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A CHECK LIST OF THE FISHES OF INDIA, BURMA & CEYLON

PART I. ELASMOBRANCHII AND HOLOCEPHALI.

By K. S. MISRA, D.Sc., F. Z. S., Assistant Zoologist, Zoological Survey of India, Kaiser Castle, Benares Cantt.

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FOREWORD.

In connection with some important enquiries it became necessary to study the distribution of Sharks and Rays in some parts of the Indo-Pacific Region. This could not be done without first ascertaining the correct scientific names of all the species occurring in this Region. The work, therefore, involved hunting through vast masses of literature. Complete synonymies of all the species had to be prepared in order to determine their up-to-date names and all locality-records noted for obtaining data for their distribution. The work, which was entrusted to Dr. K. S. Misra, was not only extremely laborious, but required intimate knowledge of rules and procedure of taxonomy.

In the information thus collected, complete data for all the species of Sharks, Skates, Rays and Chimaeras occurring in India, Burma and Ceylon became available and it was felt that if this information could be published, in a condensed form, it would prove useful to workers on Fish and Fisheries. The scope was subsequently enlarged and the idea of preparing a complete Check List of the Fishes of India, Burma and Ceylon was taken up.

Although Day's *Fishes of India* and his two volumes in the *Fauna of British India Series* still remain monumental works on Indian Ichthyology, the names of the species included in these are in many cases out-of-date. Numerous enquiries are received in the Survey from Fisheries Departments, Universities and other institutions for supplying up-to-date scientific names of the species described in Day's works. Further, a great deal of work has been done on Indian fishes since Day's time, but unfortunately references to this work are very widely scattered in literature. The Check List is intended to bring together in a handy form these scattered references and to give the correct scientific names, locality-records and distributions of fishes occurring in India, Burma and Ceylon.

The boundaries of the area to be covered by the Check List were very carefully considered. Even though it was realized that any limits that may be fixed will be more or less arbitrary, it was necessary to lay down some definite lines, at least for the present work. For land and freshwater animals the boundaries of "India" had been previously defined by Blandford, but no guidance for fixing these limits for marine animals was available. Lt.-Col. R. B. Seymour Sewell, F.R.S., Editor in England of the *Fauna of British India Series*, was consulted and it was ultimately decided to fix the following limits :—

On the West, the Gulf of Oman and then from Ras el Haad southwards along Long. 60°E.; on the South, from Lat. 1°S., where it meets Long. 60°E., eastwards to the coast of Sumatra; on the East, the coast of Burma.

The southern limit has been fixed a little below the Equator so as 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 would be

included, but it was considered that the Strait of Malacca should be outside our area. At this end the limit has been left somewhat indefinite for the present, but an imaginary line connecting Victoria Point, at the southern end of the Burmese Coast, with the north-western tip of Sumatra would roughly demarcate the areas. The limits defined above are practically the same as those adopted by authors preparing volumes on marine animals in the *Fauna of British India Series*, the only important difference being that whereas Col. Sewell had suggested the eastern limit 100°E. , it was felt that this would extend our area a little too far east and would include parts, the fauna of which should be more appropriately included in the Malayan Region.

The first part of the "Check List" deals with the Elasmobranchii and the Holocephali, or the Sharks, Skates, Rays and Chimaeras of India, Burma and Ceylon. Dr. Misra has listed 109 species of these fishes from within this area, 106 of the Elasmobranchii and 3 of the Holocephali; Day recorded only 69 species of the former and none of the latter.

The first part of the Check List, in the form in which it is published, really represents only a small part of the work that Dr. Misra had to do in collecting the information on which it is based.

KAISER CASTLE,
Benares Cantt ;
1946.

B. N. CHOPRA,
Offg. Director,
Zoological Survey of India.

INTRODUCTION

Since the publication of Day's two volumes on fishes in the *Fauna of British India Series* in 1889, numerous papers have been written on Indian fishes which are scattered in different publications. The preparation of this list, which is intended to be published in several parts, has been undertaken with the object of bringing together the widely scattered data on the fishes of India, Burma and Ceylon.

References are given under each species. 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; the others are with respect to the confines of our region. When several localities are given in the original reference, all have been included, but I regard the first-mentioned locality as the type locality. Fossils are not included in the list.

The general classification of fishes adopted in the list is according to Dr. L. S. Berg's classification of fishes, both recent and fossil, as published in *Trav. Inst. Zool. Acad. Sci. U.R.S.S. Leningrad* V, 1940. The species under their respective genera are alphabetically arranged.

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 *Genera of Fishes*, C. D. Sherborn's *Index Animalium*, S. A. Neave's *Nomenclator Zoologicus*, and F. E. Schulze, W. Kükenthal and K. Heider's *Nomenclator animalium generum et subgenerum*.

The limits of the area of which the ichthyofauna is listed here have been defined by Dr. B. N. Chopra in the Foreword.

I am indebted to Dr. B. Prashad, Fisheries Development Adviser to the Govt. of India, Dr. B. N. Chopra, Director, Zoological Survey of India, Dr. S. L. Hora, Director of Fisheries, Bengal, and Dr. D. R. Bhattacharya, Professor of Zoology, University of Allahabad, for kindly going through the manuscript and for their valuable suggestions and advice.

SYSTEMATIC ACCOUNT.

Class ELASMOBRANCHII.

Sub-Class SELACHII.

Order HEXANCHIFORMES (NOTIDANOIDEI).

Family HEXANCHIDAE.

Heptranchias Rafinesque.

1810. *Heptranchias* Rafinesque, *Caratt. Animali Piante Sicilia*, p. 13. (Type, *Squalus cinereus* Gmelin, monotypic).
 1841. *Heptranchus* Müller & Henle, *Syst. Besch. Plagiostomen*, p. 81. (Type, *Squalus cinereus* Gmelin).
 1864. *Notorhynchus* Gill, *Proc. Acad. Nat. Sci. Philadelphia*, p. 149. (Type, *Notorhynchus maculatus* Ayres).

Heptranchias platycephalus¹ (Tenore).

1809. *Squalus platycephalus*, Tenore, *Mem. Acad. Ponton. Napoli* I, pp. 241, 258, pl. iv (type locality: Naples, Italy).
 1876. *Notidanus indicus*, Day, *Fish. India*, p. 723, pl. clxxxix, fig. 4 (Madras; Cape Seas).
 1889. *Notidanus indicus*, Day, *Faun. Brit. Ind. Fish.* I, p. 30, fig. 10 (Seas of India and South Africa to California).
 1941. *Heptranchias cepedianus* (nec Peron), Fowler, *Bull U.S. Nat. Mus.* (100) XIII, p. 6.

Distribution.—South Africa, India, Indian Ocean, China, Japan, Philippines.

Order LAMNIFORMES (GALEOIDEI).

Suborder LAMONOIDEI (ISURIDA).

Family ORECTOLOBIDAE.

Genus **Chiloscyllium** Müller & Henle.

1837. *Chiloscyllium* Müller & Henle, *Arch. Naturg.* III, p. 395, Atypic. (Type, *Scyllium plagiosum* Bennett, *Syst. Besch. Plagiostomen*, p. 17, 1841; designated by Gill, *Ann. Lyc. Nat. Hist. New York* VII, p. 42, 1862).
 1838. *Hemisycyllium* Andrew Smith, *Proc. Zool. Soc. London*, p. 86. (Type, *Squalus ocellatus* Bonnaterre, monotypic).
 1862. *Synchismus*, Gill, *Ann. Lyc. Nat. Hist. New York* VII, pp. 407, 408. (Type, *Squalus tuberculatus* Schneider, orthotypic).

Chiloscyllium griseum Müller & Henle.

1841. *Chiloscyllium griseum*, Müller & Henle, *Syst. Besch. Plagiostomen*, p. 19 (type locality: India, Japan).
 1870. *Chiloscyllium indicum* var. *obscura*, Günther, *Cat. Fish. Brit. Mus.* VIII, p. 413 (Moluccas; Batavia; Vizagapatam).
 1878. *Chiloscyllium indicum* (nec Gmelin), Day, *Fish India*, p. 726, pl. clxxxviii, 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, *Faun. Brit. Ind. Fish.* I, p. 34, fig. 14 (Seas of India to Malay Archipelago and beyond).
 1908. *Chiloscyllium griseum*, Regan, *Proc. Zool. Soc.*, p. 360, pl. xi, fig. 1, pl. xiii, fig. 1 (young) (India; Malay Archipelago).
 1913. *Chiloscyllium griseum*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 64 (South Africa; India; Japan).
 1914. *Chiloscyllium griseum*, Raj, *Rec. Ind. Mus.* X, pp. 318, 319 (Madras).
 1919. *Chiloscyllium griseum*, Southwell & Prashad, *Rec. Ind. Mus.* XVI, p. 222, pl. xix, fig. 5 (Port Canning, Bengal).
 1928. *Chiloscyllium griseum* Fowler, *Journ. Bombay Nat. Hist. Soc.* XXXIII, p. 100 (Bombay).
 1929. *Chiloscyllium griseum*, Pillay, *Journ. Bombay Nat. Hist. Soc.* XXXIII, p. 350 (Travancore).
 1938. *Chiloscyllium griseum*, Aiyar & Nalini, *Proc. Indian Acad. Sci.* VII, Sec. B, p. 252 (Madras).
 1941. *Hemisycyllium griseum*, Fowler, *Bull. U.S. Nat. Mus.* (100) XIII, p. 88.

Distribution.—South Africa, Red Sea, India, Malay Peninsula, China, Japan.

Chiloscyllium indicus (Gmelin).

1789. *Squalus indicus*, Gmelin, *Syst. Nat. Linn.* I, p. 1503 (type locality : Indian Ocean).
 1878. *Chiloscyllium indicum* (part), Day, *Fish India*, p. 726, *nec* pl. clxxxviii, fig. 3 (Seas of India to the Malay Archipelago and beyond).
 1889. *Chiloscyllium indicum* (part), *Faun. Brit. Ind. Fish.* I, p. 34, *nec* fig. 14 (Seas of India to the Malay Archipelago and beyond).
 1915-18. *Chiloscyllium indicum*, Pearson, *Ceylon Adminstr. Rep.*, p. F 12.
 1919. *Chiloscyllium indicum* Southwell & Prashad, *Rec., Ind. Mus.* XVI, p. 222 (reference only).
 1933. *Chiloscyllium indicum*, Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
 1933. *Chiloscyllium indicum*, Deraniyagala, *Ceylon Journ. Sci.(c)* V-p. 80 Ceylon.
 1934. *Chiloscyllium indicum*, Deraniyagala, *Spol. Zeyl.* XVIII, p. 249 (Ceylon).
 1941. *Hemiscyllium colax* (*nec* Meuschen) Fowler, *Bull. U.S. Nat. Mus.* (100) XIII, p. 89.

Distribution.—Cape of Good Hope, Red Sea, Arabian Sea, India, Burma, Ceylon, Malay Peninsula, Siam, Indo-China, Formosa, China, Malay Archipelago, Melanesia (Solomon Islands).

Chiloscyllium ocellatum (Bonnaterre).

1738. *Squalus ocellatus*, Bonnaterre, *Tableau Encyclop. Ichth.*, p. 8 (type locality : La mer du Sud).
 1941. *Hemiscyllium ocellatum* Fowler, *Bull. U.S. Nat. Mus.* (100) XIII, p. 81.

Distribution.—India ?, Malay Archipelago, N. W. Australia, Queensland, Melanesia. Fowler (*loc. cit.*) mentions that *Hemiscyllium ocellatum* (Bonnaterre) [= *Chiloscyllium ocellatum* (Bonnaterre)] has been recorded from India ; but this requires further confirmation. Whitley in the "Fishes of Australia" Part I, p. 74, 1940 writes : "This shark was originally discovered by the Naturalists of Cook's party near the present site of Cook town and I have read Solander's manuscript description of it in Latin as *Squalus ocellatus*."

Chiloscyllium plagiosum (Bennett).

1830. *Scyllium plagiosum*, Bennett, *Life of Raffles*, p. 694 (type locality : Sumatra).
 1865. *Chiloscyllium plagiosum*, Day, *Fish Malabar*, p. 267 (Malabar).
 1939. *Chiloscyllium plagiosum* Herre, *Rec. Ind. Mus.* XLI, p. 111 (Maungmagan, Burma).
 1941. *Hemiscyllium plagiosum*, Fowler, *Bull. U.S. Nat. Mus.* (100) XIII, p. 88.

Distribution.—Cape Colony, Madagascar, India, Burma, Malay Peninsula, Siam, China, Japan and Malay Archipelago.

Nebrius Rüppell

1837. *Nebrius Rüppell*, *Neue Wirbelth Fische*, p. 62. (Type, *Nebrius concolor* Rüppell, monotypic).
 1837. *Ginglymostoma* Müller & Henle, *Sitz Ber. preuss. Akad. Wiss. Berlin*, p. 113. (Type, *Squalus cirratus* Gmelin ; designated by Hay, *U.S. Geol. Surv. Bull.* CLXXIX, p. 310, 1902.)
 1913. *Nebrodes* Garman, *Mem. Mus. Comp. Zool.* Harvard XXXVI, p. 56. (Type, *Nebrius concolor* Rüppell.)

Nebrius concolor Rüppell.

1837. *Nebrius concolor*, Rüppell, *Neue Wirbelth. Fische*, p. 62, pl. xvii, fig. 2 (type locality: Massaua, Red Sea).
 1878. *Ginglymostoma concolor*, Day, *Fish, Ind. Suppl.*, p. 811, fig. (Red Sea through the Seas of India to Malay Archipelago).
 1889. *Ginglymostoma concolor*, Day, *Faun. Brit. Ind. Fish.* I, p. 32, fig. 12 (Red Sea through the Seas of India to Malay Archipelago).
 1912-13. *Ginglymostoma concolor*, Southwell, *Ceylon Administr. Rep.*, p. E49.
 1913. *Nebrodes concolor*, Garman, *Mem. Mus. Comp. Zool. Harvard.* XXXVI, p. 57 (Red Sea to India).

Distribution.—Madagascar, Red Sea, India, Ceylon, Malay Peninsula, Java, Philippines, Solomon Islands.

Nebrius ferrugineum (Lesson).

1830. *Scyllium ferrugineum*, Lesson, *Voy. Coquille, Zool.* II, pt. 1, fig. 95 (type locality: Port Praslin; Offack Bay, Waigiu).
 1870. *Ginglymostoma mülleri*, Günther, *Cat. Fish. Brit. Mus.* VIII, p. 408 (type locality: India).
 1878. *Ginglymostoma mülleri*, Day, *Fish India*, p. 725 (India).
 1889. *Ginglymostoma mülleri*, Day, *Faun. Brit. Ind. Fish.* I, p. 33 (Red Sea; Indian Ocean).
 1912-13. *Ginglymostoma mülleri*, Pearson, *Ceylon Administr. Rep.*, p. E 7.
 1913. *Ginglymostoma ferrugineum*, Garman, *Mem. Mus. Comp. Zool.* XXXVI, p. 56 (India; East Indies).
 1933. *Ginglymostoma ferrugineum*, Deraniyagala, *Ceylon, Journ. Sci.(c)* V, p. 80.
 1941. *Nebrius ferrugineum*, Fowler, *Bull. U.S. Nat. Mus.* (100) XIII, p. 69.
 1942. *Nebrius ferrugineus*, Sarangdhar, *Ind. Journ. Med. Res.* XXX, p. 558 (Bombay).

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

Rhincodon Smith.

1829. *Rhincodon* Smith, *Zool. Journ.* IV, p. 443. (Type, *Rhincodon typus* Smith monotypic.)
 1839. *Rhincodon* Swainson, *Nat. Hist. Animals*, pp. 191, 314, as *Rhiniodon*, p. 317. (Type, *Rhincodon typus* Smith.)
 1841. *Rhincodon* Müller & Henle, *Syst. Besch. Plagiostomen* p. 77. (Type, *Rhincodon typus* Smith.)

Rhincodon typus Smith.

1829. *Rhincodon typus*, Smith, *Zool. Journ.* IV, p. 443 (type locality: Table Bay, South Africa; according to Bertin¹ the holotype² is in the Paris Museum).
 1888. *Rhinodon typicus*, Day, *Fish India Suppl.*, p. 811 (Ceylon).
 1889. *Rhinodon typicus*, Day, *Faun. Brit. Ind. Fish.* I, p. 29 (Ceylon).
 1908. *Rhinodon typicus*, Regan, *Proc. Zool. Soc. London.* p. 353. (Ceylon; Seychelles).
 1908. *Rhinodon typicus*, Lloyd, *Rec. Ind. Mus.* II, p. 306 (Bay of Bengal).
 1912-13. *Rhinodon typicus*, Southwell, *Ceylon Administr. Rep.*, pp. E 44, E 49.
 1929. *Rhinodon typicus*, Pillay, *Journ. Bombay Nat. Hist. Soc.* XXXIII, p. 351 (Travancore).

Distribution.—South Africa, Seychelles, India, Ceylon, Siam, Japan, Java, Philippines, California, Panama, Chile and the tropical Atlantic.

¹ Bertin, P. L., *Bull. Mus. Nat. Paris* (2) XI, 1939.

² Frizzell, D. L., "Terminology of Types" *Amer. Midl. Nat.* XIV, pp. 637-668 (1933).

Genus **Stegostoma** Müller & Henle.

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

Stegostoma varium (Seba).

1758. *Squalus varius*, Seba, *Thesauri III*, pl. xxxiv, fig. 1, p. 105 (type locality not given).
1847. *Stegostoma carinatum*, Blyth, *Journ. As. Soc. Bengal XVI*, p. 725, pl. xxv, fig. 1 (type locality: India).
1870. *Stegostoma tigrinum*, Günther, *Cat. Fish. Brit. Mus. VIII*, p. 409 (India, Zanzibar, Ceylon, Formosa).
1878. *Stegostoma tigrinum*, Day, *Fish. India*, p. 725, pl. clxxxvii, fig. 4 (East Africa; Red Sea; India; Malay Archipelago).
1889. *Stegostoma tigrinum*, Day, *Faun. Brit. Ind. Fish. I*, p. 33, fig. 13 (Madras).
1908. *Stegostoma tigrinum*, Regan, *Proc. Zool. Soc. London*, p. 363 (Zanzibar, India, Ceylon, Sarawak, Formosa, North West Australia).
1912-13. *Stegostoma tigrinum*, Southwell, *Ceylon Administr. Rep.*, pp. E 41, E 49.
1913. *Stegostoma varium* Garman, *Mem. Mus. Comp. Zool. Harvard XXXVI*, p. 59 (India and East Indies to Africa).
1928. *Stegostoma tigrinum*, Fowler, *Journ. Bombay Nat. Hist. Soc. XXXIII*, p. 100 (Bombay).
1929. *Stegostoma tigrinum*, Pillay, *Journ. Bombay Nat. Hist. Soc. XXXIII*, p. 350 (Travancore).
1933. *Stegostoma tigrinum*, Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
1941. *Stegostoma fasciatum*, Fowler, *Bull. U.S. Nat. Mus. (100) XIII*, p. 100.
Distribution.—Zanzibar, East Africa, Madagascar, Red Sea, India, Ceylon, Malay Peninsula, Siam, Indo China, China, Formosa, Japan, Malay Archipelago, Australia.

Family ODONTASPIDAE.

Genus **Carcharias** Rafinesque.

1810. *Carcharias* Rafinesque, *Caratt. Animali Pianta Sicilia*, p. 10. (Type, *Carcharias taurus* Rafinesque, monotypic.)
1835. *Odontaspis* Agassiz, *Poiss. Foss. III*, p. 55 (Type, *Squalus ferox* Risso, monotypic).

Carcharias tricuspidatus Day.

1878. *Carcharias tricuspidatus*, Day, *Fish India*, p. 713, pl. clxxxvi, fig. 1 (type locality; Karachi and Baluchistan).
1888. *Odontaspis tricuspidatus*, Day, *Fish India Supl.*, p. 810 (Sind).
1889. *Odontaspis tricuspidatus*, Day, *Faun. Brit. Ind. Fish. I*, p. 27, fig. 8 (Seas of Sind).
1913. *Carcharias tricuspidatus*, Garman, *Mem. Mus. Comp. Zool. Harvard XXXVI*, p. 26 (Cape of Good Hope; India; South Australia).
1942. *Carcharias tricuspidatus*, Sarangdhar, *Ind. Journ. Med. Res. XXX*, p. 558 (Bombay).

Distribution.—South Africa, India, Indo-China, Philippines. Whitley¹ (1940, p. 136) gives the distribution of *Carcharias tricuspidatus* as: "I suspect that records of this shark from Southern Australia and New South Wales may be really referable to *arenarius*. No specimens have been preserved and the published accounts leave much to be desired. India etc., N.S.W.? S. Australia? W. Australia? "Queensland ??."

¹ Whitley, G. P., *The Fishes of Australia*, pt. 1 (1940).

Family LAMNIDAE.

Genus **Alopias** Rafinesque.

1768. *Vulpecula* Valmont, *Dict. Hist. Nat. Paris* III, p. 740. (Type, *Squalus vulpes* Gmelin; inadmissible, according to Opinion¹ 89 of the International Commission of Zoological Nomenclature.)
 1810. *Alopias* Rafinesque, *Caratt. Animali Pianta Sicilia*, p. 12. (Type, *Alopias macrourus* Rafinesque, monotypic.)
 1937. *Alopias* Müller & Henle, *Sitz Ber. preuss. Akad. Wiss. Berlin*, p. 114. (Type, *Alopias macrochirus* Rafinesque.)
 1838. *Alopius* Swainson, *Nat. Hist. Animals*, I, p. 91. (Type, *Alopius macrourus* Rafinesque.)

Alopias vulpinus (Bonnaterre).

1788. *Squalus vulpinus*, Bonnaterre, *Tabl. Ichth.*, pl. lxxxv, fig. 349 (type locality: Mediterranean).
 1888. *Alopias vulpes*, Day, *Fish. Ind. Suppl.*, p. 810 (Ceylon).
 1889. *Alopias vulpes*, Day, *Faun. Brit. Ind. Fish.* I, p. 28, fig. 9 (Ceylon).
Distribution.—S. Africa, Natal, Arabia, Ceylon, China, Japan, Korea, Philippines, California and Chile.

Genus **Isurus** Rafinesque.

1810. *Isurus* Rafinesque, *Caratt. Animali Pianta Sicilia*, p. 11. (Type, *Isurus oxyrinchus* Rafinesque, monotypic.)
 1817. *Lamna* Cuvier, *Règne Animal*, II, ed. 1, p. 126. (Type, *Lamna cornubica* Cuvier = *Squalus cornubicus* Gmelin, designated by Gill, *Ann. Lyc. Nat. Hist. New York* VIII, p. 32, 1862.)
 1836. *Oxyrhina* Agassiz, *Poiss. Foss.* III, pp. 87, 276 (Type, *Lamna oxyrhina* Valenciennes, monotypic.)

Isurus glauca (Müller & Henle).

1841. *Oxyrhina glauca*, Müller & Henle, *Syst. Besch. Plagiostomen*, p. 69, pl. xxix (type locality: Java).
 1878. *Lamna spallanzanii*, Day, *Fish. India*, p. 722, pl. clxxxvi, fig. 2 (Madras).
 1889. *Lamna spallanzanii*, Day, *Faun. Brit. Ind. Fish.* I, p. 26, fig. 7 (Red Sea; Indian Ocean; Atlantic; Mediterranean).
 1933. *Lamna spallanzani*, Deraniyagala, *Ceylon Journ. Sci.* (c) V, p. 80 (Ceylon).
Distribution.—Cape of Good Hope, Red Sea, Arabia, India, Ceylon, Indo-China, Japan, Chile, St. Helena in the Atlantic.

Isurus güntheri (Murray).

1884. *Lamna güntheri*, Murray, *Ann. Mag. Nat. Hist.* (5) XIII, p. 349 (type locality: Karachi, India).
 1888. *Lamna güntheri*, Day, *Fish. India Suppl.*, p. 810.
 1889. *Lamna güntheri*, Day, *Faun. Brit. Ind. Fish.* I, p. 26 (Karachi).
 1913. *Isurus güntheri*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 39 (Karachi).
 1941. *Isurus guntheri*, Fowler, *Bull. U.S. Nat. Mus.* (100) XIII, p. 106.

Distribution.—India, Philippines.

Suborder SCYLIORHINOIDEI (CARCHARINIDA).

Family SCYLIORHINIDAE.

Genus **Scyliorhinus** Blainville.

1769. *Catulus* (nec Kniphof, 1759) Valmont, *Dict. Hist. Nat. Paris* X, p. 114. (Type, *Catulus vulgaris* Valmont = *Squalus canicula* Linn., inadmissible, according to opinion 89 of the International Commission of Zoological Nomenclature).

¹ Schenk, E. T. and Mc Masters, J. H. *Procedure in Taxonomy* (1935).

1816. *Scyliorhinus* Blainville, *Bull. Soc. Philom. Paris.* p.121. (Type, *Squalus canicula* Linn., designated by Gill, *Ann. Lyceum Nat. Hist. New York* VII, p. 407, 1862.)
 1817. *Scyllium* (Cuvier, *Regne Animal* II, p. 124. (Type, *Squalus canicula* Linn., designated by Jordan, *Gen. Fish.*, p. 97, 1917.)
 1943. *Scylliodus* Agassiz, *Poiss. Foss.* III, p. 377. (Type, *Scylliodus antiquus* Agassiz, monotypic.)
 1843. *Thyellina* Agassiz, *Poiss. Foss.*, III, p. 378. (Type, *Thyellina angusta* Agassiz, monotypic) (Fossil.)
 1862. *Halaclurus* Gill, *Ann. Lyc. Nat. Hist. New York* VII, p. 407. (Type *Scyllium bürgeri* Müller & Henle, orthotypic.)

***Scyliorhinus (Scyliorhinus) capensis* (Müller & Henle).**

1837. *Scyllium capense*, Smith, *Proc. Zool. Soc. London*, p. 85 (type locality : Cape of Good Hope ; name only).
 1841. *Scyllium capense*, Müller & Henle, *Syst. Besch. Plagiostomen*, p. 11 (Cape of Good Hope).
 1878. *Scyllium capense*, Day, *Fish. India*, p. 724, pl. cxc, fig. 1 (India).
 1889. *Scyllium capense*, Day, *Faun. Brit. Ind. Fish.* I, p. 31 (India).
 1941. *Scyliorhinus capensis*, Fowler, *Bull. U.S. Nat. Mus.* (100) XIII, p. 35.

Distribution.—South Africa, Natal, India, Philippines.

***Scyliorhinus (Halaclurus) bürgeri* (Müller & Henle).**

1841. *Scyllium bürgeri*, Müller & Henle, *Syst. Besch. Plagiostomen*, p. 8, pl. ii (type locality : Japan).
 1865. *Scyllium bürgeri*, Kner, *Reise Novara Fische*, p. 412 (Madras).
 1941. *Halaclurus bürgeri*, Fowler, *Bull. U.S. Nat. Mus.* (100) XIII, p. 44.

Distribution.—India, China, Japan, Malay Archipelago.

***Scyliorhinus (Halaclurus) hispidum* (Alcock).**

1891. *Scyllium hispidum*, Alcock, *Ann. Mag. Nat. Hist.* (6) VIII, p. 21 (type locality : Andaman Islands, 188 to 200 fms ; type is in the Zoological Survey of India).
 1894. *Scyllium hispidum*, Alcock, *Ill. Zool. Investig. Fish.*, pl. viii, fig. 3, 3a (Andaman Islands).
 1908. *Scyliorhinus hispidus*, Regan, *Ann. Mag. Nat. Hist.* (8) I, p. 460 (Indian Ocean).
 1913. *Halaclurus hispidus*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 85 (Andaman Sea).
 1941. *Halaclurus hispidus*, Fowler, *Bull. U.S. Nat. Mus.* (100) XIII, p. 47.
 1941. *Scyllium hispidum*, Herre, *Mem. Ind. Mus.* XIII, p. 332 (Andamans).

Distribution.—East Africa, Andaman Islands, Philippines.

***Scyliorhinus (Halaclurus) indicus* Brauer.**

1906. *Scylliorhinus indicus*, Brauer, "Valdivia" *Tiefsee-Fische* XV, p.8, pl. xiv, fig. 1 (type locality : 2°58' N., 47°6' 1" E., in 1289 meters, off East African Coast ; 13°1' N., 47°10' 19" E., in 1840 meters, Gulf of Aden).
 1909. *Scylliorhinus indicus*, Lloyd, *Mem. Ind. Mus.* II, p. 139 (Gulf of Oman).
 1939. *Scylliorhinus (Halaclurus) indicus*, Norman, *Sci. Rep. John Murray Exped.* VII, p. 10 (off East African Coast ; Gulf of Aden ; Gulf of Oman).
 1941. *Pentachus indicus*, Fowler, *Bull. U.S. Nat. Mus.* (100) XIII, p. 60.

Distribution.—Off East African Coast, Gulf of Aden, Gulf of Oman.

Scyliorhinus (Halaelurus) quagga (Alcock).

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. xxvii, figs. 1, 1a (off Malabar Coast).
 1908. *Scyliorhinus quagga*, Regan, *Ann. Mag. Nat. Hist.* (7) I, p. 461 (Malabar).
 1913. *Halaelurus quagga*, Garman, *Mem. Mus. Comp. Zool. Harvard XXXVI*, p. 84 (Malabar).
 1941. *Halaelurus quagga*, Fowler, *Bull. U.S. Nat. Mus.* (100) XIII, p. 46.

Distribution.—India, Philippines.

Genus **Atelomycterus** Garman.

1913. *Atelomycterus* Garman, *Mem. Mus. Comp. Zool. Harvard XXXVI*, p. 100. (Type *Scyllium marmoratum* Bennett, orthotypic.)

Atelomycterus marmoratum (Bennett).

1830. *Scyllium marmoratum*, Bennett, *Life of Raffles*, p. 693 (type locality Sumatra).
 1830-32. *Scyllium maculatum* (nec Schneider), Gray, *Ill. Ind. Zool. Hardwicke I*, pl. xcvi, fig. 1 (India).
 1870. *Scyllium marmoratum*, Günther, *Cat. Fish. Brit. Mus.* VIII, p. 400 (Singapore : East Indies ; India).
 1878. *Scyllium marmoratum*, Day, *Fish. India*, p. 724, pl. cxc, fig. 2 (the figure is taken from Hardwicke's type of *Scyllium maculatum*, 18 inches in length).
 1889. *Scyllium marmoratum*, Day, *Faun. Brit. Ind. Fish.* I, p. 31, fig. 11 (Seas of India to the Malay Archipelago).
 1908. *Scyliorhinus marmoratus*, Regan, *Ann. Mag. Nat. Hist.* (8) I, p. 462 (India; Malay Archipelago).
 1913. *Atelomycterus marmoratus*, Garman, *Mem. Mus. Comp. Zool. Harvard XXXVI*, p. 100 (India ; Malay Archipelago).
 1941. *Atelomycterus marmoratus*, Fowler, *Bull. U.S. Nat. Mus.* (100) XIII, p. 62, fig. 6.

Distribution.—Ceylon, India, Malay Peninsula, Singapore, Siam, Indo-China, China, Java, Sumatra, Philippines, Amboina.

Family CARCHARHINIDAE.

Genus **Physodon** Müller & Henle.

1841. *Physodon* Müller & Henle, *Syst. Besch. Plagiostomen*, p. 30. [Type, *Carcharias (Physodon) mülleri* (val.) M. H., monotypic].

Physodon mülleri Müller & Henle.

1841. *Carcharias (Physodon) mülleri*, Müller & Henle, *Syst. Besch. Plagiostomen*, p. 30, pl. xix, fig. 1 (type locality : Bengal ; according to Bertin (*vide supra*, p. 9) holotype figure is in the Paris Museum).
 1870. *Carcharias mülleri*, Günther, *Cat. Fish. Brit. Mus.* VIII, p. 360 (Bengal).
 1878. *Carcharias mülleri*, Day, *Fish. India*, p. 713 (Bengal).
 1889. *Carcharias mülleri*, Day, *Faun. Brit. Ind. Fish.* I, p. 11 (Bengal).
 1922. *Physodon mülleri*, Hora, *Mem. Ind. Mus.* V, p. 763 (Chilka Lake).
 1941. *Physodon mülleri*, Fowler, *Bull. U.S. Nat. Mus.* (100) XIII, p. 129.

Distribution.—India, China, Philippines. According to Whitley (*vide supra*, p. 10) *Physodon mülleri* is not found in Australia and he recommends that this species should be dropped from the list of Australian Sharks in favour of *Protozygaena taylori* Ogilby.

Genus **Scoliodon** Müller & Henle.

1837. *Scoliodon* Müller & Henle, *Mag. Nat. Hist.* II, p. 114 Atypic. [Type, *Carcharias (Scoliodon) laticaudus* Müller & Henle; designated by Gill, *Ann. Lyc. Nat. Hist. New York* VIII, p. 35, 1862.]
1915. *Rhizoprion* (nec Jourdain 1861) Ogilby, *Mem. Queensland Mus.* III, p. 132. [Type, *Carcharias (Scoliodon) crenidens* Klunzinger, orthotypic; inadmissible as homonym of *Rhizoprion* Jourdain, according to the rules under article 34 of the International Commission of Zoological Nomenclature.]

Scoliodon palasorrah (Cuvier).

1829. *Carcharias palasorrah*, Cuvier, *Règne Animal*, ed. 2, II, p. 388 (on *Palasorrah* Russell, *Fish. Coromandel I*, p. 9 pl. xiv, 1803; type locality: Vizagapatam, Madras).
1841. *Carcharias (Scoliodon) acutus*, Müller & Henle, *Syst. Besch. Plagiostomen*, 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.* VIII, p. 358 (Cape of Good Hope; East Indies; Penang; Singapore; Vizagapatam; Japan).
1878. *Carcharias acutus*, Day, *Fish. India*, p. 712, pl. clxxxiv, fig. 3 (Madras).
1889. *Carcharias acutus*, Day, *Faun. Brit. Ind. Fish.* I, p. 10 (India).
1913. *Scoliodon palasorrah*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 111 (India; East Indies).
1926. *Scoliodon acutus*, Fowler, *Journ. Bom. Nat. Hist. Soc.* XXXI, p. 2 (Bombay).
1927. *Scoliodon acutus*, Fowler, *Journ. Bom. Nat. Hist. Soc.* XXXII, p. 253 (Bombay).
1928. *Scoliodon palasorrah*, Thillayampalam, *Ind. Zool. Mem.* II, p. 8 (Madras).
1933. *Scoliodon palasorrah* Deraniyagala, *Ceylon Journ. Sci.* (c) V, p. 80 (Ceylon).
1933. *Carcharias acutus*, Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
1940. *Scoliodon palasorrah*, Mahadevan, *Proc. Ind. Acad. Sci.* XI, Sec. B, p. 19 (Madras).

Distribution.—South Africa, Red Sea, Arabia, India, Ceylon, Malay Peninsula, Siam, Indo-China, China, Japan, Java, Philippines.

Scoliodon sorrakowah (Cuvier).

1829. *Carcharias sorrakowah*, Cuvier, *Règne Animal*, ed. 2, II, p. 388 (on *Sorrahkawah* Russell, *Fish. Coromandel I*, p. 9, pl. xv, 1803 (type locality: Vizagapatam)).
1841. *Carcharias (Scoliodon) laticaudus*, Müller & Henle, *Syst. Besch. Plagiostomen*, p. 28, pl. viii (type locality: India; according to Bertin (*vide supra*, p. 9) the paratypes from Malabar and Bombay are in the Paris Museum).
1860. *Squalus (Scoliodon) laticaudus*, Blyth, *Journ. As. Soc. Bengal* XXXIX, p. 35 (Calcutta).
1865. *Scoliodon laticaudus*, Kner, *Reise Novara Fische*, p. 414 (Madras).
1870. *Carcharias laticaudus*, Günther, *Cat. Fish. Brit. Mus.* VIII, p. 358 (Bengal; Batavia; China; Amoy; Japan).
1878. *Carcharias laticaudus*, Day, *Fish. India*, p. 712, pl. clxxxviii, fig. 1 (Seas of India to the Malay Archipelago and beyond).
1888. *Carcharias laticaudus*, Ogilby, *Cat. Fish. Austral. Mus.* pt. I, p. 1 (Bombay).
1889. *Carcharias laticaudus*, Day, *Faun. Brit. Ind. Fish.* I, p. 9 (Seas of India to the Malay Archipelago and beyond).
1907. *Carcharias laticaudatus*, Lloyd, *Rec. Ind. Mus.* I, p. 220 (Akyab).
- 1912-13. *Carcharias laticaudus*, Pearson, *Ceylon Adminstr. Rep.*, p. E 6.
1928. *Scoliodon sorrakowah*, Thillayampalam, *Ind. Zool. Mem.* II, p. 8 (Tuticorin; Ennur).
1929. *Carcharias laticaudatus*, Pillay, *Journ. Bombay Nat. Hist. Soc.* XXXIII, p. 350 (Travancore).

1933. *Carcharias laticaudus*, Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).

1940. *Scoliodon sorrakowah*, Mahadevan, *Proc. Ind. Acad. Sci.*, XI, Sec. B, p. 7 (Madras).

1941. *Scoliodon sorrakowah*, Fowler, *Bull. U.S. Nat. Mus.* (100) XIII, p. 140.

Distribution.—Mekran, India, Ceylon, Burma, Malay Peninsula, Siam, Indo-China, Japan, Java, Philippines.

***Scoliodon walbeehmi* Bleeker.**

1856. *Carcharias (Scoliodon) walbeehmi*, Bleeker, *Nat. Tijds. Nederland. Ind.* X, p. 353 (type locality : Rio, Bintang Island).

1878. *Carcharias walbeehmi*, Day, *Fish. India*, p. 712, pl. clxxxv, fig. 2 (Malabar).

1889. *Carcharias walbeehmi*, Day, *Faun. Brit. Ind. Fish.* I, p. 10 (India ; Malay Archipelago ; Japan).

1912-13. *Carcharias walbeehmi*, Southwell, *Ceylon Adminstr. Rep.*, p. E 49.

1913. *Scoliodon walbeehmi*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 112 (Singapore ; Colombo ; Penang).

1919. *Scoliodon walbeehmi*, Southwell & Prashad, *Rec. Ind. Mus.* XVI, p. 223, pl. xvi, figs. 1, 2, 4, 7, 8 (Ceylon).

1928. *Scoliodon walbeehmi*, Thillayampalam, *Ind. Zool. Mem.* II, p. 8 (Tuticorin ; Ennur).

1929. *Carcharias walbeehmi*, Pillay, *Journ. mBobay Nat. Hist. Soc.* XXXIII, p. 350 (Travancore).

1940. *Scoliodon walbeehmi*, Mahadevan, *Proc. Ind. Acad. Sci.* XI, Sec. B, p. 6 (Madras).

1941. *Scoliodon walbeehmi*, Herre, *Mem. Ind. Mus.* XIII, p. 332 (Andamans).

Distribution.—Natal, India, Ceylon, Malay Peninsula, Indo-China, China, Formosa, Japan, Java, Philippines.

Genus *Aprionodon* Gill.

1841. *Aprion* (nec Valenciennes, 1830) Müller & Henle, *Syst. Besch. Plagiostomen*, p. 31. [Type, *Carcharias (Aprion) brevipinna* Müller & Henle ; inadmissible.]

1862. *Aprionodon* Gill, *Ann. Lyc. Nat. Hist. New York* VII, pp. 400, 401, 411. [Type, *Carcharias (Aprion) isodon* Müller & Henle, orthotypic.]

***Aprionodon acutidens* (Rüppell).**

1837. *Carcharias acutidens*, Rüppell, *Neue Wirbelth. Fische*, p. 65, pl. xviii, fig. 3 (type locality : Djedda, Red Sea).

1878. *Carcharias acutidens*, Day, *Fish. India*, p. 713, pl. clxxxix, fig. 1 (Red Sea ; Sind ; Indian Ocean).

1889. *Carcharias acutidens*, Day, *Faun. Brit. Ind. Fish.* I, p. 11 (Red Sea ; Indian Ocean).

1941. *Aprionodon acutidens*, Fowler, *Bull. U.S. Nat. Mus.* (100) xiii, p. 141.

Distribution.—Seychelles, Red Sea, Arabia, India, Indo-China, Micronesia.

Genus *Hypoprion* Müller & Henle.

1841. *Hypoprion* Müller & Henle, *Syst. Besch. Plagiostomen*, p. 34. [Type, *Carcharias (Hypoprion) maclovi* Müller & Henle, designated by Jordan & Gilbert, *Bull. U.S. Nat. Mus.* XVI, p. 61, 1883.]

***Hypoprion hemiodon* (Müller & Henle.)**

1841. *Carcharias (Hypoprion) hemiodon*, Müller & Henle, *Syst. Besch. Plagiostomen*, p. 35, pl. xix, fig. 2 (teeth) (type locality : Pondicherry). According to Bertin (*vide supra*, p. 9), 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*, Güther, *Cat. Fish. Brit. Mus.* VIII, p. 362 (Calcutta, India).
 1878. *Carcharias hemiodon*, Day, *Fish. India*, p. 714 (India, Hooghly at Calcutta).
 1889. *Carcharias hemiodon*, Day, *Faun. Brit. Ind. Fish.* I, p. 12 (Hooghly at Calcutta).
 1913. *Hypoprion hemiodon*, German, *Men. Mus. Comp. Zool. Harvard* XXXVI, p. 122 (Pondicherry ; Calcutta).
 1941. *Hypoprion hemiodon* Fowler, *Bull. U.S. Nat. Mus.* (100) XIII, p. 146.

Distribution.—Asia, Arabia, India, Indo-China, Philippines. According to Whitley (*vide supra*, p. 10) *Hypoprion hemiodon* might well be expunged from the Australian list.

Hypoprion macloti Müller & Henle.

1841. *Carcharias (Hypoprion) macloti*, Müller & Henle, *Syst. Besch. Plagiostomen*, p. 34, pl. x (type locality : New Guinea).
 1870. *Carcharias macloti*, Günther, *Cat. Fish. Brit. Mus.* VIII, p. 362 (Indian Ocean ; New Guinea).
 1878. *Carcharias macloti*, Day, *Fish. India*, p. 713, pl. clxxxviii, fig. 2 (Malabar).
 1889. *Carcharias macloti*, Day, *Faun. Brit. Ind. Fish.* I, p. 12 (Seas of India to New Guinea).
 1913. *Hypoprion macloti*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 121 (New Guinea ; Indian Ocean).
 1933. *Carcharias macloti*, Deraniyagala, *Ceylon Journ. Sci.* (c) V, p. 80 (Ceylon).

Distribution.—Mekran, India, Ceylon, Malay Peninsula, Philippines, Melanesia. Whitley (*vide supra*, p. 10) includes, with a query, New South Wales as within the range of distribution of *Hypoprion macloti*.

Genus **Carcharhinus**¹ Blainville.

1816. *Carcharhinus* Blainville, *Bull. Soc. Philom.*, p. 121 ; *Journ. Phys.* LXXX-III, p. 264. (Type, *Squalus commersonii* Blainville, logotypic.)
 1862. *Eulamia* Gill, *Ann. Lyc. Nat. Hist. New York* VII, p. 401. (Type, *Carcharias lamia* Risso = *Squalus commersonii* Blainville.)
 1862. *Platypodon* Gill, *Ann. Lyc. Nat. Hist. New York* VII, p. 401. [Type, *Carcharias (Prionodon) menisorrhach* Muller & Henle, orthotypic.]
 1862. *Isogomphodon* Gill, *Ann. Lyc. Nat. Hist. New York* VII, p. 401. (Type, *Carcharias oxyrhynchus* Müller & Henle, orthotypic.)

Carcharhinus bleekeri Duméril.

1865. *Carcharias (Prionodon) bleekeri*, Duméril, *Hist. Nat. Poiss.* I, 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, *Faun. Brit. Ind. Fish.* I, p. 15 (East Coast of Africa : Indian Seas).
 1939. *Carcharhinus spallanzani* (nec Lesueur), Bertin, *Bull. Mus. Nat. Hist.* (2) XI, p. 73.
 1941. *Eulamia spallanzani* (nec Lesueur), Fowler, *Bull. U.S. Nat. Mus.* (100) XIII, p. 163.

Distribution.—Seychelles, Red Sea, India.

Carcharhinus dussumieri (Müller & Henle).

1841. *Carcharias (Prionodon) dussumieri*, Müller & Henle, *Syst. Besch. Plagiostomen*, p. 47, pl. xix, fig. 8 (type locality : China ; Bombay ; Pondicherry ; the paratopotypes from Bombay and Pondicherry are in the Paris Museum).

¹ Sometimes spelt *Carcharinus*. The above is the original form.

1878. *Carcharias dussumieri*, Day, *Fish. India*, p. 714, pl. clxxxvii, fig. 2 (India ; Malabar ; Malay Archipelago).
 1889. *Carcharias dussumieri*, Day, *Faun. Brit. Ind. Fish. I*, p. 13 (Seas of India to the Malay Archipelago).
 1912-13. *Carcharias dussumieri*, Southwell, *Ceylon Adminstr. Rep.*, p. E 49.
 1913. *Carcharinus dussumieri*, Garman, *Mem. Mus. Comp. Zool. Harvard XXXVI*, p. 137 (India ; East Indies ; China).
 1933. *Carcharias dussumieri*, Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
 1940. *Carcharias dussumieri*, Mahadevan, *Proc. Ind. Acad. Sci. XI*, Sec. B, p. 6 (Madras).
 1941. *Eulamia dussumieri*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 164.

Distribution.—East Africa, Arabian Sea, India, Ceylon, Malay Peninsula, Indo-China, Java, Philippines.

***Carcharhinus ellioti* (Day).**

1878. *Carcharias ellioti*, Day, *Fish. India*, p. 716, pl. clxxxix, fig. 2 (type locality : Kurrachee).
 1883. *Carcharias murrayi*, Günther, *Ann. Mag. Nat. Hist.* (5) XI, p. 137 (type locality : Kurrachee).
 1888. *Carcharias murrayi*, Day, *Fish. India Suppl.*, p. 808 (Kurrachee).
 1889. *Carcharias murrayi*, Day, *Faun. Brit. Ind. Fish. I*, p. 16 (Kurrachee).
 1913. *Carcharinus ellioti*, Garman, *Mem. Mus. Comp. Zool. Harvard XXXVI*, p. 142 (India).
 1933. *Carcharias ellioti*, Deraniyagala, *Ceylon, Journ. Sci.* (c) V, p. 79 (Ceylon).
 1941. *Eulamia ellioti*, Fowler, *Bull. U.S. Nat. Mus.* (100) XIII, p. 175.

Distribution.—Arabia, India, Ceylon, Philippines.

***Carcharhinus gangeticus* (Müller & Henle).**

1822. ? *Squalus carcharias* (nec Linn.), Hamilton, *Fish. Ganges*, p. 4 (Ganges R.).
 1841. *Carcharias (Prionodon) gangeticus*, Müller & Henle, *Syst. Besch. Plagiostomen*, p. 39, pl. xiii (type locality : 60 hours above the Sea at Hooghly ; the paratype from the Ganges is in the Paris Museum).
 1851. *Squalus (Carcharinus) gangeticus*, Gray, *List Fish Brit. Mus.*, p. 45 (Calcutta).
 1860. *Squalus (Carcharinus) gangeticus*, Blyth, *Journ. As. Soc. Bengal XXIX*, p. 36 (Calcutta).
 1870. *Carcharias gangeticus*, Günther, *Cat. Fish. Brit. Mus. VIII*, p. 367 (Calcutta ; Viti Levu ; Fiji).
 1878. *Carcharias gangeticus*, Day, *Fish. India*, p. 715, pl. clxxxvii, fig. 1 (India Japan ; the example figured, 18 inches long, was from Bombay).
 1889. *Carcharias gangeticus*, Day, *Faun. Brit. Ind. Fish. I*, p. 23 (Hooghly at Calcutta ; the Burmese Coasts).
 1907. *Carcharias gangeticus*, Llôyd, *Rec. Ind. Mus. I*, p. 220 (Akyab).
 1910. *Carcharias gangeticus*, De, *Rep. Fish. Eastern Bengal und Assam*, p. 17 (Goalundo).
 1913. *Carcharinus gangeticus*, Garman, *Mem. Mus. Comp. Zool. Harvard XXXVI*, p. 139 (India ; Fiji ; Japan).
 1918. *Carcharinus gangeticus*, Southwell & Prashad, *Rec. Ind. Mus. XVI*, p. 79 (Bengal).
 1922. *Carcharinus gangeticus*, Hora, *Mem. Ind. Mus. V*, p. 763 (Chilka Lake).
 1933. *Carcharias gangeticus*, Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
 1939. *Carcharhinus gangeticus*, Bertin, *Bull. Mus. Nat. Hist.* (2) XI, p. 71.
 1940. *Platypodon gangeticus* Whitley, *Fish. Australia*, pt. I, p. 105.
 1941. *Eulamia gangetica*, Fowler, *Bull. U.S. Nat. Mus.* (100) XIII, p. 148.

Distribution. Arabia, India, Ceylon, Burma, Indo-China, China, Japan, Java, Philippines, Fiji. Whitley (*vide supra*, p. 10) writes: "This shark, which is much feared in the river Ganges, India, has been recorded doubtfully from North-Western Australia, New South Wales and South Australia. It is found in India and the East Indies where it attains a length of about nine feet, but I think all the Australian records are open to question. Perhaps the latter were based on whaler sharks from which *gangeticus* differs in having the upper teeth not so deeply notched on their outer edges. I have seen specimens of *Notogaleus australis*, the School Shark, labelled *gangeticus* in one Museum. I therefore drop *gangeticus* from the Australian list."

Carcharhinus lamia (Blainville).

1820. *Squalus lamia*, Blainville, *Faune Francaise Poiss.*, p. 88, pl. xxii, fig. C (type locality: "Nos mers").
 1851. *Squalus* (*Carcharinus*) *milberti* (nec Müller & Henle), Gray, *List Fish Brit. Mus.* p. 45 (India).
 1860. *Squalus* (*Carcharinus*) *milberti* (nec Müller & Henle), Blyth, *Journ. As. Soc. Bengal XXIX*, p. 35 (Calcutta).
 1865. *Prionodon lamia*, Day, *Fish. Malabar*, p. 270 (Malabar).
 1865. *Carcharias* (*Prionodon*) *lamia*, Duméril, *Hist. Nat. Elasmobr.* I, p. 356 (Malabar).
 1896. *Carcharias* (*Prionodon*) *siamensis*, Steindachner, *Ann. Hofmus. Wien XI*, p. 229 (type locality: Mouth of Irrawaddy, Rangoon).
 1941. *Eulamia lamia*, Fowler, *Bull. U.S. Nat. Mus.* (100) XIII, p. 169.

Distribution.—Arabia, India, Burma, China, Malay Archipelago, Melanesia, also in California and Atlantic Ocean. Whitley (*vide supra*, p. 10) writes: "Old records of *Carcharhinus lamia*, *melanopterus*, *maou*, etc. from New Zealand may perhaps best be disposed of by being regarded as applying to Whaler Sharks."

Carcharhinus limbatus (Müller & Henle).

1841. *Carcharias* (*Prionodon*) *limbatus*, Müller & Henle, *Syst. Besch. Plagios-tomen*, p. 49, pl. xix, fig. 9 (type locality: Martinique; according to Bertin the paratype is in the Paris Museum).
 1878. *Carcharias limbatus*, Day, *Fish. India*, p. 716, nec pl. clxxxiv, fig. 2 (the example figured, 16·8 inches long, was from Malabar Coast).
 1889. *Carcharias limbatus*, Day, *Faun. Brit. Ind. Fish.* p. 17 (Coasts of India).
 1933. *Carcharias limbatus*, Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
 1941. *Eulamia limbata*, Fowler, *Bull. U.S. Nat. Mus.* (100) XIII, p. 150.
 1942. *Carcharinus limbatus*, Sarangdhar, *Ind. Journ. Med. Res.* XXX, p. 558 (Bombay).

Distribution.—Natal, Seychelles, Red Sea, Arabia, India, Cochin China, Polynesia, and also in tropical Atlantic.

Carcharhinus melanopterus (Q. G.).

1824. *Carcharias melanopterus*, Quoy & Gaimard, *Voy. Uranie, Zool.* pts. 5-6, p. 194, pl. xlii, figs. 1-2 [type locality: Ile Vaigion (Oceanie); the holotype and the paratopotypes from Ile Vaigion, Nouvelle Guinee and Ile Vanicoro respectively are in the Paris Museum].

1860. *Squalus (Carcharinus) melanopterus*, Blyth, *Journ. As. Soc. Bengal*, XXIX, p. 36 (Calcutta).
 1865. *Prionodon melanopterus*, Day, *Fish. Malabar*, p. 269 (Malabar).
 1878. *Carcharias melanopterus*, Day, *Fish. India*, p. 715, pl. clxxxv, fig. 3 (the example figured, a female, 42 inches long was from the Andamans).
 1889. *Carcharias melanopterus*, Day, *Faun. Brit. Ind. Fish.* I, p. 14 (Calicut).
 1910. *Carcharias melanopterus*, De, *Rep. Fish. Eastern Bengal & Assam*, p. 17 (Chittagong).
 1922. *Carcharinus melanopterus*, Hora, *Mem. Ind. Mus.* V, p. 763 (Chilka Lake).
 1929. *Carcharias melanopterus*, Pillay, *Journ. Bombay Nat. Hist. Soc.* XXXIII, p. 350 (Travancore).
 1933. *Eulamia melanoptera*, Deraniyagala, *Ceylon Journ. Sci.* (c) V, p. 80 (Ceylon).
 1941. *Eulamia melanoptera*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 158.
 1941. *Carcharinus melanopterus*, Herre, *Mem. Ind. Mus.* XIII, p. 332 (Andamans).
 1942. *Carcharinus melanopterus*, Sarangdhar, *Ind. Journ. Med. Res.* XXX, p. 556 (Bombay).

Distribution.—South Africa, Red Sea, Arabia, India, Burma, Ceylon, Andamans, Malay Peninsula, Siam, Indo-China, China, Japan, Java, Amboyna, Philippines, Melanesia, Micronesia, Polynesia, Hawaii. Whitley (*vide supra*, p. 10) writes : “ An old record of this species as *Carcharinus melanopterus*, from Victoria possibly refers to a Whaler Shark. The specific name *spallanzani* was given by Lesueur, one of the French naturalists in Western Australia with Baudin’s expedition in the early 19th Century, and is earlier than *melanopterus*, a name often used for this species.”

***Carcharinus menisorrah* (Müller & Henle).**

1841. *Carcharias (Prionodon) menisorrah*, Müller & Henle, *Syst. Besch. Plagios-tomen*, p. 46, pls. xvii, xix, fig. 7 (type locality : Java ; Australia ; Red Sea ; the paratopotype from Mer des Indes is in the Paris Museum).
 1873. *Carcharias malabaricus*, Day, *Journ. Linn. Soc. London* X, Zool. p. 529 (type locality : Palliport near Cochin and Calicut on Malabar Coast, India).
 1878. *Carcharias menisorrah*, Day, *Fish. India*, p. 716, pl. clxxxiv, fig. 1 (Calicut ; Red Sea ; Malay Archipelago ; the example figured, 19 inches long, was from Calicut).
 1889. *Carcharias menisorrah*, Day, *Faun. Brit. Ind. Fish.* I, p. 16 (Red Sea to the Malay Archipelago).
 1912. *Carcharias manisorrah*, Jenkins, *Rec. Ind. Mus.* VII, p. 57 (Akyab).
 1933. *Carcharias menisorrah*, Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
 1941. *Eulamia menisorrah*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 161.

Distribution.—Red Sea, Arabia, India, Burma, Malay Peninsula, Indo-China, Java, Philippines, Panama. According to Whitley (*vide supra*, p. 10) the presence of *C. menisorrah* in the Australian water is doubtful.

***Carcharinus pleurotaenia* (Bleeker).**

1852. *Carcharias (Prionodon) pleurotaenia*, Bleeker, *Verh. Bat. Gen.* (Plagiost.) XXIV, pp. 28, 40, pl. ii, fig. 6 (type locality : Batavia).
 1942. *Carcharinus pleurotaenia*, Sarangdhar, *Ind. Journ. Med. Res.* XXX, p. 558 (Bombay).

Distribution.—India, Singapore, Java, Philippines. *Carcharinus pleurotaenia* has been recorded for the first time in India by Sarangdhar (*loc. cit.*) from Bombay.

Carcharhinus sorrah Müller & Henle.

1841. *Carcharias (Prionodon) sorrah*, Müller & Henle, *Syst. Besch. Plagios-tomen*, p. 45, pl. xvi [type locality: India; Java; Madagascar: according to Bertin (*vide supra*, p. 9) the paratopotypes from Pondicherry and Madagascar are in the Paris Museum].
1878. *Carcharias sorrah*, Day, *Fish. India*, p. 714, pl. clxxxv, fig. 1 (India; Mangalore; Malay Archipelago).
1889. *Carcharias sorrah*, Day, *Faun. Brit. Ind. Fish.* I, p. 12 (Seas of India to the Malay Archipelago).
1913. *Carcharinus sorrah*, Garman, *Mem. Mus. Comp. Zool. Harvard XXXVI*, p. 132 (Indian Seas; Madagascar; Borneo; Java).
1933. *Carcharias sorrah*, Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
1939. *Carcharhinus sorrah*, Bertin, *Bull. Mus. Nat. Hist. Paris* (2) XI, p. 71.
1941. *Eulamia sorrah*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 156.

Distribution.—Madagascar, Red Sea, India, Malay Peninsula, Indo-China, China, Malay Archipelago, Melanesia, Hawaii.

Carcharhinus temminckii (Müller & Henle).

1841. *Carcharias (Prionodon) temminckii*, Müller & Henle, *Syst. Besch. Plagios-tomen*, p. 48, pl. xviii (type locality: Pondicherry).
1860. *Squalus (Carcharinus) temminckii*, Blyth, *Journ. As. Soc. Bengal XXIX*, p. 36 (Calcutta).
1870. *Carcharias temminckii*, Günther, *Cat. Fish. Brit. Mus.* VIII, p. 374 (Calcutta).
1878. *Carcharias temminckii*, Day, *Fish. India*, p. 717 (India).
1889. *Carcharias temminckii*, Day, *Faun. Brit. Ind. Fish.* I, p. 17 (India).
- 1889-90. *Carcharias temminckii*, Vinciguerra, *Ann. Mus. Civ. Stor. Nat. Genova XXIX*, p. 160 (Rangoon).
1913. *Carcharinus temminckii*, Garman, *Mem. Mus. Comp. Zool. Harvard XXXVI*, p. 142 (Indian Seas).
1941. *Eulamia temminckii*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 176.

Distribution.—India, Burma, Malay Archipelago.

Genus **Hemigaleus** Bleeker.

1852. *Hemigaleus* Bleeker, *Verh. Bat. Gen. (Plagiost.) XXIV*, p. 45. (Type, *Hemigaleus microstoma* Bleeker, designated by Jordan, *Gen. Fish.* pt. 2, p. 250, 1919.)
1862. *Chaenogaleus* Gill, *Ann. Lyc. Nat. Hist. New York*, VII, p. 411. (Type, *Hemigaleus microstoma* Bleeker.)

Hemigaleus balfouri Day.

1878. *Hemigaleus balfouri*, Day, *Fish. India*, p. 717, pl. clxxxv, fig. 4 (type locality: Waltair, Coromandel Coast).
1889. *Hemigaleus balfouri*, Day, *Faun. Brit. Ind. Fish.* p. 18, fig. 2 (Coromandel Coast).
1913. *Hemigaleus balfouri*, Garman, *Mem. Mus. Comp. Zool. Harvard XXXVI*, p. 152 (Coromandel Coast).
1941. *Hemigaleus balfouri*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 184.

Distribution.—India, Philippines.

Genus **Galeorhinus** Blainville.

1864. *Galeorhinus* Blainville, *Bull. Soc. Philom. Paris* VIII, p. 121. (Type, *Squalus galeus* Linnaeus, designated by Gill, *Ann. Lyc. Nat. Hist. New York* VII, p. 40, 1862.)
1816. *Eugaleus* Gill, *Proc. Acad. Nat. Sci. Philadelphia* p. 148. (Type, *Squalus galeus* Linnaeus, orthotypic.)

Galeorhinus omanensis Norman.

1939. *Eugaleus omanensis*, Norman, *Sci. Rep. John Murray Exped. VIII*, p. 11, text-fig. 3 (type locality : Gulf of Oman, 201m., holotype is in the British Museum).

Distribution.—Gulf of Oman.

Genus Galeocerdo Müller & Henle.

1837. *Galeocerdo* Müller & Henle, *Sitz Ber. preuss. Akad. Wiss. Berlin*, p. 115. (Type, *Squalus arcticus* Faber, monotypic.)

Galeocerdo arcticus (Faber).

1829. *Squalus arcticus*, Faber, *Nat. Fische Islands*, p. 17 (type locality : Iceland).
 1878. *Galeocerdo tigrinus*, Day, *Fish. India*, p. 718 (Red Sea ; India ; Japan).
 1878. *Galeocerdo rayneri* (nec MacDonald & Barrow), Day, *Fish. India*, p. 718, pl. clxxxvii, fig. 3 (India).
 1889. *Galeocerdo tigrinus*, Day, *Faun. Brit. Ind. Fish. I*, p. 21, fig. 3 (Red Sea, Seas of India to Japan and beyond).
 1889. *Galeocerdo rayneri* (nec MacDonald & Barrow), Day, *Faun. Brit. Ind. Fish. I*, p. 20 (Indian Seas ; nec Australian Seas).
 1912-13. *Galeocerdo tigrinus*, Southwell, *Ceylon Adminstr. Rep.*, pp. E 46, E 49.
 1913. *Galeocerdo arcticus*, Garman, *Mem. Mus. Comp. Zool. Harvard XXXVI*, p. 148, pl. xliii, figs. 6-8 (tropical and temperate seas to 70° or more from Equator).
 1929. *Galeocerdo rayneri* (nec MacDonald & Barrow), Pillay, *Journ. Bombay Nat. Hist. Soc. XXXIII*, p. 350 (Travancore).
 1933. *Galeocardus tigrinus*, Deraniyagala, *Ceylon Journ. Sci. (c) V*, p. 80 (Ceylon).
 1941. *Galeocerdo cuvier* (nec Lesueur), Fowler, *Bull. U. S. Nat. Mus. (100) XIII*, p. 186.
 1942. *Galeocerdo tigrinus*, Sarangdhar, *Ind. Journ. Med. Res. XXX*, p. 556 (Bombay).

Distribution.—Natal, Red Sea, Arabia, India, Ceylon, Indo-China, China, Japan, Java, Philippines, Melanesia, Hawaii, the Galapagos, California and the Atlantic. Whitley (*vide supra*, p. 10) writes : "Tiger Sharks are widely distributed in the world's seas and fossils very similar to the recent species are found. Since names are available for Australian forms, which differ in dentition from the Old World *G. arcticus* (Faber), I use *rayneri* and *cuvier* for the Southern and North-Western Australian species respectively."

Genus Myrmillo Gistel.

1768. *Mustelus* Valmont, *Dict. Hist. Nat. Poiss. III*, p. 138 (Type, *Galeus stellatus* Valmont=*Squalus mustelus* Linn.; inadmissible, according to Opinion 89 of the International Commission of Zoological Nomenclature.)
 1790. *Mustelus* Linck, *Mag. Phys. Naturg. Gotha (3) VI*, p. 31. (Type, *Squalus mustelus* Linn. monotypic; inadmissible according to Opinion 93 of the International Commission of Zoological Nomenclature.)
 1813. *Mustellus* Fischer-Waldheim, *Zoognosia*, ed. 3. I, p. 78. (Type, *Squalus mustelus* Linn.; inadmissible according to the rules under Art. 35, d of the International Commission of Zoological Nomenclature).
 1848. *Myrmillo* Gistel, *Naturg. Theirreichs*, p. X. (Type, *Squalus mustelus* Linn.)

Myrmillo manazo (Bleeker).

1857. *Mustelus manazo*, Bleeker, *Verh. Bat. Gen.* (Japan) XXVI, pp. 42, 126 (type locality : Nagasaki).
 1870. *Mustelus manazo*, Günther, *Cat. Fish. Brit. Mus.* VIII, p. 387 (Japan : Ceylon ?).
 1878. *Mustelus manazo*, Day, *Fish. India*, p. 720, pl. clxxxvi, fig. 3 (Kurrachee).
 1889. *Mustelus manazo*, Day, *Faun. Brit. Ind. Fish.* I, p. 24 (India ; Japan).
 1933. *Mustelus manazo*, Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
 1941. *Mustelus manazo*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 205.

Distribution.—Natal, Arabian Sea, India, Ceylon?, Malay Peninsula, Indo-China, China, Japan, Philippines.

Genus **Triaenodon** Müller & Henle.

1837. *Triaenodon* Müller & Henle, *Sitz Ber. preuss. Akad. Wiss. Berlin*, p. 117. Atypic. (Type, *Carcharias obesus* Rüppell, designated by Jordan, *Gen. Fish.*, p. 192, 1919.)

Triaenodon obesus (Rüppell).

1837. *Carcharias obesus*, Rüppell, *Neue Wirbelth. Fische*, p. 64, pl. xviii, fig. 2 (type locality : Djedda, Red Sea).
 1841. *Triaenodon obesus*, Müller & Henle, *Syst. Besch. Plagiostomen*, p. 55, pl. xx (Indian Ocean, Red Sea).
 1878. *Triaenodon obtusus*, Day, *Fish. India*, p. 720, pl. clxxxix, fig. 3 (type locality : Kurrachee).
 1889. *Triaenodon obtusus*, Day, *Faun. Brit. Ind. Fish.* I, p. 25 (Kurrachee).
 1889. *Triaenodon obesus*, Day, *Faun. Brit. Ind. Fish.* I, p. 25 (probably off India).
 1913. *Triaenodon obtusus*, German, *Mem. Mus. Comp. Zool. Harvard*, XXXVI, p. 163 (Kurrachee, India).
 1914. *Triaenodon obtusus*, Pearson, *Ceylon Adminstr. Rep.*, p. E 4.
 1941. *Triaenodon obesus*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 194.

Distribution.—Madagascar, Seychelles, Red Sea, Arabian Sea, India, Ceylon, Malay Archipelago, Melanesia, Polynesia, Hawaii.

Family SPHYRNIDAE.

Genus **Sphyrna** Rafinesque.

1792. *Cestracion* (Klein) Walbaum, *Artedi Pisc.* III, p. 580. (Type, *Squalus zygaena* Linn.; inadmissible according to Opinion 21 of the International Commission of Zoological Nomenclature.)
 1810. *Sphyrna* Rafinesque, *Indice, Itt. siciliana*, pp. 46, 60. (Type, *Squalus zygaena* Linn., designated by Jordan and Gilbert, *Bull. U. S. Nat. Mus.* XVI, p. 26, 1883.)

Sphyrna blochii (Cuvier).

1817. *Zygaena blochii*, Cuvier, *Règne animal* II, ed. 1, p. 127 (on *Squalus zygaena* nec Linn., Bloch; type locality : Mediterranean ; America).
 1837. *Zygaena laticeps*, Cantor, *Quart. Med. Journ. Calcutta*, p. 315, pls. i-iii (type locality : Calcutta).
 1860. *Sphyrnias blochii*, Blyth, *Journ. As. Soc. Bengal*, XXIX, p. 35 (Calcutta).
 1870. *Zygaena blochii*, Günther, *Cat. Fish. Brit. Mus.* VIII, p. 380 (Calcutta ; Singapore ; India ; Pinang ; Malabar).
 1878. *Zygaena blochii*, Day, *Fish. India*, p. 719, pl. clxxxiv, fig. 4 (India ; Malay Archipelago ; Malabar).
 1889. *Zygaena blochii*, Day, *Faun. Brit. Ind. Fish.* I, p. 22 (Malabar Coast).
 1917. *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 Adminstr. Rep.*, p. F 9.
 1928. *Sphyrna blochii*, Fowler, *Journ. Bombay Nat. Hist. Soc.* XXXIII, p. 101 (Bombay).

1933. *Zygaena blochii*, Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).

1941. *Sphyrna blochii*, Herre, *Mem. Ind. Mus.* XIII, p. 333 (Andamans).

1942. *Cestracion blochii*, Sarangdhar, *Ind. Journ. Med. Res.* XXX, p. 557 (Bombay).

Distribution.—Ceylon, India, Burma, Malay Peninsula, Indo-China, Malay Archipelago.

***Sphyrna mokarran* (Rüppell).**

1837. *Zygaena mokarran*, Rüppell, *Neue Wirbelth Fische*, p. 66, pl. xvii, fig. 2 (type locality : Massauh, Red Sea).

1870. *Zygaena mokarran*, Günther, *Cat. Fish. Brit. Mus.* VIII, p. 383 (Red Sea).

1887. *Zygaena dissimilis*, Murray, *Journ. Bombay Nat. Hist. Soc.* II, p. 103, pl. (type locality : Kurrachee).

1888. *Zygaena mokarran*, Day, *Fish. India. Suppl.*, p. 809 (Red Sea to Kurrachee).

1889. *Zygaena mokarran*, Day, *Faun. Brit. Ind. Fish.* I, p. 23 (Red Sea to Kurrachee).

1913. *Cestracion mokarran*, German, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 160 (Red Sea ; India).

1941. *Sphyrna mokarran*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 214.

Distribution.—Red Sea, India, Philippines, China.

***Sphyrna tudes* (Valenciennes).**

1822. *Zygaena tudes*, Valenciennes, *Mem. Mus. Hist. Nat. Paris* IX, p. 225, pl. xii, figs. 1a-b (type locality : Mediterranean ; Cayenne ; Coromandel ; types from Cayenne and Nice are in the Paris Museum).

1878. *Zygaena tudes*, Day, *Fish. India*, p. 720, pl. clxxxviii, fig. 4 (Mediterranean ; Indian Ocean ; Malay Archipelago ; Atlantic).

1888. *Zygaena tudes*, Ogilby, *Cat. Fish. Austral. Mus.*, p. 4 (Madras).

1889. *Zygaena tudes*, Day, *Faun. Brit. Ind. Fish.* I, p. 23 (Mediterranean ; Indian Ocean, Malay, Archipelago, Atlantic).

1929. *Zygaena tudes*, Pillay, *Journ. Bombay Nat. Hist. Soc.* XXXIII, p. 351 (Travancore).

1933. *Zygaena tudes*, Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).

Distribution.—Mediterranean, East Africa, Arabian Sea, India, Indo-China, Philippines Melanesia, Hawaii, Panama, Atlantic. Whitley (*vide supra*, p. 10) writes : " I think there is only one species in Australasia, but it has been recorded under various specific names : *zygaena*, *tudes*, *malleus*, *blochii*, etc." He records only *Sphyrna lewini* (Griffith) in Australia.

***Sphyrna zygaena* (Linnaeus).**

1758. *Squalus zygaena*, Linnaeus, *Syst. Nat.* I, ed. 10, p. 234 (type locality : Europe ; America).

1878. *Zygaena malleus*, Day, *Fish. India*, p. 719, pl. clxxxvi, fig. 4 (tropical and temperate Seas).

1889. *Zygaena malleus*, Day, *Faun. Brit. Ind. Fish.* I, p. 22 (tropical and temperate Seas).

1912-13. *Zygaena malleus*, Southwell, *Ceylon Adminstr. Rep.*, p. E 49.

1929. *Zygaena malleus*, Pillay, *Journ. Bombay Nat. Hist. Soc.* XXXIII, p. 351 (Travancore).

1933. *Zygaena malleus*, Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).

1942. *Cestracion zygaena*, Sarangdhar, *Ind. Journ. Med. Res.* XXX, p. 557 (Bombay).

Distribution.—N. Africa, Madagascar, Seychelles, Red Sea, Arabia, India, Ceylon, Malay Peninsula, Indo-China, China, Japan, Philippines, Polynesia, Hawaii, Eastern Pacific and tropical Atlantic.

Order SQUALIFORMES (TECTOSPONDYLI).

Suborder SQUALOIDEI.

Family SQUALIDAE.

Genus **Centrophorus** Müller & Henle.

1837. *Centrophorus* Müller & Henle, *Arch. Naturg.* III, p. 398. (Type, *Squalus granulosus* Schneider, monotypic.)
 1838. *Lepidorhinus* Bonaparte, *N. Ann. Sci. Nat. Bologna* II, p. 207. (Type, *Squalus squamosus* Bonnaterre, monotypic.)

Centrophorus rossi Alcock.

1898. *Centrophorus rossi*, Alcock, *Ann. Mag. Nat. Hist.* (7) II, p. 143. (type locality : off Travancore Coast in 430 fms., type is in the Zoological Survey of India.)
 1899. *Centrophorus rossi*, Alcock, *Ill. Zool. Investig. Fish.*, pl. xxvi, figs. 3, 3a, 3b, 3c (Off Travancore Coast).
 1899. *Centrophorus rossi*, Alcock, *Cat. Ind. Deep Sea Fish.*, p. 13 (Bay of Bengal ; Arabian Sea).
 1908. *Centrosymnus crepidater* (part) Regan, *Ann. Mag. Nat. Hist.* (8) II, p. 50 (Indian Ocean).
 1913. *Lepidorhinus rossi*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 214 (Off Travancore Coast).
 1941. *Centrophorus rossi*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 232.
- Distribution*.—Off Travancore Coast, India.

Genus **Centrosyllium** Müller & Henle.

1841. *Centrosyllium* Müller & Henle, *Syst. Besch. Plagiostomen*, p. 191. (Type, *Spinax fabricii* Reinhardt, monotypic.)
 1889. *Paracentrosyllium* Alcock, *Ann. Mag. Nat. Hist.* (6) IV p. 379. (Type, *Paracentrosyllium ornatum* Alcock, monotypic.)

Centrosyllium (Paracentrosyllium) ornatum Alc.

1889. *Paracentrosyllium ornatum*, Alcock, *Ann. Mag. Nat. Hist.* (6) IV, p. 379 (type locality : Bay of Bengal in 285-405 fms., type is in the Zoological Survey of India).
 1894. *Paracentrosyllium ornatum*, Alcock, *Ill. Zool. Investig. Fish.*, pl. viii, fig. 2 (Bay of Bengal).
 1896. *Centrosyllium ornatum*, Alcock, *Journ. As. Soc. Bengal* LXV, pp. 308, 310 (Arabian Sea).
 1900. *Centrosyllium ornatum*, Alcock, *Ill. Zool. Investig. Fish.*, pl. xxxv, figs. 1, 1a-b.
 1908. *Centrosyllium ornatum*, Regan, *Ann. Mag. Nat. Hist.* (8) II, p. 41 (Bay of Bengal).
 1912. *Centrosyllium ornatum*, Sewell, *Rec. Ind. Mus.* VII, p. 2 (Arabian Sea).
 1913. *Centrosyllium ornatum*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 233 (Bay of Bengal and Arabian Sea).
 1941. *Centrosyllium ornatum*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 254.

Distribution.—Arabian Sea, Bay of Bengal, Philippines.

Order RAJIFORMES.

Family RHINOBATIDAE.

Genus **Rhinobatos** Linck.

- 1790 *Rhinobatos* Linck, *Mag. Phys. Naturg. Gotha* (3) VI, p. 32 (Atypic ; type *Raja rhinobatos* Linn., tautotypic).

1792. *Rhinobatus* (Klein) Walbaum, *Artedi Pisc.* III, p. 581. (Atypic; type, *Raja rhinobatos* Linn., tautotypic; inadmissible according to opinion 21 of the International Commission of Zoological Nomenclature.)
 1801. *Rhinobatus* Schneider, *Syst. Ichth. Bloch*, p. 353 (type, *Raja rhinobatos* Linn., tautotypic).
 1825. *Rhinobatis* Blainville, *Faune Francaise Poiss.*, p. 47. (Type, *Raja rhinobatos* Linn.)

***Rhinobatos annandalei* (Norman).**

1888. *Rhinobatus columnae* (nec Bonaparte), Day, *Fish. India*, Suppl., p. 811 (Indian Ocean).
 1889. *Rhinobatus columnae* (nec Bonaparte), Day, *Fauna Brit. Ind. Fish.* I, p. 44 (Indian Ocean).
 1909. *Rhinobatis columnae* (nec Bonaparte), Annandale, *Mem. Ind. Mus.* II, p. 14 (off Hugli River mouth).
 1912-13. *Rhinobatus columnae* (nec Bonaparte), Southwell, *Ceylon Adminstr. Rep.*, pp. E 43, E 45, E 48, E 49.
 1914. *Rhinobatus columnae* (nec Bonaparte), Pearson, *Ceylon Adminstr. Rep.*, p. E 14.
 1926. *Rhinobatus annandalei*, Norman, *Proc. Zool. Soc. London*, p. 960, text-fig. 13 (type locality: East Channel, mouth of River Hughli, in 40 fathoms; according to Fowler¹ type is in the British Museum).
 1941. *Rhinobatus annandalei*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 309
- Distribution.*—India, Ceylon, Malaya and Philippines.

***Rhinobatos armatus* (Gray).**

1830. *Rhinobatus typus*? Bennett, *Life of Raffles*, p. 694 (type locality: Sumatra; type? is in the British Museum).
 1833-34. *Rhinobatus armatus* Gray, *Ill. Ind. Zool. Hardwicke* II, pl. xcix (type locality: India).
 1841. *Rhinobatus* (*Rhinobatus*) *armatus*, Müller & Henle, *Syst. Besch. Plagios-tomen*, p. 119 (India).
 1870. *Rhinobatus granulatus* (part) Günther, *Cat. Fish. Brit. Mus.* VIII, p. 443 (India; Sumatra).
 1878. *Rhinobatus granulatus* (part) Day, *Fish. India*, p. 732 (Seas of India to the Malay Archipelago).
 1889. *Rhinobatus granulatus* (part) Day, *Faun. Brit. Ind. Fish.* I, p. 42 (Seas of India to the Malay Archipelago).
 1926. *Rhinobatus armatus*, Norman, *Proc. Zool. Soc. London*, p. 952, text-fig. 6 (India; Singapore; Macassar; Cape York; West Australia).
 1941. *Rhinobatos typus*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 319.
- Distribution.*—India, Malay Peninsula and Malay Archipelago.

Whitley (1940, p. 168) writes: "Several nominal species of the genus *Rhinobatos* have been recorded from Australia (such as *armatus*, *thouin* or *thouiniana*, *halavi* and *granulatus*) but their inclusion in our lists has apparently rested upon old unconfirmed records, misidentifications, or wrongly localised specimens. There is apparently only one common tropical species to which I have given the name *batillum* (Latin for a chafing dish which it rather resembles in shape), and the other specific names may be expunged from our faunal list."

***Rhinobatos granulatus* (Cuvier).**

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

¹Fowler, H. W., *Bull. U. S. Nat. Mus.* (100) XIII, 1941.

1860. *Rhinobatus granulatus*, Blyth, *Journ. As. Soc. Bengal*, XXIX, p. 36 (Calcutta).
 1865. *Rhinobatus (Rhinobatus) granulatus*, Duméril, *Hist. Nat. Elasmobr.* I, p. 493 (Malabar; Ganges River; Pondicherry).
 1870. *Rhinobatus granulatus* (part), Günther, *Cat. Fish. Brit. Mus.* VIII, p. 443 (India; East Indies).
 1878. *Rhinobatus granulatus* (part) Day, *Fish. India*, p. 732, pl. cxcii, fig. 2, (Malabar).
 1878. *Rhinobatus thouini* (nec Shaw), Day, *Fish. India*, p. 732, pl. cxc, fig. 4 (Andamans).
 1889. *Rhinobatus granulatus* (part) Day, *Faun. Brit. Ind. Fish.* I, p. 42, fig. 17 (Seas of India to the Malay Archipelago).
 1889. *Rhinobatus thouini* (nec Shaw), Day, *Faun. Brit. Ind. Fish.* I, p. 44 (Red Sea through India to the Malay Archipelago).
 1908. *Rhinobatus acutus*, Garman, *Bull. Mus. Comp. Zool.* LI, p. 253 (type locality: Ceylon).
 1909. *Rhinobatis granulatus*, Annandale, *Mem. Ind. Mus.* II, p. 14 (off Orissa).
 1910. *Rhinobatis granulatus*, De, *Rep. Fish. Eastern Bengal & Assam*, p. 17 (Chittagong).
 1913. *Rhinobatus granulatus*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 272 (India).
 1913. *Rhinobatus acutus*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 273, pl. xviiB, figs. 1, 2 (Ceylon).
 1926. *Rhinobatus granulatus*, Norman, *Proc. Zool. Soc. London*, p. 949, text-fig. 3 (Madras; India; Shanghai).
 1929. *Rhinobatus granulatus*, Pillay, *Journ. Bombay Nat. Hist. Soc.* XXXIII, p. 352 (Travancore).
 1933. *Rhinobatus granulatus*, Deraniyagala, *Ceylon Journ. Sci.* (c) V, p. 81 (Ceylon).
 1933. *Rhinobatus granulatus*, Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
 1936. *Rhinobatus granulatus*, Hora & Mukerji, *Rec. Ind. Mus.* XXXVIII, pp. 18, 21, pl. ii, fig. 1 (Burma).
 1941. *Rhinobatus granulatus*, Herre, *Mem. Ind. Mus.* XIII, p. 333 (Andamans).

Distribution.—India, Ceylon, Andamans, Burma, Malay Peninsula, Malay Archipelago, Siam, Cochin-China and China.

Rhinobatos lionotus (Norman).

1909. *Rhinobatis schlegeli* (nec Müller & Henle), Annandale, *Mem. Ind. Mus.* II, p. 15 (off Hughli River mouth and Mutlah River).
 1926. *Rhinobatus lionotus*, Norman, *Proc. Zool. Soc. London*, p. 961, text-fig. 14 (type locality: East Channel, mouth of River Hughli, in 40 fathoms; according to Fowler (*vide supra*, p. 25) type is in the British Museum).
 1941. *Rhinobatos lionotus*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 310.

Distribution.—India (Bengal), Philippine Islands.

Rhinobatos obtusus (Müller & Henle).

1841. *Rhinobatus (Rhinobatus) obtusus*, (Müller & Henle, *Syst. Besch. Plagiosomen*, p. 122, pl. xxxvii, fig. 2 (type locality: India; Pondicherry; Malabar; according to Berlin (*vide supra*, p. 9) paratypes from Malabar and Pondicherry are in the Paris Museum).
 1860. *Rhinobatus obtusus*, Blyth, *Journ. As. Soc. Bengal*, XXIX, p. 37 (Calcutta).
 1865. *Rhinobatus obtusus*, Day, *Fish. Malabar*, p. 274 (Malabar).
 1878. *Rhinobatus halavi* (nec Forskal) Day, *Fish. India*, p. 731, pl. cxoiii, fig. 4 (Mangalore).
 1889. *Rhinobatus halavi* (nec Forskal) Day, *Faun. Brit. Ind. Fish.* I, p. 43 (South Africa; India; Malay Archipelago).
 1926. *Rhinobatus obtusus*, Norman, *Proc. Zool. Soc. London*, p. 950, text-fig. 4 (rostra) (India; East Indies).

Distribution.—South Africa, India, Malay Archipelago.

Rhinobatos thouiniana (Shaw).

1798. *Raja thouin*? Anonymous, *Allg. Lit-zeit.* III, pp. 287, 677, 685, pl. i, figs. 3, 4 (type locality : not given).
 1804. *Raja thouiniana*, Shaw, *Gen. Zool.* V, p. 318, pl. cxlvii, fig. 2 (locality unknown).
 1933. *Rhinobatus thouini*, Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
 1941. *Rhinobates thouin*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 317.

Distribution.—Red Sea ? India, Siam, the Malay Archipelago.

Rhinobatos thouiniana has been listed for the first time in India by Sorley.

Genus **Rhina** Schneider.

1792. *Rhina* Walbaum, *Artedi Ichth.* III, ed. 2, p. 580. (Inadmissible according to the Opinion 21 of the International Commission of Zoological Nomenclature.)
 1801. *Rhina* Schneider, *Syst. Ichth. Bloch*, p. 352. (Type, *Rhina ancylostomus* Schneider.)
 1862. *Rhombobatis* Gill, *Ann. Lyc. Nat. Hist. New York* VII, p. 408. (Type, *Rhina ancylostomus* Schneider.)

Rhina ancylostoma Schneider.

1801. *Rhina ancylostomus*, Schneider, *Syst. Ichth. Bloch*, p. 352, pl. lxxii (type locality : Indian Seas ; Coromandel).
 1833-34. *Rhina ancylostomus*, Gray, *Ill. Ind. Zool. Hardwicke* II, pl. cii, fig. 2 (India).
 1851. *Rhina ancylostomus*, Jerdon, *Madras Journ. Lit. Sci.* XVII, p. 148.
 1851. *Rhina ancylostomus*, Gray, *List Fish. Brit. Mus.* p. 92 (Madras ; China ; Pinang).
 1870. *Rhynchobatus ancylostomus*, Günther, *Cat. Fish. Brit. Mus.* VIII, p. 440 (Madras ; China ; Seychelles ; Penang).
 1878. *Rhynchobatus ancylostomus*, Day, *Fish. India*, p. 730, pl. cxciii, fig. 3 (Madras).
 1889. *Rhynchobatus ancylostomus*, Day, *Faun. Brit. Ind. Fish.* I, p. 41 (Coromandel Coast).
 1909. *Rhombobatis ancylostomus*, Annandale, *Mem. Ind. Mus.* II, p. 10, pl. v, fig. 5 (off Orissa and Hughli River mouth).
 1914. *Rhynchobatus ancylostomus*, Pearson, *Ceylon Adminstr. Rep.*, p. E 4.
 1929. *Rhynchobatus ancylostomus*, Pillay, *Journ. Bombay Nat. Hist. Soc.* XXXIII, p. 351 (Travancore).
 1933. *Rhynchobatus ancylostomus*, Deremiyagala, *Ceylon Journ. Sci.* (c) V, p. 81 (Ceylon).
 1933. *Rhynchobatus ancylostomus*, Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).

Distribution.—East Africa, Red Sea, Seychelles, India, Ceylon, Malay Peninsula, Cochin China, Japan, Philippines.

Genus **Rhynchobatus** Müller & Henle.

1837. *Rhynchobatus* Müller & Henle, *Sitz. Ber. Akad. Wiss. Berlin*, p. 116. (Type, *Rhinobatus laevis* Schneider, monotypic.)

Rhynchobatus djiddensis (Forskål).

1775. *Raja djiddensis*, Forskål, *Descript. Animal.*, pp. viii, 18 (type locality : Djedda and Lohaja, Red Sea).
 1841. *Rhynchobatus laevis*, Müller & Henle, *Syst. Besch. Plagiostomen*, p. 111 (India ; Red Sea ; Malabar).

1851. *Rhynchobatus djeddensis*, Jerdon, *Madras Journ. Lit. Sci.* XVII, p. 148.
 1865. *Rhynchobatus djeddensis*, Day, *Fish. Malabar*, p. 273 (Malabar).
 1870. *Rhynchobatus djeddensis*, Günther, *Cat. Fish. Brit. Mus.* VIII, p. 441
 (Red Sea ; Zanzibar ; Seychelles ; Sumatra ; East Indies ; India).
 1878. *Rhynchobatus djeddensis*, Day, *Fish. India*, p. 730, pl. cxcii, fig. 1 (Coromandel Coast).
 1889. *Rhynchobatus djeddensis*, Day, *Faun. Brit. Ind. Fish.* I, p. 40, fig. 16
 (Coromandel Coast).
 1909. *Rhinobatis djeddensis*, Annandale, *Mem. Ind. Mus.* II, p. 12 (Bay of Bengal).
 1913. *Rhynchobatus djiddensis*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 268 (Red Sea ; East Indies ; Africa ; India).
 1914. *Rhynchobatus djiddensis*, Pearson, *Ceylon Adminstr. Rep.*, p. E 4.
 1920. *Rhynchobatus djeddensis*, Southwell & Prashad, *Rec. Ind. Mus.* XIX, p. 4 (Ceylon).
 1922. *Rhynchobatus djiddensis*, Malpas, *Ceylon Adminstr. Rep.*, p. F 6.
 1927. *Rhynchobatus djeddensis*, Pillay, *Journ. Bombay Nat. Hist. Soc.* XXXIII, p. 352 (Travancore).
 1933. *Rhynchobatus djeddensis*, Deraniyagala, *Ceylon Journ. Sci.* (c) V, p. 81 (Ceylon).
 1933. *Rhynchobatus djeddensis*, Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
 1941. *Rhynchobatus djeddensis*, Herre, *Mem. Ind. Mus.* XIII, p. 333 (Andamans).
 1942. *Rhynchobatus djeddensis*, Sarangdhar, *Ind. Journ. Med. Res.* XXX, p. 557 (Bombay).

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

Family PRISTIDAE.

Genus *Pristis* Linck.

1779. *Pristis* Klein, *Neuer Schauplatz* VII, p. 403. (Type, *Squalus pristis* Linn., inadmissible.)
 1790. *Pristis* Linck, *Mag. Phys. Naturg. Gotha* (3) VI, p. 31. (Type, *Squalus pristis* Linn., monotypic.)
 1794. *Pristis* Latham, *Trans. Linn. Soc. London* II, p. 276. (Type, *Squalus pristis* Linn.)
 1816. *Pristobatus* Blainville, *Bull. Soc. Philom. Paris*, VIII, p. 121. (Type, *Pristis antiquorus* Latham-*Squalus pristis* Linn., designated by Fowler, *Bull. Geol. Surv. New Jersey* IV, p. 81, 1911.)

Pristis cuspidatus Latham.

1794. *Pristis cuspidatus*, Latham, *Trans. Linn. Soc. London* II, p. 279, pl. xxvi, fig. 3 (type locality ?).
 1804. *Squalus semisagittatus*, Shaw, *General Zoology* V, p. 361 (type locality Indian Seas).
 1851. *Pristis cuspidatus*, Gray, *List Fish Brit. Mus.* p. 90 (Tenasserim).
 1865. *Pristis semisagittatus* Day, *Fish. Malaabr*, p. 272 (Malabar).
 1870. *Pristis cuspidatus*, Günther, *Cat. Fish. Brit. Mus.* VIII, p. 439 (Pinang ; India ; East Indies ; Tenasserim ; Bengal).
 1878. *Pristis cuspidatus*, Day, *Fish. India*, p. 728, pl. cxc, fig. 3 (Calicut and Madras).
 1888. *Pristis cuspidatus*, Ogilby, *Cat. Fish. Austral. Mus.* I, p. 14 (Madras).
 1889. *Pristis cuspidatus*, Day, *Faun. Brit. Ind. Fish.* I, p. 37, fig. 15 (Seas of India to Malay Archipelago).
 1907. *Pristis cuspidatus* Lloyd, *Rec. Ind. Mus.* I, p. 220 (Akyab).
 1909. *Pristis cuspidatus*, Annandale, *Mem. Ind. Mus.* II, p. 5 (Off Orissa and Ganges mouth).
 1910. *Pristis cuspidatus*, Southwell, *Spol. Zeyl.* VI, 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. Ind. Mus.* VII, p. 58 (Arakan Coast).
 1913. *Pristis cuspidatus*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 261 (India ; Red Sea ; East Indies).
 1914. *Pristis cuspidatus*, Pearson, *Ceylon Adminstr. Rep.*, p. E 23 (Trincomalee).
 1919. *Pristis cuspidatus*, Southwell & Prashad, *Rec. Ind. Mus.* XVI, p. 225 (off the Coast of Ceylon).
 1928. *Pristis cuspidatus*, Fowler, *Journ. Bom. Nat. Hist. Soc.* XXXIII, p. 101 (Bombay).
 1929. *Pristis cuspidatus*, Pillay, *Journ. Bombay Nat. Hist. Soc.* XXXIII, p. 352 (Travancore).
 1941. *Pristis cuspidatus*, Herre, *Mem. Ind. Mus.* XIII, p. 333 (Andamans).

Distribution.—Red Sea, India, Burma, Ceylon, Andamans, Malay Peninsula, Cochin China, Philippines.

***Pristis microdon* Latham.**

1794. *Pristis microdon*, Latham, *Trans. Lin. Soc. London* II, p. 280, pl. xxvi, fig. 4 (type locality ?).
 1841. *Pristis perotteti*, Müller & Henle, *Syst. Besch. Plagiostomen*, p. 108 (type locality : Senegal ; paratype is in the Paris Museum).
 1878. *Pristis perotteti*, Day, *Fish. India*, p. 729, pl. cxc, fig. 1 (Mahanadi river, Orissa).
 1889. *Pristis perotteti*, Day, *Faun. Brit. Ind. Fish.* I, p. 38 (Mahanadi river, Orissa).
 1909. *Pristis perotteti*, Annandale, *Mem. Ind. Mus.* II, p. 6 (off Arakan Coast and Orissa).
 1915-18. *Pristis perotteti*, Pearson, *Ceylon Adminstr. Rep.*, p. F 9.
 1921. *Pristis perotteti*, Malpas, *Ceylon Adminstr. Rep.*, p. E 6.
 1929. *Pristis perotteti*, Pillay, *Journ. Bombay Nat. Hist. Soc.* XXXIII, p. 352 (Travancore).
 1933. *Pristis perotteti*, Deraniyagala, *Ceylon Journ. Sci.* (c) V, p. 81 (Ceylon).
 1933. *Pristis perotteti*, Sorley, *Marine Fish. Bombay Presidency*, p. 159.
 1940. *Pristis perotteti*, Prater, *Journ. Bombay Nat. Hist. Soc.* XLI, p. 435 (Bombay).
 1942. *Pristis perotteti*, Sarangdhar, *Ind. Journ. Med. Res.* XXX, p. 556 (Bombay).

Distribution.—Zanzibar, Madagascar, India, Ceylon, Siam, Malay Archipelago, tropical Atlantic.

***Pristis pectinatus* Latham.**

1794. *Pristis pectinatus*, Latham, *Trans. Zool. Soc. London* II, p. 278, pl. xxvi, fig. 2 (type locality : in the Ocean).
 1822. *Squalus pectinatus*, Hamilton, *Fish. Ganges*, pp. 5, 361 (the Ganges).
 1860. *Pristis pectinatus*, Blyth, *Journ. As. Soc. Bengal* XXIX, p. 36 (Calcutta).
 1870. *Pristis pectinatus*, Günther, *Cat. Fish. Brit. Mus.* VIII, 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, *Faun. Brit. Ind. Fish.* I, p. 39 (Akyab).
 1908. *Pristis annandalei*, Chaudhuri, *Rec. Ind. Mus.* II, p. 391, fig. (type locality : Burma).
 1909. *Pristis annandalei*, Annandale, *Mem. Ind. Mus.* II, p. 8, pl. v, fig. 4 (Bay of Bengal).
 1910. *Pristis pectinatus*, De, *Rep. Fish. Eastern Bengal & Assam*, p. 17 (Chittagong).
 1913. *Pristis pectinatus*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 262 (tropical and temperate Seas).
 1922. *Pristis pectinatus*, Hora, *Mem. Ind. Mus.* V, p. 763 (Chilka Lake).

Distribution.—South Africa, Red Sea, India, Burma, Philippines and tropical Atlantic.

Pristis zysron Bleeker.

1851. *Pristis zysron*, Bleeker, *Nat. Tijds. Nederland, Ind.* II, p. (417) 442 (type locality: Bandjer-massing, Borneo, in rivers).
 1870. *Pristis zysron*, Günther, *Cat. Fish. Brit. Mus.* VIII, p. 438 (Ceylon).
 1878. *Pristis zysron*, Day, *Fish. India*, p. 729 pl. cxc, fig. 2 (the example figured, 34 inches long, was from Madras).
 1889. *Pristis zysron*, Day, *Faun. Brit. Ind. Fish.* I, p. 38 (the Mekran and Sind Coasts).
 1909. *Pristis zysron*, Annandale, *Mem. Ind. Mus.* II, p. 8 (India).
 1913. *Pristis zysron*, Garman, *Mem. Mus. Comp. Zool.* XXXVI, p. 262 (India; East Indies; Ceylon; Borneo; Amboina).

Distribution.—India, Ceylon, East Indies and Philippines.

Family DISCOBATIDAE.

Genus **Zanobatus** Garman.

1913. *Zanobatus* Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 291. (Type, *Platyrrhina schoenleinii* Müller & Henle, monotypic).

Zanobatus schoenleinii (Müller & Henle).

1841. *Platyrrhina schoenleinii*, Müller & Henle, *Syst. Besch. Plagiostomen*, p. 125, pl. xlv (type locality: India).
 1865. *Platyrrhina schoenleinii*, Duméril, *Hist. Nat. Elasmobr.* I, p. 577 (India).
 1870. *Platyrrhina schonleinii*, Günther, *Cat. Fish. Brit. Mus.* VIII, p. 471 (India).
 1878. *Platyrrhina schonleinii*, Day, *Fish. India*, p. 735 (Madras).
 1889. *Platyrrhina schonleinii*, Day, *Faun. Brit. Ind. Fish.* I, p. 47 (Coromandel Coast; Madras).
 1913. *Zanobatus schoenleinii*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 291 (India).
 1941. *Zanobatus schoenleinii*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 327.

Distribution.—India, Philippines.

Family RAJIDAE.

Genus **Raja** Linnaeus.

1758. *Raja* Linnaeus, *Syst. Nat.* I, ed. 10, p. 231. (Type, *Raja clavata* Linn.: designated by Jordan & Gilbert, *Proc. U. S. Nat. Mus.* V, p. 36, 1882.)
 1775. *Leiobatus* Klein, *Neuer Schauplatz* I, p. 316. (Type, *Raja oxyrinchus* Linn., designated by Jordan, *Genera Fish.*, pt. I, p. 36, 1917; inadmissible.)
 1777. *Raja* Scopoli, *Introd. Hist. Nat.* p. 464. (Type, *Raja clavata* Linn.)

Raja andamanica (Lloyd).

1909. *Raja andamanica*, Lloyd, *Mem. Ind. Mus.* II, p. 140 (type locality: Andaman Sea in 279 fathoms; type is in the Zoological Survey of India).
 1909. *Raja andamanica*, Lloyd, *Ill. Zool. Investig. Fish.*, pl. xlv, fig. 2 (Andaman Sea).
 1913. *Raja andamanica*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 352 (Andaman Sea).
 1941. *Raja andamanica*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 399.

Distribution.—India, Philippines.

Raja johannis-davisi Alcock.

1899. *Raja johannis-davisi*, Alcock, *Cat. Ind. Deep Sea Fish.*, p. 21 (type locality: Travancore Coast in 224-284 fathoms; type is in the Zoological Survey of India).
 1900. *Raja johannis-davisi*, Alcock, *Ill. Zool. Investig. Fish.*, pl. xxvii, figs. 2, 2a (Travancore Coast).
 1913. *Raja johannis-davisi*, Garman, *Mem. Mus. Comp. Zool. Harvard XXXVI*, p. 355 (off Travancore Coast).
 1939. *Raja johannis-davisi*, Norman, *Sci. Rep. John Murray Exped.* VII, p. 14 (Travancore Coast; Gulf of Aden; Zanzibar?).
 1941. *Raja johannis-davisi*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 367

Distribution.---India, Philippines, Gulf of Aden, Zanzibar ?

Raja mamillidens Alcock.

1889. *Raja mamillidens*, Alcock, *Ann. Mag. Nat. Hist.* (6) IV, p. 380 (type locality: Gulf of Manaar in 597 fathoms; type is in the Zoological Survey of India).
 1892. *Raja mamillidens*, Alcock, *Ill. Zool. Investig. Fish.*, pl. viii, fig. 1 (Gulf of Manaar).
 1899. *Raja mamillidens*, Alcock, *Cat. Ind. Deep Sea Fish.*, p. 19 (Gulf of Manaar).
 1913. *Raja mamillidens*, Garman, *Mem. Mus. Comp. Zool. Harvard XXXVI*, p. 350 (Gulf of Manaar).
 1941. *Raja mamillidens*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 377.

Distribution.---India, Philippines.

Raja powelli Alcock.

1898. *Raja powelli*, Alcock, *Ann. Mag. Nat. Hist.* (7) II, p. 145 (type locality: Gulf of Martaban, Burma, in 67 fathoms; type is in the Zoological Survey of India).
 1899. *Raja powelli*, Alcock, *Ill. Zool. Investig. Fish.*, pl. xxvi, 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) XVIII, p. 309 (type locality: Gulf of Aden, in 130 fathoms; type is in the Zoological Survey of India).
 1907. *Raia philipi*, Lloyd, *Rec. Ind. Mus.* I, p. 5 (13° 36' 00"N., 47° 32' 00"E., in 130 fathoms, Arabian Sea).
 1908. *Raia philipi*, Lloyd, *Ill. Zool. Investig. Fish.*, pls. xl, xli, fig. 1 (Gulf of Aden).
 1909. *Raja powelli*, Annandale, *Mem. Ind. Mus.* II, p. 16 (off Trivandrum, West Coast of India).
 1909. *Raia philipi*, Lloyd, *Mem. Ind. Mus.* II, p. 142, fig. 1c (Gulf of Aden).
 1913. *Raia powelli*, Garman, *Mem. Mus. Comp. Zool. Harvard XXXVI*, p. 353 (Gulf of Martaban).
 1913. *Raia philipi*, Garman, *Mem. Mus. Comp. Zool. Harvard XXXVI*, p. 353 (Gulf of Aden).
 1929. *Raia powelli*, Pillay, *Journ. Bombay Nat. Hist. Soc.* XXXIII, p. 352 (Travancore).
 1939. *Raja powelli*, Norman, *Sci. Rep. John Murray Exped.* London, VII, p. 13 (Gulf of Aden; Travancore Coast; Gulf of Martaban).
 1941. *Raja philipi*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 386.
 1941. *Raja powelli*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 387.

Distribution.---Gulf of Aden, India, Philippines.

Raja reversa (Lloyd).

1906. *Raia reversa*, Lloyd, *Ann. Mag. Nat. Hist.* (7) XVIII, p. 310 (type locality: Arabian Sea, off Beluchistan Coast in 820 fathoms; type is in the Zoological Survey of India).
 1908. *Raia reversa*, Lloyd, *Ill. Zool. Investig. Fish.*, pls. xxxix, xl, fig. 2 (Arabian Sea, off Beluchistan Coast).

1909. *Raja reversa*, Lloyd, *Mem. Ind. Mus.* II, p. 141 (Arabian Sea, off the Baluchistan Coast).
 1913. *Raja reversa*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 354 (Arabian Sea, off the Baluchistan Coast).
 1941. *Raja reversa*, Fowler, *Bull. U.S. Nat. Mus.* (100) XIII, p. 362.

Distribution.—Arabian Sea, Philippines.

Family TRYGONIDAE (*DASYBATIDAE*, *DASYATIDAE*).

Genus **Taeniura** Müller & Henle.

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

Taeniura lymma (Forskål).

1775. *Raja lymma*, Forskal, *Descript. Animal*, p. viii, 17 (type locality; Lohaja, Red Sea).
 1841. *Taeniura lymma*, Müller & Henle, *Syst. Besch. Plagiostomen*, p. 171, pl. lv, fig. 3 (India; Red Sea; Timor; New Ireland).
 1878. *Taeniura melanospilos*, Day, *Fish. India*, p. 740 (off Coromandel Coast).
 1889. *Taeniura melanospilos*, Day, *Faun. Brit. Ind. Fish.* I, p. 56 (Coromandel Coast).
 1910. *Taeniura melanospilos*, Southwell, *Rep. Ceylon Marine Lab.* I, p. 185 (Ceylon).
 1912-13. *Taeniura melanospilos*, Southwell, *Ceylon Adminstr. Rep.*, pp. E 43, E 49 (Ceylon).
 1933. *Taeniura melanospilus*, Deraniyagala, *Ceylon Journ. Sci.* (c) V, p. 81 (Ceylon).
 1941. *Taeniura lymma*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 398.

Distribution.—Zanzibar, Mozambique, Mauritius, Red Sea, Arabia, India, Ceylon, Malay Peninsula, Siam, Malay Archipelago, Australia, Melanesia, Polynesia.

Taeniura meyeri Müller & Henle.

1841. *Taeniura meyeri*, Müller & Henle, *Syst. Besch. Plagiostomen*, p. 172, pl. lv. (type locality; Mauritius, according to Bertin (*vide supra*, p. 9) the type is in the Paris Museum).
 1912-13. *Taeniura meyeri*, Pearson, *Ceylon Adminstr. Rep.*, p. E13.
 1941. *Taeniura meyeri*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 401.

Distribution.—Mauritius, Ceylon, Philippines. Whitley (*vide supra*, p. 10) writes thus: "A Mauritius species listed from Cape Upstart, Queensland, by Gray (*List. Spec. Fish. Brit. Mus.* I., *Chondropt.*, 1851, p. 124) apparently in error. This species may be expunged from the Australian list."

Genus **Dasyatis** Rafinesque.

1792. *Dasybatus* (Klein) Walbaum, *Artedi Pisc.* III, p. 581. (Atypic: type, *Raja pastinaca* Linn., designated by Jordan, *Proc. U. S. Nat. Mus.* IV, p. 35, 1881; inadmissible according to the opinion 21 of the International Commission of Zoological Nomenclature.)
 1810. *Dasyatis* Rafinesque, *Caratt. Animal. Piante Sicilia*, p. 16. (Type, *Dasyatis ujo* Rafinesque, monotypic.)
 1817. *Trygon* (Adanson) Cuvier, *Règne Animal*, ed. 1, II, p. 316. (Type, *Raja pastinaca* Linn., designated by Jordan, *Gen. Fish.*, p. 98, 1917.)
 1828. *Pastinachus* Rüppell, *Atlas Reise Nördl. Afrika Fische*, p. 82. (Type *Raja sephen* Forskal.)
 1837. *Himantura* Müller & Henle, *Arch. Naturg.* III, p. 400. Atypic; type *Raja uarnak* Forskal, designated by Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 375, 1913).

1845. *Dasibatis* Agassiz, *Nomencl. Zool. Pisces*, p. 21. (Type, *Raja pastinaca* Linn.).
 1913. *Amphotistius* Garman, *Mem. Mus. Comp. Zool. Harvard XXXV* I, p. 375 (Type, *Trygon savinus* Le Sueur, orthotypic).

***Dasyatis* (*Himantura*) *alcockii* (Annandale).**

1909. *Trygon alcockii*, Annandale, *Mem. Ind. Mus.* II, p. 27, fig. 3 (type locality: Puri, Orissa Coast; type is in the Zoological Survey of India).
 1913. *Dasybatus alcockii*, Garman, *Mem. Mus. Comp. Zool. Harvard XXXVII* p. 378 (Orissa Coast).
 1941. *Dasyatis alcockii*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 411.

Distribution.—India, Philippines.

***Dasyatis* (*Himantura*) *bleekeri* (Blyth).**

1860. *Trygon bleekeri*, Blyth, *Journ. As. Soc. Bengal*, XXIX, p. 41 (type locality: Bengal).
 1870. *Trygon bleekeri*, Günther, *Cat. Fish. Brit. Mus.* VIII, p. 475 (Bay of Bengal).
 1878. *Trygon bleekeri*, Day, *Fish. India*, p. 738, pl. cxcv, fig. 3 (the example figured, 8 inches across the disk, was from Bengal).
 1889. *Trygon bleekeri*, Day, *Faun. Brit. Ind. Fish.* I, p. 54 (Bengal).
 1909. *Trygon bleekeri*, Annandale, *Mem. Ind. Mus.* II, p. 26, pl. iii, fig. 9 (off Burma & Orissa).
 1913. *Dasybatus bleekeri*, Garman, *Mem. Mus. Comp. Zool. Harvard XXXVI*, p. 379 (Burma; Orissa; Bengal).
 1915-18. *Trygon bleekeri*, Pearson, *Ceylon Adminstr. Rep.*, p. F 14.
 1933. *Trygon bleekeri*, Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
 1941. *Dasyatis bleekeri*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 410.

Distribution.—India, Ceylon, Siam, Cochin China, Philippines.

***Dasyatis* (*Himantura*) *favus* (Annandale).**

1909. *Trygon favus*, Annandale, *Mem. Ind. Mus.* II, p. 25, pl. i, fig. 3, pl. iii, fig. 10 (type locality: off Orissa; type is in the Zoological Survey of India).
 1913. *Dasybatus favus*, Garman, *Mem. Mus. Comp. Zool. Harvard XXXVI*, p. 377 (off Coast of Orissa).
 1941. *Dasyatis favus*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 412.

Distribution.—India, Philippines.

***Dasyatis* (*Himantura*) *gerrardi* (Gray).**

1851. *Trygon gerrardi*, Gray, *List Fish Brit. Mus.* p. 116 (type locality: India).
 1870. *Trygon gerrardi*, Günther, *Cat. Fish. Brit. Mus.* VIII, p. 474 (India, East Indies; Japan).
 1878. *Tryson uarnak* (nec Forskal), Day, *Fish. India*, pl. exciv, fig. 1.
 1909. *Trygon gerrardii*, Annandale, *Mem. Ind. Mus.* II, p. 24, pl. ii, fig. 2, pl. iii, fig. 6 (Burma; Chittagong; Orissa).
 1913. *Dasybatus gerrardi*, Garman, *Mem. Mus. Comp. Zool. Harvard XXXVI*, p. 377 (India; East Indies; Samoa; Zanzibar).
 1941. *Dasyatis gerrardi*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 409.

Distribution.—Zanzibar, Red Sea, India, Burma, Japan, Malay Archipelago, Polynesia.

***Dasyatis* (*Himantura*) *uarnak* (Forskāl).**

1775. *Raja uarnak*, Forskal, *Descript. Animal.*, pp. viii, 18 (type locality Arabia).
 1833-34. *Trygonobatus russellii*, Gray, *Ill. Ind. Zool. Hardwicke*, II, pl. c (type locality: India),

1841. *Trygon variegatus*, McClelland, *Calcutta Journ. Nat. Hist.* I, p. 60, pl. ii, fig. 2 (type locality : Salt lake, near Calcutta).
 1853. *Trygon chindrakee*, Bleeker, *Verh. Bat. Gen.* (Bengal) XXV, p. 82 (on *Tenkee shindraki* Russell, *Fish. Coromandel I*, p. 3, pl. v, 1803 ; type locality : Vizagapatam).
 1860. *Trygon elliotti*, Blyth, *Journ. As. Soc. Bengal* XXIX, p. 41, (type locality : Lower Bengal).
 1860. *Trygon russellii*, Blyth, *Journ. As. Soc. Bengal* XXIX, p. 42 (Calcutta).
 1860. *Trygon uarnak*, Blyth, *Journ. As. Soc. Bengal* XXIX, p. 44 (Calcutta).
 1865. *Trygon uarnak*, Day, *Fish. Malabar*, p. 277 (Malabar).
 1865. *Trygon (Himantura) undulatus*, Duméril, *Hist. Nat. Elasmobr.* I, p. 586 (Malabar).
 1870. *Trygon uarnak*, Günther, *Cat. Fish. Brit. Mus.* VIII, p. 473 (Red Sea, Zanzibar ; Seychelles ; Madras ; Pinang ; India ; East Indies).
 1878. *Trygon uarnak*, Day, *Fish. India*, p. 737, nec. pl. exciv, fig. 1 (Red Sea : Seas of India to the Malay Archipelago, China and Cape of Good Hope).
 1889. *Trygon uarnak*, Day, *Faun. Brit. Ind. Fish.* I, p. 53 (Red Sea : Seas of India to the Malay Archipelago, China and Cape of Good Hope).
 1907. *Trygon uarnak*, Lloyd, *Rec. Ind. Mus.* I, p. 220 (Akyab).
 1909. *Trygon uarnak*, Annandale, *Mem. Ind. Mus.* II, p. 22, pl. i, figs. 1, 2, pl. ii, figs. 1, 1a, pl. iii, fig. 2 (Bay of Bengal).
 1910. *Trygon uarnak*, De, *Rep. Fish. Eastern Bengal & Assam*, p. 17 (Chittagong).
 1912-13. *Trygon uarnak*, Pearson, *Ceylon Adminstr., Rep.* p. E 13.
 1912-13. *Trygon uarnak*, Southwell, *Ceylon Adminstr. Rep.*, pp. E 43, E 44.
 1913. *Dasybatus uarnak*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 376 (Indian Ocean ; Red Sea ; East Indies).
 1914. *Trygon uarnak*, Pearson, *Ceylon Adminstr. Rep.*, p. E 4.
 1922. *Trygon uarnak*, Moses, *Madras Fish. Bull.* XV, p. 157 (Madras).
 1922. *Trygon pareh*, Hora, *Mem. Ind. Mus.* V, p. 763 (Chilka Lake).
 1928. *Dasyatis uarnak*, Fowler, *Journ. Bombay Nat. Hist. Soc.* XXXIII, p. 101 (Bombay).
 1933. *Dasyatis uarnak*, Deraniyagala, *Ceylon Journ. Sci.* (c) V, p. 80 (Ceylon).
 1933. *Trygon uarnak*, Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
 1941. *Dasybatus uarnak*, Herre, *Mem. Ind. Mus.* XIII, p. 333, (Andamans).
 1942. *Dasybatus uarnak*, Sarangdhar, *Ind. Journ. Med. Res.* XXX, p. 558 (Bombay).

Distribution.—Cape of Good Hope, Natal, Madagascar, Seychelles, Zanzibar, Red Sea, Arabia, India, Ceylon, Andamans, Burma, Malay Peninsula, Siam, Cochin China, Malay Archipelago, Melanesia, Polynesia.

Dasyatis (Pastinachus) bennetti (Müller & Henle).

1841. *Trygon bennetti*, Müller & Henle, *Syst. Besch. Plagiostomen*, p. 160, pl. liii (type locality : China and Trinidad).
 1870. *Trygon bennettii*, Günther, *Cat. Fish. Brit. Mus.* VIII, p. 480 (China ; India ; British Guiana).
 1878. *Trygon bennettii*, Day, *Fish. India*, p. 739 (Seas of India to China and Ceylon).
 1889. *Trygon bennettii*, Day, *Faun. Brit. Ind. Fish.* I, p. 52 (Seas of India to China and Ceylon).
 1913. *Dasybatus bennettii*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 383 (China ; India).
 1941. *Dasyatia bennettii*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 413.

Distribution.—India, Cochin China, Philippines.

Dasyatis (Pastinachus) sephen (Forskāl).

1775. *Raja sephen* Forskāl, *Descript. Animal.*, pp. viii, 17, (type locality : Djedda, Lohaja, Red Sea).
 1822. *Raia fluviatilis*, Hamilton, *Fish. Ganges*, p. 1 (type locality : Kanpur, Ganges river).
 1822. *Raia sancur*, Hamilton, *Fish. Ganges*, p. 2 (type locality : Ganges river).
 1851. *Hypolophus sephen*, Gray, *List Fish. Brit. Mus.* p. 123 (India).
 1860. *Hypolophus sephen*, Blyth, *Journ. As. Soc. Bengal* XXIX, p. 37 (Calcutta).
 1870. *Trygon sephen*, Günther, *Cat. Fish. Brit. Mus.* VIII, p. 482 (Indian Ocean ; East Indies ; Pinang ; Seychelles).

1878. *Trygon sephen*, Day, *Fish. India*, p. 740, pl. cxcv, fig. 2 (Red Sea, through the Seas of India to the Malay Archipelago, and beyond).
 1889. *Trygon sephen*, Day, *Faun. Brit. Ind. Fish.* I, p. 50, figs. 21-21 (Red Sea, through the Seas of India to the Malay Archipelago, and beyond).
 1909. *Hypolophus sephen*, Annandale, *Mem. Ind. Mus.* II, p. 35 (off Burma).
 1912-13. *Trygon sephen*, Southwell, *Ceylon Adminstr. Rep.*, pp. E 41, E 42, E 45, E 48, E 50.
 1913. *Dasybatus sephen*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 384 (Indian Ocean ; Red Sea ; East Indies ; India).
 1922. *Hypolophus sephen*, Hora, *Mem. Ind. Mus.* V, p. 763 (Chilka Lake).
 1928. *Dasyatis sephen*, Fowler, *Journ. Bombay Nat. Hist. Soc.* XXXIII, p. 102 (Bombay).
 1929. *Trygon sephen*, Pillay, *Journ. Bombay Nat. Hist. Soc.* XXXIII, p. 353 (Travancore).
 1933. *Dasyatis sephen*, Deraniyagala, *Ceylon Journ. Sci.* (c) V, p. 80 (Ceylon).
 1933. *Trygon sephen*, Sorley, *Marine Fish. Bombay Presidency* p. 159 (Bombay).

Distribution.—Seychelles, Red Sea, Arabia, India, Ceylon, Burma, Singapore, Siam, Indo-China, Malay Archipelago, Micronesia.

***Dasyatis (Dasyatis) pastinaca* (Linnaeus).**

1758. *Raja pastinaca*, Linnaeus, *Syst. Nat.* I, ed. 10, p. 232 (type locality : Europe).
 1789. *Raja pastinaca*, Gmelin, *Syst. Nat. Linn.* I, p. 1509 (Europe ; Red Sea ; Indian Sea).
 1929. *Trygon pastinaca*, Pillay, *Journ. Bombay Nat. Hist. Soc.* XXXIII, p. 353 (Travancore).
 1941. *Dasyatis pastinacus*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 420.

Distribution.—South Africa, Natal, Madagascar, India, Philippines, also in the Atlantic.

***Dasyatis (Amphotistius) imbricata* (Schneider).**

1801. *Raja imbricata*, Schneider, *Syst. Ichth. Bloch.*, p. 366 (type locality : Coromandel).
 1841. *Trygon walga*, Müller & Henle, *Syst. Besch. Plagiostomen*, p. 159, pl. li, fig. 1 (type locality : India ; Red Sea ; the paratypes from Red Sea and India are in the Paris Museum).
 1870. *Trygon walga*, Günther, *Cat. Fish. Brit. Mus.* VIII, p. 475 (Bengal Bay ; East Indies ; Pinang ; Java).
 1870. *Trygon nuda*, Günther, *Cat. Fish. Brit. Mus.* VIII, p. 476 (type locality : Singapore ; India).
 1870. *Trygon imbricata*, Günther, *Cat. Fish. Brit. Mus.* VIII, p. 481 (Indian Seas).
 1878. *Trygon walga*, Day, *Fish. India*, p. 738, pl. cxciv, fig. 3 (Red Sea through the Seas of India to the Malay Archipelago).
 1878. *Trygon imbricata*, Day, *Fish. India*, p. 739 (Coromandel Coast of India).
 1889. *Trygon imbricata*, Day, *Faun. Brit. Ind. Fish.* I, p. 52 (Coromandel Coast of India).
 1889. *Trygon walga*, Day, *Faun. Brit. Ind. Fish.* I, p. 55 (Red Sea, through the Seas of India to the Malay Archipelago).
 1907. *Trygon walga*, Lloyd, *Rec. Ind. Mus.* I, p. 220 (Akyab).
 1909. *Trygon imbricata* : Annandale, *Mem. Ind. Mus.* II, p. 32, pl. iii, fig. 5, text-fig. 6 (Puri on Orissa Coasts).
 1912-13. *Trygon imbricata*, Pearson, *Ceylon Adminstr. Rep.*, p. E 13.
 1912-13. *Trygon walga*, Southwell, *Ceylon Adminstr. Rep.*, pp. E 43, E 45, E 47, E 48, E 49.
 1914. *Trygon walga*, Pearson, *Ceylon Adminstr. Rep.*, p. E 4.
 1922. *Trygon walga*, Moses, *Madras Fish. Bull.* XV, p. 157 (Madras).
 1922. *Trygon imbricata*, Hora, *Mem. Ind. Mus.* V, p. 763 (Chilka Lake).
 1926. *Trygon walga*, Malpas, *Ceylon Journ. Sci.* (c) II, p. 34 (Ceylon).
 1929. *Trygon walga*, Pillay, *Journ. Bombay Nat. Hist. Soc.* XXXIII, p. 353 (Travancore).
 1933. *Trygon walga*, Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
 1941. *Dasyatis imbricatus*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 434.

Distribution.—Red Sea, Mauritius, Seychelles, India, Ceylon, Burma, Malay Peninsula, Siam, Indo-China, China, Java, Philippines.

***Dasyatis (Amphotistius) jenkinsii* (Annandale).**

1909. *Trygon jenkinsii*, Annandale, *Mem. Ind. Mus.* II, 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. Mus. Comp. Zool. Harvard XXXVI*, p. 378 (off Ganjam Coast, India).
 1941. *Dasyatis jenkinsii*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 432.

Distribution.—India (Ganjam Coast), Philippines.

***Dasyatis (Amphotistius) kuhlii* (Müller & Henle).**

1841. *Trygon kuhlii*, Müller & Henle, *Syst. Besch. Plagiostomen*, Rep., 164, pl. li, fig. 2 (type locality : India, Vanicore, New Guinea ; paratopotypes from Vanicore and New Guinea are in the Paris Museum).
 1878. *Trygon kuhlii*, Day, *Fish. India*, p. 739, pl. cxci, fig. 2 (Madras).
 1889. *Trygon kuhlii*, Day, *Faun. Brit. Ind. Fish.* I, p. 52 (Madras).
 1909. *Trygon kuhlii*, Annandale, *Mem. Ind. Mus.* II, p. 34 (off Gopalpur, 24 fathoms).
 1912-13. *Trygon kuhlii*, Pearson, *Ceylon Adminstr.*, p. E 12.
 1913. *Dasybatus kuhlii*, Garman, *Mem. Mus. Comp. Zool. Harvard XXXVI*, p. 395 (Japan to India ; East Indies).
 1914. *Trygon kuhlii*, Raj, *Rec. Ind. Mus.* X, p. 317 (Madras).
 1919. *Trygon kuhlii*, Southwell & Prashad, *Rec. Ind. Mus.* XVI, p. 229, pl. xix, fig. 1 (Periya Paar on the Coast of Ceylon).
 1921. *Trygon kuhlii*, Malpas, *Ceylon Adminstr. Rep.*, pp. E 5-E 8.
 1933. *Trygon kuhlii*, Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
 1941. *Dasyatis kuhlii*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 424.

Distribution.—Zanzibar, India, Ceylon, Singapore, Siam, Cochin China, China, Japan, Java, Celebes, Philippines, Melanesia, Polynesia, Australia.

***Dasyatis (Amphotistius) marginatus* (Blyth).**

1860. *Trygon marginatus*, Blyth, *Journ. As. Soc. Bengal XXIX*, p. 38 (type locality : Lower Bengal).
 1860. *Trygon atrocissimus*, Blyth, *Journ. As. Soc. Bengal XXIX*, p. 39 (type locality : Indian Ocean ; tail with spine).
 1865. *Trygon (Himantura) marginatus*, Duméril, *Nat. Hist. Elasmobr.* I, p. 588 (Calcutta).
 1878. *Trygon marginatus*, Day, *Fish. India*, p. 738 (Hooghly at Calcutta).
 1889. *Trygon marginatus*, Day, *Faun. Brit. Ind. Fish.* I, p. 54 (Hooghly at Calcutta).
 1909. *Trygon marginatus*, Annandale, *Mem. Ind. Mus.* II, p. 30, text-fig. 5, pl. iii, fig. 11 (off Burma and Ganjam).
 1913. *Dasybatus marginatus*, Garman, *Mem. Mus. Comp. Zool. Harvard XXXVI*, p. 378 (Burma ; Ganjam ; India).
 1915-18. *Trygon marginatus*, Pearson, *Ceylon Adminstr. Rep.*, p. E 16.
 1941. *Dasyatis marginatus*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 433.

Distribution.—India, Burma, Ceylon, Philippines.

***Dasyatis (Amphotistius) microps* (Annandale).**

1908. *Trygon microps*, Annandale, *Rec. Ind. Mus.* II, p. 393, pl. xxvii (type locality : Bay of Bengal off Chittagong, in 17 fathoms ; type is in the Zoological Survey of India).
 1909. *Trygon microps*, Annandale, *Mem. Ind. Mus.* II, p. 20, text-fig. 1, pl. ii, fig. 3, pl. iii, fig. 1, pl. iv, fig. 1 (off Orissa).
 1913. *Dasybatus microps*, Garman, *Mem. Mus. Comp. Zool. Harvard XXXVI*, p. 381 (Bay of Bengal).
 1941. *Dasyatis microps*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 431.

Distribution.—India, Philippines.

Dasyatis (Amphotistius) zugei (Müller & Henle).

1841. *Trygon zugei*, Müller & Henle, *Syst. Besch. Plagiostomen*, p. 165, pl. liv (type locality : Japan : China ; Pondicherry, India).
 1860. *Trygon crozieri*, Blyth, *Journ. As. Soc. Bengal*, p. 45 (type locality : Lower Bengal).
 1870. *Trygon zugei*, Günther, *Cat. Fish. Brit. Mus.* VIII, p. 481, (Japan ; East Indies ; Pinang ; Madras).
 1878. *Trygon zugei*, Day, *Fish. India*, p. 739, pl. cxc, fig. 3 (Madras).
 1888. *Trygon zugei*, Ogilby, *Cat. Fish. Austral. Mus.* p. 20 (Madras).
 1889. *Trygon zugei*, Day, *Faun. Brit. Ind. Fish.* I, p. 52 (Seas of India to the Malay Archipelago and Japan).
 1909. *Trygon zugei*, Annandale, *Mem. Ind. Mus.* II, p. 33, pl. iv, fig. 2 (off Burma and Orissa).
 1913. *Dasybatus zugei*, Garman, *Mem. Mus. Comp. Zool. Harvard XXXVI*, p. 398, pl. lxxi, fig. 3 (Pinang ; China ; India ; Japan ; East Indies).
 1915-18. *Trygon zugei*, Pearson, *Ceylon Adminstr. Rep.*, pp. F 12-F 14.
 1928. *Dasyatis zugei*, Fowler, *Journ. Bombay Nat. Hist. Soc.* XXXIII, p. 102 (Bombay).
 1933. *Trygon zugei*, Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
 1936. *Dasybatus zugei*, Hora & Mukerji, *Rec. Ind. Mus.* XXXVIII, p. 18 (Maungmagan, Burma.)

Distribution.—India, Burma, Ceylon, Malay Peninsula, Cochin China, Japan, Java, Philippines.

Genus Urogymnus Müller & Henle.

1833. *Anacanthus* (nec. Gray, 1831) (Ehrenberg) Hoven, *Handb. Dierk.* II, p. 179, (Type, *Raja africana* Schn., inadmissible.)
 1837. *Gymnura* (nec Kuhl, 1823) 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, *Journ. As. Soc. Bengal* XVIII, p. 404. (Type, *Raja africana* Schn., inadmissible.)

Urogymnus africana (Schneider).

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. Plagiostomen*, p. 157, pl. lx, figs. 5-7 (India).
 1870. *Urogymnus asperrimus*, Günther, *Cat. Fish. Brit. Mus.* VIII, p. 471 (India ; Pinang ; Africa ; Seychelles).
 1878. *Urogymnus asperrimus*, Day, *Fish. India*, p. 736 pl. cxcv, fig. 1 (Madras).
 1889. *Urogymnus asperrimus*, Day, *Faun. Brit. Ind. Fish.* I, p. 48, fig. 20 (Madras).
 1909. *Urogymnus asperrimus*, Annandale, *Mem. Ind. Mus.* II, p. 37, pl. iii, fig. 8, pl. v, figs. 2-2a (off Chittagong).
 1909. *Urogymnus laevior*, Annandale, *Mem. Ind. Mus.* II, 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. Mus. Comp. Zool. Harvard XXXVI*, p. 374 (Indian Ocean ; East Indies).
 1941. *Urogymnus africanus*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 438.

Distribution.—E. Africa, Seychelles, Red Sea, Arabia, India, Ceylon, Malay Peninsula, Siam, Indo-China, Borneo Java, Philippines, Melanesia.

Genus **Gymnura** Kuhl.

1823. *Gymnura* Kuhl, *Allgemein Konst Letterbode*, p. 316. (Type *Raja micrura* Schneider, monotypic.)
 1837. *Pteroplatea* Müller & Henle, *Sitz. Ber. preuss. Akad. Wiss. Berlin*, p. 117. (Atypic; type, *Raja altavela* Linn., virtually affixed by Jordan & Gilbert. *Bull. U. S. Nat. Mus.* XVI, p. 46, 1883).
 1841. *Aetoplatea* (Valenciennes) Müller & Henle, *Syst. Besch. Plagiostomen*, p. 175. (Type, *Aetoplatea tentaculata* Müller & Henle, monotypic.)

Gymnura (Aetoplatea) tentaculata Müller & Henle.

1841. *Aetoplatea tentaculata*, Müller & Henle, *Syst. Besch. Plagiostomen*, p. 175 (type locality: Indian Sea; Red Sea; according to Bertin holotype *mesuré* and paratypes from Mer des Indes are in the Paris Museum).
 1909. *Pteroplatea tentaculata*, Annandale, *Mem. Ind. Mus.* II, p. 40, pl. iv, fig. 4 (off Hughli River mouth; Orissa and Ganjam Coasts).
 1913. *Aetoplatea tentaculata*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 411 (Red Sea; Indian Ocean; Malabar).
 1941. *Gymnura tentaculata*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 450.
Distribution.—Natal, Red Sea, India, Philippines.

Gymnura (Aetoplatea) zonurus Bleeker.

1852. *Aetoplatea zonurus*, Bleeker, *Verh. Bat. Gen. (Plagiost.)* XXIV, p. 79 (type locality: Batavia, Java).
 1909. *Pteroplatea zonura*, Annandale, *Mem. Ind. Mus.*, II, p. 40, pl. iv, fig. 3 (Puri, Orissa Coast, in 15-20 fathoms).
 1941. *Gymnura zonura*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 451.
Distribution.—India, Singapore, Java, Philippines.

Gymnura (Gymnura) micrura (Schneider).

1801. *Raja micrura*, Schneider, *Syst. Ichth. Bloch*, p. 360 (type locality: "Surinam", Dutch Guiana).
 1878. *Ceraoptera Ehrenbergii* (nec Müller & Henle), Day, *Fish. India*, p. 745, fig. (type locality: Madras; monstrosity).
 1907. *Pteroplatea micrura*, Lloyd, *Rec. Ind. Mus.* I, p. 220 (Akyab).
 1929. *Pteroplatea micrura*, Pillay, *Journ. Bombay Nat. Hist. Soc.* XXXIII, p. 353 (Iravancore).
 1933. *Pteroplatea micrura* Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
 1941. *Gymnura micrura*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 455.
Distribution.—Arabian Sea, India, Ceylon, Burma, Malay Peninsula, Siam, Indo-China, Malay Archipelago.

Gymnura (Gymnura) poecilura (Shaw).

1804. *Raja poecilura*, Shaw, *General Zoology* V, p. 291 (on *Tenkee kunsal* Russell, *Fish. Coromandel* I, p. 4, pl. vi, 1803; type locality: Vizagapatam).
 1870. *Pteroplatea micrura* (nec Schneider) Günther, *Cat. Fish. Brit. Mus.* VIII, p. 487 (Calcutta; Pinang; Singapore; India).
 1878. *Pteroplatea micrura* (nec Schneider) Day, *Fish. India*, p. 741, pl. cxciv, fig. 2.
 1889. *Pteroplatea micrura* (nec Schneider) Day, *Faun. Brit. Ind. Fish.* I, p. 56, fig. 23 (Madras).
 1909. *Pteroplatea micrura* (nec Schneider) Annandale, *Mem. Ind. Mus.* II, p. 39 (Puri).
 1912-13. *Pteroplatea micrura* (nec Schneider), Southwell, *Ceylon, Administr. Rep.*, pp. E 43-45, E 49.
 1919. *Pteroplatea poecilura*, Southwell & Prashad, *Rec. Ind. Mus.* XVI, p. 232, pl. xix, figs. 3, 3a (Portugal Bay, Ceylon Coast).
 1941. *Gymnura poecilura*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 452.
Distribution.—Red Sea, India, Ceylon, Malay Peninsula, Siam, China, Japan, Java, Sumatra, Philippines.

Family MYLIOBATIDAE.

Genus **Aetomylaeus** Garman.

1908. *Aetomylaeus* Garman, *Bull. Mus. Comp. Zool. Harvard* LI, p. 252. (Type *Myliobatis maculatus* Gray, orthotypic.)

***Aetomylaeus maculatus* (Gray).**

- 1833-34. *Myliobatis maculatus*, Gray, *Ill. Ind. Zool. Hardwicke* II, pl. ci (type locality : Penang).
 1841. *Myliobatis maculatus*, Müller & Henle, *Syst. Besch. Plagiostomen*, p. 178 (India).
 1870. *Myliobatis maculata*, Günther, *Cat. Fish. Brit. Mus.* VIII, p. 490 (India).
 1878. *Myliobatis maculata*, Day *Fish. India*, p. 742 (Seas of India to Malay Archipelago).
 1889. *Myliobatis maculata*, Day, *Faun. Brit. Ind. Fish.* I, p. 59 (Seas of India to Malay Archipelago).
 1909. *Myliobatis maculata*, Annandale, *Mem. Ind. Mus.* II, p. 53 (off Orissa Coast).
 1913. *Aetomylaeus maculatus*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 435 (Indian Seas ; East Indies ; Penang).
 1921. *Myliobatis maculata*, Malpas, *Ceylon Adminstr. Rep.*, p. E 8.
 1933. *Mylobatus maculatus*, Deraniyagala, *Ceylon Journ. Sci.* (c) V, p. 80 (Ceylon).
 1941. *Aetomylus maculatus*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 464.

Distribution.—India, Ceylon, Malay Peninsula, Siam, East Indies, China Sea.

***Aetomylaeus milvus* (Müller & Henle).**

1841. *Myliobatis milvus*, Müller & Henle, *Syst. Besch. Plagiostomen* p. 178 (type locality : Red Sea ; according to Bertin (*vide supra* p. 10) types from Mer des Indes are in the Paris Museum).
 1928. *Aetomylaeus milvus*, Fowler, *Journ. Bombay Nat. Hist. Soc.* XXXIII p. 103 (Bombay).
 1941. *Aetomylus milvus*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, 466.

Distribution.—Red Sea, India, Pinang, East Indies, Philippines, China.

***Aetomylaeus nicholfii* (Schneider).**

- 1801 *Raja nicholfii*, Schneider, *Syst. Ichth. Bloch.* p. 364 (on *Zee-oleermuis* Nieuhoi, *Gadenk. Reiz.* I, p. 278, fig. 1682 ; type locality : East Indies).
 1804. *Raja fasciata*, Shaw, *General. Zoology* II, p. 286, pl. cxliii (on *Mookarah tenkee* Russell, *Fish. Coromandal* I, p. 4, pl. vii, 1803).
 1878. *Myliobatis nieuhoftii*, Day, *Fish. India*, p. 742 (Madras).
 1889. *Myliobatis nieuhoftii*, Day, *Faun. Brit. Ind. Fish.* I, p. 58 (Seas of India to the Malay Archipelago and Japan).
 1909. *Myliobatis nieuhoftii*, Annandale, *Mem. Ind. Mus.* II, p. 51 (off Orissa Coast ; Chittagong ; Ganges mouth ; Burma).
 1913. *Aetomylaeus nicholfii*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 436 (India ; East Indies ; Japan).
 1915. *Aetomylaeus nicholfii*, Chandhuri, *Mem. Ind. Mus.* V, p. 413 (Chilka Lake).
 1919. *Aetomylaeus nicholfii*, Southwell & Prashad, *Rec. Ind. Mus.* XVI, p. 233, pl. xix, figs. 4, 4a (Portugal Bay, Ceylon).
 1921. *Myliobatis nieuhoftii*, Malpas, *Ceylon Adminstr. Rep.*, p. E 8.
 1929. *Myliobatis nieuhoftii*, Pillay, *Journ. Bombay. Nat. Hist. Soc.* XXXIII, p. 353 (Travancore).
 1941. *Aetomylus nicholfii*, Fowler, *Bull. U. S. Nat. Mus.* (100) XII, p. 467.

Distribution.—India, Ceylon, Burma, Malay Peninsula, Cchin-China, China, Japan, Malay Archipelago.

Aetomylaeus nicholfii var **cornifera** (Annandale).

1909. *Myliobatis nieuhofti* var. *cornifera*, Annandale, *Mem. Ind. Mus.* II, p. 52, pl. ii, fig. 4 (type locality : Balasore, Orissa Coast; type is in the Zoological Survey of India).

Distribution.—India, Burma.

Genus **Aetobatus** Blainville.

1816. *Aetobatus* Blainville, *Bull. Soc. Philom. Paris*, VIII, p. 122. (Type, *Raja narinari* Euphrasen, designated by Gill, *Proc. U. S. Nat. Mus.* XVII, p. 122, 1894).
 1825. *Aetobatis* Blainville, *Faun. Francaise Poiss.*, p. 38, (Type, *Raja narinari* Euphrasen).
 1849. *Stoasodon* Cantor, *Journ. As. Soc. Bengal* XVIII, p. 1416. (Type, *Raja narinari*, Euphrasen, monotypic).

Aetobatus narinari (Euphrasen).

1790. *Raja narinari*, Euphrasen, *K. svenska Vetensk-Akad. Handl. Stockholm* XI, p. 217, pl. x (type locality : St. Bartholomieu, West Indies).
 1801. *Raja flagellum*, Schneider, *Syst. Ichth. Bloch*, p. 361, pl. lxxiii (type locality : Coromandel).
 1839. *Aetobatis indica*, Swainson, *Nat. Hist. Animals* II, p. 321. (on *Eel tenkee* Russell, *Fish. Coromandel* I, p. 5, pl. viii, 1803 ; Vizagapatam).
 1841. *Myliobatus macroptera*, McClelland, *Calcutta Journ. Nat. Hist.* I, p. 60, pl. ii, fig. 1 (type locality : Bengal).
 1870. *Aetobatis narinari*, Günther, *Cat. Fish. Brit. Mus.* VIII, p. 492 (Pinang ; India ; Seychelles ; Sumatra).
 1878. *Aetobatis narinari*, Day, *Fish. Ind.*, p. 743, pl. cxciv, fig. 4 (Red Sea ; Seas and estuaries of India to the Malay Archipelago and beyond).
 1889. *Aetobatis narinari*, Day, *Faun. Brit. Ind. Fish.* I, p. 59, fig. 24 (Red Sea ; Seas and estuaries of India to the Malay Archipelago and beyond).
 1907. *Aetobatis narinari*, Lloyd, *Rec. Ind. Mus.* I, p. 220 (Akyab).
 1909. *Aetobatis flagellum*, Annandale, *Mem. Ind. Mus.* II, p. 57 pl. iv, fig. 5 (off Orissa Coast and Chilka Lake).
 1910. *Aetobatis narinari*, Annandale, *Mem. Ind. Mus.* III, p. 4, pl. ii, fig. 2 (off Madras Coast).
 1912-13. *Aetobatis narinari*, Pearson, *Ceylon Adminstr. Rep.*, p. E 5.
 1913. *Aetobatus flagellum*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 440 (Red Sea ; Indian Ocean).
 1913. *Aetobatus narinari*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 441 (tropical and temperate parts of the Atlantic and the Eastern Pacific).
 1929. *Aetobatis narinari*, Pillay, *Journ. Bombay Nat. Hist.* XXXIII, p. 353 (Travancore).
 1933. *Stoasodon narinari*, Deraniyagala, *Ceylon Journ. Sci.* (c) V, p. 81 (Ceylon).
 1933. *Aetobatis narinari*, Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
 1941. *Aetobatus narinari*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 471.

Distribution.—Natal, Madagascar, Seychelles, Red Sea, Arabia, India, Burma, Ceylon, Malay Peninsula, Siam, Cochin China, China, Java, Borneo, Celebes, Philippines, Melanesia, Polynesia, Hawaii Group, Micronesia. According to Fowler (*vide supra* p. 25) *Aetobatus narinari* “ ranges through the tropical Atlantic and along the American shores in the tropical eastern Pacific.”

Family RHINOPTERIDÆ.

Genus **Rhinoptera** Cuvier.

1829. *Rhinoptera* Cuvier, *Régne Animal*, II, ed. 2, p. 401. (Type, *Myliobatis marginata* Geoffroy Saint-Hilaire, designated by Fowler, *Bull. Geol. Surv. New Jersey* IV, p. 101, 1911).

Rhinoptera adpersa Müller & Henle.

1841. *Rhinoptera adpersa*, Müller & Henle, *Syst. Besch. Plagiostomen*, p. 183 (type locality : India ; according to Bertin (*vide supra*, p. 9) holotype is in the Paris Museum).
 1878. *Rhinoptera adpersa*, Day, *Fish. India*, p. 744 (Madras).
 1889. *Rhinoptera adpersa*, Day, *Faun. Brit. Ind. Fish.* I, p. 61 (Seas of India).
 1913. *Rhinoptera adpersa*, Garman, *Mem. Mus. Comp. Zool. Harvard XXXVI*, p. 447 (Indian Ocean).
 1933. *Rhinoptera adpersa*, Deraniyagala, *Ceylon Journ. Sci.* (c) V, p. 81 (Ceylon).
 1941. *Rhinoptera adpersa*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 477.

Distribution.—India, Ceylon, East Indies.

Rhinoptera javanica Müller & Henle.

1841. *Rhinoptera javanica*, Müller & Henle, *Syst. Besch. Plagiostomen*, p. 182, pl. lviii (type locality : Java ; according to Bertin (*vide supra*, p. 9) type from Malabar Coast is in the Paris Museum).
 1865. *Rhinoptera javanica*, Duméril, *Hist. Nat. Elasmobr.* I, p. 647 (Malabar).
 1878. *Rhinoptera javanica*, Day, *Fish. India*, p. 744, pl. cxcv, fig. 4 (Kurrachee).
 1889. *Rhinoptera javanica*, Day, *Faun. Brit. India, Fish.* I, p. 61, fig. 25 (Seas of India to Malay Archipelago).
 1912-13. *Rhinoptera javanica*, Southwell, *Ceylon Adminstr. Rep.*, p. E 50.
 1913. *Rhinoptera javanica*, Garman, *Mem. Mus. Comp. Zool. Harvard XXXVI*, p. 446 (Java ; India).
 1929. *Rhinoptera javanica*, Pillay, *Journ. Bombay Nat. Hist.* XXXIII, p. 354 (Travancore).
 1933. *Rhinoptera javanica*, Deraniyagala, *Ceylon Journ. Sci.* (c) V, p. 81.
 1942. *Rhinoptera javanica*, Sarangdhar, *Ind. Journ. Med. Res.* XXX, p. 558 (Bombay).

Distribution.—India, Ceylon, Malay Peninsula, Siam, China, Malay Archipelago.

Rhinoptera jayakari Boulenger.

1895. *Rhinoptera jayakari*, Boulenger, *Ann. Mag. Nat. Hist.* (6) XV, p. 141 (type locality ; Muscat, Arabia ; type is in the British Museum).
 1913. *Rhinoptera jayakari*, Garman, *Mem. Mus. Comp. Zool. Harvard XXXVI*, p. 448 (Muscat).
 1941. *Rhinoptera jayakari*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 478.

Distribution.—Muscat.

Rhinoptera sewelli Misra.

1946. *Rhinoptera sewelli*, Misra, *Rec. Ind. Mus.* XLIV, p. 361, pl. i (type locality : West Hill, off the Calicut coast, Arabian Sea ; holotype is in the Zoological survey of India).

Distribution.—Arabian Sea, off the coast of Calicut.

Family MOBULIDAE.

Genus **Mobula** Rafinesque.

1810. *Mobula* Rafinesque, *Indice d' Ittiol, Sicil.*, pp. 48, 61. (Type, *Mobula auriculata* Rafinesque, monotypic).
 1810. *Apterurus* Rafinesque, *Indice d' Ittiol Sicil.*, p. 48, 62. (Type, *Raja fabroniana* Lacepede, monotypic).
 1810 *Cephalopterus* (nec Geoffroy St. failaire 1809) (Dumeril) Risso, *Ichth. Nice*, p. 14 ; type, *Raja giorna* Lac.-*Raja cephaloptera* Schn., virtually tautotypic ; inadmissible.

1816. *Dicerobatus* Blainville, *Bull. Soc. Philom. Paris* VIII, p. 121. (Type, *Raja mobular* Bonnaterre, designated by Jordan, *Gen. Fish.* p. 95, 1917.)
 1817. *Cephaloptera* Cuvier, *Régne Animal*. II, ed. 1, pl. 138. (Type, *Raja cephaloptera* Schneider, monotypic).
 1825. *Dicerobatis* Blainville, *Faune Francaise* Vertebr., p. 40. (Type, *Raja mobular* Bonnaterre).

Mobula diabolus (Shaw).

1804. *Raja diabolus*, Shaw, *General Zoology* V, p. 291 (on *Eregoodoo-tenkee* Russell, *Fish. Coromandel* I, p. 5, pl. ix, 1803 (type locality : Vizagapatam)).
 1829. *Raja eregoodoo-tenkee*, Cuvier, *Régne Animal*, ed. 2, II p. 402 (on *Eregoodoo-tenkee* Russell, 1803).
 1841. *Cephaloptera kuhlii*, Müller & Henle, *Syst. Besch. Plagiostomen*, p. 185, pl. lix, fig. 1 (type locality : India, according to Bertin (*vide supra*, p. 9) the paratype is in the Paris Museum).
 1870. *Dicerobatis eregoodoo*, Günther, *Cat. Fish. Brit. Mus.* VIII, p. 497 (Indian Seas).
 1870. *Dicerobatis kuhlii*, Gunther, *Cat. Fish. Brit. Mus.* VIII, p. 497 (India ; Zanzibar).
 1878. *Dicerobatis eregoodoo*, Day, *Fish. India*, p. 744, pl. cxviii, fig. 1 (Seas of India to Malay Archipelago).
 1878. *Dicerobatis kuhlii*, Day, *Fish. India*, p. 745 (East Coast of Africa, through the Seas of India to the Malay Archipelago).
 1889. *Dicerobatis eregoodoo*, Day, *Faun. Brit. Ind. Fish.* I, p. 62, fig. 26 (Seas of India to the Malay Archipelago).
 1889. *Dicerobatis kuhlii*, Day, *Faun. Brit. Ind. Fish.* I, p. 63 (East Coast of Africa, through the Seas of India to the Malay Archipelago).
 1908. *Dicerobatis eregoodoo*, Lloyd, *Rec. Ind. Mus.* II, p. 179, text-fig. 2, pl. iv, fig. 1 (Madras).
 1908. *Dicerobatis thurstoni*, Lloyd, *Rec. Ind. Mus.* II, p. 179, text-fig. 3, pl. iv, fig. 2 (type locality : Madras).
 1913. *Mobula eregoodoo-tenkee*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 451 (Seas of India ; Malay Archipelago ; Red Sea).
 1913. *Mobula kuhlii*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 452 (Indian Ocean ; East Indies ; Japan).
 1929. *Dicerobatis eregoodoo*, Pillay, *Journ. Bombay Nat. Hist.* XXXIII, p. 354 (Travancore).
 1933. *Mobula eregoodoo-tankee*, Deraniyagala, *Ceylon Journ. Sci.* (c) V, p. 80 (Ceylon).
 1933. *Dicerobatis eregoodoo*, Sorley, *Marine Fish. Bombay Presidency*, p. 159 (Bombay).
 1941. *Mobula diabolus*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 480.

Distribution.—Red Sea, Arabia, India, Ceylon, Penang, Malay Archipelago and Queensland.

Genus Manta Bancroft.

1829. *Manta* Bancroft, *Zool. Journ.* IV, p. 444. (Type, *Cephalopterus manta* Bancroft, monotypic).
 1837. *Ceratoptera* Müller & Henle, *Sitz Ber. preuss. Akad. Wiss. Berlin*, p. 118. [Atypic ; type, *Cephalopterus giorna* (nec Lac.) Lesueur, orthotypic].
 1849. *Brachioptilon*, Newman, *Zoologist*. VII, p. 74. (Type, *Brachioptilon hamiltoni* Newman, monotypic).
 1856. *Diabolichthys* Holmes, *Proc. Elliott Soc. Nat. Hist.* I, p. 39. (Type, *Diabolichthys elliottii* Holmes, monotypic).
 1936. *Indomanta* Whitley, *Austral. Mus. Mag.* VI, p. 11. (Type, *Indomanta tombazii* Whitley, orthotypic).

Manta birostris (Walbaum).

1792. *Raja birostris*, Walbaum, *Artedi Pisc.* III, p. 535 (on *Diabolus marinus* Willoughby, *Hist. Pisc. Append.*, p. 5, pl. ix, fig. 3, 1686 ; type locality : not given).
 1878. *Ceratoptera ehrenbergii*, Day, *Fish. India*, p. 745 (nec woodcut).
 1908. *Ceratoptera orissa*, Lloyd, *Rec. Ind. Mus.* II, p. 176, text-fig. 1, pls. v, figs. 1, 2 (type locality : Puri).
 1936. *Indomanta tombazii*, Whitley, *Austral. Mus. Mag.* VI, p. 11 (on *Dicero-batis* nec Cantor, Tombazi, *Journ. Bombay Nat. Hist. Soc.* XXXVII, p. 227, pl., 1934 ; type locality : Cape Mouze, 20 miles from Karachi, India).
 1941. *Manta birostris*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 483.

Distribution.—S. Africa, Red Sea, India, Malay Peninsula, Malay Archipelago, Melanesia, North America, South America, Galapagoes Islands and West Indies.

Order TORPEDINIFORMES (*NARCOBATOIDEI*,
NARCAUTIONTES).

Family TORPEDINIDAE.

Genus **Narcine** Henle.

1834. *Narcine* Henle, *Über Narcine*, p. 31. (Type, *Torpedo brasiliensis* Olfers).

Narcine brunnea Annandale.

1878. *Narcine timlei* (part), Day, *Fish. India*, p. 733, pl. cxcii, fig. 3 (Seas of India to Malay Archipelago).
 1889. *Narcine timlei* (Part), Day, *Faun. Brit. Ind. Fish.* I, p. 45, fig. 18 (Seas of India to Malay Archipelago).
 1909. *Narcine brunnea*, Annandale, *Mem. Ind. Mus.* II, p. 45, pl. iia, fig. 2, 2a (type locality : Hughli river mouth ; type is in the Zoological Survey of India).
 1913. *Narcine brunnea*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 300 (off the Coasts of India).
 1913. *Narcine firma*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 301 (type locality : Colombo, Ceylon).

Distribution.—India, Ceylon, Philippines.

Narcine indica Henle.

1834. *Narcine indica*, Henle, *Über Narcine*, p. 35 ; pl. ii, fig. 2 (type locality : Tranquebar Coast, Madras).
 1851. *Narcine indica*, Jerdon, *Madras Journ. Lit. Sci.* XVII, p. 148.
 1865. *Narcine indica*, Day, *Fish. Malabar*, p. 276 (Malabar).
 1878. *Narcine timlei* (part) Day, *Fish. India*, p. 733, nec. pl. cxcii, fig. 3 (India ; Malay Archipelago).
 1889. *Narcine timlei* (part) Day, *Faun. Brit. Ind. Fish.* I, p. 45, nec. fig. 18 (India ; Malay Archipelago).
 1909. *Narcine timlei* (part) Annandale, *Mem. Ind. Mus.* II, p. 44, pl. iia, figs. 1, 1a (Puri, Orissa Coast).
 1920. *Narcine indica*, Prashad, *Rec. Ind. Mus.* XIX, p. 99, pl. vii, figs. 4-9 (Orissa Coast).
 1939. *Narcine indica*, Norman, *Sci. Rep. John Murray Exped. London*, VII, p. 12 (Gulf of Aden ; Indian Seas).
 1941. *Narcine maculata*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 333.

Distribution.—India, Malay Archipelago, Gulf of Aden.

Narcine timlei (Schneider).

1801. *Raja timlei*, Schneider, *Syst. Ichth. Bloch*, p. 359 (type locality : Tranquebar, Madras).
 1834. *Narcine timlei*, Henle, *Über. Narcine*, p. 34, pl. ii, fig. 1, 1a (Tranquebar).
 1941. *Narcine timlei*, Müller & Henle, *Syst. Besch. Plagiostomen*, p. 130 (India ; Japan).
 1878. *Narcine timlei*, (part), Day, *Fish. India*, p. 733, nec pl. cxcii, fig. 3 (Seas of India to the Malay Archipelago, China, Japan).
 1889. *Narcine timlei*, (part), Day, *Faun. Brit. Ind. Fish.* I, p. 45, nec fig. 18 (Seas of India to the Malay Archipelago).
 1933. *Narcine timlei*, Deraniyagala, *Ceylon Journ. Sci.* (c) V, p. 80 (Ceylon).
 1941. *Narcine timlei*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 334.

Distribution.—India, Ceylon, Malay Archipelago, China, Japan.

Genus **Benthobatis** Alcock.

1898. *Benthobatis* Alcock, *Ann. Mag. Nat. Hist.* (7) II, p. 144. (Type, *Benthobatis moresbyi* Alcock, monotypic).

Benthobatis moresbyi Alcock.

1898. *Benthobatis moresbyi* Alcock, *Ann. Mag. Nat. Hist.* (7) II, p. 145 (type locality : Off Travancore Coast, in 430 fathoms ; type is in the Zoological Survey of India).
 1899. *Benthobatis moresbyi*, Alcock, *Ill. Zool. Investig. Fish*, pl. xxvi, fig. 1 (off Travancore Coast).
 1899. *Benthobatis moresbyi*, Alcock, *Cat. Ind. Deep Sea Fish.*, p. 18 (off Travancore Coast).
 1907. *Benthobatis moresbyi*, Lloyd, *Rec. Ind. Mus.* I, p. 4 (15° 55' 30" N., 52° 38' 30" E., in 585 fms., Arabian Sea).
 1909. *Benthobatis moresbyi*, Annandale, *Mem. Ind. Mus.* II, pl. iia, figs. 5, 5a.
 1909. *Benthobatis moresbyi*, Lloyd, *Mem. Ind. Mus.* II, p. 145. (Arabian Sea).
 1941. *Benthobatis moresbyi*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 339.

Distribution.—Arabian Sea, India, Philippines.

Genus **Torpedo** Houttuyn.

1764. *Torpedo* Houttuyn, *Nat. Hist. Linn.* p. 453. (Atypic ; type, *Raja torpedo* Linn., tautotypic).
 1776. *Narcacion* Klein, *Neuer Schauplatz* II, p. 237. (Type, *Raja torpedo* Linn., designated by Jordan, *Gen. Fish.*, p. 39, 1917 ; inadmissible according to Opinion 89 of the International Commission of Zoological Nomenclature).
 1806. *Torpedo* Duméril, *Zool. Analytique*, p. 343. (Atypic ; type, *Raja torpedo* Linn.).
 1816. *Narcobatus* Blainville, *Bull. Soc. Philom. Paris* VIII, p. 121. (Type *Raja torpedo* Linn., designated by Jordan, *Gen. Fish.*, p. 95, 1917).
 1825. *Narcobatis* Blainville, *Faune Francaise Poiss.*, p. 43. (Type, *Raja torpedo* Linn. ; monotypic).

Torpedo marmorata Risso.

1810. *Torpedo marmorata*, Risso, *Ichth. Nice*, p. 20, pl. cxi, fig. 4 (type locality Nice).
 1909. *Torpedo m. morata*, Annandale, *Mem. Ind. Mus.* II, p. 42 pl. iia, fig. 4 ; pl. v, fig. 3 (Puri ; Quilon).
 1912. *Torpedo zugmayeri*, Englehardt, *Zool. Anz.* XXXIX, p. 647 (type locality : Gwadar, Beluchistan).
 1920. *Torpedo marmorata*, Prashad, *Rec. Ind. Mus.* XIX, p. 98 (Orissa Coast).
 1941. *Torpedo marmorata*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 342.

Distribution.—E. Africa, Madagascar, Mauritius, Seychelles, Red Sea, India, Philippines.

Torpedo sinus persici Olfers.

1831. *Torpedo sinus persici*, Olfers, *Torpedo*, pp. 15, 17 (on Kampfer).
 1926. *Torpedo sinus persici*, Fowler, *Journ. Bombay Nat. Hist. Soc.* XXX, p. 2 (Bombay).
 1928. *Torpedo sinus persici*, Fowler, *Journ. Bombay Nat. Hist.* XXXIII, p. 101 (Bombay).

Distribution.—S. Africa, Madagascar, Persian Gulf, India, Philippines.

Genus **Narke** Kaup.

1826. *Narke* Kaup, *Isis* XVIII, p. 88. (Type, *Raja capensis* Gmelin, monotypic).
 1837. *Astrape* Müller & Henle, *Sitz. Ber. Akad. Wiss. preuss. Berlin*, p. 117. (Atypic; type, *Raja capensis*, Gmelin designated by Jordan, *Gen. Fish.* II, p. 193, 1919).

Narke dipterygia (Schneider).

1801. *Raja dipterygia*, Schneider, *Syst. Ichth. Bloch*, p. 359 (type locality : Tranquebar, Madras).
 1851. *Astrape dipterygia*, Jerdon, *Madras Journ. Lit. Sci.* XVII, p. 149.
 1878. *Astrape dipterygia* (part) Day, *Fish. India*, p. 734, nec pl. xcii, fig. 4 (Seas of India to the Malay Archipelago, China and Japan).
 1889. *Astrape dipterygia* (part) Day, *Faun. Brit. Ind. Fish.* I, p. 46, nec fig. 19 (Seas of India to the Malay Archipelago, China and Japan).
 1909. *Astrape dipterygia*, Annandale, *Mem. Ind. Mus.* II, p. 46, pl. iiii, fig. 6 (off Orissa Coast).
 1913. *Narke dipterygia*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 313 (Penang; Singapore; Malay Peninsula; Lencavay Islands; Malacca; Hindustan; Canton).
 1914. *Astrape dipterygia*, Pearson, *Ceylon Adminstr. Rep.*, p. E 4.
 1920. *Narke dipterygia*, Prashad, *Rec. Ind. Mus.* XIX, p. 100, pl. vi, figs. 1, 2 (Puri, Orissa).
 1927. *Narke dipterygia*, Fowler, *Journ. Bombay Nat. Hist. Soc.* XXXII, p. 253 (Bombay).
 1929. *Astrape dipterygia*, Pillay, *Journ. Bombay Nat. Hist. Soc.* XXXIII, p. 355 (Travancore).

Distribution.—Arabian Sea, India, Ceylon, Malay Peninsula, Indo-China, China, Japan, Philippines.

Genus **Bengalichthys** Annandale.

1909. *Bengalichthys* Annandale, *Mem. Ind. Mus.* II p. 46 (Type, *Bengalichthys impennis* Annandale, monotypic).

Bengalichthys impennis Annandale.

1878. *Astrape dipterygia* (part) Day, *Fish. India*, p. 734, pl. xcii, fig. 4 (Madras).
 1889. *Astrape dipterygia* (part) Day, *Faun. Brit. Ind. Fish.* I, p. 46, fig. 19 (Seas of India to the Malay Archipelago).
 1909. *Bengalichthys impennis*, Annandale, *Mem. Ind. Mus.* II, p. 48, text-fig. 9 pl. iiii, figs. 7, 7a (type locality : Orissa Coast).
 1913. *Narke impennis*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 315 (Coast of Orissa, Bay of Bengal).
 1920. *Bengalichthys impennis*, Prashad, *Rec. Ind. Mus.* XIX, p. 103, pl. vi, figs. 3, 4; pl. vii, figs. 1-3 (Puri, Orissa).
 1941. *Narke impennis*, Fowler, *Bull. U. S. Nat. Mus.* (100) XIII, p. 352.

Distribution.—India, Philippines,

Class HOLOCEPHALI.

Sub-Class CHIMAERAE.

Order CHIMAERIFORMES.

Family CHIMAERIDAE.

Genus **Chimaera** Linnaeus.

1758. *Chimaera* Linnaeus, *Syst. Nat.* I, ed. 10, p. 236. (Type, *Chimaera monstrosa* Linnaeus, designated by Jordan & Gilbert, *U. S. Nat. Mus. Bull.* p. 54, 1884).

Chimaera monstrosa Linnaeus.

1758. *Chimaera monstrosa*, Linnaeus, *Syst. Nat.* I, ed. 10, p. 236 (type locality : Atlantic Ocean).
 1812. ?*Chimaera monstrosa*, Alcock, *Ann. Mag. Nat. Hist.* (6) X, p. 347 (Bay of Bengal, 16° 1' N., 81° 25' E., 410 fms. an empty egg capsule 9" in length).
 1906. *Chimaera monstrosa*, Brauer, "Valdivia" *Tiefsee Fisch.* XV, p. 10 (West coast of Sumatra, 0° 15' 5" S., 98° 4' E.).

Distribution.—South Africa, Bay of Bengal, west coast of Sumatra, North and Middle Atlantic and Mediterranean.

Family RHINOCHIMAERIDAE.

Genus **Harriotta** Goode & Bean.

1895. *Harriotta* Goode & Bean, *Proc. U. S. Nat. Mus.* XVII, p. 471. (Type, *Harriotta raleighana* Goode & Bean, monotypic).

Harriotta (?) indica (Garman).

1891. *Callorhynchus* ? sp., Wood-Mason & Alcock, *Ann. Mag. Nat. Hist.* (6) VIII, p. 21, fig. 1 (Bay of Bengal 13° 47' 30" N., 92° 36' E.).
 1899. *Callorhynchus indicus*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXIV, p. 21 (Bay of Bengal).
 1906. *Harriotta (?) indica*, Dean, *Chimaeroid Fish. and their Devel.*, p. 30 (Bay of Bengal).
 1939. *Harriotta (?) indica*, Norman, *Sci. Rep. John Murray Exped.* VII, p. 14 (Gulf of Aden ; Bay of Bengal).

Distribution.—Gulf of Aden ; Bay of Bengal. *Harriotta (?) indica* has been provisionally recorded from the egg-capsules, the parent fish has not yet been recognised.

Rhinochimaera sp.

1913. *Rhinochimaera* sp., Sewell, *Rec. Ind. Mus.* VII, p. 2 (off Travancore Coast 9° 14' 10" N., 75° 45' E.).

Distribution.—Arabian Sea, off Travancore Coast. Col. Sewell (*op. cit.*) writes : "The occurrence of this egg-case and embryo is of extreme interest, as it is, so far as I am aware, the first occasion on which an embryo of *Rhinochimaera* has been obtained and affords undoubted evidence of the occurrence of this genus in Indian waters."

CYCLOPOIDES (CRUSTACES COPEPODES) NOUVEAUX DE L'INDE

I. DESCRIPTION DES PREMIERS BRYOCYCLOPS DÉCOUVERTS DANS L'INDE.

Par Knut Lindberg.

Il y a 18 ans F. Kiefer a, dans cette même revue, fait une étude d'ensemble des Cyclopoides rapportés jusqu'alors de l'Inde. Il a pu réunir un total de 18 espèces, dont quelques unes douteuses, et a émis l'opinion que ce nombre n'est nullement représentatif de la faune cyclopidéenne réelle de ce vaste pays.

Au cours des années suivantes la présence dans l'Inde de nombreuses espèces nouvelles a été signalée et l'opinion de Kiefer a ainsi été pleinement confirmée.

On sait actuellement que les divers groupes de Cyclopides sont en général bien représentés dans l'Inde, à part quelques genres, renfermant surtout des espèces arctiques, qui n'ont été trouvées que dans les confins nord de la péninsule, et quelques formes aberrantes, à répartition apparemment très localisée. Cependant les *Bryocyclops* de Kiefer, habitants de mousses et d'autres microbiotopes, que Menzel a en 1925 été le premier à découvrir dans les Indes hollandaises, n'avaient pas encore été rapportés de l'Inde.

Pendant l'été 1945 j'ai rencontré deux représentants différents de ce groupe d'animaux intéressants dont je donne ici la description.

***Bryocyclops constrictus*, sp. nov.**

Description.—♀ Longueur 475 à 665 μ . Petite espèce, assez élancée, à segments thoraciques nettement délimités les uns des autres. Largeur maxima du corps au niveau de Th. 2. Extrémité céphalique légèrement prolongée, paraissant un peu pointue vue de dos. Segment génital trapu, très élargi, bien plus large que long et beaucoup plus large que les segments abdominaux suivants. Ligne de soudure plus ou moins distincte des deux segments primitifs, visible sur la face dorsale. La face ventrale montre à sa partie distale une ornementation de la cuticule d'épinules disposées en lignes sinueuses. Rebords postérieurs des trois premiers segments abdominaux découpés sur la face ventrale en denticules, en général peu distinctes, sauf au niveau du segment génital. Rebord postérieur du segment anal garni sur la face ventrale d'une rangée régulière, composée d'une vingtaine de petites épines. Opercule anal bien développé, empiétant sur plus d'un cinquième de la longueur de la furca ; sa forme est arrondie ou un peu ovalaire, son rebord libre lisse et uni. Branches de la furca parallèles ou légèrement divergentes

de 1.90 à 2.33 fois aussi longues que larges. Soie latérale insérée vers le milieu, ou un peu au-dessus du milieu, du rebord externe de la branche de la furca. Soie dorsale ciliée, légèrement inférieure à la longueur de la soie apicale externe. Celle-ci assez forte et considérablement plus longue que la soie apicale interne. Soies apicales médianes longues, à pennation faiblement hétéronyme. Première antenne formée de 11 articles, courte, dépassant un peu le milieu du premier segment céphalothoracique. Cinquième article pourvu d'un bâtonnet sensoriel presque aussi long que le sixième article. Branches des pattes natatoires formées de deux articles, sauf l'enp. P 4 chez lequel les deux articles originaux ont fusionné en un seul. Formule des épines 3.3.3.2. Article 2 de l'enp. P 1 à grosse épine apicale, un peu courbée, insérée en dedans d'une forte apophyse épineuse. Lamelle basilaire de P 4 à rebord libre droit ou légèrement concave; soies des angles internes du basp. 2 de P 4 absentes; élevures internes du basp. 2 de P 4 ornées de quelques courts et fins poils. Article unique de l'enp. P 4 large, de forme irrégulièrement ovalaire (rapport longueur : largeur 1.29 : 1 à 1.68 : 1), portant une épine apicale bien plus courte que l'article, insérée du côté externe, deux longues soies apicales en dedans de l'épine et deux soies beaucoup plus courtes sur le rebord interne, dont la proximale est un peu moins longue que la soie distale. P 5 représentée par une soie thoracique assez forte, peu recourbée, d'insertion dorsale, et deux petits appendices du côté ventral : une courte épine interne et une soie ciliée externe qui est un peu plus longue que l'épine. Ces appendices sont attachés sur une petite protubérance du segment thoracique; un article proprement dit fait défaut. Réceptacle séminal formé d'une partie médiane plus ou moins arrondie ou transversalement ovalaire; les parties latérales amincies et aux contours sinueux; le rebord postérieur de tout l'organe paraissant presque droit. Ovisacs écartés du corps, renfermant de 4 à 8 oeufs; le plus souvent de 6 à 7. Couleur rouge brique étincelant, tacheté de gris.

♂ Longueur 465 à 522 μ . Branches de la furca de 1.75 à 2.18 fois aussi longues que larges. Le ♂ offre une particularité structurale au niveau de l'endop. P 4. Celui-ci, toujours formé d'un seul article, est beaucoup plus allongé que chez la ♀ et montre vers le milieu de son rebord externe un prolongement pointu, espèce d'apophyse séparée du rebord par une encoche; évidemment un vestige de la limite entre les deux articles originaux. L'épine apicale externe, les deux longues soies apicales et les deux courtes soies du rebord interne ressemblant aux parties correspondantes de la ♀, mais, des deux soies du rebord interne, c'est la soie distale qui est la plus courte. P 6 constituée par trois appendices : une soie externe qui est l'appendice le plus long, une soie médiane et une petite épine interne, plus courte que la soie médiane.

Habitats.—Dans de la mousse humide à Kodikanel (plusieurs stations à une altitude de 2100 m, Chembaganour (altitude 1808 m) et Attakatti (altitude environ 900 m.); les deux premières localités se trouvant dans les monts Palni, la troisième, plus au nord, dans les monts Anaimalai. (Text fig. 1 a, b.)

***Bryocyclops travancoricus*, sp. nov.**

Description.—♀ Longueur 541 à 570 μ . Forme ressemblant beaucoup à l'espèce précédente ; segment génital, opercule anal, furca et première antenne semblables aux parties correspondantes chez *B. constrictus*. Branches des pattes natatoires formées de deux articles, sauf l'enp. P 4 qui n'en a qu'un seul. Formule des épines 3.3.3.2. Lamelle basilaire et basp. 2 de P 4 pareils à ceux de *B. constrictus*. La différence principale entre les deux formes se trouve dans la structure de l'enp P 4. L'article unique est très large, de forme irrégulièrement ovale et porte toujours une épine apicale du côté externe considérablement plus courte que l'article et, en dedans de celle-ci, deux longues soies apicales. Cependant des deux soies du rebord interne la distale est représentée par une très courte épine sétiforme qui semble dépourvue de cils, tandis que la soie proximale est de structure et de dimensions ordinaires. Au niveau de P 5 l'épine interne et la soie insérée auprès de celle-ci sont plus longues que chez *B. constrictus*, bien que cette espèce soit de dimensions supérieures. Le réceptacle séminal présente aussi quelques différences dans sa configuration, les parties latérales étant notamment beaucoup plus développées. Ovisacs renfermant de 5 à 8 oeufs de chaque côté. La couleur n'a pas été observée.

♂ Longueur 399 à 518 μ . La caractéristique distinctiv réside chez le mâle aussi dans la structure de l'enp. P 4. Il est de forme plus allongée, mais autrement pareil à celui de la ♀, la soie distale du rebord interne étant transformée en une très petite épine sétiforme. De plus, la soudure des deux articles primitifs a été parfaite, de sorte que le prolongement épineux et l'entaille du milieu du rebord externe, distinctifs du ♂ de *B. constrictus* font entièrement défaut. P 6 semblable à celle de l'espèce précitée.

Habitat.—Dans de la mousse humide sur un rocher dans les montagnes de bordure de Travancore, au-dessus de Courtallam (Kouttalam), à une altitude d'environ 700 m.

Remarques.—Parmi la dizaine de *Bryocyclops* déjà décrits on ne connaît que trois présentant un enp. P 4 formé d'un seul article, deux de ceux-ci trouvés dans les îles de la Sonde et le troisième sur la Côte d'Ivoire. Ce dernier, *B. africanus* Kiefer, possède l'enp. P 4 pourvu de deux épines apicales et présente aussi d'autres différences structurales. *B. muscicola* (Menzel), imparfaitement décrit et figuré, a l'enp. P 4 muni de 4 appendices apicaux et le *B. bogoriensis* (Menzel) est pourvu au niveau de l'enp. P 4 d'une seconde épine subapicale du côté externe et d'une soie unique sur le rebord interne ; du reste cette espèce se distingue nettement par d'autres particularités qu'il est inutile d'énumérer.

Les deux *Bryocyclops* décrits ici ne peuvent être identifiés avec aucune forme déjà connue. Il n'est guère possible de dire à présent s'il faut les considérer comme deux variantes d'une même espèce. C'est à titre provisoire qu'ils sont distingués comme représentant deux entités

distinctes. Un matériel beaucoup plus abondant et une connaissance complète des divers *Bryocyclops* qu'hébergent peut-être l'Inde et les pays voisins en nombre considérable, sont nécessaires pour trancher la question. (Text fig. 1 c, d.)

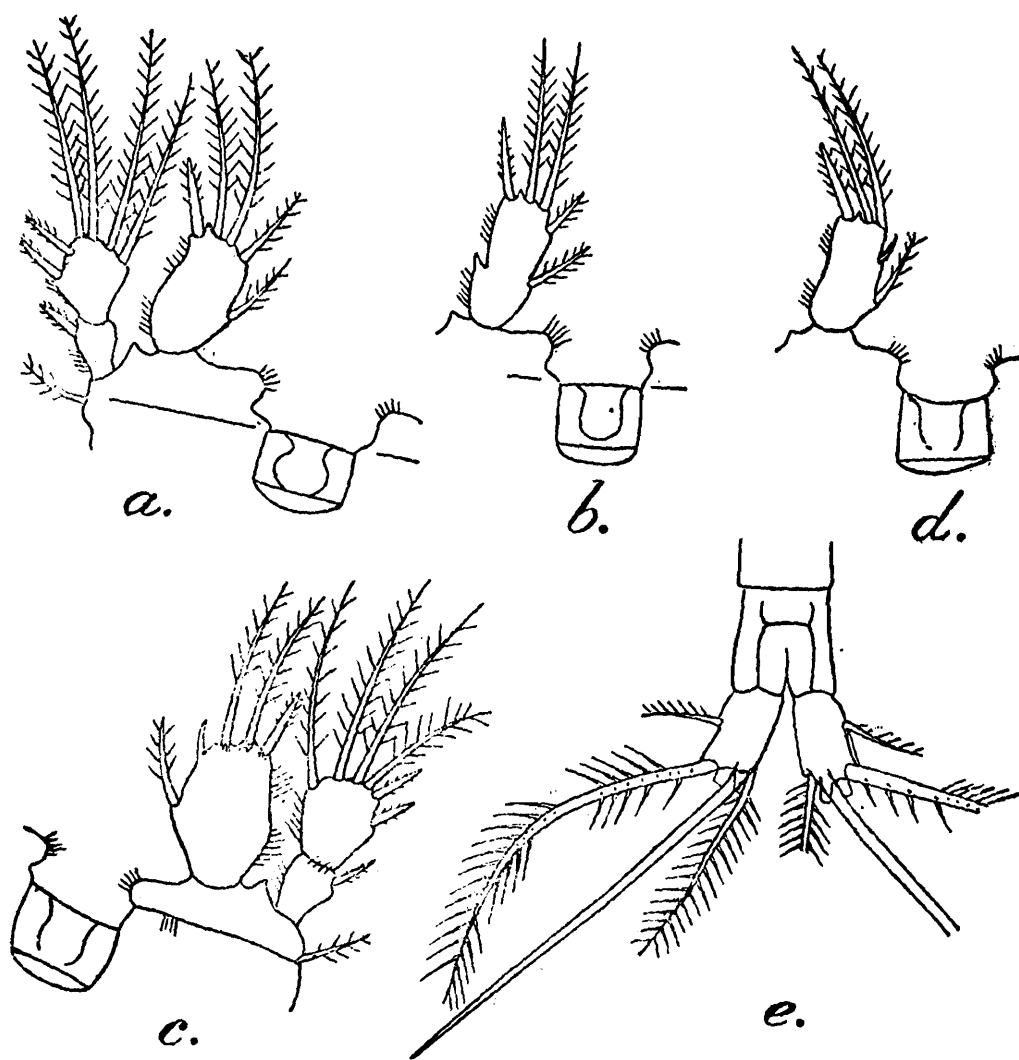
II. OITHONAS NOUVEAUX DE L'INDE.

Le nombre d'*Oithona* et de *Dioithona* trouvés sur le littoral, près de la côte ou dans les mers baignant la péninsule indienne s'élève actuellement à plus de 20. Ce nombre doit cependant être loin de représenter la totalité des espèces différentes de "vierges de l'onde" vivant dans cette partie du monde, puisque j'ai dernièrement pu distinguer trois formes nouvelles dont je donne ici la description.

Oithona plumosa, sp. nov.

Description.—♀ Longueur 560 à 598 μ ; largeur 147 à 152 μ . Petite espèce de forme élancée. Partie antérieure du corps (y compris Th. 5) plus longue que la partie postérieure (abdomen + furca), le rapport variant de 1.28 : 1 à 1.42 : 1 chez trois adultes. Extrémité céphalique arrondie. Rostre absent. Segment génital presque aussi long que les deux segments suivants combinés ; il présente de chaque côté dans sa partie antérieure, au niveau de l'insertion de P 6, une protubérance pointue, en arrière de laquelle le segment commence à s'amincir. Abd. 2 et Abd. 3 de longueur à peu près égale. Segment anal plus court que le segment précédant. Furca à branches bien divergentes, de longueur égale ou légèrement inférieure à celle du segment anal, de 1.8 à 2 fois aussi longues que larges. Soie latérale à peu près aussi longue que la branche de la furca, insérée bien en avant du milieu du rebord externe. Soie dorsale forte et longue ne portant que quelques fins cils épars sur sa partie terminale. Soie apicale externe environ deux fois plus longue que la soie apicale interne, très puissante près de sa base, elle présentait chez deux des trois individus examinés une courbure caractéristique. Soies apicales médianes externe et interne apparemment fortes et longues ; elles étaient cassées chez tous les spécimens. La particularité la plus frappante de la présente espèce réside dans la pennation des soies apicales ; celle-ci est faite de cils très gros, longs et touffus, colorés en jaune orange chez les animaux conservés dans la formoline, donnant une apparence très particulière aux appendices de la furca. Première antenne composée de 14 articles, dont le quatrième armé d'une épine, atteignant, lorsqu'elle est rabattue, le quatrième segment thoracique. Deuxième antenne portant deux soies au niveau du rebord externe du premier article. Basopodite 2 de la mandibule se terminant par une seule soie crochue, spiniforme, forte et pourvue de quelques gros cils ; en dedans d'elle et un peu plus proximale se trouve une fine soie nue ; enp. avec 4 soies ; exp. formé de 4 articles portant de longues soies. Toutes les branches des pattes natatoires triarticulées. Formule des épines 4.4.4.3. (Épines du rebord externe des exopodites des pattes 1 à 4 : 1,1,3-1,1,3-1,1,3,-1,1,2.). Epine apicale de l'article 3 de l'exp. de P 4 presque

aussi longue que la longueur totale de l'exopodite sans épine apicale. Endopodite de P 4 beaucoup plus court que l'exopodite. Cinquième patte représentée par une soie thoracique bien développée et par un article très allongé, environ cinq fois plus long que large, portant apicalement une soie unique. Sixième patte représentée par une petite épine à pointe recourbée en haut Mâle inconnu.



TEXT FIG. 1.—*Byrocyclops constrictus*, sp. nov. ; *Bryocyclops travancoricus*, sp. nov. and *Oithona plumosa*, sp. nov.

B. constrictus, sp. nov. a. ♀, P 4 ; b. ♂, Endop. P 4—*B. travancoricus*, sp. nov. c. ♀, P 4 ; d. ♂, Endop. P 4—*O. plumosa*, sp. nov. e. ♀, segment anal et furca, face dorsale.

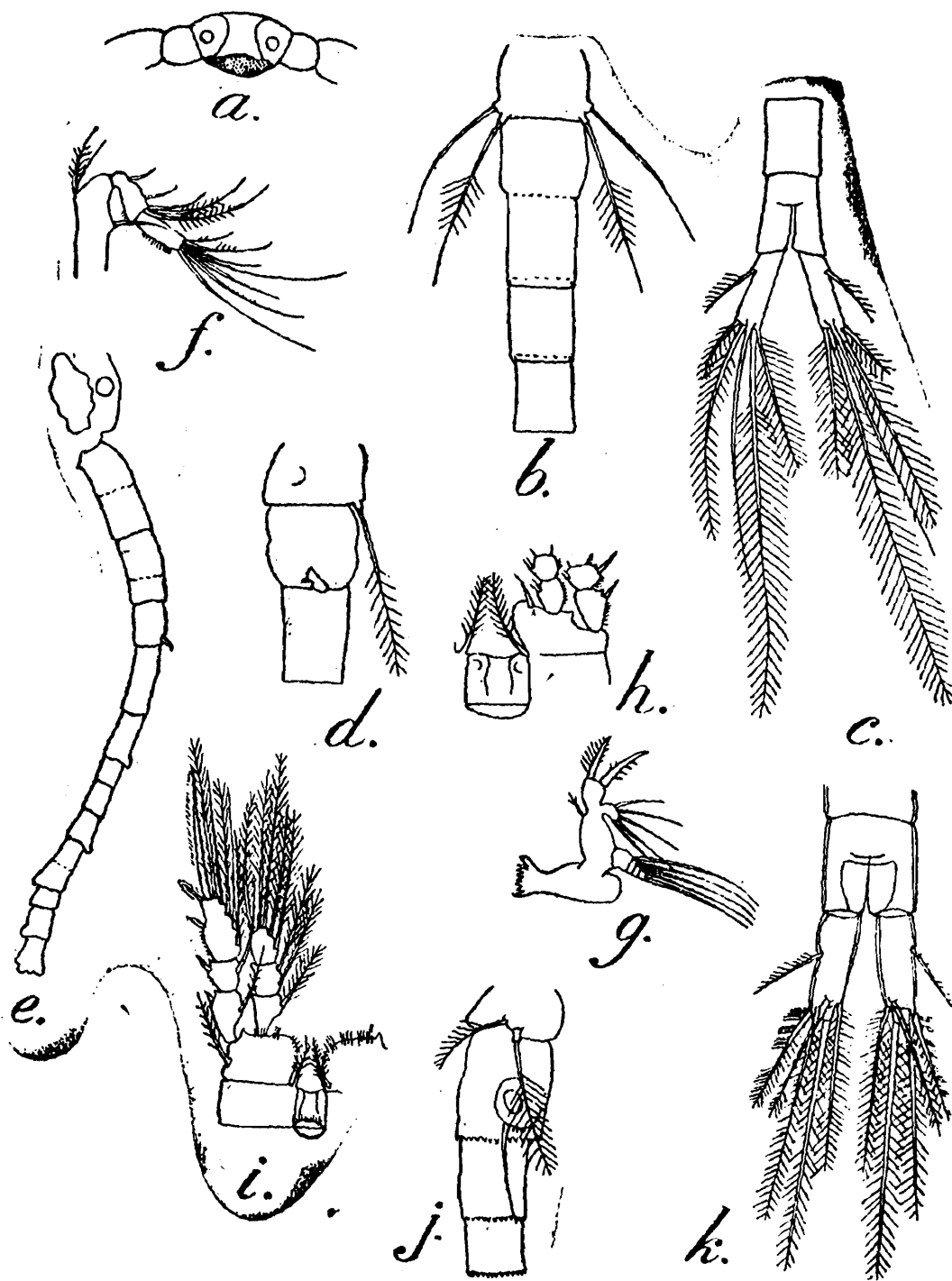
Habitat.—Les trois animaux décrits se trouvaient dans un échantillon de plancton marin, très obligeamment fourni par le Dr. N. K. Panikkar, prélevé à 1 ou 2 km. au large de Madras le matin le 7 août 1945.

Remarques.—L'espèce présente montre des analogies avec *Oithona nana* Giesbrecht en ce qui concerne la structure de la mandibule et de la cinquième patte, mais s'en distingue entièrement par sa furca et ses appendices et ne peut être identifiée à aucune espèce déjà décrite. (Text-fig. 1 e.)

***Oithona dissimilis oceanica*, subsp. nov.**

Description.—♀ Longueur 622 à 660 μ . Rapport entre le céphalo-thorax (y compris Th. 5) et la queue (abdomen + furca) chez trois spécimens : 1.36 : 1, 1.43 : 1, 1.62 : 1. Largeur de 206 à 209 μ . Front tronqué. Rostre absent. Une ♀ montrait, au milieu du front, une masse ganglionnaire bilobée qui cependant ne se distinguait pas chez les deux autres individus examinés. Th. 5 garni sur les parties latérales d'un petit groupe de poils, inséré dorsalement, dont quelques uns très gros et assez longs, d'autres fins et courts. Furca plus longue que le segment anal, à branches divergentes, de 3.30 à 3.46 fois plus longues que larges. Soie latérale, aussi longue que la soie apicale externe, insérée bien en avant du milieu du rebord externe. Soie dorsale très développée, surpassant un peu en longueur celle de la soie apicale médiane externe. Soie apicale interne plus de deux fois aussi longue que la soie apicale externe. Première antenne formée de 12, 13 ou 14 articles ; rabattue elle atteint le bord postérieur de Th. 2, le milieu de Th. 3 ou le tiers postérieur de Th. 3. Article 1 de la deuxième antenne pourvu de deux soies sur le rebord externe. Basopodite 2 de la mandibule se terminant par deux assez fortes soies spiniformes, crochues et ciliées ; enp. petit avec 5 soies ; exp. formé de 4 articles armés de longues soies. Formule des épines 4.4.4.3. (Épines du rebord externe des exp. des pattes natatoires : 1,1,3-1,1,3-1,1,3-1,1,2). Soies des exp. P 1 à P 4 : 0,1, 4-1, 1, 5-1,1, 5-1, 1, 5. Soies des enp. P 1 à P 4 : 1, 1, 6-1, 2, 6-1, 2, 6-1, 2, 5. Soie au niveau de l'article 1 de l'exp. P 2 courte et forte, celle du même article de l'exp. P 3 rudimentaire ; soie de l'article 1 de l'exp. P 4 mieux développée. Lamelle basilaire de P 4 pourvue d'une rangée de petits poils ; rebord libre légèrement concave. Elevures internes du basp. 2 de P 4 garnies de groupes de longs poils. Epine apicale de l'article 3 de l'exp. P 4 un peu moins longue que la longueur totale de l'exp. P 4 (rapport 71 : 82 μ). Enp. P 4 considérablement plus court que l'exp. P 4 (rapport 52 : 82 μ). P 5 représentée par une longue et fine soie thoracique et par une seconde soie insérée sur un article très petit ; cette soie est ciliée et paraît plus longue que la soie thoracique ; son extrémité dépasse le bord postérieur du segment génital. P 6 représentée par deux petites épines dont l'externe est la plus longue. Ovisacs assez petits, écartés du corps, renfermant de 6 à 8 oeufs.

♂ Longueur 618 à 646 μ ; largeur 181 μ . Formule des épines 4.4.4.3 comme chez la ♀. P 5 semblable à celle de la ♀. P 6 formée par une soie unique atteignant le bord postérieur du segment génital.



TEXT FIG. 2.—*Oithona dissimilis oceanica*, subsp. nov. and *Dioithona aurea*, sp. nov.

O. d. oceanica, subsp. nov. a. ♀, extrémité céphalique; b. ♀, P 5; c. ♀, Furca; d. ♀, P 6; e. ♀, A 1; f. ♀, A 2; g. ♀, mandibule; h. ♀, P 1; i. ♀, P 4; j. ♂, P 5 et P 6.—*D. aurea*, sp. nov. k. ♀ segment anal et furca, face dorsale.

Habitat.—Côte ouest de l'Inde, à Ratnagiri. Dans la mer, à la surface, à environ 300 m. de la terre (3 ♀♀, 2 ♂♂ le 28 mars 1945).

Remarques.—La forme qui vient d'être décrite se rapproche beaucoup d'*Oithona dissimilis* mihi au point de vue de la configuration générale, de la structure de l'extrémité céphalique, de la furca et de ses appendices, des pièces buccales et des pattes natatoires. Dans la description originale d'*O. dissimilis* la formule des épines avait été donnée comme 3.4.4.3., mais des examens ultérieurs ont montré qu'elle est bien de 4.4.4.3, l'une des petites épines du rebord externe de l'exp. P 1 ayant échappé à l'attention. La conformité entre les deux formes est si grande que je crois que les animaux pélagiques au large de Ratnagiri doivent tout au plus être considérés comme représentant une sous-espèce d'*O. dissimilis* habitant de lagunes et de mares boueuses saumâtres du littoral. (Text fig. 2 a-j.)

***Dioithona aurea*, sp. nov.**

Description.—♀ Longueur 912 μ (céphalothorax 551 μ , queue 361 μ). Forme robuste, à partie antérieure du corps (y compris Th. 5) considérablement plus longue que la partie postérieure (abdomen + furca). Front légèrement prolongé en une apophyse mousse; rostre proprement dit absent. Segment génital à peu près aussi long que les deux segments suivants combinés. Segment anal plus court que le segment précédant. Bords postérieurs des segments abdominaux garnis sur la face ventrale d'une rangée d'épinules. Branches de la furca légèrement divergentes, environ 2.5 fois aussi longues que larges (57 : 23 μ = 2.48 : 1), à cuticule fortement épaissie. Soie latérale moins longue que la branche de la furca, insérée en avant du milieu du rebord externe. Soie dorsale, faiblement ciliée à sa partie terminale, légèrement plus longue que la soie apicale externe. Celle-ci un peu inférieure à la longueur de la soie apicale interne. Soies apicales médianes très courtes et offrant peu de différence de longueur entre elles. Près de l'insertion de la soie apicale externe se distingue une petite apophyse épineuse légèrement crochue de l'extrémité de la branche de la furca. Première antenne formée de 14 articles atteignant, lorsqu'elle est rabattue, le tiers postérieur de Th. 2; le cinquième article porte une petite épine. Basopodite 2 de la mandibule armé de deux fortes soies crochues terminales; enp. avec 5 soies; exp. formé de 4 articles portant 5 longues soies plumeuses. Toutes les branches des pattes natatoires triarticulées. Formule des épines 4.4.4.3. (Épines du rebord externe des exopodites des pattes 1 à 4 : 1, 1, 3-1, 1, 3-1, 1, 3-1, 1, 2). Soies des exopodites des pattes 1 à 4 : 1, 1, 4-1, 1, 5-1, 1, 5-1, 1, 5. Soies des endopodites des pattes 1 à 4 : 1, 1, 6-1, 2, 6-1, 2, 6-1, 2, 5. Epine apicale de l'article 3 de l'exp. de P 4 moins longue que l'article (rapport article : épine apicale 87 : 78 μ). Exp. P 4 considérablement plus long que l'enp. (rapport exp. sans épine apicale : enp. sans soies apicales 147 : 77 μ). Cinquième patte représentée par la soie thoracique usuelle et un article de forme ovoïde à l'extrémité duquel se trouvent une soie externe moins longue que le segment génital

et une épine mince sétiforme, atteignant environ la moitié de la longueur de la soie. P 6 représentée par une épine recourbée assez forte. L'animal conservé dans de la formaline avait une coloration rouge orangée de la moitié distale du segment génital ; le segment anal, la furca et les soies apicales étaient jaune doré.

♂ Longueur 769 μ (céphalothorax 456 μ , queue 313 μ) ; largeur 218 μ . Furca à branches presque parallèles plus courtes que chez la femelle (45 : 23 μ = 1.96 : 1). Soie dorsale relativement moins longue. Epines des exopodites et soies des exopodites et des endopodites au même nombre que chez la femelle. Epine apicale de l'article 3 de l'exp. de P 4 un peu plus longue que l'article (rapport article : épine apicale 63 : 68 μ). Cinquième patte semblable à celle de la femelle. Sixième patte représentée par une soie qui n'atteint pas le bord postérieur du deuxième segment abdominal. Coloration comme chez la femelle.

Habitat.—Le même échantillon de plancton dans lequel se trouvait *Oithona plumosa*, en compagnie d'assez nombreux *D. rigida*.

Remarques.—L'espèce qui vient d'être décrite présente de grandes analogies avec *D. rigida* Giesbrecht en ce qui concerne les longueurs relatives des soies apicales de la furca et la structure des pattes natatoires. La présence dans le même échantillon de *D. rigida* la faisait cependant distinguer très nettement, indépendamment de sa coloration frappante. Les *D. rigida* présentaient des branches de la furca bien divergentes et considérablement plus allongées et ne montraient pas d'épaississement de la cuticule ; leur première antenne était formée de 12 ou 13 articles. (Text fig. 2 k.)

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CATALOGUE OF BIRDS IN THE INDIAN MUSEUM, CALCUTTA.

II. PTEROCLETES (SAND-GROUSE OR PIGEON-GROUSE).¹

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INTRODUCTION.

Part I of this *Catalogue*² dealt with the Columbæ (Pigeons and Doves), and also contained a brief history of the bird collections of the Indian Museum. The present part follows, with certain modifications, nearly the same general plan as Part I, but Indian and extra-Indian forms have not been separated into different sections because of the comparatively small number of species dealt with.

CLASSIFICATION OF THE PTEROCLETES.

The Sand-grouse, or Pigeon-grouse as they are sometimes called because of their close affinity to the pigeons, constitute a single, well-defined order, the Pterocletes, coming in between the Columbæ (pigeons and doves) and the Gallinæ (pheasants, partridges and quails).³ In this order, a single family, the Pteroclididae, is recognized. The family has been generally divided in recent years into only two genera, *Syrrhaptes* Illiger and *Pterocles* Temminck. Some authors (e.g., Sclater, 1924, p. 157 ; 1930, p. 848 ; and Mackworth-Praed and Grant, 1937, p. 179), however, recognize a third, *Eremiector* W. L. Sclater, which replaces *Pteroclorus* Bonaparte of the older authors such as Ogilvie-Grant (1893). In the present *Catalogue*, I have not accepted this genus.

INDIAN SPECIES OF THE PTEROCLETES.

The Sand-grouse are confined to the Old World where they range practically over the whole of Africa (including the Canary Islands off N. W. Africa), Madagascar, S. W. Europe (Iberian Peninsula and

¹This part was completed towards the end of 1942 but, owing to the temporary stoppage of the *Rec. Ind. Mus.*, it could not be published earlier.

²Roonwal, M. L., *Rec. Ind. Mus.* XLIII, pp. 281-360 (1941).

³Some authors, e.g., Peters (1937), assign only subordinal rank to the Pterocletes and the Columbæ, the two together being combined into the order Columbiiformes.

S. France), and S. W. Asia (including Arabia, Asia Minor to Iran, Afghanistan and India); Central Asia, and north up to about lat. 51° N. in S. E. European Russia; and North China. In certain years, known as "irruption years", large numbers of the Pallas's Sand-grouse, *Syrrhaptes paradoxus*, break the normal western limit of their range, namely S. E. European Russia, and invade the whole of W. Europe as far west as Ireland and as far north as N. Norway; similarly, the eastern limit is extended to N. E. China.

Within Indian limits the range covers practically the whole of India, with the exception of certain areas mentioned hereafter. In the east the range extends to Sikkim, the Santal Parganas in E. Bihar and Sambalpur in W. Orissa. E. Orissa, Bengal, Assam and Burma are outside the range. In Peninsular India the west coast from the neighbourhood of Bombay down to N. Travancore, and, again, the south-eastern portion of the Madras Presidency from the south of Vellore downwards, are outside the range. All over the Deccan Plateau, however, Sand-grouse are found. They are absent in Ceylon. The existence of these blank areas in India is probably due to excessive humidity in such areas, except in E. Orissa which has not been adequately surveyed.

According to Peters (1937), there are 16 world species, several with a number of subspecies—both totalling 45.

Within Indian limits are represented all the known genera and 9 out of the 16 species. Of each species, as a rule only one subspecies occurs within Indian limits, though in a few cases more have been claimed by certain authors.

The nomenclature adopted here is almost identical to that followed by Stuart Baker (1928), with the exception of *Pterocles exustus erlangeri* Neumann. It has now been shown (see p. 68) that the correct name of the subspecies occurring in India is *P. exustus ellioti* Bogdanow.

Of the 9 Indian Sand-grouse, 6 breed with certainty within Indian limits. Two, namely, *Pterocles coronatus atratus* Hartert and *Pterocles alchata caudacutus* (S. G. Gmelin), most probably breed within Indian limits, though neither breeding birds nor eggs have as yet been obtained. The remaining one, *Syrrhaptes paradoxus* (Pallas), is only a winter visitor.

In India the Sand-grouse largely occur and breed in the dry, sandy north-western region, but three species, viz., *Pterocles orientalis*, *P. indicus* and *P. exustus ellioti*, cover between themselves practically the whole of India, reaching east to E. Bihar and south to Travancore. Those species that breed only in N. W. India migrate south and east in winter.

GENERAL PARTICULARS REGARDING THE *PTEROCLETES* SKINS IN THE INDIAN MUSEUM.

The total number of registered Sand-grouse skins in the Indian Museum is only 64. Of these, 55 are of forms occurring within Indian

limits, the remaining 9 being extra-Indian. The desiderata are given below and skins of these species will be gratefully received.

The following persons have largely contributed to the Pterocletes collection of the Indian Museum :—

Mr. W. T. Blanford (a few skins from the Central Provinces, 1867 ; several skins from Abyssinia-Eritrea region collected during the British Abyssinian Expedition of 1867-68 and described by Blanford in *Obs. Geol. Zool. Abyssinia*, 1870, pp. 419-429 ; and a few skins from S. and E. Iran collected during the travels of the Persian Boundary Commission of 1870-72 and described by Blanford in *Eastern Persia*, Vol. II, *Zool. & Geol.*, 1876, pp. 271, 272). Mr. G. King (a few skins from various places in Rajputana, 1868). Major St. John and "Mus. Coll." (a few skins from S. Iran, 1869). Mr. A. O. Hume (a few skins from the Punjab, 1869). Dr. F. Stoliczka (a few skins from Kashmir and E. Turkestan, collected during Forsyth's Second Yarkand Mission of 1873-74, and described by B. Sharpe in *Sci. Results Second Yarkand Miss. : Aves*, Vol. I, 1881, pp. 119, 120). Mr. V. Ball (some skins from Orissa, 1876). Surgeon J. E. T. Aitchison and others (several skins from W. and S. Afghanistan collected in 1884 during the travels of Afghan Delimitation Commission of 1884-85, and described by B. Sharpe in *Trans. Linn. Soc. Lond.* (2) V, 1889, p. 85). Dr. F. P. Maynard (a few skins collected in S. Afghanistan during the travels of the Afghan-Baluch Boundary Commission of 1896, and described by F. Finn in *Journ. Asiat. Soc. Bengal* LXV, Pt. 2 (*Nat. Hist.*), 1897, pp. 566, 567). Sir Henry McMahon (a few skins from British Baluchistan collected in 1907 for the Quetta Museum). Drs. B. N. Chopra and M. L. Roonwal (a few skins from the Mewar State, Rajputana, 1941). Besides these, there are a few skins collected by the "Mus. Coll." or the official collector of the Indian Museum ; and a few other stray skins.

The following Indian Sand-grouse are unrepresented or poorly represented in the Indian Museum. The number indicated within the square brackets gives the number of skins present.

1. *Pterocles lichtensteini* *arabicus* Neumann.—[No skin.]
2. *Pterocles coronatus atratus* Hartert.—[No Indian skin.]
3. *Pterocles alchata caudacutus* (S. G. Gmelin).—[Only two skins.]
4. *Pterocles senegallus* (Linnaeus).—[Only one Indian skin.]
5. *Syrrhaptes paradoxus* (Pallas).—[Only one, juvenile ; no Indian skin.]

GENERAL REMARKS.

For measurements, localities, abbreviations used, etc., the same procedure was followed as indicated in Part I of this series (Roonwal, 1941, p. 289). The only difference is in the bill ("B.") which has been measured from the base, i.e., from the junction with the skull to the tip, in contrast to the culmen-length ("C.") given in Part I.

SYSTEMATIC ACCOUNT.

The following species and subspecies are listed in the present *Catalogue* :—

PTEROCLES Temm.

- P. orientalis* (Linn.) (subsp. ?), p. 60.
P. indicus (J. F. Gm.), p. 62.
P. lichtensteinii Temm., p. 63.
P. l. lichtensteinii Temm., p. 64. (Extra-Indian.)
P. coronatus Lichten., p. 64.
P. c. ?atratus Hart., p. 65.
P. coronatus (subsp. ?), p. 66. (Extra-Indian.)
P. alchata (Linn.), p. 66.
P. a. caudacutus (S. G. Gm.), p. 66.
P. exustus Temm., p. 67.
P. ex. ellioti Bogd., p. 68.
P. senegallus (Linn.), p. 69.

SYRRHAPTES Illig.

- S. tibetanus* Gould, p. 70.
S. paradoxus (Pall.), p. 71.

Order PTEROCLETES.

Family PTEROCLIDIDAE.

Genus **Pterocles** Temminck.**Pterocles orientalis** (Linnaeus) (subsp. ?)

(The Large, Imperial, or Black-bellied Sand-grouse.)

1758. *Tetrao orientalis*, Linnaeus, *Syst. Nat.* (10th ed.) I, p. 161. ("In Oriente" = Anatolia, Asia Minor, ex Hasselquist.)
 1849. *Pterocles arenarius*, Blyth, *Catal. Birds Mus. Asiat. Soc. Bengal*, p. 249, No. 1489.
 1928. *Pterocles orientalis*, Stuart Baker, *Faun. Brit. Ind., Birds* (2nd ed.) V, p. 262.
 1937. *Pterocles orientalis* (subsp. ?), Peters, *Check-list Birds World* III, p. 6.

This species is resident from the Canary Islands, over S. W. Europe (Iberian Peninsula), N. W. Africa, Cyprus, Asia Minor, Palestine, S. E. European Russia (the Volga lowlands and the Orenburg District), south to the Turko-Iranian frontier, Afghanistan and N. Baluchistan. It overwinters in the whole of N. W. India, and specimens have been shot as far east as the central United Provinces and Nepal and as far south as Mysore.

Some recent workers have recognized the following four subspecies one of which is doubtfully distinct: *orientalis* (Linnaeus), type-locality Anatolia; *koslovae* Meinertzhagen, type-locality Emba R., Orenburg, Russia; *enigmaticus* Neumann, type-locality Rann of Cutch, N. W. India; and *aragonica* (Latham) (*vide* Meinertzhagen, 1940, p. 229), type-locality Aragon, Spain. Of these, *enigmaticus* is regarded as doubtfully distinct.

In the Indian Museum collection the skins from S. Iran, W. and S. Afghanistan, Kashmir, the Punjab and Rajputana cannot be separated. In none of the females is the lower breast pure white as in *koslovae*, but varies from sand colour to pale grey-white with sand-coloured tinge. In view of the diversity of opinion regarding the various subspecies, it is not possible to assign the skins in the Indian Museum to anyone. Skins from S. Iran, Afghanistan and N. W. India seem to belong to a single subspecies.

The male No. 20394, labelled "Ruschk" (coll. by Dr. D. G. Radde, June 27, 1886) has a darker back than all the other males,

Pterocles orientalis is represented in the Indian Museum collection by the following skins :—

Reg. No.	Sex.	Locality.	Date.	Collector or Donor.	Measurements (mm.).			
					W.	Tl.	Tr.	B.
9895	♂	"Oak forest near Shiraz, 6000 ft." (S. Iran).	July 1869 ..	Major St. John & "Mus. Coll."	243	110	..	17
9896	♀	"Oak forest near Shiraz, 6000 ft." (S. Iran).	July 1869 ..	Major St. John & "Mus. Coll."	..	..	..	21
14521	♂	Karez-Dasht (W. Afghanistan).	Nov. 9, 1884 ..	Surg. Aitchison (Afghan Delimit. Comm.).	244	110	..	19
14524	♀	Zagin (W. Afghanistan).	Nov. 5, 1884 ..	Capt. Cotton (Afghan Delimit. Comm.).	231	106	..	17
14522	♂	Jagin or Zagin (W. Afghanistan).	Nov. 6, 1884 ..	Capt. Cotton (Afghan Delimit. Comm.).	241	107	..	18
14523	♀	Kin (S. W. Afghanistan).	Nov. 3, 1884 ..	Major Yate (Afghan Delimit. Comm.).	229	102	..	20.5
21861	(♂)	Shorawuk (S. Afghanistan).	1896 ..	Dr. F. P. Maynard (Afghan-Baluch Bound. Comm.).	233	107	..	19
21859	♂	Shorawuk (S. Afghanistan).	1896 ..	Dr. F. P. Maynard (Afghan-Baluch Bound. Comm.).	240	103	..	21
21860	♂	Shorawuk (S. Afghanistan).	1896 ..	Dr. F. P. Maynard (Afghan-Baluch Bound. Comm.).	241	103	..	21
21864	♀	Shorawuk (S. Afghanistan).	1896 ..	Dr. F. P. Maynard (Afghan-Baluch Bound. Comm.).	237	100	..	18.5
17378	♀	Gilgit, 5000 ft. (Kashmir).	Dec. 20, 1880	Mr. J. Biddulph	233	85	..	18
4163	(♀)	Sirsa Dist. (Punjab).	Dec. 24, 1869	Mr. A. O. Hume (exchange).	247	114	..	20
4164	♂	Sirsa Dist. (Punjab).	Dec. 31, 1869	Mr. A. O. Hume (exchange).	234	100	..	20.5
25396	(♂)	Lahore (Punjab).	Dec. 11, 1911	Mr. D. Ezra ..	..	..	..	19
17380	(♀)	"Rajpootana."	(?) ..	Mr. G. King ..	243	104	..	..
17379	(♂)	"Burra L. E."	Nov. 17, 1865	Dr. J. Scully ..	244	103	..	20
20394	♂	"Ruschk" ..	June 27, 1886	Dr. D. G. Radde	221	96	..	2
25947 (Mounted in Gallery).	♂	(?) ..	1929 ..	Zool. Garden, Calcutta.	..	..	..	..
25948 (Mounted in Gallery).	♀	(?) ..	1929 ..	Zool. Garden, Calcutta.	..	..	..	..

Remarks.—The skins from Iran, Afghanistan and N. W. India are indistinguishable either on plumage characters or on measurements. The sexes are alike in measurements as shown by the following lengths (in mm.) :—

			Wing	Tail	Bill
♂♂	..	..	221-244	90-110	17-21
♀♀	..	..	229-247	85-114	17-20.5

Distribution.—In addition to the specific distribution given above some further remarks are necessary regarding breeding. Within Indian limits, Stuart Baker (1928, p. 263 ; 1935, p. 177) considers it only as a winter visitor. Actually, it breeds in N. Baluchistan, records having been obtained from the following places (*vide* Ticehurst, 1927, p. 74 ; 1930, p. 479) :—Chaman ; around Quetta ; Kushdilkhan ; Zhob Valley ; Harboi ; probably also south of Kalat around Panjgur.

***Pterocles indicus* (J. F. Gmelin).**

(The Painted Sand-grouse.)

1786. *Tringa fasciata*, Scopoli, *Del Flor. et Faun. Insubr.*, fasc. 2, p. 92. ("In Indis" = Coromandel Coast, *ex* Sonnerat.), Name preoccupied. (Not *Tringa fasciata* S. G. Gmelin, 1774.)
1789. *Tetrao indicus*, J. F. Gmelin, *Syst. Nat.* I, pt. 2, p. 755. (Coromandel, India).
1849. *Pterocles fasciatus*, Blyth, *Catal. Birds. Mus. Asiat. Soc. Bengal*, p. 249, No. 1490.
1928. *Pterocles indicus*, Stuart Baker, *Faun. Brit. Ind., Birds* (2nd ed.) V, p. 264.
1937. *Pterocles indicus*, Peters, *Check-list Birds World* III, p. 9.

This species is peculiar to India. No subspecies are recognized.

Pterocles indicus is represented in the Indian Museum collection by the following skins :—

Reg. No.	Sex.	Locality.	Date.	Collector or Donor.	Measurements (mm.).			
					W.	Tl.	Tr.	B.
17382	♂	Jodhpur (Rajputana).	Mar. 1868 ..	Mr. G. King ..	175	..	26	..
17381	♂	Sirohi (Rajputana).	Sept. 19, 1868	Mr. G. King ..	174	81	24	19
26572	♂	Parsad (Mewar State, Rajputana).	Oct. 23, 1941	Drs. B. N. Chopra & M. L. Roonwal.	180	85	27	18
26574	♂	Parsad (Mewar State, Rajputana).	Oct. 23, 1941	Drs. B. N. Chopra & M. L. Roonwal.	188	75	26	19.5
26573	♀	Parsad (Mewar State, Rajputana).	Oct. 23, 1941	Drs. B. N. Chopra & M. L. Roonwal.	170	..	28	17
4155	♂	"Near Nagpoor" (Central Prov.).	Jan. 17, 1867	Mr. W. T. Blandford.	179	80	25	17
4154	♀	"Jungles W. of Nagpoor" (Central Prov.).	Jan. 12, 1867	Mr. W. T. Blandford.	174	79	25	15
7634	♂	Sambalpur (Orissa).	Mar. 3, 1876 ..	Mr. V. Ball ..	170	69	23	15
7683	♀	Sambalpur (Orissa).	Jan. 24, 1876	Mr. V. Ball ..	169	76	..	16

Remarks.—The two males, Nos. 26572 and 26574, from Parsad (October 23, 1941) had the testes in the non-breeding condition, measuring about 2×2 mm. They were shot in the evening at a pool where they congregate at dusk (about 7 p. m.) in large numbers to drink.

Females are smaller than males as shown by the following measurements (in mm.) of the Indian Museum skins :—

			Wing	Tail	Bill
6♂♂	..	..	170-188	69-85	15-19.5
3♀♀	..	..	169-174	76-79	15-17

Distribution.—Practically the whole of India excluding certain areas in the north (Kashmir, Sikkim and Bhutan, but not Nepal), east (E. Bihar, E. Orissa, Bengal and Assam), west (Sind and Baluchistan) and south (S. W. coast from Bombay to Cape Comorin and the south-eastern portion of the Madras Presidency south of the neighbourhood of Madras and Vellore). Breeds throughout its range. (Hartert (1920, p. 1513) says that though Zarudny records it from the southern portion of Iranian Baluchistan, this may be an error.) Does not occur in Burma and Ceylon.

Some further remarks about its range may be given. In the North-West Frontier Province it has been recorded from Rustom near Mardan (Peshawar District), from Orakazi between Peshawar and Bannu (Kohat District) and from Shinauri, 3,800 feet. It is found in the Punjab, the United Provinces, Nepal (Ogilvie-Grant, 1893, p. 29), Rajputana, Kathiawar and Cutch. Its occurrence in Sind is doubtful (*vide* Ticehurst, 1923, p. 647). Does not occur in Baluchistan. Absent from the West Coast from Bombay downwards. Common in Central India, the Central Provinces, Hyderabad State, and south to Mysore. Absent from S. E. Madras Presidency, south of Madras and Vellore (*vide* Whistler & Kinnear, 1936, p. 680). In the east it has been recorded up to the Santal Parganas (E. Bihar), and there are two skins from Sambalpur (W. Orissa) in the Indian Museum.

***Pterocles lichtensteinii* Temminck.**

This species ranges from the Central Sahara in N. Africa south to Kenya, and east *via* Egypt, Abyssinia, Somaliland and S. Arabia to S. Afghanistan, Baluchistan and Sind west of the R. Indus. Peters (1937, pp. 9, 10) admits seven subspecies of which *arabicus* Neumann is the one which occurs from S. Arabia to India. Ticehurst (1930, p. 479 : 1937, p. 408) says that *arabicus* is indistinguishable from the typical *lichtensteinii* from E. Africa, while Mackworth-Praed & Grant (1937, p. 181) and Bates (1937, p. 824) hold the contrary view. I follow Mackworth-Praed & Grant who have carefully studied this species and have recognized only four subspecies.

***Pterocles lichtensteinii lichtensteinii* Temminck.**

(The Close-barred Sand-grouse.)

1825. *Pterocles lichtensteinii*, Temminck, *Pl. Color. d'Oiseaux*, livr. 60, pl. 355 ♂, pl. 361 ♀. (Nubia, Sudan, E. Africa.)1937. *Eremialector lichtensteinii lichtensteinii*, Mackworth-Praed & Grant, *Ibis* (14) I, p. 181.

Pterocles lichtensteinii lichtensteinii is represented in the Indian Museum collection by the following skins which were obtained from Eritrea by W. T. Blanford (1870, pp. 419-421) during the Abyssinian Expedition.

Reg. No.	Sex.	Locality.	Date.	Collector or Donor.	Measurements (mm.).			
					W.	Tl.	Tr.	B.
4157	♀	Amba (Samhar, Eritrea).	Aug. 22, 1868	Mr. W. T. Blanford.	179	73	..	18
4167	♀	Ailat (Samhar, Eritrea).	June 29, 1868	Mr. W. T. Blanford.	174	..	24	18
4166	♀	"Ain on R. Lebk a" (Samhar, Eritrea).	July, 5, 1868	Mr. W. T. Blanford.	179	..	..	17
9280	♀	Ain, 1200 ft. (Samhar, Eritrea).	(?) ..	Mr. W. T. Blanford.	..	..	..	..
9279	♂	"Koomeylee" (=Kamayli or Komayli), 500 ft. (Eritrea).	June 3, 1868	Mr. W. T. Blanford.	186	74	..	17
4156	(♂)	Near Zoulla (=Zula) (Annesley Bay, Red Sea Coast, Eritrea).	Dec. 29, 1867	Mr. W. T. Blanford.	172	73	25	18

Distribution.—"Sudan, Eritrea, British Somaliland, and Abyssinia" (Mackworth-Praed & Grant, 1937, p. 181).

***Pterocles coronatus* Lichtenstein.**

(The Coronetted Sand-grouse.)

This species ranges from the eastern Sahara in N. Africa, *via* Algeria, Tripoli, Egypt and N. Sudan to Palestine, Arabia and the deserts of Iraq, Iran, Afghanistan and N. W. India south to Sind. Peters (1937, pp. 6, 7) admits four subspecies of which one, *atratus*, or possibly two, occur within Indian limits.

The subspecies of the Coronetted Sand-grouse have been subject to some discussion in recent years. In the Indian Museum there are three skins (1♂, 2♀♀) from Shorawuk (S. Afghanistan) which seem to be *atratus* Hartert. Three others (1♂, 2♀♀) from Iranian Baluchistan and southern and central Iran are much darker, the difference being specially noticeable in the females. On the upper parts the dark bands fuse together in several places, giving the impression of a black bird with light spots ;

on the underside there are distinct dark bands instead of small spots on the abdomen ; the dark streaks on the throat and chin are also very prominent. These skins must be separated from the Afghanistan ones ; they might possibly be *saturatus* Kinnear.

The lumping together of the birds from Afghanistan, Baluchistan and Iran into a single subspecies does not appear to be justified. Possibly, two races, a darker and a paler, might be found within the Indian limits. The skins available to me are, however, too few for the elucidation of the question.

***Pterocles coronatus ?atratus* Hartert.**

1902. *Pterocles coronatus atratus*, Hartert, *Bull. Brit. orn. Cl.* XII, p. 48. (E. Iran).
1928. *Pterocles coronatus atratus*, Stuart Baker, *Faun. Brit. Ind., Birds* (2nd ed.) V, p. 267.
1937. *Pterocles coronatus atratus*, Peters, *Check-list Birds World* III, p. 7.

Pterocles coronatus ?atratus is represented in the Indian Museum collection by the following skins :—

Reg. No.	Sex.	Locality.	Date.	Collector or Donor.	Measurements (mm.).			
					W.	Tl.	Tr.	B.
22896	♂	Shorawuk (S. Afghanistan).	1896	Dr. F. P. Maynard (Afghan-Baluch Bound. Comm.).	200	114	...	19
21883	♀	Shorawuk (S. Afghanistan).	1896	Dr. F. P. Maynard (Afghan-Baluch Bound. Comm.).	191	91	(24)	18
21884	♀	(Shorawuk, S. Afghanistan).	1896	Dr. F. P. Maynard (Afghan-Baluch Bound. Comm.).	187	101	24	18

Distribution.—Peters (1937, p. 7) gives the following range of *atratus* : “ Deserts of Iraq, Persia, Afghanistan, Baluchistan and northern India to the Indus and Sind. ”

Ogilvie-Grant (1893, p. 24) lists three skins (coll. by Lt.-Col. Swinhoe in February) from “ Mhow District ” (Indore State, Central India), but none else seems to have obtained it so far east—these Mhow birds were probably winter stragglers.

Some further remarks are necessary regarding the range. In the west, Bates (1937*a*, p. 307 ; 1937*b*, p. 824 ; 1938, p. 463) refers birds from western, central and southern Arabia to *atratus*.

Persian and Baluchistan skins in the Indian Museum are different from those from Afghanistan, as stated above.

The range in India is given by Stuart Baker (1928, p. 268) as follows : “ West of the Indus all along the North-West Provinces to the south of Sind. Swinhoe obtained three specimens from Mhow in Dhar¹. ”

It most probably breeds in Sind, but breeding birds and eggs have not so far been obtained. Breeding, however, is suggested by the following observations : Stuart Baker (1935, p. 182) refers to oviduct eggs (April and May) from Sind ; and Ticehurst (1923*a*, p. 471) mentions having met the birds, in June in Sind.

¹ Actually in Indore State, as pointed out above.

Pterocles coronatus (subsp. ?).

Reg. No.	Sex.	Locality.	Date.	Collector or Donor.	Measurements (mm.).			
					W.	Tl.	Tr.	B.
10284	♀	"Bahu Kelat, Persian Baluchistan".	Feb. 4, 1872 ..	Mr. W. T. Blandford.	191	90	24	15
9936	♀	"Kadreu, E. of Shiraz" (S. Iran).	May 31, 1872	Mr. W. T. Blandford.	185	..	..	17
9935	♂	"Yezdikhast, between Shiraz and Ispahn, 700 ft." (S. Iran).	July 1872 ..	Mr. W. T. Blandford.	186	86	24	..

Remarks.—These skins from S. and E. Iran are much darker than the Afghanistan skins listed above under *P. c. ?atratus*.

Pterocles alchata (Linnaeus).

1766. *Tetrao alchata*, Linnaeus, *Syst. Nat.* (12th ed.) I, p. 276. ("Monspeli, in Pyrenaeis, Syria, Arabia"=Spain, S. W. Europe, *vide* Bagdanow, 1881.)

The species ranges from S. W. Europe to N. Africa south to the Sahara and east to Asia Minor, Arabia, the Caucasus, Transcaspia, Iraq, Afghanistan and N. W. India. Peters (1937, p. 4) admits two subspecies of which one, *caudacutus*, occurs within Indian limits.

Pterocles alchata caudacutus (S. G. Gmelin).

(The Large Pin-tailed Sand-grouse.)

1774. *Tetrao caudacutus*, S. G. Gmelin, *Reise Russld.* III. p. 93, pl. 18. (N. Iran.)

1928. *Pterocles alchata caudacutus*, Stuart Baker, *Faun. Brit. Ind., Birds* (2nd ed.) V, p. 268.

1937. *Pterocles alchata caudacutus*, Peters, *Check-list Birds World* III, p. 4.

Pterocles alchata caudacutus is represented in the collection of the Indian Museum by the following skins:—

Reg. No.	Sex.	Locality.	Date.	Collector or Donor.	Measurements (mm.)			
					W.	Tl.	Tr.	B.
26570	(Juv. ♂)	"Saiyad Hamid" (Quetta Dist., Baluchistan).	Nov. 4, 1907 ..	Sir Henry McMahon. (Quetta Mus.)	[210]	98	..	18]
26571	(Juv. ♀)	"Saiyad Hamid" (Quetta Dist., Baluchistan).	Nov. 26, 1907	Sir Henry McMahon. (Quetta Mus.)	[210]	83	26	20]

Remarks.—No. 26570 is labelled ♀ on the original Quetta Museum label, but is a juvenile ♂; the central rectrices are not greatly prolonged. No. 26571 is apparently a juvenile ♀; the breast is marked with smoky bands and the rufous collar has not yet developed; the central rectrices are rather short.

Distribution.—"Resident in northern Africa from central Morocco to Cyrenaica and south to Sahara; resident also from Asia Minor, the Caucasus, Transcaspia, Afghanistan and northwestern India, south to Palestine, Mesopotamia, and Baluchistan" (Peters).

Bates (1937*a*, p. 305) records it from central Arabia. This is probably the first Arabian record.

Stuart Baker (1928, pp. 269, 270; 1935, p. 183) gives the Indian distribution as follows: Occurs in enormous numbers in the N. W. Trans-Indus area, and again between the Indus and the Chenab; occurs in the Punjab north-east up to the Beas, east *via* Ludhiana to Delhi; south across the Rajputana desert to Deesa in Palanpur State. Breeds only in Baluchistan and probably also around Peshawar in the N. W. Frontier Province.

Ticehurst (1923*a*, p. 468) says that it is common as a winter visitor in Jacobabad District (Upper Sind), but is either very rare or does not occur at all in Lower Sind.

Ticehurst (1927, p. 75) again remarks that though actual breeding in Baluchistan has never been observed, breeding probably occurs on or over the Afghan-Baluchistan boundary and in central Mekran (around Panjgur) where birds have been observed in July. In N. Baluchistan it is a spring and autumn passage migrant.

In the remaining portion of its Indian range it is a winter visitor, coming in huge flocks.

***Pterocles exustus* Temminck.**

1825. *Pterocles exustus*, Temminck, *Pl. Color. d'Ois.*, livr. 60, pl. 354 ♂, 360 ♀ (W. coast of Africa, Egypt and Nubia=Senegal.)

This species ranges over the whole of N. Africa and *via* Palestine, S. Arabia and S. Iran to practically the whole of India east to E. Bihar and south to Travancore.

In recent years its specific and subspecific nomenclature has been subject to many changes, and with regard to the name of the subspecies occurring in India unanimity has been lacking. Peters (1937, pp. 5, 6) admits seven subspecies; of these the S. W. Arabian form is *erlangeri* Neumann, while the Indian form is *hindustan* Meinertzhagen. Stuart Baker (1928, p. 271) does not separate these two forms. Hartert (1920, p. 1510) considers *elliotti* Bogdanow as a synonym of *P. e. exustus*. Friedmann (1930, pp. 197-200) and Archer & Godman (1937, pp. 559-561) also discuss the question of the races, without, however, coming to any definite conclusions. Mackworth-Praed & Grant (1937, pp. 179, 180), who have examined the question of races *de novo*, have come to the conclusion that only three races, namely, *exustus* Temminck, *elliotti* Bogdanow and *floweri* Nicoll, can be recognized. I follow the last named authors.

***Pterocles exustus ellioti* Bogdanow.**

(The Common Indian Sand-grouse.)

1849. *Pterocles exustus*, Blyth, *Catal. Birds Mus. Asiat. Soc. Bengal*, p. 249, No. 1492.
1881. (Dec.). *Pterocles Ellioti*, ♂, Bogdanow, *Bull. Acad. Imp. Sci. St. Petersburg* XXVII, Col. 167. (Abyssinia.)
1881. *Pterocles ellioti*, Bogdanow, *Mel. Biol.* XI, p. 54. (Eritrea and S. Abyssinia.)
1909. *Pterocles exustus erlangeri*, Neumann, *Orn. Monatsb.* XVII, p. 154. (El Hota, Lahej, S. Arabia.)
1920. *Pterocles senegalensis erlangeri*, Hartert, *Vögel paläark. Faun.* II, p. 1511.
1923. *Pterocles senegalensis hindustan*, Meinertzhagen, *Bull. Brit. orn. Cl.* XLIII, p. 158. (Sambhar, Rajputana, India.)
1928. *Pterocles exustus erlangeri*, Stuart Baker, *Faun. Brit. Ind., Birds* (2nd ed.) V, p. 271.
1937. *Pterocles exustus*, subsp. *erlangeri*, *hindustan*, etc., Peters, *Check-list Birds World* III, p. 5.

Pterocles exustus ellioti is represented in the collection of the Indian Museum by the following skins:—

Reg. No.	Sex.	Locality.	Date.	Collector or Donor.	Measurements (mm.).			
					W.	Tl.	Tr.	B.
22895	(♂)	Sirsa Dist (Punjab).	Dec. 18, 1869	Mr. A. O. Hume (exchange).	188	149	..	..
4161	♀	Nagpur (Central Prov.).	Jan. 30, 1867	Mr. W. T. Blandford.	167	91	..	15.5
4160	♀	Nagpur (Central Prov.).	Jan. 30, 1867	Mr. W. T. Blandford.	182	108	..	17
4148	♂	"S. of Nagpore" (Central Prov.).	Jan. 31, 1867	Mr. W. T. Blandford.	184	129	27	15
4149	♂	"S. of Nagpore" (Central Prov.).	Jan. 30, 1867	Mr. W. T. Blandford.	181	151	..	16
4151	♂	"S. of Nagpore" (Central Prov.).	Feb. 1, 1867 ..	Mr. W. T. Blandford.	185	176	..	19
4159	(♀)	Chanda (Central Prov.).	Feb. 16, 1867	Mr. W. T. Blandford.	168	102	..	17
18927	♂	"Gya" (=Gaya, Gaya Dist., Bihar).	(?) ..	"Mus. Coll." ..	183	126	..	18
18928	♀	"Gya" (=Gaya, Gaya Dist., Bihar).	(?) ..	"Mus. Coll." ..	188	122	..	18
18929	♀	"Gya" (=Gaya, Gaya Dist., Bihar).	(?) ..	"Mus. Coll." ..	175	101	22	18
4152	♂	"Near Zoulla" (=Zula), 300 ft. (Eritrea).	June 5, 1868 ..	Mr. W. T. Blandford.	174	133	..	16.5
4153	♀	"Near Zoulla" (=Zula), 300 ft. (Eritrea).	June 5, 1868 ..	Mr. W. T. Blandford.	168	100	..	15

Remarks.—The three skins listed by Blyth (1849, p. 249, No. 1492 A, B, C) from "S. India" (coll. by T. C. Jerdon, 1844) are not present in the Indian Museum collection.

The females are appreciably smaller than the males, as shown by the following measurements (in mm.) :—

			Wing	Tail	Bill
7♂♂	..	..	174-188	122-176	15-19
5♀♀	..	..	167-182	91-108	15.5-18

Distribution.—"Eritrea, central and northern Abyssinia, British Somaliland, Arabia, and India" (Mackworth-Praed & Grant, 1937, p. 180).

Bates (1937*a*, pp. 305, 306 ; and 1939, pp. 148, 149) is of the opinion that the birds from western and southern Arabia are not *elliotti* Bogdanow but *erlangeri* Neumann.

The Indian range is given by Stuart Baker (1928, pp. 272, 273) as follows : Practically everywhere in the plains where the rainfall is not too heavy. Does not occur in Ceylon, but is found in the open parts of Travancore, whilst Blanford shot them near Trichinopoly. East it is found as far as Ranigunj and Birbhum in W. Bengal. Common in parts of Sind and in the Punjab, and has been killed in Kashmir.

Ogilvie-Grant (1893, p. 14) lists two skins (♂ and ♀ adults) from Nepal, collected by B. H. Hodgson.

***Pterocles senegallus* (Linnaeus).**

(The Spotted Sand-grouse.)

- 1771. *Tetrao senegallus*, Linnaeus, *Mantissa Plant., Reg. Anim.*, Appendix p. 526. (Senegal, *errore*=Algeria, *vide* Hartert, *Nov. Zool.* XXXI, 1924, p. 7.)
- 1928. *Pterocles senegallus*, Stuart Baker, *Faun. Brit. Ind., Birds* (2nd ed.) V, p. 273.
- 1934. *Pterocles senegallus remotus*, Neumann, *Verh. orn. Ges. Bayern* XX, p. 471. (Kunaria, Cutch, N. W. India.)
- 1937. *Pterocles senegallus senegallus* and *P. s. remotus*, Peters, *Check-list Birds World III*, p. 6.

This species ranges from N. Africa to S. W. Asia, including the Indian Desert. Neumann (1934, p. 471) distinguishes the birds inhabiting the Indian Desert as *remotus*. They are said to differ from the typical *senegallus* of Africa in the following particulars :—Ground colour darker and more ochre-brown ; crown pure grey, not with sand-coloured tinge ; the spots and middle of abdomen in the female darker, being quite black. Peters (1937, p. 6), however, considers *remotus* doubtfully distinct from *senegallus*. The specimens in the Indian Museum are too few to enable me to give an opinion. For the present, I retain the Indian skins under the typical *senegallus*.

Pterocles senegallus is represented in the collection of the Indian Museum by the following skins :—

Reg. No.	Sex.	Locality.	Date.	Collector or Donor.	Measurements (mm.).			
					W.	Tl.	Tr.	B.
21885	♂	" Lazechah to Lijji Karez " (N. Baluchistan).	Mar. 11, 1896	Dr. F. P. Maynard (Afghan-Baluch Bound. Comm.).	206	148	..	19
9937	♂	Bampur, 2000 ft. (S. E. Iran).	Apr. 6, 1872 ..	Mr. W. T. Blanford.	200	143	25	(20)
9938	♀	Bampur, 2000 ft. (S. E. Iran).	Apr. 6, 1872 ..	Mr. W. T. Blanford.	200	120	..	19

Remarks.—Nos. 9937 and 9938 are listed by Blanford (1876, p. 271).

Distribution.—*P. s. senegallus* : " Resident in northern Africa from Algeria to Egypt, south to El-Golea, Air, Fezzan, Khartoum and Somaliland ; in southwestern Asia from Palestine, Iraq and Afghanistan to Arabia " (Peters).

P. s. remotus : " Baluchistan, Sind and the Indian Desert south to Cutch " (Peters).

Stuart Baker (1928, p. 274) gives the Indian distribution as follows : Occurs in Baluchistan ; common in Sind east of the Indus, rarer in the west ; not rare in Rann of Cutch ; occurs in Jaisalmere and Jodhpur States, and in Shahpur District in the Punjab.

Ogilvie-Grant (1893, p. 15) lists in the British Museum collection a ♀ adult skin from Mhow, Central India (coll. by Lt.-Col. Swinhoe in May).

Genus *Syrrhaptes* Illiger.

Syrrhaptes tibetanus Gould.

(The Tibetan Sand-grouse.)

1850. *Syrrhaptes tibetanus*, Gould, *Birds Asia*, Pt. 2, pl. and text (=vol. VI, pl. 61 of bound vol.). (Tsomoriri Lake, Ladak, Tibet"=? Tsho Marari Lake, Ladak, Kashmir.)

1850 (after May 14). *Syrrhaptes tibetanus*, Gould, *Proc. zool. Soc. Lond.*, p. 92. (" Stumerri Lake ", " Ladakh in Thibet " =? Tsho Marari Lake, Ladak, Kashmir.)

1928. *Syrrhaptes tibetanus*, Stuart Baker, *Faun. Brit. Ind., Birds* (2nd ed.) V, p. 277.

1937. *Syrrhaptes tibetanus*, Peters, *Check-list Birds World* III, p. 3.

Syrrhaptes tibetanus is represented in the collection of the Indian Museum by the following skins :—

Reg. No.	Sex.	Locality.	Date.	Collector or Donor.	Measurements (mm.).			
					W.	Tl.	Tr.	B.
23152	(Juv.)	Spti (Kangra Dist., Punjab).	About 1900 ..	Mr. H. H. Hayden	[244	134	29	13]
20291	(?)	Chagra (Ladak, Kashmir).	Sept. 21, 1873	Dr. F. Stoliczka (2nd Yarkand Miss.).	251	126	26	14
20292	(?)	Gogra (Ladak, Kashmir).	Sept. 25, 1873	Dr. F. Stoliczka (2nd Yarkand Miss.).	252	139	25	17
7866	(?)	"Tibet N. of Sikkim".	Nov. 10, 1870	Mr. Rutledge ..	..	..	25	21
7867	(?)	"Tibet N. of Sikkim".	Nov. 18, 1870	Mr. Rutledge ..	..	..	26	20
26569	(?)	(?)	Jan. 18, 1903	Mr. F. Finn. ..	260	194	28	(17)

Remarks.—No. 23152 is evidently a juvenile ; the whole of its upper parts and the secondaries are barred with black ; the ochreous patch at the sides of the head and neck is only faintly seen. The pinnate median rectrices are present only in No. 26569 ; in others they are either trimmed artificially or absent.

Stuart Baker's (1928, pp. 277, 278) description of the plumage is confusing and, in places, incorrect. He omits to mention the ochreous patch at the sides of the head and neck. Again, he refers (p. 278) to the presence of "yellow on the breast" ; no such yellow is present in any of the Indian Museum skins, nor has it been described by other workers.

Distribution.—"Breeds in inner Asia at elevations ranging between 12000 and 16000 feet from the Pamirs to Kokonor, south to Lahul and Sikkim ; in winter descending to somewhat lower altitudes" (Peters).

Within the Indian limits, it occurs in Ladak, the Upper Sutlej Valley and N. Sikkim.

***Syrrhaptes paradoxus* (Pallas).**

(Pallas's Sand-grouse.)

1773. *Tetrao paradoxa*, Pallas, *Reise Versch. Prov. russ. Reichs.* II, p. 712 (Southern part of the Tartarian Desert.)

1928. *Syrrhaptes paradoxus*, Stuart Baker, *Faun. Brit. Ind., Birds* (2nd ed.) V, p. 276.

1937. *Syrrhaptes paradoxus*, Peters, *Check-list Birds World* III, p. 3.

Syrrhaptes paradoxus is represented in the collection of the Indian Museum by the following skin :—

Reg. No.	Sex.	Locality.	Date.	Collector or Donor.	Measurements (mm.).			
					W.	Tl.	Tr.	B.
20293	(Juv. ?)	East of Kizil (E. Turkestan).	May 19, 1874	Dr. F. Stoliczka (2nd Yarkand Miss.).	[168	83	20	16]

Remarks.—The specimen is evidently a juvenile and is much smaller than the adults; the black patch on the underparts is well marked. Regarding this specimen Sharpe (1891, p. 120) wrote: "A female bird, which Mr. Ogilvie Grant thinks to be not quite mature."

Distribution.—"Breeds in the steppe region of extreme southeastern and central Asia from the Government of Ufa and the lower Volga east to Mongolia, north to about lat. 51° N. on the Kirghiz Steppes, the Altai, northwestern Mongolia and southern Transbaikalia, south to the Tian Shan, Zungaria and northeastern Kansu. Winters somewhat irregularly to the plains of northwestern China; sporadic irruptions occur from time to time, during which large numbers sometimes reach western Europe" (Peters).

In invasion years it also breeds in Jehol in N. China (Hartert & Steinbacher, 1936, p. 463).

Regarding the Indian range, Stuart Baker (1928, p. 276) writes: "Its only record is that of the Nawab of Dhar who shot a single specimen." He does not state when and where the specimen was shot.

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NOTES ON BREEDING, GROWTH AND JUVENILE REGENERATION IN *PERIONYX SANSIBARICUS* MICHAELSEN 1891
(OLIGOCHAETA).

By G. E. GATES, *Ewing College, Allahabad.*

Breeding.—This Indian species has now been bred in the laboratory. Worms apparently may be fully sexual, as indicated by a marked spermatozoal iridescence (visible through body wall of anesthetized specimens) on male funnels, from July 15 onwards. In the laboratory however first deposition of cocoons was observed only on July 31. Cocoons have been deposited, but only sparingly, in the laboratory during August-October, much more freely in November-March. No cocoons were deposited in the laboratory during April but in a cellar, where temperature remained between 70-75° F., cocoons were deposited until April 20. There was no deposition of cocoons during the remainder of April and the whole of May, even in the cellar (temperature between 75-80° F.). Cocoons have been found in soil of areas inhabited by the species only to end of February. Copulation has not been observed.

Cocoons.—Cocoons are of the usual form, rather spindle-shaped, 4-7 mm. long, portion distended with albumen 2-3 mm. long and 1 mm. thick at middle. Case itself has a light brown or yellowish brown colour.

Cocoon deposition terminated by anesthesia and/or operation.—On several occasions worms that had deposited cocoons during the previous night were anesthetized with chlorotone and the first five to ten segments removed. Although all such excisions are well anterior to the clitellum, no cocoons were ever deposited after operation.

Duration of development and hatching.—From cocoons deposited during night of December 10, in the cold season, worms first hatched out on December 24. Other cocoons hatched during the next four days. In embryos of cocoons deposited during night of March 7, in much warmer weather, circulating blood was first observed on the fifteenth. Worms hatched out March 16-19.

In the period between first and last hatching, in both series, no albumen was recognizable in viable cocoons, which were usually open at one end. In periods between first and last hatchings, on numerous occasions, individual worms were seen protruding the head to the exterior, to varying distances, and apparently exploring the substratum. No worm emerged completely from the cocoon while under observaiton, without some slight assistance. Withdrawal of worm into cocoon, after partial emergence, may have been a reaction to the rather strong light. So far as is known, all worms emerged from the cocoons during the night time. Only one worm emerged from each cocoon.

Many of the cocoons deposited in the laboratory did not give rise to young worms. Best percentages of hatching were obtained in December-January.

Just hatched juveniles.—Just hatched worms are 6-10 mm. long, 0.5-0.75 mm. thick. Pigmentation may be quite unrecognizable (1), or as follows; slight and recognizable only in first sixteen to twenty segments (several), recognizable behind xx only in region of mid-dorsal muscle band (several), i-x heavily pigmented, xi-xxi slightly pigmented (1). In a late-hatching worm with 82 segments, i-lxxiii are pigmented.

Number of setigerous segments, in 35 specimens, is 53-82 as follows :—53 (1), 61 (1), 64 (1), 66 (1), 67 (1), 68 (1), 69 (2), 70 (3), 71 (2), 72 (2), 73 (5), 74 (4), 75 (4), 76 (2), 77 (3), 78 (1), 82 (1). At the posterior end of each worm there is always a large, white growth zone, anteriorly with every small, closely crowded rudiments of segments marked off by rudimentary intersegmental furrows, setae and nephropores either lacking or unrecognizable. Posteriorly even the rudimentary intersegmental furrows are lacking, though there is usually space for a number. The small size, close crowding and (more posteriorly) vagueness of, what appear to be rudiments of intersegmental furrows render it impossible to determine with certainty the number of actual segments. Hence only setigerous segments, *i.e.*, those on which setae are actually recognizable, were counted. If recognizable rudiments of segments were counted the number would in each case still be much less than a hundred. The smooth posteriormost zone, in which no rudiments of segmental furrows are recognizable, may occasionally be unusually long. The long growth zone apparently indicates a region of rapid production of new tissues and differentiation of new segments, as compared with a much smaller and less obvious growth zone of larger specimens where new tissues are produced much more slowly and segments may be differentiated only one at a time.

“*Do earthworms grow by adding segments?*” This question has been answered by Sun and Pratt (1931), after study of the Lumbricid *Eisenia foetida*, apparently in the negative, with the suggestion that juveniles have a larger mean number of segments than adults. This latter is of course entirely possible in view of the known frequency of autotomy¹ posteriorly.

Number of segments in adult individuals of *P. sansibaricus* may be as many as 200 and clitellate specimens with normal posterior portions usually have much more than a hundred segments. The largest, just-hatched juvenile has only 82 setigerous segments. Each juvenile obviously has a large growth zone, in which rapid production of new segments is under way. It may however be possible that all of the juveniles hatched in the laboratory emerged prematurely. To check on that possibility, on several occasions, number of juveniles were collected from natural habitats and segmental counts were made on those of such small size as to indicate recent hatching. Results obtained are much the same as from juveniles hatched in the laboratory. Larger juveniles and presumably older juveniles may also have a large zone of rapid growth, as in the following series. (1) Length 14-25 mm,

¹This is used as a convenient single word to indicate loss of a portion of the body whether by action of the worm itself or by action of some unknown external agent.

diameter 1-1.75 mm, number of segments 85-133. (2) Length 26-35 mm, diameter 2-2.5 mm, number of segments 118-153. In many of those specimens with no large zone of rapid growth these are indications of autotomy, with or without regeneration of a short or very short tail portion.

All the evidence available, accordingly, seems to show that in *P. sansibaricus* at least, worms continue to grow by "adding segments", after hatching.

Furthermore, clitellate and fully sexual specimens of *P. sansibaricus* without any indication of posterior autotomy and regeneration, but with a large, white zone of growth, have occasionally been found. Apparently then, in this species, an occasional individual may become sexual before growth in length has ended, and before segmental differentiation or formation has been completed.

Autotomy.—During the very first week after hatching, three out of eleven juveniles autotomized short tail portions. One of the three developed a short anal bud but no regeneration by the other two was recognizable during the remainder of the time the specimens were under observation.

Juvenile regeneration.—As previously shown (Gates, 1944), *P. sansibaricus* has an unusually high regenerative capacity for an earthworm. As in all previous work on regeneration in earthworms, the experiments were on mature specimens. Do very young juveniles, just hatched out from the cocoon, have a similar regenerative capacity? A single experiment has been tried.

On December 26, three juveniles which had emerged from cocoons during the previous night, were cut approximately into equal halves according to length, without anesthetic. During the next three weeks one anterior and one posterior substrate died. Each of the other two anterior portions (of 23 and 27 segments) developed a small white tail regenerate with terminal anus but no metameric differentiation. Each of the posterior halves (of 37 and 44 setigerous segments) regenerated a head. One head regenerate had no externally recognizable metameric differentiation. The second was marked off into nine segments but setae and nephropores, as well as pigment, were unrecognizable.

SUMMARY.

Cocoons have been deposited in the laboratory from July 31 to April 1, in a cooler cellar to April 20. Worms hatched in 14-18 days in December, in 9-12 days in March. Just hatched juveniles have only 53-82 segments and a large growth zone from which new segments are differentiated to a total of 200. An occasional individual may become sexually mature while rapid formation and differentiation of segments is still continuing. 27% of one series autotomized posteriorly within first week after hatching. Anterior substrates of just-hatched juveniles can regenerate a tail from 23/24 posteriorly. Posterior substrates of 37 or more setigerous segments can regenerate a head.

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NOTES ON *LAMPITO MAURITII* KINBERG 1867 (OLIGOCHAETA).

By G. E. GATES, *Ewing College, Allahabad.*

During four years spent in India, a considerable number of specimens of *L. mauritii*, from various portions of India, in a region from Madras north through Bombay and Cuttack to Saharanpur, came into the author's possession. Advantage has been taken of the opportunity provided by this mass of material to check on certain disagreements in previous descriptions, to look for evidence of geographical variation (which was not found), to ascertain how much could be learned about regeneration in natural conditions, and to obtain some information as to variation and abnormality. Localities from which material was obtained are in course of publication elsewhere and need not be repeated here. Results of study of regeneration will be presented separately. Certain portions of the remainder of the information secured are presented herewith.

Several specimens from each locality were dissected, a total of more than fifty. Most of the material examined was preserved by the simple and quick methods that must ordinarily be used when dealing with large amounts of material. In these circumstances it is not surprising that some blood vessels or portions of vessels in all dissected specimens appear to be inadequately preserved for study of the circulatory system. However, when carefully anaesthetized specimens that had been fixed in Bouin's fluid were examined, it was again found that certain vessels, or portions thereof, were either unrecognizable or traceable only with difficulty, of ten presumably because they were empty at time of fixation. That even major blood vessels, as for instance a subneural trunk in species of *Perionyx*, may be temporarily quite or nearly empty can be confirmed from examination of living worms. At one moment the subneural may be clearly visible through the body wall as a solid red line that shortly after may be quite unrecognizable. In these circumstances it probably will be desirable to try, when conditions once more permit, coloured latex injections for detailed study of circulatory systems. Ordinary methods of preservation are not satisfactory for study of the excretory system, especially in the pharyngeal region and accordingly only one brief reference to that system is made below.

Number of segments.—Number of segments in clitellate specimens varies up to 190. In the smallest juveniles that were available, 20-30 mm. long and about one mm. thick, the number of segments varies only between 100 and 135. In most of these specimens there is at the hind end of the body a region in which the anterior part has several slight grooves, apparently rudimentary intersegmental furrows marking off still incompletely differentiated segments, in which setae are either lacking or are externally unrecognizable. A fairly long posterior portion of the region in which no rudiments of furrows are recognizable

apparently is still more embryonic, with the size possibly indicative of fairly rapid production of new cells and tissues. The furrowed anterior part, apparently without setae, externally seems to be a portion of the region in which metameric differentiation is taking place.

Several juveniles of smallest size have tail regenerates, showing that a tail may be lost very early in life. The remainder of the smallest size juveniles are characterized at posterior ends by one or the other of these conditions that develop on loss of tail prior to or without tail regeneration.

Very rarely a clitellate and fully sexual specimen was found with a terminal portion comprised of the two zones of no metameric differentiation and of metameric differentiation as in the smallest juveniles. Along the whole axis of such specimens, segment size posteriorly decreases gradually to and through the terminal zone and indications of regeneration are unrecognizable.

The evidence available from these collections seems to indicate that in *L. mauritii*, the young hatch out from cocoons with much smaller number of segments than may characterize fully grown specimens; that young juveniles have a growth zone which is of two parts, a posterior more embryonic region possibly of fairly rapid production of new cells and tissues, and an anterior region of metameric differentiation; that occasionally an individual may become sexually mature while the terminal portion of the body is still in a condition characteristic of the smallest juveniles. All this is of importance in connection with an assumption, apparently supposed to be applicable generally to earthworms, to the effect that growth does not take place by addition of new segments. In fact, Sun and Pratt (1931) seem to indicate that just-hatched juveniles of at least one species may have more segments than are ever found in adults of the same species.

Male pore region.—On small juveniles, setae and apertures of follicles are usually lacking on *a* lines of xviii, but on or very close to each *b* line there are two very closely paired setae or follicle apertures. On a specimen nearly one mm. thick, the medianmost follicle aperture is at mid *ab* the next on the *b* line. On large juveniles only one aperture, on or close to *b* line, has been recognizable.

In juvenile specimens only 20 mm. long and one mm. thick, perisetal follicles are already protuberant into coelomic cavity. In one such follicle, *i.e.*, the whole mass of tissue median to a prostatic duct, there are five setae. Each of the two ectalmost has a simple tip, rounded or slightly clawed and is ornamented with spines, which are more shortly triangular and not so closely crowded as on adult penial setae. The other three setae have tip only slightly bifid and relatively broader and flatter than in adults; ornamentation is again sparse.

In specimens of adult size, there is very considerable variation in appearance of the male pore region, even on fully clitellate specimens. Male porophores may be sharply demarcated or indistinctly delimited

with lateral margins more or less deeply trilobed or without indications of such lobing, markedly protuberant from general surface or not at all protuberant. On a number of specimens with the scattered brown flecks on clitellar segments that indicate last stages of clitellar regression, male porophores may be almost or entirely unrecognizable. Apparently then the porophores also, like the clitellum, regress as period of sexual function ends.

No evidence was found to indicate that presence or absence of a trilobate condition of male porophores has any taxonomic value as was thought in case of *L. trilobata*.

Digestive system.—The gizzard is always in v. (Always in this connection, as well as below, refers only to normal specimens without metameric or organ location abnormalities.) The delicate funnel-shaped septum 5/6 is in contact with the gizzard, to which it may be more or less firmly adherent, but with care can be lifted off at least back to posterior margin of gizzard. In those few specimens in which there is an unusual amount of coelomic coagulum in v, the coagulum is quite obviously between the gizzard and 5/6. The intestinal origin is always in xv.

Vascular system.—The dorsal blood vessel, when empty, may be scarcely recognizable anteriorly, but when filled with blood is large to commissures of v, then anteriorly gradually decreasing in size. In several specimens, a small median branch, which passes forwards over the cerebral ganglia, is visible. This vessel, apparently without deeper exploration, in the past, in other genera as well as in *Lampito*, has been regarded as the dorsal trunk. However, a larger vessel, more or less deeply buried in tissues of the pharyngeal bulb, continues the dorsal trunk forwards to and under cerebral ganglia, where after bifurcating two branches pass ventrally along with the nervous commissures, then turn mesially and unite above the subpharyngeal ganglia to form a median vessel, which passes posteriorly, as the ventral trunk.

The dorsal trunk is said to have an embryonic double origin and in this connection it is of interest that in one worm the dorsal vessel is double throughout the whole of xiv. In one head regenerate, the dorsal trunk is double throughout.

Lateroparietal trunks have never been recognizable behind xix in any specimen. One worm has a large ventral connective between the two lateroparietals, in xvii.

Each segmental commissure of x-xiii bifurcates dorsally, the anterior branch passing into supra-oesophageal trunk, always distended with blood, the posterior branch passing to dorsal trunk, always white, very slender and without blood. To indicate the double dorsal connections and the function, these commissures are referred to as latero-oesophageal hearts. Ventral bulbs of hearts of x-xiii are close to ventral trunk. No branch vessels have been found opening into hearts of x-xiii.

Commissures of segments ix anteriorly are always different from those behind and no variation in this respect has been found in worms of any locality. In ix, commissures are slenderer than in x-xiii, slightly

thicker than those of v-viii, and always open directly into dorsal trunk. Connections with supra-oesophageal trunk have not been found, though commissures are often in contact with a pair of midsegmental vessels that pass ventrally on wall of gut from the supra-oesophageal. Even if a connection with supra-oesophageal does exist, relationships to dorsal trunk would still be exactly opposite from those in x-xiii, for commissures of ix are always filled with blood clear to dorsal trunk. Ventral bulbs of commissures of ix are further from median plane than in x-xiii, and from region of the bulb there are always given off several small branch vessels.

Passing anteriorly from ix, ventral bulbs of segmental commissures are progressively further, though only slightly in each segment, from median plane and branches in region of the bulbs more conspicuous. As branches become larger, the portion of the commissure passing from bulb region to ventral trunk certainly becomes less conspicuous, perhaps actually smaller, and at times quite unrecognizable, possibly actually lacking. Thus in v only one commissure, either right or left, usually can be traced to the ventral trunk. In vi, usually no connection with ventral trunk is recognizable. In vii, only one connection may be visible but in viii connections on both sides usually are recognizable. The commissures of vi do not encircle the gizzard but are well behind posterior margin of gizzard and of course in a different segment. Commissures of v pass near to or actually come in contact with extra-oesophageal trunks but in none of the specimens has any indication been found of segmental commissures opening into extra-oesophageals. As in case of commissures of ix, no connection with supra-oesophageal has been found in vii and viii, and even if connections are present, relationships of commissures to dorsal vessels would be like those of ix rather than of x-xiii, as the vessels are filled with blood clear to dorsal trunk. Pending demonstration of definite connection to other longitudinal trunks, commissures from ix anteriorly should be characterized as lateral.

The anterior connectives between dorsal and ventral trunks are regarded as commissures of segment i. Between these commissures of i and those of v, segmental commissures seem to be most modified, and, if present, represented only by short branches passing out from dorsal and ventral trunks, major middle portions of commissures being quite unrecognizable. Ventrally portions of only two pairs are usually recognizable, where three pairs are expected—those of ii, iii and iv. Occasionally, however, one of the supposed pairs is markedly asymmetrical in its junctions with the ventral trunk, and if each of the asymmetrical vessels is regarded as one remaining member of a segmental pair, the full number is attained. Dorsally, paired branches from the dorsal trunk are usually unrecognizable. In one specimen, however, and in which no median vessel to prostomium is recognizable, five pairs of branches are clearly recognizable between commissures of i and v, one more than is expected.

Abnormality.—Abnormality was found most frequently in connection with the spermathecae. In the list below all other organs, aside from spermathecae, appear to be normal and in normal segmental locations.

Abnormality in spermathecal battery. (Normal, three pairs of spermathecae in vii, viii, ix, with pores on 6/7, 7/8, and 8/9.)

Interseg- mental furrow.	Spermathecal pore lacking on side.	Extra spermathecal pore present on side.	Number of specimens.
6/7	right		19
6/7	left		22
6/7	right left		4
6/7	..	right	2
6/7	..	left	1
7/8	right	..	3
7/8	left	..	5
7/8	right left	..	3
7/8	..	right	5
7/8	..	left	3
7/8	..	right left	1
8/9	right	..	11*
8/9	left	..	10
8/9	right left	..	1
8/9	..	right	3
8/9	..	left	3
	left 6/7, right 6/7, left 7/8, right 8/9	.	..
		..	..
		..	1
	left 6/7, left 8/9	..	..
		..	2
	left 6/7, right left 8/9	..	..
		..	1
	right 7/8, right 8/9		1
	right 7/8, right and left 8/9	..	..
		..	1
	right left 6/7, right 7/8, right left 8/9	..	..
		..	..
		..	1
		left 6/7, right 7/8	..
			1
		left 7/8, right 8/9	..
			1
	right and left 6/7	right 8/9	1
	right left 6/7	right 7/8, left 8/9	..
			1

* One specimen, not included above, has on right side in ix a testes and male funnel instead of a spermatheca.

In each case presence or absence of a spermathecal pore indicates presence or absence of a spermatheca. An extra spermathecal pore, wherever present, is usually fairly close to a normal positioned pore.

In both groups shown in the table, all of the spermathecae may be normal or one or more of the spermathecae may lack one diverticulum, either median or lateral. Most interesting perhaps is a condition shown by several specimens with an extra spermatheca, the normal positioned spermatheca having no lateral diverticulum, the extra spermatheca, which is lateral, having no median diverticulum.

Abnormality may involve only the male terminalia, male porophore and pore, penial setae, prostate and duct: right terminalia lacking (2), left terminalia lacking (2), left terminalia in xvii (1), left terminalia in xix (1). In case of absence of terminalia on one side of xviii, the setae of *a-b* lines may be lacking (1), the setae of *a-e* or *a-f* lines lacking, or the *a*, *b*, and *c* setae may be present and normally sigmoid.

More complicated abnormalities are shown in the table below. In none of these, as well as those above, are metameric abnormalities present.

Spermathecal pores.	Female pores.		Male pores.	
2. 5/6-7/8	13.		17	
3. L 7/8	13.		17.	
4. 5/6-8/9. Extra on R 7/8		14.		18
5. 6/7-R 9/10		14.		18,
6. L 6/7, L 7/8-8/9		14.	L 17.	R 18.
7. R 6/7, 8/9		14.	R 17.	L 18.
8. 6/7-8/9	13.	14.	R 17.	L 18.
9. 6/7-L 8/9	13.	14.	R 17.	L 18.

The first specimen, not included in table above, at first appeared to have a head hypomeric by one segment, *i.e.*, with all organs one segment anterior to usual location. More careful examination showed that 1/2 is present and that *i* is represented by only a very narrow strip just in front of 1/2 and the prostomial region which is nearly normal.

The second specimen is characterized by a hypomery of one, throughout, except that the gizzard appears to be in *v*. The third is characterized by a hypomery of one throughout, except that the gizzard appears to be in *vi*.

In No. 5, the right testis and male funnel of *x* is lacking, there is a male funnel in *xii* on the right side but no testis, and in *xiv* there is a pair of ovaries but no oviducal funnels.

In No. 9, the clitellum is on *xii-xvi* on right side, on *xiii-xvii* on left side. Seminal vesicle in *viii* is on right side, and there are testis and male funnel, but no spermatheca in *ix* on right side. In *xi* seminal vesicle is on right side, and testis and male funnel are on left side. In *xii* ovary and female funnel are on right side. In *xiii* left female funnel lacking and right heart. Intestinal origin in *xiv* is on right side, in *xv* on left side.

Spiral metamerism.—In region of first 18 segments, 33 specimens have a single spiral metamerism involving two to four segments as shown below.

Single spiral metamerisms in first eighteen segments.

Segments involved	Side on which unrecognizable	Number of specimens.
2-3	D (1) ? (1)	2
3-4	0	1
4-7	0	1
5-6	D (3)	3
7-8	D (1)	1
7-9		1
8-10	D (1)	1
9-10	L (2)	2
10-12	D (1)	1
10-13	D (1)	1
12-13	D (1) L (1)	2
14-16	D (1) L (1)	2
15-17	D (1)	1
16-17	D (1)	1
16-18	D (1) ? (2)	3
16-19	D (2) ? (1)	3
17-18	O (1) R (1)	2
17-20	L (1)	1
18-19	V (1) R (1)	2
18-20	? (1)	1
18-21	? (1)	1
		33

D dorsal, V ventral, R right, L left, O recognizable on all sides.

Segmental enumerations was made by counting on side on which metamerism was unrecognizable. When metamerism was recognizable on all four sides, counting was done on side on which abnormal metamerism was least obvious or was only estimated.

In the majority of these specimens, by thus counting the segments, female and male pores are as usual on xiii and xviii. Number and location of spermathecal pores is more affected.

Four specimens have two spiral metamerisms in region of first eighteen segments: iv-vi (D), xiv-xvii (D); v-vii, (D), xi-xiv (O); x-xii (O), ixv-xv (V); x-xiii (O), xvii-xx (?). Three specimens have three spiral metamerisms in first eighteen segments: iv-vi, viii-ix, xviii-xxi; vii-viii, xiv-xv, xviii-xix; viii-ix, (D), xv-xvi (?), xvii-xviii (O). Other specimens have more or less complicated spiral metamerisms involving all of following segments: ix-xx (1), ii-xvii (2). One of the last mentioned specimens doubtless has more than 17 segments involved in the spiral or spirals, perhaps as many as 21, estimation of number of segments is, however, impractical as metamerism is so complicated, but the segment bearing male pores which is just behind the end of the spiral is about at level of xxii on a normal worm.

Six specimens each have one or more abnormal non-spiral metamerisms in region of first eighteen segments, the type or types being different in each individual.

As indicated below, specimens with one or two spiral metamerisms are not very rare, and some with more have been found. Most interesting is a specimen with xxxvii split into two on left side, and in addition with 13 spiral metamerisms involving v-xviii, xxix-xxxi, xlvi-xlviii, l-liii, lvii-lix, lxiii-lxiv, lxvii-lxviii, lxxiii-lxxxiv, lxxix-lxxxvii, xciii-xcv, xcvi-xcviii, civ-cv, cx-cxii. The specimen has a tail regenerate at 112/113.

Some indication as to frequency of metameric abnormalities is available. In one series, of 22 specimens from one locality that were examined, ten have one or more spiral metamerisms in region behind 18/19. Postprostatic metameric abnormalities in a series of 240 specimens from a single locality are shown in a table below. In neither of the two series just mentioned were the specimens selected wholly at random. All those specimens with abnormalities in region of first eighteen segments were set aside for further study. Then all those specimens having tail regenerates were selected and the abnormal metamerisms were noted while determining level of regeneration. Metameric abnormalities may be present in tail regenerates but are not included in the table.

	Number of specimens.
One spiral abnormality	38
Two spiral abnormalities	11
Three spiral abnormalities ..	1
Six spiral abnormalities ..	1
One segment split into two parts on left side	10
One metamere split into two parts on right side	12
One metamere split into two parts	4
dorsal half (3) ..	
dorsal three-fourths (1)	
An anteroposterior half segment	1
Two split segments, one on right side and one on left side	1
Four spiral abnormalities and two split segments	1
Total	80
Duplications	6
Number of specimens with metameric abnormalities	74
Percentage ..	31%

Split metamere.—On the split side there is an intersegmental furrow marking off the two portions each of which has setae. If the split is dorsal the furrow between the halves contains a dorsal pore. In these cases the furrow between the two halves of a split side ends abruptly without connection with another intersegmental furrow, thus distinguishing a split portion from a wedge-shaped fractional segment one of the boundaries of which joins the other.

An anteroposterior half segment is marked off by intersegmental furrows containing dorsal pores but is about half the length of adjacent segments and has no setae.

DISCUSSION.

Although frequently referred to as "The Indian Earthworm", *Pheretima posthuma* (L. Vaillant) 1868, is almost certainly an immigrant or importation from regions to the east. Widely distributed throughout the Indo-Gangetic Plains, though more or less restricted to a special, sandy soil habitat, the species has been recorded to the south only from Bombay, Poona, Baroda and Gwalior. If any one form is to be called "The Indian Earthworm" it should be *L. mauritii*. The original home of this species is in India, not in the eastern archipelago (Bahl, 1924), and presumably in or close to an area that includes the Cardamom and Palni Hills, from whence it has migrated or been carried into the whole of India from Cape Comorin to Siliguri, Lahore and Kapurthala, at elevations from sea level to 2,500 feet (Gates, 1938). South of the Indo-Gangetic Plains, *L. mauritii*, because of its common occurrence and the ease with which it is secured in numbers, is often the megadrilid type that is studied in the laboratory even though the syllabus may prescribe *P. posthuma*. In these circumstances, it is unfortunate that a species so characteristically Indian has not been more thoroughly studied. Aside from the information scattered through primarily taxonomic articles (*vide* Gates, 1938 for references) our knowledge of the species is based on two publications.

The earlier of these (Bahl, 1924), dealing with the excretory system, makes no mention of nephridia in segments i-iv and x-vix. While nephridia may be absent in i-iv, though Vasudevan mentions nephridia in iii (p. 315), nephridia are definitely present in x-xiv and on the anterior faces of the septa as are the larger tufts of pharyngeal nephridia in v-ix. It is hardly to be expected that nephridia as far back as in x-xiv are pharyngeal, but if not pharyngeal they appear to be of a type hitherto undescribed in the species and which needs adequate characterization.

The other publication, on the circulatory system (Vasudevan, 1939) both in text and figures, in definite statements and implications, disagrees with previous records as well as the account above. In these days of paper shortage it would appear to be unnecessary to list all these disagreements. Accordingly all that need now be said is that while certain discrepancies, as for instance in connection with the anterior portion of the dorsal trunk, may be attributable to varying morphological interpretation, others, such as those with regard to segmental commissures of v-ix, segmental location of the gizzard, etc., cannot be so regarded.

SUMMARY.

Smallest juveniles have a definite growth zone and fewer segments than fully grown normal adults, indicating that growth does take place in this species by addition of new segments after hatching. In the smallest juvenile, penisetal follicles are already protuberant into coelomic cavity but setae are unlike penial setae of adults. On basis of dissection of more than fifty specimens, location of gizzard in v is confirmed.

Segmental commissures of v-ix are lateral, or theoretically so in v-vii where connection to ventral trunk may be unrecognizable on one or both sides. Frequency of occurrence of various types of organ-location and metameric abnormalities is indicated.

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PRELIMINARY OBSERVATIONS ON THE BIONOMICS, RE- PRODUCTION AND EMBRYONIC STAGES OF *PALAEEMON* *IDAE* HELLER (CRUSTACEA, DECAPODA).

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INTRODUCTION.

Though a number of species of *Palaemon* have been recorded from India, some of which are of considerable economic importance, the Bionomics, Reproduction and Life-history of even the common species are unknown. The chief and probably the only contribution on the subject is a description of the larval forms of *Palaemon carinus* and *P. rudis* by Menon (1938).

The observations reported here were made during the years 1940-1942, while I was engaged on an investigation of the Marine and Fresh water Prawn Fisheries of Travancore, at the suggestion of Dr. C. C. John, Professor of Marine Biology and Fisheries of the University of Travancore. During this investigation I found that *Palaemon idae* Heller, which is one of the commonest species of freshwater prawn in Travancore, was most suited for rearing under Laboratory conditions, owing to its hardy nature, convenient size and availability.

BIONOMICS.

Occurrence.—*P. idae* occurs in large numbers in almost all the fresh and brackish water lakes, rivers and canal systems in Travancore from June to December. These months constitute the season when this prawn is fished on a commercial scale and the catches consist mainly of adult males and ovigerous females. It continues to appear in the catches in lesser numbers till the end of February but from March onwards it is seldom seen in the hauls. The July and August collections are mainly composed of small and immature specimens. Females obtained during September to December, from the different parts of the same lake and from the different lakes in Travancore, are ovigerous and they continue to appear in lesser numbers till the end of February. Males collected during these months are very large and are mature. The breeding season for *P. idae*, therefore, appears to be a prolonged one, beginning from September and extending to the end of February.

Habits.—Like most species of *Palaemon*, *P. idae* prefers stagnant and shallow waters with a muddy bottom rich in organic matter. In their natural habitat the prawns of this species are seen to keep close to the bottom, often walking along the bed in search of food. During night, however, they swim freely and are photopositive. This habit has given the clue for one of the most popular methods of nocturnal 'prawning', which consists in fixing a light to the mouth of a net for alluring the prawns. In the aquarium they hide among aquatic weeds during day time and in the absence of weeds they generally keep to the bottom, except when food is dropped or when they are subjected to external disturbances. They either lie flat on the bottom with all their thoracic

legs folded and their pleopods flexed underneath the abdomen, remaining motionless for an indefinite period or they stand on their posterior walking legs, usually on the last three pairs, with the body almost in a horizontal position. During the latter mode of resting their chelipeds are seen to be very active, either picking up small particles of food from the bottom or removing foreign particles that might have settled on their body and antennae. Occasionally the abdomen is flexed forwards beneath the body and brought nearer to the chelipeds for a thorough cleaning. During the incubation period the female frequently stands on its walking legs and rapidly waves the pleopods, thus probably aerating the eggs in the incubation chamber.

Food and feeding habits.—The stomach contents of a large number of males and females, ranging from 1" to 4.5" in length, were examined, and these indicated the presence of a large percentage of decaying vegetable matter, broken bits of molluscan shells and mud in many cases. In a few of the larger examples, undigested remains of crustacean appendages were also seen. In the aquarium they readily fed on cooked and uncooked rice, Mysids, *Acetes*, non-calcarious portions of Pteropods, small Polychaetes and fish fry. On continued starvation for two or three days, they exhibited cannibalistic tendencies, the larger and stronger ones feeding on the limbs and softer portions of the body of the smaller and weaker individuals. Very often they were found to consume the appendages of their own cast-off skin.

During the breeding season the stomachs of those females in which the ovaries were fully mature and about to spawn, were seen to be empty. Specimens reared in the laboratory in which the ovaries were fully mature abstained from food, but after spawning they fed vigorously. This habit is evidently correlated with the maturation and swelling of the ovary, the increasing volume of which occupies all the available space in the cephalothoracic region. A similar tendency to starve is also noticed for two or three days before ecdysis in order to keep the stomach empty, since it is also cast off along with the outer shell during ecdysis.

Colour.—In life large males of *P. idae* are uniformly light brown in colour and their long chelipeds are of a deeper tinge in the older specimens. The females and freshly moulted males are semi-transparent, while the young ones are almost transparent, the only coloured portion of the body being the eyes, which are black.

REPRODUCTION.

Mature males of *P. idae* vary from 70 to 110 mm. and mature females from 50 to 90 mm. in total length. The number¹ of eggs produced by a female varies from 2,000 to 20,000 according to the size of the animal.

Experimental.—Live specimens of *P. idae* were brought from the Veli lake and reared in table tanks, for studying the life-history. After three days of acclimatization in a large table tank 2' × 1' × 1', mature

¹ Only approximate determinations of the number of eggs present in the brood have been made, following the method adopted by Cecil von Bonde (1936).

males and females were selected and reared in pairs in small glass tanks measuring 10"×6"×6". Some aquatic weeds were introduced into each tank and the water aerated daily. Females in which the transference of the eggs from the ovary to the incubation chamber took place in the laboratory, were kept under observation and the developmental changes recorded in a general way.

All the eggs in the incubation chamber of a particular female are found to be more or less in the same stage of development at any given time. This renders possible the observation of certain general features of development by direct examination of the broods. Since a large number of eggs are present in each brood, the removal of a few eggs at regular intervals will not completely exhaust the brood before the time of hatching.

As soon as spawning¹ was over in a particular individual, it was caught by the hand and holding it under water with its head and tail gently pressed between the fingers, a few eggs were carefully detached and removed with a pippette into a watch glass for examination. The grip was then slowly loosened and the animal allowed to escape. After an interval of twenty-four hours a few more eggs were again stripped in the same way from the same individual. This process was repeated regularly at intervals of twenty-four hours.

Eggs in the early stages of development, when stripped from the pleopods and reared in petri-dishes, were found to degenerate and perish rapidly due to fungal infection even though the water was constantly aerated, but advanced eggs, six to eight hours before hatching, when detached from the brood were found to hatch in petri-dishes. Similar difficulty in the artificial rearing of young embryos of *Astacus fluviatilis* has been recorded by Reichenbach, as mentioned by von Bonde (1936).

At 6 p.m. on the 16th September 1940, the female in one of the small tanks was seen spawning. As soon as the spawning was over a few eggs were stripped from its brood for observation, and the stripping was repeated at intervals of twenty-four hours. The last stripping was done on the 30th night, even after which a good number of eggs was left in the brood. In the morning of 1st October all the remaining eggs in the brood hatched, and a number of young ones were seen attached to the illuminated surface of the glass tank.

On the 19th September at 8 p.m., the male of a second set in a different tank was observed in the act of "fencing"² the female. However, mating did not take place till 9 p.m. On the following morning all the eggs were seen in its brood, mating and spawning evidently having taken place during the preceding night. This individual was kept as a control for comparing the period of incubation in the undisturbed state. This brood hatched during the night of 4th October.

¹ The extrusion of eggs into the brood chamber has been referred to as "spawning".

² As a preliminary to mating the male is seen to "fence" the female between its long chelipeds without allowing it to escape.

With a view to varifying the period of incubation, different broods were kept under observation till the end of December, and in all cases it was seen that the period of incubation was from 14 to 16 days, most commonly 14 days, and that the daily disturbance caused by the stripping of a few eggs from the brood did not in any way hinder the natural development of the eggs still remaining in the incubation chamber or cause any appreciable variation in the period of incubation.

Development of the embryo in the brood. (Text. figs. 1, 2a-c).—Soon after spawning, the eggs are deep green in colour, broadly oval in shape and measure about 0.56 mm. along the long axis and 0.44 mm. along the short axis. No trace of segmentation is visible externally. The egg is enveloped in a thin membrane outside which is another thin chitinous covering, prolonged at one end into a short flexible and elastic stalk, which secures attachment to the brood. The chitinous covering is thin and transparent and is not only capable of withstanding considerable tension but also permits a slight increase in volume.

About 24 hours after spawning (Text-fig. 1 a) a slight increase in the size of the egg is noticed. Examination of the egg at this stage shows the presence of superficial hexagonal markings which are probably the limits of the primary yolk pyramids. Scattered all over the surface of the egg, inside the egg case, could be seen numerous oil globules.

On the second day (48 hours after spawning) a small portion at one end of the egg becomes differentiated into a thick transparent plate, the blastoderm or the ventral plate.

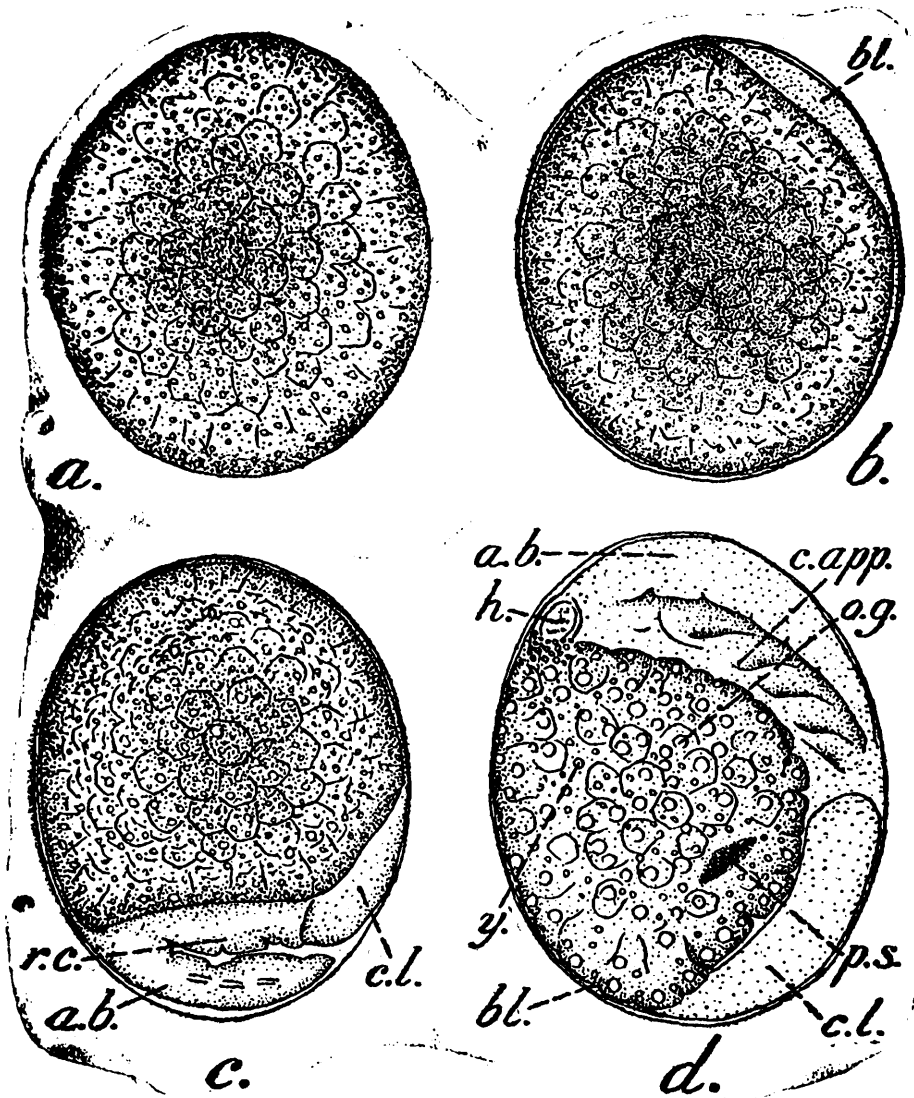
As development proceeds by the gradual assimilation of the yolk, the ventral plate becomes very distinct and on the third day (Text-fig. 2) the rudiments of the cephalic and thoracico-abdominal regions can be seen.

On the fourth day indications of the posterior or abdominal lobe is visible. The anterior region of the ventral plate is now distinguishable as a thick and rather stout rudiment of the cephalic lobe. Posteriorly the thoracico-abdominal lobe develops a forwardly directed ventral lobe which marks the beginning of the abdominal lobe. Thus at this stage the rudiments of the three regions of the body become visible, though no sign of segmentation is seen either in the cephalic or in the abdominal lobe. Between the cephalic and abdominal lobes four irregular rounded buds could be seen which represent the rudiments of the cephalic appendages.

On the fifth day (Text-fig. 1 c) the oil globules, which are scattered all over the yolk, become larger in size and the quantity of yolk is appreciably reduced, with the result that the deep green colour of the yolk has begun to fade slowly. The cephalic lobe has increased in size, differentiation of the cephalic appendages is more prominent and one more pair of buds has developed posteriorly. The abdominal lobe has elongated considerably and now appears like a flap overlapping the greater part of the thoracic region ventrally. Faint indications of segmentation are also visible; though the number of segments of the

abdomen cannot be counted *in situ*. The hind gut also becomes discernible as a straight narrow tube running through the middle of the abdominal lobe.

By the beginning of the sixth day the abdominal lobe has elongated considerably and approaches almost the anterior end of the cephalic lobe. The yolk has become pale green. The pigment spots of the eyes make their appearance as small dark crescentic streaks. In the postero-dorsal region of the embryo, at the junction of the thoracic and abdominal lobes, a small oval vesicle is visible, in which an occasional gentle throbbing is noticeable. This marks the beginning of the embryonic heart.



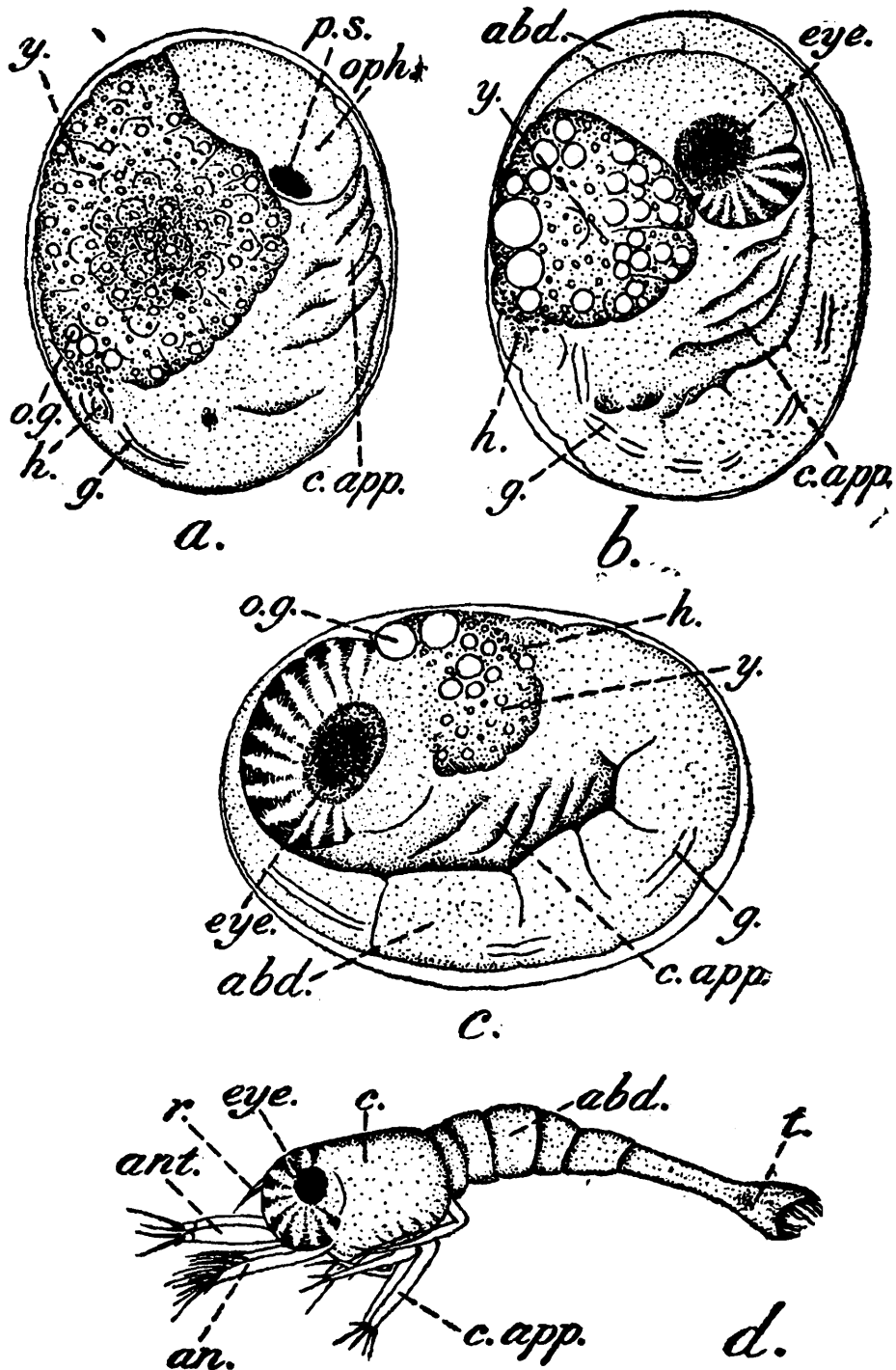
TEXT FIG. 1.—Developing embryo of *Palaemon idae* Heller.

a. 24 hours after spawning : X 86 ; b. third day stage ; X 86 ; c. fifth day stage ; d. seventh day stage.

a.b. abdominal lobe ; bl. blastoderm ; c.app. cephalothoracic appendage ; cl. cephalic lobe ; h. heart ; o.g. oil globule ; p.s. pigment spot of eye ; r.c. rudiments of cephalic appendage ; y. yolk.

Regular rhythmic pulsation of the heart is observed on the seventh day. At the same time the rudiments of the cephalothoracic appendages have elongated considerably and as many as six pairs of stump-like appendages can be seen in a side view (Text-fig. 1d). The tip of the abdominal lobe is marked off as the tail region, from which the uropod of the adult is developed at a later stage.

On the eighth day, the anterior part of the cephalic lobe is differentiated into the ophthalmic lobe by the appearance of a shallow constriction between it and the more posterior part of the cephalic lobe. A pericardial sinus envelops the heart, in which rhythmic pulsation is clearly seen.



TEXT FIG. 2.—Developing embryo of *Palaemon idae* Heller.

a. ninth day stage : X 86 ; b. twelfth day stage ; c. fourteenth day stage ; d. newly hatched larva : X 32.

abd. abdomen ; an. antenna ; ant. antennule ; c.app. cephalothoracic appendage ; eye. eye ; g. gut ; h. heart ; o.g. oil globule ; oph. ophthalmic lobe ; p.s. pigment spot of eye ; r. rostrum ; t. tail ; y. yolk.

On the ninth day (Text-fig. 2 a) the pigmented eyes become more prominent. The yolk has dwindled to a third of its original volume and

is still pale green. The ophthalmic lobe is more distinct and the cephalothoracic appendages have elongated considerably. The embryo lies bent up, with the ophthalmic lobe directed forwards, the yolk occupying the middle region, and the elongated abdomen curving round and overlapping the cephalothoracic region.

On the tenth day the remaining yolk is almost semi-transparent. The region between the cephalic and ophthalmic lobes is marked off by a short constriction.

On the eleventh and twelfth days (Text-fig. 2 *b*) the abdominal lobe elongates further. The tip of the tail lies flat over the basal region of the ophthalmic lobe. The abdominal segments are clearly marked.

By this time all the embryonic structures have been developed and the yolk disappears gradually. Jerky movements of the embryo, which are occasionally noticed even earlier, become more frequent on the thirteenth day. On the fourteenth day (Text-fig. 2 *c*) the embryo hatches as a ~~tiny~~ larva.

Hatching.—As a result of the jerky movements of the embryo the inner and the outer chitinous coverings break and the larva emerges out. All the eggs in the brood are not hatched simultaneously. Hatching takes place in batches of twos and threes. There is a regular sequence in the process of hatching; the first spawned eggs, which lie towards the periphery of the incubation chamber, hatch first, while those lying more internally follow in succession. Generally hatching takes place at night and the time taken depends upon the number of eggs present in the brood.

Dispersal.—Dispersal of the newly hatched larvae is brought about by the currents set up by the rapid movements of the pleopods. As soon as the larvae are liberated in the water, they make a few jerky movements by bending and straightening their abdomen. After some time the larvae begin to swim with the help of their thoracic appendages towards the side of the glass tank facing the window. Reaching this surface they attach themselves to the sides of the glass by the thoracic appendages, with the tail directed upwards. This reversed posture of the larvae is indicative of the relative weight of the anterior portion of the body. On being disturbed they make a few jerky movements and scatter themselves temporarily in all directions.

During the day the larvae are seen attached to the more illuminated surface of the glass tank, but during night they scatter themselves in all directions. However, when a light is placed at one side of the tank, all the larvae move towards that side and attach themselves to the surface opposite the source of light. When the light is slowly moved to the left or right, the larvae also follow the source of illumination and if the light is switched off, slowly they scatter themselves in all directions.

The freshly hatched larvae of another species, *viz.* *Palaemon dolychodactylus* Hilgendorf, were seen to behave likewise in the laboratory. Lyon (1906-7) observed a similar phenomenon in the larvae of *Palaemonetes*.

THE LARVA.

The newly hatched larvae are transparent and measure about 1.60 mm. to 2.00 mm. from the tip of the rostrum to the end of the tail. The carapace is produced anteriorly into a long and slender rostrum, reaching to about three quarters the length of the antennular peduncle. The cephalothoracic region possesses a pair of large sessile eyes, a pair of antennules, a pair of antennae, a pair of mandibles, two pairs of maxillae, three pairs of maxillipeds and large biramous rudiments of the first two pairs of peraeopods. The abdomen is long and slender and is devoid of any appendage. The telson is longer than broad, with a concave outer margin bearing seven pairs of spines, the innermost pair being the shortest. The larva is practically identical with stage 1 of the larvae of *P. rudis* and *P. carcinus* (Menon 1938).

ACKNOWLEDGMENT.

I take this opportunity to express my grateful thanks and indebtedness to Dr. C. C. John, Professor of Marine Biology and Fisheries, for his constant guidance, help and encouragement throughout this work. I am also indebted to Dr. B. N. Chopra, Director, Zoological Survey of India for giving me valuable suggestions, and for kindly going through the manuscript with me. I also wish to thank the University of Travancore for facilities to carry on this work in the Marine Biological Laboratory, Trivandrum, and for the award of a scholarship.

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THE ENTERONEPHRIC TYPE OF NEPHRIDIAL SYSTEM IN VARIOUS SPECIES OF THE GENERA *LAMPITO* AND *MEGASCOLEX* (OLIGOCHAETA).

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of Lucknow, India.

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1. INTRODUCTION.

With recent advances in our knowledge and understanding of the structure and development of the nephridia in the family Megascolecidae, due largely to the remarkable work of Bahl (1919-1946), the classification of nephridia has undergone great changes. The old terms meganephridia and micronephridia have now given place to holonephridia and meronephridia and these are again divided into open or closed, and exonephric or enteronephric. Further, the meronephridia are of two kinds, mega-meronephridia and micro-meronephridia.

The enteronephric type of nephridial system has been described by Bahl in six genera of earthworms, i.e., *Pheretima* (1919), *Lampito* (1924), *Woodwardiella* (1926), *Tonoscolex* (1941), *Megascolex* (1942), and *Travoscolides* (1946). Of these six genera *Megascolex* is the largest and includes about 117 species of which about 56 are Indian (Stephenson 1923); of these 56 Indian species, the nephridia of only twelve species have so far been carefully examined, and this examination has revealed that ten of them are enteronephric, while the other two are exonephric (Bahl, 1946). At the kind suggestion of Prof. K. N. Bahl, I undertook to examine the nephridia of as many of the remaining Indian species as could be made available to me, in order to find out if they were enteronephric or exonephric. Through the courtesy of Dr. B. N. Chopra,

Offg. Director of the Zoological Survey of India, I have been able to obtain specimens of three species of *Lampito* and twelve species of *Megascolex* from the Zoological Survey collection, and find that while all the species of *Lampito* are enteronephric, nine species of *Megascolex* are enteronephric and three are exonephric. Examination of the nephridial system of these species has proved a very laborious task, as all the work had to be carried out on preserved specimens, the preservation of which was not always satisfactory. I am deeply indebted to Prof. K. N. Bahl for his kind supervision and help throughout the course of this work as also for his painstaking criticism of my manuscript. My best thanks are due to Dr. B. N. Chopra for sending me specimens of all these species of *Lampito* and *Megascolex*.

2. ENTERONEPHRIC SPECIES WITH PAIRED OPEN MEGA-MERONEPHRIDIA.

Under this category are included three species, *i.e.*, *Lampito sylvicola*, *Lampito kumiliensis*, and *Lampito escherichi* var. *papillifer*, the nephridial system of which closely resembles that of *Lampito mauritii*, first described by Bahl (1924). The species, *Megascolex sylvicola* was, in fact, first described as *Lampito sylvicola* by Michaelsen, but later in 1916 he fused the two genera and included all the species of *Lampito* within the genus *Megascolex*. With the discovery of the enteronephric character of the mega-meronephridia in these three species, there is a very good case now for the renewal of the name *Lampito*, at least as a subgenus of the very large genus *Megascolex*. As I have already mentioned (Vidyavati, 1945), Michaelsen emphasised the condition of the prostates and ignored that of the nephridia in the classification of the species of the sub-family Megascolecinae. It is time now to take into account the condition of the nephridia as well, and on the basis of the presence of enteronephric mega-meronephridia, the reinstitution of *Lampito* as an independent genus is fully justified.¹

(i) *Lampito sylvicola* Mich.

In 1909, Michaelsen described the nephridial system of *Megascolex sylvicola* as follows:—"In each segment behind the clitellar region is found a pair of meganephridia besides a number of micronephridia. In the more anterior segments only micronephridia were seen." Since Michaelsen wrote his description before the enteronephric system was discovered, he did not examine the nephridial system in detail and so made no mention of the septal excretory canals and the supra-intestinal excretory duct. Bahl (1924) described the nephridial system in two species of *Lampito*, *L. mauritii* and *L. trilobata*, but did not examine this species.

¹ Since this paper was completed, Dr. Chopra has called my attention to a paper by Gates (*Rec. Ind. Mus.*, XL, 1938), who has definitely revived the generic name *Lampito* for these three species. He has described their nephridia but not so fully as I have done, as he was concerned with the entire general anatomy and not with the nephridia alone.

The nephridia are of three kinds :—(i) The first set comprises a pair of *septal mega-meronephridia*, one on each side of the nerve-cord, in almost all the segments of the worm behind the clitellum. These nephridia are large and prominent ; each of them has a pre-septal funnel and a post-septal body lying in the segment following the one containing the funnel ; they discharge their excretory products in each segment into a pair of septal excretory canals which in their turn empty themselves into a median longitudinal supra-intestinal excretory duct ; this duct runs all along the length of the intestine and opens into the intestinal lumen at segmental intervals ; these nephridia are therefore enteronephric. (ii) The second set includes the *integumentary micro-meronephridia*, which are found in all the segments of the worm except the first five, and co-exist with the nephridia of the first set in the post-clitellar segments ; they open to the outside and are exonephric. (iii) The *pharyngeal tufted nephridia* forming the third set comprise a single pair of tufts in the fifth segment, one on each side of the gizzard ; the ductules of these nephridia run forwards in bundles and open into the pharynx in the third segment ; they are, therefore, enteronephric.

The excretory system of *Lampito sylvicola*, therefore, closely resembles that of *Lampito mauritii* described by Bahl (1924), but there are two points of difference which may be noted here. The first is the absence of vestigial funnels in *L. sylvicola*. Bahl (1924) writes, "A remarkable feature of the funnel in *Lampito mauritii* and *L. trilobata* is that, although the nephridium in these two species has a single funnel, there are one or more masses of cells (vestigial funnels) projecting from the ciliated tube following the funnel." These masses of cells are absent in *L. sylvicola*. The second point of difference is that in *L. mauritii* there are five pairs of pharyngeal tufted nephridia, while in *L. sylvicola* there is only a single pair of pharyngeal tufted nephridia.

***Lampito kumiliensis* Aiyer.**

This species was instituted by Aiyer in 1929 who describes its nephridial system as follows :—"In the pre-clitellar region there are one pair of tufted nephridia in each segment. In the clitellar region there are four or five similar (but smaller in size) nephridial tufts on each side. From segment XXI onwards, in addition to these small nephridial tufts, there is a meganephridium on each side." The nephridial system of this species also closely resembles that of *Lampito mauritii* ; in fact, Aiyer himself says, "The present form is very closely related to *M. sylvicola*."

The nephridial system consists of :—(i) a pair of *septal mega-meronephridia* in each segment behind the 10th segment. These nephridia are enteronephric, being connected with a supra-intestinal excretory duct through a pair of septal excretory canals on each septum ; (ii) *integumentary micro-meronephridia* which are present in all the segments behind the 12th and co-exist with the mega-meronephridia behind the 20th segment ; these are exonephric, opening to the outside on the body-wall ; (iii) *pharyngeal tufted nephridia*, a single pair in the 5th segment,

opening by a pair of very short sheaves of ductules into the pharynx in the 4th segment and being, therefore, enteronephric; in the other species the sheaves of ductules are not so short as they are here; and (iv) seven pairs of *integumentary tufted micro-meronephridia* from 6th to the 12th segment, which are exonephric, opening to the outside by sheaves of long ductules in each segment.

The nephridial system of *L. kumiliensis* is, therefore, distinctly enteronephric and resembles that of *Lampito mauritii*; but it differs in the fact that of the eight pairs of tufted nephridia, only the anterior single pair opens into the pharynx, while in *L. mauritii*, all the five pairs of tufted nephridia open into the pharynx. In this respect the tufted nephridia of *L. kumiliensis* resemble those of *M. cochiniensis* (Bahl, 1942).

(iii) ***Lampito escherichi* var. *papillifer* Steph.**

Megascolex escherichi var. *papillifer* was instituted by Stephenson in 1915 who describes its nephridial system as follows:—"There are considerable tufts of micronephridia by the side of the alimentary tube in segments V-IX, and micro-nephridia are thinly scattered over the body-wall throughout. The remarkable feature is the presence, in addition, of a large nephridium on each side from segment XVII backwards; *these have however no connection with the septa*.¹ On opening the specimen and pinning out in the usual way they appear as wavy or curled tubes, emerging on each side from under the intestine, and extending outwards on the body-wall for a distance equal to half the diameter of the intestine or less. Their ventral ends are, as a matter of fact, only just covered by the intestine in this position, as may be seen by drawing the intestine slightly to one side; towards the posterior end of the body these nephridia are smaller though still easily visible to the naked eye; they may here be absent on one or both sides or there may be more than one minute tuft." I find that Stephenson's description of nephridia is only partially correct since he has missed altogether the essential enteronephric character of the so-called meganephridia. He is mistaken when he says that the large nephridia have no connection with the septa; in fact, these nephridia have distinct pre-septal funnels and septal excretory canals on the septa; they are really large *septal mega-meronephridia* which are distinctly enteronephric. The *integumentary micro-meronephridia* are found in all the segments except the first ten and co-exist with the mega-meronephridia from the 17th segment backwards. They open to the outside and are exonephric. There are seven pairs of *tufted meronephridia* from 3rd to 9th segment, the first pair of tufts being present in the 3rd segment and not in the 5th as described by Stephenson (1915); this pair covers the nerve-ring in a dissection and is enteronephric as it opens into the buccal cavity, while the other six pairs are exonephric. The nephridial system of *Lampito escherichi* var. *papillifer* differs from that of *Lampito mauritii*, *L. kumiliensis* and *L. sylvicola* in the absence of a supra-intestinal excretory duct. Here each mega-meronephridium leads into its septal excretory canal which meets its fellow of the other side in

¹ The italicising is mine.

the mid-dorsal line and the common canal opens directly into the intestine. There is no connection from segment to segment through a continuous supra-intestinal excretory duct. This condition in *M. escherichi* is obviously primitive as the nephridial system is separate from segment to segment, although it is enteronephric, while in the other three species the enteronephridial system forms one continuous system over the greater part of the post-clitellar region.

3. ENTERONEPHRIC SPECIES WITH OPEN MICRO-MERONEPHRIDIA.

Under this category are included nine enteronephric species in which there are numerous septal micro-meronephridia in place of the paired meganephridia. The nephridial system of these species resembles that of *Megascolex cochiniensis* described by Bahl (1942) and that of *M. travancorensis* described by myself (1945).

(i) *Megascolex insignis* (Mich.).

The species *Megascolex insignis* was instituted by Michaelsen in 1910 and was described again by Stephenson in 1916, but neither Michaelsen nor Stephenson seems to have examined its nephridia, since neither of them makes any mention of them. The nephridial system, according to my observations, consists of:—(1) *septal micro-meronephridia* which are present in the last forty-eight segments in a worm having a total of 98 segments. The structure of each nephridium resembles that of *Megascolex auriculata* (Vidyavati, 1945) and, like it, has a long terminal nephridial canal which runs in a zig-zag manner along the whole length of the posterior face of the septum. All the terminal canals of each side join one another to form a septal canal which meets a similar canal from the opposite side in the mid-dorsal line beneath the dorsal vessel to form one common canal; this pierces the roof of the intestine and opens into the intestinal lumen, there being no typhlosole in this species, (2) *integumentary micro-meronephridia* which are found scattered on the body-wall in all the segments behind the 16th and co-exist with the septal meronephridia in the last forty-eight segments; they are attached to the parietes, have no funnels and are exonephric; (3) *pharyngeal tufted meronephridia* which form a single pair of large tufts in the 4th segment; they open into the buccal cavity in the 2nd segment by means of a pair of sheaves of long canals; (4) *integumentary tufted meronephridia* which are present in eleven segments, from the 5th to the 15th; they are also without funnels and are exonephric and open on the body-wall by sheaves of canals. In the first nine segments (5th to 13th) the canals are long, but in the last two segments (14th and 15th) the canals of the tufted nephridia are short.

The nephridial system of *Megascolex insignis* is, therefore, distinctly enteronephric, although it is separate from segment to segment and clearly resembles that found in *Megascolex trivandranus*, *M. travancorensis* and *M. auriculata* (Vidyavati, 1945).

(ii) **Megascolex longiseta** (Mich.).

The species *Megascolex longiseta* was instituted by Michaelsen (1907 and 1909) who as usual did not examine its nephridial system, since he does not make any mention of it in his description. My observations are also incomplete, as I had only one already dissected and partially damaged specimen. As far as I can make out, the nephridial system of this worm consists of:—(1) *septal micromeronephridia* which are present in the last ninety-two segments, 20 to 25 in number on each side of the septum; these nephridia possess pre-septal funnels and post-septal bodies and are enteronephric, discharging their excretory products into the intestine in each segment. In structure each nephridium is identical with that of *Megascolex cochinensis* (Bahl, 1942), consisting of a short straight limb and a long twisted loop; the terminal canal is very long and runs in a zig-zag manner across the whole width of the septum to enter the septal excretory canal which runs close to the inner intestinal border of each septum. The two septal excretory canals of each septum meet in the mid-dorsal line just on the outer surface of the roof of the intestine and form a common excretory canal which immediately penetrates the shallow typhlosole and opens into the lumen of the gut in the mid-dorsal line; (2) *integumentary micro-meronephridia* which are found scattered on the body-wall from the 15th to the 91st segment; they are attached to the parietes, have no funnels and are exonephric; (3) *pharyngeal tufted meronephridia* which form a pair of large tufts in the 5th segment and open into the pharynx by a pair of long sheaves of canals; (4) *integumentary tufted nephridia* which are present in the 6th to the 14th segments; they are also without funnels but are exonephric, opening on the body-wall by sheaves of canals.

The nephridial system of *Megascolex longiseta* is, therefore, distinctly enteronephric and closely resembles that of *M. cochinensis* and *M. cingulatus* (Bahl, 1942 and 1946), the only difference being that in the former the terminal excretory canals are longer and run in a zig-zag manner along the whole width of the septum while in the latter two species they are more or less straight.

(iii) **Megascolex varians** var. **insolitus** (Steph.).

The species *Megascolex varians* var. *insolitus* was instituted by Stephenson in 1915, who describes its nephridial system as follows:—“The excretory system is micronephridial. There is a large tuft on each side of the posterior part of the pharyngeal mass, but none on the body-wall in the region of the gizzard or in front; from this point they are few till clitellum is reached. In the clitellar region they are thickly set, and behind this they form a transverse line in each segment behind the anterior septum.” This description is obviously inadequate. As I find it, the nephridial system consists of:—(1) *septal micro-meronephridia* which begin from the 6th post-clitellar or 22nd segment and are present all along the rest of the body of the worm. These nephridia possess pre-septal funnels with very long necks each of which measures about 350 μ in length. The number of septal nephridia in each segment

is very small, there being only about ten nephridia on each side of a segment. These nephridia are enteronephric, discharging their excretory products into the intestine in each segment exactly in the same way as in *M. trivandranus* (Vidyavati, 1945). (2) *integumentary micro-meronephridia* which are found only in the four clitellar and the first five post-clitellar segments, i.e., from segments XIV-XXII; they are attached to the parietes, have no funnels and are exonephric; (3) *pharyngeal tufted meronephridia* which form a pair of large tufts in the 5th segment and open into the buccal cavity in the 2nd segment; (4) *integumentary tufted meronephridia* which are present from the 6th to the 10th segment; they are without funnels and are exonephric, opening on the body-wall by long sheaves of ductules. Stephenson unfortunately missed altogether these integumentary tufted meronephridia.

The nephridial system of *Megascolex varians* var. *insolitus* is, therefore, distinctly enteronephric and closely resembles that of *M. trivandranus*, etc., the only special feature being that here the necks of the funnels are extremely long.

(iv) *Megascolex polytheca* (Steph.).

This species was instituted by Stephenson in 1915 who describes its nephridial system very briefly thus: "The excretory system is micro-nephridial." According to my observations the nephridial system consists of:—(1) *septal micro-meronephridia* which are present in the last 103 segments; these nephridia are enteronephric and resemble in their form and arrangement those of *Megascolex trivandranus* (Vidyavati, 1945); (2) *integumentary micro-meronephridia* which are found scattered on the body-wall from the 16th segment to one segment in front of that in which the septal nephridia begin; they are attached to the parietes, have no funnels and are exonephric; it should be noted that there are no integumentary nephridia in the last 104 segments; (3) *pharyngeal tufted meronephridia* which form a single pair of large tufts in the 5th segment; they open into the pharynx in the 2nd segment through a pair of sheaves of long canals; (4) *integumentary tufted meronephridia* which are present in ten segments, i.e., from 6th to 15th; they are without funnels but are exonephric and open on the body-wall. The sheaves of canals of the first pair (of the 6th segment) extend over a long distance; some of the canals open on the 5th segment, while others open on the 4th, 3rd and 2nd segments; there are a few canals which extend even as far forward as to open on the first segment. The nephridial system of this species, therefore closely resembles that of *M. trivandranus* (Vidyavati, 1945).

(v) *Megascolex kavalianus* (Steph.).

The species *Megascolex kavalianus* was instituted by Stephenson in 1915 who describes its nephridial system as follows:—"The excretory system is micronephridial; the nephridia are relatively few and scattered, most numerous on the body-wall in the clitellar segments." According to my observations the nephridial system consists of:—(1)

septal micro-meronephridia which are present in the last 49 segments in a worm having a total number of 97 segments; these nephridia are enteronephric and resemble those of *M. trivandranus* (Vidyavati, 1945). As in *M. insignis*, each transverse row on each side of the nerve-cord contains only 10 to 12 nephridia but they are larger in size than those of *M. insignis*; (2) *integumentary micro-meronephridia* which are found scattered on the body-wall from 13th to the 48th segment and are attached to the parietes; they have no funnels and are exonephric; (3) *pharyngeal tufted nephridia* which form a single pair of large tufts in the 5th segment; they open into the pharynx in the 2nd segment by a pair of long sheaves of canals and are enteronephric; (4) *integumentary tufted nephridia* which are present in seven segments, from 6th to the 12th; they are also without funnels and open on the body-wall by long sheaves of ductules. The tufts in this species are very small and consist only of about ten to twelve nephridia, while in the other species the tufts are much larger and are at least double the size.

(vi) **Megascolex hortonensis** (Steph.).

The species *Megascolex hortonensis* was instituted by Stephenson in 1915 who just mentions that "the excretory system is micronephridial." The excretory system of this worm also consists of four sets of nephridia, i.e., *septal micro-meronephridia*, *integumentary meronephridia*, the *pharyngeal tufted meronephridia* and *integumentary tufted meronephridia*. In a worm having 134 segments the *septal micro-meronephridia* with pre-septal funnels and post-septal bodies occur in the posterior 94 segments; they ultimately open into the intestine in the same way as do the septal nephridia of *M. trivandranus* (Vidyavati, 1945). The *integumentary meronephridia* occur from the 14th to the 48th segment. In the clitellar segments (XIV-XVI) they form a thick forest of nephridia and are distributed irregularly. In the post-clitellar segments they are few in number and are attached to the parietes, and are exonephric. The *pharyngeal tufted nephridia* occur in the 6th segment and open by long sheaves of ductules into the buccal cavity in the 2nd segment; these sheaves of ductules soon get embedded into the pharyngeal wall and run on it for about three segments before opening into the buccal cavity. Seven pairs of *integumentary tufted meronephridia* occur from the 7th to the 13th segment. They are exonephric and open to the outside by long wavy sheaves of ductules as in *M. trivandranus* (Vidyavati, 1945).

(vii) **Megascolex multispinus** (Mich.).

The species *Megascolex multispinus* was instituted by Michaelsen in 1897 who did not describe its nephridial system at all. The nephridial system consists of:—(1) *septal micro-meronephridia* which are arranged in transverse rows on the posterior faces of the septa in the last 53 segments in a worm having a total of 133 segments; they have pre-septal funnels and post-septal bodies and have long terminal canals which run along the whole length of the septa in a zig-zag manner and

meet dorsally with one another to form a single canal on each side of a septum, which, in its turn, meets a similar canal of the opposite side and opens into the intestine in the same manner as in *M. trivandranus* (Vidyavati, 1945); (2) *integumentary meronephridia* while are found in all the segments except the first four, and co-exist with septal meronephridia in the last 53 segments. In the clitellar segments ($\frac{3}{4}$ XIV— $\frac{1}{2}$ XVIII) they form a thick cluster, while in the post-clitellar segments they are scattered and are only a few in number; they are attached to the parietes and are exonephric; (3) the *pharyngeal tufted meronephridia* which form a single pair in the 6th segment and open into the pharynx by short ducts as in *Eutyphoeus nicholsoni* (Bahl, 1942). There are no integumentary tufted nephridia.

Megascolex multispinus is, therefore, distinctly enteronephric and differs from the other species of *Megascolex*, e.g., *Megascolex trivandranus* and *M. cochiniensis*, etc., in having no integumentary tufted meronephridia behind the pharyngeal meronephridia.

(viii) ***Megascolex quintus*** (Steph.).

The species *Megascolex quintus* was instituted by Stephenson in 1913 but he does not describe its nephridial system. As its nephridial system closely resembles that of *M. insignis*, I do not think it is necessary to describe it in detail. The four types of nephridia are:—(1) *septal micromeronephridia*, about 10 on each side of the nerve-cord in each segment; they occur in the posterior 50 segments in a worm having a total number of 133 segments; they open into the intestine in the same way as in *M. trivandranus*; (2) *integumentary meronephridia* which occur in the four clitellar and 66 post-clitellar segments; they are attached to the parietes and are exonephric; (3) *pharyngeal tufted meronephridia* which form one pair in the 6th segment and open into the pharynx by short ductules as they do in *M. multispinus*; (4) seven pairs of *integumentary tufted meronephridia* in segments VII-XIII; they open to the outside by short ductules of their own and are exonephric.

(ix) ***Megascolex funis*** (Mich.).

The species *Megascolex funis* was instituted by Michaelsen in 1887 who as usual does not describe its nephridial system. As its nephridial system closely resembles that of *M. cochiniensis* (Bahl, 1942), I shall only mention its leading features. The *septal meronephridia* are present only in the posterior one-third of the body as in *M. travancorensis* var. *proboscidea* (Vidyavati, 1945); they open into the intestine and are enteronephric. The *integumentary meronephridia* occur in the clitellar and the anterior half of the post-clitellar segments, and are exonephric. The *pharyngeal tufted meronephridia* occur as a single pair in the 5th segment in front of the gizzard and open into the buccal cavity in the 2nd segment by a pair of long sheaves of ductules. The *integumentary tufted meronephridia* are present behind the 5th segment but as the anterior part of the worm was already dissected I could not ascertain their exact number.

The nephridial system of *M. funis* is, therefore, distinctly enteronephric and resembles that of *M. cochinensis* (Bahl, 1942).

4. EXONEPHRIC SPECIES.

Under this category are included those forms, the nephridial system of which is purely exonephric, there being no enteronephridia (except the pharyngeal). Bahl (1945 and 1946) has already described two exonephric species of *Megascolex* and it is interesting to add three more species to this category, but it may be noted that both the previously described exonephric species have only closed nephridia, while of the exonephric species described by me, one has open septal nephridia but is still exonephric.

(a) *Exonephric Species with Open Nephridia.*

(i) *Megascolex filiciseta* (Steph.).

This species was instituted by Stephenson in 1925 who describes its nephridial system as follows:—"The excretory system is micro-nephridial but its peculiarities merit a short description. In each segment the nephridia—one might almost say, the nephridium,—appear on either side as a bushy tuft attached by a narrow base, as numerous twigs springing from a common stem, or sometimes radiating from a common centre. The tufts of successive segments form a regular longitudinal series; *there is no connection with the septa.*¹ The tufts begin in front just behind the pharynx, where they are large structures lying at the sides of the oesophagus between the successive cone-shaped septa. Some distance behind the clitellum it may be possible to distinguish a dorsally (laterally as the parts lie in the dissection) directed loop which is rather larger than the rest; towards the posterior end the loop gains an increased prominence, but it still has no attachment to the septum; no funnels could be seen microscopically in tufts from either anterior or posterior regions, but I can scarcely regard this observation as conclusive." A careful examination of the nephridia has revealed that although Stephenson was correct in describing the nephridia as bushy tufts, he made a mistake in saying that the nephridia had no connection with the septa and that they had no funnels. In fact, the bushy nephridia are of four kinds:—(i) *septal meronephridia* which are found in the last 50 segments in a worm having a total of 111 segments; they possess pre-septal funnels and post-septal bodies but open to the outside by their short terminal nephridial ducts. Each tuft of septal meronephridia contains about 25 nephridia, each with its own pre-septal funnel. Both the funnels and the bodies of the nephridia are closely situated so as to form clusters. All attempts at finding out the septal excretory canals and the supra-intestinal duct were unsuccessful and I can, therefore, conclude that these nephridia are exonephric and resemble those of *Megascolex dubius* where also they occur in tufts throughout the body (Bahl, 1926); (ii) *integumentary meronephridia*, which are without funnels and are found in segments X to LXI; they

¹ The italicising is mine.

also form tufts and open to the outside and are exonephric (iii) *tufted meronephridia* with long ductules form *seven* pairs in segments III-IX ; of these, five pairs are exonephric while the other two are enteronephric. The first two pairs in the 3rd and 4th segments open to the outside in the first segment by sheaves of long ductules which run side by side. The next two pairs of tufts of the 5th and 6th segments open into the pharynx in the same manner as do the pharyngeal nephridia in the other species of *Megascolex*. The next three pairs of segments VII-IX again open to the outside by sheaves of long ductules. Although the nephridia are tufted throughout the worm, the tufts of the anterior seven segments are peculiar in that they have very long ductules. This worm shows an unique condition in having two pairs of tufted exonephridia in front of the pharyngeal enteronephridia and in having all its nephridia arranged in tufts.

(b) *Exonephric Species with Closed Nephridia.*

Bahl (1945 and 1946) has already described two exonephric species of *Megascolex* with closed nephridia, i.e., *M. templetonianus* and *M. caeruleus* and with the two species listed below the total of such species now comes to four.

(i) ***Megascolex nureliyensis*** (Mich.).

This species was instituted by Michaelsen in 1897 and was described later also by Stephenson (1915), but neither Michaelsen nor Stephenson makes any mention of its nephridial system.

According to my observations, the first three segments of the worm have no nephridia. The fourth segment contains the pharyngeal tufted nephridia which have the same arrangement and distribution as described by Bahl (1945) in *Megascolex templetonianus* and open into the buccal cavity. Behind the fourth segment all the segments possess integumentary meronephridia which are quite small but are clearly visible under a binocular dissecting microscope. At a few places some of the integumentary nephridia are bigger than others. All the nephridia, whether pharyngeal or integumentary, are closed, there being no funnels on any of the nephridia. This species differs from *M. templetonianus* in having shorter pharyngeal nephridial ducts and in the absence of tufted meronephridia of segments VI to XII and also in the absence of phagocytic organs. The nephridial system of *M. nureliyensis* closely resembles that of *M. caeruleus*, as in both of them the tufted integumentary meronephridia are absent, the only nephridia present being the pharyngeal and the integumentary.

(ii) ***Megascolex ratus*** (Cogn.).

The species *Megascolex ratus* was instituted by Cognetti in 1911 and later Stephenson (1916) added a short note amplifying Cognetti's description, but he does not describe its nephridial system. There are only two types of nephridia here as in *Megascolex caeruleus* (Bahl, 1946);

i.e., (1) the *pharyngeal nephridia* which form a pair of big tufts in the 5th segment and open into the pharynx by a long sheaf of ductules on each side and (2) the *integumentary nephridia* which occur in all the other segments. They are very small in size and lie scattered over the body-wall and open to the outside and are exonephric. The nephridial system of this worm also resembles that of *Megascolex caeruleus*, but the phagocytic organs of *M. caeruleus* are absent in this species.

5. SUMMARY.

The enteronephric type of nephridial system had previously been found by Bahl in two species of *Lampito* and ten species of *Megascolex*. The results of this investigation extend the distribution of the enteronephric type of nephridial system over another three species of *Lampito* and nine species of *Megascolex*, but at the same time it has been found that three species of *Megascolex* are exonephric besides the two already known. Altogether five species of *Lampito* and nineteen species of *Megascolex* are now known to be enteronephric and five species of *Megascolex* to be exonephric. It may, therefore, be justifiably said that the genus *Megascolex* is largely enteronephric. On the basis of the nephridial system the genus may be divided into three groups: (1) *Megascolex* proper, in which there are septal meronephridia in the greater part of the post-clitellar region of the body and they are enteronephric, (2) the genus *Lampito* comprising five species in which the post-clitellar segments possess paired mega-meronephridia and they are also enteronephric, and (3) the exonephric species of *Megascolex* in which all the micro-meronephridia except the pharyngeal are exonephric.

The following species of *Megascolex* are enteronephric:—(1) *Megascolex ceylonicus*, (2) *M. sarasinorum*, (3) *M. cochiniensis*, (4) *M. konkanensis*, (5) *M. travancorensis*, var. *ghatensis*, var. *proboscidea*, and var. *typicus* (6) *M. trivandranus*, (7) *M. auriculata*, (8) *M. cingulatus*, (9) *M. campester*, (10) *M. bifoveatus*, (11) *M. insignis*, (12) *M. longiseta*, (13) *M. varians* var. *insolitus*, (14) *M. polytheca*, (15) *M. kavalianus*, (16) *M. hortonensis*, (17) *M. multispinus*, (18) *M. quintus* and (19) *M. funis*.

All the species of *Lampito* are enteronephric:—(1) *L. sylvicola*, (2) *L. kumiliensis*, (3) *L. escherichi* var. *papillifer*; (4) *L. mauritii* and (5) *L. trilobata*.

The following species of *Megascolex* are exonephric:—(1) *M. templetonianus*, (2) *M. caeruleus*, (3) *M. filiciseta*, (4) *M. nureliyensis*, and (5) *M. ratus*. Of these four species *M. filiciseta* has open meronephridia, while the other three have closed nephridia.

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