus* Günther (*partim*), *Cat. Fish. Brit. Mus.*, 8, p. 443 (India; Sumatra).
 1878. *Rhinobatos granulatus* Day (*partim*), *Fish. India*, p. 732 (Seas of India to the Malay Archipelago).
 1889. *Rhinobatos granulatus* Day (*partim*), *Fauna Brit. India*, Fish., 1, p. 42 (Seas of India to the Malay Archipelago).



TEXT-FIG. 37—*Rhinobatos typus* (Benn.)

(a) Dorsal view of head. (b) Ventral view of head.
 (After J. R. Norman)

1926. *Rhinobatos armatus* Norman, *Proc. zool. Soc. Lond.*, p. 952, text-fig. 6 (India, Singapore, Macassar; Cape York; West Australia).
 1941. *Rhinobatos typus* Fowler, *Bull. U. S. nat. Mus.*, (100) 13, p. 319.
 1949. *Rhinobatos armatus* Misra, *Rec. Indian Mus.*, 45 (1947), p. 25.
 1952. *Rhinobatos armatus* Misra, *Rec. Indian Mus.*, 49 (1951), p. 115.
 1958. *Rhinobatos armatus* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 83.

Disc triangular, longer than broad; its length 2.3 in total length. Snout broadly triangular, bluntly pointed, margins not concave, 2.2 in length of disc. Eyes 6.5 in snout, 2.0 in interorbital. Width of mouth 2.8 in preoral, much longer than internarial. Nostrils wide, oblique, a little less than width of mouth. Internarial 7.0 in preoral. Preorbital 3.3 times the distance between the spiracles. Spiracles equal to eye, close behind it, with both folds poorly developed. Five pairs of ventral gill openings. Two spineless, subequal dorsal fins. First dorsal origin far behind pelvic origin, at a distance 1.4 times the interdorsal. Second dorsal origin equidistant between 1st dorsal and supracaudal origins. Rayed portion of pectorals continued below the spiracles. Pelvics large, origin about 1.7 eye diameters behind pectorals. Caudal moderate. Supracaudal pointed. No subcaudal lobe. Anal fin absent. Tail depressed, without spine, about equal to trunk.

Tubercles enlarged on back, scapular region and top of head; a series of strong, compressed spines in the median line of back, one or 2 on each shoulder and several smaller spines around orbits and above spiracles. Greyish red above becoming white beneath.

It attains a length of 550 mm.; littoral, bottom living.

Distribution.—India, Pakistan.—Singapore, Indonesia, Cape York, N. & W. Australia; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 25°N.—10°S., 72°—142°E. in the Indo-Pacific=(25°N.—10°S., 72°—142°E. in the Indian Ocean+1°N.—5°S., 103°—119°E. in the Pacific Ocean).

27. Genus *Rhina* Schneider

1760. *Rhina* Schaffer, *Epistola studi ichth.*, p. 20 (type, mentioned, non-binomial, hence inadmissible).
1792. *Rhina* (*nec* Schaffer, 1760) Walbaum, *Artedi Ichth.*, 3, ed. 2, p. 580 (type, *Rhina ancylostomus* Schn. : inadmissible according to Opinion 21 of the International Commission of Zoological Nomenclature).
1801. *Rhina* Schneider, *Syst. Ichth. Bloch*, p. 352 (type, *Rhina ancylostomus* Schn.).
1848. *Demiurga* Gistel, *Naturg. Thierreichs*, p. x (type, *Rhina ancylostomus* Schn.).
1862. *Rhynchobatis* Gill, *Ann. Lyc. nat. Hist. New York*, 7, p. 408 (type, *Rhina ancylostomus* Schn.).

Body depressed, elongated. Disc subtriangular, obtusely rounded in front. Tail depressed, nearly equal to trunk. Snout broad, obtusely rounded. Nostrils slightly oblique,

wide. Spiracles large, without posterior folds and about an eye diameter and a half behind eyes. 5 pairs of gill-openings on ventral side. Two spineless dorsal fins; first dorsal fin opposite pelvics, nearer to snout end than to caudal end. The fayed portion of pectoral extends only upto spiracles. Anal fin absent. Teeth obtusely rounded, each with several longitudinal ridges.

Distribution.—Red Sea, Arabia, E. Africa, Seychelles, India, Ceylon, Penang, Indonesia, Philippines, China, Japan, Australia.

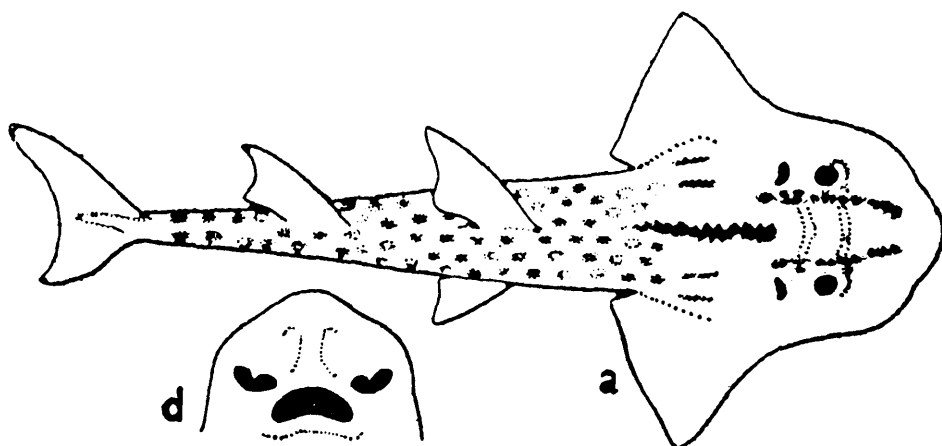
Rhina ancylostomus Schn., is the only species of this genus found in India and Ceylon.

56. *Rhina ancylostomus* Schn.

(Text-fig. 38)

1801. *Rhina ancylostomus* Schneider, *Syst. Ichth. Bloch*, p. 352, pl. 72 (type locality : Indian Seas; Coromandel).
1824. *Rhina ancylostoma* van Hasselt, *Bull. Sci. nat. Ferussac*, 2, p. 90 (Java).
- 1833-34. *Rhina ancylostomus* Gray, *Ill. Ind. Zool. Hardwicke*, 2, pl. 102, fig. 2 (India).
1851. *Rhina ancylostomus* Jerdon, *Madras J. Lit. Sci.*, 17, p. 148.
1851. *Rhina ancylostomus* Gray, *List Fish. Brit. Mus.*, p. 92 (Madras; China ; Penang).
1870. *Rhynchobatus ancylostomus* Günther, *Cat. Fish. Brit. Mus.*, 8, p. 440 (Madras, China; Seychelles; Penang).
1878. *Rhynchobatus ancylostomus* Day, *Fish. India*, p. 730, pl. 193, fig. 3 (Madras).
1889. *Rhynchobatus ancylostomus* Day, *Fauna Brit. India*, Fish. 1, p. 41 (Coromandel Coast).
1909. *Rhynchobatis ancylostomus* Annandale, *Mem. Indian Mus.*, 2, p. 10, pl. 5, fig. 5 (off Orissa and Hughli River mouth).
1914. *Rhynchobatus ancylostomus* Pearson, *Ceylon Administr. Rep.*, p. E 4.
1926. *Rhynchobatis ancylostoma* Norman, *Proc. zool. Soc. Lond.*, p. 943, text-fig. A (nostril) (E. Africa, Red Sea, Australia, Japan).
1929. *Rhynchobatus ancylostomus* Pillay, *J. Bombay nat. Hist. Soc.*, 33, p. 351 (Travancore).
1931. *Rhina ancylostoma* Chu, *Biol. Bull. St. John's Univ.*, No. 1, p. 6 (China).
1933. *Rhynchobatus ancylostomus* Deraniyagala, *Ceylon J. Sci.*, (c), 5, p. 81 (Ceylon).
1933. *Rhynchobatus ancylostomus* Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).

1938. *Rhina ancylostoma* Fowler, *List Fish Malaya Suppl.*, p. 246 (Singapore).
1940. *Rhina ancylostoma* Whitley, *Fish. Australia*, p. 179, figs. 205, 206 (Australia).
1941. *Rhina ancylostoma* Fowler, *Bull. U. S. nat. Mus.*, (100) 13, p. 299 (Philippines).
1949. *Rhina ancylostoma* Misra, *Rec. Indian Mus.*, 45 (1947), p. 27.
1952. *Rhina ancylostoma* Misra, *Rec. Indian Mus.*, 49 (1951), p. 116.
1952. *Rhina ancylostoma* Mciri, *Mem. Hyogo Univ. Agric.*, 1, No. 3, p. 24 (Mokpo; Korea).
1953. *Rhina ancylostoma* Herre, *Check List Philippine Fish.*, p. 35 (Philippines).
1953. *Rhina ancylostoma* Smith, *Sea. Fish, S. Africa*, p. 503, fig. 59 a (tropical Indo-Pacific, reaching Kosi Bay).
1955. *Rhina ancylostoma* Munro, *Mar. Freshwater Fish. Ceylon*, p. 10.
1958. *Rhina ancylostoma* Misra & Menon, *Rec. Indian Mus.*, 53, (1955), p. 83.



TEXT-FIG. 38.—*Rhina ancylostomus* Schn.

(a) Dorsal view: $\times \frac{1}{24}$. (b) Ventral view of head: $\times \frac{1}{24}$.

(After F. Day)

Vernacular names.—INDIA: *Sakshi* or *Lanj*, Marathi; *Mun ulava*, Tamil; *Nalla dindi* or *Pottila sora*, Telegu. CEYLON: *Thitha mora* or *Pulaman oliya*, Sinhalese; *Pulaman uluvai*, Tamil.

Disc wider than long, obtusely triangular, its length 3 in total length. Snout broadly convex or rounded, 3 in length of disc; rostral cartilages short. Eyes 4.5 in snout, 3.6 in interorbital, width of mouth 1.1 in preoral, equal to internarial. Nostrils wide, nearly half in width of mouth. Internarial 1.1 in preoral. Teeth 75-77 rows; 22 vertical rows in the centre of upper jaw and 27 in the centre of lower jaw. Dental surface deeply undulated, with one

large median and smaller lateral elevations in lower jaw and with corresponding emarginations in upper jaw; teeth largest on the summit of each elevation, all obtusely rounded with several longitudinal ridges across each. Spiracles small, without folds on hind edge, more than a eye diameter, away from orbit. Five pairs of ventral gill openings. Two spineless dorsals, more or less subequal. First dorsal origin slightly before pelvic origin, nearer to snout end than to caudal end, about over pelvic origin. Second dorsal origin midway between first dorsal and supracaudal origins. Rayed portion of pectorals extends only up to spiracles. Pelvics moderate, about snout length, away from pectorals. Caudal moderate, supracaudal pointed. No subcaudal lobe. No anal fin. Tail depressed, without spine, as long as trunk, with a lateral ridge on either side.

Irregular rows of large tubercles from ridges above each eye to nape; a vertebral row before 1st dorsal, 2 parallel rows each side above pectoral base, of which inner continuous with supraorbital row. Dull brown above, lighter below often with whitish spots on body and fins.

It attains a length of 2,432 mm. Said to be a scavenger of shallow waters. Ovo-viviparous; flesh good eating; littoral, bottom living.

Distribution.—India, Pakistan, Ceylon.—Red Sea, Seychelles, E. & S. Africa, Oman, Penang, Indonesia, Hongkong, China, Japan, Philippines, W. & N. Australia; in the mean annual isotherm of 20° C. with the latitudinal and longitudinal range of 35°N.—30°S., 32°—142°E. in the Indo-Pacific=(25°N.—30°S., 32°—142°E. in the Indian Ocean+35°N.—7°S., 103°—130°E. in the Pacific Ocean).

28. Genus *Rhynchobatus* Müller & Henle

1837. *Rhynchobatus* Müller & Henle, *Sitz. Ber. Preuss. Akad. Wiss. Berlin*, p. 116 (type, *Rhinobatus laevis* Schn., orthotypic).

1841. *Rhynchobatis* Müller & Henle, *Syst. Besch. Plagiost.*, p. 111 (type, *Rhinobatus laevis* Schn., orthotypic).

Genus *Rhynchobatus* M. & H. differs mainly from genus *Rhinobatos* Linck in having (i) the two dorsals wide apart from each other with the first dorsal origin opposite or slightly behind pelvic origin *versus* two closely placed dorsals with the first dorsal origin far behind pelvic origin, (ii) a well developed subcaudal *versus* an indistinct subcaudal, and (iii) pectorals not extending beyond level of mouth, *versus* pectorals extending beyond level of mouth.

Distribution.— E. Africa, Madagascar, Seychelles, Zanzibar, Red Sea, Arabia, India, Ceylon, Andamans, Malay Peninsula, Malay Archipelago, Ccchin-China, China, Japan, Melanesia.

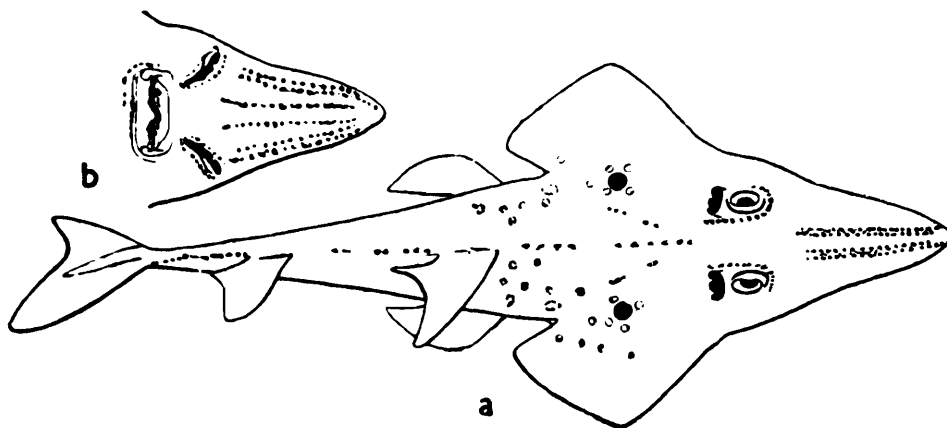
Rhynchobatus djiddensis (Forsk.) is the only species of the genus recorded from India and Ceylon.

57 *Rhynchobatus djiddensis* (Forsk.)

(Text-fig. 39)

1775. *Raja djiddensis* Forskal, *Descript. Animal.*, pp. 8, 18 (type, locality : Djedda and Lohaja, Red Sea).
1801. *Rhinobatus laevis* Schneider, *Syst. Ichth. Bloch*, p. 354, pl. 71 (type locality : Tranquebar).
1841. *Rhynchobatus laevis* Müller & Henle, *Syst. Besch. Plagiost.*, p. 111 (India, Red Sea; Malabar).
1851. *Rhynchobatus djeddensis* Jerdon, *Madras J. Lit Sci.*, **17**, p. 148.
1865. *Rhynchobatus djeddensis* Day, *Fish. Malabar*, p. 273 (Malabar).
1870. *Rhynchobatus djeddensis* Günther, *Cat. Fish. Brit. Mus.*, **8**, p. 441 (Red Sea; Zanzibar; Seychelles; Sumatra; East Indies; India).
1878. *Rhynchobatus djeddensis* Day, *Fish. India*, p. 730, pl. 192, fig. 1 (Coromandel Coast).
1889. *Rhynchobatus djeddensis* Day, *Fauna Brit. India*, Fish., **1**, p. 40, fig. 16 (Coromandel Coast).
1901. *Rhynchobatus djeddensis* Jordan & Snyder, *Annot. Zool. Japan.*, **3**, p. 41 (Nagasaki).
1909. *Rhinobatis djeddensis* Annandale, *Mem. Indian Mus.*, **2**, p. 12 (Bay of Bengal).
1913. *Rhynchobatus djiddensis* Garman, *Mem. Harv. Mus. Comp. Zool.*, **36**, p. 268 (Red Sea; East Indies; Africa; India).
1913. *Rhynchobatus djiddensis* Weber, "*Siboga*" *Exped. Fische*, **57**, p. 597 (Makassar).
1914. *Rhynchobatus djiddensis* Pearson, *Ceylon Administr. Rep.*, p. E 4.
1920. *Rhynchobatus djeddensis* Southwell & Prashad, *Rec. Indian Mus.*, **19**, p. 4 (Ceylon).
1922. *Rhynchobatus djiddensis* Malpas, *Ceylon Administr. Rep.*, p. F 6.
1927. *Rhynchobatus djeddensis* Pillay, *J. Bombay nat. Hist. Soc.*, **33**, p. 352 (Travancore).
1933. *Rhynchobatus djeddensis* Deraniyagala, *Ceylon Journ. Sci.* (c), **5**, p. 81 (Ceylon).
1933. *Rhynchobatus djeddensis* Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
1936. *Rhynchobatus djeddensis* Suvatti, *Index Fish. Siam*, p. 4 (Gulf of Siam).
1938. *Rhynchobatus djiddensis australiae* Whitley, *Fish. Australia*, **1**, p. 173, fig. 197 (Queensland; New South Wales).

1940. *Rhynchobatus djiddensis* Fowler, *List Fish. Malaya*, p. 14 (Penang, Singapore).
1941. *Rhynchobatus djeddensis* Herre, *Mem. Indian Mus.*, 13, p. 333.
1941. *Rhynchobatus djiddensis* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 300.
1942. *Rhynchobatus djeddensis* Sarangdhar, *Ind. J. med. Res*, 30, p. 557 (Bombay).
1949. *Rhynchobatus djiddensis* Misra, *Rec. Indian Mus.*, 45 (1947), p. 27.
1952. *Rhynchobatus djiddensis* Misra, *Rec. Indian Mus.*, 49 (1951), p. 117.
1953. *Rhynchobatus djiddensis* Herre, *Check List Philippine Fish.*, p. 35 (Philippines).
1953. *Rhynchobatus djiddensis* Smith, *Sea Fish. S. Africa*, p. 63, fig. 60 (Natal coast).
1955. *Rhynchobatus djiddensis* Anonymous, *Mar. Fish. Karachi, Sind & Makran*, p. 6 (Coasts of Sind and Makran).
1955. *Rhynchobatus djiddensis* Munro, *Mar. Freshwater Fish. Ceylon* p. 10 (Ceylon).
1958. *Rhynchobatus djiddensis* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 53.



TEXT-FIG. 39.—*Rhynchobatus djiddensis* (Forsk.)

(a) Dorsal view. (b) Ventral view of head.

(After F. Day)

Vernacular names.—INDIA: *Ranja*, Marathi; *Padangan*, Tamil; *Walawah tenkee*, *Nul ulavi* or *Tipi ulavi*, Telegu; Standardised names: *Buther tiruke*, *Lanj*. PAKISTAN: *Muchcho*, Sind & Makran. CEYLON: *Kiri uluva*, Sinhalese; *Pal uluvai*, Tamil.

Disc triangular, longer than broad, its length 2.1 in total length. Snout triangularly pointed, 2.4 in length of disc. Eyes 5.0 in snout, 1.3 in interorbital. Width of mouth 2.8 in preoral, more than internarial, short upper and lower labial folds at the angles of mouth. Nostrils oblique, wide, about $\frac{3}{4}$ the width of mouth. Internarial 4.0 in

preoral. Teeth in 40 rows in each jaw, smooth, rhomboid. Spiracles large, about an eye diameter close behind orbit, with folds on hind edge. Five pairs of ventral gill openings. Two spineless dorsals. First dorsal larger than second dorsal; origin slightly behind pelvic origin, nearer to snout end than to caudal end. Second dorsal origin nearer to caudal origin than to first dorsal origin. Rayed portion of pectorals reaching only up to spiracle origin. Pelvics moderate; origin about an eye diameter from inner angle of pectoral fin. Caudal moderate. Supracaudal pointed. No subcaudal lobe. Anal fin absent. Tail depressed, without spine, nearly equal to trunk.

A row of small tubercles along each supraorbital edge interrupted by division of spiracle; median row of small vertebral tubercles down back, also short series on each shoulder broken midway in its length. Grey above with light small white spots scattered about surrounding round blackish spots less than eye in size, which is above each of shoulder girdle; whitish below.

It grows to a length of 3,044 mm. and a weight of at least 226.8 kilograms (500 lbs.). It is a famous angling fish.

Distribution.—India, Pakistan, Ceylon.—Red Sea, Zanzibar, Seychelles, Madagascar, E. & S. Africa, Arabia, Malay Peninsula, Indonesia, Thailand, Japan, Philippines, Melanesia, Queensland; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 35°N.—29°S., 30°—145°E. in the Indo-Pacific= (25°N.—29°S., 30°—100°E. in the Indian Ocean+35°N.—18°S., 101°—145°E. in the Pacific Ocean).

X. Family PRISTIDAE

Saw-fishes

Body shark-like, elongate, more or less depressed, flattened below. Snout flattened, very long, saw-like, each side with a row of teeth-like points set in sockets. Eyes without nictitating membrane. Mouth inferior, transverse. Labial folds absent. Oronasal grooves and cirri absent. Teeth in jaws very small, obtuse, numerous. Nostrils inferior, oblique. Spiracles large, behind eye. Five pairs of ventral gill openings. Two spineless dorsal fins. Anal absent. Caudal well developed. No caudal pits. A distinct or indistinct caudal keel. Pectorals moderate, front edge not reaching snout. Viviparous.

The family is represented by a single genus in the Indian region.

29. Genus *Pristis* Linck

1779. *Pristis* Klein, *Neuer Schauplatz*, 7, p. 403 (type, *Squalus pristis* L., inadmissible).
1790. *Pristis* Linck, *Mag. Phys. Naturg. Gotha*, (3) 6, p. 31 (type, *Squalus pristis* L., monotypic).
1794. *Pristis* Latham, *Trans. Linn. Soc. Lond.*, 2, 276 (type, *Squalus pristis* L.).
1816. *Pristobatus* Blainville, *Bull. Soc. philom. Paris*, 8, p. 121 (type, *Pristis antiquorus* Latham = *Squalus pristis* L., designated by Fowler, *Bull. geol. Surv. New Jersey*, 4, p. 81, 1911).
1818. *Pristobatys* Blainville, *Nouv. Diet. Sci. nat.*, 27, ed. 2, p. 385 (type, *Pristis antiquorus* Latham).
1825. *Pristibatis* Blainville, *Faune Francaise Poiss.*, p. 49 (type, *Pristis antiquorus* Latham).
1905. *Pristiopsis* Fowler, *Proc. Acad. nat. Sci. Philad.*, p. 459 (Aug. 14) (type, *Pristis perrotteti* M. & H., orthotypic. *Pristiopsis* Schmidt precluded, being published in November, 1905).

Body elongated and moderately depressed. Rostrum very much produced and saw-like. Nostrils oblique. Eyes without nictitating membrane. Spiracles large, behind the eyes. 5 pairs of gill openings on the ventral side. Two spineless dorsal fins. Pectorals moderate, front edge quite free neither joining with head nor reaching snout. Anal fin absent. Rostral teeth strong and large, set in sockets on either edges of the blade-like snout. Oral teeth small, pavement-like. Viviparous; timid, dangerous when cornered; flesh edible; liver yields oil of good quality.

Distribution.—E. Africa, Madagascar, Seychelles, Zanzibar, Red Sea, Arabia, India, Burma, Ceylon, Andamans, Malay Peninsula, Indonesia, Thailand, Philippines, Japan, Melanesia, Queensland, Tropical Atlantic.

Key to species

- | | | |
|---|----|--------------------------------|
| 1. First dorsal origin distinctly behind or opposite pelvic origin : rostral teeth more in number, 23—35 on either side | 3 | |
| 2. First dorsal origin clearly in front of pelvic origin: rostral teeth less in number, 17-20 on either side | .. | <i>P. microdon</i> Lath. |
| 3. Subcaudal lobe present | 5 | |
| 4. Subcaudal lobe absent | 7 | |
| 5. Subcaudal lobe well developed, pointed | | <i>P. cuspidatus</i> Lath. |
| 6. Subcaudal lobe moderate, rounded | | <i>P. annandalei</i> Chaudhuri |
| 7. First dorsal origin opposite pelvic origin | | <i>P. pectinatus</i> Lath. |
| 8. First dorsal origin behind pelvic origin | | <i>P. zysron</i> Blkr. |

58. *Pristis annandalei* Chaudhuri

(Text-fig. 40)

1908. *Pristis annandalei* Chaudhuri, *Rec. Indian Mus.*, 2, p. 391 fig. (type-locality : near Elephant Pt., Burma Coast).
 1939. *Pristis annandalei* Annandale, *Mem. Indian Mus.*, 2, p. 8, pl. 5, fig. 4 (off Burma Coast).



TEXT-FIG. 40.—Dorsal view of *Pristis annandalei* Chaudhuri : $\times ca \frac{1}{30}$.
 (After B. L. Chaudhuri)

Distance between snout end and spiracle 3.3; depth 9.8 to subcaudal origin. Rostrum 3.8 to subcaudal origin, with 25-26 pairs of long, closely-set teeth commencing at base of rostrum. Eyes without nictitating membrane, 11.2 in rostrum. Oronasal grooves and cirri absent. Mouth transverse. Teeth small, pavement-like. Spiracles oblique, large, close behind eye a little more than twice eye diameter. First dorsal origin a little behind pelvic origin. Second dorsal smaller than first dorsal; second dorsal origin more or less between first dorsal and subcaudal origin. Anal absent. Subcaudal slightly lobed. No caudal pits. An imperfectly developed on the posterior portion of tail.

Head and upper part of body ash grey becoming light blue and then to light yellow on sides; edged with a reddish line from snout to pectorals; claspers red in males, eyes golden.

It attains a length 3,067 mm.; littoral.

Distribution.—Burma; in the mean annual isotherm of 20°C. in 17°N., 97°E. in the Bay of Bengal.

59. *Pristis cuspidatus* Latham

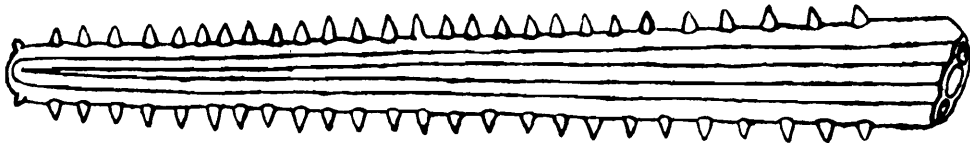
(Text-fig. 41)

1794. *Pristis cuspidatus* Latham, *Trans. Linn. Soc. Lond.*, 2, p. 279, pl. 26, fig. 3 (type locality: not known).
 1804. *Squalus semisagittatus* Shaw, *General Zoology*, 5, p. 361 (type locality : Indian Seas) (on *Yuhla Russell Fish Coromandel*, 1, p. 8, pl. 13, 1803 (type locality : Vizagapatam).
 1851 *Pristis cuspidatus* Gray, *List Fish. Brit. Mus.*, p. 90 (Tenasserim).

1852. *Pristis semisagittatus* Bleeker, *Verh. Bat. Gen. (Plagiost.)*, 24, p. 33 (Batavia, Samarang).
1865. *Pristis semisagittatus* Day, *Fish. Malabar*, p. 272 (Malabar).
1870. *Pristis cuspidatus* Günther, *Cat. Fish. Brit. Mus.*, 8, p. 439 (Penang; India; East Indies; Tenasserim; Bengal).
1878. *Pristis cuspidatus* Day, *Fish. India*, p. 728, pl. 191, fig. 3 (Calicut and Madras).
1886. *Pristis cuspidatus* Ogilby, *Cat. Fish. Austral. Mus.*, 1, p. 14 (Madras).
1889. *Pristis cuspidatus* Day, *Fauna Brit. India, Fish.*, 1, p. 37, fig. 15 (Seas of India to Malay Archipelago).
1907. *Pristis cuspidatus* Lloyd, *Rec. Indian Mus.*, 1, p. 220 (Akyab).
1909. *Pristis cuspidatus* Annandale, *Mem. Indian Mus.*, 2, p. 5 (off Orissa and Ganges mouth).
1910. *Pristis cuspidatus* Southwell, *Spol. Zeyl.*, 6, pt. 24, p. 137 (Portugal Bay, Ceylon).
1911. *Pristis cuspidatus* Gupta, *Extract Preliminary Rep. Fish. Bengal in collection of papers Fishery Survey Bay of Bengal*, p. 2 (Bengal).
1912. *Pristis cuspidatus* Jenkins, *Rec. Indian Mus.*, 7, p. 58 (Arakan Coast).
1913. *Pristis cuspidatus* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 261 (India; Red Sea; East Indies).
1914. *Pristis cuspidatus* Pearson, *Ceylon Administr. Rep.*, p. E 23 (Trincomalee).
1919. *Pristis cuspidatus* Southwell & Prashad, *Rec. Ind. Mus.*, 16, p. 225 (off the Coast of Ceylon).
1928. *Pristis cuspidatus* Fowler, *J. Bombay nat. Hist. Soc.*, 33, p. 101 (Bombay).
1929. *Pristis cuspidatus* Pillay, *J. Bombay nat. Hist. Soc.*, 33, p. 352 (Travancore).
1936. *Pristis cuspidatus* Suvatti, *Index Fish. Siam*, p. 3 (Gulf of Siam).
1938. *Pristis cuspidatus* Fowler, *List Fish. Malaya*, p. 12 (Penang, Patani, Singapore).
1941. *Pristis cuspidatus* Herre, *Mem. Indian Mus.*, 13, p. 333 (Andamans).
1941. *Pristis cuspidatus* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 296.
1949. *Pristis cuspidatus* Misra, *Rec. Indian Mus.*, 45 (1947), p. 28.
1952. *Pristis cuspidatus* Misra, *Rec. Indian Mus.*, 49 (1951), p. 117.
1953. *Pristis cuspidatus* Herre, *Check List Philippine Fish.*, p. 34 (Philippines).
1955. *Pristis cuspidatus* Anonymous, *Mar. Fish. Karachi, Sind & Makran.*, p. 6 (Coasts of Sind and Makran).

1955. *Pristis cuspidatus* Munro, *Mar. Freshwater Fish. Ceylon*, p. 11 (Ceylon).

1958. *Pristis cuspidatus* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 83.



TEXT-FIG. 41.—Rostrum of *Pristis cuspidatus* Latham. (After J. Latham).

Vernacular names.—INDIA: *Vela meen*, Tamil; *Yahla*, Telegu; Standardised names: *Wall tiruke*, *Ween*. CEYLON: *Dhathi mora*, Sinhalese; *Vela schura*, Tamil.

Distance between snout end and spiracle 2.7; depth 11.8 to subcaudal origin. Rostrum 2.9 to subcaudal origin, with 23—25 pairs of broad, close-set teeth commencing at a distance from base to rostrum. Eyes without nictitating membrane, 12.0 in rostrum. Oronasal grooves and cirri absent. Mouth transverse. Teeth small, longer than broad, pavement-like, in 62 rows. Spiracles oblique, close behind eye, half in eye diameter. First dorsal origin entirely behind pelvics. Second dorsal slightly smaller than first dorsal; origin midway between posterior end of first dorsal and subcaudal origins; upper margins of dorsals concave with posterior lobes of each produced. Anal absent. Subcaudal with well developed pointed lobe. No caudal pits. A lateral keel on tail.

Greyish yellow above, whitish below; iris golden with a black edge.

It attains a length of 6,096 mm. or more. The flesh is much esteemed, its liver yields considerable oil. It ascends rivers; euryhaline.

Distribution.—India, Pakistan, Burma, Ceylon.—Red Sea, Malay Peninsula, Indonesia, Thailand, Philippines; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 25°N.—7°S., 39°—123°E. in the Indo-Pacific=(4°—25°N., 39°—100°E. in the Indian Ocean+15°N.—7°S., 100°—123°E. in the Pacific Ocean).

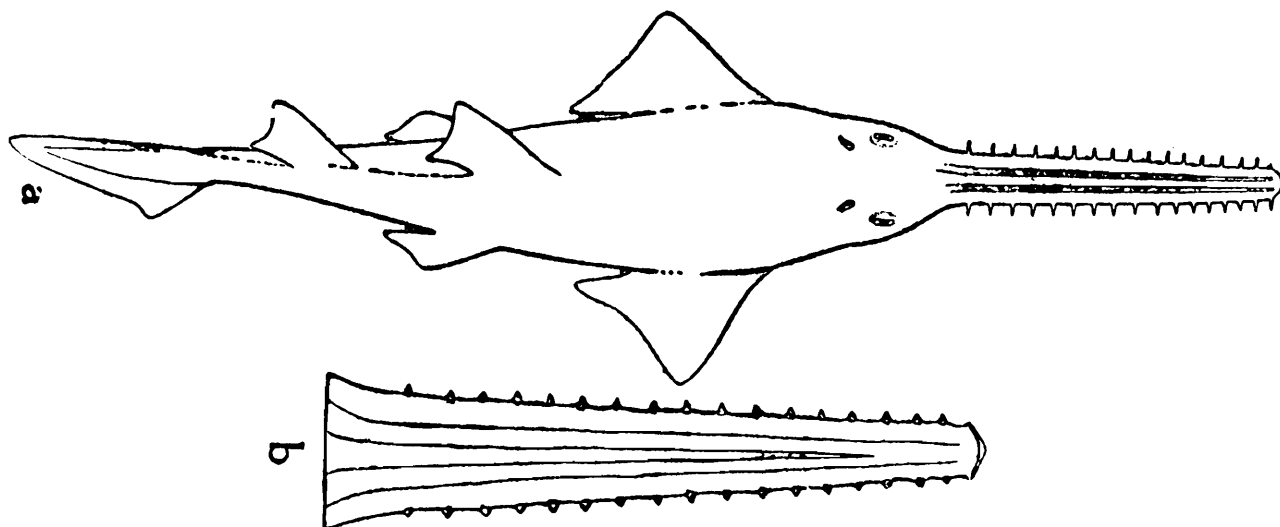
60. *Pristis microdon* Latham

(Text-fig. 42)

1794. *Pristis microdon* Latham, *Trans. Linn. Soc. Lond.*, p. 280, pl. 26, fig. 4 (type locality : not known).
1841. *Pristis perotteti* Müller & Henle, *Syst. Besch. Plagiost.*, p. 108 (type locality : Senegal, freshwater; paratype is in the Paris Museum).
1852. *Pristis microdon* Bleeker, *Verh. Bat. Gen. (Plagiost.)*, 24, p. 54 (Batavia, Gresik, Suracarta, Java; Bandjermassing, Borneo).
1860. *Pristis antiquorum* (*nec* Latham) Blyth, *J. Asiat. Soc. Bengal*, 29, p. 36 (Calcutta).
1878. *Pristis perotteti* Day, *Fish. India*, 1, p. 729, pl. 191, fig. 1 (Mahanadi river, Orissa).
1889. *Pristis perotteti* Day, *Fauna Brit. India*, Fish., 1, p. 38 (Mahanadi river, Orissa).
1894. *Pristis perotteti* Weber, *Zool. Ergebn. Reise Nederland Ost—Indien*, p. 458 (Borneo and Sumatra, freshwater).
1909. *Pristis perottetii* Annandale, *Mem. Indian Mus.*, 2, p. 6 (off Arakan Coast and Orissa).
- 1915-18. *Pristis perotteti* Pearson, *Ceylon Administr. Rep.*, p. F 9.
1921. *Pristis perotteti* Malpas, *Ceylon Administr. Rep.*, p. E 6.
1929. *Pristis perottetti* Pillay, *J. Bombay nat. Hist. Soc.*, 33, p. 352 (Travancore).
1933. *Pristis perrotetti* Deraniyagala, *Ceylon J. Sci.*, (c), p. 81 (Ceylon).
1933. *Pristis perotteti* Sorley, *Marine Fish. Bombay Presidency*, p. 159.
1936. *Pristis perotteti* Suvatti, *Index Fish. Siam*, p. 4 (Siam).
1940. *Pristis perotteti* Prater, *J. Bombay nat. Hist. Soc.*, 41, p. 435.
1941. *Pristis microdon* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 295.
1942. *Pristis perotteti* Sarangdhar, *Ind. J. Med. Res.*, 30, p. 556.
1949. *Pristis microdon* Misra, *Rec. Indian Mus.*, 45 (1947), p. 29.
1952. *Pristis microdon* Misra, *Rec. Indian Mus.*, 49 (1951), p. 117.
1953. *Pristis microdon* Herre, *Check List Philippine Fish.*, p. 33 (Philippines).
1953. *Pristis microdon* Smith, *Sea Fish. S. Africa*, pp. 62, 63 (Zambasi river in freshwater miles inland; as far south Port Alfred).
1955. *Pristis microdon* Munro, *Mar. Freshwater Fish. Ceylon* p. 11 (Ceylon).

1958. *Pristis microdon* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 83.

1958. *Pristis perotteti* Briggs, *Bull. Florida Mus. Biol. Sci.*, 2, No. 8, p. 250 (Gulf of Mexico).



TEXT-FIG. 42.—*Pristis microdon* Latham

(a) Dorsal view. (After F. Day)

(b) Rostrum. (After J. Latham)

Vernacular names : INDIA: *Komben sorah*, Travancore; *Kundah*, Oorlah; *Nali* or *Shinshi*, Marathi. CEYLON: *Illipara vellava*, Sinhalese; *Vaal schura* or *Vela schura*, Tamil.

Distance between snout end and spiracle 2.6; depth 10.0 to subcaudal origin. Rostrum 2.8 to subcaudal origin, with 17—20 pairs of short, widely-set teeth commencing at base of rostrum. Oronasal grooves and cirri absent. Teeth in $\frac{70}{72}$ rows, pavement-like. Spiracles oblique, smaller than eye, 1.2 eye diameters behind orbit. First dorsal entirely before pelvics. Second dorsal subequal with first dorsal; origin midway between posterior end of first dorsal and the subcaudal origin. Anal absent. Subcaudal slightly lobed. No caudal pits or keels.

Reddish brown above becoming dull white below; iris golden with a black edge.

It attains a length of 5,486 mm. Its liver yields considerable oil; ascends estuaries and freshwater, euryhaline.

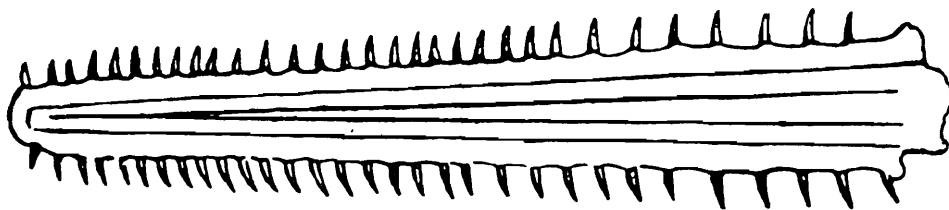
Distribution.—India, Pakistan, Burma, Ceylon.—Zanzibar, Madagascar, S. Africa, Indonesia, Thailand, "Indo-China," Philippines, tropical Atlantic; in the mean annual isotherm of 20°C. with the latitudinal and

longitudinal range of 25°N.—29°S., 30°—123°E. in the Indo-Pacific=(25°N.—29°S., 30°—100°E. in the Indian Ocean +15°N.—7°S., 100°—123°E. in the Pacific Ocean); 26°N., 92°W. in the Atlantic.

61. *Pristis pectinatus* Latham

(Text-fig. 43)

1794. *Pristis pectinatus* Latham, *Trans. zool. Soc. Lond.*, 2, p. 278, pl. 26, fig. 2 (type locality : in the Ocean).
 1822. *Squalus pectinatus* Hamilton, *Fish. Ganges*, pp. 5, 361 (the Ganges).
 1860. *Pristis pectinatus* Bleeker, *Nat. Tijds. Ned. Indie*, 21, p. 166 (Cape of Good Hope).
 1860. *Pristis pectinatus* Blyth, *J. Asiat. Soc. Bengal*, 29, p. 36, (Calcutta).
 1870. *Pristis pectinatus*, Günther, *Cat. Fish. Brit. Mus.*, 8, p. 437 (West Indies, Mexico, Calcutta, Cape of Good Hope).
 1888. *Pristis pectinatus* Day, *Fish. India, Suppl.*, p. 811 (Red Sea through the Indian Ocean).
 1889. *Pristis pectinatus* Day, *Fauna Brit. India, Fish.*, 1, p. 31 (Akyab).
 1910. *Pristis pectinatus* De, *Rep. Fish. Eastern Bengal and Assam*, p. 17 (Chittagong).
 1913. *Pristis pectinatus* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 262 (tropical and temperate Seas).
 1922. *Pristis pectinatus* Hora, *Mem. Indian Mus.*, 5, p. 763 (Chilka Lake).
 1941. *Pristis pectinatus* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 291.
 1949. *Pristis pectinatus* Misra, *Rec. Indian Mus.*, 45 (1947), p. 29.
 1952. *Pristis pectinatus* Misra, *Rec. Indian Mus.*, 49 (1951), p. 117.
 1953. *Pristis pectinatus* Smith, *Sea Fish. S. Africa*, pp. 62, 63 (Natal, Mozambique, East London).
 1958. *Pristis pectinatus* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 83.
 1958. *Pristis pectinatus* Briggs, *Bull. Florida Mus. Biol. Sci.*, 2, No. 8, (Gulf of Mexico).



TEXT-FIG. 43.—Rostrum of *Pristis pectinatus* Latham. (After J. Latham)

Vernacular names.—BURMA : *Nga tat way*. PAKISTAN : *Khurra mach*, Chittagong.

Distance between snout end and spiracle 2.8; depth 9.1 to subcaudal origin. Rostrum 3.2 to subcaudal origin, with

25—34 pairs of long, closely-set teeth commencing at base of rostrum. Oronasal groove and cirri absent. Eyes without nictitating membrane. Mouth transverse. Teeth in 70 rows, small, blunt in jaws. First dorsal origin opposite pelvics. Second dorsal and first dorsal subequal. Second dorsal origin nearer to subcaudal origin than to first dorsal. No caudal pits. A low lateral keel on tail. Subcaudal not lobed.

Sandy brown becoming lighter beneath.

It grows to a length of 7,600 mm. The flesh is good eating; it fights well when hooked; euryhaline.

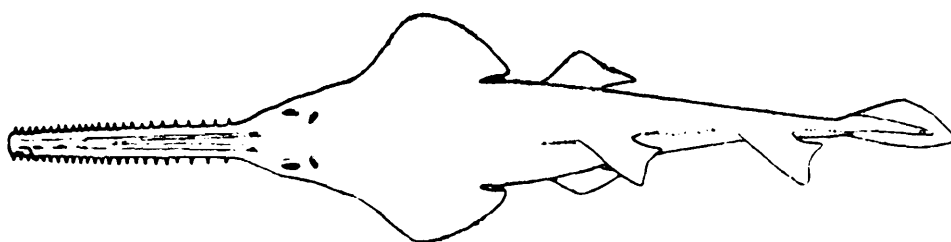
Distribution.—India, Pakistan, Burma.—Red Sea, Madagascar, S. Africa, Arabia, tropical Atlantic; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 25°N.—35°S., 18°—92°E. in the Indian Ocean and 26°N., 92°W. in the Atlantic Ocean.

62. *Pristis zysron* Blkr.

(Text-fig. 44)

1851. *Pristis zysron* Bleeker, *Nat. Tijds. Ned. Ind.*, 2, pp. 417, 442 (type locality: Bandjermassing, Borneo, in rivers).
1852. *Pristis dubius* Bleeker, *Verh. Bat. Gen. (Plagiost.)*, 24, p. 56, pl. 4, fig. 11 (type locality: East Indies).
1870. *Pristis zysron* Günther, *Cat. Fish. Brit. Mus.*, 8, p. 438 (Ceylon).
1878. *Pristis zysron* Day, *Fish. India*, p. 729, pl. 191, fig. 2 (the example figured, 34 inches long, was from Madras).
1889. *Pristis zysron* Day, *Fauna Brit. India, Fish.*, 1, p. 38 (the Makran and Sind Coasts).
1894. *Pristis zysron* Weber, *Zool. Ergebn. Reise Nederland Ost-Indien*, p. 458 (Borneo, Java, Ternate, freshwater).
1904. *Pristis zysron* Volz, *Rev. Suisse Zool.*, 12, p. 484 (Sakaranda, Sumatra).
1909. *Pristis zysron* Annandale, *Mem. Indian Mus.*, 2, p. 8 (India).
1913. *Pristis zysron* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 262 (India; East Indies; Ceylon; Borneo, Amboina).
1929. *Pristis zysron* Tirant, *Serv. Oceanogr. Peches Indo-Chine*, 6° note, p. 71 (Cochin-China).
1940. *Pristis zysron* Whitley, *Fish. Australia*, 1, p. 175, fig. 203 (Queensland, sometimes straying down our eastern coast in late summer as far as Sydney).
1941. *Pristis zysron* Fowler, *Bull. U. S. nat. Mus.*, (100) 13, p. 293.
1949. *Pristis zysron* Misra, *Rec. Indian Mus.*, 45 (1947), p. 30.

1952. *Pristis zijsron* Misra, *Rec. Indian Mus.*, **49** (1951), p. 118.
 1953. *Pristis zysron* Smith, *Sea Fish. S. Africa*, p. 63 (Lourenco Marques).
 1955. *Pristis zysron* Anonymous, *Mar. Fish. Karachi, Sind & Makran*, p. 6 (Coasts of Sind and Makran).
 1955. *Pristis zijsron* Munro, *Mar. Freshwater Fish. Ceylon*, p. 11 (Ceylon).
 1958. *Pristis zijsron* Misra & Menon, *Rec. Indian Mus.*, **53** (1955), p. 83.



TEXT-FIG. 44.—Dorsal view of *Pristis zysron* Blkr.: $\times ca \frac{1}{10}$. (After F. Day)

Vernacular names.—INDIA : *Vella sorrah*, Tamil.
 PAKISTAN: *Wakhan*, Sind & Makran.

Distance between snout end and spiracle 2·7; depth 9·4 to subcaudal origin. Rostrum 3·0 to subcaudal origin, with 25—32 pairs of teeth commencing at base of rostrum. Eyes without nictitating membrane, 11·0 in rostrum. Oronasal grooves and cirri absent. Mouth transverse. Teeth small pavement-like. Spiracles oblique, close behind eye. First dorsal origin behind pelvic origin. Second dorsal subequal with first dorsal; origin midway between posterior end of first dorsal and subcaudal origin, slightly nearer to subcaudal origin. Anal absent. Subcaudal without lobe, broadly rounded. No caudal pits. A lateral keel after first dorsal, obsolete after two-thirds of the space to second dorsal.

Sandy brown becoming lighter below.

It grows to 6,096 mm. in length; littoral.

Distribution.—India, Pakistan, Ceylon.—S. Africa, Indonesia, Queensland; in the mean annual isotherm of 20°C. with the longitudinal and latitudinal range of 25° N.—32° S., 30°—150° E. in the Indo-Pacific=(25° N.—32° S., 30°—100° E. in the Indian Ocean+5° N.—25° S., 110°—150° E. in the Pacific Ocean).

XI. Family DISCOBATIDAE

Body depressed, ray-like; disc large, subcircular. Snout broad, blunt; rostral cartilage small. Eyes without nictitating membrane, close together on either side of median line. Mouth inferior, transverse. Nostrils almost transverse, interspace wide. Nasoral grooves rudimentary, cirri absent. Dental plate undulating with corresponding depression in jaw. Spiracles large, close behind eyes. Five pairs of ventral gill openings. Two spineless dorsals, far behind pelvics. Rayed portion of pelvics continued to snout forming a subcircular disc. Pelvics close to pectorals. Anal absent. Tail depressed, half in total length with a fold along each side, without spine. Caudal small. Subcaudal without lobe, equal to supracaudal. Caudal keels and pits absent.

The family DISCOBATIDAE is represented by a single genus and species in the Indian region.

30. Genus *Zanobatus* Garman

1913. *Zanobatus* Garman, *Mem. Harv. Mus. Comp. Zool.*, **36**, p. 291 (type, *Platyrrhina schoenleinii* M. & H., monotypic).

Disc wider than long, partly rounded. Tail depressed, slender, nearly half total length. Rostral cartilage small. Snout short, obtuse. Nasoral grooves rudimentary. Nostrils transverse; internarial space about $\frac{2}{3}$ mouth width. Spiracles close behind eyes. 5 pairs of gill openings on ventral side. Two spineless dorsal fins. The rayed portion of pectorals continued to the snout to form a subcircular disc. Anal fin absent. Teeth very small.

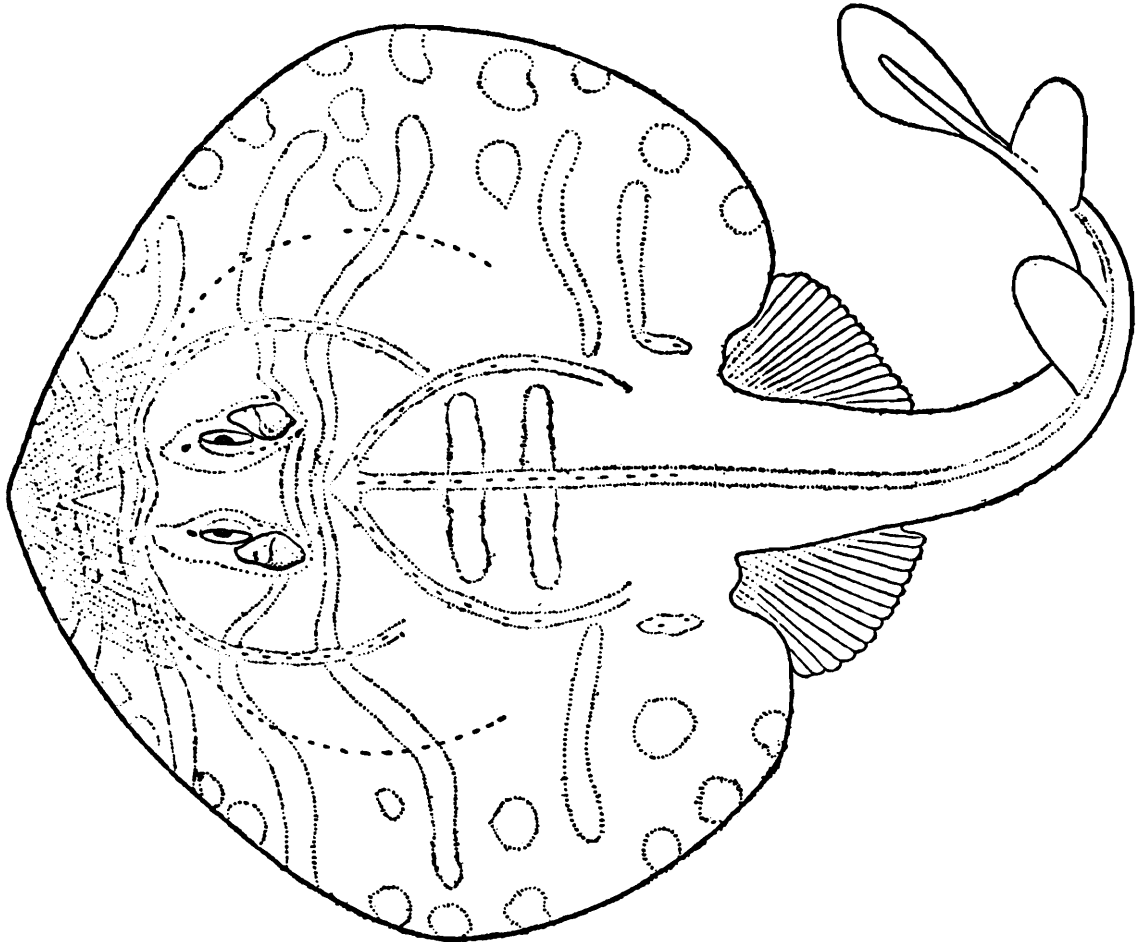
Distribution.—Africa, India.

63. *Zanobatus schoenleinii* (M. & H.)

(Text-fig. 45)

1841. *Platyrrhina schoenleinii* Müller & Henle, *Syst. Besch.* *Plagiost.*, p. 125, pl. 45 (type locality : India).
 1865. *Platyrrhina schoenleinii* Dumeril, *Hist. nat. Elasmobr.*, **1**, p. 577 (India).
 1870. *Platyrrhina schoenleinii* Günther, *Cat. Fish. Brit. Mus.*, **8**, p. 471 (India).
 1878. *Platyrrhina schoenleinii* Day, *Fish. India*, p. 735 (Madras).
 1889. *Platyrrhina schoenleinii* Day, *Fauna Brit. India*, Fish., **1**, p. 47 (Coromandel Coast; Madras).
 1913. *Zanobatus schoenleinii* Garman, *Mem. Harv. Mus. Comp. Zool.*, **36**, p. 291 (India).

1941. *Zanobatus schoenleinii* Fowler, *Bull. U. S. nat. Mus.*, (100) 13, p. 327.
 1949. *Zanobatus schoenleinii* Misra, *Rec. Indian Mus.*, 45 (1947), p. 30.
 1952. *Zanobatus schoenleinii* Misra, *Rec. Indian Mus.*, 49 (1951), p. 119.
 1958. *Zanobatus schoenleinii* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 78.



TEXT-FIG 45.—Dorsal view of *Zanobatus schoenleinii* (M. & H.).
 (After J. Müller & F. Henle)

Disc slightly broader than long, more or less circular. Snout 1.5 in distance between snout end and hind edge of spiracle. Eyes 3.5 in snout, 1.5 in interorbital. Width of mouth 2.2 in head to first gill opening, wider than internarial. Nostrils wide. Internarial 2.7 in head to first gill opening. Dental plate undulating with 3 elevations in the lower jaw and 3 corresponding depressions in the upper jaw. Dorsals subequal, on tail. First dorsal origin midway between hind pelvic ends and second dorsal origin. Second dorsal origin nearer to caudal origin than to first dorsal origin. Pectorals form subcircular disc with the

blunt snout anteriorly. Pelvics obtuse longer than dorsals, close to pectorals. Caudal small, rounded. No subcaudal lobe. Tail depressed, without spine, as long as disc.

Small tubercles above rostral cartilages, orbital ridges, basal pectoral cartilages, and entire vertebral series to dorsal. Brownish above and below; upper surface with darker transverse bands and scattered dark spots; under surface with irregular, dark blotches.

According to Dumeril it attains a length of 473 mm.; littoral.

Distribution.—India; in the mean annual isotherm of 20°C. in the 13°N., 80°E. in the Bay of Bengal.

XII. Family RAJIDAE

Skates

Body and head greatly depressed, united with pectorals forming a rhomboid disc. Snout produced, pointed. Rostral cartilage produced from skull, pointed. Eyes without nictitating membrane, wide apart on either side of median line. Mouth inferior, transverse or crescentic. Nostrils with 2 valves, front wide reaching mouth, hind folded in tube. Nasoral groove to each nostril; nasal cirri absent. Teeth small, numerous, tessellate, flat to sharply pointed. Spiracles larger, close behind eye. Five pairs of small, ventral gill openings. Two spineless dorsals on tail. Rayed portion of pectorals reaches beyond eye but not up to snout. Pelvics notched, very close to pectorals. Anal absent. Tail depressed, not whip-like, without spine and without fold along either side. Caudal rudimentary or absent. No caudal keel. Skin with small, sharp spines and larger tubercles. Oviparous.

The family RAJIDAE is represented by a single genus.

Upper Cretaceous to Recent.

31. Genus *Raja*¹ Linnaeus

1758. *Raja* Linnaeus, *Syst. Nat.*, 1, ed. 10, p. 231 (type, *R. clavata* L., designated by Jordan & Gilbert, *Proc. U. S. nat. Mus.*, 5, p. 36, 1882).

1775. *Leiobatus* Klein, *Neuer Schauplatz*, 1, p. 316 (type, *Raja oxyrinchus* L., designated by Jordan, *Genera Fish.*, pt. 1, p. 36, 1917: inadmissible).

1777. *Raia* Scopoli, *Introd. Hist. nat.*, p. 464 (type, *Raja clavata* L.).

¹Also spelt *Raia* by some authors.

1810. *Dipturus* Rafinesque, *Caratt. Animal. Piante Sicilia*, p. 16 (type, *Raja batos* Raf. = *Raja batis* L.).
1810. *Cephaleutherus* Rafinesque, *Indice Ittiol. Siciliana*, pp. 48, 61 (type, *C maculatus* Raf., monotypic).
1815. *Platopterus* Rafinesque, *Analyse nature*, p. 93 (type, *Raja clavata* L.).
1821. *Propterygia* Otto, *Nov. Act. Acad. Leop. Bon.*, 10, p. 112 (type, *P. hyposticta* Otto, monotypic).
1834. *Laeviraja* Bonaparte, *Icon. Fauna Italica, Pesci.*, 3, fasc. 6 (type, *Raja oxyrinchus* L.).
1841. *Hieroptera* Fleming, *Phil. J. Edinburgh*, 31, p. 236 (type, *H. abredonensis* Fleming, monotypic).
1843. *Actinobatis* Agassiz, *Poiss. Fossil.*, 3, p. 372 (type, *Raia (Actinobatis) ornata* Agassiz).
1846. *Eleutherocephalus* Agassiz, *Nomenclatoris Zoologici Index Universalis*, pp. 71, 136 (type, *Cephaleutherus maculatus* Raf.).
1877. *Amblyraja* Malm, *Goteborgs Bohusl. Fauna*, p. 607 (type, *Raja radiata* Donovan).
1924. *Alpharaia* Leigh-Sharpe, *J. Morphol.*, 39, pp. 567, 568 (type, *Raja circularis* Couch, orthotypic).
1924. *Betaraia* Leigh-Sharpe, *J. Morphol.*, 39, pp. 567, 568 (type, *Raja clavata* L., orthotypic).
1924. *Gammaraia* Leigh-Sharpe, *J. Morphol.*, 39, pp. 567, 571 (type, *Raja batis* L., orthotypic).
1924. *Deltaraia* Leigh-Sharpe, *J. Morphol.*, 39, pp. 567, 573 (type, *Raja radiata* Donovan, orthotypic).
1924. *Epsilonraia* Leigh-Sharpe, *J. Morphol.*, 39, pp. 568, 574 (type, *Raia platana* Gthr., orthotypic).
1924. *Zetaraia* Leigh-Sharpe, *J. Morphol.*, 39, pp. 568, 575 (type, *Raia brachyura* Gthr., orthotypic).
1924. *Etaraiia* Leigh-Sharpe, *J. Morphol.*, 39, pp. 568, 576 (type, *Raja murrayi* Gthr., orthotypic).
1924. *Thetaraia* Leigh-Sharpe, *J. Morphol.*, 39, pp. 568, 577 (type, *Raja eatoni* Gthr., orthotypic).
1924. *Iotaraia* Leigh-Sharpe, *J. Morphol.*, 39, pp. 568, 577 (type, *Raja marginata* Lac., orthotypic).

Disc subcircular to quadrangular. Tail not whip-like, without spines and without cutaneous folds. Snout produced, pointed. Eyes prominent. Nasoral grooves present. 5 pairs of gill openings on ventral side. Two spineless dorsals. The rayed portion of pectorals reaches beyond eyes but not up to the snout. Anal fin absent. Teeth small, tessellate, flat to sharply pointed. Oviparous, bottom-living in deep waters, feeding on shell-fish and fish.

Distribution.—Atlantic Ocean : North of Scotland, 486 m.; Florida, 417-608 m.; Spitzbergen, 80° N., 225—839 m. ; Norway, 280—456 m.; Denmark Strait, 778—1064 m.; Davis Strait, 778-1064 m.; Greenland 60° 30' N., 580 m.; South of Faroes Is., 555—750 m.; Faroes channel, 943-1111 m.; North of Faroes Is., 1241—2392 m.; Eastern Atlantic; Off South Carolina, 608 m.; Mediterranean; Egypt; Saldanha Bay, 180—457 m.; Washington; Indian Ocean : South Africa, 65—545 m.; Cape of Good Hope; Off Natal Coast, 235—859 m.; Off Cape Town, 1914 m.; South Africa, 1097 m.; Off Cape Point, 62—182 m.; Gulf of Aden, 220—237 m.; OT, 457—549 m.; Zanzibar area, OT, 457—658 m.; Arabian Sea, 409—1499 m.; Gulf of Manaar, 1091 m.; Andaman Sea, 510 m.; Gulf of Martaban, 122 m.; Kirguelen Is.; Pacific Ocean : Bali Sea, 289 m.; Halmahera Sea, 827 m.; Philippines; China; Formosa; Japan; Korea; Manchuria; New Zealand; Off Botany Bay, New South Wales, 73—219 m.; Australia; Okhotsk Sea, 126 m.; Aleutian Is., 148 m.; Virgin Is., 2903 m.; Between Alaska and California, 1140—1502 m.; Gulf of Panama, 849—2321 m.; Sakhalin, Bering Sea; British Columbia; Antarctic Ocean, 70°—71°S., 87°W., 400—450 m.

Key to species

1. Snout about 3—3.5 times the interorbital distance : dorsals very close together . 3
2. Snout about 4.5 times the interorbital distance : dorsals widely separated (by a distance about the length of base of first dorsal fin) 5
3. A single row of prominent spines on tail *R. mamillidens* Alc.
4. More than one row (*i.e.*, 3) of prominent spines on tail *R. reversa* Lloyd
5. A single row of spines on tail : second dorsal fin situated away from the tip of the caudal fin by a distance equal to base of both the dorsals *R. johannis-davisi* Alc.
6. More than one row of spines on tail (*i.e.*, 3) : second dorsal fin situated nearer to tip of caudal fin by a distance equal to or less than the base of the first dorsal fin . 7
7. Interdorsal space equal to or longer than base of first dorsal : no prominent rostral spine *R. powelli* Alc.
8. Interdorsal space less than base of first dorsal : prominent rostral spine *R. andamanica* (Lloyd)

64. *Raja andamanica* (Lloyd)

(Pl. VIII, fig. 1)

1909. *Raja andamanica* Lloyd, *Mem. Indian Mus.*, 2, p. 140 (type locality: Andaman Sea, 10°21' N., 92°46' 15" E., 279 fathoms; type is in the Zoological Survey of India).
1909. *Raja andamanica* Lloyd, *Ill. Zool. Investig. Fish.*, pl. 46, fig. 2 (Andaman Sea).
1913. *Raja andamanica* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 352 (Andaman Sea).
1941. *Raja andamanica* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 389.
1949. *Raja andamanica* Misra, *Rec. Indian Mus.*, 45 (1947), p. 30.
1952. *Raja andamanica* Misra, *Rec. Indian Mus.*, 49 (1951), p. 121.
1958. *Raja andamanica* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), pp. 77, 78.

Disc broader than long, more or less quadrangular; its length 2.2 in total length. Snout broadly triangular, projecting slightly, 3.7 in length of disc. Rostral cartilage moderate, ridges slightly convergent, but not meeting. Eyes 3.2 in snout, equal to interorbital. Mouth slightly arched, width one-third of the length of snout, 3.0 in preoral, longer than internarial. Front limit of nostril away from mouth corner by a space equal to width of mouth. Teeth in $\frac{54}{40}$ rows, on oval base; front ones worn, flat, back ones with low, pointed cusp. Spiracles small, about half eye diameter. Interspiracle 1.8 in snout. Two small spineless dorsals towards end of tail. First dorsal slightly larger than second; dorsals close together; separated by a distance less than the length of base of either. Pectorals large, rayed portion continued beyond eye. Pelvics notched. Anal fin absent. Tail long, slender, 1.2 times length of disc. Caudal vestigial as a narrow fold of skin on lower side.

A continuous row of eight, large spines on the supra-orbital ridge, about 15 large spines over rostral cartilage; a single series of large spines in the median line extending from a short distance behind the level of spiracles to the tail where the series become less regular; side and top of tail spiny, spines being larger on the upper surface; lower surface smooth, without spines except distal half of tail. Uniform slaty grey above and below.

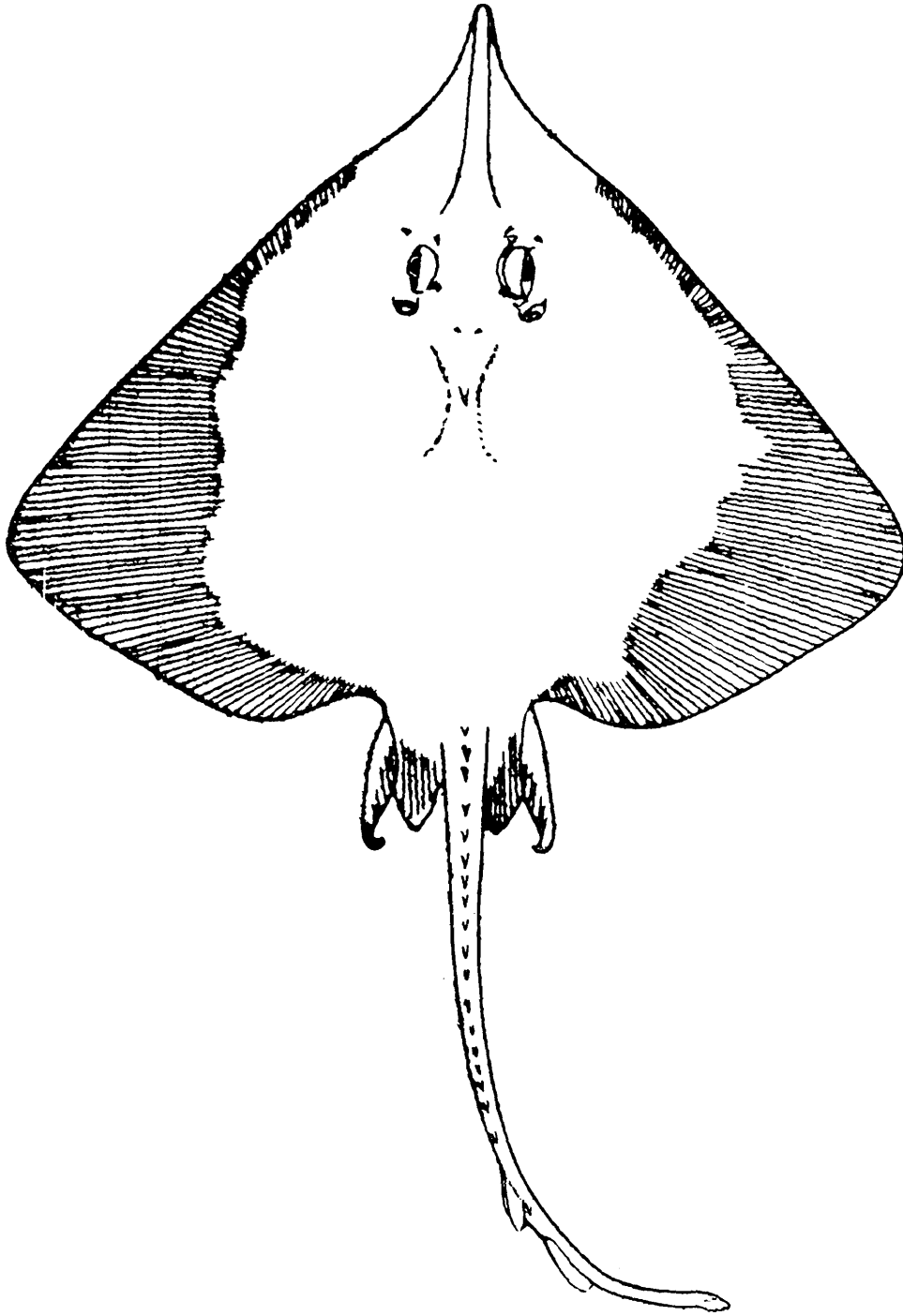
The type-specimen measured 210 mm., bathypelagic.

Distribution.—Andaman Sea, India, in 510 metres; in the mean annual isotherm of 20°C.; in 10° 21'N., 92° 46' 15"E. in the Bay of Bengal.

65. *Raja johannis-davisi* Alc.

(Text-fig. 46)

1899. *Raja johannis-davisi* Alcock, *Cat. Ind. Deep Sea Fish.*, p. 21 (type locality: Travancore Coast, 8° 37' N., 75° 37' 30" E., 224-284 fathoms; bottom temp. 12·2° —11·1° C., surface temp. 28·9° C., type is in the Zoological Survey of India).



TEXT-FIG. 46.—Dorsal view of *Raja johannis-davisi* Alc. : $\times ca \frac{3}{4}$.
(After A. Alcock)

1900. *Raja johannis-davisi* Alcock, *Ill. Zool. Investig. Fish.*, pl. 27, figs. 2, 2a (Travancore Coast).
1906. *Raja johannis-davisi* Brauer, "*Valdivia*" *Tiefsce Fische*, 15, p. 367 (Arabian Sea, 520 m.).
1913. *Raja johannis-davisi* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 355 (off Travancore Coast).
1939. *Raja johannis-davisi* Norman, *Sci. Rep. John Murray Exped.*, 7, p. 14 (Travancore Coast; Gulf of Aden, 13° 14' 24" N., 46° 14' 12" E., OT, 457-549 m.; a female, 340: 230 mm. across disc.).
1941. *Raja johannis-davisi* Fowler, *Bull. U. S. nat. Mus.*, (100) 13, p. 367 (reference).
1949. *Raja johannis-davisi* Misra, *Rec. Indian Mus.*, 45 (1947), p. 31.
1952. *Raja johannis-davisi* Misra, *Rec. Indian Mus.*, 49 (1951), p. 121.
1953. *Raja johannis-davisi* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 84.

Disc broader than long, more or less quadrangular; its length 1.9 in total length. Snout slender, produced, 3.0 in length of disc. Eyes 5 in snout, equal to interorbital. Mouth straight, twice in preoral, slightly longer than internarial. Front limit of nostril away from mouth corner by a space equal to half of mouth width. Teeth in $\frac{32}{30}$ rows, obtusely pointed, upper in oblique rows. Spiracle small, about half of eye diameter, interspiracle 2.4 in snout. Two small spineless dorsals towards end of tail. Second dorsal slightly smaller than first dorsal, confluent with caudal. Interdorsal equal to base of first dorsal. Pectorals large, rayed portion continued beyond eye, not reaching snout. Pelvics notched. Anal fin absent. Caudal rudimentary. Tail slender, nearly equal to length of disc.

Disc smooth, except for stellate spines on ventral surface of rostral cartilage, snout edges and adjacent parts of pectorals; 2 strong preorbital, one postorbital spines, a strong spine in middle of nape; tail smooth with a median row of strong spines to second dorsal base. Smoky black above, black mottled with white below.

The type-specimen measured 263 mm.; bathypelagic.

Distribution.—Off Travancore Coast, 409—529 metres. Gulf of Aden, in AT, 220—237 m.; OT, 457—549 m., in the mean annual isotherm of 20° C. with the latitudinal and longitudinal range of 8°—13° N., 46° —75° E.

66. *Raja mamillidens* Alcock

(Pl. IX)

1889. *Raja mamillidens* Alcock, *Ann. Mag. nat. Hist.*, (6) 4, p. 380 (type locality: Gulf of Manaar 8° 59' N., 79° 55' E., 597 fathoms; type is in the Zoological Survey of India).
1892. *Raja mamillidens* Alcock, *Ill. Zool. Investig. Fish.*, pl. 8, fig. 1 (Gulf of Manaar).
1899. *Raja mamillidens* Alcock, *Cat. Ind. Deep Sea Fish.*, p. 19 (Gulf of Manaar).
1913. *Raja mamillidens* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 350 (Gulf of Manaar).
1941. *Raja mamillidens* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 377.
1949. *Raja mamillidens* Misra, *Rec. Indian Mus.*, 45 (1947), p. 31.
1952. *Raja mamillidens* Misra, *Rec. Indian Mus.*, 49 (1951), p. 121.
1955. *Raja mamillidens* Munro, *Mar. Freshwater Fish. Ceylon*, p. 12.
1958. *Raja mamillidens* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), pp. 77, 78.

Disc broader than long; its length 2.0 in total length. Snout broadly triangular, 3.8 in length of disc. Eyes 4.0 in snout. Mouth crescentic. Teeth in $\frac{24}{18}$ rows, with a globular base and a mammary point, oblique in upper jaw. Spiracles close behind hind eye edge, almost equal to orbit. Interspiracle 1.7 in snout. Two moderate spineless dorsals adjacent to each other, but separate towards end of tail. Second dorsal larger than first dorsal, with interdorsal as a very narrow notch. Pectorals large, rayed portion extending beyond eye. Pelvics large. Anal fin absent. Caudal vestigial as a narrow fold of skin. Tail slender, 1.1 times length of disc.

Whole upper surface of disc, pelvics, tail, dorsals and rudimentary caudal covered with small sharp close-set prickles; a large spine at angle of each orbit, a pair between spiracles, one or two on each shoulder, and a median vertebral series on back and tail; under surface of disc glandular. Uniform jet black when alive; dark chocolate in spirit.

The type-specimen (female) measured 292 mm.; bathypelagic.

Distribution.—Gulf of Manaar, India, in 1091 metres; in the mean annual isotherm of 20°C. in 8°59'N., 79°55'E. in the Indian Ocean.

67. *Raja powelli* Alc.

(Pl. VIII, fig. 2)

1898. *Raja powelli* Alcock, *Ann. Mag. nat. Hist.*, (7) 2, p. 142 (type locality : Gulf of Martaban, Burma, 14°46' N., 95°52' E., 67 fathoms; type is in the Zoological Survey of India).
1899. *Raja powelli* Alcock, *Ill. Zool. Investig. Fish.*, pl. 26, fig. 4 (Gulf of Martaban, Burma).
1899. *Raja powelli* Alcock, *Cat. Ind. Deep Sea Fish.*, p. 20 (Gulf of Martaban).
1906. *Raia philipi* Lloyd, *Ann. Mag. nat. Hist.*, (7) 18, p. 309 (type locality : Gulf of Aden, in 130 fathoms; type is in the Zoological Survey of India).
1907. *Raia philipi* Lloyd, *Rec. Indian Mus.*, 1, p. 5 (13° 36' 00" N., 47° 32' 00" E., in 130 fathoms, Arabian Sea).
1908. *Raia philipi* Lloyd, *Ill. Zool. Investig. Fish.*, pls. 40, 41, fig. 1 (Gulf of Aden).
1909. *Raia philipi* Lloyd, *Mem. Indian Mus.*, 2, p. 142, fig. 1c (Gulf of Aden).
1913. *Raia powelli* Garman, *Mem. Harv. Mus., Comp. Zool.*, 36, p. 353 (Gulf of Martaban).
1913. *Raia philipi* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 353 (Gulf of Aden).
1929. *Raia powellii* Pillay, *J. Bombay nat. Hist. Soc.*, 33, p. 352 (Travancore).
1939. *Raja powelli* Norman, *Sci. Rep. John Murray, Exped.*, London, 7, p. 13 (Gulf of Aden 13° 16' N., 46° 14' E., AT, 220 m. : 1 male, 350 : 210 mm. across disc).
1941. *Raja philipi* Fowler, *Bull. U. S. nat. Mus.*, (100) 13, p. 386.
1941. *Raja powelli* Fowler, *Bull. U. S. nat. Mus.*, (100) 13, p. 387.
1949. *Raja powelli* Misra, *Rec. Indian Mus.*, 45 (1947), p. 31.
1952. *Raja powelli* Misra, *Rec. Indian Mus.*, 49(1951), p. 121.
1958. *Raja powelli* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 84.

Vernacular name.—INDIA: *Thirandi*, Travancore.

Disc much broader than long, more or less quadrangular; its length 1.7 in total length. Snout projecting, 3.4 in length of disc. Eyes 4.2 in snout, 1.1 in interorbital. Mouth straight or gently arched, its width 1.6 in preoral, longer than internarial. Front limit of nostril away from mouth corner by a space equal to half of mouth width. Teeth in $\frac{55-80}{55-60}$ rows, triangular on rhomboid base, obtusely pointed or obscurely tricuspid. Spiracles equal to eye, large, oblique, close behind eye. Interspiracle 2.6 in snout. Two subequal spineless dorsals, towards end of tail. Interdorsal wider than dorsal bases, nearly equal to distance between the posterior end of second dorsal base and caudal tip. Pectorals large, rayed portion extending beyond eyes.

Pelvics notched. Anal fin absent. Caudal lobe vestigial as a narrow fold of skin. Tail slender, more or less equal to length of disc.

In male, small spines on snout tip above and close to antero-lateral disc edge in posterior half only; 4 spines before and 3 behind orbit, a row of 5 spines in the median line over branchial region; between ocellus and pectoral edge group of lanceolate denticles pointing inward; whole lower surface of snout covered with fine denticles; 3 somewhat irregular rows of spines on tail above; its sides spiny, smooth below. In female disc smooth, except for prickles near snout edge and edge of interior half of pectoral fin; 2-3 spines on the front edge of orbit and behind orbit; a row of 3 spines in the median line at nape; 2 or 3 rows of spines from hind fourth of disc to first dorsal; each side of tail spiny; interdorsal with a sharp series of spines. In male uniform brown above with a dark ocellus surrounded by paler ring on the posterior median base of each pectoral; uniform white below; tail dark, mottled below. In female deep brown with a large ocellus of light colour surrounded by a dark ring on the base of each pectoral; lower surface dirty white.

The type-specimens : female measured 318 mm. and the male 360 mm.; bathypelagic.

Distribution.—India : Off Travancore Coast; Burma : Gulf of Martaban, in 122 metres.—Gulf of Aden, in 220-237 metres; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 13°—14°N., 46°—95°E.

68. *Raja reversa* Lloyd

(Pl. X, fig. 1)

1906. *Raja reversa* Lloyd, *Ann. Mag. nat. Hist.*, (7) 18, p. 31 (type locality: Arabian Sea, off Baluchistan Coast, 24°4' 4"N., 65° 43' 15"E., 820 fathoms, 5·6°C., surface temp. 23·3°C. type is in the Zoological Survey of India).

1908. *Raja reversa* Lloyd, *Ill. Zool. Investig. Fish.*, pls. 39, 40, fig. 2 (Arabian Sea, off Baluchistan Coast).

1909. *Raja reversa* Lloyd, *Mem. Indian Mus.*, 2, p. 141 (Arabian sea, off Baluchistan Coast).
1913. *Raja reversa* Garman, *Mem. Harv. Mus. Comp. Zool.* 36, p. 354 (Arabian sea, off Baluchistan Coast).
1941. *Raja reversa* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 362.
1949. *Raja reversa* Misra, *Rec. Indian Mus.*, 45 (1947), p. 31.
1952. *Raja reversa* Misra, *Rec. Indian Mus.*, 49 (1951), p. 121.
1958. *Raja reversa* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 78.

Disc slightly broader than long, quadrangular; its length 1.7 in total length. Snout moderately projecting, 3.7 in length of disc. Eyes 5.0 in snout, 1.4 in interorbital. Mouth slightly arched, its width 1.8 in preoral, slightly shorter than internarial. Front limit of nostril away from mouth corner by a space equal to two-third of mouth width. Teeth in $\frac{42}{42}$ rows, median teeth long, curved, with cordioid bases. Spiracles nearly equal to eye and close behind it. Inter-spiracle 2.1 in snout. Two spineless dorsals towards end of tail, joined at base, separated by a narrow notch. Pectorals large, rayed portion extending beyond eye. Pelvics large, notched. Anal absent. Caudal rudimentary. Tail slender, more or less equal to length of disc.

Skin over skull, but not over snout, covered with fine denticles; anterior half of pectorals covered with small denticles; 2 series of larger spines on pectorals, one series of about 20 opposite the shoulder girdle and another of about 15 opposite orbit. One large stellate spine in front and 2 or 5 ones behind orbit; 4 or 5 similar spines in the mid-dorsal line; 3 regular rows of large spines on tail above, those of the middle row long. Upper surface of disc pure white passing into dark grey towards pectoral margin; upper surface of claspers and pelvics grey; outer lower surface purplish black; body soft and flabby.

The type-specimen measured 600 mm.; bathypelagic.

Distribution.—Pakistan: Off Baluchistan Coast, in 1,499 metres; in the mean annual isotherm of 20° C. in 24° 4'4" N., 65° 43' 15" E. in the Arabian Sea.

XIII. Family DASYATIDAE

Sting Rays

Body and head greatly depressed, united with pectorals anteriorly forming oval, subcircular or rhomboid disc. Rostral cartilage absent, snout not projecting. Rigidity of the disc around the head and the branchial chamber is secured by the elongation and firmness of the propterygial segment of the pectoral base. Front copula of segmented hypobranchial cartilages unlike that of Rajidae. Eyes without nictitating membrane, wide apart on either side of median line. Nasoral grooves well developed or rudimentary; nasal cirri present or absent. Mouth inferior, transverse or slightly curved, with or without buccal processes. Teeth small, in quincunx, tessellated. Spiracles large, close behind eyes. No rayed dorsals, but often 1-3 caudal spines on tail. Rayed portion of pectorals meeting in front of cranium. Five pairs of narrow, ventral gill openings. Anal fin absent. Pelvics small. Tail short or long, whip-like, with or without serrated spines, with or without cutaneous folds. Caudal absent or when present rayless, at the end of tail. Viviparous; most species good eating.

Skin smooth or rough, with spines or tubercles or both.

Upper Cretaceous to Recent.

The family DASYATIDAE is represented by 4 genera.

Key to genera of family DASYATIDAE

- | | | |
|---|-----------|-------------------------------------|
| 1. Tail shorter than length of disc : disc
twice as broad as long | . | Genus <i>Gymnura</i> Kuhl |
| 2. Tail as long as or much longer than
length of disc : disc not twice as broad
as long | 3 | |
| 3. Serrated caudal spine present : body
not profusely covered with tubercles | 5 | |
| 4. Serrated caudal spine absent : body
profusely covered with tubercles | | Genus <i>Urogymnus</i>
M. & H. |
| 5. Disc oval or round | | Genus <i>Taeniura</i> M. & H. |
| 6. Disc quadrangular | | Genus <i>Dasyatis</i>
Rafinesque |

32. Genus *Taeniura* Müller & Henle

1837. *Taeniura* Müller & Henle, *Sitz. Ber. preuss. Akad. Wiss. Berlin*, p. 117 (atypic; type, *Trygon ornatum* Gray).

1861. *Alexandrinum* Molin, *Sitz., Ber. Akad. Wiss. Wein. math-nat. Kl.*, **42**, p. 579 (atypic; type, *A. molini* Zigno).
1910. *Discotrygon* Fowler, *Proc. Acad. nat. Sci. Philad.*, p. 468 (type, *Discobatis marginipinnis* Macleay & Macleay, orthotypic).
1913. *Taeniurops* Garman, *Mem. Harv. Mus. Comp. Zool.*, **36**, p. 339 (type, *Taeniura meyeri* M. & H.).

Disc rounded, with head not distinct from it. Tail compressed, longer than body, with midcaudal serrated spines and without any lateral folds. Mouth with buccal processes. No rostral cartilage. Nostrils slightly oblique. Spiracles wide, behind eyes. 5 pairs of gill openings on ventral side. Dorsal fins absent. Rayed portion of pectorals united anteriorly. Anal fin absent. Subcaudal rayless, below terminal end of tail. Teeth small, tessellate, grooved transversely.

Distribution.—Zanzibar, Mozambique, Mauritius, Red Sea, Arabia, India, Ceylon, Malay Peninsula, Indonesia, Thailand, Philippines, Australia, Melanesia, Polynesia.

Key to species

1. Mouth straight, 5 oral papillae : disc circular *T. meyeri* M. & H.
2. Mouth curved; 2 or 3 oral papillae: disc oval or circular 3
3. Disc oval; 2 oral papillae; round, dark-edged bluish spots *T. lymma* (Forsk.)
4. Disc circular; 2 or 3 oral papillae; round black spots *T. melanospilos* Blkr.

69. *Taeniura lymma* (Forsk.)

(Pl. X, fig. 2)

1775. *Raja lymma* Forskal, *Descript. Animal.*, p. viii, **17** (type locality : Lohaja, Red Sea).
1830. *Trygon halgani* Lesson, *Voy. "Coquille". Zool.*, **2**, pt. 1, p. 100, pl. 3 (type locality : Offack Bay; Waigiu; Port Praslin, New Ireland).
1841. *Taeniura lymma*, Müller & Henle, *Syst. Besch. Plagiost.*, p. 171, pl. 55, fig. 3 (India, Red Sea ; Timor; New Ireland).
1870. *Taeniura lymma* Günther, *Cat. Fish. Brit. Mus.*, **8**, p. 483.
1886. *Discobatis marginipinnis* Macleay & Macleay, *Proc. Linn. Soc. New South Wales*, **10**, p. 676, pl. 46, figs. 7-15 (type locality: Pacific Ocean near Admiralty Is.).
1938. *Taeniura lymma* Fowler, *List Fish. Malaya*, p. 18 (Penang, Singapore).
1940. *Taeniura lymma halgani* Whitley, *Fish. Australia*, **1**, p. 210 (Queensland, North Australia, New Guinea).

1941. *Taeniura lymma* Fowler, *Bull. U. S. nat. Mus.*, (100) **13**, p. 398.
 1949. *Taeniura lymma* Misra (*partim*), *Rec. Indian Mus.*, **45** (1947), p. 32.
 1952. *Taeniura lymma* Misra (*partim*), *Rec. Indian Mus.*, **49** (1951), p. 121.
 1953. *Taeniura lymma* Herre, *Check List Philippine Fish.*, p. 48 (Philippines).
 1953. *Taeniura lymma* Smith, *Sea Fish. S. Africa*, p. 70 (E. Africa, Delagoa Bay).
 1955. *Taeniura lymma* Munro, *Mar. Freshwater Fish. Ceylon*, p. 13 (Ceylon).
 1958. *Taeniura lymma* Misra & Menon (*partim*), *Rec. Indian Mus.*, **53** (1955), p. 84.

Vernacular names.—CEYLON: *Ali maduva* or *Ath maduva*, Sinhalese.

Disc longer than broad, more or less oval; its length 2.0 in total length. Snout not produced, 5.3 in length of disc. No rostral cartilage. Eyes 2.1 in snout, equal to interorbital. Mouth small, one-third in snout, curved, with a fringed velum, with 2 buccal processes. Oronasal grooves and cirri absent. Teeth small, unequal, tessellate, with transverse ridges or sharp cusps in male. Spiracles large, deep, larger than eye, edges entire. Interspiracle 1 1 in snout. Five pairs of small, ventral gill openings. No rayed dorsals. Rayed portion of pectorals united anteriorly in front of cranium. Pelvics elongate, subtriangular. Anal fin absent. Tail longer than disc, with 1 or 2 spines, the posterior longer, as long as snout. Subcaudal lobe wider than tail depth; origin slightly behind spine.

Skin smooth in young, rough in adult. Greyish brown with rounded spots of blue regularly scattered over back and fin.

It attains at least a length of 2,436 mm.; littoral.

Distribution.—India, Ceylon.—Red Sea, S. E. Africa, Indonesia, Philippines, Australia, Admiralty Is: in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 20° N. —25° S., 32°—142°E. in the Indo-Pacific=(20° N.—25° S., 32° —142° E. in the Indian Ocean + 14° N.—7° S., 103° —125° E. in the Pacific Ocean).

70. *Taeniura melanospilos* Blkr.

(Pl. X, fig. 3)

1853. *Taeniura melanospilos* Bleeker, *Nat. Tijds. Ned. -Ind.*, **4**, p. 513 (type locality : Batavia, Java).
 1870. *Taeniura melanospila* Günther, *Cat. Fish. Brit. Mus.*, **8**, p. 484.

1878. *Taeniura melanospilos* Day, *Fish. India*, p. 740 (Off Coromandel Coast).
1889. *Taeniura melanospilos* Day, *Fauna Brit. India*, Fish., 1, p. 56 (Coromandel Coast).
1910. *Taeniura melanospilos* Southwell, *Rep. Ceylon Marine Lab.*, 1, p. 185 (Ceylon).
- 1912-13. *Taeniura melanospilos* Southwell, *Ceylon Administr. Rep.*, pp. E 43, E 49 (Ceylon).
1933. *Taeniura melanospilos* Deraniyagala, *Ceylon J. Sci. (c)*, 5, p. 81 (Ceylon).
1941. *Taeniura lymma* Fowler (*partim*), *Bull. U. S. nat. Mus.*, (100) 13, p. 398.
1949. *Taeniura lymma* Misra (*partim*), *Rec. Indian Mus.*, 45 (1947), p. 32.
1952. *Taeniura lymma* Misra (*partim*), *Rec. Indian Mus.*, 49 (1951), p. 121.
1953. *Taeniura melanospila* Smith, *Sea Fish. S. Africa*, p. 513, fig. 78a (Natal).
1958. *Taeniura lymma* Misra & Menon (*partim*), *Rec. Indian Mus.*, 53 (1955), p. 84 (Natal; E. Africa; Red Sea; Gulf of Oman; Muscat; Ceylon; India; Celebes; Macassar; Java).

Vernacular name.—INDIA: *Jiluga tirike*, Telegu.

Disc broader than long, more or less circular; its length 2.2 in total length. Snout 5.5 in the length of disc. No rostral cartilage. Eyes 3.0 in snout, 2.0 in interorbital. Mouth curved, with 2 or 3 buccal processes, 1.3 in preoral. Teeth small, tessellate, grooved transversely. Spiracles larger than eye. Interspiracle 1.1 in snout. Five pairs of small, ventral gill openings. No rayed dorsal. Rayed portion of pectorals united anteriorly in front of cranium. Pelvics small. Anal fin absent. Tail rough, depressed in the basal portion, longer than length of disc; a spine, longer than snout, a little behind the first third of the tail. Subcaudal deeper extending from below the insertion of the spine to the end of tail.

Skin rough; a dorsal series of tubercles. Back greyish with numerous rounded blackish spots.

It attains a disc-length of 1,475 mm. and a width of 175 mm.; littoral.

Distribution.—India, Ceylon.—Red Sea, Natal, Africa, Muscat, Indonesia; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 23° N.—29° S., 30°—110° E. in the Indo-Pacific=(23° N.—29° S., 30°—80° E. in the Indian Ocean+70° 30' S., 110° E. in the Pacific Ocean).

71. *Taeniura meyeri* M. & H.

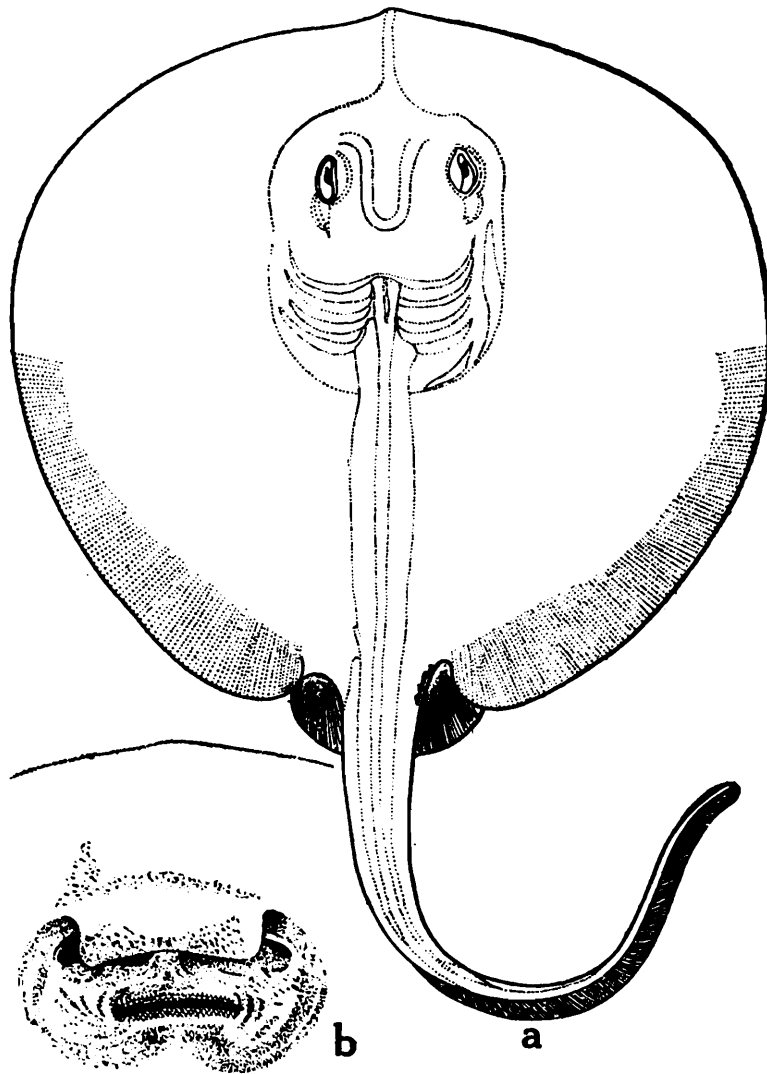
(Text-fig. 47)

1841. *Taeniura meyeri* Müller & Henle, *Syst. Besch. Plagiost.*, p. 172, pl. 55 (type locality: Mauritius; according to Bertin the type is in the Paris Museum).

1870. *Taeniura meyeri* Günther, *Cat. Fish. Brit. Mus.*, 8, p. 483.

1912-13. *Taeniura meyeri* Pearson, *Ceylon Administr. Rep.*, p. E 13.

1913. *Taeniura meyeri* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 400.



TEXT- FIG. 47.—*Taeniura meyeri* M. & H.

(a) Dorsal view. (b) Mouth. (After J. Müller & F. Henle)

1941. *Taeniura meyeri* Fowler, *Bull. U. S. nat. Mus.*, (100) 13, p. 401.

1949. *Taeniura meyeri* Misra, *Rec. Indian Mus.*, 45 (1947), p. 32.

1952. *Taeniura meyeri* Misra, *Rec. Indian Mus.*, 49 (1951), p. 121.

1955. *Taeniura meyeni* Munro, *Mar. Freshwater Fish. Ceylon*, p. 13 (Ceylon).
 1958. *Taeniura meyeni* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 84.

Disc broader than long, more or less circular; its length 2.0 in total length. Snout not produced, 5.1 in length of disc. No rostral cartilage. Eyes 3.0 in snout, 2.0 in interorbital; upper eye lid slightly produced. Mouth small, straight, with 5 buccal processes, 1.2 in preoral. Oronasal grooves and cirri absent. Teeth in about 28 rows in lower jaw, each tooth with transverse groove. Spiracles small, about three-fourths eye, close behind eye. Interspiracle 1.1 in snout. 5 pairs of small, ventral gill openings. No rayed dorsals. Rayed portion of pectorals united anteriorly in front of cranium. Pelvics small, margin rounded. Anal fin absent. Tail equal to disc, without spine, with a low keel. Subcaudal extends over a great part of tail terminally, as deep medially as terminally.

Skin smooth. Blackish brown above, whitish below pectorals and pelvics with black edges.

According to Dumeril the type measured 480 mm. in length; littoral.

Distribution.—Ceylon.—Mauritius; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 4° N.—20° S., 57° E.—80° E. in the Indian Ocean.

33. Genus *Dasyatis* Rafinesque

1792. *Dasybatus* (Klein) Walbaum, *Artedi Pisc.*, 3, p. 581 (atypic type, *Raja pastinaca* L., designated by Jordan, *Proc. U.S. nat. Mus.*, 4, p. 35, 1881; inadmissible according to opinion 21 of the International Commission of Zoological Nomenclature).
 1810. *Dasyatis* Rafinesque, *Caratt. Animal. Piante Sicilia*, p. 16 (type, *D. ujo* Raf., monotypic).
 1810. *Uroxis* Rafinesque, *Indice Ittiol. Siciliana*, p. 48 (type, *Dasyatis ujo* Raf.).
 1816. *Trygonobatus* Blainville, *Bull. Soc. philom. Paris*, 8, p. 112 (type, *T. vulgaris* Blainv. = *Raja pastinaca* L., logotypic).
 1817. *Trygon* (Adanson) Cuvier, *Règne Animal.*, ed. 1, 2, p. 136 (type, *Raja pastinaca* L., designated by Jordan, & Evermann, *Gen. Fish.*, p. 98, 1917).
 1825. *Trygonobatis* Blainville, *Faune Francaise Poiss.*, p. 35 (type, *Raja pastinaca* L.).
 1828. *Pastinachus* Rüppell, *Atlas Reise Nord Afrika Fische*, p. 82 (type, *Raja sephen* Forsk.).

1837. *Himantura* Müller & Henle, *Arch. Naturg.*, 3, 400 (atypic; type, *Raja uarnak* Forskål, designated by Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 375, 1913).
1837. *Hypolophus* Müller & Henle, *Arch. Naturg.*, p. 400 (type, *Raja sephen* Forsk.).
1838. *Pastinaca* Swainson, *Nat. Hist. Animal.*, 1, p. 172 (type, *Raja sephen* Forsk.).
1838. *Hemistrygon* Müller & Henle, *Mag. nat. Hist.*, 2, p. 90 (type, *Trygon bennetti* M. & H., monotypic).
1839. *Pastinacha* Swainson *Nat. Hist. Animal.*, 2, pp. 192, 319 (type, *P. olivacea* Swns. = *Raja pastinaca* L., virtually tautotypic).
1845. *Dasibatis* Agassiz, *Nomencl. Zool. Pisces*, p. 21 (type, *Raja pastinaca* L.).
1877. *Heliobatis* Marsh, *Amer. J. Sci. Arts*, (3) 14, p. 256 (type, *H. radians* Marsh, monotypic).
1879. *Xiphotrygon* Cope, *Amer. Nat.*, 13, p. 333 (type, *X. acutidens* Cope, monotypic).
1910. *Pteroplatytrygon* Fowler, *Proc. Acad. nat. Sci., Philad.*, p. 474 (type, *Trygon violaceum* Bon., orthotypic).
1913. *Amphotistius* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 375 (type, *Trygon sabina* Le Sueur, orthotypic).
1933. *Toshia* Whitley, *Rec. Australian Mus.*, 19, No. 1, p. 60 (type, *Dasyatis fluviatorum* Ogilby, orthotypic).
1933. *Bathytoshia* Whitley, *Rec. Australian Mus.*, 19, No. 1, p. 61 (type, *Dasyatis thetidis* Whitley, orthotypic).

Disc oval to rhomboidal. Tail elongate, whip-like with serrated caudal spines, with or without dermal fin folds, not terminal in position but behind spines; without lateral folds on caudal base. No rostral cartilage. Nasoral grooves present. Nostrils slightly oblique. Spiracles large, behind eyes. 5 pairs of gill openings on the ventral side. Rayed dorsal fins absent. Rayed portion of the pectoral fins united anteriorly. Anal fin absent. Teeth flattened, or with a central point or transverse ridge.

Most species of this genus are wholesome eating and are found in warm shallows of all oceans many entering estuaries and penetrating freshwaters. Spears of primitive men were tipped with the caudal spines of these species, and Ulysses was slain with such a spear.

Distribution.—Atlantic Ocean, Cape of Good Hope, Natal, Zanzibar, Red Sea, Arabia, India, Ceylon, Burma, Malay Peninsula, Indonesia, Thailand, China, Formosa, Japan, Philippines, Australia, Melanesia, Micronesia, Polynesia, Hawaii.

The genus *Dasyatis* is divided into four subgenera.

Key to subgenera of genus Dasyatis

- | | | |
|---|---|--|
| 1. Cutaneous folds on tail present | 3 | |
| 2. Cutaneous folds on tail absent | | Subgenus <i>Himantura</i>
M. & H. |
| 3. Cutaneous fold either above or below tail .. | 5 | |
| 4. Cutaneous folds both above and below tail | | Subgenus <i>Amphotistius</i>
Garman |
| 5. Cutaneous fold above tail | | Subgenus <i>Dasyatis</i>
Rafinesque |
| 6. Cutaneous fold below tail | | Subgenus <i>Pastinachus</i>
Rüpp. |

Key to species

- | | | |
|---|----|---|
| 1. Tail with cutaneous folds | 3 | |
| 2. Tail without cutaneous folds | 13 | |
| 3. With either dorsal or ventral cutaneous fold on tail | 5 | |
| 4. With dorsal and ventral cutaneous folds on tail | 9 | |
| 5. With ventral cutaneous fold on tail | 7 | |
| 6. With dorsal cutaneous fold on tail | | <i>D. (Dasyatis) pastinaca</i>
(L.) |
| 7. Cutaneous fold on tail well developed, broad, 4 times the length of caudal spine | | <i>D. (Pastinachus) sephen</i>
(Forsk.) |
| 8. Cutaneous fold on tail not well developed, narrow, about as long as caudal spine | | <i>D. (Pastinachus) bennetti</i>
(M. & H.) |
| 9. With 2 buccal processes | 11 | |
| 10. Without buccal processes | | <i>D. (Amphotistius) zugei</i>
(M. & H.) |
| 11. Tail short, scarcely as long as length of disc | | <i>D. (Amphotistius) imbricata</i>
(Schn.) |
| 12. Tail long, exceeding length of disc | | <i>D. (Amphotistius) kuhlii</i>
(M. & H.) |
| 13. With 2 buccal processes | 15 | |
| 14. With 4 buccal processes | 21 | |
| 15. Tail more than 3 times the length of disc | | <i>D. (Himantura) bleekeri</i>
(Blyth) |
| 16. Tail less than 2.5 times the length of disc | 17 | |

- | | | |
|---|----|--|
| 17. Disc broader than long : tail 2·3 times length of disc | | <i>D. (Himantura) marginatus</i> (Blyth) |
| 18. Disc longer than broad or as long as broad | 19 | |
| 19. Tail 1·8 times the length of disc : eyes 6·0 in interorbital | | <i>D. (Himantura) favus</i> (Ann.) |
| 20. Tail less than 1·5 times the length of disc: eyes 3·3 in interorbital | | <i>D. (Himantura) walga</i> (M. & H.) |
| 21. Tail short, nearly as long as length of disc | | <i>D. (Himantura) microps</i> (Ann.) |
| 22. Tail long exceeding the length of disc | 23 | |
| 23. Tail banded | 25 | |
| 24. Tail not banded | 27 | |
| 25. Teeth 25-38 rows in both jaws | | <i>D. (Himantura) uarnak</i> (Forsk.) |
| 26. Teeth 13 rows in upper and 23 in lower jaw | | <i>D. (Himantura) gerrardi</i> (Gray) |
| 27. Eyes 4·6 in interorbital : snout 4·2 in length of disc | | <i>D. (Himantura) alcockii</i> (Ann.) |
| 28. Eyes 2·1 in interorbital : snout 5·8 in length of disc | | <i>D. (Himantura) jenkinsii</i> (Ann.) |

iv. Subgenus *Amphotistius* Garman

Tail with cutaneous folds above and below

72. *Dasyatis (Amphotistius) imbricata* (Schn.)

1801. *Raja imbricata* Schneider, *Syst. Ichth. Bloch*, p. 366 (type locality : Coromandel).
1870. *Trygon imbricata* Günther, *Cat. Fish. Brit. Mus.*, **8**, p. 481 (Indian Seas).
1878. *Trygon imbricata* Day, *Fish. India*, p. 739 (Coromandel Coast of India).
1889. *Trygon imbricata* Day, *Fauna Brit. India, Fish.*, **1**, p. 52 (Coromandel Coast of India).
1909. *Trygon imbricata* (*nec* Schn.) Annandale, *Mem. Indian Mus.*, **2**, p. 32, pl. 3, fig. 5, text-fig. 6 (Puri on Orissa Coast).
- 1912-13. *Trygon imbricata* Pearson, *Ceylon Administr. Rep.*, p. E 13.
1922. *Trygon imbricata* Hora, *Mem. Indian Mus.*, **5**, p. 763 (Chilka Lake).

1931. *Dasyatis imbricatus* Chu, *Biol. Bull. St. John's Univ.* No. 1, p. 9 (China).
1936. *Dasybatus imbricatus* Suvatti, *Index Fish. Siam*, p. 6 (Gulf of Siam).
1938. *Dasyatis imbricatus* Fowler, *List Fish. Malaya*, p. 16 (Penang, Singapore).
1941. *Dasyatis imbricatus* Fowler (*partim*), *Bull. U. S. nat. Mus.*, (100) 13, p. 434.
1949. *Dasyatis (Amphotistius) imbricata* Misra (*partim*), *Rec. Indian Mus.*, 45 (1947), p. 35.
1952. *Dasyatis (Amphotistius) imbricata* Misra, *Rec. Indian Mus.*, 49 (1951), p. 124.
1953. *Dasyatis imbricatus* Herre (*partim*), *Check List Philippine Fish.*, p. 42 (Philippines).
1955. *Amphotistius imbricatus* Munro., *Mar. Freshwater Fish.* p. 14 (Ceylon).
1958. *Dasyatis (Amphotistius) imbricata* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 84.

Vernacular names.—INDIA : *Sankara, Mookkan therandi or Moogu thorake*, Tamil; Standardised name : *Mookkan tiruke*.

Disc as long as broad; its length 2.0—2.5 in total length. Snout produced, pointed, a little longer than preoral, and double interorbital. Eyes about 6.0 in snout, 3.5 in interorbital. Mouth undulate, width 3.0 in preoral, with 2 buccal processes. Teeth in 32—42 rows in each jaw. Spiracles as large as eye, close behind it. Five pairs of ventral gill openings. Rayed portion of pectorals united anteriorly. Pelvics moderate, triangular. No rayed dorsal. One caudal spine. No anal fin. Tail whip-like, as long as or 1.5 times longer than the length of disc; with low upper and lower cutaneous folds.

Small tubercles on the nape and back with a row of conical spines on the shoulder and back; along the tail as far as the caudal spine large tubercles intermixed with small ones. Uniform grey.

Specimens measuring 210—220 mm. across the disc have been obtained; littoral.

Distribution.—India, Ceylon.—Thailand, Philippines; in the mean annual isotherm of 20° C. with the latitudinal and longitudinal range of 4°—19° N., 80°—123° E. in the Indo-Pacific=(4°—19°N., 80°—100°E. in the Indian Ocean +1°—14° N., 101°—123° E. in the Pacific Ocean).

73. *Dasyatis (Amphotistius) kuhlii* (M. & H.)
(Text-fig. 48)

1841. *Trygon kuhlii* Müller & Henle, *Syst. Besch. Plagiost.*, p. 164, pl. 51, fig. 2 (type locality : India, Vanicoro, New Guinea; paratopotypes from Vanicoro and New Guinea are in the Paris Museum).
1865. *Trygon (Trygon) kuhlii* Dumeril, *Hist. nat. Elasmobr.*, **1**, p. 603 (Sea of the Indies, Amboina, Java, Vanicolo, New Guinea).
1868. *Leiobatus kuhli* Bleeker, *Versl. Meded. Akad. Wet. Amsterdam*, (2) **2**, p. 290 (Rio Bintang).
1873. *Raya trigonoides* Castelnau, *Proc. zool. Acclimat. Soc. Victoria*, **2**, p. 121 (type locality: New Caledonia).
1878. *Trygon kuhlii* Day, *Fish. India*, p. 739, pl. 193, fig. 2 (Madras).
1885. *Dasybatus varidens* Garman, *Proc. U. S. nat. Mus.*, **8**, p. 40 (type locality : Hong Kong).
1889. *Trygon kuhlii* Day, *Fauna Brit. India*, *Fish.*, **1**, p. 52 (Madras).
1909. *Trygon kuhlii* Annandale, *Mem. Indian Mus.*, **2**, p. 34 (off Gopalpur, 24 fathoms).
- 1912-13. *Trygon kuhlii* Pearson, *Ceylon Administr. Rep.*, p. E 12.
1913. *Trygon kuhlii* Garman, *Mem. Harv. Mus. Comp. Zool.*, **36**, p. 395 (Japan to India, East Indies).
1913. *Trygon kuhlii* Raj, *Rec. Indian Mus.*, **10**, p. 317 (Madras).
1919. *Trygon kuhlii* Southwell & Prashad, *Rec. Indian Mus.*, **16**, p. 229, pl. 19, fig. 1 (Periya Paar on the Coast of Ceylon).
1921. *Trygon kuhlii* Malpas, *Ceylon Administr. Rep.*, pp. E 5-E 8.
1928. *Dasyatis kuhlii* Fowler, *Mem. Bishop Mus.*, **10**, p. 25 (East Indies, Japan and Samoa).
1931. *Dasyatis kuhlii* Chu, *Biol. Bull. St. John's Univ.*, No. 1, p. 10.
1932. *Dasyatis kuhlii* Fang & Wang, *Contr. Biol. Lab. Sci. Soc. China*, **8**, p. 270, fig. 24 (Chefoo).
1933. *Trygon kuhlii* Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
1936. *Dasybatus kuhlii* Suvatti, *Index Fish. Siam*, p. 6 (Gulf of Siam).
1940. *Neotrygon kuhlii* Whitley *Fish. Australia*, **1**, p. 208, fig. 235 (Queensland, New South Wales).
1941. *Dasyatis kuhlii* Fowler, *Bull. U. S. nat. Mus.*, (100) **13**, p. 424.
1949. *Dasyatis (Amphotistius) kuhlii* Misra, *Rec. Indian Mus.*, **45** (1947), p. 36.
1952. *Dasyatis (Amphotistius) kuhlii* Misra, *Rec. Indian Mus.*, **49** (1951), p. 124.
1953. *Dasyatis kuhlii* Herre, *Check List Philippine Fish.*, p. 43 (Philippines).

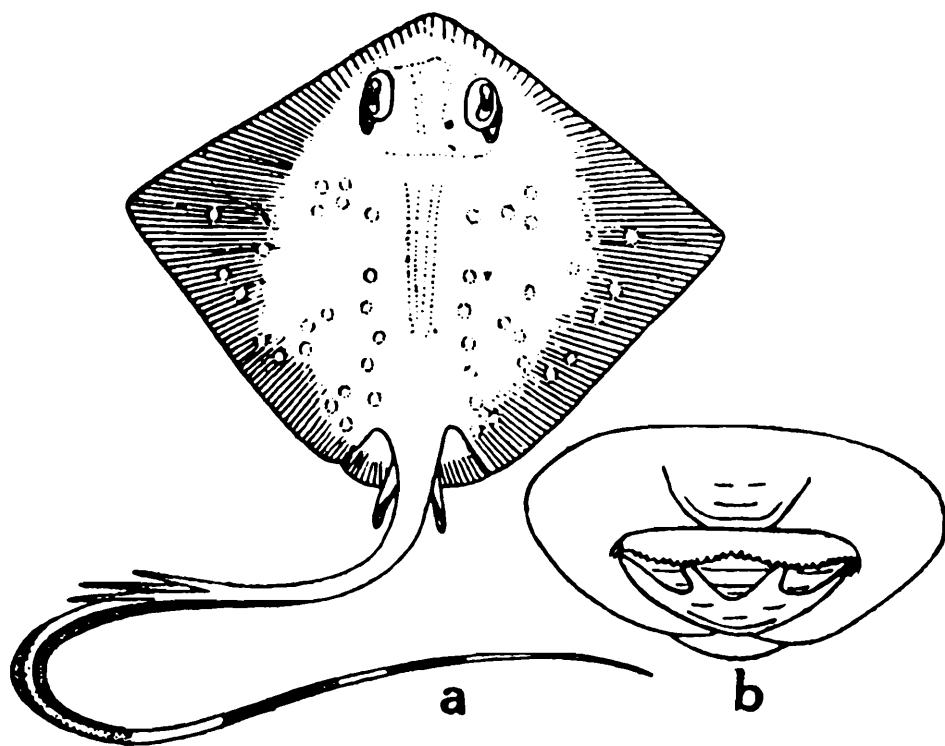
1955. *Trygon kuhlii* Anonymous, *Mar. Fish. Karachi, Sind & Makran*, p. 9 (Coasts of Sind and Makran).

1955. *Amphotistius kuhlii* Munro, *Mar. Freshwater Fish. Ceylon*, p. 14 (Ceylon).

1958. *Dasyatis (Amphotistius) kuhlii* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 80.

Vernacular names.—INDIA: *Palwa*, Marathi; *Kunnoo tirike*, Tamil; *Shemen tenkee*, Telegu. PAKISTAN: *Chittipitan*, Sind & Makran.

Disc rhomboidal, much broader than long; its length 3.7 in total length. Snout short, not produced, 5.6 in



TEXT-FIG. 48.—*Dasyatis (Amphotistius) kuhlii* (M. & H.).

(a) Dorsal view : $\times ca \frac{5}{11}$ (After F. Day)

(b) Mouth showing oral papillae. (After N. Annandale)

length of disc. Eyes prominent, 2.0 in snout, 1.6 inter-orbital. Mouth undulated, with 2 buccal processes. Nostrils deep, simple. Internarial equals width of mouth. Teeth in 25—30 rows in jaws, rhombic cusps as slight keel. Spiracles as large as eye. Interspiracle 1.5 times snout. Five pairs of small, ventral gill openings. Rayed portion of pectorals united anteriorly. Pelvics moderate, triangular. No rayed dorsal fin. Two or three serrated caudal spines. No anal fin. Tail whip-like, 2.6 times the length of disc, with upper and lower cutaneous folds

□Skin smooth in young; in adults back and head with small, flattened, more or less uniform denticles; often several enlarged tubercles in the mid-line of scapular region and a row of denticles with backwardly directed spines in the middle line in the posterior part of disc and on the base of tail. Above dull brown, covered with numerous, small, black spots and blue, black-edged ocelli; tail with 3 distinct buff rings terminally but crossing cutaneous folds; below whitish with darker edges.

It grows to 630 mm. in length; littoral.

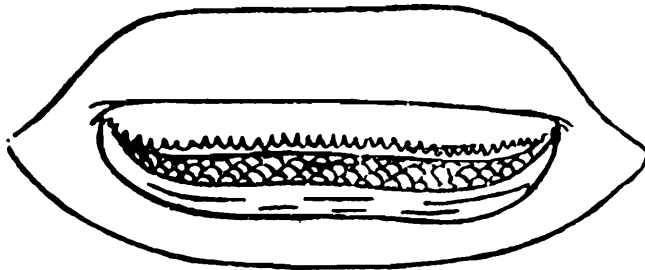
Distribution.—India, Pakistan, Ceylon.—Zanzibar, Singapore, Indonesia, Thailand, China, Japan, Philippines, Queensland, Melanesia, Micronesia, Polynesia; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 35°N.—26° S., 38°E.—170°W. in the Indo-Pacific = (25°N.—26°S., 62° —100°E. in the Indian Ocean + 35°N.—20° S., 101°E.—170° W. in the Pacific Ocean).

74. *Dasyatis (Amphotistius) zugei* (M. & H.)

(Pl. XI, fig. 2; Text-fig. 49)

1841. *Trygon zugei* Müller & Henle, *Syst. Besch. Plagiost.*, p. 165, pl. 54 (type locality: Japan; China; Pondicherry, India).
1852. *Trygon zugei* Bleeker, *Verh. Bat. Gen. (Plagiost.)*, 24, p. 68 (Batavia).
1857. *Trygon zugei* Bleeker, *Verh. Bat. Gen. (Japan)*, 26, p. 6 (Nagasaki).
1860. *Trygon crozieri* Blyth, *J. Asiat. Soc. Bengal*, p. 45 (type locality: Lower Bengal).
1870. *Trygon zugei* Günther, *Cat. Fish. Brit. Mus.*, 8, p. 481 (Japan, East Indies, Penang, Madras).
1878. *Trygon zugei* Day, *Fish. India*, p. 739, pl. 190, fig. 3 (Madras).
1888. *Trygon zugei* Ogilby, *Cat. Fish. Austral. Mus.*, p. 20 (Madras).
1889. *Trygon zugei* Day, *Fauna Brit. India, Fish.*, 1, p. 52 (Seas of India to the Malay Archipelago and Japan).
1909. *Trygon zugei* Annandale, *Mem. Indian Mus.*, 2, p. 33, pl. 4, fig. 2 (off Burma and Orissa).
1913. *Dasybatus zugei* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 398, pl. 71, fig. 3 (Penang, China, India, Japan, East Indies).
1913. *Trygon zugei* Weber, "Siboga" *Exped., Fische*, 57, p. 603 (Java).
- 1915-18. *Trygon zugei* Pearson, *Ceylon Administr. Rep.*, pp. F 12, F 14.
1928. *Dasyatis zugei* Fowler, *J. Bombay nat. Hist. Soc.*, 33, p. 102 (Bombay).

1929. *Dasybatus zugei* Wu, *Contr. Biol. Lab. Sci. Soc. China*, 5, No. 4, p. 13, fig. 10 (Amoy).
1931. *Dasyatis zugei* Chu, *Biol. Bull. St. John's Univ.*, No. 1, p. 10 (China).
1933. *Trygon zugei* Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
1936. *Dasybatus zugei* Hora & Mukerji, *Rec. Indian Mus.*, 38, p. 18 (Maungmagan, Burma).
1941. *Dasyatis zugei* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 429.
1949. *Dasyatis (Amphotistius) zugei* Misra, *Rec. Indian Mus.*, 45 (1947), p. 37.
1952. *Dasyatis (Amphotistius) zugei* Misra, *Rec. Indian Mus.*, 49 (1951), p. 123.
1952. *Dasyatis zugei* Mori, *Mem. Hyogo Univ. Agric.*, 1, No. 3, p. 26 (Mokpo; Quelpart 1).
1953. *Dasyatis zugei* Herre, *Check List Philippine Fish.*, p. 47.
1955. *Trygon zugei* Anonymous, *Mar. Fish. Karachi, Sind & Makran*, p. 9 (Coasts of Sind and Makran).
1955. *Amphotistius zugei* Munro, *Mar. Freshwater Fish. Ceylon*, p. 13 (Ceylon).
1958. *Dasyatis (Amphotistius) zugei* Misra and Menon, *Rec. Indian Mus.*, 53 (1955), p. 85.



TEXT-FIG. 49.—Mouth showing oral papillae of *Dasyatis (Amphotistius) zugei* (M. & H.). (After N. Annandale)

Vernacular names.—INDIA : *Wagli* or *Pakat*, Marathi; *Chumbara Kah*, Tamil. PAKISTAN : *Pitan*, Sind & Makran.

Disc subquadrangular, broader than long, or as broad as long; its length 3.2 in total length. Snout very much produced, acute, "sharper than in any other *Trygon*", 2.8–3.0 in length of disc, 3 times interorbital. Eyes small, 6.9 in snout, 2–3 in interorbital. Nostrils deep, simple. Internarial equals width of mouth. Mouth undulated, without buccal processes. Teeth white, in 24 rows in jaws, cusps low or obsolete. Spiracles slightly larger than eye, close behind it. Interspiracle 2.5–3.3 in snout. Five pairs of ventral gill openings, last the smallest. Rayed portion

of pectorals united anteriorly. Pelvics moderate, triangular. No rayed dorsal fin. One serrated spine. No anal fin. Tail whip-like, 2.2 times the length of disc; with upper and lower cutaneous folds.

Skin smooth in young; in adults an incomplete median series of tubercles, in very large specimens a complete median series of tubercles; tail roughened with small spines. Yellowish to reddish becoming paler marginally; white below, cutaneous folds on tail golden; dusky brown.

Specimens measuring 730 mm. in length have been obtained; littoral.

Distribution.—India, Pakistan, Burma, Ceylon.—Penang, Singapore, Indonesia, China, Japan, Philippines; in the mean annual isotherm of 20° C. with the latitudinal and longitudinal range of 35°N.—7° S., 62°—130° E. in the Indo-Pacific=(4°—25°N., 62°—100° E. in the Indian Ocean +35°N.—7°S., 103°—130° E. in the Pacific Ocean).

v. Subgenus **Dasyatis** Rafinesque

Tail with a low dorsal cutaneous fold and a keel above

75. **Dasyatis (Dasyatis) pastinaca** (L.)

1758. *Raja pastinaca* Linnaeus, *Syst. Nat.*, 1, ed. 10, p. 232 (type locality : Europe).
1775. *Raja pastinaca* Forskål, *Descript. Animal.*, p. 18 (Malta).
1789. *Raja pastinaca* Gmelin, *Syst. Nat. Linn.*, 1, p. 1509 (Europe, Red Sea, Indian Sea).
1929. *Trygon pastinaca* Piliay, *J. Bombay nat. Hist. Soc.*, 33, p. 353 (Travancore).
1941. *Dasyatis pastinacus* Fowler, *Bull. U. S. nat. Mus.*, (100) 13, p. 420.
1949. *Dasyatis (Dasyatis) pastinaca* Misra, *Rec. Indian Mus.*, 45 (1947), p. 53.
1952. *Dasyatis (Dasyatis) pastinaca* Misra, *Rec. Indian Mus.*, 49 (1951) p. 123.
1953. *Dasyatis pastinacus* Smith. *Sea Fish. S. Africa*, p. 70 (Natal).
1958. *Dasyatis (Dasyatis) pastinaca* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 84.

Vernacular name.—INDIA: *Thirukay*, Travancore.

Disc broader than long, quadrangular; its length 2.5 in total length. Snout broadly projecting, 5.0 in length of

disc. Eyes widely placed on either side of median line, 4 in snout, 4 in interorbital. Mouth straight, with 5 buccal processes; width less than half the distance from the end of snout. Teeth in $\begin{smallmatrix} 23-33 \\ 22-32 \end{smallmatrix}$ rows, small, with obtuse points or cusps. Spiracles, large, not oblique, nearly 1.5 times larger than eye, close behind it. Interspiracle 1.1 times snout. Five pairs of small, ventral gill openings; 3rd gill opening the largest, equal to eye. Rayed portion of pectorals united anteriorly. Pelvics broad, obtuse. No rayed dorsal. One serrated caudal spine equal to interorbital. No anal fin. Tail 1.5 times the length of disc, with the serrated, caudal spine away from its base, with a short, low, cutaneous fold behind spine ending distally in a keel and a longer lower one below.

Skin smooth. Colour variable, grey to brown, uniform or marbled above; underface of disc creamy white; tail deeply dark.

Specimens measuring 410 mm. have been obtained; good eating; rather sluggish on lines.

Distribution.—India.—Red Sea, Madagascar, Natal, S. Africa, Mediterranean, Malta; in the mean annual isotherms of 20°C. and 12°C. with the latitudinal and longitudinal range of 20°N.—29°S., 30°—76°E. in the Indian Ocean and 36°N., 14°E. in the Mediterranean Sea.

vi. Subgenus **Himantura** Müller & Henle

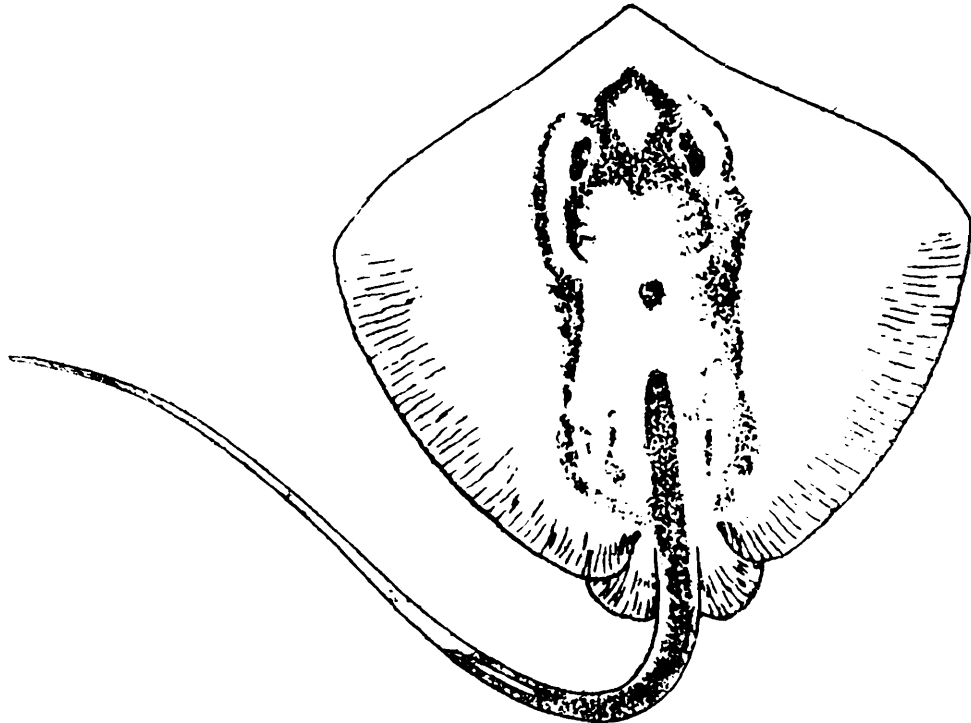
Tail without keels or cutaneous folds

76. **Dasyatis (Himantura) alcockii** (Annandale)

(Text-fig. 50)

1909. *Trygon alcockii* Annandale, *Mem. Indian Mus.*, 2, p. 27, fig. 3 (type locality : Puri, Orissa Coast; type is in the Zoological Survey of India).
1913. *Dasybatus alcockii* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 378 (Orissa Coast).
1941. *Dasyatis alcockii* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 411.
1949. *Dasyatis (Himantura) alcockii* Misra, *Rec. Indian Mus.*, 45 (1947), p. 33.
1952. *Dasyatis (Himantura) alcockii* Misra, *Rec. Indian Mus.*, 49 (1951), p. 125.

1958. *Dasyatis (Himantura) alcockii* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 78.



TEXT-FIG. 50.—Dorsal view of *Dasyatis (Himantura) alcockii* (Annandale) : $\times ca \frac{1}{15}$. (After N. Annandale)

Disc broader than long, quadrangular; its length 2.4 in total length. Snout pointed, 4.2 in length of disc. Eyes small, 6.5 in snout, 4.6 in interorbital. Mouth small, jaws distinctly but not strongly undulated, with 4 blunt, small, buccal processes, situated at equal distance from one another, one much longer than the rest. Teeth white, with a single distinct central transverse ridge, larger on the upper at sides than in the middle, not occupying the whole of exposed surface of either jaw. Spiracles larger than eye, close behind it. Interspiracle 1.1 in snout. Five pairs of ventral gill openings. Rayed portion of pectorals united anteriorly. Pelvics moderate, edges rounded. No rayed dorsal fin. One serrated, caudal spine. No anal fin. Tail whip-like, 1.8 times the disc length, without upper and lower cutaneous folds.

Skin tough. Scales flat more or less rounded, differ greatly in size on the different parts of head and body; on the disc the largest in a small patch behind shoulder girdle; those between eyes and the middle of the posterior part of the back and the base of the tail larger; those on the central part of the disc so small and so deeply sunk in the skin as to be invisible in fresh specimens; the tail completely

covered with black scales except the ventral surface of the part anterior to the spine, the surface of the pectorals and pelvics bare. Dark olive-brown with small obscure pale spots scattered all over disc and base of tail; fin edges purplish above; dorsal and lateral surfaces of tail brown without markings except at base; ventral surface including base of tail white, suffused with pink.

The type-specimen measured 1,983 mm.; littoral.

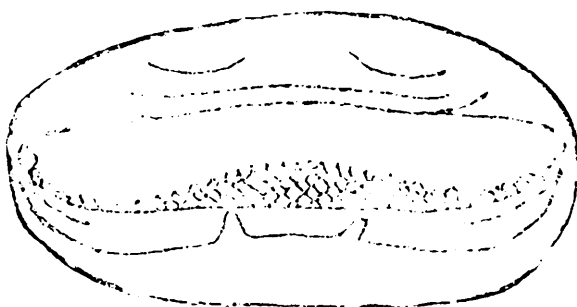
Distribution.—India : Orissa Coast; in the mean annual isotherm of 20°C., in 19°N., 85°E. in the Bay of Bengal.

77. *Dasyatis (Himantura) bleekeri* (Blyth)

(Text-fig. 51)

1860. *Trygon bleekeri* Blyth, *J. Asiat. Soc. Bengal*, 29, p. 41 (type locality : Bengal).
1870. *Trygon bleekeri* Günther, *Cat. Fish. Brit. Mus.*, 8, p. 475 (Bay of Bengal).
1878. *Trygon bleekeri* Day, *Fish. India*, p. 738, pl. 195, fig. 3 (the example figured, 8 inches across the disc, was from Bengal).
1889. *Trygon bleekeri* Day, *Fauna Brit. India. Fish.*, 1, p. 54 (Bengal).
1909. *Trygon bleekeri* Annandale, *Mem. Indian Mus.*, 2, p. 26, pl. 3, fig. 9 (off Burma & Orissa).
1913. *Dasybatus bleekeri* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 379 (Burma; Orissa, Bengal).
- 1915-18. *Trygon bleekeri* Pearson, *Ceylon Administr. Rep.*, p. E 14.
1933. *Trygon bleekeri* Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
1936. *Trygon bleekeri* Suvatti, *Index Fish. Siam*, p. 5 (Tale Sap, Siam).
1941. *Dasyatis bleekeri* Fowler, *Bull. U. S. nat. Mus.*, (100) 13, p. 410.
1949. *Dasyatis (Himantura) bleekeri* Misra, *Rec. Indian Mus.*, 45 (1947), p. 33.
1952. *Dasyatis (Himantura) bleekeri* Misra, *Rec. Indian Mus.*, 49 (1951), p. 124.
1953. *Dasyatis bleekeri* Herre, *Check List Philippine Fish.*, p. 42 (Philippines).
1955. *Trygon bleekeri* Anonymous, *Mar. Fish. Karachi, Sind & Makran*, p. 9 (Coasts of Sind and Makran).
1955. *Himantura bleekeri* Munro, *Mar. Freshwater Fish. Ceylon*, p. 14 (Ceylon).

1958. *Dasyatis (Himantura) bleekeri* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 84.



TEXT-FIG. 51.—Mouth showing oral papillae of *Dasyatis (Himantura) bleekeri* (Blyth). (After N. Annandale)

Vernacular names.—INDIA: *Pakat*, Marathi; *Seman tiruke*, Tamil; Standardised names: *Chemlipakat*, *Chamli tiruke*.

Disc subrhomboidal, larger than broad; its length 3.2 in total length. Snout pointed, 3.7 in length of disc. Eyes 5.5 in snout, 3.1 in interorbital. Mouth strongly waved, with 2 long, buccal processes nearer to one another than to mouth angle. Teeth dark, reddish-brown with a single, transverse ridge very distinct on unworn teeth and divided as 2 equal convex surfaces marked with longitudinal corrugations. Spiracle larger than eye by 1.5 times, close behind it. Interspiracle 1.4 in snout. Five pairs of ventral gill openings. Rayed portion of pectorals united anteriorly. Pelvics moderate, more or less triangular. No rayed dorsal fin. One serrated caudal spine. No anal fin. Tail whip-like, 2.5 times length of disc, without upper and lower cutaneous folds.

A large round tubercle in middle of back, usually with 3 smaller ones before and 3 similar ones behind. Tubercles sometimes along above tail surface to caudal spine; with age extending to its extremity. Uniform dark brown above. Ventral surface in young white, with broad, dark-brown margin with age broadening over most of disc; sometimes with a distinct median streak often obscured by dark blotches.

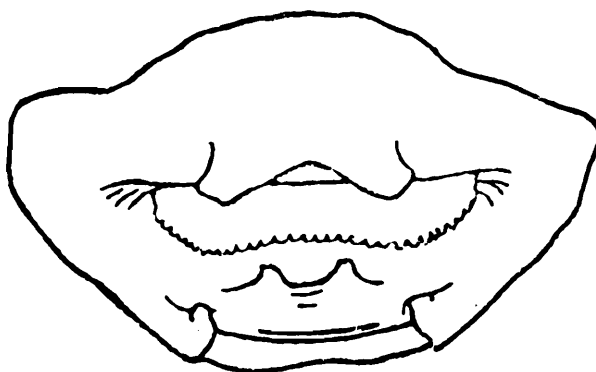
Blyth recorded a specimen measuring 2,465 mm. in length; littoral.

Distribution.—India, Pakistan, Burma, Ceylon.—Thailand, Philippines; in the mean annual isotherm of 20° C. with the latitudinal and longitudinal range of 4°—25°N., 62°—123°E. in the Indo-Pacific=(4°—25°N., 62°—96°E. in the Indian Ocean+13°—15°N., 100°—123°E. in the Pacific Ocean).

78. *Dasyatis (Himantura) favus* (Annandale)

(Pl. XI, fig. 1; Text-fig. 52)

1909. *Trygon favus* Annandale, *Mem. Indian Mus.*, 2, p. 25, pl. 1, fig. 3; pl. 3, fig. 10 (type locality : off Orissa; type is in the Zoological Survey of India).
1913. *Dasybatus favus* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 377 (off the Coast of Orissa).
1941. *Dasyatis favus* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 412.
1949. *Dasyatis (Himantura) favus* Misra, *Rec. Indian Mus.*, 45 (1947), p. 33.
1952. *Dasyatis (Himantura) favus* Misra, *Rec. Indian Mus.*, 49 (1951), p. 124.
1958. *Dasyatis (Himantura) favus* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 78.



TEXT-FIG. 52.—Mouth showing oral papillae of *Dasyatis (Himantura) favus* (Annandale). (After N. Annandale)

Disc rhomboidal, longer than broad; its length 1.8 in total length. Snout pointed, rather produced, 3.6 in length of disc. Eyes small, widely separated, 11.0 in snout, 6.0 in interorbital. Mouth large, waved, with 2 buccal processes. Teeth white, transverse ridge feeble even on unworn teeth. Spiracles larger than eye, close behind it, 4.2 in snout. Interspiracle 2.8 in snout. Five pairs of ventral gill openings. Rayed portion of pectorals united anteriorly. Pelvics rather small. No rayed dorsal fin. One serrated caudal spine. No anal fin. Tail whip-like, 1.8 times the length of disc, without upper and lower cutaneous folds.

Skin devoid of denticles with stellate bases. Dark brown above with bold reticulations of dull yellow becoming less regular on anterior part of disc; yellow spots or streaks in middle of meshes of reticulations; lower surface white.

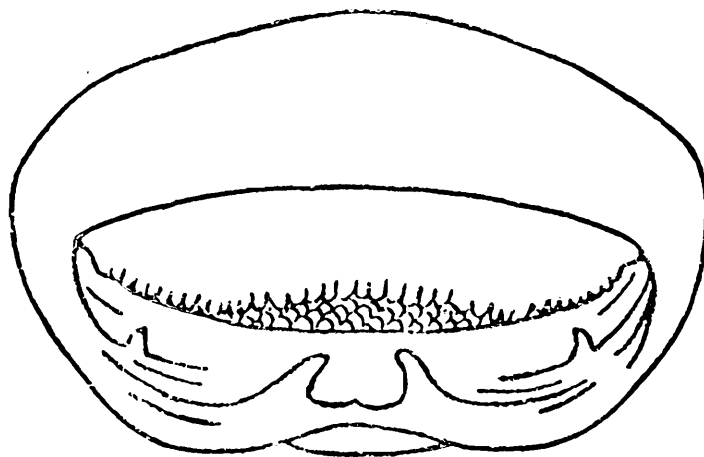
The type-specimen measured 1,300 mm. across the disc; littoral.

Distribution.—India: Off Orissa Coast; in the mean annual isotherm of 20°C. in 19°N., 85°E. in the Bay of Bengal.

79. *Dasyatis (Himantura) gerrardi* (Gray)

(Text-fig. 53)

1851. *Trygon gerrardi* Gray, *List Fish. Brit. Mus.*, p. 116 (type locality : India).
 1852. *Trygon macrurus* Bleeker, *Nat. Tijds. Ned. Ind.*, 3, p. 607 (type locality : Padang; Batavia; Samarang).
 1870. *Trygon gerrardi* Günther, *Cat. Fish. Brit. Mus.*, 8, p. 474 (India, East Indies, Japan).
 1871. *Trygon liocephalus* Klunzinger, *Verh. Zool. bot. Ges. Wien*, 21, p. 678 (type locality : Koseir, Red Sea).
 1878. *Trygon uarnak* (*nec* Forsk^o!) Day, *Fish. India*, pl. 194, fig. 1.
 1906. *Himantura fai* Jordan & Seale, *Bull. Bur. Fisher.*, 25 (1905), p. 184, fig. 2 (type locality : Apia, Samoa).
 1909. *Trygon gerrardii* Annandale, *Mem. Indian Mus.*, 2, p. 24, pl.2 fig.2, pl.3, fig.6. (Burma; Chittagong; Orissa).
 1913. *Dasybatus gerrardi* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 377 (India; East Indies; Samoa; Zanzibar).
 1938. *Dasyatis gerrardi* Fowler, *List Fish. Malaya*, p. 116 (Singapore).
 1941. *Dasyatis gerrardi* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 409.
 1949. *Dasyatis (Himantura) gerrardi* Misra, *Rec. Indian Mus.*, 45 (1947), p. 33.
 1952. *Dasyatis (Himantura) gerrardi* Misra, *Rec. Indian Mus.*, 49 (1951), p. 125.
 1958. *Dasyatis (Himantura) gerrardi* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 84.



TEXT-FIG. 53.—Mouth showing oral papillae of *Dasyatis (Himantura) gerrardi* (Gray). (After N. Annandale)

Disc broader than long, subquadrangular; its length 4.5 times in total length. Snout not projecting, forming

widely obtuse angle, 4.2 in the length of disc. Eyes 4.0 in snout, 2.5 in interorbital. Mouth small, undulated, with 4 buccal processes; width 2.4 in preoral. Teeth white; a single stout transverse ridge across centre of the each unworn tooth separating 2 equal convex surfaces, each of which strongly corrugated longitudinally. Spiracles subequal with eye, close behind it. Interspiracle 1.2 in snout. Five pairs of small, ventral gill openings. Rayed portion of pectorals united anteriorly. Pelvics moderate, edges rounded. No rayed dorsal fin. One serrated, caudal spine. No anal fin. Tail very long, whip-like, 3.5 times the length of disc, without upper and lower cutaneous folds.

In adults a closely set, median row of spines on head and trunk, extending backwards to the tail before caudal spine. Skin smooth in young. Uniform dull brown above, uniform white below; upper surface of tail dusk with irregular black and white rings from base to tip.

It attains 1,195 mm. in length; littoral.

Distribution.—India, Pakistan, Burma.—Red Sea, Zanzibar, Indonesia, Japan, Polynesia; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 35°N.—12°S., 38°E.—170°W. in the Indo-Pacific = (25°N.—0°55'S., 38° —100°E. in the Indian Ocean + 35°N.—12° S., 103° E.—170° W in the Pacific Ocean).

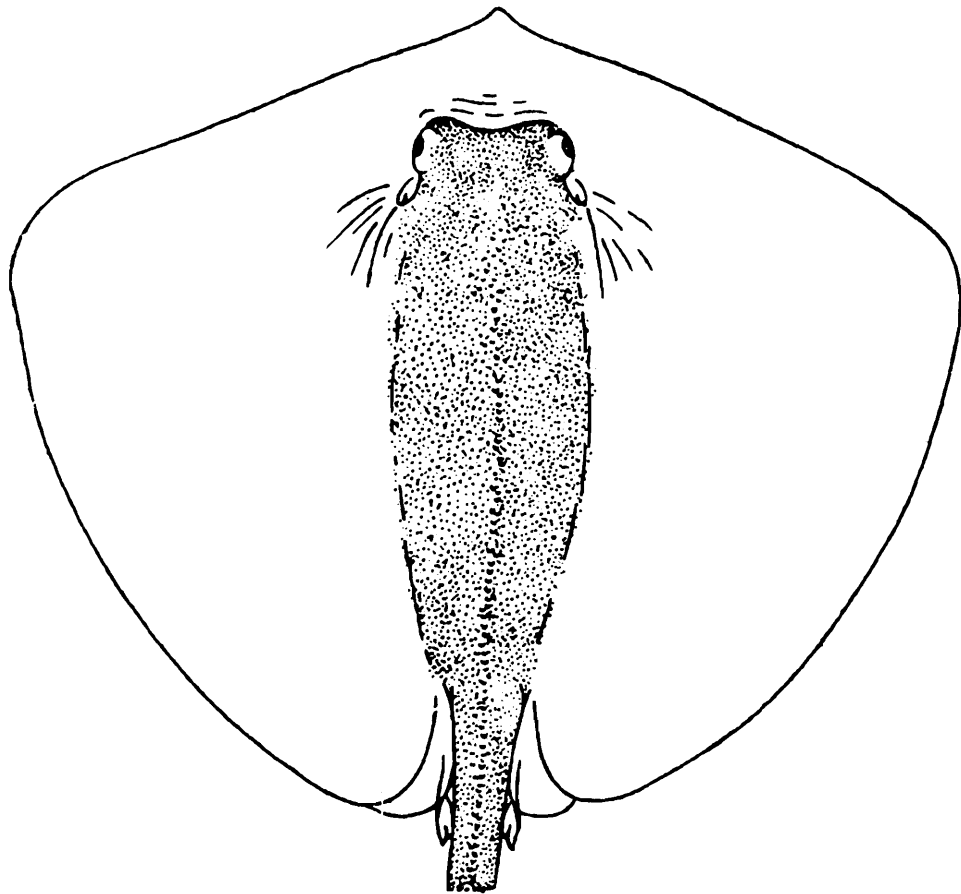
80. *Dasyatis (Himantura) jenkinsii* (Annandale)

(Text-fig. 54)

1909. *Trygon jenkinsii* Annandale, *Mem. Indian Mus.*, 2, p. 28 text-figs. 4, 4a (type locality : off Ganjam Coast, India, in 23-27 fathoms; type (dried skin, mouth in spirit) is in the Zoological Survey of India).
1913. *Dasybatus jenkinsii* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 378 (off Ganjam Coast, India).
1941. *Dasyatis jenkinsii* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 432.
1949. *Dasyatis (Amphotistius) jenkinsii* Misra, *Rec. Indian Mus.*, 45 (1947), p. 36.

Disc quadrilateral, much broader than long, outer angles rounded; its length 2.3 in total length. Snout not much produced, sharply pointed, 5.8 in length of disc. Eyes 3.0 in snout, 2.1 in interorbital. Mouth feebly undulated, with 4 buccal processes. Teeth white, mostly uniform, each with a low, transverse ridge situated near the posterior margin and with a distinct transverse depression in front. Spiracles equal to eyes, close behind it.

Interspiracle equal to snout. Five pairs of small, ventral gill openings. Rayed portion of pectorals united anteriorly.



TEXT-FIG. 54.—Dorsal view of disc of *Dasyatis (Himantura) jenkinsii* (Annandale): $\times ca - \frac{1}{12}$. (After N. Annandale)

Pelvics moderate, triangular. No rayed dorsal fin. One or two serrated caudal spines. No anal fin. Tail whip-like, cylindrical throughout, without upper and lower cutaneous folds, 1.4 times the length of disc, not much longer than width of disc.

Skin tough. A few enlarged denticles in the scapular region followed posteriorly by a single row of stout, short, recurved spines with flat bases, the row extending on tail to the base of anterior caudal spine. Middle of the back with a pavement of small, flat rounded scales; pectorals and pelvics naked; tail with small, bluntly spinous tubercles. Reddish olive above becoming paler at edge of the fins; tail dark grey, mottled on the ventral surface with brown white; ventral surface of the disc creamy white.

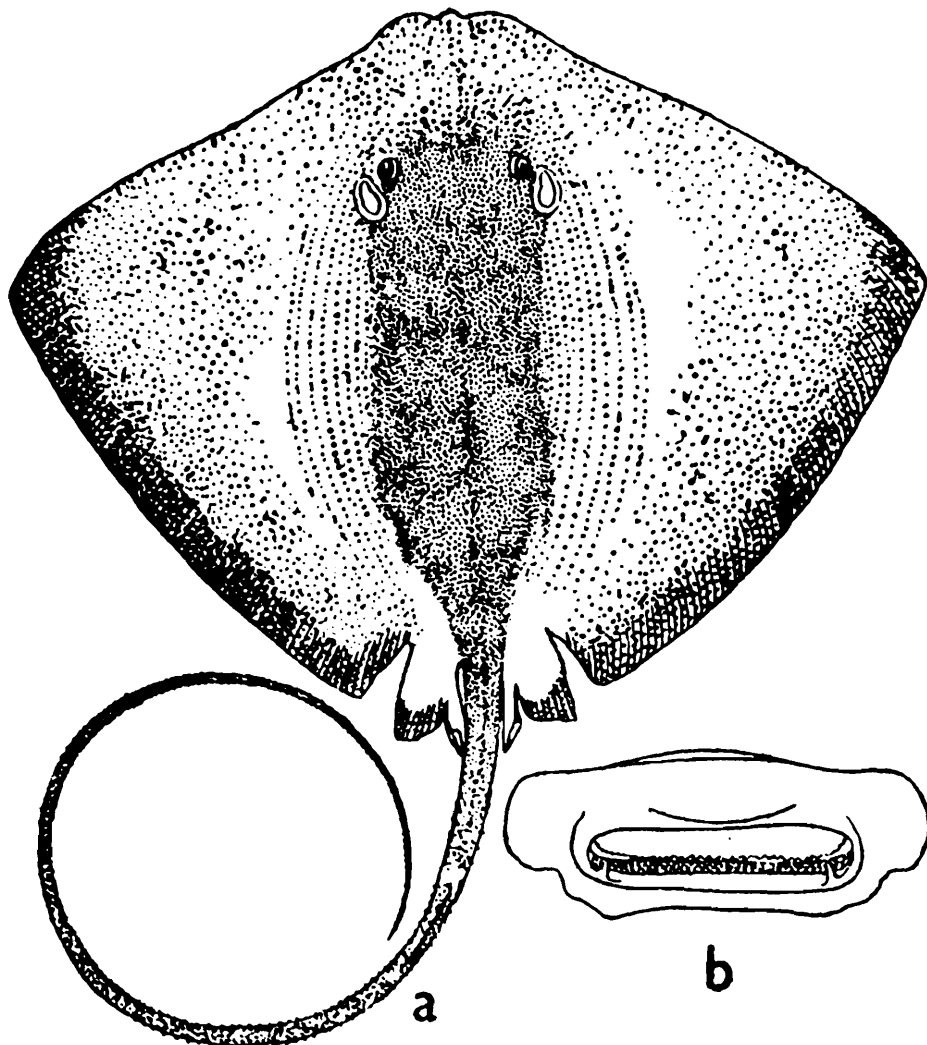
The type-specimen measured 192 mm. in length; littoral.

Distribution.—India: Off Ganjam Coast; in the mean annual isotherm of 20°C. in 17°N., 85°E. in the Bay of Bengal.

81. *Dasyatis (Himantura) marginatus* (Blyth)

(Text-fig. 55)

1860. *Trygon marginatus* Blyth, *J. Asiat. Soc. Bengal*, 29, p. 38 (type locality : Lower Bengal).
 1860. *Trygon atrocissimus* Blyth, *J. Asiat. Soc. Bengal*, 29, p. 39 (type locality: Indian Ocean).
 1865. *Trygon (Himantura) marginatus* Dumeril, *Nat. Hist. Elasmobr.*, 1, p. 588 (Calcutta).
 1878. *Trygon marginatus* Day, *Fish. India*, p. 738 (Hooghly at Calcutta).

TEXT-FIG. 55.—*Dasyatis (Himantura) marginatus* (Blyth)

(a) Dorsal view : $\times ca \frac{1}{15}$. (b) Mouth showing oral papillae. (After N. Annandale)

1889. *Trygon marginatus* Day, *Fauna Brit. India*, Fish., 1, p. 54 (Hooghly at Calcutta).
 1909. *Trygon marginatus* Annandale, *Mem. Indian Mus.*, 2, p. 30, text-fig. 5, pl. 3, fig. 11 (off Burma and Ganjam).
 1913. *Dasybatus marginatus* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 378 (Burma; Ganjam; India).

- 1915-18. *Trygon marginatus* Pearson, *Ceylon Administr. Rep.*, p. E 16.
1941. *Dasyatis marginatus* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 433.
1949. *Dasyatis (Amphotistius) marginatus* Misra, *Rec. Indian Mus.*, 45 (1947), p. 36.
1955. *Amphotistius marginatus* Munro, *Mar. Freshwater Fish. Ceylon*, p. 14 (Ceylon).

Disc quadrangular, much broader than long; its length 3.3 in total length. Snout broadly rounded, with short terminal projection, 4.5 in the length of disc. Eyes small, 7.0 in snout, 4.5 in interorbital. Mouth small; upper jaw undulated, lower almost straight, with 2 buccal processes. Teeth light brown, unworn teeth minutely ridged longitudinally; transverse ridge strong with a very marked concavity on the surface in front of it. Spiracles large, about twice eye, close behind it. Interspiracle nearly equal to snout. Five pairs of small ventral gill openings. Rayed portion of pectorals united anteriorly. Pelvics moderate, somewhat triangular. No rayed dorsal fin. One serrated caudal spine. No anal fin. Tail whip-like, 2.3 times the length of disc, without upper and lower cutaneous folds.

Skin rather soft. Head and centre of back with closely set rounded denticles, in bigger specimens extending on to the edge of the disc and even to its inner surface; tail tuberculated, intermixed with stellate spines. Grey above, buffy white below, with a dark border except in front.

Specimens measuring 342 mm. have been obtained; littoral.

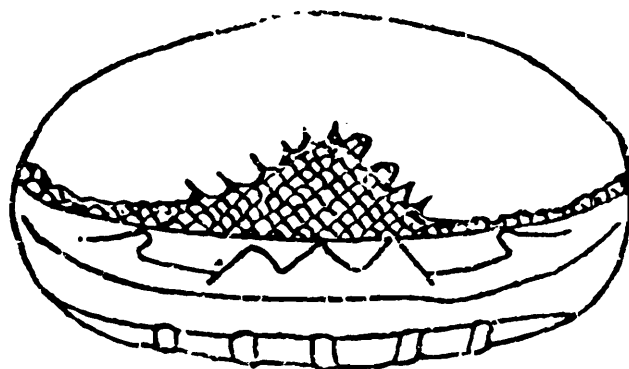
Distribution.—India, Burma, Ceylon; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 4°—22°N., 80°—92°E.

82. *Dasyatis (Himantura) microps* (Annandale)

(Pl. XI, fig. 3; Text-fig. 56)

1908. *Trygon microps* Annandale, *Rec. Indian Mus.*, 2, p. 393, pl. 27 (type locality : Bay of Bengal, off Chittagong, in 17 fathoms; type is in the Zoological Survey of India).
1909. *Trygon microps* Annandale, *Mem. Indian Mus.*, 2, p. 20, text-fig. 1; pl. 2, fig. 3; pl. 3, fig. 1; pl. 4, fig. 1 (off Orissa).
1913. *Dasybatus microps* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 381 (Bay of Bengal).
1941. *Dasyatis (Amphotistius) microps* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 404.

1952. *Dasyatis (Himantura) microps* Misra, *Rec. Indian Mus.*,
49 (1951), p. 124.



TEXT-FIG. 56.—Mouth showing oral papillae of *Dasyatis (Himantura) microps* (Annandale). (After N. Annandale)

Disc rhombic, broader than long by more than one quarter of its width. Snout rounded, slightly projecting, 3.5—4.5 in length of disc, 2.1 times interorbital. Eyes very small, dark in colour, 10.0 in snout, 5.5 interorbital. Mouth large, upper jaw slightly undulated, lower not undulated, with 5 buccal processes. Teeth white, transverse ridge prominent in the unworn teeth, the part anterior to it slightly concave and considerably greater in area than the posterior convex part. Spiracles much larger than eye, about 8 times eye, without dorsal flaps. Interspiracle 1.7 in snout. Five pairs of ventral gill openings. Rayed portion of pectorals united anteriorly. Pelvics moderate, edges rounded. No rayed dorsal fin. No anal fin. Tail shorter than the length of disc, consisting of a broad, flat, proximal part about half disc length and a slender cylindrical part of approximately the same length distally, with the massive spine at the junction of the two parts; a very low ridge at the ventral surface of the distal part; without cutaneous folds.

Skin soft, delicate, without enlarged tubercles on disc and bearing numerous minute, spiny, denticles with stellate bases; denticles longer on top of snout and the regions surrounding eyes and spiracles than elsewhere, often extending to ventral surface at edge of pectorals. Proximal part of tail with much larger denticles, largest on sides and short stellate spines on the ventral surface: the distal part dense with denticles similar to but smaller than those on the sides of the proximal part. Whitish; dorsal surface of disc suffused with rose-pink, tail grey above, darker distally; eyes dark,

Specimens measuring 3,170 mm. have been obtained; littoral.

Distribution.—India, E. Pakistan; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 19°—22°N., 85°—91°E.

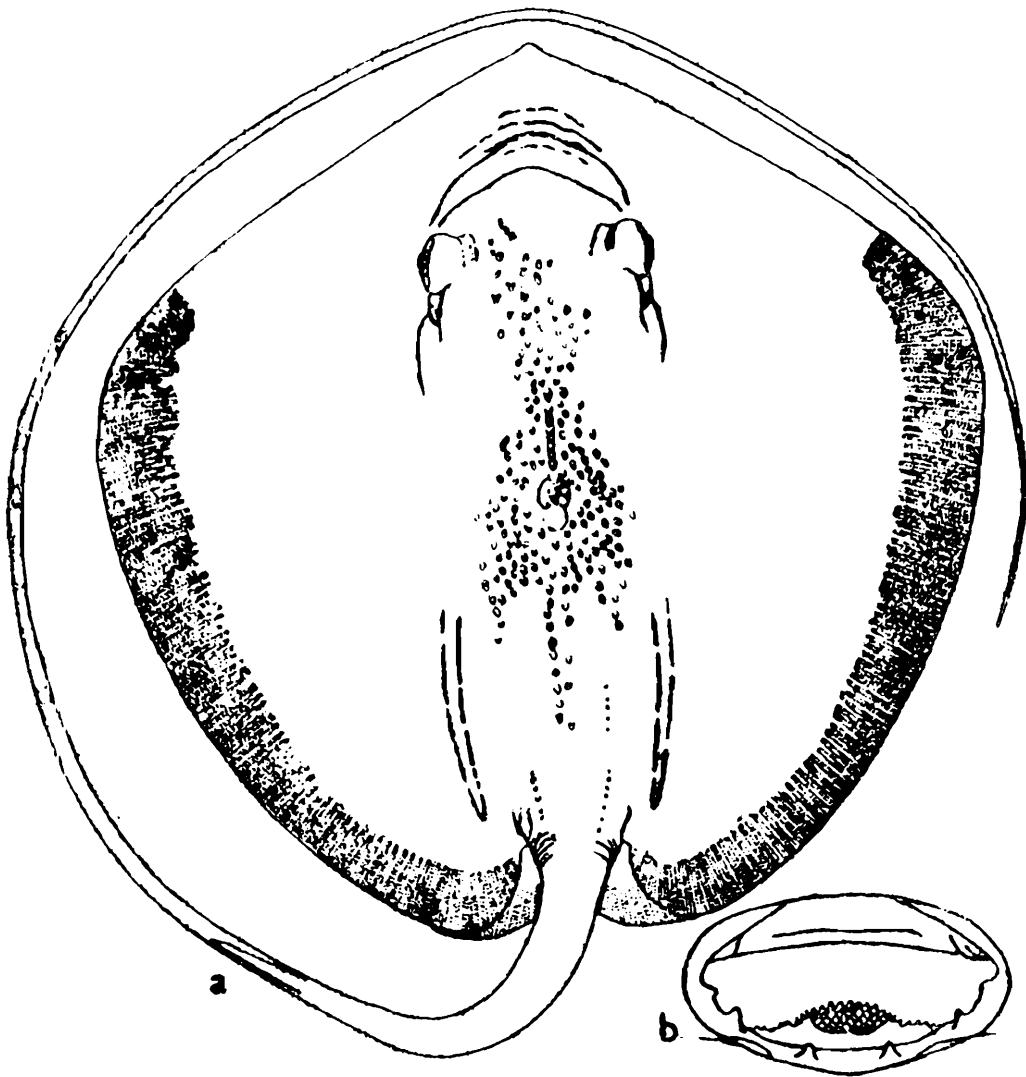
83. *Dasyatis (Himantura) uarnak* (Forsk.)

(Text-fig. 57)

1775. *Raja uarnak* Forskål, *Descript. Animal.*, pp. viii, 18 (type locality : Arabia).
- 1833-34. *Trygonobatus russellii* Gray, *Ill. Ind. Zool. Hardwicke*, 2, pl. 100 (type locality : India).
1841. *Trygon variegatus* McClelland, *Calcutta J. nat. Hist.*, p. 60, pl. 2, fig. 2 (type locality : Salt lake, near Calcutta).
1852. *Trygon undulata* Bleeker, *Verh. Bat. Gen. (Plagiost.)*, 24, p. 70 (type locality : Batavia ; Samarang).
1852. *Trygon pareh* Bleeker, *Verh. Bat. Gen. (Plagiost.)*, 24, p. 71 (type locality : Batavia).
1852. *Trygon uarnacoides* Bleeker, *Verh. Bat. Gen. (Plagiost.)*, 24, p. 72 (type locality : Batavia).
1853. *Trygon chindrakee* Bleeker, *Verh. Bat. Gen. (Bengal)*, 25, p. 82 (on *Tenkee shindraki* Russell, *Fish. Coromandel*, 1, p. 3, pl. 5, 1803; type locality: Vizagapatam).
1860. *Trygon ellioti* Blyth, *J. Asiat. Soc. Bengal*, 29, p. 41 (type locality : Lower Bengal).
1860. *Trygon russellii* Blyth, *J. Asiat. Soc. Bengal*, 29, p. 42 (Calcutta).
1860. *Trygon uarnak* Blyth, *J. Asiat. Soc. Bengal*, 29, p. 44 (Calcutta).
1865. *Trygon uarnak* Day, *Fish. Malabar*, p. 277 (Malabar).
1865. *Trygon (Himantura) undulatus* Dumeril, *Hist. nat. Elasmobr.*, p. 586 (Malabar).
1870. *Trygon uarnak* Günther, *Cat. Fish. Brit. Mus.*, 8, p. 473 (Red Sea; Zanzibar; Seychelles; Madras; Penang; India; East Indies).
1876. *Trygon uarnak* Peters, *Monatsb. Akad. Wiss. Berlin*, p. 853 (New Ireland).
1878. *Trygon uarnak* Day, *Fish. India*, p. 737, *nec* pl. 194, fig. 1 (Red Sea; Seas of India to the Malay Archipelago, China and Cape of Good Hope).
1889. *Trygon uarnak* Day, *Fauna Brit. India; Fish.*, 1, p. 53 (Red Sea, Seas of India to the Malay Archipelago, China and Cape of Good Hope).

1907. *Trygon uarnak* Lloyd, *Rec. Indian Mus.*, **1**, p. 220 (Akyab).
1909. *Trygon uarnak* Annandale, *Mem. Indian Mus.*, **2**, p. 22, pl. 1, figs. 1, 2,; pl. 2, fig. 1, 1 a,; pl. 3, fig. 2 (Bay of Bengal).
1910. *Trygon uarnak* De, *Rep. Fish. Eastern Bengal and Assam*, p. 17 (Chittagong).
1910. *Trygon uarnak* Günther, *J. Mus. Godeffroy*, pt. 17, p. 402 (Samoa).
- 1912-13. *Trygon uarnak* Pearson, *Ceylon Administr. Rep.*, p. E 13.
- 1912-13. *Trygon uarnak* Southwell, *Ceylon Administr. Rep.*, pp. E 43, E 44.
1913. *Dasybatus uarnak*, Garman, *Mem. Harv. Mus. Comp. Zool.*, **36**, p. 376 (Indian Ocean; Red Sea; East Indies).
1914. *Trygon uarnak* Pearson, *Ceylon Administr. Rep.*, p. E 4.
1922. *Trygon uarnak* Moses, *Madras Fish. Bull.*, **15**, p. 157 (Madras).
1922. *Trygon pareh* Hora, *Mem. Indian Mus.*, **5**, p. 763 (Chilka Lake).
1928. *Dasyatis uarnak* Fowler, *J. Bombay nat. Hist. Soc.*, **33**, p. 101 (Bombay).
1931. *Dasyatis uarnak* Chu, *Biol. Bull. St. John's Univ.*, No. 1, p. 9 (Seas of China).
1933. *Dasyatis uarnak* Deraniyagala, *Ceylon J. Sci.*, (c), **5**, p. 80 (Ceylon).
1933. *Trygon uarnak* Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
1936. *Dasybatus uarnak* Suvatti, *Index Fish. Siam*, p. 7 (Gulf of Siam).
1941. *Dasybatus uarnak* Herre, *Mem. Indian Mus.*, **13**, p. 333 (Andamans).
1941. *Dasyatis uarnak* Fowler, *Bull. U.S. nat. Mus.*, (100) **13**, p. 405.
1942. *Dasybatus uarnak* Sarangdhar, *Ind. J. med. Res.*, **30**, p. 558.
1949. *Dasyatis (Himantura) uarnak* Misra, *Rec. Indian Mus.*, **45** (1947), p. 33.
1952. *Dasyatis (Himantura) uarnak* Misra, *Rec. Indian Mus.*, **49** (1951), p. 125.
1953. *Dasyatis uarnak* Herre, *Check List Philippine Fish*, p. 45 (Philippines).
1953. *Dasyatis uarnak* Smith, *Sea Fish. S. Africa*, p. 70 (East London).
1955. *Trygon uarnak* Anonymous, *Mar. Fish. Karachi, Sind & Makran*, p. 9 (Coasts of Sind and Makran).
1955. *Himantura uarnak* Munro, *Mar. Freshwater Fish. eylon*, p. 14.

1958. *Dasyatis (Himantura) uarnak* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 84.



TEXT-FIG. 57.—*Dasyatis (Himantura) uarnak* (Forsk.)
 (a) Dorsal view : $\times ca\frac{1}{2}$. (After K. S. Misra).
 (b) Mouth showing oral papillae. (After N. Annandale)

Vernacular names.—INDIA: *Belya*, Kanarese; *Bhatya*, Marathi; *Sankush*, Oorlah; *Sona kah tirike*, Tamil; *Puli tenke*, Telegu; Standardised name : *Pulli tiruke*. PAKISTAN : *Hankoos*, Chittagong; *Achopitan*, Sind and Makran. BURMA : *Lek kyook*. CEYLON : *Vali maduva*, Sinhalese; *Manal thirukai*, Tamil.

Disc as long as broad, rhomboidal; its length 3.5 in total length. Snout 4.2 in length of disc. Eyes 4.5 in snout 4.0 in interorbital. Mouth long, undulated, with 4—7 buccal processes. Teeth brown, $\frac{25-38}{25-38}$ rows in jaws, curves in bands of teeth abrupt. Spiracles longer than eye.

Interspiracle equal to snout. Five pairs of ventral gill openings. Rayed portion of pectorals united anteriorly. Pelvics triangular, rather pointed. No rayed dorsal fin. One serrated, caudal spine. No anal fin. Tail whip-like, 2.5 times the length of disc, without upper and lower cutaneous folds.

Skin tough, the tubercles spread over head, trunk and tail, but ventral series not extending on to tail. In young whitish, dorsal surface of disc with long, round or oval black spots; tail boldly ringed with black, with age the spots coalescing into reticulations or disappearing to become uniform greyish brown.

It grows to 1,500 mm. across the disc and 1,690 mm. in length. Taken on lines; affords fair sport; flesh good; dangerous with a large serrated spine; littoral.

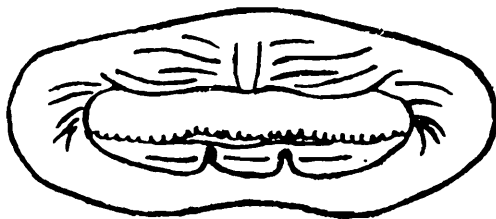
Distribution.—India, Pakistan, Burma, Ceylon.—Red Sea, Zanzibar, Seychelles, Madagascar, Natal, Cape of Good Hope, S. Africa, Arabia, Penang, Singapore, Indonesia, Thailand, Philippines, Melanesia, Polynesia; in the mean annual isotherm of 20° C. with the latitudinal and longitudinal range of 25° N.—35° S., 18° E.—170° W. in the Indo-Pacific=(25° N.—35° S., 18° —100° E. in the Indian Ocean+15° N.—12° S., 101° E.—170° W. in the Pacific Ocean).

84. *Dasyatis (Himantura) walga* (M. & H.)

(Text-fig. 58)

1841. *Trygon walga* Müller & Henle, *Syst. Besch. Plagiost.*, p. 159, pl. 51, fig. 1 (type locality : India; Red Sea; the paratypes from Red Sea and India are in the Paris Museum).
1852. *Trygon heterurus* Bleeker, *Verh. Bat. Gen. (Plagiost.)*, 24, p. 67 (type locality : Batavia).
1852. *Trygon polylepis* Bleeker, *Verh. Bat. Gen. (Plagiost.)*, 24, p. 73 (type locality : Batavia).
1856. *Trygon dadong* Bleeker, *Nat. Tijds. Ned. Ind.*, 10, p. 355 (type locality : Rio, Bintang.).
1870. *Trygon walga* Günther, *Cat. Fish. Brit. Mus.*, 8, p. 475 (Bengal Bay; East Indies; Penang; Java).
1870. *Trygon nuda* Günther, *Cat. Fish. Brit. Mus.*, 8, p. 476 (type locality : Singapore; India).
1878. *Trygon walga* Day, *Fish. India*, p. 738, pl. 194, fig. 3 (Red Sea through the seas of India to the Malay Archipelago).
1880. *Trygon walga* Peters, *Monatsb. Akad. Wiss. Berlin*, p. 926 (Ningpo).
1881. *Trygon walga* Sauvage, *Bull. Soc. philom. Paris*, 5 (7), p. 104 (Swatow).
1889. *Trygon walga* Day, *Fauna Brit. India, Fish.*, 1, p. 55 (Red Sea, the Seas of India to the Malay Archipelago).

1907. *Trygon walga* Lloyd, *Rec. Indian Mus.*, 1, p. 220 (Akyab).
 1912-13. *Trygon walga* Southwell, *Ceylon Administr. Rep.*, pp. E 43, E 45, E 47, E 48, E 49.
 1914. *Trygon walga* Pearson, *Ceylon Administr. Rep.*, p. E 4.
 1922. *Trygon walga* Moses, *Madras Fish. Bull.*, 15, p. 157 (Madras).
 1926. *Trygon walga* Malpas, *Ceylon J. Sci. (c)*, 2, p. 34 (Ceylon).
 1929. *Trygon walga* Pillay, *J. Bombay nat. Hist. Soc.*, 33, p. 353 (Travancore).
 1933. *Trygon walga* Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).



TEXT-FIG. 58.—Mouth showing oral papillae of *Dasyatis (Himantura) walga* (M.&H.). (After N. Annandale)

Vernacular names.—INDIA: *Isacurrah tenkee* or *Tenkee Shindraki*, *Thirachi*, Telegu. PAKISTAN: *Kutti*, Sind & Makran.

Disc subcircular, slightly longer than broad or as broad as long; its length 2 in total length. Snout pointed, produced, 3.7 in length of disc. Eyes 5.5 in snout, 3.3 in interorbital. Mouth undulate, with 2 buccal processes. Teeth small, each with a transverse, elevated ridge. Spiracles nearly equal eye, close behind it. Interspiracle 1.8 in snout. Five pairs of small, ventral gill openings. Rayed portion of pectorals united anteriorly. Pelvics moderate triangular. No rayed dorsal fin. One or 2 large, serrated, caudal spine on tail at the commencement of its second third. No anal fin. Tail whip-like, slightly longer than length of disc, without upper and lower cutaneous folds.

Interorbital, interspiracle and mid-dorsal surface of disc with small, uniform tubercle; a series of short spines between the root of tail and caudal spine. Dull grey or brown above, whitish below.

It grows to about 523 mm. in length.

Distribution.—India, Pakistan, Burma, Ceylon.—Red Sea, Penang, Singapore, Indonesia, Thailand, China; in the mean annual isotherm of 20°C. with the latitudinal and

longitudinal range of 30°N.—7°S., 39°—121°E. in the Indo-Pacific=(4°—25° N., 39°—100°E. in the Indian Ocean+30°N.—7°S., 103°—121°E. in the Pacific Ocean).

vii. Subgenus **Pastinachus** Rüppell

Cutaneous fold on tail below, not above

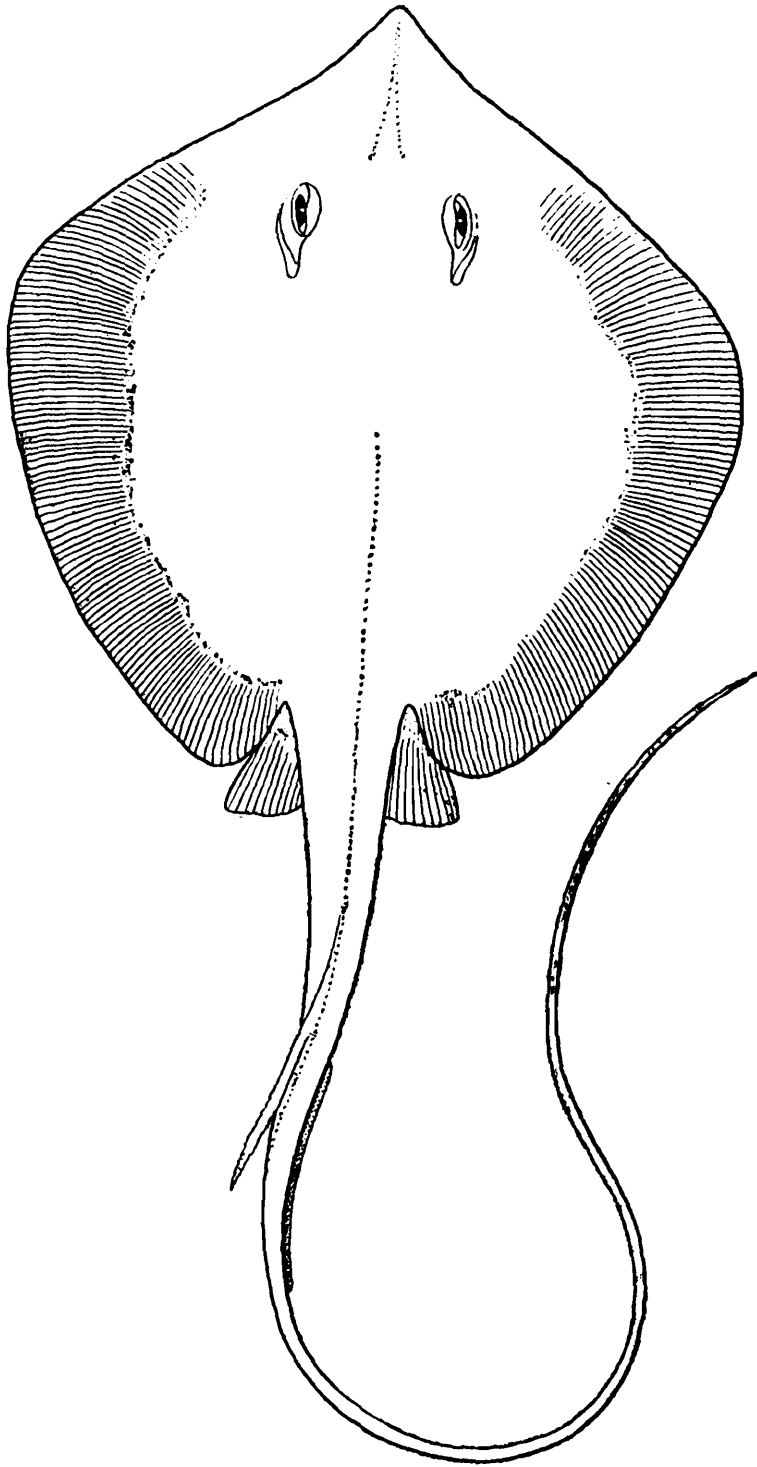
85. **Dasyatis (Pastinachus) bennetti** (M. & H.)

(Text-fig. 59)

1841. *Trygon bennetti*, Müller & Henle, *Syst. Besch. Plagiost.*, p. 160, pl. 53 (type locality : China and Trinidad).
1846. *Trygon carnea* Richardson, *Ichth. China Japan*, p. 197 (type locality : China sea, Macao).
1865. *Trygon bennetti* Bleeker, *Ned. Tijdschr. Dierk.*, 2, p. 55 (Amoy).
1870. *Trygon bennettii* Günther, *Cat. Fish. Brit. Mus.*, 8, p. 480 (China; India; British Guiana).
1878. *Trygon bennettii* Day, *Fish. India*, p. 739 (Seas of India to China and Ceylon).
1889. *Trygon bennetti* Day, *Fauna Brit. India*, Fish., 1, p. 52 (Seas of India to China and Ceylon).
1913. *Dasybatus bennetti* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 383 (China; India).
1931. *Dasyatis bennetti* Chu, *Biol. Bull. St. John's Univ.*, No. 1, p. 9 (China Sea; Macao).
1941. *Dasyatis bennettii* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 413.
1942. *Dasyatis (Pastinachus) bennetti* Misra, *Rec. Indian Mus.*, 41 (1951), p. 123.
1949. *Dasyatis (Pastinachus) bennetti* Misra, *Rec. Indian Mus.*, 45 (1947), p. 34.
1958. *Dasyatis (Pastinachus) bennetti* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 84.

Disc subrhomboid, slightly longer than or as broad as long; its length 4 in total length. Snout projecting, 4·1 in length of disc. Eyes widely placed on either side of median line, 4·1 in snout, 2·5 in interorbital. Mouth transverse, with 5 buccal processes; width 2·1 in preoral, equal to internarial. Nostrils simple, deep. Spiracles large, not oblique, 1·5 times eye, close behind it; interspiracle 1·2 in snout. Five pairs of ventral gill openings. Rayed portion of pectorals united anteriorly. Pelvics short, broad. No rayed dorsal. One serrated caudal spine. Tail 3 times the length of disc, with the serrated spine at end of the anterior sixth of its length; a narrow, cutaneous fold below

tail behind spine covering one-sixth of the caudal length;
no cutaneous fold above tail.



TEXT-FIG. 59.—Dorsal view of *Dasyatis (Pastinachus) bennetti* (M. & H.).
(After J. Müller & F. Henle)

Smooth in young, with age rough with tubercles on back and tail. Greyish yellow above, white below; tail dark grey.

According to Dumeril it attains a length of 914 mm.; littoral.

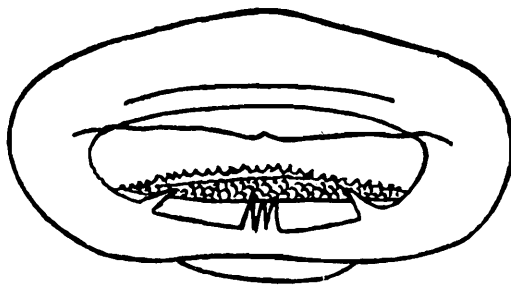
Distribution.—India, Pakistan, Burma, Ceylon.—Amoy, China, Trinidad, British Guiana; in the mean annual isotherm of 20° C. with the latitudinal and longitudinal range of 4°—25°N., 62°—114°E. in the Indo-Pacific=(4°—25°N., 62°—96°E. in the Indian Ocean+10°—24°N., 105°—114°E. in the Pacific Ocean); 7°—11°N., 59°—61°W. in the Atlantic.

86. *Dasyatis* (*Pastinachus*) *sephen* (Forsk.)

(Text-fig. 60)

1775. *Raja sephen* Forskål, *Descript. Animal.*, pp. viii, 17 (type locality : Djedda, Lohaja, Red Sea).
1822. *Raja fluviatilis* Hamilton, *Fish. Ganges*, p. 1 (type locality : Kanpur, Ganges river).
1822. *Raja sancur* Hamilton, *Fish. Ganges*, p. 2 (type locality : Ganges river).
1828. *Trygon forskalii* Rüppell, *Atlas Reise Nordl. Afrika, Fische.*, p. 53, pl. 13, fig. 2 (type locality : Red Sea).
1829. *Trygon wolga-tenkee* Cuvier, *Règne Animal.*, 2, ed. 2, p. 399 (on *Wolga-tenkee* Russell).
1851. *Hypolophus sephen* Gray, *List Fish. Brit. Mus.*, p. 123 (India).
1852. *Hypolophus sephen* Bleeker, *Verh. Bat. Gen. (Plogiost.)*, 24, p. 77 (Batavia, Samarang, Surabaja, Kammal, Surakarta).
1860. *Hypolophus sephen* Blyth, *J. Asiat. Soc. Bengal*, 29, p. 37 (Calcutta).
1870. *Trygon sephen* Günther, *Cat. Fish. Brit. Mus.*, 8, p. 482 (Indian Ocean; East Indies, Penang, Seychelles).
1876. *Trygon sephen* Peters, *Monatsb. Akad. Wiss. Berlin*, p. 853 (New Britain).
1878. *Trygon sephen* Day, *Fish. India*, p. 740, pl. 195, fig. 2 (Red Sea, through the seas of India to the Malay Archipelago, and beyond).
1889. *Trygon sephen* Day, *Fauna Brit. India, Fish.*, 1, p. 50, figs. 21, 22 (Red sea, through the seas of India to the Malay Archipelago, and beyond).
1909. *Hypolophus sephen* Annandale, *Mem. Indian Mus.*, 2, p. 35 (off Burma).
1910. *Trygon sephen* Günther, *J. Mus. Godeffroy*, pt. 17, p. 384 (Pelew Is.).
- 1912-13. *Trygon sephen* Southwell, *Ceylon Administr. Rep.*, pp. E 41, E 42, E 45, E 48, E 50.
1913. *Dasybatus sephen* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 384 (Indian Ocean, Red sea, East Indies, India).
1913. *Trygon sephen* Weber, "*Siboga*" *Exped., Fische*, 57, p. 604 (Aru Is.).

1922. *Hypolophus sephen* Hora, *Mem. Indian Mus.*, 5, p. 763 (Chilka Lake).
1928. *Dasyatis sephen* Fowler, *J. Bombay nat. Hist. Soc.*, 33, p. 102 (Bombay).
1929. *Trygon sephen* Pillay, *J. Bombay nat. Hist. Soc.*, 33, p. 353 (Travancore).
1933. *Dasyatis sephen* Deraniyagala, *Ceylon J. Sci. (c)*, 5, p. 80 (Ceylon).
1933. *Trygon sephen* Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
1936. *Dasybatus sephen* Suvatti, *Index Fish. Siam*, p. 6 (Tale Sap, Siam).
1938. *Dasyatis sephen* Fowler, *List Fish. Malaya*, p. 17 (Penang, Singapore).
1940. *Dasyatis sephen* Setna & Sarangdhar, *Proc. nat. Inst. Sci. India*, 12, p. 256 (Bombay waters).
1941. *Dasyatis sephen* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 415.
1949. *Dasyatis (Pastinachus) sephen* Misra, *Rec. Indian Mus.*, 45 (1957), p. 34.
1952. *Dasyatis (Pastinachus) sephen* Misra, *Rec. Indian Mus.*, 49 (1951), p. 123.
1953. *Dasyatis sephen* Herre, *Check List Philippine Fish.*, p. 44 (Philippines).
1955. *Trygon sephen* Anonymous, *Mar. Fish. Karachi, Sind & Makran*, p. 10 (Coasts of Sind and Makran).
1955. *Pastinachus sephen* Munro, *Mar. Freshwater Fish. Ceylon*, p. 13 (Ceylon).
1958. *Dasyatis (Pastinachus) sephen* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 84.



TEXT-FIG. 60.—Mouth showing oral papillae of *Dasyatis (Pastinachus sephen)* (Forsk.). (After N. Annandale)

Vernacular names.—INDIA : *Goval*, *Pakat*, Marathi; *Adavalan tiriki*, Tamil; *Volugiri tenkee*, *Wolga tenkee*, Telegu; Standardised name : *Oleval tiruke*. PAKISTAN : *Gadum*, Sind & Makran. CEYLON : *Pol kolle maduva*, Sinhalese; *Ada thirukai*, Tamil.

Disc subquadrangular, broader than long; its length 2.5 in total length. Snout blunt, 4.6 in length of disc.

Eyes 3.7 in snout, 2.3 in interorbital. Mouth strongly undulate, with 5 buccal processes of which the middle 3 elongate and close together. Teeth in $\frac{20}{20}$ rows; upper dental plate bent forward, lower plate more flattened. Spiracles not oblique, twice eye, as deep pits close behind it. Interspiracle equals snout. Five pairs of equidistant, ventral gill openings, last the smallest. Rayed portion of pectorals united anteriorly. Pelvics short, wide, obtuse. No rayed dorsal fin. One or 2 serrated spines. Tail 3 times the length of disc, depressed and short anteriorly, slender and filamentous behind the spine; with a long deep cutaneous fold below, beginning in front of the spine and extending more than half way to its slender tip; no cutaneous fold below tail or keel above.

Skin smooth in young, with age roughened all over the disc with tubercles. Uniform brown above, whitish below; cutaneous fold below tail blackish.

It grows to 1,750 mm. across the disc; most common on the Indian Coast during the S.W. monsoon; ascends estuaries and freshwater rivers.

Distribution.—India, Pakistan, Burma, Ceylon.—Red Sea, Seychelles, Arabia, Penang, Singapore, Malay Peninsula, Indonesia, Thailand, "Indo-China", Philippines, Micronesia, Melanesia; in the mean annual isotherm of 20° C. with the latitudinal and longitudinal range of 25°N.—7°S., 55°—152°E. in the Indo-Pacific=(25°N.—5°S., 55°—100°E. in the Indian Ocean+15°N.—7°S., 101°—152°E. in the Pacific Ocean).

34. Genus *Urogymnus* Müller & Henle

1833. *Anacanthus* (nec Gray, 1931) (Ehrenberg) Hoven, *Handb. Dierk.*, 2, p. 179 (type, *Raja africana* Schn., inadmissible).
1837. *Gymnura* (nec Kuhl, 1824) Müller & Henle, *Sitz. Ber. preuss. Akad. Wiss. Berlin*, p. 117 (type, *Raja asperrima* Schn., monotypic; inadmissible).
1837. *Urogymnus* Müller & Henle, *Sitz. Ber. preuss. Akad. Wiss. Berlin*, p. 434 (type, *Raja asperrima* Schn.).
1849. *Rhachinotus* (nec Gray, 1831 or Serville, 1832) Cantor, *J. Asiat. Soc. Bengal*, 18, p. 404 (type, *Raja africana* Schn., inadmissible).

Disc subcircular, profusely tuberculated. Tail feeble, about as long as disc length, without caudal spine. Nasoral grooves rudimentary; cirri present. Rostral cartilage absent. Spiracles large, close behind eyes. 5 pairs of

gill openings on the ventral side. Rayed dorsal fins absent. Rayed portion of pectoral fins united anteriorly. Anal fin absent. Teeth tessellated, flattened, rhomboid.

Distribution.—E. Africa, Seychelles, Red Sea, Arabia, India, Ceylon, Malay Peninsula, Thailand, "Indo-China", Borneo, Java, Philippines, Melanesia.

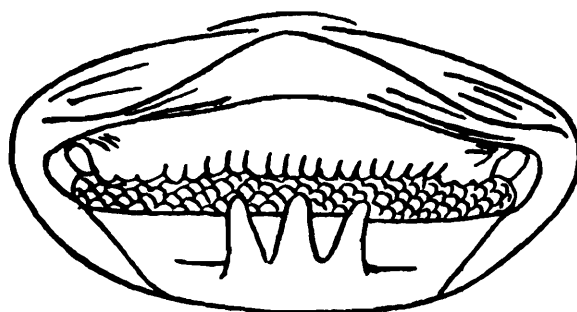
Urogymnus africana (Schn.), is found in India and Ceylon.

87 *Urogymnus africana* (Schn.)

(Pls. XII, XIII ; Text-fig. 61)

1801. *Raja africana* Schneider, *Syst. Ichth. Bloch*, p. 367 (type locality : African Sea : Guinea).
1801. *Raja asperrima* Schneider, *Syst. Ichth. Bloch*, p. 367 (type locality : Indian Ocean; Bombay).
1841. *Anacanthus asperrimus* Müller & Henle, *Syst. Besch. Plagiost.*, p. 157, pl. 60, figs. 5-7 (India).
1853. *Rhachinotus africanus* Bleeker, *Nat. Tijds. Ned. Indie*, **4**, p. 514 (Batavia).
1870. *Urogymnus asperrimus* Günther, *Cat. Fish. Brit. Mus.*, **8**, p. 471 (India, Penang, Africa, Seychelles).
1871. *Urogymnus rhombeus* Klunzinger, *Verh. zool.-bot. Ges. Wien*, **21**, p. 683 (type locality : Koseir, Red Sea).
1878. *Urogymnus asperrimus* Day, *Fish. India*, p. 736, pl. 195, fig. 1 (Madras).
1889. *Urogymnus asperrimus* Day, *Fauna Brit. India, Fish.*, **1**, p. 48, fig. 20 (Madras).
1909. *Urogymnus asperrimus* Annandale, *Mem. Indian Mus.*, **2**, p. 37, pl. 3, fig. 8, pl. 5, figs. 2, 2a (off Chittagong).
1909. *Urogymnus laevior* Annandale, *Mem. Indian Mus.*, **2**, p. 37 (type locality : Malpe, South Canara on Malabar Coast).
- 1912-13. *Urogymnus asperrimus* Southwell, *Ceylon Administr. Rep.*, pp. E 47, E 49.
1913. *Rhachinotus africanus* Garman, *Mem. Harv. Mus. Comp. Zool.*, **36**, p. 374 (Indian Ocean, East Indies).
1913. *Urogymnus asperrimus* Weber, "*Siboga*" *Exped., Fische*, **57**, p. 602, fig. 123 (Borneo).
1931. *Urogymnus africanus* Chu, *Biol. Bull. St. John's Univ.*, No. 1, p. 9 (Hong Kong).
1936. *Urogymnus asperrimus* Suvatti, *Index Fish. Siam*, p. 5 (Ko Chang, Siam).
1940. *Urogymnus asperrimus solanderi* Whitely, *Fish. Australia*, **1**, p. 213 (Queensland).
1941. *Urogymnus africanus* Fowler, *Bull. U.S. nat. Mus.* (100) **13**, p. 438.
1949. *Urogymnus africana* Misra, *Rec. Indian Mus.*, **45** (1947), p. 37.

1952. *Urogymnus africana* Misra, *Rec. Indian Mus.*, 49 (1951), p. 125.
1953. *Urogymnus africanus* Herre, *Check List Philippine Fish.*, p. 49.
1953. *Urogymnus africanus* Smith, *Sea Fish. S. Africa*, p. 514 (Natal, Mozambique).
1955. *Urogymnus asperrimus* Anonymous, *Mar. Fish. Karachi, Sind & Makran*, p. 8 (Coasts of Sind and Makran).
1955. *Urogymnus africanus* Munro, *Mar. Freshwater Fish. Ceylon*, p. 13 (Ceylon).
1958. *Urogymnus africana* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 85.



TEXT-FIG. 61.—Mouth showing oral papillae of *Urogymnus africana* (Schn.). (After N. Annandale)

Vernacular names.—INDIA: *Moollan tiriki*, Tamil. PAKISTAN: *Pitan*, Sind & Makran. CEYLON: *Eramudhu maduva*, Sinhalese; *Mullam thirukai* or *Kallu thirukai*, Tamil.

Disc suboval; its length 1.2 times its width, 2.2 in total length. Snout broadly obtuse, slightly projecting in front, 4.8 in length of disc to hind spiracle edge. Eyes 4.6 in snout, 3.4 in interorbital, 6.4 in head. Snout 1.3 in head to hind spiracle edge. Oronasal groove present. Mouth short, undulated, transverse, a little arched, with 3–4 buccal processes, 2.0 in snout. Teeth blunt, broader than long, dark purple brown, in 48 rows in jaws. Spiracles larger than eye, close behind it, 1.2 in width of mouth. Inter-spiracle 1.1 in snout. Five pairs of small ventral gill openings. Rayed portion of pectorals united anteriorly. Pelvics well covered by pectorals; length 1.5 times its breadth. No dorsal. No anal. No serrated caudal spine. Tail long, tapering, whip-like, 1.2 times the length of disc, with or without narrow ventral fold. No caudal fin.

Skin tough, richly supplied with slime glands. Head, back and tail with prominent bony tubercles interspersed with numerous spiny denticles with stellate bases; pectorals

covered with spiny denticles with smooth circular bases. Uniform greyish brown above, whitish below.

It attains a disc length of 1,125 mm.; littoral.

Distribution.—India, Pakistan, Ceylon.—Red Sea, Seychelles, E. & S. Africa, Arabia, Penang, Malay Peninsula, Indonesia, Thailand, “Indo-China”, Hong Kong, China, Philippines, Queensland, Guinea, Tropical Atlantic; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 25°N.—29°S., 30°—142°E. in the Indo-Pacific=(25°N.—29°S., 30°—142°E. in the Indian Ocean+22°N.—7°S., 100°—123°E. in the Pacific Ocean); 3°N., 2°W. in the Atlantic.

35. Genus *Gymnura* Kuhl

1823. *Gymnura* Kuhl, *Alg. Konst. Letterbode*, p. 316 (type, *Raja micrura* Schn., monotypic).
 1837. *Pteroplatea* Müller & Henle, *Sitz. Ber. preuss. Akad. Wiss. Berlin*, p. 117 (atypic; type, *Raja altavela* L., logotypic).
 1841. *Aetoplatea* Müller & Henle, *Syst. Besch. Plagiost.*, p. 175 (type, *A. tentaculata* M. & H., monotypic).
 1846. *Aetoplatia* Agassiz, *Nomencl. zool., Index*, p. 10 (type, *Aetoplatea tentaculata* M. & H.).
 1882. *Aetoplatia* Scudder, *Nomencl. zool. Univers. Index*, p. 8 (type, *Aetoplatea tentaculata* M. & H.).
 1906. *Planerocephalus* Gratzianow, *Zool. Anz.*, pp. 400, 403 (type, *P. ellioti* Gratzianow=*Raja micrura* Schn., monotypic).

Disc much wider than long. Tail short, slender, with serrated spine. Rostral cartilage absent. Spiracles large, close behind eyes. 5 pairs of gill openings on the ventral side. Rayed dorsal fins absent. Rayed portion of pectoral fins united anteriorly. Anal fin absent. Teeth, minute, numerous, in broad bands, each tooth with one to three cusps.

Distribution.—S. Africa, Natal, Red Sea, India, Ceylon, Burma, Singapore, Indonesia, Thailand, China, Japan, Korea, Philippines, Australia, Polynesia.

The genus *Gymnura* is divided into two subgenera.

Key to subgenera of genus Gymnura Kuhl

- | | |
|---|---------------------------------------|
| 1. A small dorsal fin: a small cutaneous fold on tail | Subgenus <i>Aetoplatea</i>
M. & H. |
| 2. No dorsal fin: no cutaneous fold on tail | Subgenus <i>Gymnura</i>
Kuhl |

Key to species of subgenera Aetoplatea & Gymnura

- | | | |
|--|----|---|
| 1. A small dorsal cutaneous fold on tail | .. | 3 |
| 2. No dorsal cutaneous fold on tail | | 5 |

- | | |
|---|--|
| 3. Tentacles behind spiracles | <i>G. (Aetoplatea) tentaculata</i> M. & H. |
| 4. No tentacles behind spiracles | <i>G. (Aetoplatea) (zonurus)</i> Blkr. |
| 5. Tail about as long as length of disc | <i>G. (Gymnura) poecilura</i> (Shaw) |
| 6. Tail less than half the length of disc | <i>G. (Gymnura) micrura</i> (Schn.) |

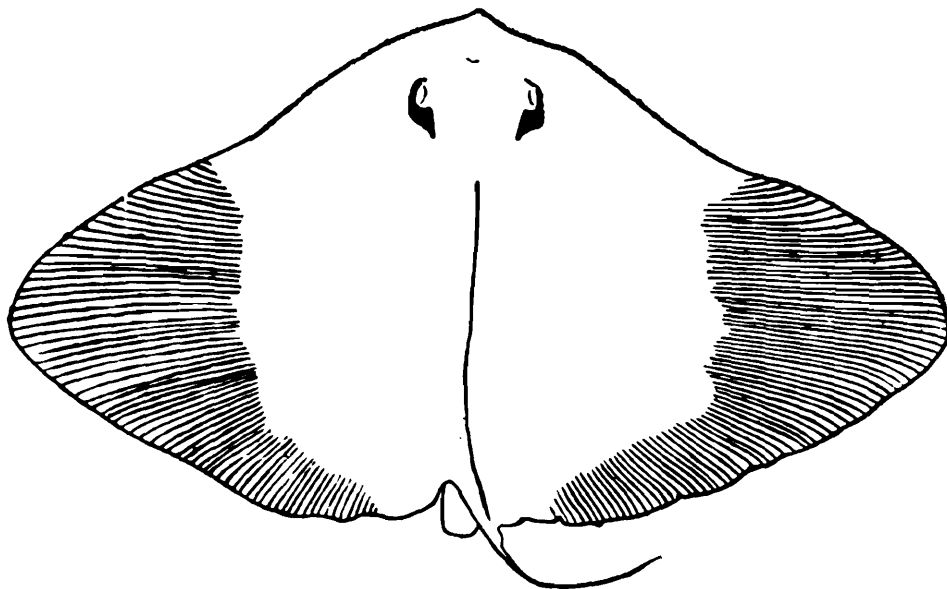
viii. Subgenus *Aetoplatea* Müller & Henle

Tail with a small dorsal fin ; a faint dorsal and ventral cutaneous folds or with a ventral fold only.

88. *Gymnura (Aetoplatea) tentaculata* M. & H.

(Text-fig. 62)

1841. *Aetoplatea tentaculata* Müller & Henle, *Syst. Besch. Plagiost.*, p. 175 (type locality : Indian Sea; Red Sea; according to Bertin holotype *measure* and paratypes from Mer des Indes are in the Paris Museum).
1909. *Pteroplatea tentaculata* Annandale, *Mem. Indian Mus.*, 2, p. 40, pl. 4, fig. 4 (off Hughli river mouth, Orissa and Ganjam Coasts).
1913. *Aetoplatea tentaculata* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 411 (Red Sea; Indian Ocean; Malabar).
1941. *Gymnura tentaculata* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 45.



TEXT-FIG. 62.—Dorsal view of *Gymnura (Aetoplatea) tentaculata* M. & H. : $\times ca\frac{1}{3}$. (After N. Annandale)

1949. *Gymnura (Aetoplatea) tentaculata* Misra, *Rec. Indian Mus.*, 45 (1947), p. 38.
1952. *Gymnura (Aetoplatea) tentaculata* Misra, *Rec. Indian Mus.*, 49 (1951), p. 125.
1958. *Gymnura (Aetoplatea) tentaculata* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 85.

Disc subrhomboid, broader than long; its length 1.9 in its width, 1.4 in total length. Snout broadly obtuse, slightly projecting, 5.5 in length of disc. Eyes 4.0 in snout, 4.0 in interorbital. Interorbital equals snout. Mouth wide, transverse, a little arched, without buccal processes. Teeth acute. Spiracles large, with tentacle at posterior angle, close behind eyes. Interspiracle equals snout. Five pairs of ventral gill openings. Rayed portion of pectorals united anteriorly; anterior edges of pectorals waved, posterior nearly straight. Pelvics small. A single rayed, small, round dorsal at base of tail before caudal spine. A minute, serrated, caudal spine. No anal fin. Tail whip-like, 2.2 in length of disc, with faint upper and lower cutaneous folds. No caudal fin.

Skin smooth. Greenish grey with irregular round spots of dark brown in young; in adults dark spots and blotches of yellowish green; tail faintly barred; white below; in young marbled and clouded, darker in adults.

It attains 730 mm. across the disc; littoral.

Distribution.—India.—Red Sea; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 11°—20°N., 39°—88°E. in the Indian Ocean.

89. *Gymnura (Aetoplatea) zonurus* Blkr.

1852. *Aetoplatea zonurus* Bleeker, *Verh. Bat. Gen. (Plagiost.)*, **24**, p. 79 (type locality: Batavia, Java).
1870. *Pteroplatea zonura* Günther, *Cat. Fish. Brit. Mus.*, **8**, p. 488.
1909. *Pteroplatea zonura* Annandale, *Mem. Indian Mus.*, **2**, p. 40, pl. 4, fig. 3 (Puri, Orissa Coast, in 15-20 fathoms).
1913. *Aetoplatea zonurus* Garman, *Mem. Harv. Mus. Comp. Zool.*, **36**, p. 411.
1941. *Gymnura zonura* Fowler, *Bull. U.S. nat Mus.*, (100) **13**, p. 451.
1949. *Gymnura (Aetoplatea) zonurus* Misra, *Rec. Indian Mus.*, **45** (1947), p. 38.
1952. *Gymnura (Aetoplatea) zonurus* Misra, *Rec. Indian Mus.*, **49** (1951), p. 125.
1958. *Gymnura (Aetoplatea) zonurus* Misra & Menon, *Rec. Indian Mus.*, **53** (1955), p. 85.

Disc subrhomboid; its length 2.0 in its width, 1.5 in total length. Snout broadly obtuse, with short, distinct projection in front, 7.2 in length of disc. Eyes 3.0 in snout, 4.5 in interorbital. Interorbital equals snout. Mouth wide, transverse, a little arched, without buccal processes. Teeth minute, numerous, in broad bands. Spiracles without tentacle, close behind eyes. Interspiracle 1.2 times snout. Five pairs of ventral gill openings. Rayed

portion of pectorals united anteriorly; anterior edges of pectorals very little waved, outer angle slightly; posterior margin and angle rounded. Pelvics small. A single, small, rounded, rayed dorsal fin, twice as long as eye; origin in front of pelvic ends. Serrated caudal spine minute or absent. No anal fin. Tail whip-like, 1·8 in length of disc, without upper cutaneous fold, but with a low cutaneous fold on lower side. No caudal fin.

Skin smooth. Olive green above with minute, closely speckled dots of darker shade; body marked with large round or irregular spots of greenish yellow; lower whitish; tail brown with 8—10 white rings behind the dorsal.

It attains 850 mm. across the disc; littoral.

Distribution.—India.—Singapore, Java; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 19°N.—7°S., 85°—110°E. in the Indo-Pacific (=19°N., 85°E. in the Indian Ocean+1°N.—7°S., 103°—110°E. in the Pacific Ocean).

ix. Subgenus *Gymnura* Kuhl

A small rudimentary dorsal present or absent : no cutaneous folds on tail.

90. *Gymnura* (*Gymnura micrura*) (Schn.)

1801. *Raja micrura* Schneider, *Syst. Ichth. Bloch*, p. 360 (type locality : "Surinam", Dutch Guiana).
1849. *Pteroplatea micrura* Cantor, *J. Asiat. Soc. Bengal*, 18, p. 1409 (Penang, Singapore).
1878. *Ceratoptera ehrenbergii* (*nec* Müller & Henle) Day, *Fish. India*, p. 745, fig. (type locality : Madras) (monstrosity).
1905. *Pteroplatea micrura* Fowler, *Proc. Acad. Nat. Sci. Philad.*, p. 461 (Baram, North Borneo).
1907. *Pteroplatea micrura* Volz, *Nat. Tijdschr. Ned. Indie*, 66, p. 241 (Sumatra).
1907. *Pteroplatea micrura* Lloyd, *Rec. Indian Mus.*, 1, p. 220 (Akyab).
1913. *Pteroplatea micrura* Zugmayer, *Abh. Bayer. Akad. Wiss. math-phys. Kl.*, 26, p. 8 (Mekran).
1929. *Pteroplatea micrura* Pillay, *J. Bombay nat. Hist. Soc.*, 33, p. 353 (Travancore).
1933. *Pteroplatea micrura* Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
1936. *Pteroplatea micrura* Suvatti, *Index Fish. Siam*, p. 5 (Siam).
1941. *Gymnura micrura* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 455.
1949. *Gymnura* (*Gymnura*) *micrura* Misra, *Rec. Indian Mus.*, 45 (1947), p. 38.

1952. *Gymnura (Gymnura) micrura* Misra, *Rec. Indian Mus.*, **49** (1951), p. 125.
1955. *Gymnura micrura* Munro, *Mar. Freshwater Fish. Ceylon*, p. 12 (Ceylon).
1958. *Gymnura (Gymnura) micrura* Misra & Menon, *Rec. Indian Mus.*, **53** (1955), p. 85.

Vernacular name.—INDIA : *Shewta*, Marathi.

Disc subrhomboid, less than 2 times broader than long; its length 1.3 to 1.8 in total length. Snout not projecting, blunt, 1.6 in head. Eyes 7.0 in head, 5.0 in snout, 5.0 in interorbital. Interorbital 1.5 in head. Width of mouth more than half of head. Teeth in 60–65 rows, with pointed cusps. Nostrils broad, oblique. Internarial 1.4 in mouth width; front valve broad, low, hind valve short. Spiracles large, broad, 1.7 times eye; no tentacle behind spiracle. Five pairs of small, ventral gill openings, last the smallest. Rayed portion of pectorals united anteriorly. A vestigial dorsal equal to eye. Pelvics small, broad, 2 in head. Tail slender, tapering, in length of disc; without spine.

Skin smooth. Oviparous; flesh excellent; enter estuaries freely. Uniform blackish brown above, whitish or slightly brownish below; tail with 2 blackish blotches above, whitish below; tip of tail blackish.

It attains 1,827 mm. across the disc; littoral, bottom living.

Distribution.—India, Pakistan, Ceylon, Burma.—Penang, Malay Peninsula, Singapore, Indonesia, Thailand, “Indo-China”, Dutch Guiana; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 0°—25°N., 62°—118°E. in the Indo-Pacific=(4°—25°N., 62°—100°E. in the Indian Ocean+0°—15°N., 102°—118°E. in the Pacific); 5°N., 55°W. in the tropical Atlantic.

91. *Gymnura (Gymnura) poecilura* (Shaw)

(Pl. XIV, fig. 2; text-fig. 63)

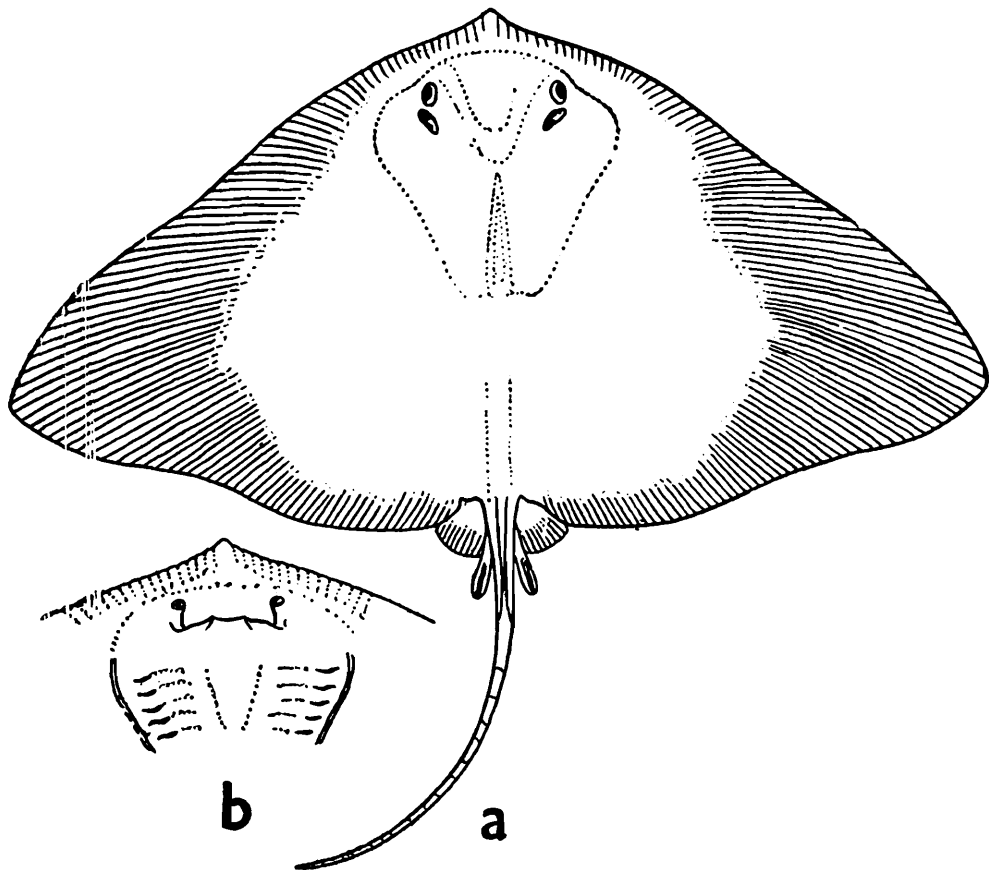
1804. *Raja poecilura* Shaw, *General Zoology*, **5**, 291 (on *Tenkee kunsal* Russell, *Fish Coromandel*, **1**, p. 4, pl. 6, 1803 (type locality: Vizagapatnam).
1829. *Pastinaca kunsal* Cuvier, *Régne Animal.*, **2**, ed. 2, p. 400 (on *Tenkee kunsal*).
1839. *Pteroplatea annulata* Swainson, *Nat. Hist. Animal.*, **2**, p. 319 (on *Tenkee kunsal*).

1870. *Pteroplatea micrura* (*nec* Schneider) Günther, *Cat. Fish. Brit. Mus.*, 8, p. 487 (Calcutta, Penang, Singapore, India).
1878. *Pteroplatea micrura* (*nec* Schneider) Day, *Fish. India*, p. 741, pl. 194, fig. 2.
1889. *Pteroplatea micrura* (*nec* Schneider) Day, *Fauna Brit. India*, Fish., 1, p. 56, fig. 23 (Madras).
1909. *Pteroplatea micrura* (*nec* Schneider) Annandale, *Mem. Indian Mus.*, 2, p. 39 (Puri).
- 1912-13. *Pteroplatea micrura* (*nec* Schneider) Southwell, *Ceylon Administr. Rep.*, pp. E 43-45, E 49.
1913. *Pteroplatea poecilura* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 412 (Red Sea, India, Calcutta, Penang, Java).
1919. *Pteroplatea poecilura* Southwell & Prashad, *Rec. Indian Mus.*, 16, p. 232, pl. 19, figs. 3, 3a (Portugal Bay, Ceylon Coast).
1931. *Pteroplatea poecilura* Chu, *Biol. Bull. St. John's Univ.*, No. 1, p. 10 (China).
1941. *Gymnura poecilura* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 452.
1946. *Gymnura poecilura* Setna & Sarangdhar, *Proc. nat. Inst. Sci. India*, 12, No. 5, p. 256 (Bombay waters).
1949. *Gymnura* (*Gymnura*) *poecilura* Misra, *Rec. Indian Mus.*, 45 (1947), p. 38.
1952. *Gymnura* (*Gymnura*) *poecilura* Misra, *Rec. Indian Mus.*, 49 (1951), p. 125.
1953. *Pteroplatea poecilura* Herre, *Check List Philippine Fish.*, p. 50 (Philippines).
1955. *Pteroplatea micrura* (*nec* Schneider) Anonymous, *Mar. Fish. Karachi, Sind & Makran*, p. 10, fig. 20.
1955. *Gymnura poecilura* Munro, *Mar. Freshwater Fish. Ceylon*, p. 12 (Ceylon).
1958. *Gymnura* (*Gymnura*) *poecilura* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 80.

Vernacular names.—INDIA : *Peroom tirik* or *Tappor kooti tiriki*, Tamil; *Tappu cooti* or *Tenkee kunsul*, Telegu. PAKISTAN : *Thappa*, Sind & Makran. BURMA : *Lek kyook temengnee*.

Disc subrhomboid; its length 1.9 in its width, 1.5 in total length. Snout broadly obtuse, with a little projection in front 5.8 in length of disc. Eyes 4.3 to 6.0 in snout, 4.8 to 6.4 in interorbital. Interorbital equals snout. Mouth wide, transverse, a little arched, without buccal processes. Teeth minute, 40 rows in each jaw. Spiracles without tentacle, larger than eye, behind it. Interspiracle equals

snout. Five pairs of ventral gill openings. Rayed portion of pectorals united anteriorly. Pelvics small. Dorsal



TEXT-FIG. 63.—*Gymnura (Gymnura) poecilura* (Shaw).

(a) Dorsal view. (b) Ventral view of head. (After F. Day)

absent. No serrated caudal spine. No anal fin. Tail whip-like, 1.2 to 1.6 in length of disc, without upper and lower cutaneous folds. No caudal fin.

Skin smooth. Brown above, whitish below; iris grey; tail whitish with broad, blackish rings much wider than pale interspaces.

It attains 820 mm. across the disc; littoral, bottom living.

Distribution.—India, Pakistan, Burma, Ceylon.—Red Sea, Penang, Singapore, Indonesia, China, Philippines; in the mean annual isotherm of 20° C. with the latitudinal and longitudinal range of 25°N.—7°S., 62°—123°E. in the Indo-Pacific=(4°—25°N., 39°—100°E. in the Indian Ocean+1°—22°N., 103°—123°E. in the Pacific Ocean).

XIV. Family MYLIOBATIDAE

Eagle Rays

Head and body moderately depressed with the rayed portion of pectorals reaching up to below eye, forming a lozenge-shaped disc. Cranium moderately conspicuous, rostral fins forming a unilobed or bilobed snout, either separated from pectorals or united with them at the side of head. Eyes without nictitating membrane, prominent, lateral, wide apart on either side of median line. Nasoral grooves present, cirri present or absent. Mouth inferior, transverse. Teeth in pavement. Five pairs of ventral gill openings. Spiracles large, behind eyes, opening laterally. A single dorsal fin. Pelvics moderate or small. Anal fin absent. Tail long, whip-like, with or without a serrated caudal spine and without cutaneous folds. Caudal fin absent.

Upper Cretaceous to Recent.

The family MYLIOBATIDAE is represented by three genera in the Indian region.

Key to genera of family MYLIOBATIDAE

- | | | |
|---|---|-----------------------------------|
| 1. Unilobed snout | 3 | |
| 2. Bilobed snout | . | Genus Rhinoptera C. |
| 3. Teeth in several rows of which the lateral ones narrower than the central: caudal spine absent | | Genus Aetomylus Garman |
| 4. Teeth in single broad series : caudal spine present — — .. | | Genus Aetobatus Blainville |

36. Genus **Aetomylus** Garman

1908. *Aetomylus* Garman, *Bull. Harv. Mus. Comp. Zool.*, 51, p. 252 (type, *Myliobatis maculatus* Gray, orthotypic).

1910. *Aetomyleus* Sharp, *Zool. Rec.*, No. 44 (1908), index, p. 1 (type, *Myliobatis maculatus* Gray).

1913. *Aetomylaeus* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 434 (type, *Myliobatis maculatus* Gray).

Disc lozenge-shaped, about twice as broad as long. Tail whip-like, much longer than disc and without caudal spine. Head moderately conspicuous, rostral fins forming a unilobed snout. Eyes lateral. Nasoral grooves present. Spiracles large, behind eyes. 5 pairs of gill openings on the ventral side. First dorsal fin small, situated at basal part of tail; the second dorsal and anal fins absent. Rayed portion of the pectorals, falciform and extending only upto

the posterior region of the orbit. Teeth in 3 rows of which the lateral narrower than the central ones.

Distribution.—Red Sea, India, Ceylon, Burma, Malay Peninsula, Indonesia, Thailand, China, Japan, Philippines, Australia.

Key to species

1. Origin of dorsal fin behind ends of pelvic bases *A. maculatus* (Gray)
2. Origin of dorsal fin opposite ends of pelvic bases 3
3. Orbital horns present *A. nichofii cornifera* (Ann.)
4. Orbital horns absent 5
5. About 5 blue cross bands on disc : spiracles twice eye *A. nichofii nichofii* (Schn.)
6. Green brown-edged ocelli on hind part of disc : spiracles about the size of eye *A. milvus* (M. & H.)

92. *Aetomylus maculatus* (Gray)

- 1833-34. *Myliobatis maculatus* Gray, *Ill. Ind. Zool. Hardwicke*, **2**, p. 101 (type locality : Penang).
1841. *Myliobatis maculatus* Müller & Henle, *Syst. Besch. Plagiost.*, p. 178 (India).
1852. *Myliobatis maculatus* Bleeker, *Verh. Bat. Gen. (Plagiost.)*, **24**, p. 84 (Batavia, Samarang).
1859. *Myliobatis maculatus* Bleeker, *Act. Soc. Sci. Indo-Neerl.*, **5**, No. 7, p. 2 (Sinkawang, Borneo).
1870. *Myliobatis maculata* Günther, *Cat. Fish. Brit. Mus.*, **8**, p. 490 (India).
1878. *Myliobatis maculata* Day, *Fish. India*, p. 742 (Seas of India to Malay Archipelago).
1889. *Myliobatis maculata* Day, *Fauna Brit. India*, *Fish.*, **1**, p. 59 (Seas of India to Malay Archipelago).
1909. *Myliobatis maculata* Annandale, *Mem. Indian Mus.*, **2**, p. 53 (off Orissa Coast).
1913. *Aetomylaeus maculatus* Garman, *Mem. Harv. Mus. Comp. Zool.*, **36**, p. 435 (Indian Seas, East Indies, Penang).
1930. *Aetomylus maculatus* Fowler, *Hong Kong Nat.*, **1**, p. 183, fig. 22.
1931. *Aetomylaeus maculatus* Chu, *Biol. Bull. St. John's Univ.*, No. 1, p. 11 (China).
1936. *Aetomylaeus maculatus* Suvatti, *Index Fish. Siam*, p. 7 (Gulf of Siam).
1941. *Aetomylus maculatus* Fowler, *Bull. U.S. nat. Mus.*, (100) **13**, p. 464.
1946. *Aetomylaeus maculatus* Sétna & Sarangdhar, *Proc. nat. Inst. Sci. India*, p. 256 (Bombay).

1949. *Aetomylaeus maculatus* Misra, *Rec. Indian Mus.*, 45 (1947), p. 39.
1955. *Aetomylaeus maculatus* Munro, *Mar. Freshwater Fish. Ceylon*, p. 15 (Ceylon).
1958. *Aetomylus maculatus* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 85.

Vernacular names.—CEYLON: *Punjadiya*, Sinhalese; *Punjadi thirukai*, *Neduvilai thirukai*, Tamil.

Disc lozenge-shaped; its length 1.8 in its width, 4.7 times in total length. Snout (rostral fins) bluntly pointed, unilobed, 6.0 in length of disc. Eyes 2.5 in snout, 3.2 in interorbital, pupils erect. Mouth straight, 1.8 in preoral, without buccal processes. Teeth in median row 5–6 times as broad as long. Spiracles large, not visible from above, 2.2 times eye. Inter-spiracle a little more than twice snout. Five pairs of small ventral gill openings. Rayed portion of pectorals not united with rostral fins at side of head. Pelvics longer than broad, edges rounded. A single rayed dorsal fin at base of tail, behind ends of pelvic base. No serrated caudal spine. No anal fin. Tail long, whip-like, 3.7 times the length of disc; without upper and lower cutaneous folds.

Skin rough, with small tubercles or spines in dorsal area in young. Brown above with dark edged round white spots posteriorly; tail indistinctly banded brown and grey; white below.

It attains 724 mm. in length; littoral, bottom living.

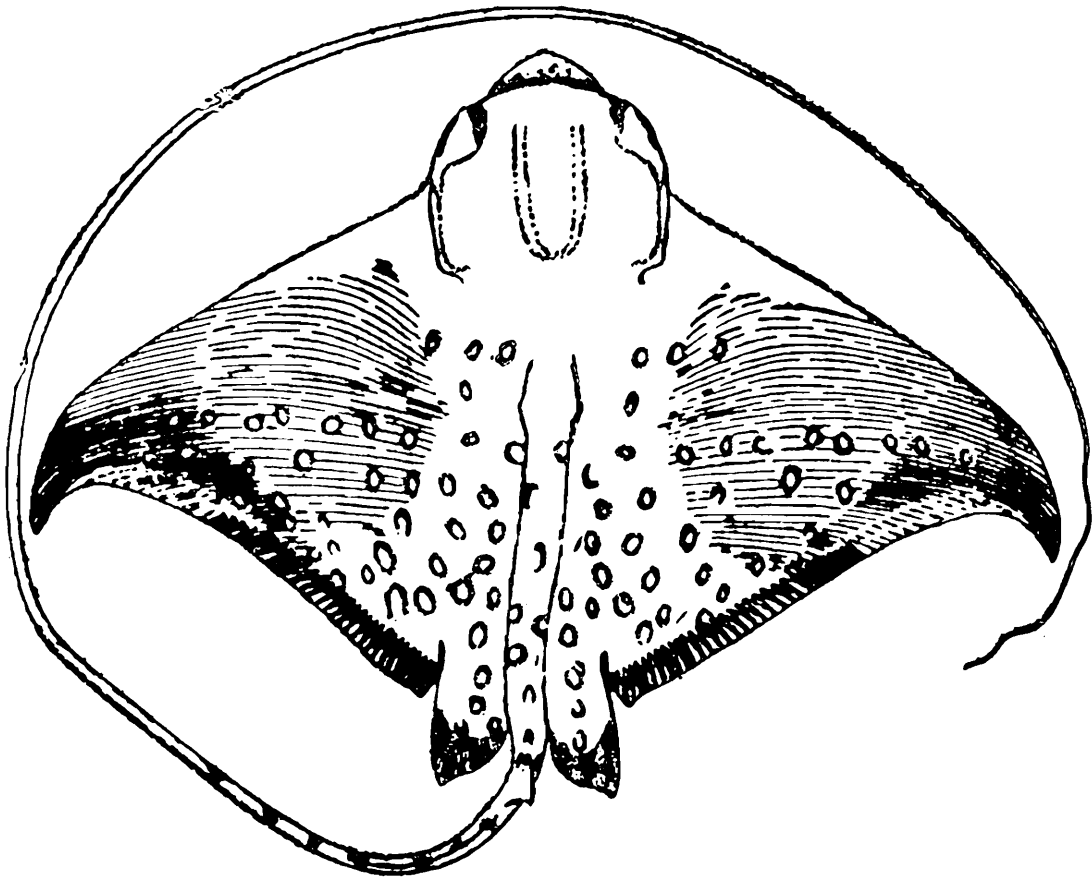
Distribution.—India, Ceylon.—Penang, Singapore, Indonesia, Thailand, China; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 7°S.—22°N., 72°—114°E. in the Indo-Pacific (4°—19°N., 72°—100°E. in the Indian Ocean + 22°N.—7°S., 101°—114°E. in the Pacific Ocean).

93. *Aetomylus milvus* (M. & H.)

(Text-fig. 64)

1841. *Myliobatis milvus* Müller & Henle, *Syst. Besch. Plagiost.*, p. 178 (type locality: Red Sea; according to Bertin types from Mer des Indes are in the Paris Museum).
1852. *Myliobatis milvus* Bleeker, *Verh. Bat. Gen. (Plagiost.)*, 24, p. 87 (Batavia, Samarang).
1928. *Aetomylaeus milvus* Fowler, *J. Bombay nat. Hist. Soc.*, 33, p. 103 (Bombay).
1931. *Aetomyleus milvus* Chu, *Biol. Bull. St. John's Univ.*, No. 1, p. 11 (China).

1935. *Aetomylaeus milvus* Suvatti, *Index Fish. Siam*, p. 7 (Siam).
 1941. *Aetomylus milyus* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, 466.
 1949. *Aetomylaeus milvus* Misra, *Rec. Indian Mus.*, 45 (1947), p. 39.
 1958. *Aetomylus milvus* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 85.



TEXT-FIG. 64.—Dorsal view of *Aetomylus milvus* (M. & H.) $\times ca \frac{5}{6}$.
 (After K. S. Misra)

Disc lozenge-shaped; its length 1.5 in its width, 5.0 in total length. Snout (rostral fins) unilobed, rounded, 6.5 in length of disc. Eyes 2.0 in snout, 5.2 interorbital. Mouth straight, 2.5 in interorbital, without buccal processes. Internarial 1.8 in preoral. Teeth in median row 7.8 times as broad as long, and 3 series of small laterals on each side. Spiracles equal eyes, not visible from above, 2 times snout. Five pairs of small, ventral gill openings. Rayed portion of pectorals not united with rostral fins at the side of head. Pelvics longer than broad, pointed at ends. Claspers do not extend beyond pelvics. A small, single, rayed dorsal fin at base of tail above or opposite pelvic ends. No serrated caudal spine. No anal fin. Tail

whip-like, 4 times the length of disc, without upper and lower cutaneous folds.

Skin smooth. Dark uniform brown, with green brown-edged ocelli on hind part of disc and pelvics; tail brown, paler below anteriorly.

It grows to 608 mm. in length; littoral, bottom living.

Distribution.—India.—Red Sea, Penang, Indonesia, Thailand, China; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 22°N.—7°S., 39°—114°E. in the Indo-Pacific = (5°—20°N., 39°—100°E. in the Indian Ocean + 22°N.—7°S., 101°—114°E. in the Pacific Ocean).

1. *Aetomylus nichofii nichofii* (Schn.)

(Pl. XIV, fig. 1)

1801. *Raja nichofii* Schneider, *Syst. Ichth. Bloch*, p. 364 (on *Zeevleermuis* Nieuhof, *Gadenk. Reiz.*, 1, p. 278, fig. 1682; type locality: East Indies).
1804. *Raja fasciata* Shaw, *General Zoology*, 2, p. 286, pl. 143 (on *Mookarah tenkee* Russell, *Fish. Coromandel*, 1, p. 4, pl. 7, 1803).
1852. *Myliobatis nieuhoftii* Bleeker, *Verh. Bat. Gen. (Plagiost.)*, 24, p. 85 (Batavia).
1878. *Myliobatis nieuhoftii* Day, *Fish. India*, p. 742 (Madras).
1889. *Myliobatis nieuhoftii* Day, *Fauna Brit. India*, Fish., 1, p. 58 (Seas of India to the Malay Archipelago and Japan).
1909. *Myliobatis nieuhoftii* Annandale, *Mem. Indian Mus.*, 2, p. 51 (off Orissa Coast; Chittagong; Ganges mouth; Burma).
1913. *Aetomylaeus nichofii* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 436 (India; East Indies; Japan).
1915. *Aetomylaeus nichofii* Chaudhuri, *Mem. Indian Mus.*, 5, p. 413 (Chilka Lake).
1919. *Aetomylaeus nichofii* Southwell & Prashad, *Rec. Indian Mus.*, 16, p. 233, pl. 19, figs. 4, 4a (Portugal Bay, Ceylon).
1921. *Myliobatis nieuhoftii* Malpas, *Ceylon Administr. Rep.*, p. E 8.
1929. *Myliobatis nieuhoftii* Pillay, *J. Bombay nat. Hist. Soc.*, 33, p. 353 (Travancore) (error in spelling).
1931. *Aetomyleus nichofii* Chu, *Biol. Bull. St. John's Univ.*, No. 1, p. 11 (China).
1938. *Myliobatis nichofii* Fowler, *List Fish. Malaya*, p. 19 (Penang, Singapore).
1941. *Aetomylus nichofii* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 467.
1949. *Actomylaeus nichofii* Misra, *Rec. Indian Mus.*, 45 (1947), p. 39.

1955. *Aetomylaeus nichofii* Munro, *Mar. Freshwater Fish. Ceylon*, p. 15 (Ceylon).

1958. *Aetomylus nichofii* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 85.

Vernacular names.—INDIA: *Tuppa koollee* or *Chuppa tirike*, Tamil; *Mookarah tenkee*, *Sappa-thiruky*, Telegu.

Disc lozenge-shaped; its length 1.8 in its width, 4.4 in total length. Snout (rostral fins) 5.6 in length of disc, shorter than in *A. milvus* (M. & H.), unilobed, much less produced, tapering more rapidly forming a pointed lobe at low level in front. Eyes 3.5 in snout, 5.0 in interorbital. Internarial a little less than mouth width. Mouth straight, longer than snout, without buccal processes. Teeth in median row 6–10 times as broad as long, with 3 series of laterals on each side. Spiracles large, deep, twice eye. Five pairs of small, ventral gill openings, the last smallest. Rayed portion of pectorals not united with rostral fins at side of head. Pelvics longer than broad, rounded. Claspers extend well beyond pelvics. A single rayed dorsal fin at base of tail, opposite ends of pelvics. No serrated caudal spine. No anal fins. Tail long, whip-like, 3.4 times the length of disc, without upper and lower cutaneous folds.

Skin smooth in young, very finely tuberculated over much of disc above with age. Dark brown anteriorly with 3–5 blue, cross bands on disc, disappearing with age; posteriorly large, close-set, rounded, greyish blotches; tail irregularly blotched or dark brown when young; whitish below.

It attains 1,540 mm. in length; littoral.

Distribution.—India, Pakistan, Burma, Ceylon.—Penang, Singapore, Indonesia, China, Japan; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 35°N.—7°S., 62°—135°E. in the Indo-Pacific—(4°—25°N., 62°—100°E. in the Indian Ocean + 35°N.—7°S., 103°—135°E. in the Pacific Ocean).

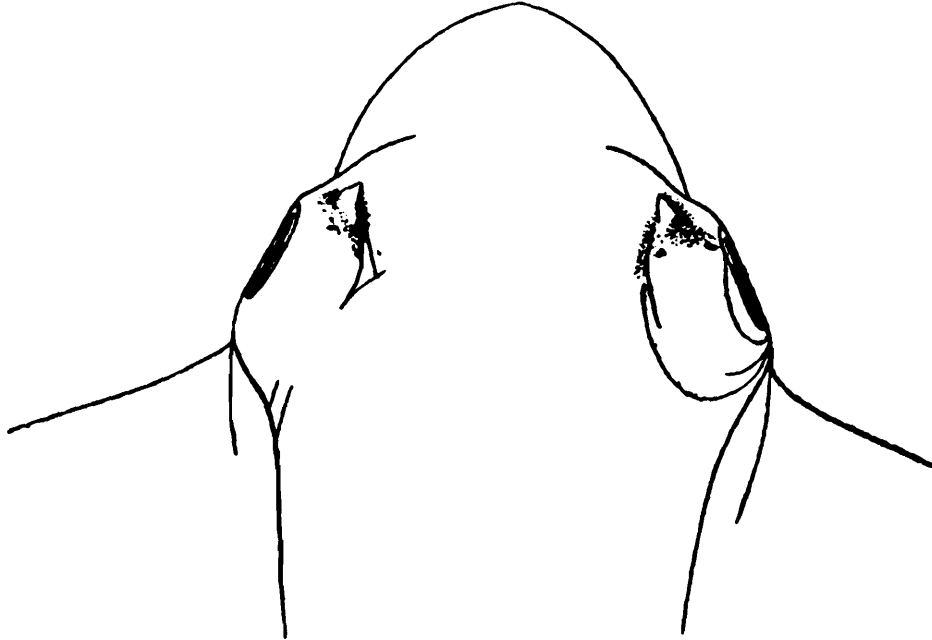
2. *Aetomylus nichofii cornifera* (Annandale)

(Text-fig. 65)

1909. *Myliobatis nieuhofti* var. *cornifera* Annandale, *Mem. Indian Mus.*, 2, p. 52, pl. 2, fig. 4 (type locality : Balasore, Orissa Coast; type is in the Zoological Survey of India).

1949. *Aetomylaeus nichofii* var. *cornifera* Misra, *Rec. Indian Mus.*, 45 (1947), p. 40.

1952. *Aetomylaeus nichofii cornifera* Misra, *Rec. Indian Mus.*, 49 (1951), p. 127.
 1958. *Aetomylus nichofii cornifera* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 78.



TEXT-FIG. 65.—Dorsal view of head of *Aetomylus nichofii cornifera* (Annandale) $\times \frac{10}{13}$. (After N. Annandale)

The subspecies differs from the forma typica in the presence of a horn immediately above each orbit and in having denticles on back more strongly developed.

It attains a length of 750 mm.; specimens measuring 445 mm. across the disc have been obtained; littoral.

Distribution.—India, E. Pakistan, Burma in the mean annual isotherm of 20°C. in the Bay of Bengal.

37. Genus *Aetobatus* Blainv.

1816. *Aetobatus* Blainville, *Bull. Soc. philom. Paris*, 8, p. 122 (type, *Raja narinari* Euphr., designated by Gill, *Proc. U.S. nat. Mus.*, 17, p. 122, 1894).
 1825. *Aetobatis* Blainville, *Faune Francaise Poiss.*, p. 38 (type, *Raja narinari* Euphr.).
 1846. *Aetobates* Richardson, *Ichth. China Japan*, p. 198 (type, *Raja narinari* Euphr.).
 1849. *Stoasodon* Cantor, *J. Asiat. Soc. Bengal*, 18, p. 1416 (type, *Raja narinari* Euphr., monotypic).
 1856. *Aetobatys* Dumeril, *Mem. Acad. Sci. France*, 27, p. 145 (type, *Raja narinari* Euphr.).
 1859. *Goniobatis* Agassiz, *Proc. Boston Soc. nat. Hist.*, 6, p. 385 (type, *Raja flagellum* Schn., monotypic).

Disc lozenge-shaped, about twice as broad as long. Tail whip-like, larger than the length of the disc and with a serrated caudal spine. Head conspicuous, rostral fins forming a unilobed, pointed snout. Eyes lateral. Nasoral grooves present. Spiracles large, about twice eye diameter and laterally situated, about an eye diameter and a half behind eyes. 5 pairs of gill openings on the ventral side. First dorsal fin small, situated at basal part of tail; second dorsal and anal fins absent. Rayed portion of pectorals falciform extending upto the anterior margin of spiracles. Teeth in a single row.

Distribution.—India, Ceylon, Burma, Tropical Atlantic Ocean, Natal, Red Sea, Arabia, Seychelles, Malay Peninsula, Indonesia, Thailand, China, Philippines, Melanesia, Polynesia, Micronesia, Hawaiian groups.

The genus *Aetobatus* is represented by two species in the Indian region.

Key to species

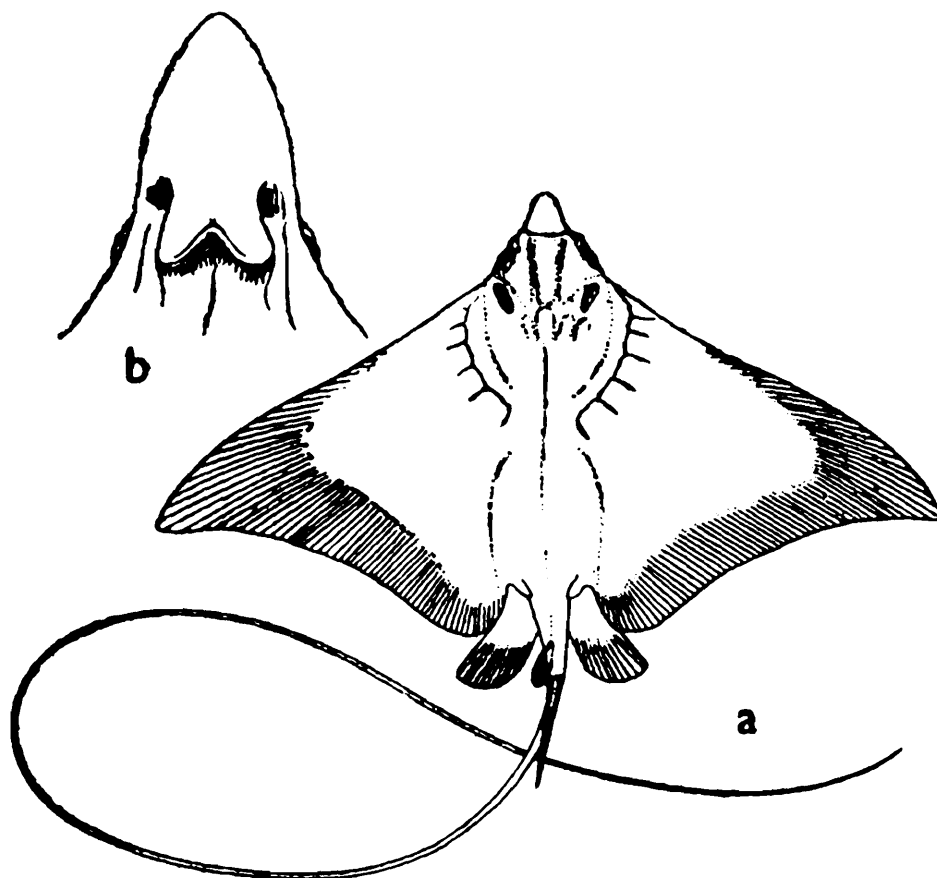
1. Snout conical, bluntly pointed, nearly as broad as or broader than long at base, 1.3 times width of mouth; spotted closely with small dark-edged spots: dorsal end not reaching pelvic ends *A. ocellatus* (Kuhl)
2. Snout straight, pointed, longer than broad at base, 1.8 times width of mouth: uniform or spotted with whitish: dorsal end reaching pelvic ends *A. flagellum* (Schn.)

94. *Aetobatus flagellum* (Schn.)

(Text-fig. 66)

1801. *Raja flagellum* Schneider, *Syst. Ichth. Bloch*, p. 361, pl. 73 (type locality: Coromandel).
1804. *Raja guttata* (nec Schneider, 1801) Shaw, *General Zoology*, 5, pt. 2, p. 285 (type locality: Coromandel; Madagascar; Brazil).
1846. *Aetobates flagellum* Richardson, *Ichth. China Japan*, p. 198 (China Seas, Macao).
1852. *Aetobatus flagellum* Bleeker, *Verh. Bat. Gen. (Plagiost.)*, 24, p. 82 (China).
1878. *Aetobatis narinari* (nec Euphrasen) Day (*partim*), *Fish. India*, p. 743, pl. 194, fig. 4 (Red Sea; Seas and estuaries of India to the Malay Archipelago and beyond).
1889. *Aetobatis narinari* (nec Euphrasen) Day (*partim*), *Fauna Brit. India*, Fish., 1, p. 59, fig. 24 (Red Sea; Seas and estuaries of India to the Malay Archipelago and beyond).
1907. *Aetobatis narinari* (nec Euphrasen) Lloyd (*partim*), *Rec. Indian Mus.*, 1, p. 220 (Akyab).

1909. *Aetobatis flagellum* Annandale, *Mem. Indian Mus.*, 2, p. 57, pl. 4, fig. 5 (off Orissa Coast and Chilka Lake).
1913. *Aetabatus flagellum* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 440 (Red Sea; Indian Ocean).
1929. *Aetobatis narinari*, (*nec* Euphrasen) Pillay, *J. Bombay nat. Hist. Soc.*, 33, p. 353 (Travancore).
1930. *Aetobatis flagellum* Fowler, *Proc. 4th (1929) Pacific Sci. Congr., Java*, p. 507 (Hawaii ; Indian Ocean).
1936. *Aetobatus narinari* (*nec* Euphrasen) Suvatti, *Index Fish. Siam*, p. 7 (Gulf of Siam).
1941. *Aetabatus narinari* (*nec* Euphrasen) Fowler (*partim*), *Bull. U.S. nat. Mus.*, (100) 13, p. 471.



EXT-FIG. 66.—*Aetobatus flagellum* (Schn.)

(a) Dorsal view. (After F. Day)

(b) Ventral view of head. (After N. Annandale)

1949. *Aetobatus narinari* (*nec* Euphrasen) Misra (*partim*), *Rec. Indian Mus.*, 45 (1947), p. 40.
1952. *Aetobatus narinari* (*nec* Euphrasen) Misra (*partim*), *Rec. Indian Mus.*, 49 (1951), p. 129.
1955. *Aetobatis narinari* (*nec* Euphrasen) Anonymous (*partim*), *Mar. Fish. Karachi, Sind & Makran*, p. 11, fig. 22 (Coasts of Sind and Makran).
1958. *Aetobatus narinari* (*nec* Euphrasen) Misra & Menon, (*partim*), *Rec. Indian Mus.*, 53 (1955), p. 79.

Vernacular names.—INDIA: *Ra-ta-charm-dah*, Andaman; *Boladi*, Marathi; *Currooway tiriki*, Tamil; *Eel-tenkee*, Telegu; Standardised name : *Bolad*. PAKISTAN : *Kodokuto*, Sind & Makran.

Disc lozenge-shaped, its length 1.6 to 1.8 in its breadth, 4.4—4.8 in total length. Snout (rostral fins) unilobed, pointed, straight, longer than broad at base, 7.6 in the length of disc. Oronasal grooves present, cirri absent. Eyes lateral, about 3.5 in snout, 3.2 in interorbital. Mouth gently curved, without buccal processes, 1.8 in preoral. Nostrils deep, internarial 2.5 in preoral. Lips papillose. Teeth in a single row on each side, fused, lower pavement produced. Spiracles dorsally placed, nearly equal to eye, about an eye diameter behind it. Interspiracle nearly equal to snout. Five pairs of ventral gill openings. Rayed portion of pectorals not united with rostral fins at side of head. Pelvics 2.8 times longer than broad, edges more or less rounded. A single rayed dorsal fin; origin at a distance 1.5 times its base behind the inner pelvic base, dorsal end almost reaching pelvic ends. One or two serrated caudal spines. No anal fin. Tail long, whip-like, 3.4—3.8 times the length of disc.

Skin smooth; tail rough in old specimens. Uniform dark greenish bronze colour, without spots.

Specimens measuring 1,190 mm. have been obtained; littoral.

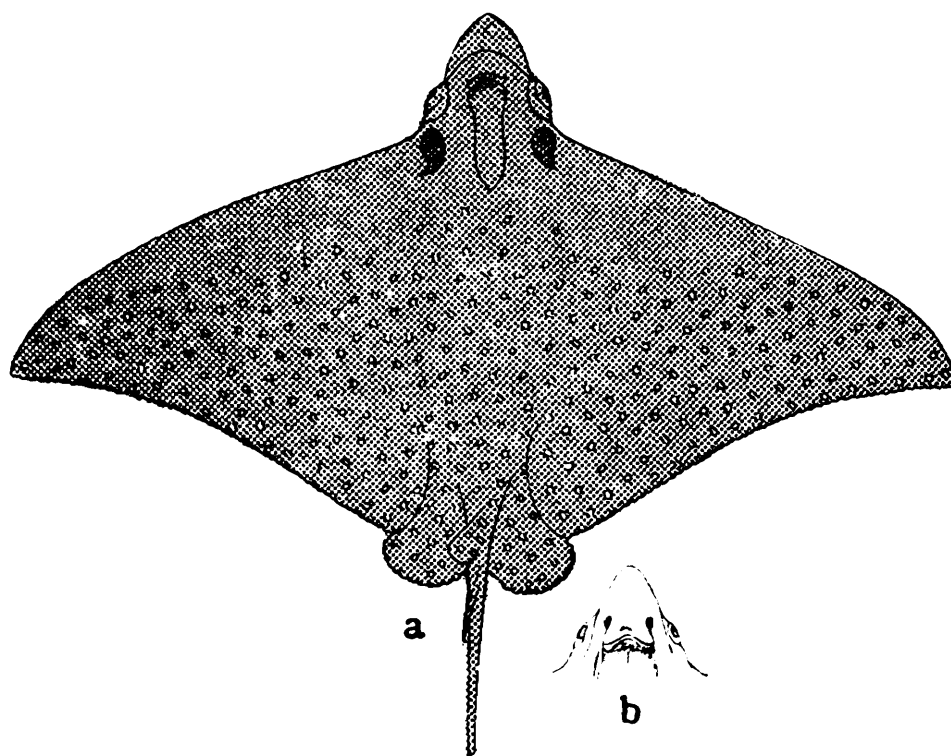
Distribution.—India, Pakistan, Burma.—Red Sea, Madagascar, China, Japan, Hawaii, Indonesia; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 35°N.—20°S., 39°E.—155°W. in the Indo-Pacific=(25°N.—20°S., 39°—100°E. in the Indian Ocean + 35°N.—7°S., 101°E.—155°W. in the Pacific Ocean).

95. *Aetobatus ocellatus* (Kuhl)

(Text-fig. 67)

- 1823. *Myliobatis ocellatus* Kuhl, *Alg. Konst Letterbode* (type locality : Java).
- 1837. *Myliobatis eeltenkee* Rüppell, *Neue Wirbelth. Fische*, p. 79, pl. 19, fig. 3 (type locality: Djidda).
- 1839. *Aetobatis indica* Swainson, *Nat. Hist. Animal.*, 2, p. 321, (on *Eel-tenkee* Russell, *Fish. Coromandel*, 1, p. 5, pl. 8, 1803; Vizagapatam).
- 1841. *Myliobatis macroptera* McClelland, *Calcutta J. nat. Hist.*, 1, p. 60, pl. 2, fig. 1 (type locality: Bengal).

1878. *Aetobatis narinari* (nec Euphrasen) Day (*partim*), *Fish. India*, p. 743, nec pl. 194, fig. 4.
1889. *Aetobatis narinari* (nec Euphrasen). Day (*partim*), *Fauna Brit. India*, Fish., 1, p. 59, nec fig. 24.
1909. *Aetobatis guttatus* Annandale, *Mem. Indian Mus.*, 2, p. 56.
- 1912-13. *Aetobatis narinari* (nec Euphrasen) Pearson (*partim*), *Ceylon Administr. Rep.*, p. E 5.
1933. *Stoasodon narinari* (nec Euphrasen) Deraniyagala, *Ceylon J. Sci.* (c), 5, p. 81 (Ceylon).
1938. *Aetobatis narinari* (nec Euphrasen) Fowler, *List Fish. Malaya*, p. 19 (Penang, Singapore).
1940. *Aetobatus punctatus* Whitley, *Fish. Australia*, 1, p. 225, fig. 357 (Port Darwin).
1949. *Aetobatus narinari* (nec Euphrasen) Misra (*partim*), *Rec. Indian Mus.*, 45 (1947), p. 40.
1952. *Aetobatus narinari* (nec Euphrasen) Misra (*partim*), *Rec. Indian Mus.*, 49 (1951), p. 129.
1953. *Stoasodon narinari* (nec Euphrasen) Smith, *Sea Fish. S. Africa*, p. 68, fig. 74 (Knysna to Bira).
1955. *Aetobatis narinari* (nec Euphrasen) Anonymous (*partim*), *Mar. Fish. Karachi, Sind and Makran*, p. 11, nec fig. 22.
1955. *Aetobatus narinari* (nec Euphrasen) Munro, *Mar. Freshwater Fish. Ceylon*, p. 15, pl. 3, fig. 43 (Ceylon).
1958. *Aetobatus narinari* (nec Euphrasen) Misra & Menon (*partim*), *Rec. Indian Mus.*, 53 (1955), p. 79.



TEXT-FIG. 67.—*Aetobatus ocellatus* (Kuhl)

(a) Dorsal view. (After P. Russell)

(b) Ventral view of head. (After N. Annandale)

Vernacular names.—CEYLON: *Vavoul maduva*, Sinhalese; *Valval thirukai*, *Kuruvi thirukai*, Tamil.

Disc lozenge-shaped; its length 2.0 in its width, 5.0 in total length. Snout (rostral fins) unilobed, conical, bluntly pointed, 4.9 in length of disc, nearly as broad as long. Oronasal groove present, cirri short. Eyes lateral, 3.0 in snout, 4.0 in interorbital. Mouth gently curved, without buccal processes; width 1.3 in preoral. Nostrils deep as a single slit. Internarial 2.3 in preoral. Lip papillose. Teeth in a single series of wide, flat, shevron-shaped grinders. Spiracles dorsally placed, large, 1.5 times eye, about half eye diameter behind eye. Interspiracle 1.1 times snout. Five pairs of ventral gill openings, last the smallest. Rayed portion of pectorals not united with rostral fins at side of head. Pelvics 2.7 times longer than broad, rounded on edges; claspers not reaching pelvic ends. A single rayed dorsal fins origin at a distance half its base, behind the inner pelvic base; dorsal end far away, not reaching pelvic ends. One or two serrated caudal spines. No anal fin. Tail long, whip-like, 4.0 times the length of disc, without upper and lower cutaneous folds.

Skin smooth. Brown above with many dark-edged, close-set, whitish spots becoming smaller at disc edges; whitish below; tail dusky.

It is said to attain 3,344 mm. across the disc. Viviparous; causing damage to oyster beds; littoral.

Distribution.—India, Pakistan, Ceylon.—Red Sea, S. Africa, Indonesia, Port Darwin, Australia; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 25°N.—34°S., 20°—131°E. in the Indo-Pacific=(25°N.—34°S., 20°—131°E. in the Indian Ocean + 1°N.—7°S., 103°—110°E. in the Pacific Ocean).

38. Genus *Rhinoptera* Cuvier

- 1829. *Rhinoptera* Cuvier, *Règne Animal.*, 2, ed. 2, p. 401 (type, *Myliobatis marginata* Geoffroy Saint-Hilaire, designated by Fowler, *Bull. geol. Surv. New Jersey.*, 4, p. 101, 1911).
- 1838. *Zygobatis* Agassiz, *Poiss. Fossil.*, 3, p. 79 (type, *Myliobatis jussieui* C.).
- 1843. *Zygobates* Agassiz, *Poiss. Fossil.*, 3, p. 328 (type, *Myliobatis jussieui* C.).
- 1850. *Trikeras* Harless, *Abh. nat. Phys. Kl.*, 5, p. 841 (type, *Myliobatis marginata* Geoffroy St.-Hilaire).
- 1865. *Mylorhina* (nec Boisduval, 1835) Gill, *Ann. Lyc. nat. Hist. New York*, p. 139 (type, *Rhinoptera lalandii* M. & H.).
- 1865. *Micromesus* Gill, *Ann. Lyc. nat. Hist. New York*, p. 139 (type, *Rhinoptera adspersa* M. & H., orthotypic).
- 1885. *Trycera* (Koch) Döderlfin, *Manuale Ittiologico Mediterraneo*, 3, p. 242 (type, *Myliobatis typica* Koch = *Myliobatis marginata* Geoffroy St.-Hilaire).

Disc lozenge-shaped, about twice as broad as long. Tail whip-like, longer than disc, with basal serrated spine. Head somewhat conspicuous, rostral fins forming a bilobed snout, not continuous with pectorals at side of head and not joined in front of snout. Eyes prominent, lateral. Nasoral grooves present. Spiracles large, behind eyes, open laterally. 5 pairs of gill openings on ventral side. First dorsal fin above basal part of the tail. Second dorsal and anal fins absent. Rayed portion of pectorals falciform, not joined with rostral fins in the front. Teeth wide, angular, flat, in pavement, median row widest.

Distribution.—Mediterranean, Arabian Sea, Africa, Muscat, India, Ceylon, Malay Peninsula, Java, Thailand, China, Philippines, Australia, Brazil, Lower California.

Key to species

- | | |
|---------------------------------|----------------------------|
| 1. Teeth in 9 rows in upper jaw | 3 |
| 2. Teeth in 7 rows in upper jaw | <i>R. javanica</i> M. & H. |
| 3. Teeth in 9 rows in lower jaw | <i>R. sewelli</i> Misra |
| 4. Teeth in 7 rows in lower jaw | <i>R. adpersa</i> M. & H. |

96. *Rhinoptera adpersa* M. & H.

1841. *Rhinoptera adpersa* Müller & Henle, *Syst. Besch. Plagiost.*, p. 183 (type locality : India ; according to Bertin holotype is in the Paris Museum).
1849. *Rhinoptera adpersa* Cantor, *J. Asiat. Soc. Beng.*, pp. 1, 418 (Penang).
1870. *Rhinoptera adpersa* Günther, *Cat. Fish. Brit. Mus.*, 8, p. 494 (East Indies).
1878. *Rhinoptera adpersa* Day, *Fish. India*, p. 744 (Madras).
1889. *Rhinoptera adpersa* Day, *Fauna Brit. India*, Fish., 1, p. 61 (Seas of India).
1913. *Rhinoptera adpersa* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 447 (Indian Ocean).
1933. *Rhinoptera adpersa* Deraniyagala, *Ceylon J. Sci.* (c), 5, p. 81 (Ceylon).
1941. *Rhinoptera adpersa* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 477.
1949. *Rhinoptera adpersa* Misra, *Rec. Indian Mus.*, 45 (1947), p. 41.
1952. *Rhinoptera adpersa* Misra, *Rec. Indian Mus.*, 49 (1951), p. 129.
1955. *Rhinoptera adpersa* Munro, *Mar. Freshwater Fish. Ceylon*, p. 16 (Ceylon).
1958. *Rhinoptera adpersa* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 85.

Vernacular names.—INDIA : *Mutta tiriki*, *Kurivi tiriki*, Tamil. CEYLON : *Hudja madupa*, Sinhalese; *Muthra thirukai* or *Mundekanni thirukai*, Tamil.

Disc lozenge-shaped, twice as broad as long. Snout (rostral fins) short, broad, bilobed. Notch on snout shallow. Eyes prominent, lateral. Upper teeth in 9 rows, median row 2 to 3 times wider from side to side than from back to front, but not so wide as those in the next row; lower teeth in 7 rows, the median row wider, others narrowing to outer. Spiracles large, lateral, behind eyes. Five pairs of ventral gill openings. Rayed portion of pectorals not united with rostral fins at sides of head. A single rayed dorsal fin at base of tail, behind pelvic base. A strong serrated caudal spine. No anal fin. Tail whip-like, long, 3 times length of disc, without upper and lower cutaneous folds.

Upper surface of back rough with fine stellate tubercles. Greenish brown above becoming lighter at edges of disc; whitish beneath.

It attains 991 mm. in length; littoral.

Distribution.—India, Pakistan, Ceylon.—Penang; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 4°—25°N., 62°—100°E. in the Indian Ocean.

97. *Rhinoptera javanica* M. & H.

1841. *Rhinoptera javanica* Müller & Henle, *Syst. Besch. Plagiost.*, p. 182, pl. 58 (type locality: Java; according to Bertin type from Malabar Coast is in the Paris Museum).
1865. *Rhinoptera javanica* Dumeril, *Hist. nat. Elasmobr.*, 1, p. 647 (Malabar).
1878. *Rhinoptera javanica* Day, *Fish. India*, p. 744, pl. 195, fig. 4 (Kurrachee).
1889. *Rhinoptera javanica* Day, *Fauna Brit. India*, Fish., 1, p. 61, fig. 25 (seas of India to Malay Archipelago).
- 1912-13. *Rhinoptera javanica* Southwell, *Ceylon Administr. Rep.*, p. E 50.
1913. *Rhinoptera javanica* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 446 (Java ; India).
1929. *Rhinoptera javanica* Pillay, *J. Bombay nat. Hist.*, 33, p. 354 (Travancore).
1929. *Rhinoptera javanica* Fowler, *Proc. Acad. nat. Sci. Philad.*, p. 597 (Hong Kong).
1931. *Rhinoptera javanica* Chu, *Biol. Bull. St. John's Univ.*, No. 1, p. 11 (China).
1933. *Rhinoptera javanica* Deraniyagala, *Ceylon J. Sci. (c)*, 5, p. 81.
1936. *Rhinoptera javanica* Suvatti, *Index Fish. Siam*, p. 8 (Gulf of Siam).
1938. *Rhinoptera javanica* Fowler, *List Fish. Malaya*, p. 20 (Malaya).
1941. *Rhinoptera javanica* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 476 (Manila market).

1942. *Rhinoptera javanica* Sarangdhar, *Indian J. med. Res.*, 30, p. 558 (Bombay).
 1946. *Rhinoptera javanica* Misra, *Rec. Indian Mus.*, 45 (1947), p. 41.
 1952. *Rhinoptera javanica* Misra, *Rec. Indian Mus.*, 49 (1951), p. 129.
 1953. *Rhinoptera javanica* Munro, *Mar. Freshwater Fish. Ceylon*, p. 16 (Ceylon).
 1958. *Rhinoptera javanica* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 85.

Vernacular names.—INDIA : *Kaka-thirukay*, Travancore.
 CEYLON : *Valuvadi thirukai*, Tamil.

Disc lozenge-shaped; its length 1.7 in its width, 3.2 in total length. Snout (rostral fins) bilobed, 8.0 in length of disc, median notch shallow. Oronasal grooves present, cirri absent. Eyes lateral, 3.0 in snout, 3.5 in interorbital. Mouth straight. Upper lip fringed, lower papillose; width equal to preoral. Nostrils deep. Internarial 1.3 in preoral. Teeth in 7 rows in jaws, median row 3–5 times as wide as long, those in the two next rows about half as wide as median and those in the outer rows on each side as wide as long; median rows narrower in lower jaw. Spiracles dorsally placed, 2.0 times eye and close behind it. Interspiracle 2.0 times snout. Five pairs of ventral gill openings, last the smallest. Rayed portion of pectorals not united with rostral fins at sides of head. Pelvics nearly 1.7 times longer than broad, edges rounded. A single, small, rayed dorsal fin at caudal base; origin at pelvic base; dorsal ends not reaching pelvic ends. A single, serrated, caudal spine, 1.7 in interorbital, immediately behind dorsal. No anal fin. Tail long, whip-like, 2.2 times length of disc.

Skin smooth. Greenish-grey above, whitish below.

It grows to a length of 1,010 mm.; littoral.

Distribution.—India, Pakistan, Burma, Ceylon.—S. Africa, Java, Thailand, China, Hong Kong, Philippines; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 25°N.—7°S., 62°—123°E. in the Indo-Pacific=(4°—25°N., 62°—100°E. in the Indian Ocean+22°N.—7°S., 100°—123°E. in the Pacific Ocean).

98. *Rhinoptera sewelli* Misra

(Pl. XV, figs. 1, 2 and 3)

1946. *Rhinoptera sewelli* Misra, *Rec. Indian Mus.*, 44, p. 361, pl.1 (type locality: West Hill, off the Calicut Coast, Arabian Sea; holotype is in the Zoological Survey of India).
 1949. *Rhinoptera sewelli* Misra, *Rec. Indian Mus.*, 45 (1947), p. 41.

1952. *Rhinoptera sewelli* Misra, *Rec. Indian Mus.*, 49 (1951), p. 129.

1955. *Rhinoptera sewelli* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 78.

Disc lozenge-shaped; its length 1.7 in its width, 2.2 in total length. Snout (rostral fins) short, broad, bilobed, 7.0 in length of disc, median notch shallow. Oronasal grooves present, cirri absent. Eyes lateral, 2.5 in snout, 5.5 in interorbital. Mouth straight, upper lip fringed, lower papillate; its width a little less than preoral. Nostrils deep. Internarial 1.2 in preoral. Teeth in 9 rows in both jaws, median row 3.6 times as wide as long, those in next row 2.3 times as wide as long and those in outer 3 rows on each side as wide as long; median rows narrower in lower jaw. Spiracles dorsally placed, 2.0 times eye, close behind it. Interspiracle 2.0 times snout. Five pairs of moderate, equidistant, ventral gill openings. Rayed portion of pectorals not united with rostral fin at sides of head. Pelvics 1.4 times longer than broad, edges rounded. A single, small, rayed dorsal fin at caudal base; origin at a distance equal to its base behind the inner pelvic base, reaching pelvic ends. Two serrated caudal spines, closely apposed together, just behind dorsal; the anterior and posterior spines 9.4 to 13.7 and 2.4 to 3.0 times respectively in interorbital. No anal fin. Tail long, whip-like. 1.6 times in length of disc.

Skin smooth. Blackish grey above, pinkish white below.

It attains a length of 752 mm.; good eating; littoral.

Distribution.—India : Off Calicut Coast (Kozhicode); in the mean annual isotherm of 20°C. in 11°15'N., 75°49'E. in the Arabian Sea.

XV Family MOBULIDAE

Devil Rays

Head and body moderately depressed with the rayed portion of pectorals reaching much below eye, forming a subrhomboid disc broader than long. Head conspicuous, broad, flat, with 2 curled or uncurled cephalic horns (fins) separated from the pectorals. Eyes moderate, lateral, wide apart on each side of head at base of each cephalic horn. Mouth transverse, large, inferior, well behind head, or terminal in front of head. Dental plate in both jaws or in lower or upper jaw only. Internarial wide. Spiracles lateral, small, behind eyes. Five pairs of large, ventral gill

openings. A single dorsal fin above and between pelvics. Rayed portion of pectorals falciform, not continuous at sides of head, acute, angular laterally and posteriorly. Pelvics small, between pectorals. Anal fin absent. Tail slender, whip-like, with or without serrated caudal spine, without cutaneous folds at its base. Caudal fin absent.

Mild unless attacked. Viviparous.

The family MOBULIDAE is divided into two genera both of which are found in the Indian region.

Key to genera of family MOBULIDAE

1. Mouth inferior, well behind head :
dental plate in both jaws or at least in
upper jaw : cephalic horns curled Genus *Mobula* Rafinesque
2. Mouth terminal, in front of head :
dental plate usually on lower
jaw and sometimes in both jaws :
cephalic horns rarely curled Genus *Manta* Bancroft

39. Genus *Mobula* Rafinesque

1810. *Mobula* Rafinesque, *Indice d' Ittiol. Siciliana*, pp. 48, 61 (type, *Mobula auriculata* Raf., monotypic).
1810. *Apterurus* Rafinesque, *Indice d' Ittiol. Siciliana*, pp. 48, 62 (type, *Raja fabroniana* Lac., monotypic).
1810. *Cephalopterus* (nec Geoffroy St. Hilaire, 1809) (Dumeril) Risso, *Ichth. Nice*, p. 14 (type, *Raja giorno* Lac.=*Raja cephaloptera* Schn., virtually tautotypic; inadmissible).
1816. *Dicerobatus* Blainville, *Bull. Soc. philom. Paris*, 8, p. 121 (type *Raja mobular* Bon., designated by Jordan & Evermann, *Gen. Fish.*, p. 95, 1917).
1817. *Cephaloptera* Cuvier, *Règne Animal.*, 2, ed. 1, p. 138 (type, *Raja cephaloptera* Schn., monotypic).
1825. *Dicerobatis* Blainville, *Faune Francaise, Vertebr.*, p. 40 (type, *Raja mobular* Bon.).
1828. *Apturus* Cuvier, *Hist. nat. Poiss.*, 1, p. 215 (type, *Raja fabroniana* Lac.).
1838. *Pterocephalus* Swainson, *Nat. Hist. Animal.*, 1, pp. 170, 174 (type, *Raja cephaloptera* Schn.).
1839. *Pterocephala* Swainson, *Nat. Hist. Animal.*, 1, p. 319 (type, *Raja giorno* Lac., monotypic).

Disc lozenge-shaped, about twice as broad as long. Tail short, whip-like, in the young $1\frac{1}{2}$ times the length of the disc, and in the adults a little more than half the disc length; with or without serrated spine. Head conspicuous, broad and flat with two, curled, cephalic horns. Mouth inferior, well behind head. Eyes large, lateral. Spiracles

moderate, behind eyes. 5 pairs of gill-openings on the ventral side. First dorsal fin small, triangular between pelvics; origin before or opposite pelvic origin. Second dorsal and anal fins absent. Rayed portion of pectorals falciform extending upto the postorbital region. Teeth small, numerous in both jaws or at least in the upper jaw.

Distribution.—Red Sea, Arabia, India, Ceylon, Penang, Indonesia, Philippines, Queensland.

The genus *Mobuia* is represented by four species in the Indian region.

Key to species

1. A serrated caudal spine : tail more than twice the length of disc *M. mobular* (Bonn.)
2. No serrated caudal spine : tail less than twice the length of disc 3
3. Teeth in $\frac{140}{140}$ rows : termination of disc between cephalic horns straight *M. thurstoni* (Lloyd)
4. Teeth in $\frac{44-80}{54-95}$ rows : termination of disc between cephalic horns curved 5
5. Dorsal origin before pelvic origin : teeth in $\frac{60-80}{95}$ rows *M. diabolus* (Shaw)
6. Dorsal origin nearly opposite to pelvic origin : teeth in $\frac{44}{54}$ rows *M. kuhlii* (M. & H.)

99. *Mobula diabolus* (Shaw)

(Pl. XVI, figs. 1, 2; Text-fig. 68)

1804. *Raja diabolus* Shaw, *General Zoology*, 5, p. 291 (on *Eregoodoo tenkee* Russell, *Fish. Coromandel*, 1, p. 5, pl. 9, 1803 (type locality: Vizagapatam).

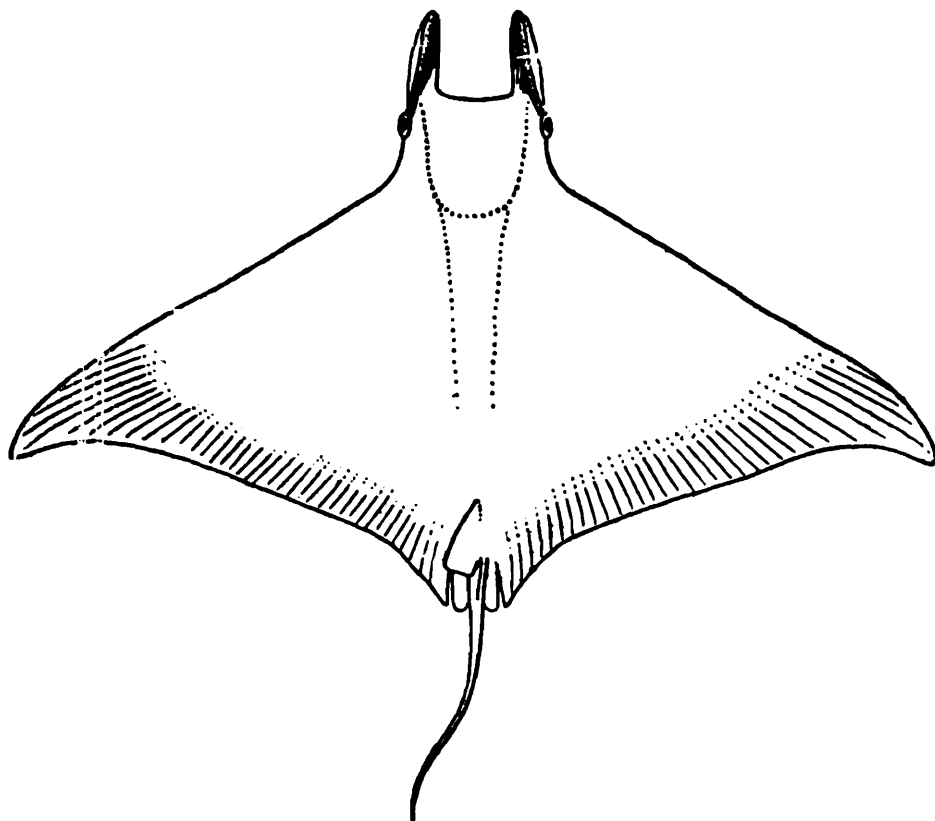
1829. *Raja eregoodoo-tenkee* Cuvier, *Règne Animal.*, 2, ed. 2, p. 402 (on *Eregoodoo-tenkee* Russell, 1803).

1870. *Dicerobatis eregoodoo* Günther, *Cat. Fish. Brit. Mus.*, 8, p. 497 (Indian Seas).

1878. *Dicerobatis eregoodoo* Day, *Fish. India*, p. 744, pl. 193, fig. 1 (Seas of India to Malay Archipelago).

Dicerobatis eregoodoo Day, *Fauna Brit. India, Fish.*, 1, p. 62, fig. 26 (Seas of India to the Malay Archipelago).

1908. *Dicerobatis eregoodoo* Lloyd, *Rec. Indian Mus.*, 2, p. 179, text-fig. 2, pl. 4, fig. 1 (Madras).
1913. *Mobula eregoodoo-tenkee* Garman, *Mem. Harv. Mus. Comp. Zool.*, 35, p. 451 (Seas of India; Malay Archipelago; Red Sea).
1916. *Mobula eregoodoo* Ogilby, *Mem. Queensland Mus.*, 5, p. 90 (Moreton Bay).
1929. *Dicerobatis eregoodoo* Pillay, *J. Bombay nat. Hist. Soc.*, 33, p. 354 (Travancore).
1933. *Mobula eregoodoo-tenkee* Deraniyagala, *Ceylon J. Sci. (c)*, 5, p. 80 (Ceylon).
1933. *Dicerobatis eregoodoo* Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
1938. *Mobula eregoodoo-tenkee* Fowler, *List Fish. Malaya*, p. 20 (Penang.)
1940. *Mobula diabolus* Whitley, *Fish. Australia*, 1, p. 226, fig. 259 (Queensland).
1941. *Mobula diabolus* Fowler, *Bill. U.S. nat. Mus.*, (100) 13, p. 480.



TEXT-FIG. 68.—Dorsal view of *Mobula diabolus* (Shaw). (After F. Day)

1946. *Mobula diabolus* Setna & Sarangdhar, *Proc. nat. Inst. Sci. India*, 12, No. 5, p. 257 (Bombay waters).
1949. *Mobula diabolus* Misra, *Rec. Indian Mus.*, 45 (1947), p. 42.

1952. *Mobula diabolus* Misra, *Rec. Indian Mus.*, 49 (1951), p. 130.
1953. *Mobula eregoodoo-tenkee* Herre, *Check List Philippine Fish.*, p. 53 (Philippines).
1953. *Mobula diabolus* Smith, *Sea Fish. South Africa*, p. 72, fig. 87 (Delagoa Bay).
1955. *Dicerobatis eregoodoo* Anonymous, *Mar. Fish. Karachi, Sind & Makran*, p. 11 (Coasts of Sind and Makran).
1955. *Mobula diabolus* Munro, *Mar. Freshwater Fish. Ceylon*, p. 16 (Ceylon).
1958. *Mobula diabolus* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 85.

Vernacular names.—INDIA: *Wagla*, Kanarese; *Shing pakat* or *Mhorcha*, Marathi; *Yeliki* or *Komun tiriki*, Tamil; *Eregoodoo tenkee*, Telegu; Standardised name: *Shing pakat*. PAKISTAN: *Karunj*, Sind & Makran. CEYLON: *Ath maduva*, Sinhalese; *Kombu thirukai*, Tamil.

Disc subrhomboid; its length 1.8 in its width, 1.4 in total length. Snout (cephalic fins) 5.0 in length of disc, in the form of 2 curled, cephalic horns. Eyes prominent, pupil vertical, 4.0 in snout, 5.0 in interorbital. Interorbital 1.3 times snout. Internarial wide. Mouth large, inferior, well behind head. Teeth in $\frac{60-80}{95}$ rows, in pavement, dental plate reaching angles of mouth. Spiracles lateral, small, in deep grooves, about the size of pupil. Five pairs of large, ventral gill openings. Rayed portion of pectorals not united with cephalic fins at sides of head. Pelvics small, between pectorals. A single, rayed dorsal fin; origin in advance of pelvic origin; the posterior end of dorsal base at a distance nearly equal to its base in front of pelvic ends. No serrated caudal spine. No anal fin. Tail short, whip-like, shorter than the length of disc, without upper and lower cutaneous folds.

Skin smooth. Grey to greyish brown above, whitish below.

It grows to 1,218 mm. across the disc; pelagic.

Distribution.—India, Pakistan, Ceylon.—Red Sea, S. Africa, Arabia, Penang, Indonesia, Philippines, Queensland; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 25°N.—25°S., 32°—153°E. in the Indo-Pacific—(25°N.—25°S., 32°—100°E. in the Indian Ocean—14°N.—27°S., 103°—153°E. in the Pacific Ocean).

100. *Mobula kuhlii* (M. & H.)

1841. *Cephaloptera kuhlii* Müller & Henle, *Syst. Besch. Plagiost.*, p. 185, pl. 59, fig. 1 (type locality : India; according to Bertin the paratype is in the Paris Museum).
1858. *Cephaloptera kuhlii* Bleeker, *Act. Soc. Sci. Indo-Neerl.*, 3, No. 7, pp. 1, 6 (Amboina).
1879. *Dicerobatis kuhlii* Günther, *Cat. Fish. Brit. Mus.*, 8, p. 497 (India; Zanzibar).
1878. *Dicerobatis kuhlii* Day, *Fish. India*, p. 745 (East Coast of Africa, through the Seas of India to the Malay Archipelago).
1889. *Dicerobatis kuhlii* Day, *Fauna Brit. India*, Fish., 1, p. 63 (East Coast of Africa, through the Seas of India to the Malay Archipelago).
1899. *Mobula kuhli* Millar, *Zoologist*, No. 694, p. 145, pl. 1 (Durban).
1913. *Mobula kuhlii* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 452 (Indian Ocean; East Indies; Japan).
1925. *Mobula kuhli* Barnard, *Ann. S. African Mus.*, 21, pt. 1, p. 86, pl. 5, fig. 2 (Natal).

Disc subrhomboid; its length 1.7 in its width, 2.0 in total length. Snout (cephalic fins) 6.6 in length of disc in the form of 2 curled, cephalic horns. Eyes prominent, 2.7 in snout, 5 in interorbital. Interorbital 1.7 times snout. Internarial wide. Mouth large, inferior, well behind head. Teeth in $\frac{44}{54}$ rows, in pavement, dental plate two-third the width of mouth, not reaching angles of mouth. Spiracles small, in deep groove behind eye. Five pairs of large, ventral gill openings. Rayed portion of pectorals not united with cephalic fins at sides of head. Pelvics moderate, between pectorals. A single rayed dorsal fin; origin nearly opposite to pelvic origin, its posterior end at a short distance in front of pelvic ends. No serrated caudal spine. No anal fin. Tail moderately long, whip-like, a little shorter than length of disc, without cutaneous folds.

Skin smooth. Dark brown above, whitish below.

It grows to 420 mm. across the disc; pelagic.

Distribution.—India, Pakistan, Burma.—S. E. Africa, Zanzibar, Indonesia, Japan; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 35°N.—29°S., 30°—130°E. in the Indo-Pacific=(25°N.—29°S., 30°—72°E. in the Indian Ocean+35°N.—7°S., 118°—130° E. in the Pacific Ocean).

101. *Mobula mobular* (Bonn.)

1788. *Raja mobular* Bonnaterre, *Tableau Encyclop. Ichth.*, p. 5 (type locality : Mediterranean).
 1816. *Dicerobatis mobular* Blainville, *Bull. Soc. philom. Paris*, p. 116.
 1913. *Mobula mobular* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 450.
 1946. *Mobula mobular* Setna & Sarangdhar, *Proc. nat. Inst. Sci. India*, 12, No. 5, p. 257 (Bombay waters).

Disc subrhomboid, twice or more than twice as wide as long; its length more than 3 in total length. Snout in the form of 2 curled, cephalic fins. Eyes prominent. Internarial wide. Mouth large, inferior, well behind head. Teeth in $\frac{150}{150}$ rows or more, in pavement, extending to angles of mouth; median teeth more rounded. Spiracles small, behind eyes. Five pairs of large, ventral gill openings. Rayed portion of pectorals not united with cephalic fins at sides of head. Pelvics between pectorals. A single, rayed dorsal fin; origin above pelvic base; the posterior end of dorsal base almost reaching pelvic ends. A serrated caudal spine behind dorsal. No anal fin. Tail whip-like, long, more than twice length of disc, without cutaneous folds.

Skin smooth. Dark brown to bluish black above, white beneath.

It attains a length of about 1,500 mm. across the disc; pelagic.

Distribution.—India.—Mediterranean; in the mean annual isotherm of 20°C. and 12°C. in 18°N., 72°E. in the Arabian Sea and 37°N., 14°E. in the Mediterranean Sea.

102. *Mobula thurstoni* (Lloyd)

1908. *Dicerobatis thurstoni* Lloyd, *Rec. Indian Mus.*, 2, p. 179, text-fig. 3, pl. 4, fig. 2 (type locality : Madras).

Disc subrhomboid; its length 2.2 in its width, 1.7 in total length. Snout (cephalic fins) 5.6 in length of disc, with the termination of the disc between the cephalic fins wider than in *M. kuhlii* (M. & H.) and *M. diabolus* (Shaw) forming a more open curve or merely a straight line. Eyes 3.2 in snout, 5.5 in interorbital. Internarial 1.2 times snout, interorbital 2.0 times snout. Mouth wide, large, inferior, well behind head. Teeth in $\frac{140}{140}$ rows, in upper jaw extending nearly to angles of mouth; each tooth separated

from one another by an interval, and with an irregular nodular base bearing 2–4 spinous cusps. Spiracles small. Five pairs of large, ventral gill openings. Rayed portion of pectorals not united with cephalic fins at sides of head. Pelvics moderate, between pectorals. A single, rayed dorsal fin: origin more or less opposite pelvic origin; its posterior end at a short distance in front of pelvic ends. Serrated caudal spine absent. No anal fin. Tail moderate, whip-like, shorter than length of disc, without cutaneous folds.

Skin smooth.

It attains 1,600 mm. across the disc; pelagic.

Distribution.—India; in the mean annual isotherm of 20°C. in 13°N., 80°E. in the Bay of Bengal.

40. Genus *Manta* Bancroft

1829. *Manta* Bancroft, *Zool. J.*, 4, p. 144 (type, *Cephalopterus manta* Bancroft, monotypic).
 1837. *Ceratoptera* Müller & Henle, *Sitz. Ber. preuss. Akad. Wiss. Berlin*, p. 118 (atypic; type, *Cephalopterus giorna* (nec Lac.) Le Sueur, orthotypic).
 1849. *Brachioptilon* Newman, *Zoologist*, 7, p. 74 (type, *B. hamiltoni* Newman, monotypic).
 1856. *Diabolichthys* Holmes, *Proc. Elliott Soc. nat. Hist.*, 1, p. 39 (type, *D. elliotii* Holmes, monotypic).
 1932. *Daemomanta* Whitley, *Rec. Austral. Mus.*, 18, No. 6, p. 327 (type, *Manta alfredi* Stead).
 1936. *Indomanta* Whitley, *Austral. Mus. Mag.*, 6, p. 11 (type, *I. tombazii* Whitley, orthotypic).

Disc lozenge-shaped, about twice as broad as long. Tail whip-like about as long as disc length, without serrated caudal spine. Head greatly depressed, broad and flat with two cephalic horns, rarely curled. Mouth large, terminal in front of head. Eyes prominent, lateral. Spiracles moderate, behind eyes. 5 pairs of gill openings on ventral side. First dorsal fin small, between pelvics; origin before pelvics. Second dorsal and anal fins absent. Rayed portion of pectorals falciform extending up to the postorbital region. Teeth small, numerous, in pavement, usually on lower jaw and sometimes on both jaws.

Distribution.—Atlantic Ocean, S. Africa, Red Sea, India, Malay Peninsula, Indonesia, Melanesia, N. and S. America, Galapagos Islands, West Indies.

Manta ehrenbergii (M. & H.) is the only species of the genus found in the Indian region.

103. *Manta ehrenbergii* (M. & H.)

1841. *Ceratoptera ehrenbergii* Müller & Henle, *Syst. Besch.* *Plagiost.*, p. 187 (type locality : Red Sea).
1870. *Ceratoptera ehrenbergii* Günther, *Cat. Fish. Brit. Mus.*, **8**, p. 498 (Red Sea).
1878. *Ceratoptera ehrenbergii* Day, *Fish. India*, p. 745 (*nec* woodcut).
1899. *Cephaloptera stelligera* Hilgendorf, *Symbol. Physic. Hemprich—Ehrenberg*, pl. 2, figs. 1—9 (type locality: Red Sea).
1908. *Ceratoptera orissa* Lloyd, *Rec. Indian Mus.*, **2**, p. 176, text-fig. 1, pls. 5, figs. 1, 2 (type locality : Puri).
1913. *Manta ehrenbergii* Garman, *Mem. Harv. Mus. Comp. Zool.*, **36**, p. 455.
1925. *Manta ehrenbergi* Barnard, *Ann. S. African Mus.*, **21**, pt. 1, p. 87 (Table Bay, East London, Durban, Natal).
1936. *Indomanta tombazii* Whitley, *Austral. Mus. Mag.*, **6**, p. 11 (on *Dicerobatis (nec Cantor) Tombazii*, *J. Bombay nat. Hist. Soc.*, **37**, p. 227, pl., 1934 (type locality : Cape Mouze, 20 miles from Karachi).
1949. *Manta birostris (nec Walbaum)* Misra, *Rec. Indian Mus.*, **45** (1947), p. 43.
1953. *Manta birostris (nec Walbaum)* Smith, *Sea Fish. S. Africa*, p. 73, fig. 88 (Cape to Natal, East London).
1958. *Manta ehrenbergii* Misra & Menon, *Rec. Indian Mus.*, **53** (1955), p. 83.

Disc subrhomboid; its length 1.1 in its width, 1.0 or 1.2 in total length. Snout (cephalic fins) 8.5 in length of disc, in the form of 2 cephalic horns, rarely curled. Eyes 7.4 in snout, 8.7 in internarial. Mouth terminal, very wide. Teeth in 200—370 series in lower jaw, each consisting of 14 teeth, close together or separated by well marked interspace; teeth band occupying half width of lower jaw. Spiracles moderate, close behind eye, smaller than it. Five pairs of large, ventral gill openings, first and last smaller. Rayed portion of pectorals not united with cephalic fins at sides of head. Pelvics moderate, between pectorals. A single rayed dorsal fin between pelvics; origin before pelvic origin. No serrated caudal spine. No anal fin. Tail nearly one-fourth length of disc, without cutaneous folds.

Skin rough with denticles. Upper surface of head and adjacent portions of disc dark greenish grey contrasting sharply with the pure white of the oral surface: upper surface of cephalic fins and sides of head white as also the lower two-thirds of the ocular prominences; lower surface whitish.

It attains 7,308 mm. across the disc and weighs over 2 tons. Probably viviparous; often ascends estuaries; pelagic.

Distribution.—India, Pakistan.—Red Sea, S. Africa; in the mean annual isotherm of 20° C. with the latitudinal and longitudinal range of 25°N.—33°S., 27°—85°E. in the Indian Ocean.

V Order TORPEDINIFORMES

Electric organs between head and pectoral fins. Pre-orbital cartilages greatly enlarged.

Lower Eocene to Recent.

Order TORPEDINIFORMES is represented by a single family in the Indian waters.

XVI. Family TORPEDINIDAE

Body depressed, ray-like. Disc large, partly circular, subcircular or oblong, with head not distinct from it. Snout broad, blunt. Rostrum short, orbital cartilages extended forward to upper edges of disc. Eyes rudimentary or well developed, without nictitating membrane, on either side of median line. Nasoral grooves present, cirri absent. Mouth small, inferior, transverse. Teeth small, in narrow pavements. Spiracles large, close behind eyes. Five pairs of small, ventral gill openings between electric organs and head. One or two spineless dorsal fins on tail behind pelvic origin. Rayed portion of pectorals continued up to snout forming a disc. Electric organs on each side of head separating the pectorals. Pelvics large, close to pectorals. Anal absent. Tail depressed, without spine, equal to or shorter than length of disc, with lateral fold on each side and base very wide. Caudal moderate, lobed or not lobed. Caudal pits absent. Viviparous.

Lower Eocene to Recent.

The family TORPEDINIDAE is represented by five genera in the Indian waters.

Key to genera of family TORPEDINIDAE

- | | |
|---|---------------------------------|
| 1. Two dorsal fins | 5 |
| 2. One dorsal fin | 3 |
| 3. Pectorals, pelvics and eyes poorly developed | Genus <i>Bengalichthys</i> Ann. |

- | | |
|---|---------------------------------|
| 4. Pectorals, pelvics and eyes well developed | Genus Narke Kaup |
| 5. Origin of first dorsal fin opposite pelvics | 7 |
| 6. Origin of first dorsal fin distinctly behind pelvics | Genus Narcine Henle |
| 7. Disc elongate : eyes rudimentary | Genus Benthobatis Alcock |
| 8. Disc broad, subcircular : eyes well developed | Genus Torpedo Houttuyn |

41. Genus **Narcine** Henle

1834. *Narcine* Henle, *Über Narcine*, p. 31 (type, *Torpedo brasiliensis* Olfers).
1862. *Cyclonarce* Gill, *Ann. Lyc. nat. Hist. New York*, 7, p. 387 (type, *Raja timlei* Schn.).
1862. *Gonionarce* Gill, *Ann. Lyc. nat. Hist. New York*, 7, p. 387 (type, *Narcine indica* H.).

Disc subcircular, with head not distinct from it. Tail with lateral folds, slightly shorter than the length of disc, without serrated caudal spine. Snout broadly rounded, twice the interorbital distance. Rostral cartilage present. Nasoral grooves present. Spiracles large, situated close behind small eyes. 5 pairs of gill openings on ventral side between the electric organs. Two spineless dorsal fins on tail. Anal absent. Pelvics well developed. The rayed portion of the pectorals continued to the orbital region. Teeth in narrow bands.

Distribution.—India, Ceylon, Indonesia, China, Japan, Philippines, Australia, Tasmania.

Key to species

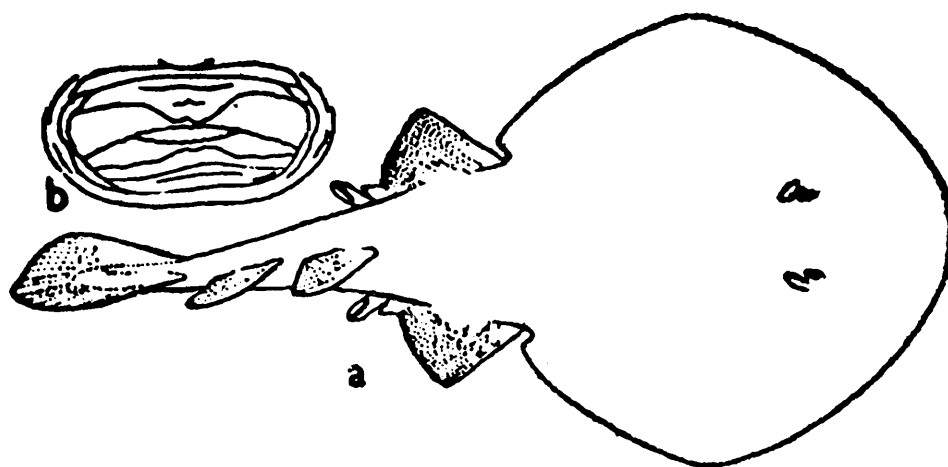
- | | |
|---|---------------------------|
| 1. Brown spotted above : a pair of buccal processes both on roof and floor of mouth | 3 |
| 2. Uniform brown above : no buccal processes | <i>N. brunnea</i> Ann. |
| 3. Teeth in 27 rows in upper jaw and 26 in lower jaw | <i>N. maculata</i> (Shaw) |
| 4. Teeth in 23 rows in upper jaw and 21 in lower jaw | <i>N. timlei</i> (Schn.) |

104. **Narcine brunnea** Annandale

(Text-fig. 69)

1878. *Narcine timlei* Day (*partim*), *Fish. India*, p. 733, pl. 192, fig. 3.

1889. *Narcine timlei* Day (*partim*), *Fauna Brit. India*, Fish., 1, p. 45, fig. 18.
1909. *Narcine brunnea* Annandale, *Mem. Indian Mus.*, 2, p. 45, pl. 3, figs. 2, 2a (type locality : Hughli river mouth : type is in the Zoological Survey of India).
1913. *Narcine brunnea* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 300 (off the Coasts of India).
1913. *Narcine firma* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 301 (type locality : Colombo, Ceylon).
1941. *Narcine brunnea* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, 335.
1949. *Narcine brunnea* Misra, *Rec. Indian Mus.*, 45 (1947), p. 43.
1952. *Narcine brunnea* Misra, *Rec. Indian Mus.*, 49 (1951), p. 132.
1955. *Narcine brunnea* Munro, *Mar. Freshwater Fish. Ceylon*, p. 17 (Ceylon).
1958. *Narcine brunnea* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 78.



TEXT-FIG. 69.—*Narcine brunnea* Annandale

(a) Dorsal view : $\times \frac{1}{2}$. (After K.S. Misra)

(b) Mouth showing cutaneous ridge with irregular serrations. : $\times 2$. (After N. Annandale)

Disc subcircular, as long as broad; its length 2.1 in total length. Snout broad, blunt, 2.8 in length of disc. Oronasal grooves present, cirri absent, 1.3 in head to hind spiracle edge. Eyes small, 6.4 in snout, 2.9 in interorbital. Free edge of nasal flap with distinct median projection. Rostral ridges strongly divergent. Interorbital 3.0 in head to hind spiracle edge. Mouth small, straight, roof and floor behind teeth with cutaneous ridge, with irregular serrations. Teeth in narrow bands, posterior projection of teeth much shorter

than transverse diameter of base, rather broad and blunt. Spiracles large, 2 in interspiracle, without papillae on edges. Five pairs of small, ventral gill openings. Rayed portion of pectorals continued up to snout forming the disc. Electric organs on each side of head separating pectorals. Pelvics large, 2.6 in length of disc, longer than broad, triangular ends pointed. Two subequal, spineless rayed dorsal fins. First dorsal origin a little behind pelvic ends. Second dorsal origin equidistant from first dorsal origin and caudal origin. Interdorsal 3.0 in first dorsal base, 1.7 in second dorsal length. No serrated caudal spine. No anal fins. Tail short, not whip-like, nearly equal to length of disc. Caudal without lobe, slightly shorter than snout.

Skin smooth. Uniform chocolate brown above, creamy white below.

It attains a length of 220 mm.; littoral.

Distribution.—India, Ceylon; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 6°—22°N., 79°—88°E.

105. *Narcine maculata* (Shaw)

(Pls. XVII, XVIII)

1804. *Raja maculata* Shaw, *General Zoology*, 5, pt. 2, p. 316 (type locality : Indian Seas; on *Temeree* Russell, *Fish. Coromandel*, 1, p. 1, pl. 1, 1803, type locality : Vizagapatam).
1804. *Raja bicolor* Shaw, *General Zoology*, 5, pt. 2, 316 (on *Nalla temeree* Russell, *Fish. Coromandel*, 1, p. 2, pl. 2, 1803 (type locality : Vizagapatam).
1834. *Narcine indica* Henle, *Uber. Narcine*, p. 35, pl. 2, fig. 2 (type locality : Tranquebar Coast, Madras).
1849. *Narcine indica* Cantor, *J. Asiat. Soc. Beng.*, 18, p. 1399 (Penang).
1851. *Narcine indica* Jerdon, *Madras J. Lit. Sci.*, 17, p. 148.
1865. *Narcine indica* Day, *Fish. Malabar*, p. 276 (Malabar).
1878. *Narcine timlei* Day (*partim*), *Fish. India*, p. 733, *nec* pl. 192, fig. 3 (India; Malay Archipelago).
1909. *Narcine timlei* Annandale (*partim*), *Mem. Indian Mus.*, 2, p. 44.
1913. *Narcine indica* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 299 (Penang).
1920. *Narcine indica* Prashad, *Rec. Indian Mus.*, 19, p. 90, pl. 7, figs. 4—9 (Orissa Coast).
1938. *Narcine maculata* Fowler, *List Fish. Malaya*, p. 14 (Penang).

1939. *Narcine indica* Norman, *Sci. Rep. John Murray Exped. Lond.*, 7, p. 12 (Gulf of Aden, 11° 56' 42" N., 50° 35' E., OT, 37—91 m.).
1941. *Narcine maculata* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 333.
1946. *Narcine indica* Setna & Sarangdhar, *Proc. nat. Inst. Sci. India*, 12, No. 5, p. 257 (Bombay waters).
1949. *Narcine indica* Misra, *Rec. Indian Mus.*, 45 (1947), p. 43.
1952. *Narcine indica* Misra, *Rec. Indian Mus.*, 49 (1951) p. 132.
1958. *Narcine indica* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 85.

Disc subcircular, as long as broad; its length 1·9 in total length. Snout broad, blunt, 3·7 in length of disc. Oronasal grooves present, cirri absent. Eyes small, 10·5 in snout, 5·7 in interorbital. Anterior nasal valves short, posterior valves feeble. Mouth small, protractile, a pair of buccal processes both on roof and floor of the mouth, straight; rostral ridges divergent. Teeth in $\frac{26}{27}$ rows, small, acuminate on the inner edge of the crown; teeth bands narrow, round at outer end. Spiracles without papillae on edges, large, 2·4 times eye, an eye diameter behind it. Five pairs of small, ventral gill openings. Rayed portion of pectorals continued to snout forming the disc. Electric organs on each side of head separating pectorals. Pelvics large, 2·7 in length of disc, longer than broad, triangular. Two subequal non-spinate dorsal fins; upper angles rounded. First dorsal origin before or opposite ends of pelvic base. Second dorsal origin nearer to first dorsal origin than to caudal origin. Interdorsal 2·0 in first and second dorsal bases. No serrated caudal spine. No anal fin. Tail short, not whip-like, equal to length of disc. Caudal obliquely rounded, without lobe, larger than snout. No caudal pits.

Skin smooth. Brown with smaller and larger dark spots above, creamy white below.

It grows to 445 mm. in length; littoral.

Distribution.—India.—Gulf of Aden, Penang, Java; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 19°N.—7°S., 50°—110°E. in the Indo-Pacific=(5°—19°N., 50°—100°E. in the Indian Ocean + °—7°S., 110°E. in the Pacific Ocean).

106. *Narcine timlei* (Schn.)

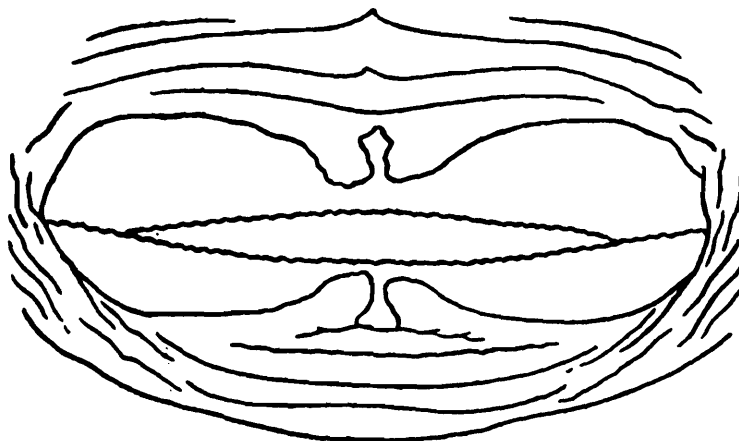
(Text-fig. 70)

1801. *Raja timlei* Schneider, *Syst. Ichth. Bloch*, p. 359 (type locality: Tranquebar, Madras).
1834. *Narcine timlei* Henle, *Uber Narcine*, p. 34, pl. 2, figs. 1, 1a (Tranquebar).
1852. *Narcine microphthalmia* Dumeril, *Rev. Mag. Zool.*, (2) 4, p. 275 (type locality : Malabar Coast, Pcondicherry Bay).
1852. *Narcine macrura* Dumeril, *Rev. Mag. Zool.*, (2) 4, p. 277 (type locality : Sea of the Indies).
1878. *Narcine timlei* Day (*partim*), *Fish. India*, p. 733, *nec* pl. 192, fig. 3 (Seas of India to the Malay Archipelago, China, Japan).
1889. *Narcine timlei* Day (*partim*), *Fauna Brit. India*, *Fish.*, 1, p. 45, *nec* fig. 18 (Seas of India to the Malay Archipelago).
1909. *Narcine timlei* Annandale (*partim*), *Mem. Indian Mus.*, 2, p. 44, pl. 3, figs. 1, 1a (Puri, Orissa Coast).
1929. *Narcine timlei* Pillay (*partim*), *J. Bombay nat. Hist. Soc.*, 33, p. 353.
1931. *Narcine timlei* Chu, *Biol. Bull. St. John's Univ.*, No. 1, p. 8 (China; Hong Kong).
1933. *Narcine timlei* Deraniyagala, *Ceylon J. Sci.* (c), 5, p. 80 (Ceylon).
1938. *Narcine timlei* Fowler, *List Fish. Malaya*, p. 15 (Singapore).
1941. *Narcine timlei* Fowler, *Bull. U. S. nat. Mus.*, (100) 13, p. 334.
1949. *Narcine timlei* Misra, *Rec. Indian Mus.*, 45 (1947), p. 44.
1952. *Narcine timlei* Misra, *Rec. Indian Mus.*, 49 (1951), p. 132.
1953. *Narcine timlei* Herre, *Check List Philippine Fish.*, p. 40 (Philippines).
1955. *Narcine timlei* Anonymous, *Mar. Fish Karachi Sind & Makran*, p. 7.
1955. *Narcine timlei* Munro, *Mar. Freshwater Fish. Ceylon*, p. 17 (Ceylon).
1959. *Narcine timlei* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 85.

Vernacular names.—INDIA: *Temeree* or *Nalla temeree*, Telegu. PAKISTAN: *Ghido*, Sind & Makran. CEYLON: *Hiri maduva* or *Thitha maduva* or *Thimbiriya*, Sinhalese; *Thimili*, Tamil.

Disc subcircular; its length 1.0 in its width, 1.9 in total length. Snout broad, blunt, 3.7 in length of disc. Oronasal grooves present, cirri absent. Eyes small, 8 in snout, 4.9 in interorbital. Anterior nasal valves short, posterior valves feeble. Mouth small, straight; roof and floor of mouth behind teeth with cutaneous ridge, with irregular

serrations, with a median notch and with two lateral, well developed processes. Teeth in $\frac{23}{21}$ rows, each with acuminate point on the inner edge of the crown. Spiracles with



TEXT-FIG. 70.—Mouth showing median notch with two well developed lateral processes of *Narcine timlei* (Schn.). (After N. Annandale)

out papillae, large, 2.1 times eye diameter, very close behind it, 1.5 in interspiracle. Five pairs of small, ventral gill openings. Rayed portion of pectorals continued to snout forming the disc. Electric organs on each side of head separating pectorals. Pelvics large, 2.3 in length of disc, triangular, nearly straight or slightly concave on the hind margin, outer angles distinct. Two subequal, spineless rayed dorsal fins. First dorsal origin opposite ends of pelvic bases. Second dorsal origin nearer to first dorsal origin than to caudal origin. Interdorsal 1.5 in first dorsal and second dorsal bases. No serrated caudal spine. No anal fin. Tail not whip-like, slightly shorter than length of disc. Caudal about two-third of its length, lower margin broadly rounded, hind margin oblique, somewhat convex, longer than snout. No caudal pits.

Skin smooth. Reddish brown above with numerous dark spots, whitish below.

It attains 340 mm. in length; littoral.

Distribution.—India, Pakistan, Ceylon.—Malay Peninsula, Singapore, Indonesia, Hong Kong, China, Japan, Philippines; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 35°N.—7°S., 62°—130°E. in the Indo-Pacific=(4°—25°N., 62°—100°E. in the Indian Ocean+35°N.—7°S., 103°—130°E. in the Pacific Ocean).

42. Genus **Benthobatis** Alcock

1898. *Benthobatis* Alcock, *Ann. Mag. nat. Hist.*, (7) 2, p. 144 (type, *B. moresbyi* Alcock, monotypic).

Disc oval with head not distinct from it. Tail without lateral folds, slightly longer than disc length and without serrated caudal spine. Snout broadly rounded, about twice the interorbital distance. Rostral cartilage present. Nasoral grooves present. Eyes obsolete as two unpigmented spots. Spiracles moderate, close behind the eye spots. 5 pairs of large gill openings on the ventral side between the electric organs. Two spineless dorsal fins on tail. Pelvics well developed. The rayed portion of the pectorals extends only to the orbital region. Anal fin absent. Teeth small, as rhomboidal plate with the crown strongly and acutely produced.

Distribution.—Indian Ocean: Northeast Coast of Africa, 823 m., Arabian Sea, 786—1,069 m.

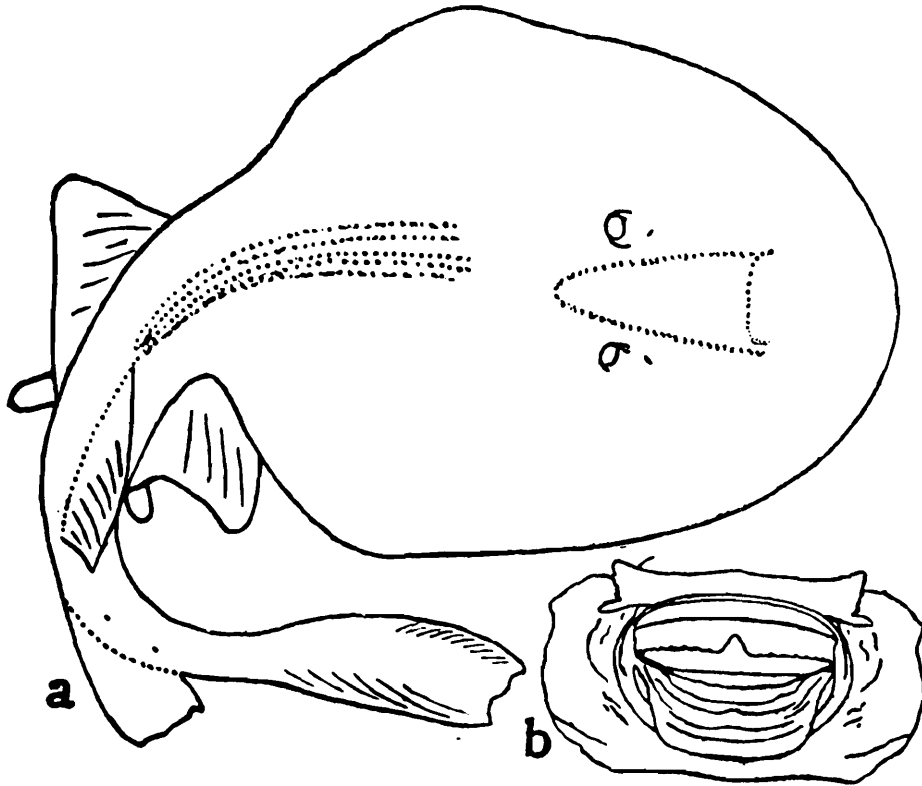
107. **Benthobatis moresbyi** Alc.

(Text-fig. 71)

1898. *Benthobatis moresbyi* Alcock, *Ann. Mag. nat. Hist.*, (7) 2, p. 146 (type locality: off Travancore Coast, 7° 17' 30" N., 76° 8' 23" E. in 430 fathoms, bottom temp. 8.3°C., surface temp., 27.8°C; type is in the Zoological Survey of India).
1899. *Benthobatis moresbyi* Alcock, *Ill. Zool. Investig. Fish.*, pl. 26, fig. 1 (off Travancore Coast).
1899. *Benthobatis moresbyi* Alcock, *Cat. Ind. Deep Sea Fish.*, p. 18 (off Travancore Coast).
1906. *Benthobatis moresbyi* Brauer, "*Valdivia*" *Tiefsee Fische*, 15, p. 9.
1907. *Benthobatis moresbyi* Lloyd, *Rec. Indian Mus.*, 1, p. 4 (15° 55' 30" N., 52° 38' 30" E. in 585 fms., bottom temp. 8.6° C., surface temp. 25°C., Arabian Sea).
1909. *Benthobatis moresbyi* Annandale, *Mem. Indian Mus.*, 2, pl. 3, figs., 5, 5a.
1909. *Benthobatis moresbyi* Lloyd, *Mem. Indian Mus.*, 2, p. 145 (Arabian Sea).
1941. *Benthobatis moresbyi* Fowler, *Bull. U.S. nat. Mus.*, (100) 13, p. 339.
1949. *Benthobatis moresbyi* Misra, *Rec. Indian Mus.*, 45 (1947), p. 44.

1952. *Benthobatis moresbyi* Misra, *Rec. Indian Mus.*, 49 (1951), p. 133.

1958. *Benthobatis moresbyi* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 78.



TEXT-FIG. 71.—*Benthobatis moresbyi* Alc.

(a) Dorsal view : \times ca. $\frac{5}{13}$. (After A. Alcock)

(b) Mouth showing median notch. (After N. Annandale)

Disc oval; its length 1.3 times its width, 2.2 in total length. Snout broad, blunt 2.7 in length of disc. Eyes minute, size of a pin head, as two small unpigmented spots. Interorbital 2.2 in snout. Anterior nasal valves confluent in a quadrangular flap on upper lip. Mouth small, protractile, roof of mouth behind teeth, with a median notch. Preoral more than one-third the length of disc. Teeth as small, rhomboidal plates with the posterior angle strongly and acutely produced; arranged in mosaic in about 10 oblique series in either jaw. Spiracles moderate, much larger than eye, 3.2 in interspiracle. Interspiracle 2.5 in snout, close behind it. Five pairs of ventral gill openings, posterior one nearer to vent than to mouth. Rayed portion of pectorals continued to snout forming the disc. Electric organs between head and pectorals. Pelvics large, triangular, 2.8 in length of disc. Claspers short, rounded, blunt. First dorsal slightly larger than the second dorsal; its base

2.0 times in interdorsal; origin opposite inner angle of pelvics. Second dorsal smaller than first dorsal; its base equal to interdorsal; origin nearer to caudal origin than to first dorsal origin. No serrated caudal spine. No anal fin. Tail not whip-like, a little longer than length of disc, without lateral folds. Caudal well developed, equal to snout. No caudal pits.

Skin smooth, glandular, with small scattered white pores on disc and round its edges, not much smaller than eyes. Purplish black above, lighter below; second dorsal and caudal tipped white.

It attains a length of 357 mm.; bathypelagic.

Distribution.—India: Off Travancore Coast. 7°17'30" N., 76°8'23" E., 768 m., North-east coast of Africa, 4°41'9" N., 48°38'9" E., 823 m., Arabian Sea, 15°55'30" N., 52°38'30" E., 1069 m., in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 4°—15°N., 48°—76° E. in the Indian Ocean.

43. Genus *Torpedo* Houttuyn

1764. *Torpedo* Houttuyn, *Nat. Hist. Linn.*, p. 453 (atypic; type, *Raja torpedo* L., tautotypic).
1776. *Narcacion* Klein, *Neuer Schauplatz*, 2, p. 237 (type, *Raja torpedo* L., designated by Jordan & Evermann, *Gen. Fish.*, pt. 1, p. 39, 1917; inadmissible according to opinion 89 of the International Commission of Zoological Nomenclature).
1806. *Torpedo* Dumeril, *Zool. Analytique*, p. 343 (atypic; type, *Raja torpedo* L.).
1816. *Narcobatus* Blainville, *Bull. Soc. philom. Paris*, 8, p. 121 (type, *Raja torpedo* L., designated by Jordan & Evermann, *Gen. Fish.*, pt. 1, p. 95, 1917).
1825. *Narcobatis* Blainville, *Faune Française Poiss.*, pl. 43 (type, *Raja torpedo* L., monotypic).
1862. *Tetronarce* Gill, *Ann. Lyc. nat. Hist. New York*, 7, p. 387 (type, *Torpedo occidentalis* Storer, monotypic).
1886. *Gymnotorpedo* Fritsch, *Arch. Anat. Phys. Leipzig*, p. 365 (type, *Torpedo occidentalis* Storer).
1886. *Fimbriotorpedo* Fritsch, *Arch. Anat. Phys. Leipzig*, p. 365 (type, *Torpedo marmorata* Risso).
1908. *Tetronarcine* Tanaka, *J. Coll. Sci. Tokyo*, 23, p. 2 (type, *T. tokionis* Tanaka, monotypic).
1910. *Eunarce* Fowler, *Proc. Acad. nat. Sci. Philad.*, p. 472 (type, *Torpedo narke* Risso).
1932. *Notastrape* Whitley, *Rec. Austral. Mus.*, 18, p. 327 (type, *N. macneilli* Whitley, orthotypic).

Disc widely circular with head not distinct from it. Tail very short, with lateral folds and without serrated

cadual spine. Snout broadly rounded, equal to interorbital distance. Rostral cartilage present, but reduced. Nasoral grooves present. Eyes well developed. Spiracles moderate, close behind eyes. 5 pairs of gill openings on the ventral side between the electric organs. Two spineless dorsal fins on tail. Pelvics well developed. The rayed portion of the pectorals extends to the orbital region. Anal fin absent. Teeth small, in pavement, irregularly rhomboidal with the crown obliquely pointed.

Distribution.—E. Africa, Madagascar, Mauritius, Seychelles, Red Sea, India, Philippines.

Genus *Torpedo* is represented by two species in the Indian region.

Key to species

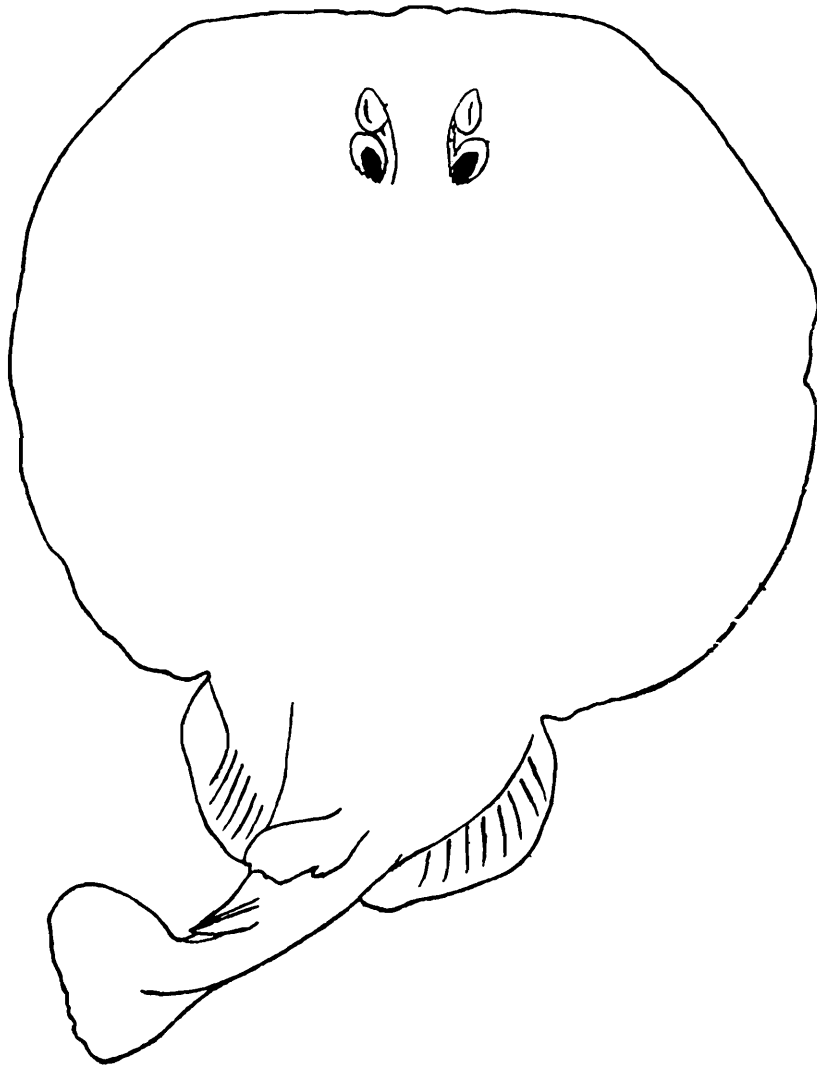
- | | |
|---|--------------------------------|
| 1. First dorsal base ending in front of pelvic bases : brown with mottlings and spots of light and dark | <i>T. panthera</i> Olfers |
| 2. First dorsal base and pelvic bases ending even : brown with irregular large spots and small ones | <i>T. sinus persici</i> Olfers |

108. *Torpedo panthera* Olfers

(Pl. XIX; Text-fig. 72)

1831. *Torpedo marmorata* var. *panthera* Olfers, *Torpedo*, p. 16 (type locality : Red Sea).
1837. *Torpedo panthera* (Ehrenberg) Rüppell, *Neue Wirbelth., Fische*, p. 68, pl. 19, fig. 1 (Tor, Red Sea).
1870. *Torpedo panthera* Günther, *Cat. Fish. Brit. Mus.*, 8, p. 451.
1871. *Torpedo panthera* Klunzinger, *Verh. Zool. bot. Ges. Wien*, 21, p. 678 (Koseir, Red Sea).
1898. *Torpedo suessi* Steindachner, *Sitz. Ber. Akad. Wiss. Wien. math.-nat. Kl.*, 107, pt. 1, p. 784, pl. 2 (Perim; Mocca; Red Sea).
1909. *Torpedo marmorata* (nec Risso) Annandale, *Mem. Indian Mus.*, 2, p. 41, pl. 3a, fig. 4; pl. 5, fig. 3 (Puri; Quilon).
1912. *Torpedo zugmayeri* Englehardt, *Zool. Anz.*, 39, 647 (type locality : Gwadar, Baluchistan).
1913. *Narcacion panthera* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 307 (Red Sea).
1920. *Torpedo marmorata* (nec Risso) Prashad, *Rec. Indian Mus.*, 19, p. 98 (Orissa Coast).
1935. *Torpedo panthera* Fowler, *Proc. Acad. nat. Sci. Philad.*, 87, p. 364 (Durban).
1949. *Torpedo marmorata* (nec Risso) Misra, *Rec. Indian Mus.*, 45 (1947), p. 44.

1952. *Torpedo marmorata* (nec Risso) Misra, *Rec. Indian Mus.*, 49 (1951), p. 134.
 1953. *Torpedo marmorata* (nec Risso) Herre, *Check List Philippine Fish.*, p. 41.
 1958. *Torpedo marmorata* (nec Risso) Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 85.



TEXT-FIG. 72.—Dorsal view of *Torpedo panthera* Olfers : $\times ca \frac{1}{3}$.
 (After N. Annandale)

Disc subcircular, broadly truncated in front; its length 1.1 in its width, 1.7 in total length. Snout short, subtruncate, 8.1 in length of disc. Eyes moderate, as large as spiracle, 1.3 in snout, 1.2 in interorbital. Nostrils small, internarial equal to mouth width. Mouth small, crescentic, between two deep, longitudinal folds converging posteriorly and diverging anteriorly; roof and floor of mouth behind teeth, with low cutaneous ridge, without lateral processes. Teeth in $\frac{18}{18}$ rows, small, crowns with acute point; obliquely directed backwards; bases wide; the

mandibular band not reaching angles of mouth. Spiracles with 7–9 papillae on the margin, as long as eye and close behind it. Interspiracle 1.2 times spiracle. Five pairs of small, ventral gill openings. Rayed portion of pectorals continued to snout forming the disc. Electric organs between head and pectorals. Two small nonspinate dorsals, second smaller than the first. Interdorsal 1.5 in first dorsal. First dorsal origin above the end of the vent, and in front of the ends of pelvic bases. Second dorsal origin nearer to first dorsal origin than to caudal origin. No serrated caudal spine. Pelvics moderate, subtriangular, 2.7 in length of disc. No anal fin. Tail not whip-like, one-third the total length, 1.7 in length of disc, with low folds on each side from opposite to second dorsal. Caudal deeper than long, rounded, hind margin slightly convex.

Burnt amber above with small irregular light broken vermiculations, some circles, dots, hooks, bars or blotches crowded along disc edges; whitish below; pelvics and tail mottled dull amber.

Torpedo panthera is found in shallow water down to 60 fms.; it gives birth to the young in summer in shallow water or moist sand; can live for a few hours out of water. A big fish produces over 100 volts; its electric nervous energy gets exhausted easily; its flesh is edible.

It attains a length of 330 mm.; sluggish and timid; littoral, bottom-living.

Distribution.—India, Pakistan.—Red Sea, Seychelles, Zanzibar, Mozambique, Natal, S. Africa, Madagascar, Mauritius, Arabia, Philippines; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 25°N.—29°S., 31°—123°E. in the Indo-Pacific=(25°N.—29°S., 31°—85°E. in the Indian Ocean+14°N., 123°E. in the Pacific Ocean).

109. *Torpedo sinus persici* Olfers

- 1831. *Torpedo sinus persici* Olfers, *Torpedo*, pp. 15, 17 (on Kampfer).
- 1871. *Torpedo sinus persici* Kluzinger, *Verh. zool. bot. Ges. Wien*, 21, p. 677 (Koseir, Red Sea).
- 1891. *Torpedo sinus persici* Sauvage, *Hist. nat. Madagascar. Poiss.*, p. 3, pl. 1 (Madagascar).
- 1913. *Narcacion sinus persici* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 309 (Persian Gulf).
- 1926. *Torpedo sinus persici* Fowler, *J. Bombay nat. Hist. Soc.*, 30, p. 2 (Bombay).
- 1928. *Torpedo sinus persic* Fowler, *J. Bombay nat. Hist., Soc.*, 33, p. 101 (Bombay).

1941. *Torpedo sinus persici* Fowler, *Bull. U. S. nat. Mus.*, (100) 13, p. 344.
 1949. *Torpedo sinus persici* Misra, *Rec. Indian Mus.*, 45 (1947), p. 45.
 1952. *Torpedo sinus persici* Misra, *Rec. Indian Mus.*, 49 (1951) p. 134.
 1958. *Torpedo sinus persici* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 85.

Disc subcircular, broader than long. Snout short, greater than width of mouth and interorbital, subtruncate. Eyes small, less than spiracle, 2.0 in interorbital. Mouth small, crescentic, 1.6 to 1.8 in snout, with longitudinal fold at angles. Nostrils small, as wide as space between them. Internarial 1.0–1.2 in width of mouth. Teeth small, in $\frac{20}{20}$ rows, mandibular band extending to angles of mouth. Spiracles with 7–9 papillae, a little longer than eye, an eye diameter behind it. Five pairs of small, ventral gill openings. Rayed portion of pectorals continued to snout forming the disc. Electric organs between head and pectorals. Pelvics moderate, subtriangular. Two small, narrow, non-spinate dorsals, with inner angles rounded. First dorsal origin before hind basal edge of pelvics, a little behind the vent. Second dorsal a little smaller than the first. No serrated caudal spine. No anal fin. Tail not whip-like, short, 2.3 in total length, with fold on each side from opposite the middle of second dorsal. Caudal deeper than long, subtruncate, angles rounded. No caudal pits.

Skin smooth. Rusty brown above with large dusky spots as large as or larger than spiracles; whitish below, darker below edges of disc and fins.

It grows to 140 mm. in length; littoral.

Distribution.—India.—Red Sea, Madagascar, Persian Gulf; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 27°N.—20°S., 39°—72°E. in the Indian Ocean.

44. Genus *Narke* Kaup

1826. *Narke* Kaup, *Isis*, 18, p. 88 (type, *Raja capensis* Gmelin, monotypic).
 1837. *Astrape* Müller & Henle, *Sitz. Ber. Preuss. Akad. Wiss.*, p. 117 (atypic; type, *Raja capensis* Gmelin designated by Jordan, *Gen. Fish.*, 2, p. 193, 1919).

Disc circular with head not distinct from it. Tail slightly shorter than the disc length, with lateral folds and without serrated caudal spine. Snout broadly rounded and

about one and a quarter times the interorbital distance. Rostral cartilage present, but reduced. Nasoral grooves present. Spiracles large, close behind eyes. 5 pairs of gill openings on the ventral side. One spineless dorsal fin. Pelvics and pectorals well developed. The rayed portion of the pectorals extends to the orbital region. Anal fin absent. Teeth in narrow band, small, quadrangular, with the crown not strongly produced.

Distribution.—Arabian Sea, India, Ceylon, Malay Peninsula, "Indo-China", Japan, Philippines.

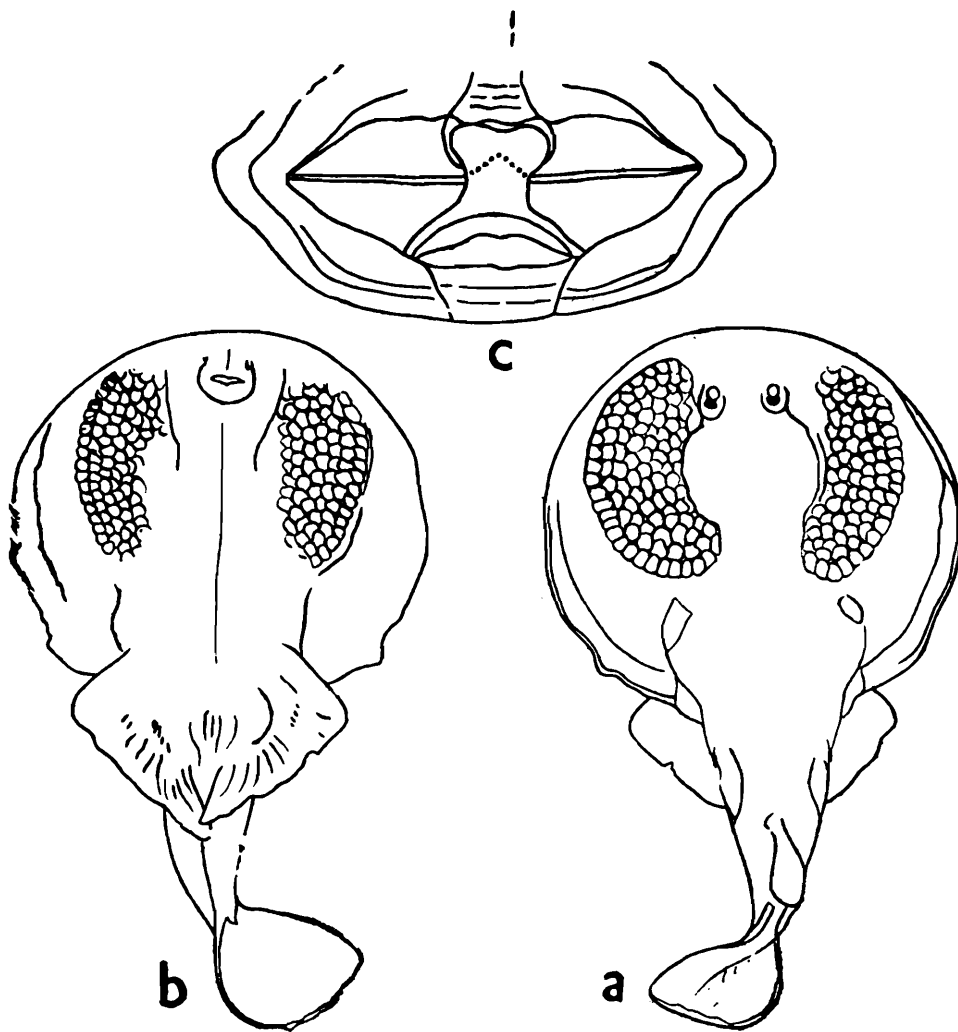
110. *Narke dipterygia* (Schn.)

(Text-fig. 73)

1801. *Raja dipterygia* Schneider, *Syst. Ichth. Bloch*, p. 359 (type locality : Tranquebar, Madras).
1851. *Astrape dipterygia* Jerdon, *Madras J. Lit. Sci.*, 17, p. 149.
1878. *Astrape dipterygia* Day (*partim*), *Fish. India*, p. 734, *nec pl.* 192, fig. 4 (Seas of India to the Malay Archipelago, China and Japan).
1889. *Astrape dipterygia* Day (*partim*), *Fauna Brit. India, Fish.*, 1, p. 46, *nec fig.* 19 (Seas of India to the Malay Archipelago, China and Japan).
1909. *Astrape dipterygia* Annandale, *Mem. Indian Mus.*, 2, p. 46, pl. 3, fig. 6 (off Orissa Coast).
1913. *Narke dipterygia* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 313 (Penang; Singapore; Malay Peninsula; Malacca; Hindustan; Canton).
1913. *Astrape dipterygia* Zugmayer, *Abh. Bayer. Akad. Wiss., math.-phys. Kl.*, 26, p. 8 (Mekran).
1920. *Narke dipterygia* Prashad, *Rec. Indian Mus.*, 19, p. 100, pl. 6, figs. 1, 2 (Puri; Orissa).
1927. *Narke dipterygia* Fowler, *J. Bombay nat. Hist. Soc.*, 32, p. 253 (Bombay).
1929. *Astrape dipterygia* Pillay, *J. Bombay nat. Hist. Soc.*, 33, p. 355 (Travancore).
1931. *Narke dipterygia* Chu, *Biol. Bull. St. John's Univ.*, No. 1, p. 8 (China).
1936. *Astrape dipterygia* Suvatti, *Index Fish. Siam*, p. 4 (Gulf of Siam).
1938. *Narke dipterygia* Fowler, *List Fish. Malaya*, p. 15 (Malacca, Penang, Singapore).
1941. *Narke dipterygia* Fowler, *Bull. U. S. nat. Mus.*, (100) 13, p. 350.
1949. *Narke dipterygia* Misra, *Rec. Indian Mus.*, 45 (1947), p. 45.
1952. *Narke dipterygia* Misra, *Rec. Indian Mus.*, 49 (1951), p. 134.
1955. *Astrape dipterygia* Anonymous, *Mar. Fish. Karachi, Sind & Makran*, p. 7 (Coasts of Sind and Makran.).

1955. *Narke dipterygia* Munro, *Mar. Freshwater Fish. Ceylon* p. 17 (Ceylon).

1958. *Narke dipterygia* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 85.



TEXT-FIG. 73.—*Narke dipterygia* (Schn.)

(a) Dorsal view (After B. Prashad). (b) Ventral view (After B. Prashad). (c) Mouth showing bilobed median process: $\times 4$. (After N. Annandale)

Vernacular names.—INDIA: *Zinzina*, Marathi; *Timri tiki*, Telegu. PAKISTAN: *Mathan*, Sind & Makran.

Disc subcircular; its length 1.1 in its width, 2.1 in total length. Snout short, rounded, 7.0 in length of disc. Eyes small, prominent, a little less than half spiracle, 5.0 in snout, 3.7 in interorbital. Oronasal grooves present, cirri absent. Nostrils small. Internarial 1.6 in snout, equal to width of mouth. Mouth small, protractile; roof and floor of mouth behind teeth, with a bilobed process medianly. Teeth small, occupying nearly the whole of mandibular surface, with

broad, bluntly pointed, transverse ridge. Spiracles without papillae, large, very close behind eye. Interspiracle 1.8 in snout. Five pairs of small, ventral gill openings, the last one the smallest. Rayed portions of pectorals continued to the snout forming the disc. Electric organs between head and pectorals. Pelvics large, subtriangular, 1.9 in length of disc. A single, non-spinate dorsal rounded along margin and with an elongated base; origin a little behind pelvic ends. No serrated caudal spine. No anal fin. Tail not whip-like, a little longer than half total length, with feebly developed cutaneous folds on either side. Caudal well developed, 2.6 times the snout. Supracaudal much longer, rounded or broadly pointed. Subcaudal rounded.

Skin smooth. Dull chocolate tinged with purple above; borders of disc, pelvics, hind margin of dorsal and caudal creamy white; circular white spot on each side behind electric organs and a similar but longer one at the junction of the pectorals and the body on each side; creamy white below.

It attains 160 mm. in length and 90 mm. across the disc; littoral.

Distribution.—India, Pakistan, Ceylon.—Penang, Malay Peninsula, Singapore, Indonesia, Siam, Indo-China, China, Japan; in the mean annual isotherm of 20°C. with the latitudinal and longitudinal range of 1°—35°N., 62°—130°E. in the Indo-Pacific=(4°—25°N., 62°—100°E., in the Indian Ocean+1°—35°N., 100°—130°E. in the Pacific Ocean).

45. Genus **Bengalichthys** Annandale

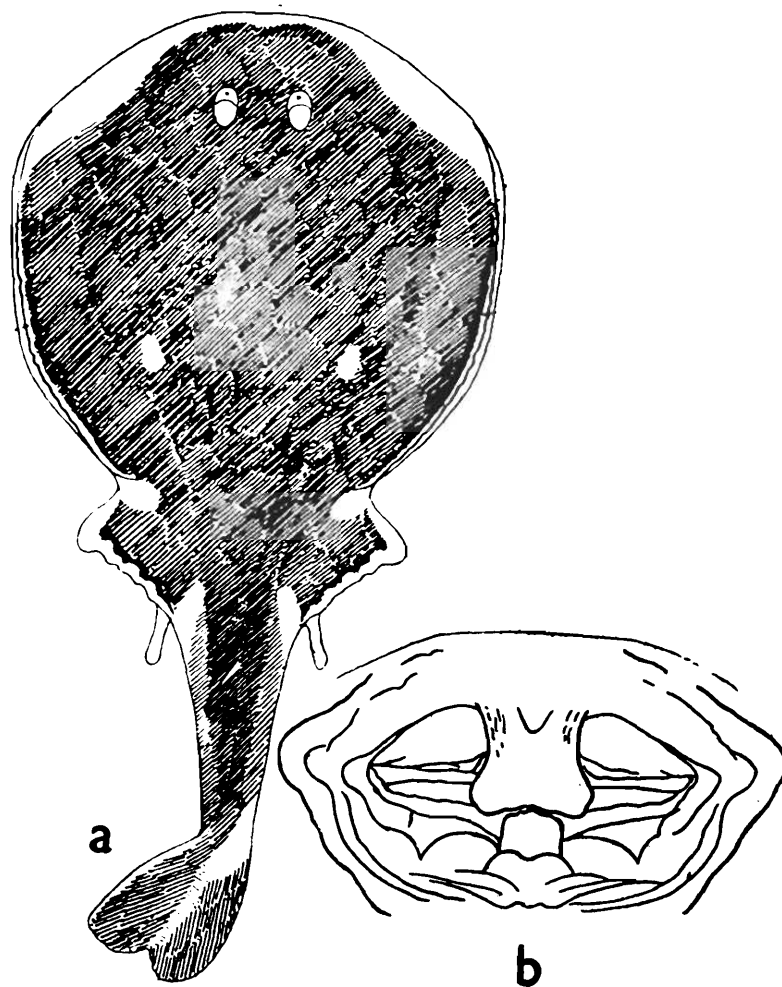
1909. *Bengalichthys* Annandale, *Mem. Indian Mus.*, 2, p. 45 (type, *Bengalichthys impennis* Annandale, monotypic).

Disc oblong. Tail slightly shorter than the disc length, with lateral folds and without serrated caudal spine. Snout broadly rounded and one and a quarter times in the inter-orbital distance. Rostral cartilage present, but reduced. Nasoral grooves present. Eyes minute. Spiracles moderate, close behind eyes. 5 pairs of small gill openings between the electric organs. One spineless dorsal fin. Pectoral and pelvic fins not well developed. The rayed portion of pectorals extends only up to the orbital region. Anal fin absent. Teeth roughly quadrangular, small, with the crown not much produced.

Distribution.—India.

111 **Bengalichthys impennis** Annandale
(Text-fig. 74)

1878. *Astrape dipterygia* Day (*partim*), *Fish. India*, p. 734, pl. 192, fig. 4 (Madras).
 1889. *Astrape dipterygia* Day (*partim*), *Fauna Brit. India, Fish.*, 1, p. 46, fig. 19 (Seas of India).
 1909. *Bengalichthys impennis* Annandale, *Mem. Indian Mus.*, 2, p. 48, text-fig. 9, pl. 3, figs. 7, 7a (type locality : Orissa Coast).
 1913. *Narke impennis* Garman, *Mem. Harv. Mus. Comp. Zool.*, 36, p. 315 (Coast of Orissa, Bay of Bengal).
 1920. *Bengalichthys impennis* Prashad, *Rec. Indian Mus.*, 19 p. 103, pl. 6, figs. 3, 4; pl. 7, figs. 1—3 (Puri, Orissa).



TEXT-FIG. 74.—*Bengalichthys impennis* Annandale

(a) Dorsal view : $\times ca \frac{3}{5}$. (b) Mouth showing median process : $\times 3$. (After Annandale)

1941. *Narke impennis* Fowler, *Bull. U. S. nat. Mus.*, (100) 13, p. 352.
 1949. *Bengalichthys impennis* Misra, *Rec. Indian Mus.*, 45 (1947), p. 45.
 1952. *Bengalichthys impennis* Misra, *Rec. Indian Mus.*, 49 (1951), p. 13.
 1958. *Bengalichthys impennis* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 78.

Disc stout, muscular, oblong or pear-shaped; its length 1.0—1.1 times the width of disc, 2.0—2.1 in total length. Snout broadly rounded, 4.0—4.8 in length of disc. Eyes minute, sunken. Interorbital 2.3—3.3 in snout. Oronasal grooves present; cirri absent. Nostrils small. Internarial nearly equal to width of mouth. Mouth small, protractile; roof and floor of mouth behind teeth with long, median, rectangular process, upper longer than lower process. Teeth with triangular, transverse ridge, very pointed. Spiracles without papillae, close to the eyes. Interspiracle 3.0 in snout. Five pairs of small, ventral gill openings. Rayed portion of pectorals extend only to orbit. Electric organs between head and pectorals, blunt on outer angles, margin sinuous, not easily visible externally. Pelvics moderate, subtriangular, 2.6 in length of disc; claspers slender, blunt, reaching to origin of dorsal. A small, single, non-spinate dorsal fin; origin about half way between pelvic ends and caudal origin. No serrated caudal spine. No anal fin. Tail not whip-like, stout, slightly longer or shorter, or equal to length of disc. Caudal slightly bilobed, 1.4 times snout. Supra and subcaudal lobes more or less equal and rounded. No caudal pits.

Skin smooth. Disc and tail deep buff, with dark brown above margin of disc and fins; a large, oval spot on each side of back in front of root of tail; a forwardly directed streak on each side of tail in front of dorsal fin and a backwardly directed streak on the base of the disc on either side of cream colour; ventral surface creamy.

It attains a length of 175 mm.; littoral.

Distribution.—India : Orissa Coast; in the mean annual isotherm of 20° C. in 17° N., 85° E. in the Bay of Bengal.

II. Class HOLOCEPHALI

Endoskeleton cartilaginous, often calcified. No dermal bones on head, jaws and pectoral girdles. Endocranium never ossified, but superficially calcified. Skull holostylic, without sutures. Palatoquadrate fused to neurocranium. Interorbital septum. An ethmoidal canal. Auditory capsule with incomplete median wall. Teeth united to form grinding plates or tritons, devoid of enamel. Hyoid arch non suspensorial, with pharyngohyal and epihyal elements. No spiracles. Five pairs of gill arches. One pair of lateral, gill openings with operculum on each side. No ribs. No air-bladder. An intestinal, spiral valve. A conus arteriosus. Pelvics abdominal; two halves of the pelvic girdle not fused but united by ligament. No cloaca. Mature males with

erectile, frontal tentacles and prepelvic claspers, simple, bifid or trifid. Internal fertilization. Oviparous.

Upper Devonian to Recent.

Class HOLOCEPHALI is divided into two subclasses *CHONDRENCHELYES* (fossil) and *CHIMAERAE* (living) of which the latter alone is represented in the Indian region.

ii. Subclass *CHIMAERAE*

Pectoral fins of non-archipterygium type. Notochord persistent, 4 or 5 ring-like calcifications to each neuromere in the chordal sheath; in the whip-like terminal portion of tail arcualia and notochord replaced by slender continuous filament of cartilage; no true centra.

Subclass *CHIMAERAE* consists of a single order CHIMAERIFORMES.

VI. Order CHIMAERIFORMES

Snout prominent, with or without proboscis or beak. Claspers simple, bifid or trifid.

Upper Devonian to Recent.

Order CHIMAERIFORMES is represented by two families in the Indian region.

Key to families of order CHIMAERIFORMES

- | | |
|--|-------------------------|
| 1. Claspers simple : head with proboscis or beak | Family RHINOCHEMAERIDAE |
| 2. Claspers trifid or bifid : head without proboscis or beak | Family CHIMAERIDAE |

XVII. Family CHIMAERIDAE

Chimaeras or Elephant-fishes

Body elongate, shark-like, tapering posteriorly to a point at tail. Snout prominent, soft, without proboscis. Head large, compressed. Eyes large, lateral; oronasal grooves present, cirri absent. Mouth small, inferior, upper lip notched. Jaws with teeth united into 4 bony laminae or tritors above, two below. Spiracles absent. A single, gill opening on either side of pharynx containing 4 gill slits, 3 free gills and 1½ gills covered over by a skinny operculum. Gill rakers small. Isthmus moderate. Notochord persistent with narrow ring-like segments. Cerebral hemispheres fused with olfactory lobes distant from optic lobes. Two dorsals; first spinate anteriorly, second non-spinate, long, lobed. Pectorals large, free, low. Pelvics many rayed. Anal small, distinct or not distinct from caudal. Claspers in males trifid or rarely bifid. Skin naked, without placoid

scales. Lateral line open canal, usually with many branches anteriorly or on head. Oviparous, egg-cases long, elliptical, with silky filaments.

Lower Jurassic to Recent.

Family CHIMAERIDAE is represented by a single genus in the Indian region.

46. Genus *Chimaera* Linnaeus

1758. *Chimaera* Linnaeus, *Syst. Nat.*, 1, ed. 10, p. 236 (type, *C. monstrosa* L., designated by Jordan & Gilbert, *U. S. nat. Mus. Bull.*, p. 54, 1884).
1798. *Chimoera* Cuvier, *Tabl. Element.* (an. 6), p. 317 (type, *Chimaera monstrosa* L.).
1815. *Chimera* Rafinesque, *Analyse de la nature*, p. 92 (type, *Chimaera monstrosa* L.).
1850. *Plethodus* Dixon, *Fossils Sussex*, p. 366 (type, *P. expansus* Dixon, monotypic) (fossil).
1856. *Chimaira* Dumeril, *Mem. Acad. Sci. France*, 27, p. 155 (type, *Chimaera monstrosa* L.).
1862. *Hydrolagus* Gill, *Proc. Acad. nat. Sci. Philad.*, p. 331 (type, *Chimaera colliei* Lay & Bennett., monotypic).
1901. *Bathyalopex* Collett, *Arch. Naturg. Christiania*, 23, p. 5 (type, *Chimaera (Bathyalopex) mirabilis* Collett, monotypic).
1907. *Psychichthys* Fowler, *Proc. Acad. nat. Sci. Philad.*, p. 419 (type, *Hydrolagus waitei* Fowler, orthotypic).
1925. *Phasmichthys* Jordan & Hubbs, *Mem. Carnegie Mus.*, 10, p. 119 (type, *Chimaera mitsukurii* Dean).

Body elongate and shark-like in form, tapering posteriorly to a point at tail. Head large, compressed, without proboscis or beak. Eyes large or moderate, lateral. Mouth inferior. Nasoral grooves present. Spiracles absent. One gill opening on either side of pharynx containing four gill-slits and four and a half gills covered over by a skinny operculum. Two dorsal fins, the first dorsal with a strong spine anteriorly; the second dorsal long and low. Pectorals large, free and low. Pelvics abdominal, many rayed. Anal fin small, distinct or not distinct from subcaudal. Mature males with trifid or rarely bifid claspers and a tentaculum on the forehead. Skin naked, devoid of placoid scales. Teeth united to form bony plates, laminae or tritors; 5 tritors in the upper jaw; 2 tritors in lower jaw. Timid and harmless, moving towards extinction.

Distribution.—Atlantic Ocean, Faroes Is., 300—1,200 m.; Norway, 300—750 m.; Faroes Channel, 923—1,014 m.;

Azores Is., 800—1,257 m.; West of Fayal, 1,962 m.; Saldanha Bay, 823—914 m.; Portugal; Gulf of Mexico, 548—1,759 m.; Cuba; East coast of North America 39°—43°N., 60°—70°W., 548—1,759 m.; Italy; Sudan, 800—1,257 m.; Mediterranean; Atlantic, 548—2,359 m.; Indian Ocean : Cape Point, 823—914 m.; Natal coast, 592 m.; Gulf of Aden, 1,061—1,080 m.; Arabian Sea, 475 m.; Bay of Bengal, 749 m.; West coast of Sumatra, 470 m.; Pacific Ocean : Off Sombrero I., West coast of Luzon, 431 m.; Sandwich Is., 1,750—1,951 m.; Australia; Victoria; Northeast Pacific from California to Alaska; New Zealand; New South Wales; China; Japan; Korea; Hawaii.

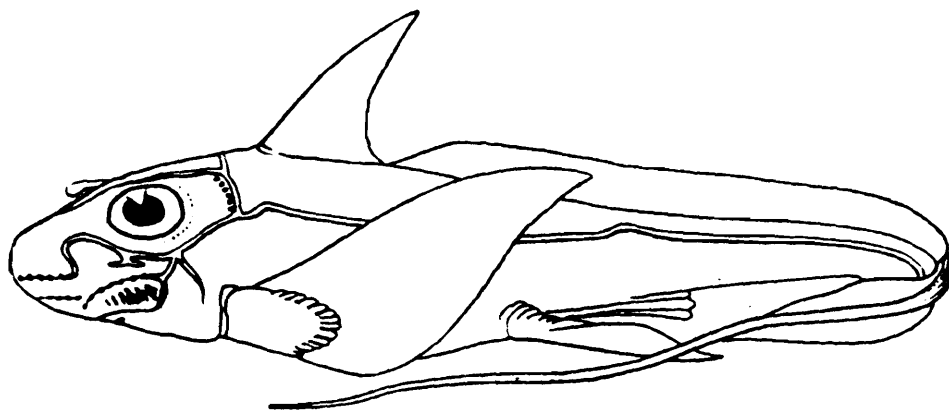
Chimaera monstrosa L., is the only species of the genus found in India.

112. *Chimaera monstrosa* L.

(Text-fig. 75)

1758. *Chimaera monstrosa* Linnaeus, *Syst. Nat.*, 1, ed. 10, p. 236 (type locality : Atlantic Ocean).
1801. *Chimaera americana* Schneider, *Syst. Ichth. Bloch*, p. 350 (on *Callorhynchus americanus* Gronow, type locality : American Ocean).
1828. *Chimaera mediterranea* Risso, *Hist. nat. Europe merid. Poiss.*, 3, p. 168 (type locality: Nice).
1854. *Callorhynchus centrina* Gray, *Cat. Fish. Gronow*, 2, p. 15 (type locality : American Ocean).
1854. *Callorhynchus atlanticus* Gray, *Cat. Fish. Gronow* 2, p. 16 (type locality: Atlantic Seas).
1906. *Chimaera monstrosa* Brauer, "Valdivia" *Tiefsee Fische*, 15, p. 10 (West coast of Sumatra, 0°15' 5" S., 98° 4' E.)
1906. *Chimaera vaillanti* Dean, *Carnegie Inst. Washington Publ.* No. 32, p. 7 (type locality : Cape of Good Hope).
1912. *Chimaera monstrosa* Alcock, *Ann. Mag. nat. Hist.*, (6) 10, p. 347 (Bay of Bengal, 16° 1' N., 81° 25' E., 410 fms. 7.5 C., surface temp. 26.1° C., an empty egg capsule 9" in length).
1941. *Chimaera monstrosa* Fowler, *Bull. U. S. nat. Mus.*, (100) 13, p. 489.
1949. *Chimaera monstrosa* Misra, *Rec. Indian Mus.*, 45 (1947), p. 46.
1952. *Chimaera monstrosa* Misra, *Rec. Indian Mus.*, 49 (1951), p. 135, text-fig. 24c.

1953. *Chimaera monstrosa* Smith, *Sea Fish. S. Africa*, p. 76 (the Cape).
 1958. *Chimaera monstrosa* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 77.



TEXT-FIG. 75.—Lateral view of *Chimaera monstrosa* L. (After G. Boulenger)

Trunk shark-like, 3.1 in total length, tapering to a point at tail. Head 6.5–8.4 in total length. Depth 7.3–8.8 in total length. Snout 2.0–2.7 in head. Nasoral grooves present, cirri absent. Eyes 1.4 in snout, 7.5 in head. Mouth interior, below middle of orbit. Teeth united to form bony plates or tritors; 4 tritors in upper jaw; 2 tritors in lower jaw. Spiracles absent. Skinny operculum present. Gill rakers 12, short, pointed. Two dorsal fins. First dorsal spinate: origin over hind gill opening edge; its base 14.0 in total length; spine 1–1.4 in head, with both edges serrated. Second dorsal confluent with first dorsal by a low fold, gradiently low; its base 2.6–3.0 in total length, ending before end of anal by a distance of an eye diameter. Pectoral large, placed low, 4.4–5.5 in total length reaching beyond pelvic base; width 2.6 in its length. Pelvics triangularly pointed, abdominal, many-rayed, slightly longer than head. Claspers trifid, 1.5 in pelvics. Anal low, small, distinct from subcaudal. Tail 1.5 in total length. Caudal with equal-sized, subcaudal and supracaudal in females; subcaudal a little longer than supracaudal in males; caudal filament in males 3.7 in total length. Lateral line irregular, without distinct even waves.

Reddish-brown, lighter or darker on back; sides mostly silvery shot with blue above and white below; under surface silvery. Silvery lateral line marked by brown edges. Iris golden or silvery, pupil greenish. Inside mouth and pharynx more or less black; tongue and branchial arches yellow.

Its flesh is wholesome, but most people not eating it. It attains 1,522 mm. in length.

Distribution.—India: Bay of Bengal, 749 m.; Azores Is., 1,165–1,257 m.; Faroes Is., 300–750 m.; Faroes Channel, 923–1,014 m.; Norway, 300–750 m.; West of Fayal, 1,962 m., North Atlantic, 1,097 m.; Saldanha Bay 722–914 m., North Sea; Nice; Cuba; Iceland; Mediterranean; Italy; Sudan, 800–1,257 m.; Indian Ocean: Off Cape Point, 722–914 m., Cape of Good Hope; West coast of Sumatra, 470 m.; Japan; in the mean annual isotherms 20°C., 12°C., 6°C. and beyond 6°C. in the Arctic or Frigid Zone with the latitudinal and longitudinal range of 35°S.—35°N., 18°—130°E., in the Indo-Pacific = (16°1'N.—35°S., 18°—98°E. in the Indian Ocean + 35°N., 130°E. in the Pacific Ocean); 43°41'N., 7°18'E. in the Mediterranean; 75°N., 20°W. Arctic Zone; 20°S.—62°N., 10°E.—80°W. in the Atlantic Ocean.

XVIII. Family RHINOCHEMAERIDAE

Body elongate, shark-like, tapering to a point at tail. Snout depressed or compressed. Head with long rostral proboscis pointed with cartilaginous mid-rib and foliaceous lateral skin expansions at base. Eyes moderate, lateral. Mouth inferior. Teeth forming dental plates or tritons, or without tritons like bony covers of jaws of tortoises or birds. Spiracles absent. One gill opening on either side of pharynx covered by skinny operculum. Isthmus wide. Notochord with rings, cerebral hemispheres distant from both olfactory and optic lobes. Two dorsal fins. First dorsal spinate, second non-spinate. Pectorals large, free. Anal fin small, distinct or not distinct from subcaudal. Supracaudal high, without spines or low with its upper edge spinate. Male with simple clasper. Skin without placoid scales. Lateral canal system subtubular.

Family RHINOCHEMAERIDAE is represented by two genera in the Indian region.

Key to genera of family RHINOCHEMAERIDAE

- | | |
|--|--|
| 1. Snout compressed : upper caudal edge spinose : egg-capsule black : patch of byssus large (14.0 sq. mm.) | Genus <i>Rhinocemaera</i>
Garman |
| 2. Snout depressed : upper caudal edge not spinose : egg-capsule pale bottle-green : patch of byssus small (7.5 sq. mm.) | Genus <i>Harriotta</i> G. & B, |

47. Genus *Harriotta* Goode & Bean

1895. *Harriotta* Goode & Bean, *Proc. U.S. nat. Mus.*, 17 (type *H. raleighana* Goode & Bean, monotypic).

1909. *Anteliochimaera* Tanaka, *J. College Sci. Tokyo*, 27, p. 7 (type, *A. chaetirhamphus* Tanaka, orthotypic),

Body elongate, tapering to a long tail with a filamentous tip. Head with long rostral proboscis. Snout depressed. Eyes moderate, lateral. Mouth inferior. Spiracles absent. One gill opening on either side or pharynx, containing four gill slits and four gills covered over by a skinny operculum. Two dorsal fins; first dorsal with a spine anteriorly; second dorsal low. Pectorals large, free. Anal indistinct. Supracaudal moderately high, upper edge without spines. Mature male with a simple clasper. Teeth with tritons.

Distribution.—Atlantic Ocean: East Coast of North America, 36°—40°N., 70°—74°W., 1,293—1,976 m.; Atlantic, 50°31'N., 11°31'W., 1,225—1,408 m.; Southwest Africa; Indian Ocean, Gulf of Aden, 1061—1080 m.; Bay of Bengal, 1,025 m.; Pacific Ocean: Sagami Sea, 731 m.

113. *Harriotta indica* (Garman)

1891. *Callorhynchus* ? sp., Wood-Mason & Alcock, *Ann. Mag. nat. Hist.*, (6) 8, p. 21, fig. 1 (Bay of Bengal, 13° 47' 30" N., 92° 36' E., 561 fms. 7·2 C., surface temp. 26·1°C.).

1899. *Callorhynchus indicus* Garman, *Mem. Harv. Mus. Comp. Zool.*, 24, p. 21 (Bay of Bengal).

1906. *Harriotta* (?) *indica* Dean, *Chimaeroid Fish. and their Devel.*, p. 30 (Bay of Bengal).

1912. *Harriotta* sp., Sewell, *Rec. Indian Mus.*, 7, pp. 2, 3 (measurements of egg-capsule in millimetres).

1939. *Harriotta* (?) *indica* Norman, *Sci. Rep. John. Murray. Exped.*, 7, p. 14 (Gulf of Aden, 13°03'N., 46° 21' 42" E., AT, 1061—1080 m., bottom temperature at 1,000 m. was 10·86 C., surface temperature was 28·69 C.).

1949. *Harriotta* (?) *indica* Misra, *Rec. Indian Mus.*, 45 (1947), p. 46.

1952. *Harriotta* (?) *indica* Misra, *Rec. Indian Mus.*, 49 (1951), p. 135.

1958. *Harriotta indica* Misra & Menon, *Rec. Indian Mus.*, 53 (1955), p. 77.

Harriotta indica (Garman) has been recorded only from the egg-capsule; the parent fish so far has not yet been obtained from the Indian waters. The table of measurements of the egg-capsule is given below in millimetres by Sewell:

Total length	..	..	130·00+
Total length of body and style	..	..	120·0

Length of membrane in front of body	10·0+
Length of body	64·0
Length of anterior narrow part of body	17·0
Greatest total width	38·0+
<i>Dorsal surface</i>	
Width of anterior part of body	15·0
Width at neck	18·0
Greatest width of body	25·0
Width of style at origin	7·5
Width of style at its middle	4·7
Width of posterior end of style	6·5
<i>Ventral surface</i>	
Width between (including ridges) at anterior end	8·0
Width between (including ridges) in front of patch of byssus	12·0
Width between (including ridges) at neck	11·0
Greatest width of body between (including ridges)	17·0
Width of gutter between ridges 8 in middle of style	5·3
Colour	Pale bottle green
Patch of byssus	7·5 mm. square

Distribution.—INDIA : Bay of Bengal 13° 47' 30"N., 92° 36'E., 1025 m.—Gulf of Aden, 1061—1080 m., in the mean annual isotherm of 20° C. with the latitudinal and longitudinal range of 13° N., 46°—92° E.

48. Genus *Rhinochimaera* Garman

1901. *Rhinochimaera* Garman, *Proc. New England Zool. Club*, 2, p. 76 (type *Harriotta pacifica* Mitsukuri)

Body elongate, tapering posteriorly to the long tail with a filamentous tip. Head with long rostral proboscis. Snout depressed. Eyes moderate. Mouth inferior. Spiracles absent. One gill-opening on either side of pharynx containing four gill-slits and four gills covered over by a skinny operculum. Two dorsal fins; first dorsal with spine anteriorly; second dorsal low. Pectorals large, free. Anal small, not distinct from subcaudal. Supracaudal low, upper edge armed with spines. Mature male with a simple clasper. Teeth united to form grinding plate.

Distribution.—Indian Ocean: Arabian Sea, 475 m.; Pacific Ocean: Off Celebes; Japan.

114. *Rhinochimaera* sp.

1912. *Rhinochimaera* sp. Sewell, *Rec. Indian Mus.*, 7, p. 2 (off Travancore Coast, 9° 14' 10" N., 75° 45' E., 260 fms.).
1949. *Rhinochimaera* sp., Misra, *Rec. Indian Mus.*, 45 (1951), p. 46.
1952. *Rhinochimaera* sp., Misra, *Rec. Indian Mus.*, 49 (1951), p. 136.
1958. *Rhinochimaera* sp., Misra & Menon *Rec. Indian Mus.*, 53 (1955), p. 77.

Only the egg-capsule of *Rhinochimaera* sp., containing an embryo, has been recorded; the parent fish has not yet been obtained. The table of measurements of the egg-capsule containing an embryo is given below in millimeters by Sewell :—

Total length				168·0+
Total length of body and style	..	..		138·0
Length of membrane in front of body		..		21·0
Length of body	..			77·0
Length of anterior narrow part of body				20·0
Greatest total width	..	..	..	50·0
<i>Dorsal surface</i>				
Width of anterior part of body				15·
Width of neck	..	..		13·0
Greatest width of body	..			23·5
Width of style at origin	.			6·0
Width of style at its middle				3·5
Width of posterior end of style	.	..	..	8·5
<i>Ventral surface</i>				
Width between (including ridges) at anterior end				10·5
Width between (including ridges) in front of patch of byssus				15·5
Width between (including ridges) at neck	..			13·0
Greatest width of body between (including ridges)				19·0
Width of gutter between ridges 8 in middle of style	..			1·5
Colour				Black
Patch of byssus		..		14 mm. square.

Distribution.—India: Off Travancore coast 9° 14' 10" N., 75° 45' E., 475 m. in the mean annual isotherm of 20°C.

A field key to PISCES : ELASMOBRANCHII and
HOLOCEPHALI (excluding DIPNOI and *TELEOSTOMI)
of the Indian Region

- | | |
|---|--|
| 1. Skeleton cartilaginous | 3 |
| 2. Skeleton bony (except order ATELEOPIFORMES where endocranium mainly cartilaginous) | 5 |
| 3. Single pair of lateral gill openings : operculum present | Class HOLOCEPHALI, 235
Subclass CHIMAERAE
Order CHIMAERIFORMES,
235 |
| 4. 5—7 pairs of lateral or ventral gill openings : operculum absent | Class ELASMOBRANCHII
Subclass SELACHII, 7 |
| 5. Atrium partially divided, with development of lungs | Class DIPNOI (not represented in the Indian region). |
| 6. Atrium not divided, without lungs | Class TELEOSTOMI |
| 7. Gill openings lateral | Superorder SELACHOIDEI, 9 |
| 8. Gill openings ventral | Superorder BATOIDEI, 109 |
| 9. One dorsal fin | Order HEXANCHIFORMES
Fam. HEPTRANCHIDAE
Genus <i>Heptranchias</i>
<i>H. indicus</i> |
| 10. Two dorsal fins | 11 |
| 11. Anal fin present .. | Order LAMNIFORMES, 13 |
| 12. Anal fin absent | Order SQUALIFORMES, 103 |
| 13. Nictitating membrane well developed or vestigial | Suborder SCYLIORHINOIDEI, 35 |
| 14. Nictitating membrane absent | Suborder LAMNOIDEI, 15 |
| 15. Nasoral grooves present | Fam. ORECTOLOBIDAE, 17 |
| 16. Nasoral grooves absent | 29 |
| 17. Nasoral grooves and cirri present: tail without lateral keels and pits. | Subfam. ORECTOLOBINI, 19 |
| 18. Only nasoral grooves present : tail with lateral keels and pits | Subfam. RHINEODONTINI
Genus <i>Rhincodon</i>
<i>R. typus</i> |
| 19. First dorsal fin behind pelvis : 1—3 distinct dermal ridges on back | Genus <i>Chiloscyllium</i> , 21 |
| 20. First dorsal fin opposite pelvis : without distinct dermal ridges on back | 25 |

*This will be dealt with in the succeeding volumes.

21. One distinct dermal ridge on back 23
22. 3 dermal ridges on back *C. indicus*
23. Origin of first dorsal above middle of pelvic bases : body with white spots *C. plagiosum*
24. Origin of first dorsal above ends of pelvic bases : body with dark spots *C. griseum*
25. Caudal fin short Genus *Nebrius*, 27
26. Caudal fin elongate Genus *Stegostoma*
S. varius
27. Teeth in 3 rows : second dorsal fin longer than anal *N. concolor*
28. Teeth in more than 3 rows : second dorsal fin smaller than anal *N. ferrugineum*
29. A lateral keel present or absent : second dorsal and anal fins very small Fam. LAMNIDAE, 31
30. No lateral keel : second dorsal and anal fins large Fam. ODONTASPIDAE
Subfam. ODONTASPINI
Genus *Carcharias*
C. tricuspidatus
31. Lateral keel on tail present : upper lobe of caudal not produced Subfam. LAMNINI
Genus *Isurus*, 33
32. Lateral keel on tail absent : upper lobe of caudal fin extraordinarily produced Subfam. ALOPIINI
Genus *Alopias*
A. vulpinus
33. Teeth in 24 rows above and 22 below : lateral line keeled only along side of tail *I. glauca*
34. Teeth in 44 rows above and 56 below : lateral line keeled from behind eye over gill openings to side of tail *I. güntheri*
35. Head with oculonarial expansions Fam. SPHYRNIDAE
Genus *Sphyrna*, 97
36. Head without oculonarial expansions 37
37. Anal fin before second dorsal fin Fam. SCYLIORHINIDAE, 39
38. Anal fin opposite second dorsal fin Fam. CARCHARHINIDAE, 53
39. Anal and subcaudal close together Genus *Pentanchus*
Subgen. *Parapristurus*
P. (Parapristurus) investigatoris
40. Anal and subcaudal wide apart 41

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|---|-------|--|
| 41. Origin of first dorsal fin before pelvics | | Genus Proscyllium
<i>P. alcocki</i> |
| 42. Origin of first dorsal fin above or behind pelvics | | 43 |
| 43. Head depressed : teeth tri-pentacuspoid : anal base distinctly longer than second dorsal base | | Genus Scyliorhinus, 45 |
| 44. Head subcylindrically compressed : teeth tricuspoid : anal base equal to second dorsal base | | Genus Atelomycterus
<i>A. marmoratum</i> |
| 45. Labial fold usually absent; if present only in lower jaw | | Subgenus Scyliorhinus
<i>S. (Scyliorhinus) capense</i> |
| 46. Labial folds present in both jaws (except in <i>H. regani</i> Gilchrist & <i>H. punctatus</i> Gilchrist) | | Subgenus Halaelurus, 47 |
| 47. First dorsal larger than second dorsal | | <i>S. (Halaelurus) hispidum</i> |
| 48. First dorsal not larger than second dorsal | | 49 |
| 49. First dorsal smaller than second dorsal : nasal cirri well developed | | <i>S. (Halaelurus) alcockii</i> |
| 50. First dorsal and second dorsal sub-equal, nasal cirri absent or rudimentary | | 51 |
| 51. Origin of first dorsal above middle of pelvic bases : transverse bands spotted with black | | <i>S. (Halaelurus) bürgeri</i> |
| 52. Origin of first dorsal a little in advance of hind ends of pelvic bases : transverse bands 20 or more, not spotted with black | | <i>S. (Halaelurus) quagga</i> |
| 53. Spiracle present | .. .. | 55 |
| 54. Spiracle absent | .. .. | 61 |
| 55. Caudal pit absent | .. | Genus Mustelus
<i>M. manazo</i> |
| 56. Caudal pit present | .. | 57 |
| 57. Teeth dimorphous; lower smooth or finely serrated | | 59 |
| 58. Teeth monomorphous : lower serrated on both edges | | Genus Galeocerdo
<i>G. cuvier</i> |
| 59. Lower teeth erect, not curved inwards; smooth | | Genus Chaenogaleus
<i>C. balfouri</i> |
| 60. Lower teeth curved inwards : finely serrated | | Genus Hemipristis
<i>H. elongatus</i> |

- snout : depth of body $4\frac{4}{5}$ —5.0
 in length from snout to subcaudal origin *C. commersonii*
83. Teeth in lower jaw serrated :
 D. F. $\frac{24-34}{23-31}$ 85
84. Teeth in lower jaw nonserrated :
 D. F. $\frac{24-28}{24-27}$.. *C. menisorrah*
85. Second dorsal distinctly smaller than anal 87
86. Second dorsal and anal subequal 89
87. Second dorsal and anal origins opposite : D. F. $\frac{34}{31}$ *C. limbatus*
88. Second dorsal origin behind anal origin : D. F. $\frac{25}{25}$ *C. sorrah*
89. Preoral length distinctly less than width of mouth 91
90. Preoral length more than or equal to width of mouth 93
91. All fins tipped with black : tail shorter than trunk : D. F. $\frac{25}{25}$ *C. spallanzani*
92. All fins not tipped with black : tail longer than trunk : D.F. $\frac{24-25}{24-26}$ *C. pleurotaenia*
3. Preoral length more than width of mouth : D.F. $\frac{24-25}{24-25}$ *C. dussumieri*
94. Preoral length equal to width of mouth : D.F. $\frac{25-31}{23-28}$ *C. bleekeri*
95. Snout pointed: labial folds present: both sides of upper teeth serrated: D. F. $\frac{27}{27}$... *H. macloti*
96. Snout rounded : labial folds absent: only outer sides of bases of upper teeth serrated : D.F. $\frac{29-32}{27-29}$ *H. hemiodon*
97. A groove along the front edge of head 99
98. No groove along the front edge of head *S. mokarran*
99. Oculonarial expansions short 101
100. Oculonarial expansions long *S. blochii*

101. Anterior edge of oculonarial expansions curved *S. tudes*
102. Anterior edge of oculonarial expansions straight *S. zygaena*
103. Body shark-like; dorsals each with or without spine Suborder *SQUALOIDEI*, 105
104. Body ray-like : dorsals without spine Suborder *SQUATINOIDEI* (not represented in the Indian region)
105. Dorsals each with a spine : snout not saw-like .. Fam. *SQUALIDAE*, 107
106. Dorsals without spine : snout saw-like Fam. *PRISIOPHORIDAE* (not represented in the Indian region)
107. Upper teeth as well as the lower with one cusp only : snout spatulate Genus *Centroscymnus*
C. rossi
108. Upper teeth with 3—7 cusps : snout depressed not spatulate Genus *Centroscyllium*
C. ornatum
109. Electric organs absent Order *RAJIFORMES*, 111
110. Electric organs present Order *TORPEDINIFORMES*
Fam. *TORPEDINIDAE*, 221
111. Disc narrow and elongate 113
112. Disc broad and expanded 139
113. Rostrum very much produced and saw-like Fam. *PRISTIDAE*
Genus *Pristis*, 131
114. Rostrum very short and not saw-like .. 115
115. Pectorals extending to end of snout : disc broader and more rounded .. Fam. *DISCOBATIDAE*
Genus *Zanobatus*
Z. schoenleinii
116. Pectorals not extending to end of snout : disc narrow and elongate Family *RHINOBATIDAE*, 117
117. Snout triangularly pointed: spiracles with folds on hind edge 119
118. Snout blunt, broad and rounded : spiracles without folds on hind edge Genus *Rhina*
R. ancylostomus
119. Origin of first dorsal distinctly nearer to tip of snout than to tip of caudal .. Genus *Rhynchobatus*
R. djiddensis

120. Origin of first dorsal distinctly nearer to tip of caudal than to tip of snout .. Genus *Rhinobatos*, 121
121. Snout long, pointed : interspiracle 3·3—3·8 in snout 123
122. Snout short, bluntly or obtusely pointed : interspiracle 2·5-2·9 in snout .. 127
123. Snout expanded at tip .. *R. thouin*
124. Snout not expanded at tip 125
125. Length of nostril equal to internarial, twice width of mouth: interspiracle 3·8 in snout *R. granulatus*
126. Length of nostril greater than internarial, less than twice width of mouth : interspiracle 3·3 in snout *R. typus*
127. Snout obtusely pointed : interspiracle 2·6 in snout : length of nostril equal to internarial, twice width of mouth .. *R. obtusus*
128. Snout not obtusely pointed: interspiracle 2·5—2·9 in snout : length of nostril greater than internarial, less than twice width of mouth 129
129. Base of first dorsal $2\frac{1}{4}$ — $2\frac{2}{5}$ in interdorsal: space between rostral ridges rather narrow: series of spines in the dorsal median line *R. annandalei*
130. Base of first dorsal $2\frac{4}{5}$ in interdorsal: space between rostral ridges broader : minute tubercles in the dorsal median line *R. lionotus*
131. First dorsal origin distinctly behind or opposite pelvic origin : rostral teeth more in number, 23—35 on either side 133
132. First dorsal origin clearly in front of pelvic origin : rostral teeth less in number, 17—20 on either side *P. microdon*
133. Subcaudal lobe present 135
134. Subcaudal lobe absent 137
135. Subcaudal lobe well developed, pointed *P. cuspidatus*
136. Subcaudal lobe moderately developed, rounded *P. annandalei*
137. First dorsal origin opposite pelvic origin .. *P. pectinatus*

138. First dorsal origin behind pelvic origin *P. zysron*
139. Tail whip-like : dorsal reduced to spines .. 149
140. Tail not whip-like, without spines: two small dorsals Fam. RAJIDAE
Genus *Raja*, 141
141. Snout about 3·0—3·5 times interorbital: dorsals close together 143
142. Snout about 4·0—5·0 times interorbital: dorsals widely separated by a distance about the length of the base of first dorsal 145
143. A single row of prominent spines on tail *R. mamillidens*
144. More than one row (*i.e.*, 3 rows) of prominent spines on tail *R. reversa*
145. A single row of spines on tail; second dorsal fin situated away from tip of caudal fin by a distance equal to bases of both dorsals *R. johannis-davisi*
146. More than one row of spines on tail (*i.e.*, 3 rows): second dorsal fin nearer to tip of caudal fin by a distance equal to or less than the base of first dorsal fin 147
147. Interdorsal space equal to or longer than base of first dorsal fin: no prominent rostral spines *R. powelli*
148. Interdorsal space half of the base of first dorsal fin: prominent rostral spine *R. andamanica*
149. Head distinct from disc with a prominent snout 195
150. Head not distinct from disc, without prominent snout Fam. DASYATIDAE, 151
151. Tail shorter than length of disc: disc twice as broad as long Genus *Gymnura*, 153
152. Tail as long as or much longer than the length of disc: disc not twice as broad as long 159
153. A small dorsal cutaneous fold on tail .. Subgenus *Aetoplatea*, 155
154. No dorsal cutaneous fold on tail Subgenus *Gymnura*, 157
155. Tentacles behind spiracles *G. (Aetoplatea) tentaculata*
156. No tentacles behind spiracles *G. (Aetoplatea) zonurus*
157. Tail as long as length of disc .. *G. (Gymnura) poecilura*
158. Tail less than half length of disc *G. (Gymnura) micrura*

159. Serrated caudal spine present :
body not profusely covered with
tubercles 161
160. Serrated caudal spine absent : body
profusely covered with tubercles. Genus **Urogymnus**
U. africana
161. Disc oval or circular Genus **Taeniura**, 163
162. Disc quadrangular Genus **Dasyatis**, 167
163. Mouth straight : 5 oral papillae :
disc circular *T. meyeri*
164. Mouth curved: 2 or 3 oral papillae:
disc oval or circular 165
165. Disc oval: 2 oral papillae: round
dark edged bluish spots *T. lymma*
166. Disc circular: 2 or 3 oral papillae :
round black spots *T. melanospilos*
167. Cutaneous fold on tail present. 185
168. Cutaneous fold on tail absent Subgenus **Himantura**, 169
169. 2 buccal processes 171
170. 4 buccal processes 177
171. Tail more than 3 times the length
of disc *D. (Himantura) bleekeri*
172. Tail less than 2.5 times the length
of disc 173
173. Disc broader than long: tail 2.3
times the length of disc *D. (Himantura) marginatus*
174. Disc longer than broad or as long
as broad 175
175. Tail 1.8 times the length of disc :
eyes 6.0 times in interorbital *D. (Himantura) fавus*
176. Tail less than 1.5 times the length
of disc : eyes 3.3 times in inter-
orbital *D. (Himantura) walga*
177. Tail short nearly as long as length
of disc *D. (Himantura) microps*
178. Tail long exceeding the length of
disc 179
179. Tail banded 181
180. Tail not banded 183
181. Teeth 25—38 rows in both jaws *D. (Himantura) uarnak*
182. Teeth 13 rows in upper and 23 in
lower jaw *D. (Himantura) gerrardi*
183. Eyes 4.6 in interorbital : snout
4.2 in length of disc *D. (Himantura) alcockii*
184. Eyes 2.1 in interorbital : snout 5.8
in length of disc *D. (Himantura) jenkinsii*

185. Cutaneous fold either above or below tail 191
186. Cutaneous folds both above and below tail Subgenus *Amphotistius*, 187
187. 2 buccal processes 189
188. No buccal processes *D. (Amphotistius) zugei*
189. Tail short, scarcely as long as length of disc *D. (Amphotistius) imbricata*
190. Tail long exceeding length of disc *D. (Amphotistius) kuhlii*
191. A ventral cutaneous fold on tail Subgenus *Pastinachus*, 193
192. A dorsal cutaneous fold on tail Subgenus *Dasyatis*
D. (Dasyatis) pastinaca
193. Cutaneous fold on tail well developed, broad, 4 times the length of caudal spine *D. (Pastinachus) sephen*
194. Cutaneous fold on tail not well developed, narrow about as long as length of caudal spine *D. (Pastinachus) bennetti*
195. With horn-like cephalic flippers Fam. MOBULIDAE, 197
196. Without horn-like cephalic flippers Fam. MYLIOBATIDAE, 205
197. Mouth inferior, well behind head : dental plate in both jaws or at least in the upper : cephalic horns curled Genus *Mobula*, 199
198. Mouth terminal, in front of head : dental plate usually on lower jaw and sometimes in both jaws : cephalic horns rarely curled Genus *Manta*
M. ehrenbergii
199. A serrated caudal spine : tail more than twice the length of disc *M. mobular*
200. No serrated caudal spine : tail less than twice the length of disc 201
201. Teeth in $\frac{140}{140}$ rows; termination of disc between cephalic horns straight *M. thurstoni*
202. Teeth in $\frac{44-80}{54-95}$ rows: termination of disc between cephalic horns curved 203
203. Dorsal origin before pelvic origin; teeth in $\frac{60-80}{95}$ rows *M. diabolus*
204. Dorsal origin nearly opposite to pelvic origin : teeth in $\frac{44}{54}$ rows. *M. kuhlii*
205. Unilobed snout 211
206. Bilobed snout Genus *Rhinoptera*, 207
207. Teeth in 9 rows in upper jaw 209

208. Teeth in 7 rows in upper jaw *R. javanica*
209. Teeth in 9 rows in lower jaw *R. sewelli*
210. Teeth in 7 rows in lower jaw *R. adspersa*
211. Teeth in several rows of which the lateral ones narrower than the central : caudal spine absent Genus *Aetomylus*, 213
212. Teeth in single broad series : caudal spine present Genus *Aetobatus*, 219
213. Origin of dorsal fin behind ends of pelvic bases *A. maculatus*
214. Origin of dorsal fin opposite ends of pelvic bases 215
215. Orbital horns present *A. nichofii cornifera*
216. Orbital horns absent 217
217. About 5 blue cross bands on disc : spiracles twice eye *A. nichofii nichofii*
218. Green brown edged ocelli on hind part of disc: spiracles about the size of eye *A. milvus*
219. Snout conical, bluntly pointed as broad as or broader than long at base, 1·3 times width of mouth: spotted closely with small dark edged spots : dorsal end not reaching pelvic ends *A. ocellatus*
220. Snout straight, pointed, longer than broad at base, 1·8 times width of mouth : uniform or spotted with whitish : dorsal end reaching pelvic ends *A. flagellum*
221. Two dorsals 223
222. One dorsal 233
223. Origin of first dorsal opposite pelvics 229
224. Origin of first dorsal distinctly behind pelvics Genus *Narcine*, 225
225. Brown spotted above 227
226. Uniform brown above *N. brunnea*
227. Teeth in 27 rows in upper jaw and 26 in lower jaw *N. maculata*
228. Teeth in 23 rows in upper jaw and 21 in lower jaw *N. timlei*
229. Disc elongate : eyes rudimentary. Genus *Benthobatis*
B. moresbyi
230. Disc broad, subcircular: eyes well developed Genus *Torpedo*, 231
231. Body speckled with small light blotches : teeth in 18 rows *T. panthera*

232. Body variably speckled with irregular large and small dark spots: teeth in 20 rows *T. sinus persici*
233. Pectorals, pelvics and eye poorly developed
Genus *Bengalichthys*
B. impennis
234. Pectorals, pelvics and eye well developed
Genus *Narke*
N. dipterygia
235. Claspers simple: head with proboscis or beak
Fam. RHINOCHIMAERIDAE, 237
236. Claspers trifid or bifid: head without proboscis or beak
Fam. CHIMAERIDAE
Genus *Chimaera*
C. monstrosa
237. Snout compressed: upper caudal edge spinose: egg-capsule black: patch of byssus large (14 sq. mm.)
Genus *Rhinochimaera*
Rhinochimaera sp.
238. Snout depressed: upper caudal edge not spinose: egg-capsule pale bottle green: patch of byssus small (7.5 sq. mm.) ..
Genus *Harriotta*
H. indica

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PLATE I

Map of the 'Indian region' : limits of sea area demarcated by dotted line for marine fishes.

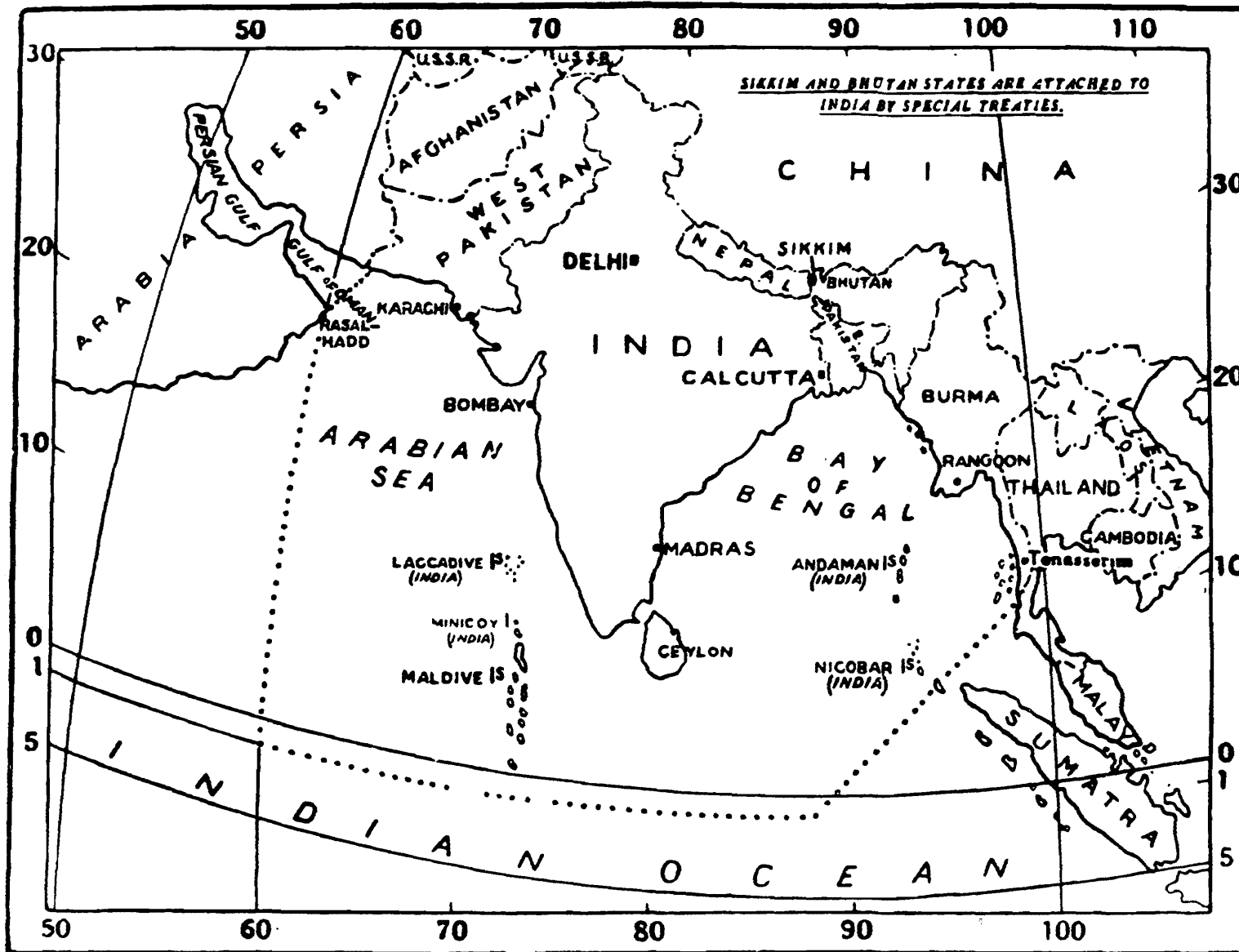


PLATE I

PLATE II

Map showing the mean annual surface isotherms of 6°C.,
12°C., 20°C. and beyond 6°C. in the Indian, Pacific,
Atlantic, Arctic and Antarctic Oceans : modi-
fied from fig. 98 of Mr. J. R. Norman's
A History of Fishes, p. 255, 1949.

PLATE II

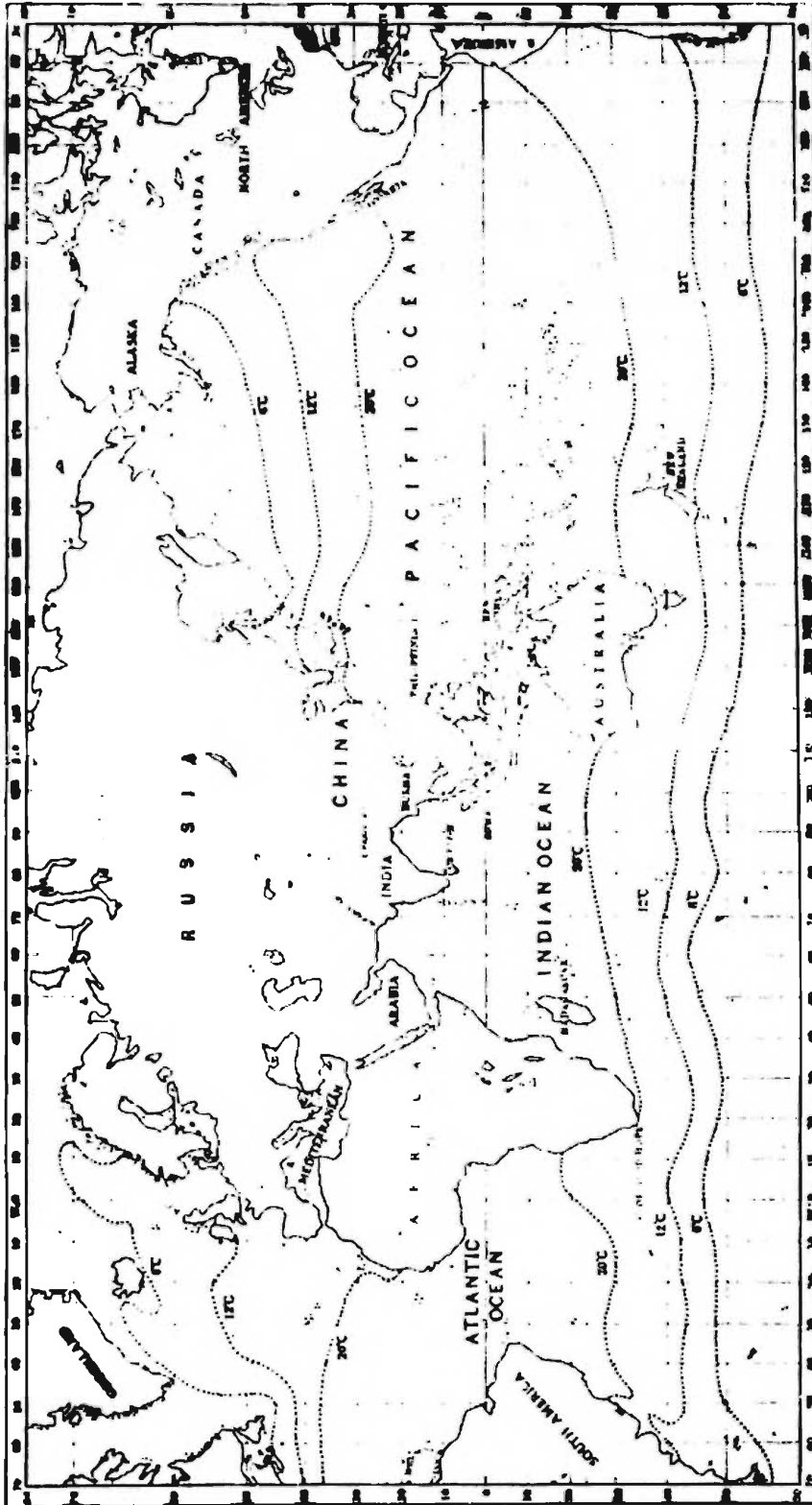


PLATE III

Map showing land distribution and the Great Island sea
in the Eocene : Eocene coast lines indicated by thick lines
and the present coast lines by thin lines.

(*After A. Alcock, compiled from Pl. II of Dr. Ernst Koken's
Die Yorweit und ihre Entwicklungsgeschichte*)

PLATE III

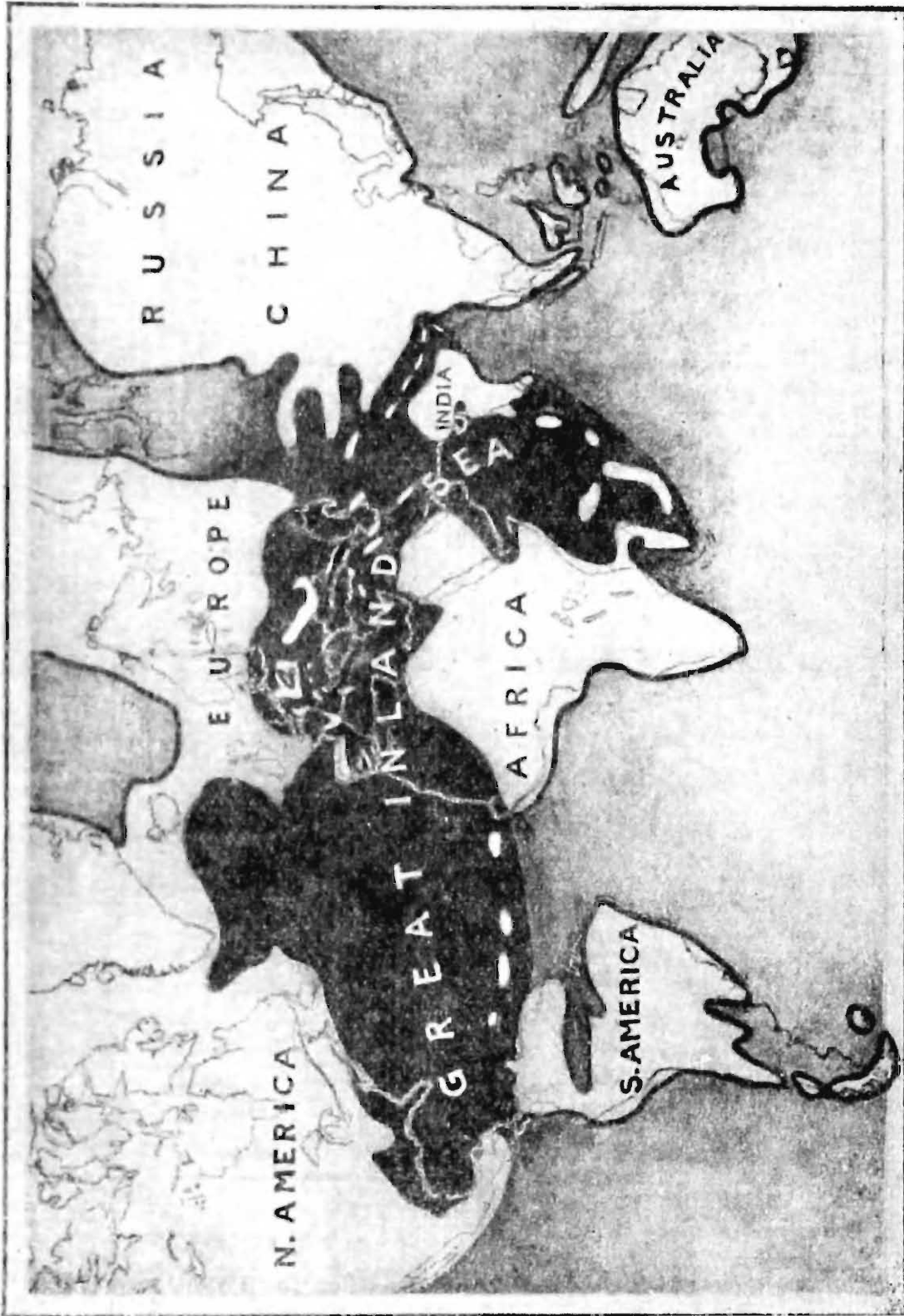


PLATE IV

Proscyllium alcocki Misra

- Fig. 1. Lateral view $\times ca \frac{4}{5}$.
Fig. 2. Ventral view of head : $\times ca \frac{3}{7}$.
Fig. 3. Tooth of upper jaw : $\times ca 79$.
Fig. 4-8s Teeth of lower jaw : $\times ca 79$.
Fig. 9. Scale : $\times ca 79$.

(After K.S. Misra)

PLATE IV

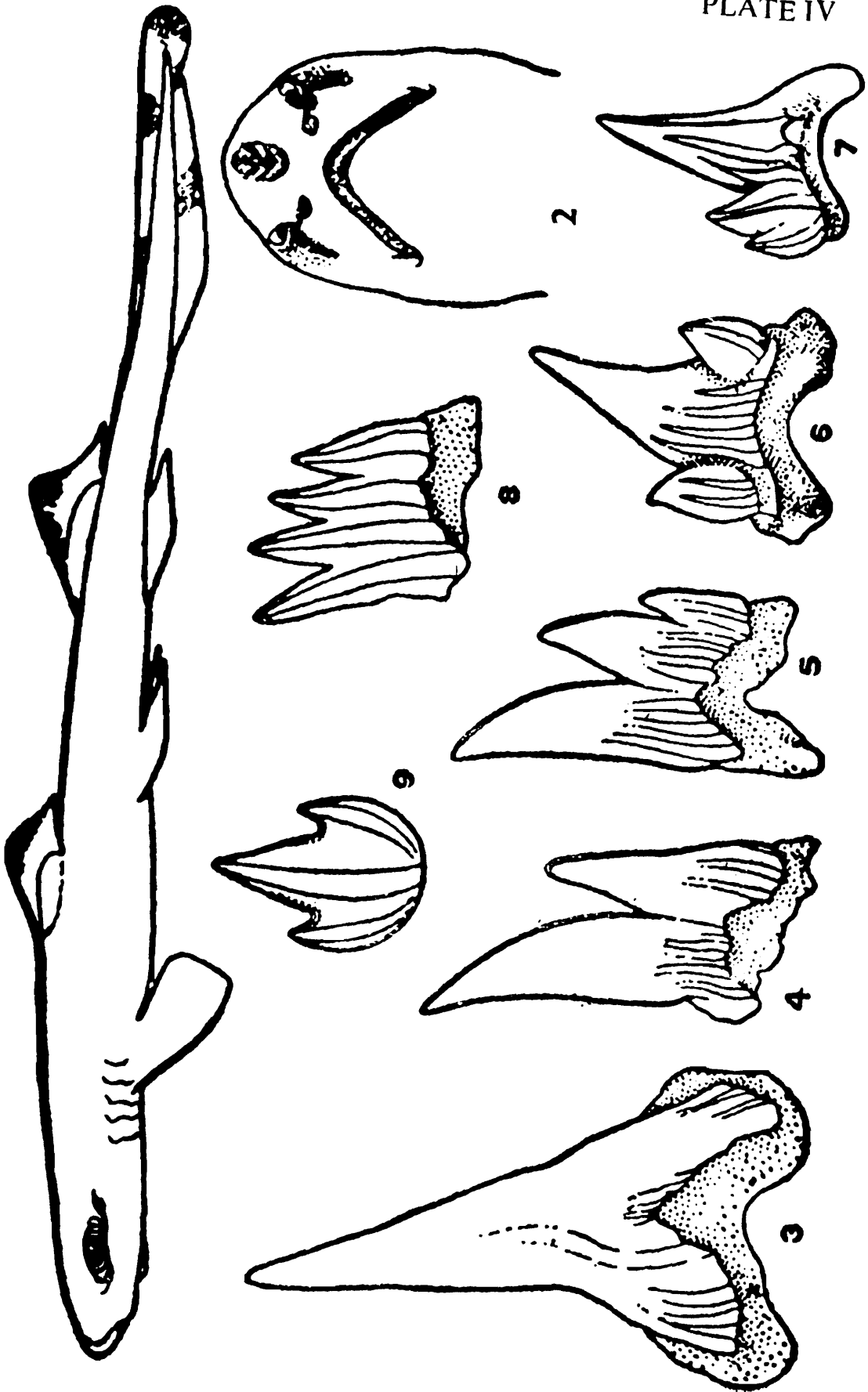


PLATE V

Pentanchus (Parapristurus) investigatoris Misra

Fig. 1. Lateral view : $\times ca \frac{3}{4}$.

Fig. 2. Ventral view of head : $\times ca \frac{3}{4}$.

Fig. 3. Upper and lower jaws with teeth : $\times ca \frac{1}{4}$.

Fig. 4. Tooth of upper jaw : $\times ca 25$.

Fig. 5. Tooth of lower jaw : $\times ca 25$.

(After K.S. Misra)

PLATE V

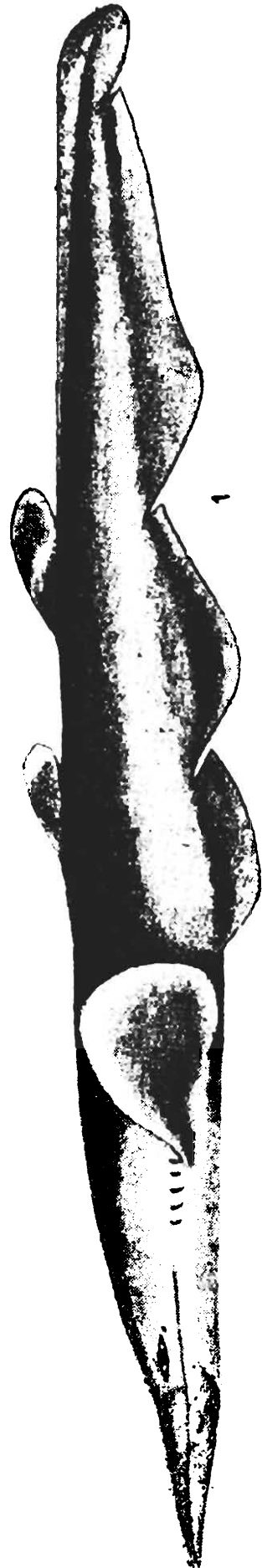
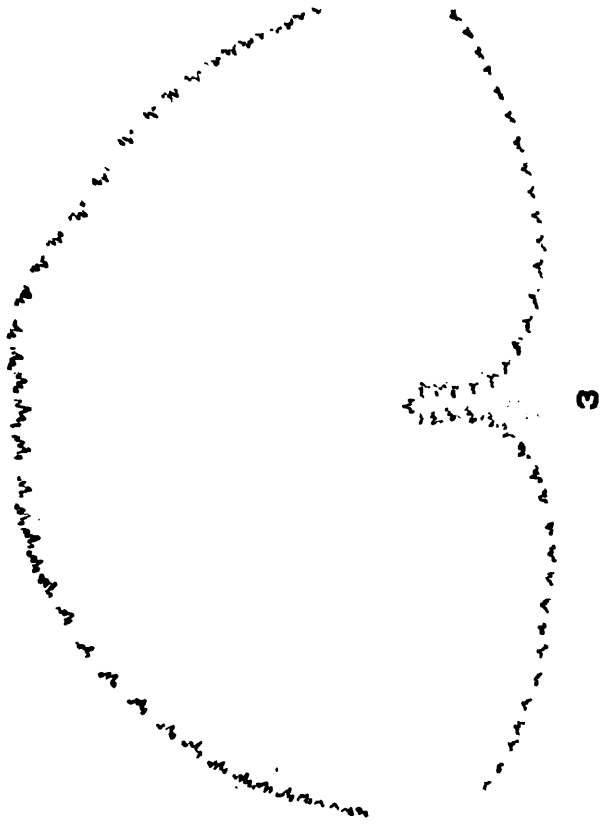
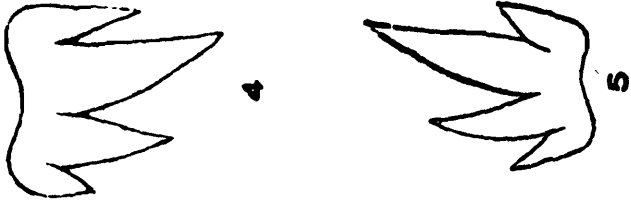


PLATE VI

Lateral view of *Carcharhinus bleekeri* (Dumeril) : $\times ca \frac{2}{3}$.
(After K. S. Misra)

PLATE VI

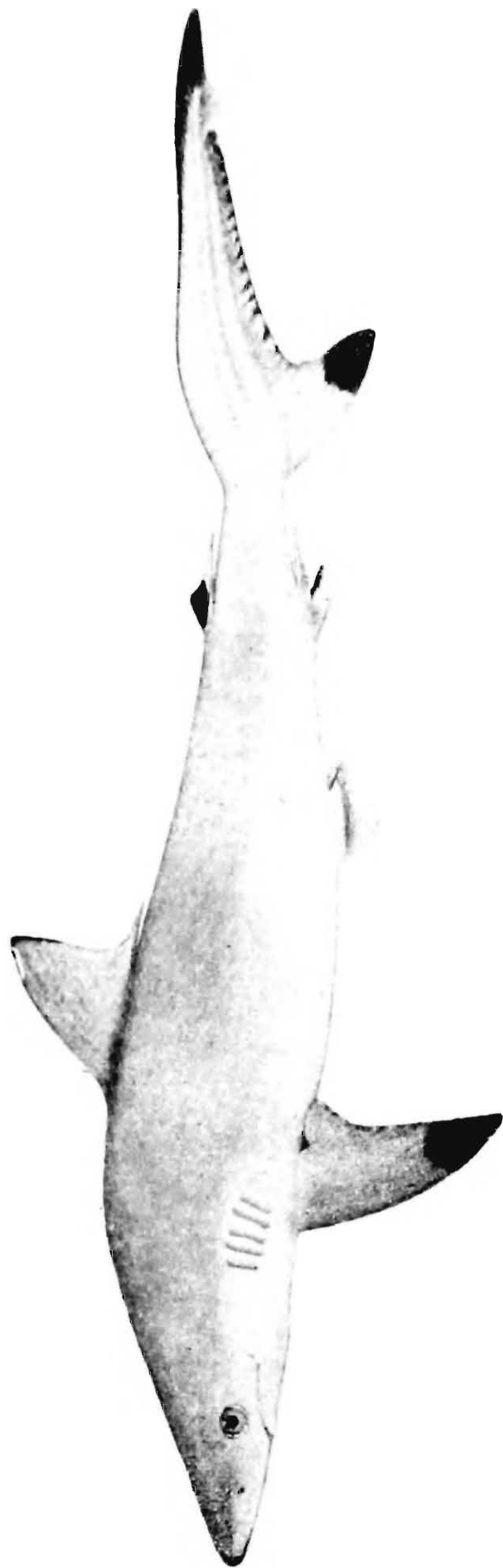


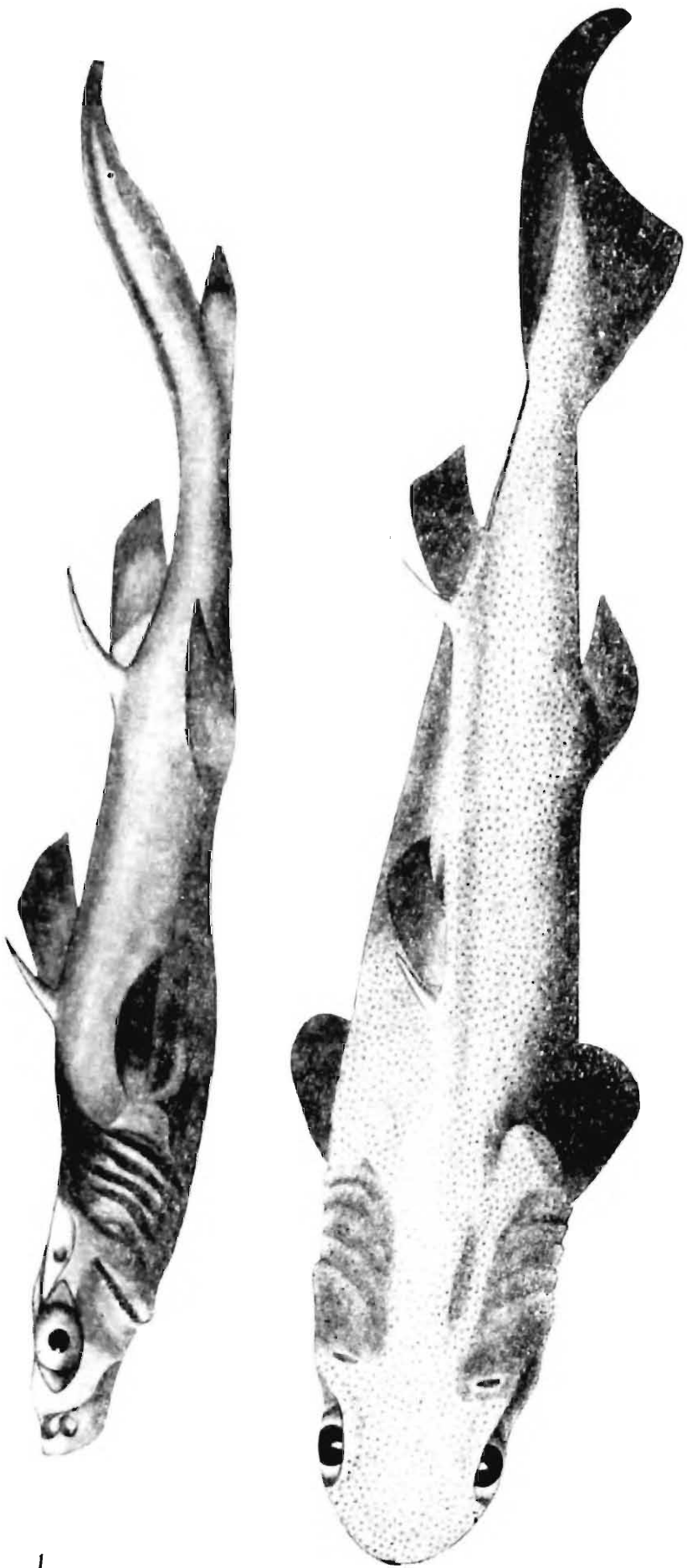
PLATE VII

Centroscyllium ornatum (Alcock)

(Both figures delineated from defective type as
caudal notch is not shown).

Fig. 1. Lateral view: $\times ca 1\frac{1}{4}$.

Fig. 2. Dorsal view: $\times ca \frac{2}{3}$.
(*After* A. Alcock)



1

2

PLATE VIII

- Fig. 1. Dorsal view of *Raja andamanica* (Lloyd) : $\times ca \frac{3}{7}$.
(After R.E. Lloyd)
- Fig. 2. Dorsal view of *Raja powelli* Alcock : $\times \frac{1}{2}$.
(After R.E. Lloyd)

PLATE VIII

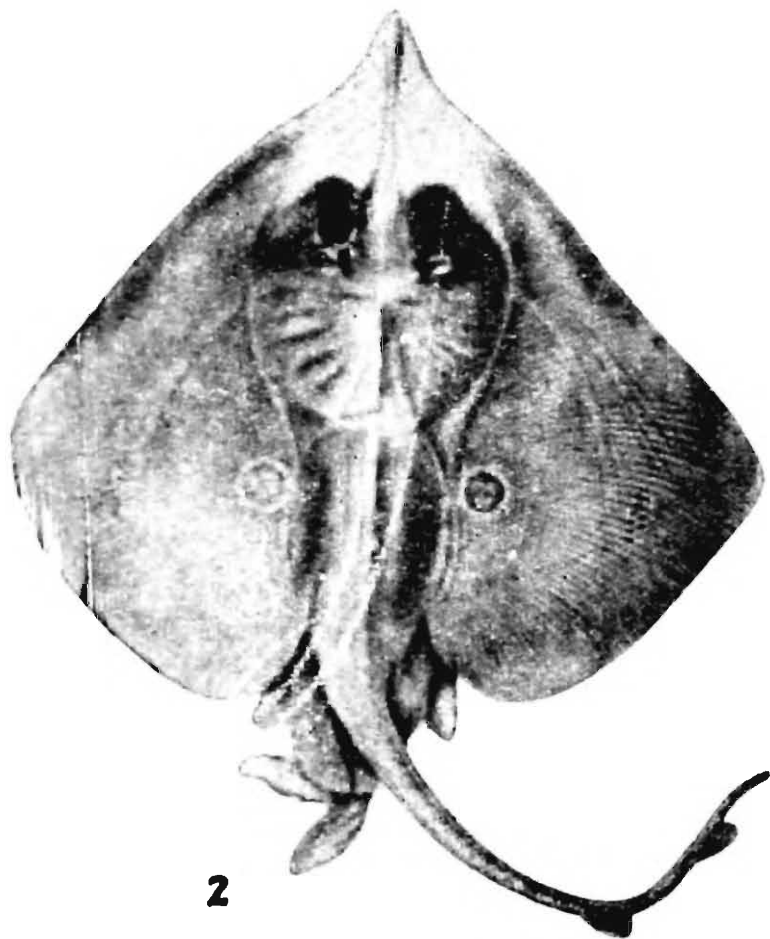
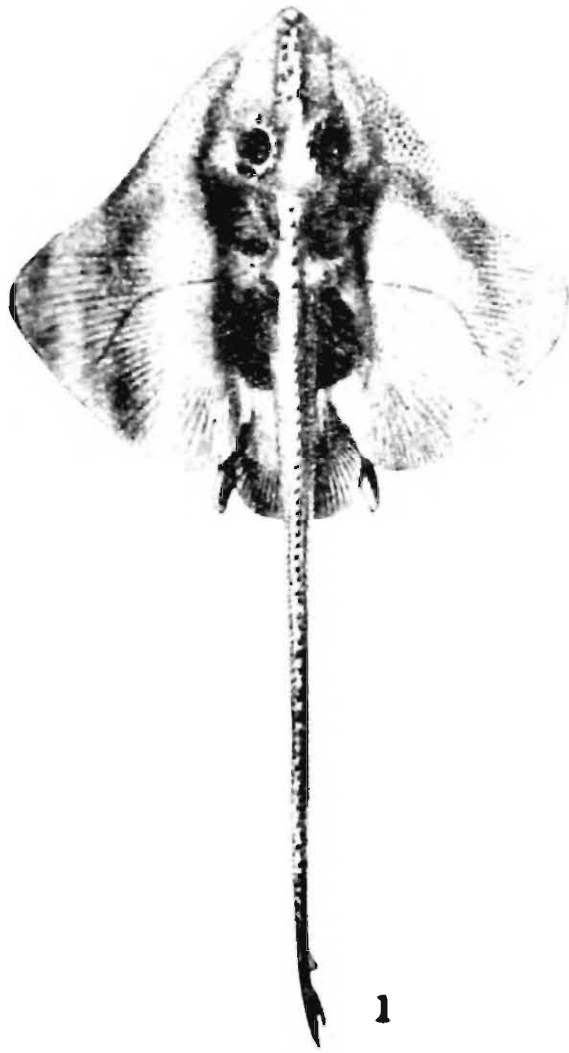


PLATE IX

Dorsal view of *Raja mamillidens* Alc. : $\times ca-\frac{5}{7}$.
(After A. Alcock)

PLATE IX

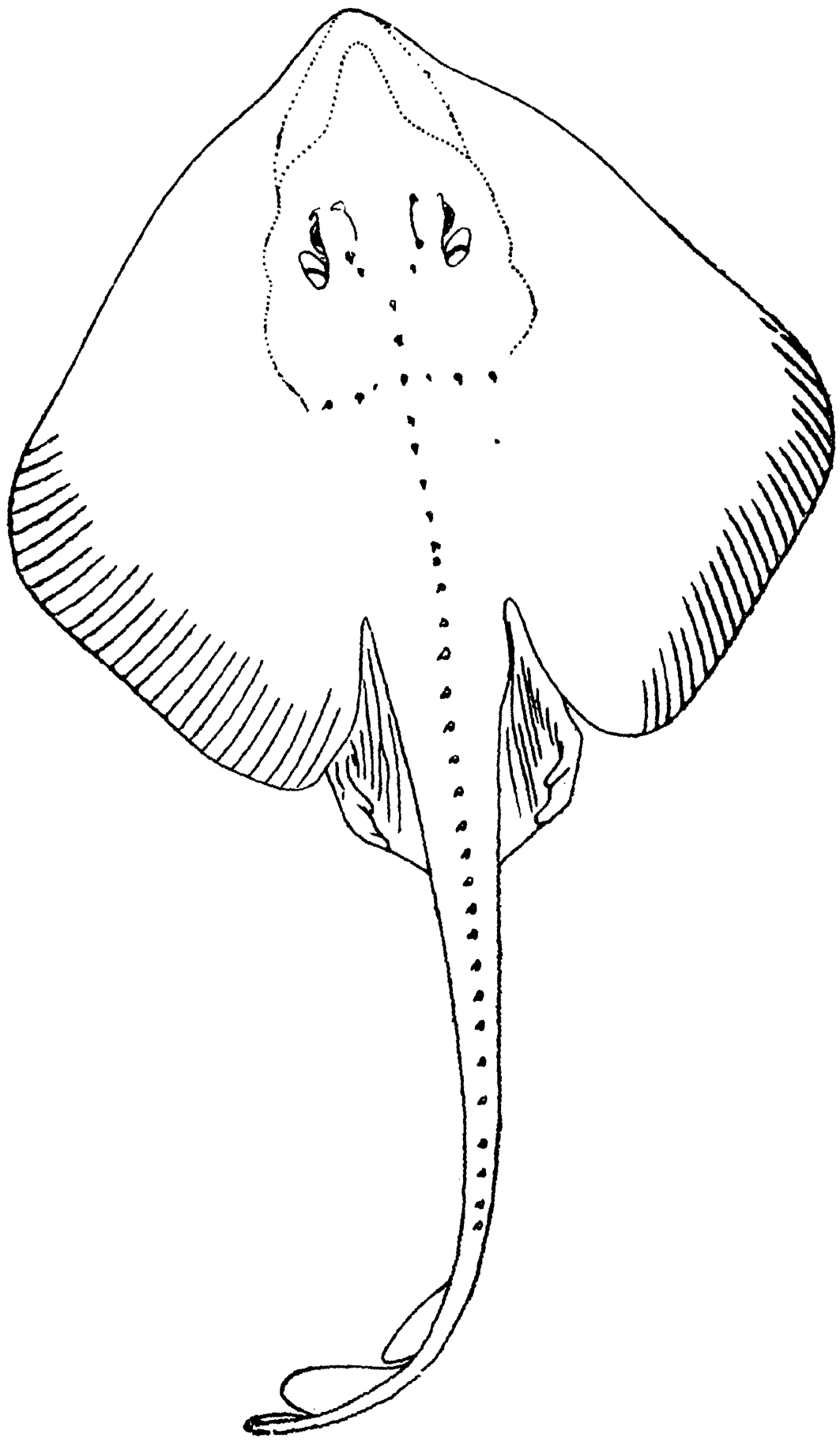


PLATE X

- Fig. 1. Dorsal view of *Raja reversa* Lloyd. : $\times ca\frac{1}{4}$.
(After R.E. Lloyd)
- Fig. 2. Mouth of *Taeniura lymma* (Forsk.). (After J.
Müller & F. Henle)
- Fig. 3. Dorsal view of *Taeniura melanospilos* Blkr. (After
J.L.B. Smith)

PLATE X

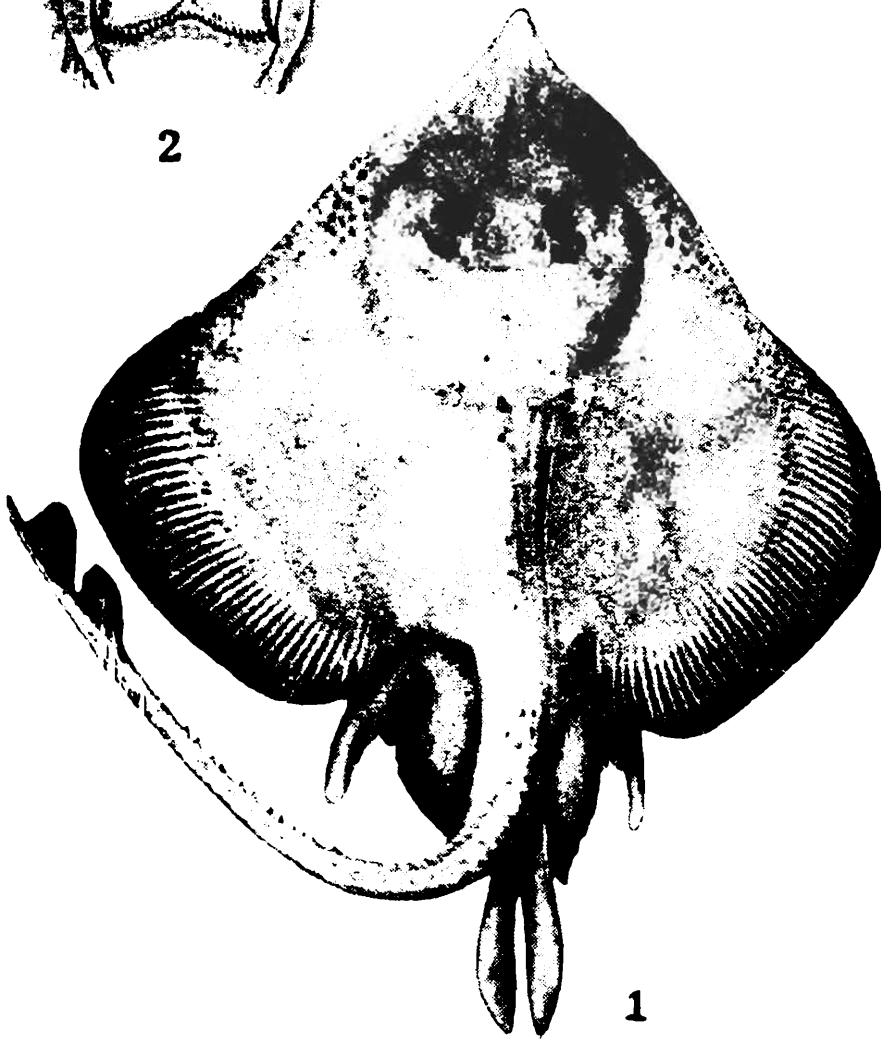
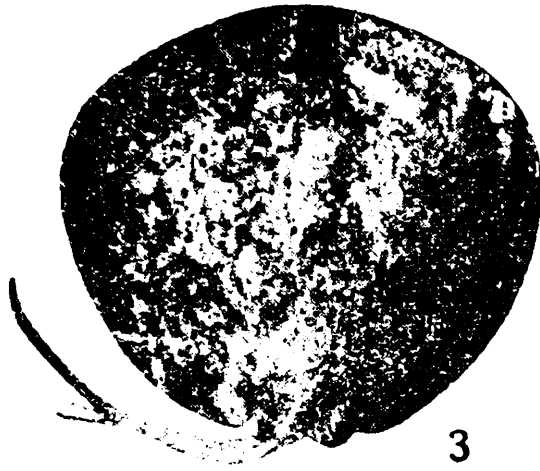
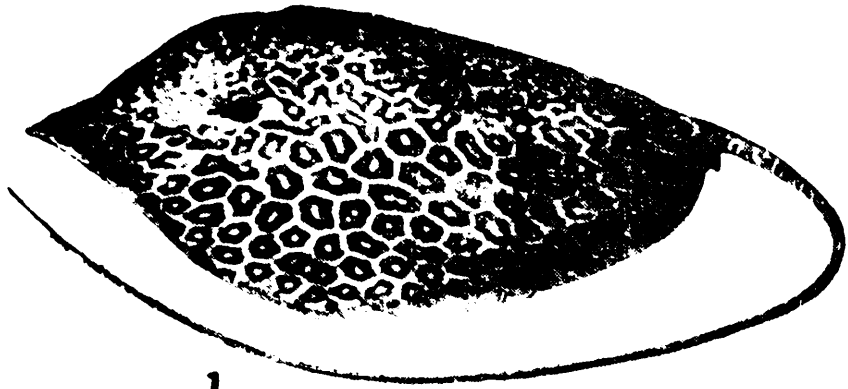
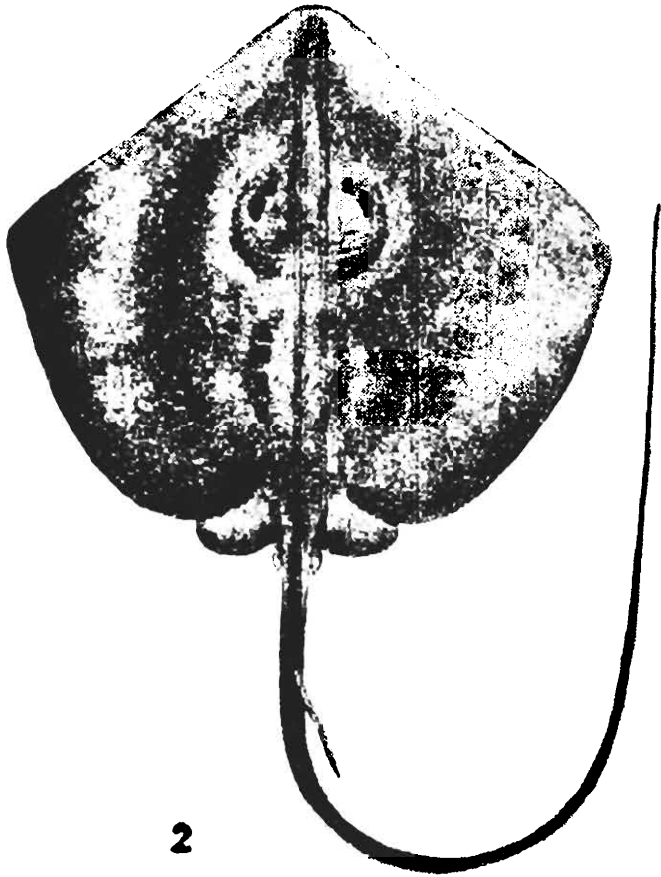


PLATE XI

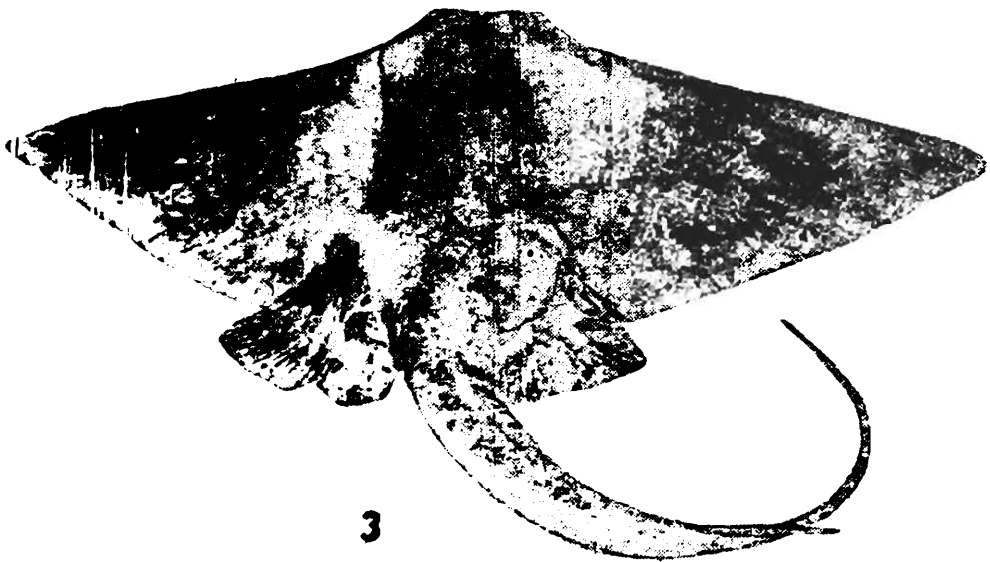
- Fig. 1. Photograph of type-specimen (♀) of *Dasyatis* (*Himantura*) *favus* (Annandale) : measuring 1320 mm. across disc. (*After* N. Annandale)
- Fig. 2. Dorsal view of *Dasyatis* (*Amphotistius*) *zugei* (M. & H.). (*After* J. Müller & F. Henle)
- Fig. 3. Photograph of type-specimen (♀) of *Dasyatis* (*Himantura*) *microps* (Annandale), measuring 1981 mm. across disc. (*After* N. Annandale)



1



2



3

PLATE XII

Dorsal view of *Urogymnus africana* (Schn.) : $\times ca \frac{1}{12}$.
(After K.S. Misra)

PLATE XII

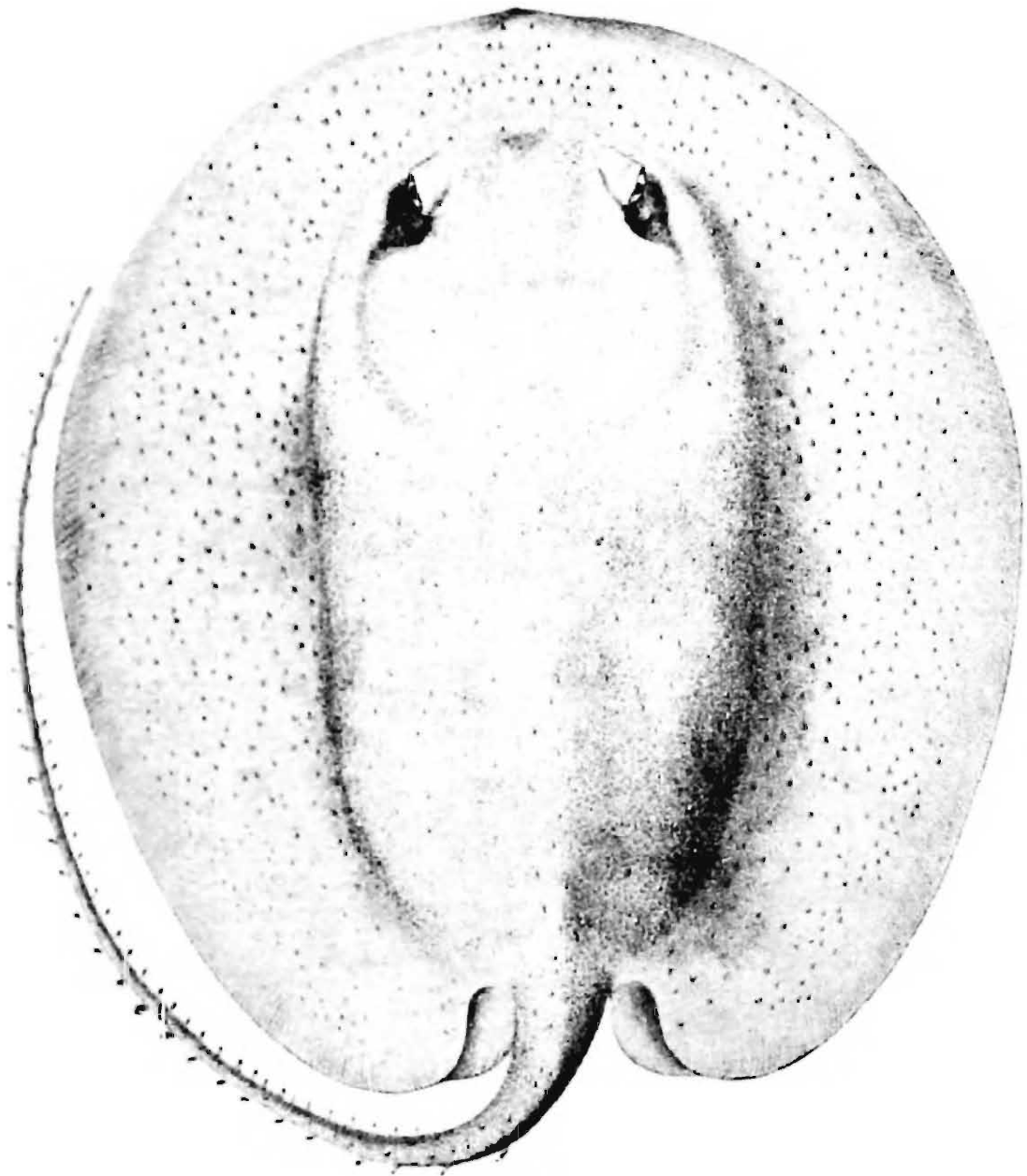


PLATE XIII

Ventral view of *Urogymnus africana* (Schn.) : $\times ca_{12}^1$.
(After K. S. Misra)

PLATE XIII

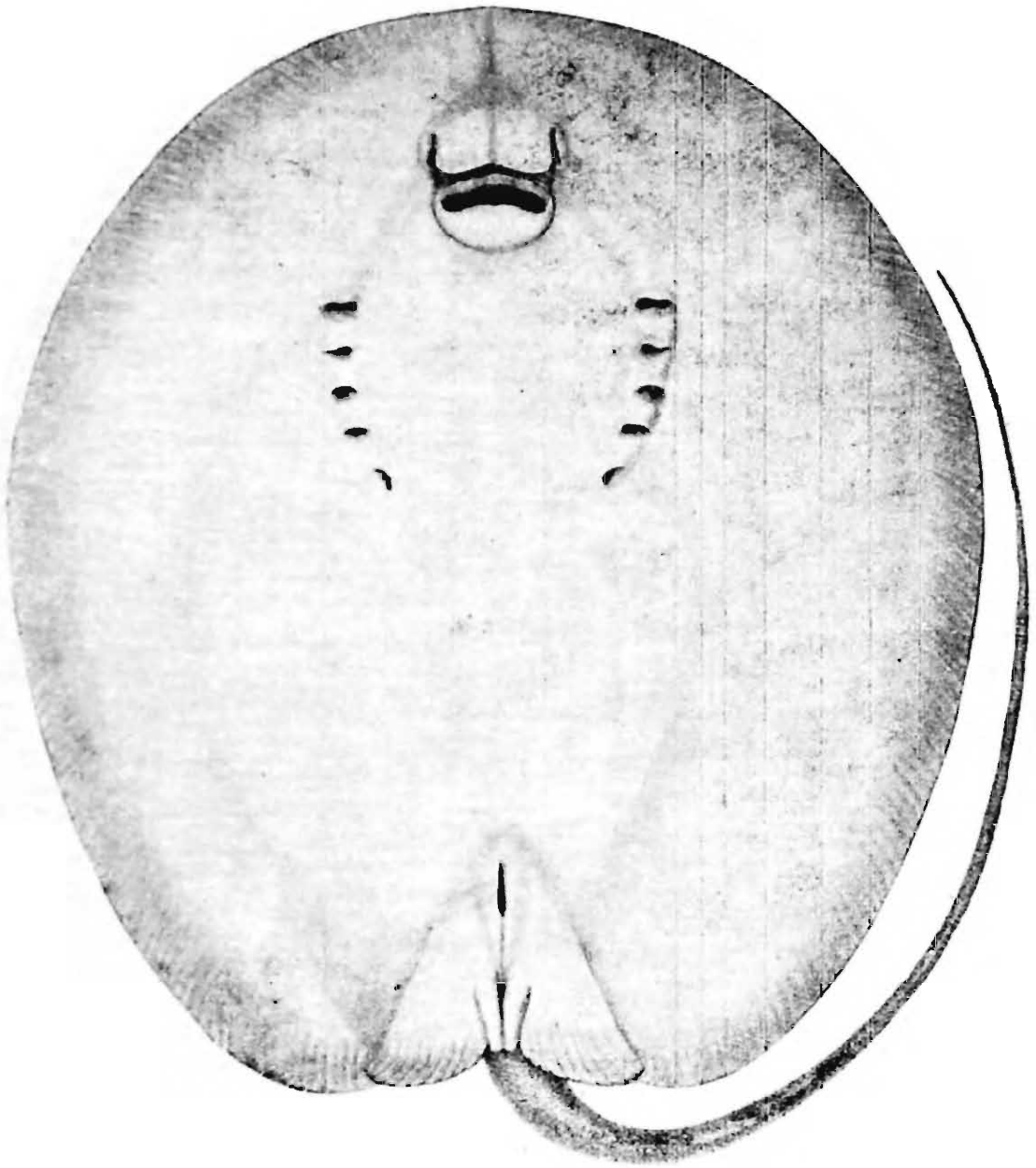


PLATE XIV

- Fig. 1. Dorsal view of *Aetomylus nichofii nichofii* (Schn.).
(After P. Russell)
- Fig. 2. Dorsal view of *Gymmura (Gymmura) poecilura*
(Shaw). (After P. Russell)

PLATE XIV

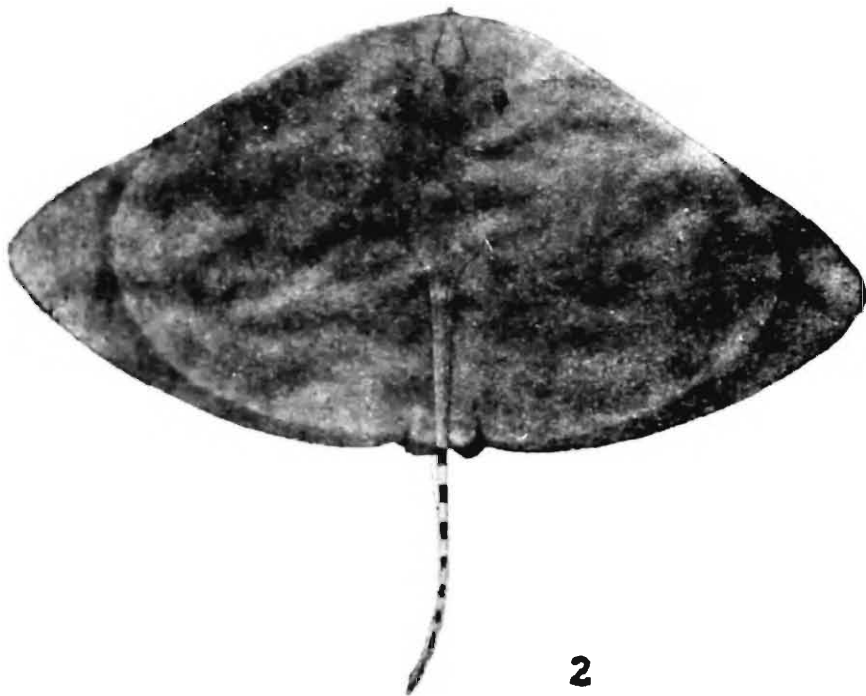


PLATE XV

Rhinoptera sewelli Misra.

- Fig. 1. Dorsal view : $\times \frac{1}{3}$.
Fig. 2. Ventral view of head : $\times \frac{1}{4}$.
Fig. 3. Dentition in upper and lower jaws : $\times \frac{3}{4}$.
(After K.S. Misra)

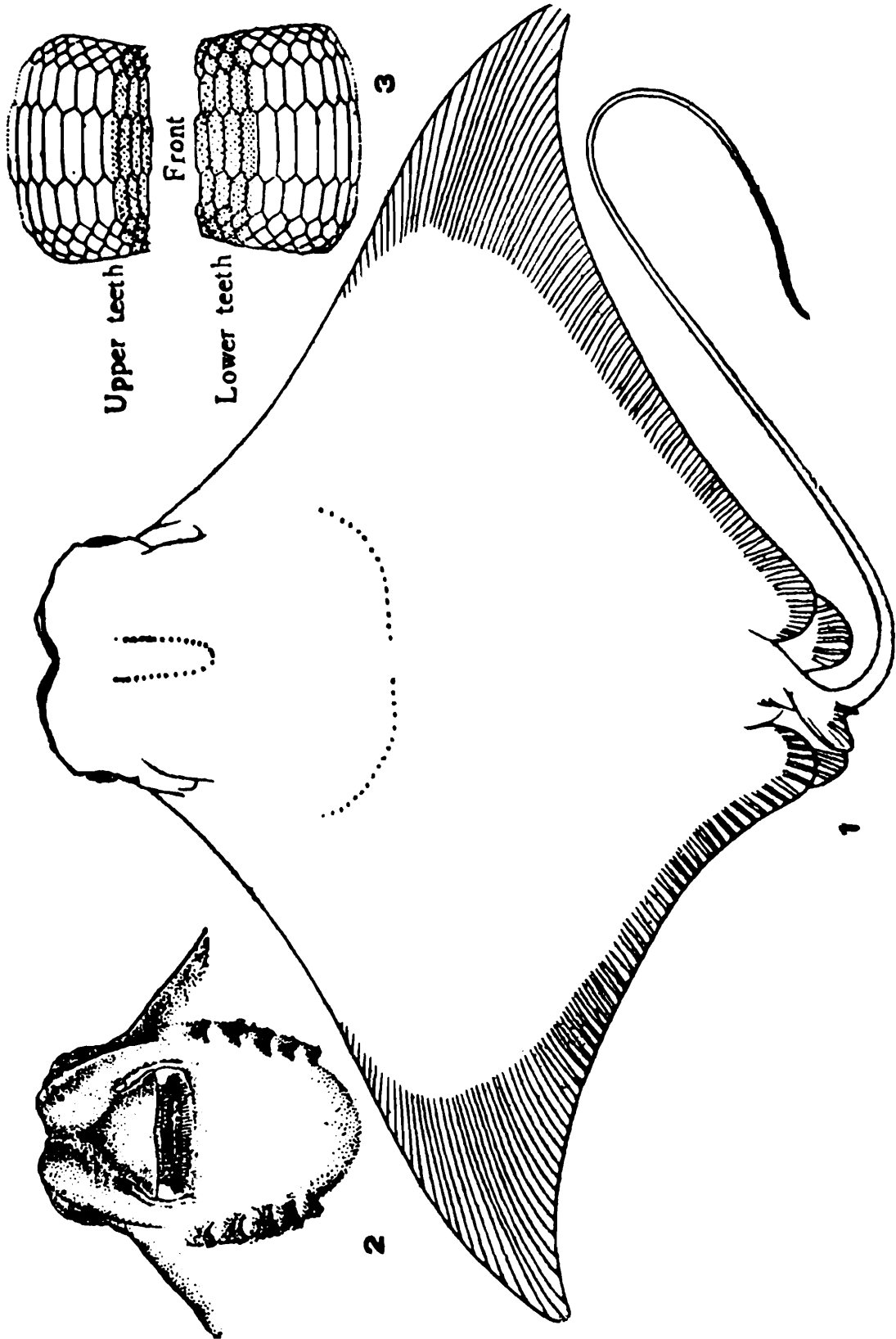


PLATE XVI

- Fig. 1. Ventral view of *Mobula diabolus* (Shaw). (After P. Russell)
- Fig. 2. Dorsal view of *Mobula diabolus* (Shaw). (After P. Russell)

PLATE XVI

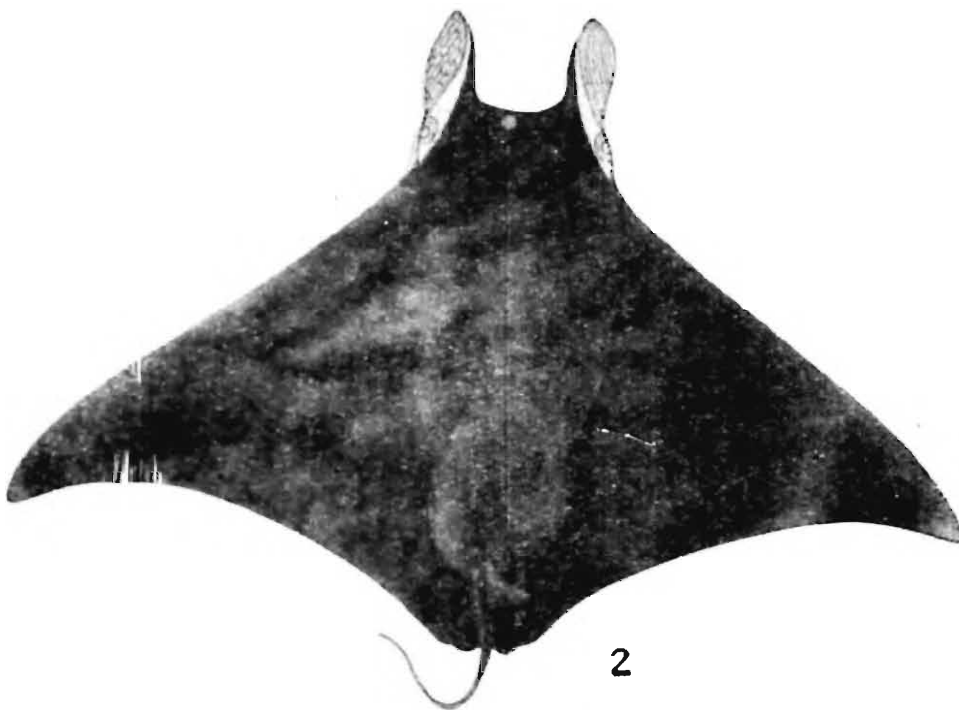
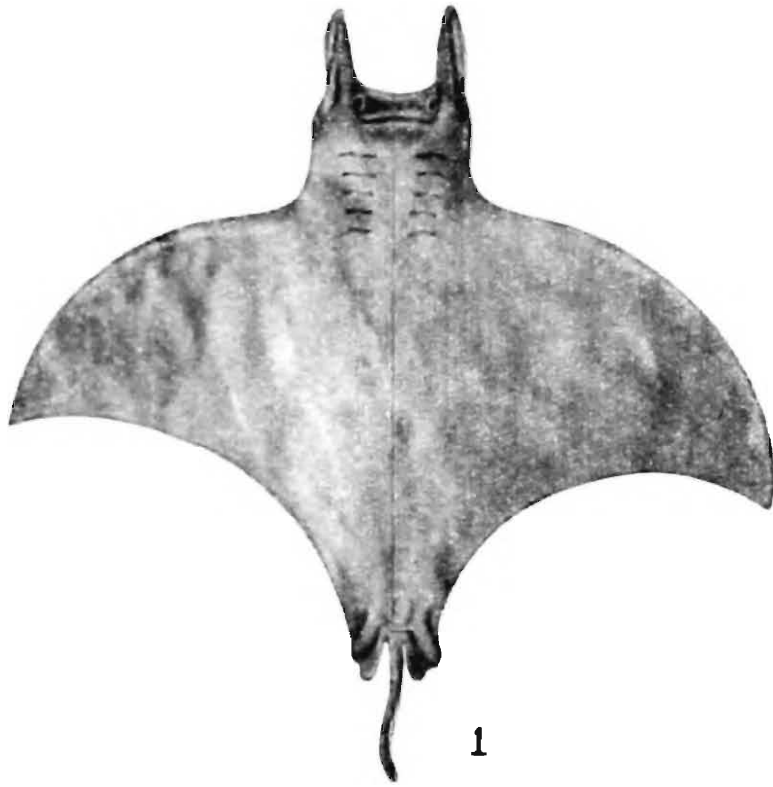


PLATE XVII

Dorsal view of dusky brown, black-spotted specimen of
Narcine maculata (Shaw). (After P. Russell)

PLATE XVII



PLATE XVIII

Dorsal view of white, black-spotted specimen of *Narcine maculata* (Shaw). (After P. Russell)

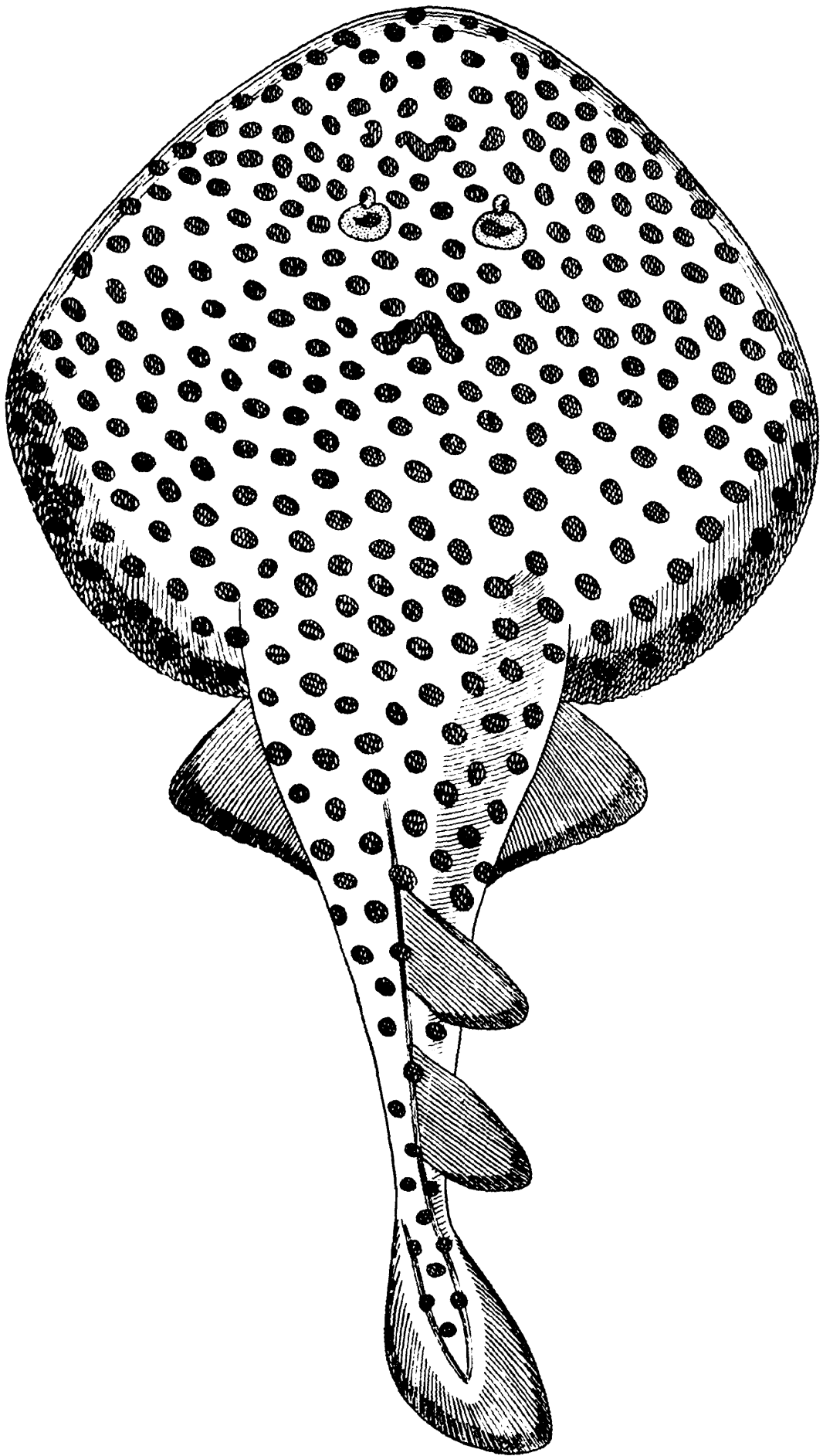
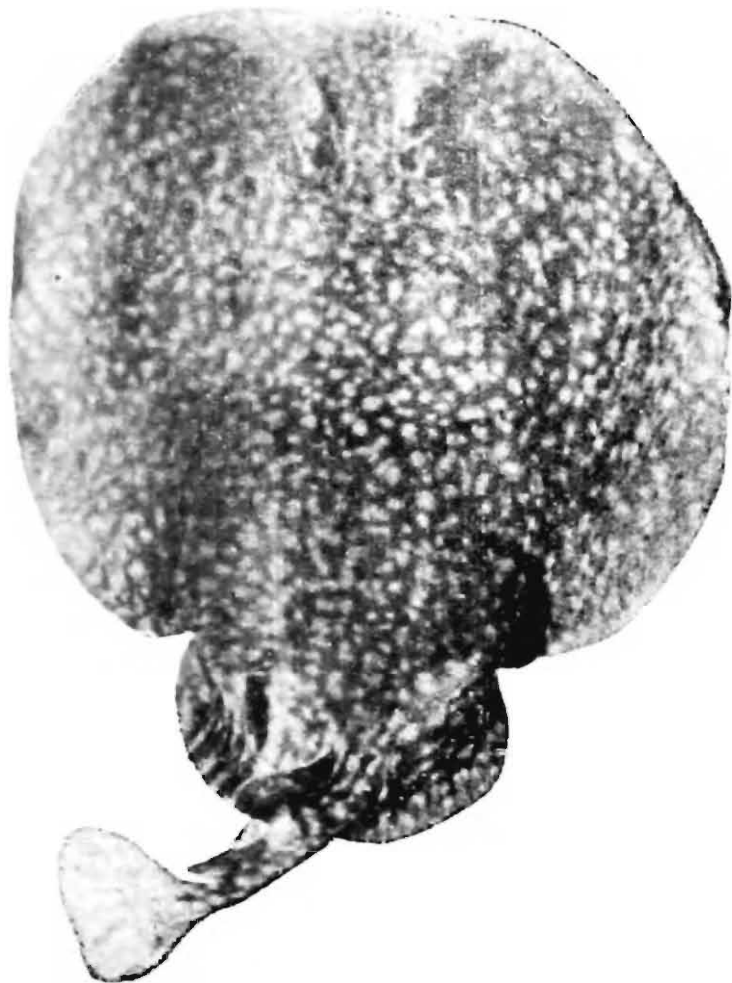


PLATE XIX

Dorsal view of *Torpedo panthera* Olfers : ca $\frac{1}{3}$. (After
N. Annandale)

PLATE XIX



LIST OF SOME ADDRESSES FROM WHERE THIS
PUBLICATION MAY BE HAD

Fauna of India Monographs

1. The High Commissioner for India,
India House,
London, W. C. 2 (England).
(For all enquiries and orders from Europe and America).
2. The Superintendent,
Printing and Stationery,
Allahabad (Uttar Pradesh).
3. Kitabistan,
17-A, Kamla Nehru Market,
Allahabad (Uttar Pradesh).
4. Standard Book Depot,
Avenue Road,
Bangalore (Mysore State).
5. International Book House (P.) Ltd.,
Bangalore (Mysore State).
6. The Superintendent,
State Government Press,
Bhopal (Madhya Pradesh).
7. The Superintendent,
Printing and Stationery,
Queens Road,
Bombay.
8. New Book Co.,
188-190, Hornby Road,
Bombay.
9. International Agencies,
195, Hornby Road,
Bombay.
10. Chakravarty, Chatterjee & Co., Ltd.,
15, College Square,
Calcutta (West Bengal).
11. Das Gupta & Co., Ltd.,
54/3, College Street,
Calcutta (West Bengal).
12. W. Newman & Co., Ltd.,
3, Old Court House Street,
Calcutta (West Bengal).
13. Oxford Book & Stationery Co.,
17, Park Street,
Calcutta-16 (West Bengal).
14. Thacker, Spink & Co. (1933) Ltd.,
Calcutta (West Bengal).
15. The Superintendent,
Government Printing and Stationery,
Chandigarh (Punjab).
16. The Press Officer,
Orissa Secretariat,
Cuttack (Orissa).
17. Manager of Publications,
Government of India,
Civil Lines,
Delhi-6.
18. Atma Ram & Sons,
Kashmiri Gate,
Delhi.
19. Director,
Government Press,
Hyderabad (Andhra Pradesh).
20. Soचना Sahitya Depot (State Book Depot),
Lucknow (Uttar Pradesh).
21. The Superintendent,
Government Press,
Mount Road,
Madras.

- | | |
|---|---|
| <p>22. The Superintendent,
Government Printing,
<i>Nagpur</i> (Maharashtra).</p> <p>23. Oxford Book & Stationery
Co.,
Scindia House,
<i>New Delhi</i>.</p> <p>24. Ram Krishna & Sons,
13/13, Connaught Place,
<i>New Delhi</i>.</p> <p>25. The Superintendent,
Government Printing,
<i>Patna</i> (Bihar).</p> | <p>26. The Superintendent,
Assam Secretariat Press,
<i>Shillong</i> (Assam).</p> <p>27. The Superintendent,
Government Press,
<i>Simla</i> (Himachal Pradesh).</p> <p>28. The Kashmir Bookshop,
Residency Road,
<i>Srinagar</i> (Jammu and Kashmir).</p> <p>29. The Superintendent,
Government Press,
<i>Trivandrum</i> (Kerala).</p> |
|---|---|