

AN AID TO THE IDENTIFICATION OF THE FISHES OF INDIA,  
BURMA AND CEYLON. I. ELASMOBRANCHII AND  
HOLOCEPHALI.

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INTRODUCTION.

On the completion of the first part of the "Check List" series dealing with Elasmobranchii and Holocephali of India, Burma and Ceylon it was felt that if a suitable dichotomous key for the identification of these groups of fishes could be published it would prove immensely useful to workers on Fish and Fisheries. In recent years much attention has been paid to sharks, skates and rays on account of the large quantities of oil which their livers yield and in order to standardise the oil known for its rich vitamin contents, it is essential that the taxonomy of these groups of fish is made well known. This work, which was subsequently taken up and is now being presented as "An Aid to the identification of the Fishes of India, Burma and Ceylon. I. Elasmobranchii and Holocephali", has been modelled after Part I of the "Check List" series.<sup>1</sup>

The preparation of the key is based on the examination of a large series of examples of cartilaginous fishes consisting of both the type and collateral specimens preserved in the collections of the Zoological Survey of India and on the observations and morphological data gathered on these groups of fishes during my five years' continuous stay in the Andaman Islands in connection with the Andaman Fisheries when I had abundant facilities to examine large fresh specimens of elasmobranchs from the catches of the local fisherman and the Japanese divers who then had the fishing license in the Andaman and Nicobar waters for the collection of button-shells. Besides, no efforts have been spared during its preparation in carefully sifting through relevant literature and comparing notes. The key, however, is purely regional in its application and deals only with species occurring in India, Burma and Ceylon.

In drawing up the key I have for the most part restricted myself only to the external and easily recognisable characters in differentiating the various Indian elasmobranchs and chimaeras. The key is thus naturally artificial and not phylogenetical.

The following explanations regarding the terms used in the paper seem necessary as the body-form and external characters of the sharks, skates, rays and chimaeras differ remarkably from one another as well as from the bony fishes.

1. *Trunk* is measured from the tip of snout to the vent.
2. *Length of disk* (in ray-like forms) is measured from the tip of snout to the hind edges of the expanded pectorals.

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<sup>1</sup>Misra, K. S., *Rec. Ind. Mus.* XLV, pp. 1-46 (1947).

3. *Length of head* is measured from the tip of snout to the anterior edge of the first gill-openings (except in the case of chimaeras in which the length of head is measured as in the bony fishes).

4. *Preoral* length is measured from tip of snout to the mouth.

5. *Internarial width* is measured from the inner edge of one nostril to that of the corresponding one on the opposite side.

In the preparation of this paper I have made use of the vast literature on the subject a complete reference to which may be had from the "Check List" Part I. Regarding illustrations those copied from other works are duly acknowledged in the legends of the figures.

The limits of the area of which the elasmobranchs and chimaeras are mentioned in the key have been defined by Dr. B. N. Chopra in the Foreword of the "Check List" Part I.

A map, however, is appended demarcating the boundaries clearly by means of dotted line.

I am very grateful to Mr. M. A. S. Menon, M.Sc., Technical Assistant, Zoological Survey of India for kindly going through the manuscripts.

*Calcutta,*

*1st October, 1950.*

K. S. MISRA.

## KEY TO THE INDIAN SHARKS, SKATES, RAYS AND CHIMAERAS.

- |   |   |     |
|---|---|-----|
| 1. Single gill-opening on either side : teeth united to form grinding plates or tritors | Class HOLOCEPHALI: Order CHIMAERIFORMES (Chimaeras, p. 134).  | 71. |
| 2. 5-7 gill-openings on either side : teeth distinct                                    | Class ELASMOBRANCHII : Subclass <i>SELACHI</i> (Sharks, p. 96, Skates, p. 113 & Rays, p. 119 )        | 3.  |
| 3. Gill-openings ventral  | Superorder BATOIDEI : Orders RAJIFORMES & TORPEDINIFORMES (Skates & Rays)                             | 55. |
| 4. Gill-openings lateral  | Superorder SELACHOIDEI : Orders HEXANCHIFORMES, LAMNIFORMES & SQUALIFORMES (Sharks)                   | 5.  |
| 5. One dorsal fin   | Order HEXANCHIFORMES : Genus <i>Heptranchias</i> , p. 96 ( <i>H. platycephalus</i> , text-fig. 1a-c). |     |
| 6. Two dorsal fins  |   | 7.  |
| 7. Anal fin present   | Order LAMNIFORMES   | 9.  |
| 8. Anal fin absent  | Order SQUALIFORMES  | 53. |
| 9. Nictitating membrane present   | Suborder <i>SCYLIORHINOIDEI</i>   | 23. |
| 10. Nictitating membrane absent   | Suborder <i>LAMNOIDEI</i>   | 11. |
| 11. Nasoral grooves present   | Family ORECTOLOBIDAE  | 15. |
| 12. Nasoral grooves absent  |   | 13  |
| 13. Teeth tricuspid   | Family ODONTASPIDAE : Genus <i>Carcharias</i> , p. 99 ( <i>C. tricuspidatus</i> , text-fig. 2b-d).    |     |
| 14. Teeth not tricuspid   | Family LAMNIDAE   | 21  |

15. Nasal cirri present                      Subfamily *ORECTOLOBINI*                      17.
16. Nasal cirri absent                      Subfamily *RHINODONTINI* :  
Genus **Rhincodon**, p. 99  
(*R. typus*, text-fig. 2a).
17. First dorsal fin behind pelvics .                      Genus **Chiloscyllium**, p. 97
18. First dorsal fin opposite pelvics .                      19.
19. Caudal fin short                      Genus **Nebrius**, p. 98.
20. Caudal fin elongate                      Genus **Stegostoma**, p. 98 (*S. varium*,  
text-fig. 1h-n).
21. Lateral keel on tail present : upper lobe of caudal fin not produced                      Subfamily *LAMNINI* : Genus **Isurus**, p. 100.
22. Lateral keel on tail absent : upper lobe of caudal fin extraordinarily produced                      Subfamily *ALOPINI* : Genus **Alopias**, p. 99 (*A. vulpinus*, text-fig. 2e).
23. Head with oculonarial expansions                      Family *SPHYRNIDAE* : Genus **Sphyrna**, p. 111.
24. Head without oculonarial expansions                      25.
25. Caudal pit absent : first dorsal fin behind or before pelvics.                      Family *SCYLIORHINIDAE*                      27.
26. Caudal pit present : (except in *Galeorhinus* & *Myrnillo*) : first dorsal fin before pelvics                      Family *CARCHARHINIDAE*                      33.
27. First dorsal fin before pelvics                      Genus **Proscyllium**<sup>1</sup> (*P. alcocki*).

<sup>1</sup> Misra, K. S., *Journ. Zool. Soc. India* II, pp. 87-90 (1950).

1951.]	K. S. MISRA : <i>Aid to Identification of Fishes.</i>	93
28. First dorsal fin behind pelvics		29.
29. With labial folds on both jaws		31.
30. With labial fold on lower jaw only	Subgenus <b>Scyliorhinus.</b>	
31. Head flatly depressed : teeth pentacuspoid or tricuspoid : base of anal fin distinctly longer than the base of second dorsal fin	Subgenus <b>Halaelurus.</b>	
32. Head subcylindrically compressed : teeth always tricuspoid : base of anal fin equal to base of second dorsal fin	Genus <b>Atelomycterus</b> , p. 103.	
33. Teeth triangular : single series		35.
34. Teeth in bands : more than one series	.. ..	51.
35. Spiracles present	.. ..	37.
36. Spiracles absent	..	43.
37. With pit at caudal base	..	39.
38. Without pit at caudal base	Genus <b>Galeorhinus</b> , p. 110 ( <i>G. omanensis</i> , text-fig. 7g-h).	
39. Teeth monomorphic, serrated in both jaws..	Genus <b>Galeocerdo</b> , p. 110 ( <i>G. arcticus</i> , text-fig. 8a).	
40. Teeth dimorphic : smooth in lower jaw.		41.
41. Teeth erect, not curved inwards	Genus <b>Hemigaleus</b> , p. 108 ( <i>H. balfouri</i> , text-fig. 7f).	
42. Teeth curved inwards	Genus <b>Hemipristis</b> , p. 109 ( <i>H. elongatus</i> ).	
43. Teeth with smooth edges		45.

44. Teeth with roughened edges 49.
45. Teeth with swollen bases Genus **Physodon**, p. 104 (*P. mulleri*).
46. Teeth without swollen bases 47.
47. Teeth with oblique cusps Genus **Scoliodon**, p. 105.
48. Teeth with erect cusps. Genus **Aprionodon**, p. 106 (*A. acutidens*, text-fig. 5f).
49. Teeth serrated at bases and cusps (in the upper jaw) Genus **Carcharhinus**, p. 107.
50. Teeth serrated on bases only (in the upper jaw). Genus **Hypoprion**, p. 106.
51. Subcaudal produced : spiracles absent : snout short, rounded Genus **Triænodon**, p. 111 (*T. obesus*, text-fig. 8f-g).
52. Subcaudal not produced : spiracles present : snout produced, pointed Genus **Myrmillo**, p. 111 (*M. manazo*, text-fig. 8b-c).
53. Teeth unicuspid Genus **Centrophorus**, p. 112 (*C. rossi*, text-fig. 9c-f).
54. Teeth multicuspid Genus **Centroscyllium**, p. 113 (*C. ornatum*-text, fig. 9g).
55. Electric organs present. Order TORPEDINIFORMES : Family TORPEDINIDÆ.
56. Electric organs absent. Order RAJIFORMES 57.
57. Disk narrow and elongate 59.
58. Disk broad and expanded 63.
59. Rostrum very much produced and saw-like. . Family PRISTIDÆ.

1951. ]	K. S. MISRA :	<i>Aid to Identification of Fishes.</i>	95
60.	Rostrum very short and not saw-like		61.
61.	Pectorals extending to end of snout : disk broader and more rounded	Family DISCOBATIDAE.	
62.	Pectorals not extending to end of snout : disk narrow and elongate	Family RHINOBATIDAE.	
63.	Tail whip-like, dorsal fins reduced to spines		65.
64.	Tail not whip-like, without spines and with 2 small dorsal fins	Family RAJIDAE.	
65.	Head distinct from disk and with a prominent snout		67.
66.	Head not distinct from disk and without prominent snout	Family TRYGONIDAE.	
67.	With horn-like cephalic flippers	Family MOBULIDAE.	
68.	Without horn-like cephalic flippers.		69.
69.	Head bilobed or notched between the rostral fins : rostral fins separate	Family RHINOPTERIDAE.	
70.	Head neither bilobed nor notched between the rostral fins : rostral fins united to form one lobe	Family MYLIOBATIDAE.	
71.	Claspers simple : head with proboscis or beak.	Family RHINOCHIMAERIDAE	73.
72.	Claspers trifid or bifid : head without proboscis or beak	Family CHIMAERIDAE : Genus <b>Chimaera</b> , p. 135 ( <i>C. monstrosa</i> , text-fig. 24c).	
73.	Snout compressed : upper caudal edge spinose : egg-capsule black, patch of byssus large (14.0 sq. mm.)	Genus <b>Rhinochimæra</b> , p. 135 ( <i>Rhinochimæra</i> sp.).	

74. Snout depressed : upper  
caudal edge not  
spinose : egg-capsule  
pale bottle-green,  
patch of byssus small  
(7.5 sq. mm.)

Genus **Harriotta**, p. 135 (*Harriotta* (?) *indica*).

Class ELASMOBRANCHII.

Subclass *SELACHII*.

*Key to superorders of subclass SELACHII.*

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

*Key to orders of superorder BATOIDEI.*

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

*Key to orders of superorder SELACHOIDEI.*

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

*Key to suborders of order LAMNIFORMES.*

1. Nictitating membrane present Suborder SCYLIORHINOIDEI.
2. Nictitating membrane absent Suborder LAMNOIDEI.

Order HEXANCHIFORMES.

Family HEXANCHIDAE.

Genus **Heptranchias** Rafinesque.

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

*Distribution.*—Atlantic, Indian and Pacific Oceans.

*Heptranchias platycephalus* (Tenore), text-fig. 1a-c, is the only species of the genus recorded from India.

Order LAMNIFORMES.

Suborder *LAMNOIDAE*.

Family ORECTOLOBIDAE.

*Key to subfamilies of family ORECTOLOBIDAE.*

1. Nasal cirri present : body not massive : tail without lateral keels : caudal pit absent.. Subfamily *ORECTOLOBINI*.
2. Nasal cirri absent : body massive : tail with lateral keels : caudal pit present .. Subfamily *RHINEODONTINI*.

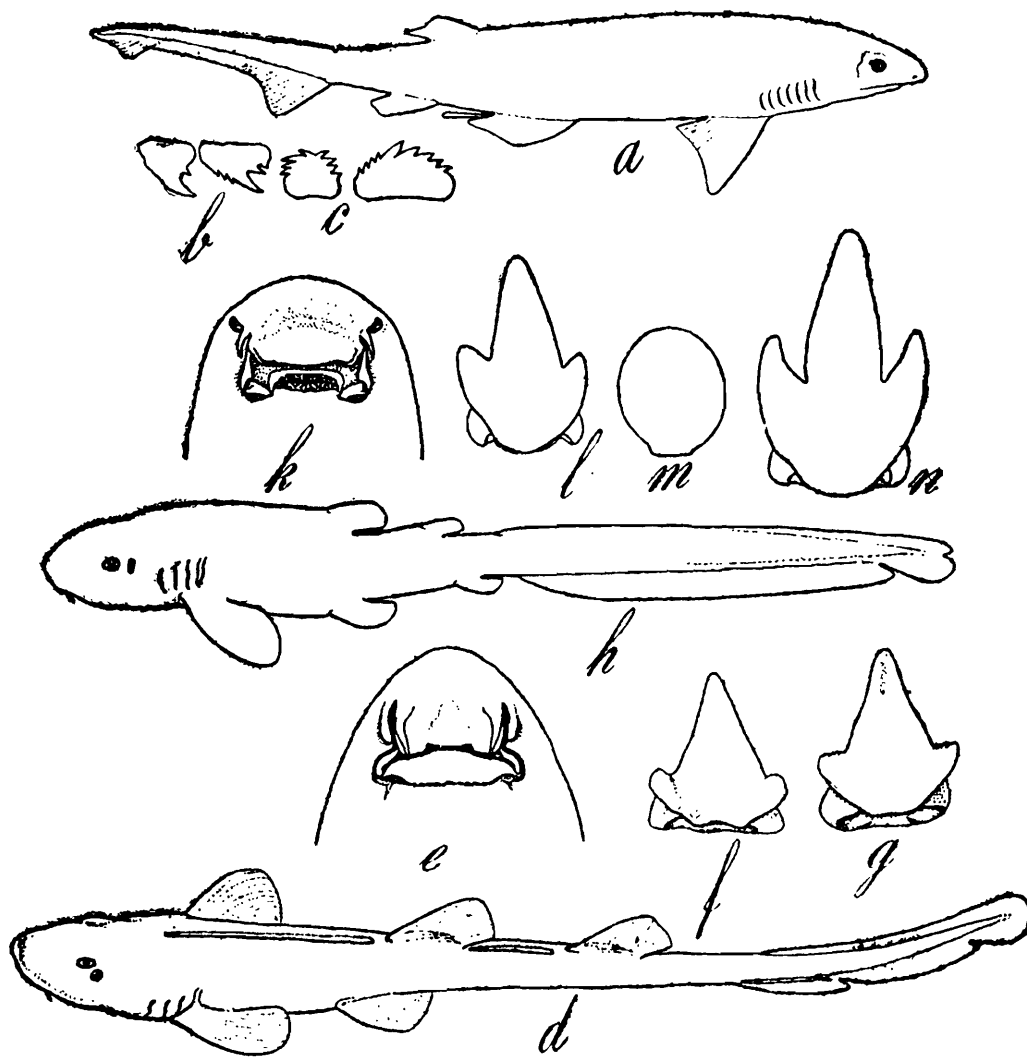


Subfamily *ORECTOLOBINI.**Key to genera of subfamily ORECTOLOBINI.*

1. First dorsal fin behind the pelvics: 1-3 dermal ridges on the back .. Genus **Chiloscyllium** M. H.
2. First dorsal fin opposite the pelvics: without dermal ridges on the back .. 3.
3. Caudal fin short .. .. Genus **Nebrius** Rüpp.
4. Caudal fin long .. .. Genus **Stegostoma** M.H.

Subfamily *ORECTOLOBINI.*Genus **Chiloscyllium** M. H.

Body elongate. Trunk shorter than tail. Eyes without nictitating membrane. Nasoral grooves and cirri present. Spiracles below eyes.



TEXT-FIG. 1.—*a.* Lateral view of *Heptanchias platycephalus* (after Day); *b.* Upper teeth of same; *c.* Lower teeth of same; *d.* *Chiloscyllium griseum*: X  $\frac{1}{4}$ ; *e.* Ventral view of head of same: X  $\frac{3}{4}$ ; *f.* Upper teeth of same: X 14; *g.* Lower teeth of same: X 14; *h.* Lateral view of *Stegostoma varium*: X  $\frac{1}{4}$ ; *i.* Ventral view of head of same: X  $\frac{1}{2}$ ; *j.* Upper teeth of same: X 25; *k.* Lower teeth of same: X 25; *l.* Upper teeth of same: X 25; *m.* Scale of same: X 25; *n.* Lower teeth of same: X 25.

5 pairs of gill-openings. Two spineless dorsal fins ; first dorsal behind the pelvics. Anal fin present. 1-3 dermal ridges on the back. Teeth small, triangular, with or without lateral cusps.

*Distribution.*—S. Africa, Red Sea, India, Ceylon, Singapore, East Indies, Indo-China, Formosa, Japan, Philippines, Australia, Melanesia.

*Key to the species.*

- |  |   |
|--|---|
| 1. Mouth nearer snout and than the vertical from front eye-edge : a clear large black ocellus just above pectoral fin .. .. .  | <i>C. ocellatum</i> (Bonn.).              |
| 2. Mouth nearer the vertical from front eye-edge than snout end : no clear large black ocellus just above pectoral fin .. .. . | 3.  |
| 3. With one dermal ridge on back .. .. .   | 5.  |
| 4. With 3 dermal ridges on back .. .. .  | <i>C. indicum</i> (Gmelin).               |
| 5. Origin of first dorsal above middle of ventral bases ; body with white spots .. .. .  | <i>C. plagiosum</i> (Benn.).              |
| 6. Origin of first dorsal above ends of ventral bases : body with dark spots .. .. .   | <i>C. griseum</i> M. H. (text-fig. 1d-g). |

Genus **Nebrius** Rüpp.

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

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

*Key to the species.*

- |   |                                 |
|---|---------------------------------|
| 1. Teeth in 3 rows : second dorsal fin longer than the anal .. .. .         | <i>N. concolor</i> Rüpp.        |
| 2. Teeth more than 3 rows : second dorsal fin smaller than the anal .. .. . | <i>N. ferrugineum</i> (Lesson). |

Genus **Stegostoma** M. H.

Body slender and elongate. Tail longer than the trunk. Snout obtuse. Eyes small without nictitating membrane. Nasoral grooves and cirri present. Labial folds well developed. Spiracles behind eyes. 5 pairs of gill-openings. Two spineless dorsal fins. Anal fin present. Caudal fin very elongate. Teeth trilobed.

*Distribution.*—Indian and western Pacific Oceans.

*Stegostoma varium* (Seba), text-fig. 1h-n, is the only species of the genus found in India and Ceylon.

Subfamily *RHINEODONTINI*.Genus *Rhincodon* Smith.

Body fusiform and massive. Snout broad, flat and short. Eyes very small without nictitating membrane and just behind the mouth. Nasoral grooves and cirri absent. Spiracle small. 5 pairs of gill-openings. Two spineless dorsal fins. Anal fin present. Subcaudal lobe well developed. Several keels along the sides. Caudal pit present. Teeth very small, pointed and numerous.

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

*Rhincodon typus* Smith, text-fig. 2a, is the only species of the genus found in India and Ceylon. It is the largest shark in the world growing upto 45 feet in length.

## Family ODONTASPIDAE.

Genus *Carcharias* Rafinesque.

Body fusiform. Trunk about more than twice the tail. Eyes small without nictitating membrane. Nasoral grooves and cirri absent. Spiracles small, behind eyes. 5 pairs of gill-openings. Two spineless, dorsal fins. Anal fin present. Caudal pit present. Teeth very large awl-shaped, smooth except at base where there exists a basal cusp on either side.

*Distribution*.—Atlantic Ocean, S. Africa, India, East Indies, Indo-China, Japan, Australia, Tasmania.

*Carcharias tricuspidatus* Day, text-fig. 2b-1, is the only species of the genus recorded from India.

## Family LAMNIDAE.

*Key to subfamilies of family LAMNIDAE.*

- |  |                            |
|--|----------------------------|
| 1. Lateral keel on tail absent : caudal fin nearly $\frac{1}{2}$ the total length ..             | Subfamily <i>ALOPINI</i> . |
| 2. Lateral keel on tail present : caudal fin much less than $\frac{1}{2}$ the total length .. .. | Subfamily <i>LAMNINI</i> . |

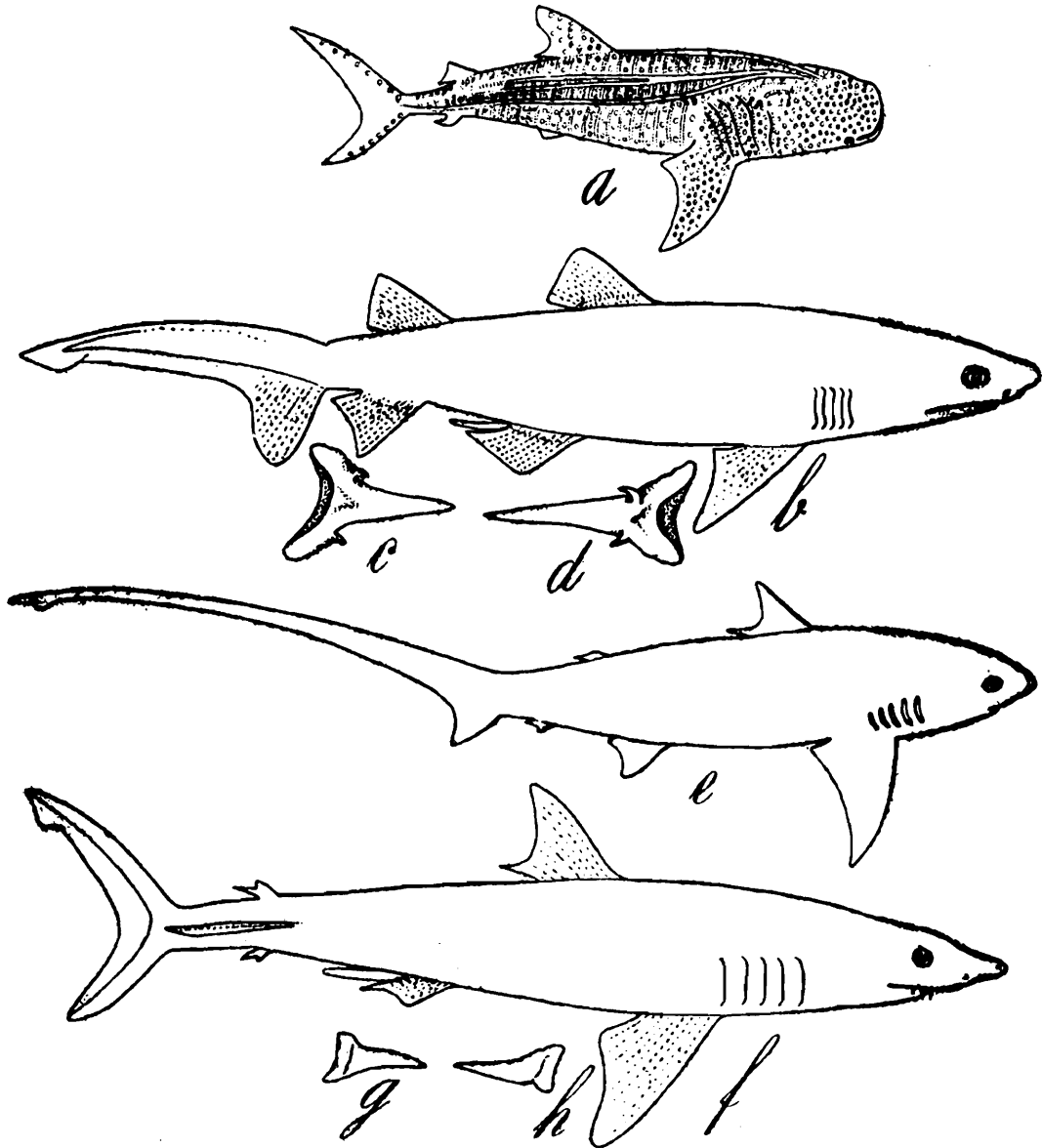
Subfamily *ALOPINI*.Genus *Alopias* Rafinesque.

Body fusiform. Trunk equal to the extraordinarily elongated upper lobe of the caudal fin. Eyes large, without nictitating membrane. Nasoral grooves and cirri absent. Spiracles minute, behind the eyes. 5 pairs of gill-openings. Two spineless dorsal fins; the second dorsal

very small and equal to the anal fin. Caudal pit present. Lateral keel on tail absent. Teeth simple, smooth and sharp-edged.

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

*Alopias vulpinus* (Bonn.), text-fig. 2e, is the only species of the genus found in Ceylon.



TEXT-FIG. 2.—a. Lateral view of *Rhincodon typus* (after Smith); b. Lateral view of *Charcharias tricuspidatus*; c. Upper teeth of same; d. Lower teeth of same (after Day); e. Lateral view of *Alopias vulpinus* (after Day); f. *Isurus glauca*; g. Upper teeth of same; h. Lower teeth of same (after Day).

#### Subfamily LAMNINI.

#### Genus *Isurus* Rafinesque.

Body fusiform. Snout pointed. Eyes without nictitating membrane. Nasoral grooves and cirri absent. Spiracles minute, above mouth angle.

5 pairs of gill-openings. Two spineless dorsal fins; the second dorsal very small and equal to anal fin. Caudal pit present. Lateral keel on tail present. Teeth long, awl-like, lanceolate, smooth and without basal cusps.

*Distribution.*—St. Helena, Cape of Good Hope, Red Sea, Arabia, India, East Indies, Indo-China, Japan, Australia, Tasmania, New Zealand, Hawaii, Chile.

*Key to the species.*

1. Teeth in 24 rows above and 22 below : lateral line keeled only along the side of tail .. *I. glauca* M. H. (text-fig. 2f-h).
2. Teeth in 44 rows above and 56 below : lateral line keeled from behind eye over gill-openings to side of tail .. .. . *I. guntheri* (Murray).

Suborder *SCYLIORHINOIDEI*.

*Key to families of suborder SCYLIORHINOIDEI.*

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

Family *SCYLIORHINIDAE*.

*Key to genera of family SCYLIORHINIDAE.*

1. Origin of first dorsal fin before pelvics Genus *Proscyllium* Hilgendorf.
2. Origin of first dorsal fin above or behind pelvics 3.
3. Head depressed : teeth tri-pentacuspoid : base of anal distinctly longer than the base of second dorsal.. Genus *Scyliorhinus* Blainville.
4. Head subcylindrically compressed : teeth tricuspoid : base of anal equal to the base of second dorsal .. Genus *Atelomycterus* Garman.

Genus *Scyliorhinus* Blainville.

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

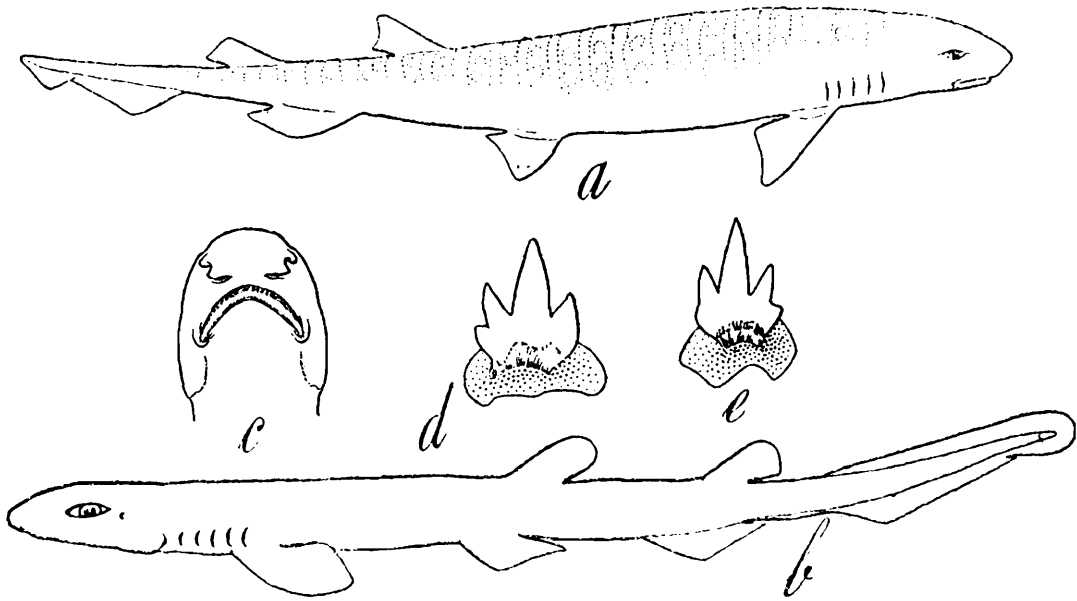
*Distribution.*—S. and E. Africa, Gulf of Aden, Arabia, Gulf of Oman, India, Andamans, Malay Archipelago, Philippines, Korea, Japan, Australia, S. E. Pacific.

**Key to subgenera of genus *Scyliorhinus*.**

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

**Subgenus *Scyliorhinus* Blainville.**

*Scyliorhinus (Scyliorhinus) capensis* (M. H.), text-fig. 3a, is the only species of the subgenus found in India.



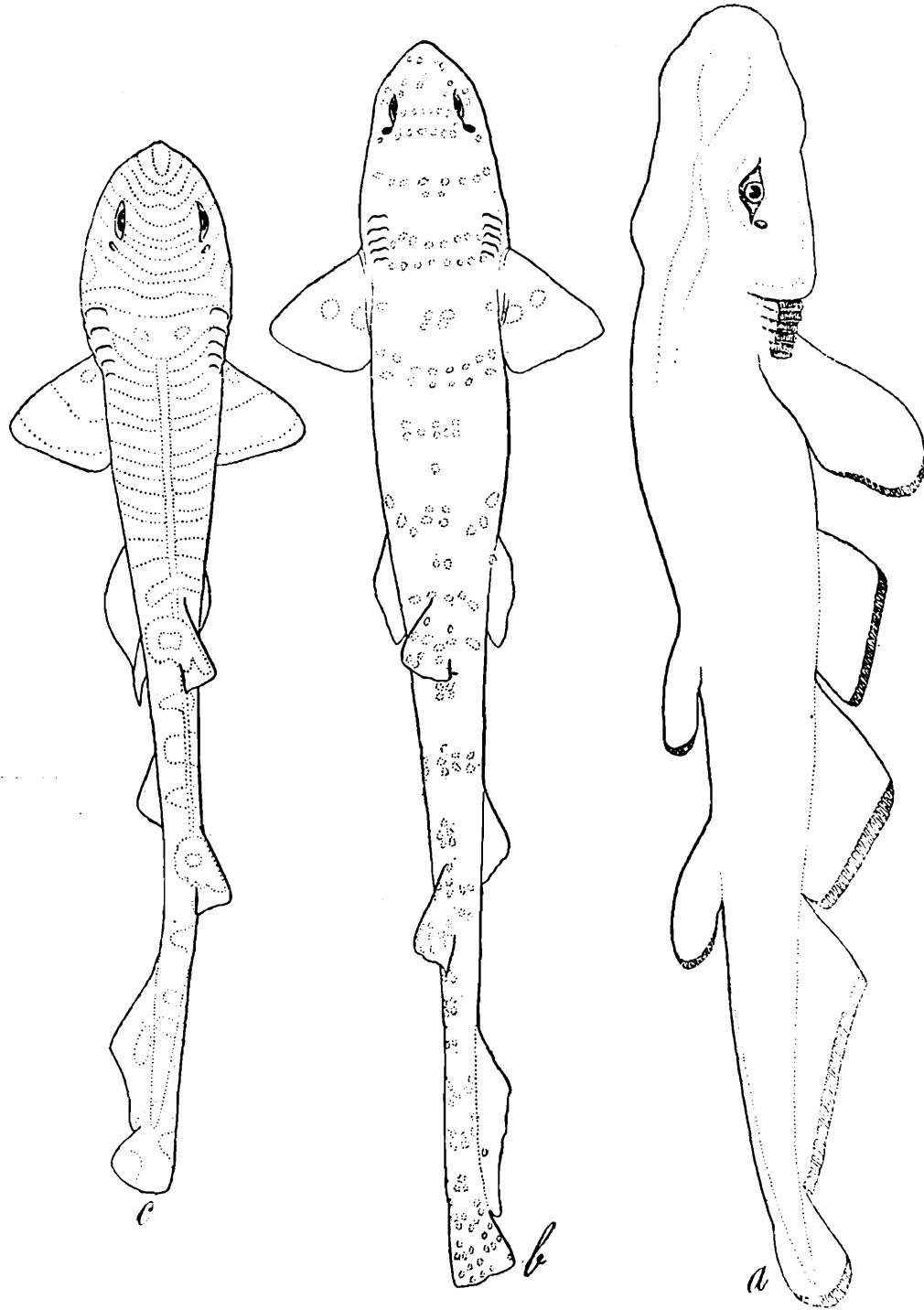
TEXT-FIG. 3.—a. Lateral view of *Scyliorhinus (Scyliorhinus) capensis* (after Day b. Lateral view of *Scyliorhinus (Halaelurus) hispidum* : X  $\frac{1}{2}$  ; c. Ventral view of head of same : X  $\frac{1}{2}$  ; d. Upper teeth of same : X 31 ; e. Lower teeth of same : X 26.

**Subgenus *Hemigaleus* Gill.****Key to the species.**

1. First dorsal larger than the second dorsal .. .. *Scyliorhinus (Halaelurus) hispidum* Alc. (text-fig. 3b-e).
2. First dorsal not larger than the second dorsal .. .. 3.
3. First dorsal smaller than the second dorsal : nasal cirri well developed .. .. *Scyliorhinus (Halaelurus) indicus* Br. (text-fig. 4a).
4. First dorsal and second dorsal subequal : nasal cirri absent or rudimentary .. .. 5.
5. Origin of first dorsal above the middle of the ventral bases : transverse bands spotted with black .. .. *Scyliorhinus (Halaelurus) burgeri* (M. H.) (text-fig. 4b).
6. Origin of first dorsal a little in advance of the hind ends of ventral bases : transverse bands 20 or more, not spotted with black .. .. *Scyliorhinus (Halaelurus) quagga* (Alc.) (text-fig. 4c).

Genus *Atelomycterus* Garman.

Body elongate and slender. Trunk shorter than tail. Eyes large : orbit oblong; nictitating membrane present. Nasoral grooves present; cirri absent. Spiracles small, close behind eyes. Labial folds



TEXT-FIG. 4.—*a.* Lateral view of *Scyliorhinus (Halaelurus) indicus* (after Lloyd); *b.* Lateral view of *Scyliorhinus (Halaelurus) burgeri* (after Müller & Henle); *c.* Lateral view of *Scyliorhinus (Halaelurus) guagga* (after Alcock).

well developed. 5 pairs of gill-openings. Two spineless dorsal fins; first dorsal fin behind the ventrals. Base of anal fin equal to the base of second dorsal. Caudal pit absent. Teeth small, tricuspid, median cusp the longest.

*Distribution*.—Ceylon, India, Malay Peninsula, Malay Archipelago, Siam, Indo-China, Philippines.

*Atelomycterus marmoratum* (Benn.), text-fig. 5a, is the only species of the genus found in India and Ceylon.

#### Genus *Proscyllium* Hilgendorf.

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

*Distribution*.—India, Formosa, Japan.

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

#### Family CARCHARHINIDAE.

##### *Key to genera of family CARCHARHINIDAE.*

- |   |                                       |
|---|---------------------------------------|
| 1. Spiracles present  | 3.                                    |
| 2. Spiracles absent   | 11.                                   |
| 3. Caudal pit absent  | 5.                                    |
| 4. Caudal pit present   | 7.                                    |
| 5. Teeth polyserial, pavement-like                            | Genus <i>Myrmillo</i> Gistel.         |
| 6. Teeth neither polyserial nor pavement-like                 | Genus <i>Galeorhinus</i> Blainville.  |
| 7. Teeth dimorphous: lower smooth .. ..                       | 9.                                    |
| 8. Teeth monomorphous: lower serrated on both edges           | Genus <i>Galeocerdo</i> M.H.          |
| 9. Lower teeth erect, not curved inwards                      | Genus <i>Hemigaleus</i> Blkr.         |
| 10. Lower teeth curved inwards                                | Genus <i>Hemipristis</i> Agassiz      |
| 11. Teeth polyserial, in bands                                | Genus <i>Triaenodon</i> M.H.          |
| 12. Teeth monoserial, not in bands                            | 13.                                   |
| 13. Teeth with smooth edges                                   | 15.                                   |
| 14. Teeth with roughened edges                                | 19.                                   |
| 15. Teeth with swollen bases                                  | Genus <i>Physodon</i> M.H.            |
| 16. Teeth without swollen bases                               | 17.                                   |
| 17. Teeth with oblique cusps                                  | Genus <i>Scoliodon</i> M. H.          |
| 18. Teeth with erect cusps                                    | Genus <i>Aprionodon</i> Gill.         |
| 19. Teeth serrated both on bases and cusps (in the upper jaw) | Genus <i>Carcharhinus</i> Blainville. |
| 20. Teeth serrated at their bases only (in the upper jaw)     | Genus <i>Hypoprion</i> M. H.          |

#### Genus *Physodon* M.H.

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

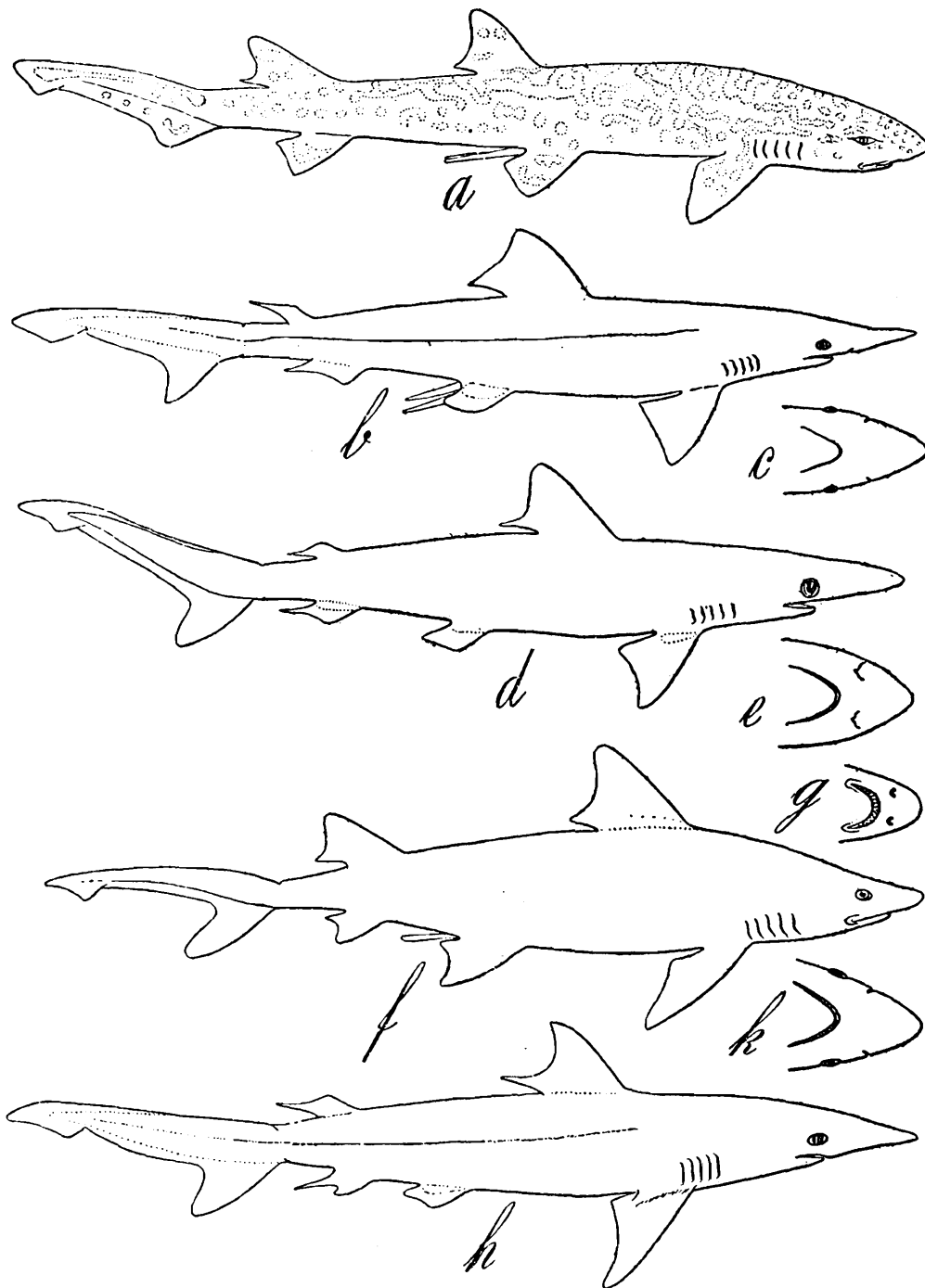


*Distribution.*—India, China, Australia.

*Physodon mulleri* M. H., is the only species of the genus found in India.

#### Genus *Scoliodon* M.H.

Body elongate and slender. Trunk nearly equal to tail. Snout elongate and pointed. Eyes moderate with nictitating membrane.



TEXT-FIG. 5.—*a.* Lateral view of *Atelomycterus marmoratum* (after Day); *b.* Lateral view of *Scoliodon sorokowah*; *c.* Ventral view of head of same (after Day); *d.* Lateral view of *Scoliodon palasorrah*; *e.* Ventral view of head of same (after Day); *f.* Lateral view of *Aprionodon acutidens*; *g.* Ventral view of head of same (after Day); *h.* Lateral view of *Hypoprion macloti* M. H.; *k.* Ventral view of head of same (after Day).

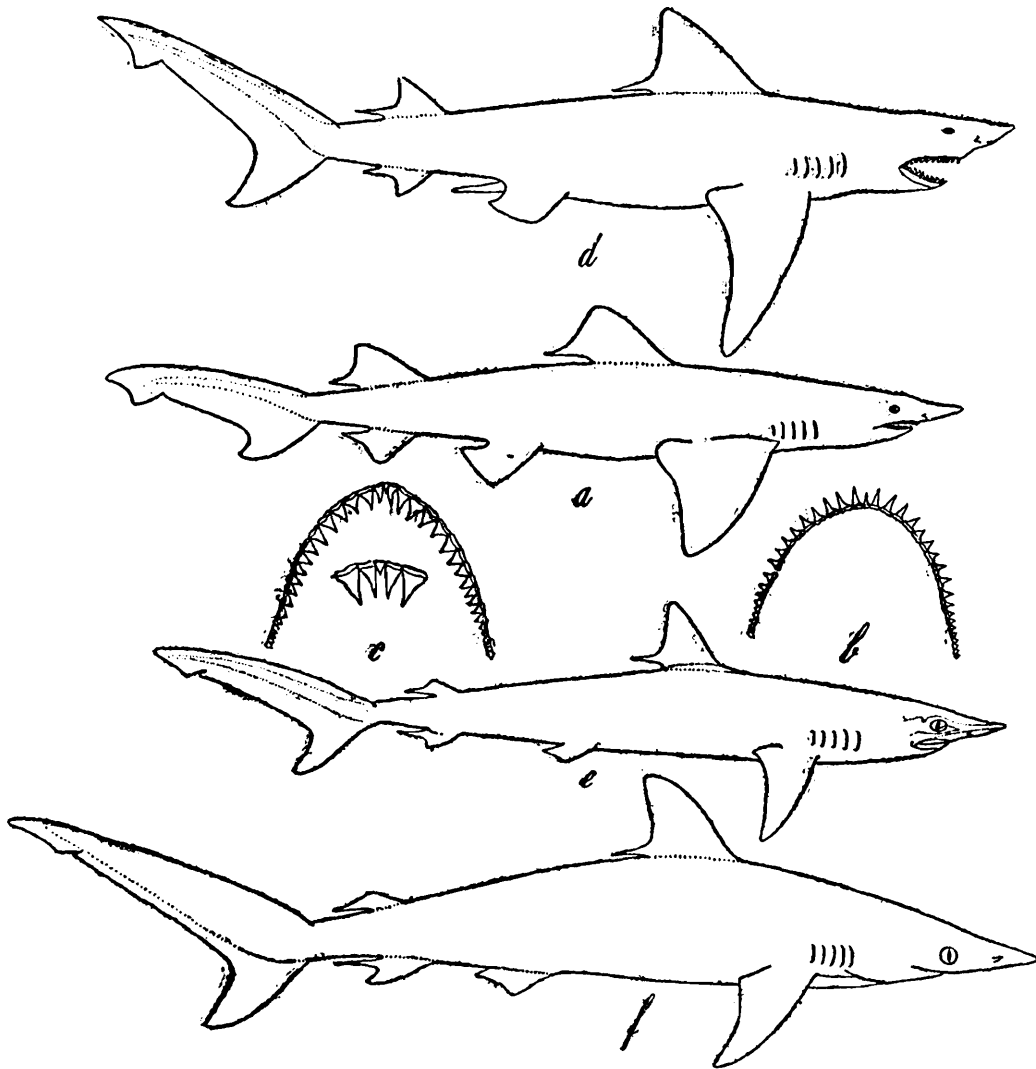
Nasoral grooves and cirri absent. Labial folds on both the jaws. Spiracles absent. 5 pairs of gill-openings. Two spineless dorsal fins.



Genus *Carcharhinus* Blainville.

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

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



TEXT-FIG. 6.—a. Lateral view of *Carcharhinus temminckii*; b. Lower jaw of same; c. Upper jaw of same (after Müller & Henle); d. Lateral view of *Carcharhinus gengeticus* (after Müller & Henle); e. Lateral view of *Carcharhinus menisorrhah* (after Müller & Henle); f. Lateral view of *Carcharhinus sorrah* (after Müller & Henle).

*Key to the species.*

- |   |    |                              |
|---|----|------------------------------|
| 1. Second dorsal fin larger than anal fin     | .. | 3.                           |
| 2. Second dorsal fin not larger than anal fin | .. | 9.                           |
| 3. Teeth in lower jaw distinctly non-serrated |    |                              |
| D. F. ———                                     | .. | ..                           |
| 37-40   |    |                              |
| 33-39   |    |                              |
|   | .. | <i>C. temminckii</i> (M. H.) |
|   |    | (text-fig. 6a-c).            |

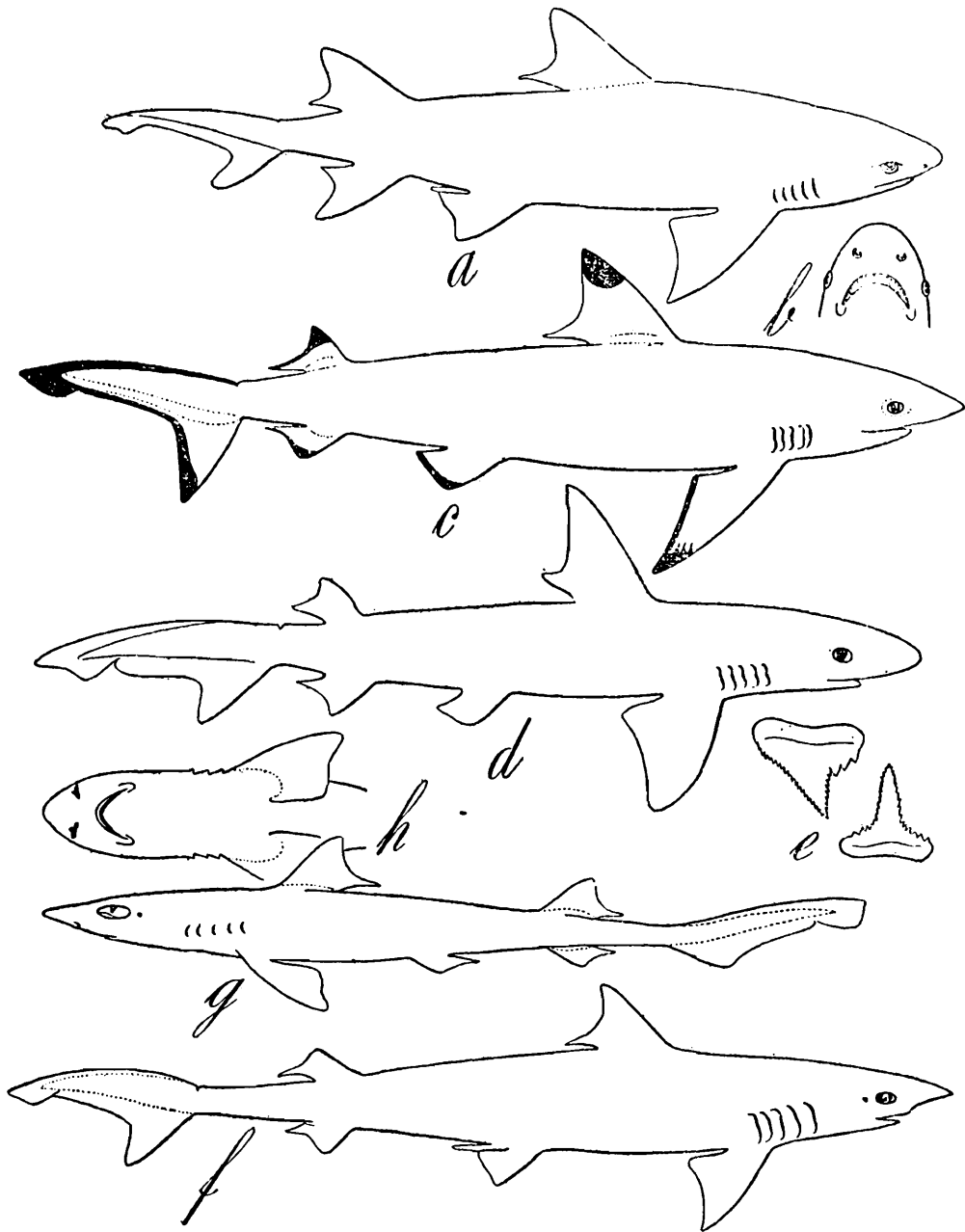
4. Teeth in lower jaw serrated .. .. 5.
5. Teeth distinctly awl-shaped : only the outer edge of cusp serrated .. .. *C. ellioti* (Day) (text-fig. 7a-b).
6. Teeth though narrow not awl-shaped : serrated entirely .. .. 7.
7. Snout very short : eye 8 times in snout : depth of body to subcaudal origin 6 times .. .. *C. gangeticus* (M. H.) (text-fig. 6d).
8. Snout moderate : eye  $4\frac{2}{3}$  to  $4\frac{1}{2}$  times in snout : depth of body to subcaudal origin  $4\frac{1}{2}$  to 5 times : .. .. *C. lamia* (Blainville).
9. Teeth in lower jaw serrated : D. F.  $\frac{24-34}{24-31}$  .. .. 11.
10. Teeth in lower jaw not serrated : D. F.  $\frac{28-32}{27-28}$  .. .. *C. menisorrah* (M. H.) (text-fig. 6e).
11. Second dorsal distinctly smaller than anal .. .. 13.
12. Second dorsal and anal subequal .. .. 15.
13. Second dorsal and anal origins opposite :  
D. F.  $\frac{34}{31}$  .. .. .. .. *C. limbatus* (M. H.).
14. Second dorsal origin behind anal origin :  
D. F.  $\frac{25}{25}$  .. .. .. .. *C. sorrah* (M. H.) (text-fig. 6f).
15. Preoral length distinctly less than width of mouth .. .. 17.
16. Preoral length more than or equal to the width of mouth .. .. 19.
17. All the fins tipped with black : tail shorter than trunk : D. F.  $\frac{25}{25}$  .. .. .. .. *C. melanopterus* (Q. G.) (text-fig. 7c).
18. All the fins not tipped with black : tail longer than trunk : D. F.  $\frac{24-26}{24-26}$  .. .. .. .. *C. pleurotaenia* (Blkr.).
19. Preoral length more than width of mouth :  
D. F.  $\frac{24-25}{24-25}$  .. .. .. .. *C. dussumieri* (M. H.) (text-fig. 7d-e).
20. Preoral length equal to width of mouth .. .. 21.
21. D. F.  $\frac{29}{26}$  .. .. .. .. *C. bleekeri* (Dumcnil).
22. D. F.  $\frac{31}{28}$  .. .. .. .. *C. watu* (Setna & Sarang-dhar).

#### Genus *Hemigaleus* Blkr.

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

*Distribution*.—Tropical Indian and Western Pacific Oceans.

*Hemigaleus balfouri* Day, text-fig. 7f, is the only species of the genus found in India.



TEXT-FIG. 7.—a. Lateral view of *Carcharhinus ellioti*; b. Ventral view of head of same (after Day); c. Lateral view of *Carcharhinus melanopterus* (after Day); d. Lateral view of *Carcharhinus dussumieri* (after Day); e. Upper and lower teeth of same (after Müller & Henle); f. Lateral view of *Hemigaleus balfouri* (after Day); g. Lateral view of *Galeorhinus omanensis*; h. Ventral view of head of same (after Norman).

#### Genus *Hemipristis* Agassiz.

Body elongate and slender. Trunk shorter than tail. Snout rounded. Eyes moderate with nictitating membrane. Nasoral grooves and cirri absent. Labial folds present. Spiracles small, close behind eyes. 5 pairs of gill-openings. Two spineless dorsal fins. Anal fin present. Caudal pit present. Teeth dimorphous; upper teeth large, broad, flat and serrated; the lower smooth, slender and curved inwards.

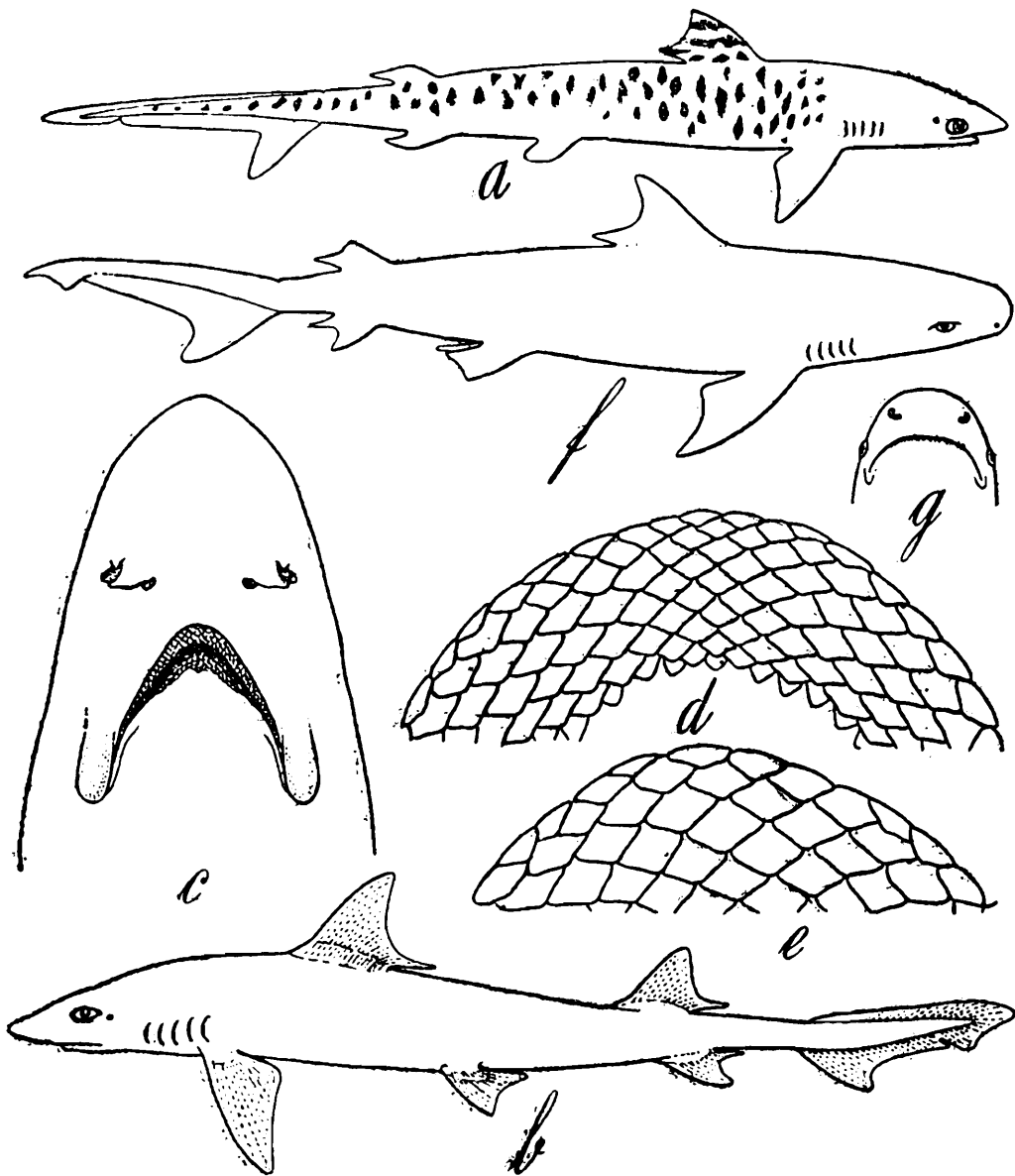
*Distribution*.—Red Sea, Ceylon, India.

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

Genus *Galeorhinus* Blainville.

Body long and slender. Trunk equal to tail. Snout obtuse, depressed. Eyes moderate with nictitating membrane. Nasoral grooves and cirri absent. Labial folds present. Spiracles minute, behind eyes. 5 pairs of gill-openings. Two spineless dorsal fins. Anal fin present. Caudal pit absent. Teeth monomorphous, oblique, notched and smooth.

*Distribution*.—Atlantic Ocean, S. Africa, Gulf of Oman, Formosa, Japan, Philippines, Australia, New Zealand, Melanesia, Polynesia, Hawaii, California.



TEXT-FIG. 8.—a. Lateral view of *Galeocerdo arcticus* (after Day); b. Lateral view of *Myrnillo manazo*: X  $\frac{1}{7}$ ; c. Ventral view of head of same: X  $\frac{4}{7}$ ; d. Upper jaw of same: X  $7\frac{1}{7}$ ; e. Lower jaw of same: X 4; f. Lateral view of *Triaenodon obesus*; g. Ventral view of head of same (after Day).

*Galeorhinus omanensis* Norman, text-fig. 7g-h, is the only species of the genus found in India.

Genus *Galeocerdo* M. H.

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

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

*Distribution.*—Arctic, Temperate and Tropical Seas.

*Galeocerdo arcticus* (Faber), text-fig. 8a, is the only species of the genus found in India and Ceylon.

#### Genus **Myrmillo** Gistel.

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

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

*Myrmillo manazo* Blkr., text-fig. 8b-e, is the only species of the genus found in India and Ceylon.

#### Genus **Triaenodon** M. H.

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

*Distribution.*—Red Sea, Arabia, India, Ceylon, East Indies, Philippines, Melanesia, Polynesia, Hawaii.

*Triaenodon obesus* (Rüpp.), text-fig. 8f-g, is the only species of the genus found in India and Ceylon.

#### Family SPHYRNIDAE.

#### Genus **Sphyrna** Rafinesque.

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

*Distribution.*—Atlantic Ocean, Mediterranean Sea, Indian Ocean, Malay Archipelago.

## Key to the species.

- |  |    |  |
|--|----|--|
| 1. A groove along the front edge of head                                 | .. | 3.                                     |
| 2. No groove along the front edge of head                                | .. | <i>S. mokarran</i> (Rüpp.).            |
| 3. Eyes and nostrils not widely separated (oculonarial expansions short) | .. | 5.                                     |
| 4. Eyes and nostrils widely separated (oculonarial expansions long)      | .. | <i>S. blochii</i> (C.) (text-fig. 9a). |
| 5. Anterior edge of oculonarial expansions curved                        | .. | <i>S. tudes</i> (V.).                  |
| 6. Anterior edge of oculonarial expansions straight                      | .. | <i>S. zygaena</i> (L.) (text-fig. 9b). |

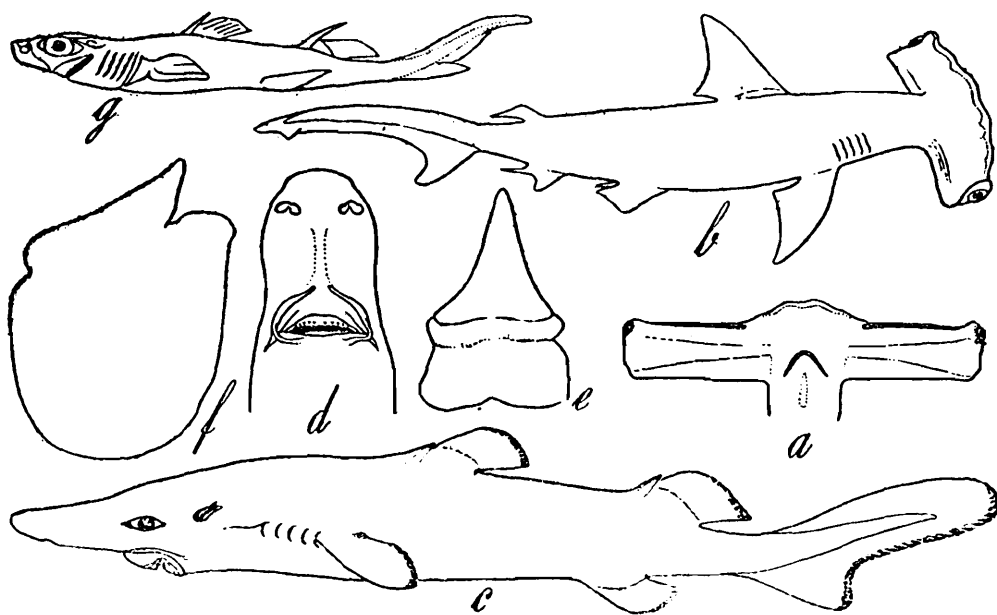
## Order SQUALIFORMES.

## Suborder SQUALOIDEI.

## Family SQUALIDAE.

## Key to genera of family SQUALIDAE.

- |  |    |                                      |
|--|----|--------------------------------------|
| 1. Teeth unicuspid : snout spatulate   | .. | Genus <b>Centrophorus</b> M.H.       |
| 2. Teeth multicuspid : snout depressed | .. | Genus <b>Centroscyllium</b><br>M. H. |



TEXT-FIG. 9.—a. Ventral view of head of *Sphyrna blochii*; b. Lateral view of *Sphyrna zygaena* (after Day); c. *Centrophorus rossi*: X 2; d. Ventral view of head of same: X  $\frac{2}{3}$ ; e. Upper tooth of same: X 20; f. Lower teeth of same: X 20; g. Lateral view of *Centroscyllium* (*Paracentroscyllium*) *ornatum* (after Alcock).

Genus **Centrophorus** M. H.

Body elongate, partly cylindrical. Trunk longer than tail. Snout spatulate and much produced. Eyes large without nictitating membranes; orbit elongate. Nasoral grooves and cirri absent. Labial folds well developed in both jaws. Spiracles large, nearly equal to eye and slightly larger than gill-slits. 5 pairs of gill-openings. Two dorsal fins each with a spine anteriorly. Anal fin absent. Caudal pit absent. Teeth unicuspid, those of upper jaw acute, triangular, in two series; those of the lower jaw oblique, in single series.

*Distribution*.—Eastern Atlantic, Mediterranean, S. Africa, Arabian Sea, Japan, Philippines, New Zealand.



*Centrophorus rossi* Alc., text-fig. 9-c-f, is the only species of the genus found off Travancore Coast, India.

### Genus **Centroscyllium** M.H.

Body elongate, fusiform. Trunk longer than tail. Snout depressed. Eyes large with nictitating membrane; orbit elongate. Nasoral grooves and cirri absent. Labial folds well developed in both jaws. Spiracles large, behind eyes, higher, superior. 5 pairs of gill-openings. Two dorsal fins each with a well developed spine anteriorly. Anal fin absent. Caudal pit absent. Caudal fin truncated or pointed. Teeth small, raptorial, multicuspid.

#### *Key to subgenera of genus Centroscyllium.*

1. Caudal truncated posteriorly: lower edge of fin with distinct posterior notch .. .. Subgenus **Centroscyllium** M. H.
2. Caudal not truncated posteriorly: lower edge of fin without distinct posterior notch .. .. Subgenus **Paracentroscyllium** Alc.

*Distribution.*—Arabian Sea, Bay of Bengal, Japan, Hawaii Islands.

*Centroscyllium (Paracentroscyllium) ornatum* Alc., text-fig. 9g, is the only species of the genus found in Bay of Bengal and Arabian Sea.

## Superorder BATOIDEI.

### Order RAJIFORMES.

#### *Key to families of order RAJIFORMES.*

1. Disk narrow and elongate .. .. 3.
2. Disk broad and expanded .. .. 7.
3. Rostrum very much produced and saw-like .. .. Family PRISTIDAE.
4. Rostrum very short and not saw-like .. .. 5.
5. Pectorals extending to end of snout: disk broader and more rounded .. .. Family DISCOBATIDAE.
6. Pectorals not extending to end of snout: disk narrow and elongated .. .. Family RHINOBATIDAE.
7. Tail whip-like, dorsals reduced to spines .. .. 9.
8. Tail not whip-like, without spines: 2 small dorsals .. .. Family RAJIDAE.
9. Head distinct from disk, without a prominent snout. 11.
10. Head not distinct from disk, without prominent snout .. .. Family TEYGONIDAE.
11. With horn-like cephalic flippers .. .. Family MOIULIDAE.
12. Without horn-like cephalic flippers .. .. 13.
13. Head bilobed or notched between the rostral fins: rostral fins separate .. .. Family RHINOPTERIDAE.
14. Head neither bilobed nor notched between the rostral fins: rostral fins united into one lobe .. .. Family MYLOBATIDAE.

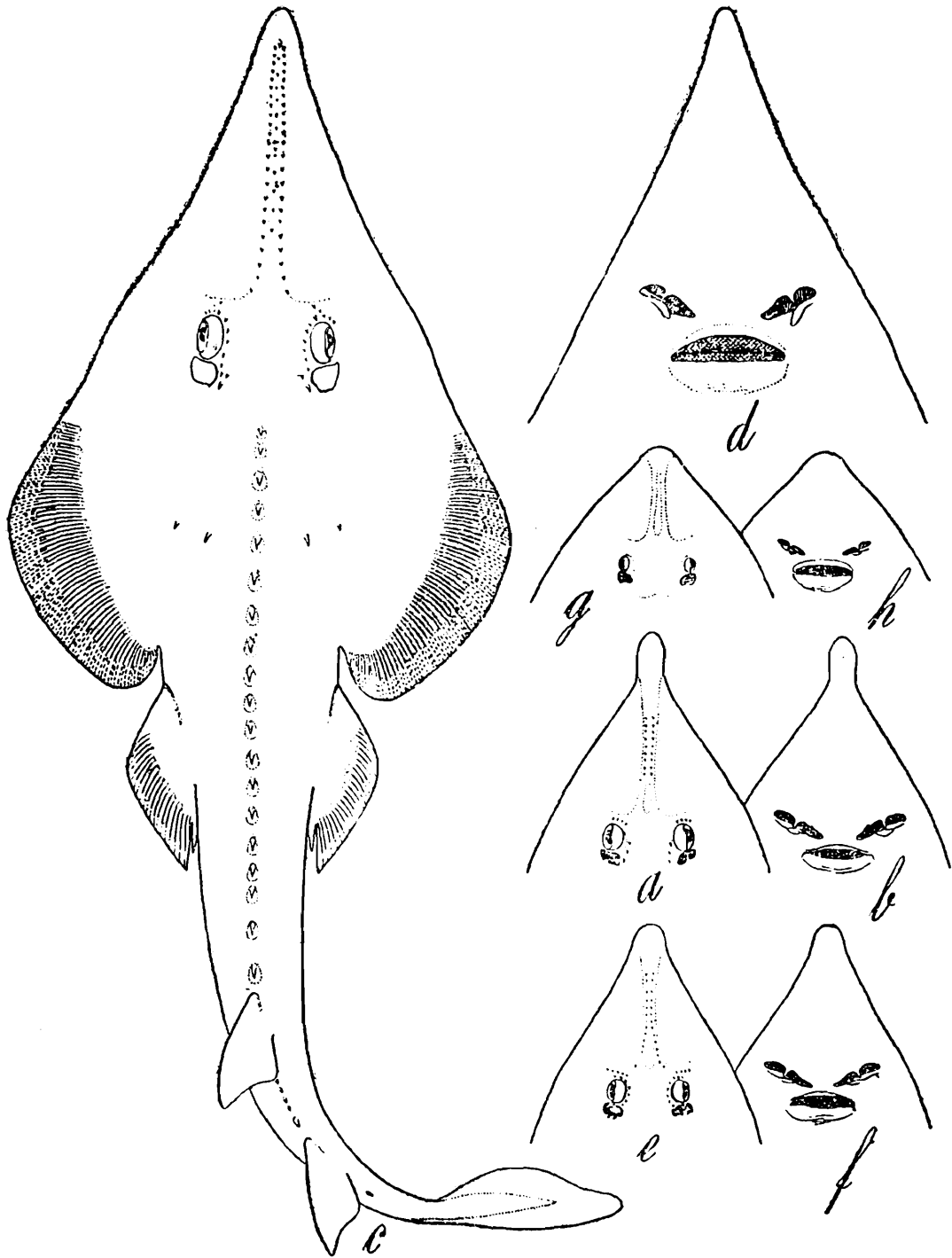
### Family RHINOBATIDAE.

#### *Key to genera of family RHINOBATIDAE.*

1. Snout triangularly pointed: spiracles with folds on hind edge .. .. 3.
2. Snout blunt, broad and rounded: spiracles without folds on hind edge .. .. Genus **Rhina** Schn.
3. Origin of first dorsal distinctly nearer to the tip of the snout than to the tip of the caudal .. .. Genus **Rhynchobatus** M. H.
4. Origin of first dorsal distinctly nearer to the tip of the caudal than to the tip of the snout .. .. Genus **Rhinobatos** Linck.

Genus *Rhinobatos* Linck.

Body depressed and elongated. Disk triangular, slightly rounded and wider behind. Tail depressed, nearly equal to trunk. Snout triangularly pointed. Nostrials oblique and wide. Spiracles wide, just behind the eyes, with folds on hind edge. 5 pairs of gill-openings



TEXT-FIG. 10.—*a*. Dorsal view of head of *Rhinobatos thouniana*; *b*. Ventral view of head of same (after Norman); *c*. Dorsal view of *Rhinobatos granulatus*: X nat. size; *d*. Ventral view of head of same: X nat. size; *e*. Dorsal view of head of *Rhinobatos armatus*; *f*. Ventral view of head of same (after Norman); *g*. Dorsal view of head of *Rhinobatos oblongus*; *h*. Ventral view of head of same (after Norman).

on the ventral side. Two spineless dorsal fins behind the pelvics and closer to caudal than to snout end: pelvics closer to the pectorals than to the dorsals. The rayed portion of the pectoral fins not continued

on to the snout. Anal fin absent. Teeth obtuse with indistinct, transverse ridges.

*Distribution.*—W and S. Africa, Red Sea, Arabia, India, Ceylon, Andamans, Burma, Malay Peninsula, Malay Archipelago, Siam, Cochin-China, Formosa, Philippines, Japan, Australia.

*Key to the species.*

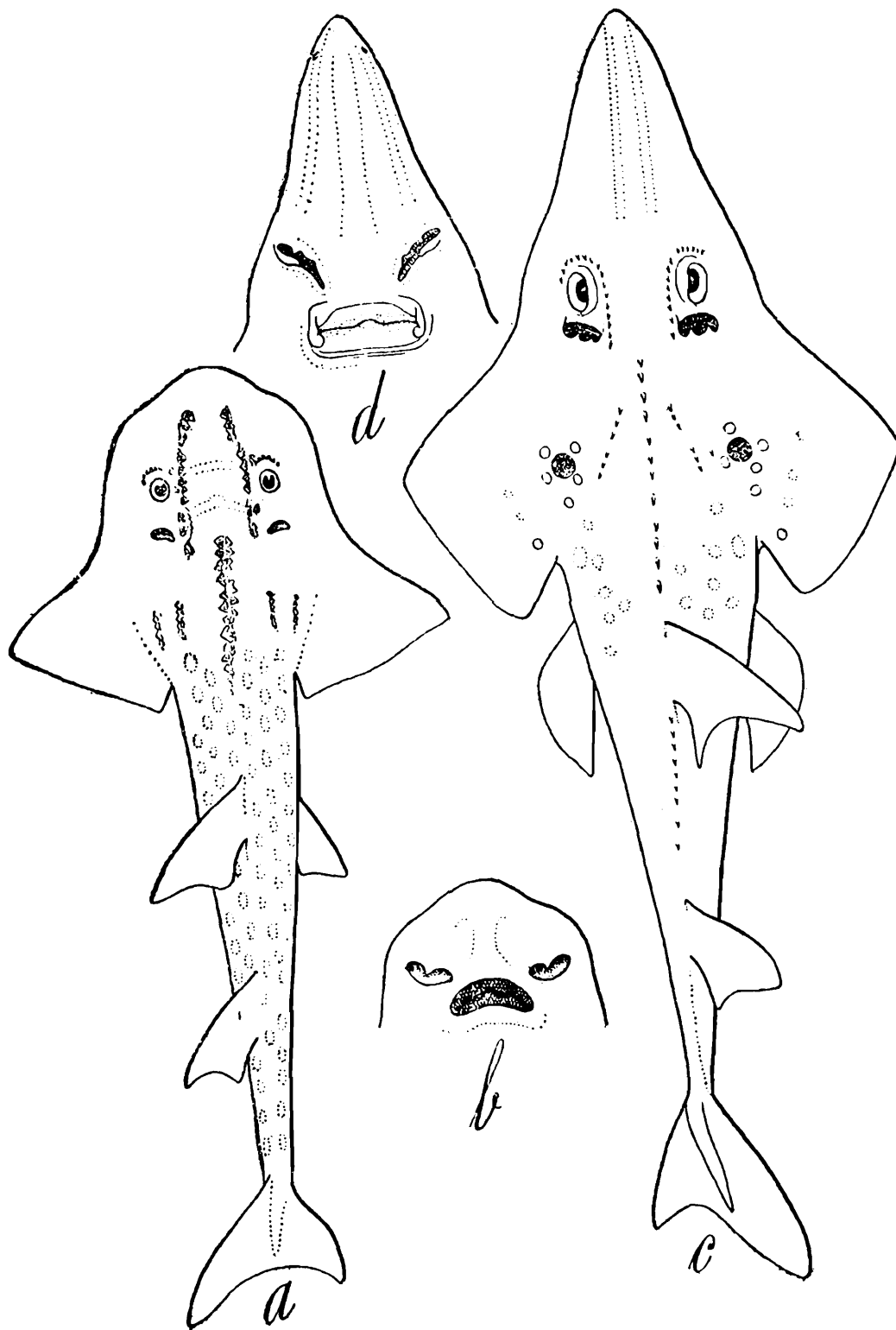
1. Snout long and pointed: preorbital length  $3-3\frac{3}{5}$  times the distance between the spiracles .. 3.
2. Snout short bluntly or obtusely pointed: preorbital length  $2\frac{1}{5}-2\frac{1}{2}$  times the distance between the spiracles. 7.
3. Snout expanded at the tip .. .. *R. thouniniana* (Shaw) (text-fig. 10a-b).
4. Snout not expanded at the tip .. .. 5.
5. Length of nostril equal to internarial space and twice the width of mouth: preorbital length  $3\frac{1}{2}-3\frac{2}{3}$  times the distance between the spiracles .. .. *R. granulatus* (C.) (text-fig. 10 c-d).
6. Length of nostril greater than internarial space and less than twice the width of mouth: preorbital length  $3-3\frac{1}{5}$  times the distance between the spiracles .. .. *R. armatus* (Gray) (text-fig. 10 c-f).
7. Snout obtusely pointed: preorbital length  $2\frac{1}{7}$  times the distance between the spiracles: length of nostril equal to internarial space and the twice the width of mouth .. .. *R. obtusus* (M. H.) (text-fig. 10 g-h).
8. Snout not obtusely pointed: preorbital length  $2\frac{1}{3}-2\frac{1}{2}$  times the distance between the spiracles: length of nostril greater than internarial space and less than twice the width of mouth .. .. 9.
9. Base of first dorsal fin  $2\frac{1}{4}-2\frac{2}{5}$  the distance between the dorsals: space between rostral ridges rather narrow: series of spines in the middle line of back .. *R. annandalei* (Norman).
10. Base of first dorsal  $2\frac{2}{5}$  times the distance between the dorsals: space between rostral ridges broader: minute tubercles in the middle line of back .. *R. lionotus* (Norman).

Genus **Rhina** Schn.

Body depressed and elongated. Disk subtriangular, obtusely rounded in front. Tail depressed, nearly equal to trunk. Snout broad, obtusely rounded. Nostrils slightly oblique and wide. Spiracles large, without posterior folds and about an eye diameter and a half behind the eyes.

5 pairs of gill-openings on the ventral side. Two spineless dorsal fins; first dorsal fin opposite pelvics and nearer to snout end than to caudal end. The rayed portion of pectoral extends only upto spiracles. Anal fin absent. Teeth obtusely rounded, each with several longitudinal ridges.

*Distribution*.—Red Sea, Arabia, E. Africa, Seychelles, India, Ceylon, Penang, East Indies, Philippines, Cochin-China, China, Japan, Australia.



TEXT-FIG. 11.—*a*. Dorsal view of *Rhina ancylostoma*; *b*. Ventral view of head of same (after Day); *c*. Dorsal view of *Rhynchobatus djiddensis*; *d*. Ventral view of head of same (after Day).

*Rhina ancylostoma* Schn., text-fig, 11 *a-b*, is the only species of genus found in India and Ceylon.

Genus **Rhynchobatus** M. H.

Body depressed and elongated. Disk triangular, longer than wide. Tail depressed, nearly equal to trunk. Snout triangularly pointed. Nostrils oblique. Spiracles large, close behind eyes and with two small folds on hind edge. 5 pairs of gill-openings on the ventral side. Two spineless dorsal fins; first dorsal opposite pelvics and nearer to snout end than to caudal end. The rayed portion of pectorals extends only upto spiracles. Anal fin absent. Teeth obtuse, pavement-like, dental surfaces undulated.

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

*Rhynchobatus djiddensis* (Forsk.), text-fig. 11 *c-d*, is the only species of the genus recorded from India and Ceylon.

Genus **Pristis** Linck.

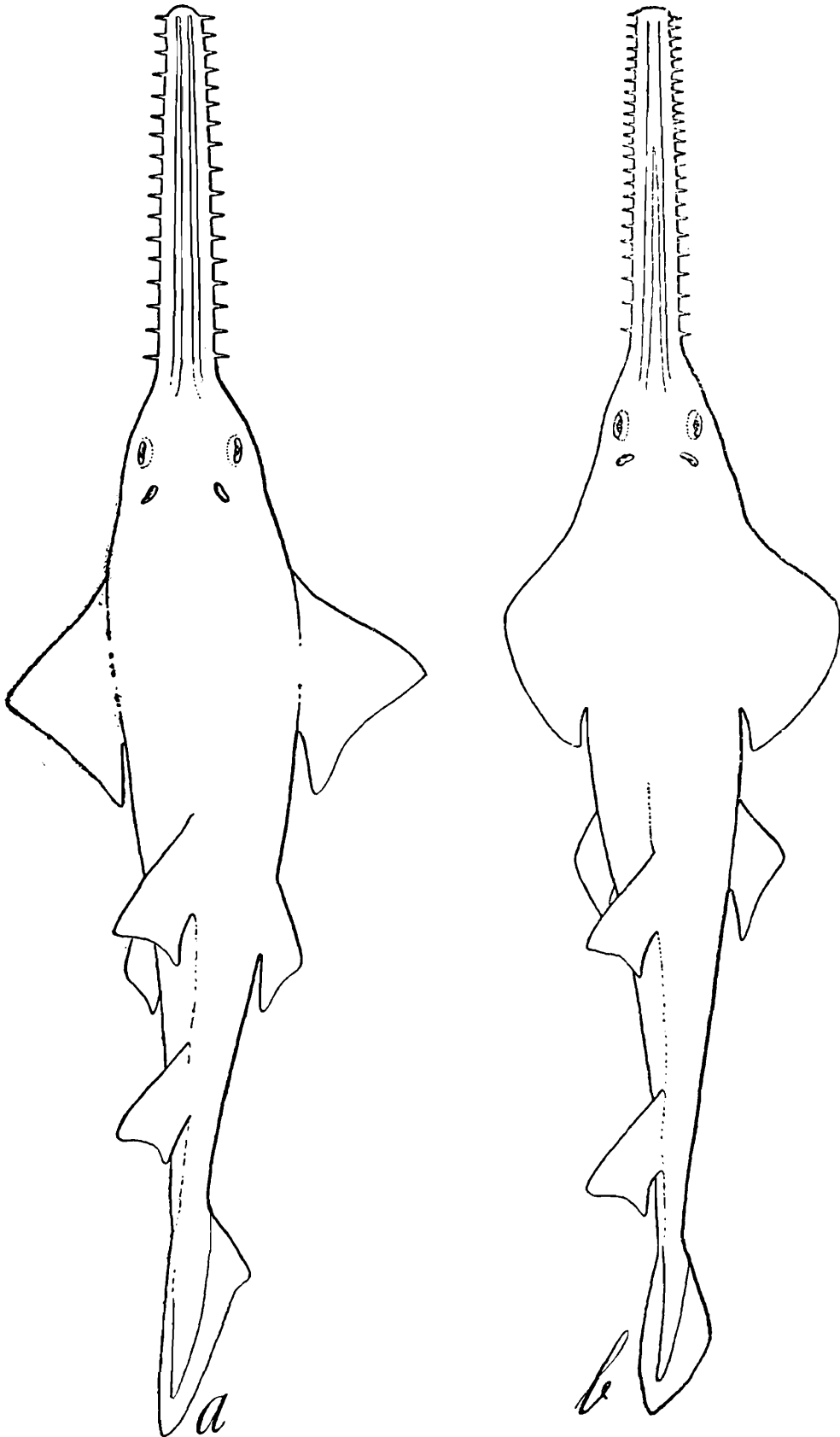
Body elongated and moderately depressed. Rostrum very much produced and saw-like. Nostrils oblique. Eyes without nictitating membrane. Spiracles large, behind the eyes. 5 pairs of gill-openings on the ventral side. Two spineless dorsal fins. Pectorals moderate, front edge quite free neither joining with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

*Distribution.*—E. Africa, Madagascar, Seychelles, Zanzibar, Red Sea, Arabia, India, Burma, Ceylon, Andamans, Malay Peninsula, Malay Archipelago, Siam, Cochin-China, Philippines, Japan, Melanesia, Queensland, Tropical Atlantic.

*Key to the species.*

1. First dorsal origin distinctly behind or opposite pelvics : rostral teeth more in number, 23-35 on either side .. .. . 3.
2. First dorsal origin clearly in front of pelvics : rostral teeth less in number, 17-20 on either side .. *P. microdon* Lath. (text-fig. 12a).
3. First dorsal origin behind pelvics .. .. . 5.
4. First dorsal origin opposite pelvics .. .. . *P. pectinatus* Lath.
5. Upper margins of the dorsals deeply concave with the posterior lobes produced : subcaudal lobe well developed .. .. . *P. cuspidatus* Lath.

6. Upper margins of the dorsals slightly concave with their posterior lobes not produced: subcaudal lobe not well developed .. .. . *P. zijnsron* Blkr. (text-fig. 12b).

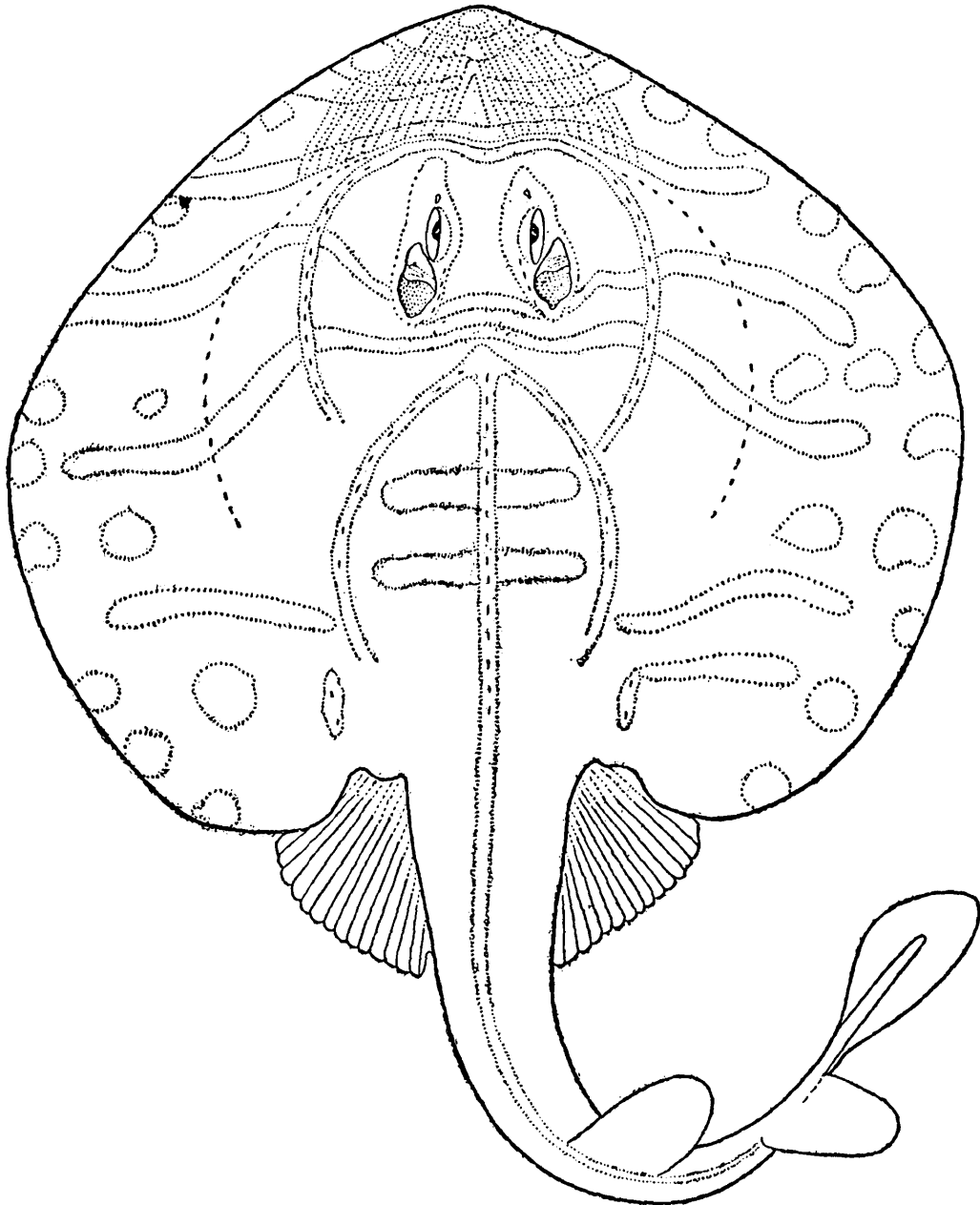


TEXT-FIG. 12.—*a*. Dorsal view of *Pristis microdon* (after Day); *b*. Dorsal view of *Pristis zijnsron* (after Day).

## Family DISCOBATIDAE.

Genus *Zanobatus* Garman.

Disk wider than long, partly rounded. Tail depressed, slender, nearly half total length. Rostral cartilage small. Snout short, obtuse, Nasoral grooves rudimentary. Nostrils transverse; internarial space about  $\frac{2}{3}$  mouth width. Spiracles close behind eyes. 5 pairs of gill-openings on ventral side. Two spineless dorsal fins. The rayed portion



TEXT-FIG. 13.—Dorsal view of *Zanobatus schoenleinii* (after Müller & Henle).

of the pectorals continued to the snout to form a subcircular disk. Anal fin absent. Teeth very small.

*Distribution.*—Africa, India.

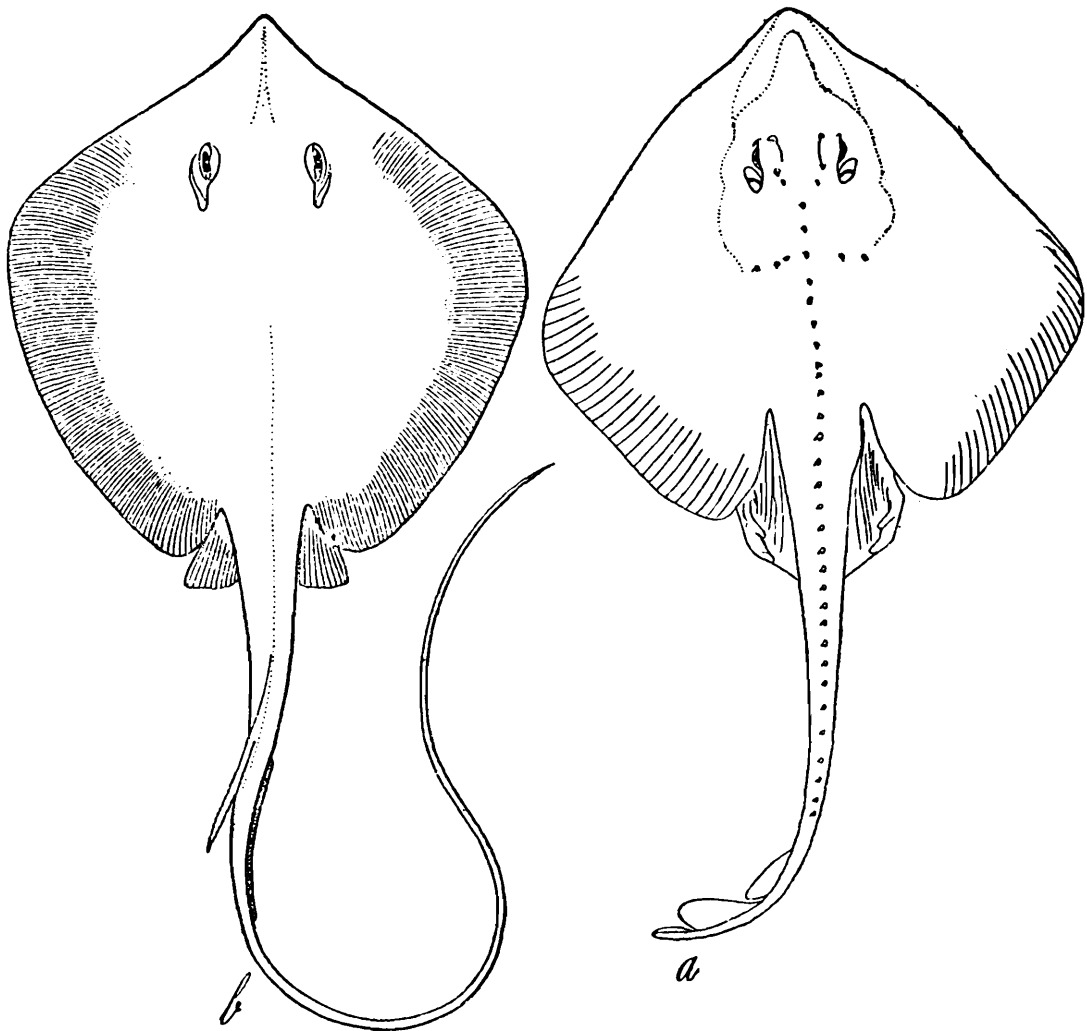
*Zanobatus schoenleinii* (M. H.), text-fig. 13, is found in India.

## Family RAJIDAE.

Genus **Raja** L.

Disk subcircular to quadrangular. Tail not whip-like, without spines and without fold along either side. Snout produced and pointed. Eyes prominent. Nasoral grooves present. 5 pairs of gill-openings on the ventral side. Two spineless dorsal fins. The rayed portion of the pectorals reaches beyond the eyes but not upto the snout. Anal fin absent. Teeth small, tessellate, flat to sharply pointed.

*Distribution*.—Atlantic Ocean, Mediterranean Sea, Gulf of Aden, S. Africa, Arabian Sea, India, Andamans, East Indies, Formosa,



TEXT-FIG. 14.—*a*. Dorsal view of *Raja mamallidens* (after Alcock) *b*. Dorsal view of *Dasyatis* (*Pastinachus*) *bennetti* (after Müller & Henle).

Philippines, Korea, Japan, China, Manchuria, Kamchatka, Alaska, Australia, New Zealand, California, Washington.

*Key to the species.*

1. Snout about 3-3.5 times the interiorbital distance :  
dorsals very close together .. **3.**
2. Snout about 4-5 times the interiorbital distance :  
dorsals widely separated (by a distance about the  
length of the base of the first dorsal fin) .. **5.**



3. A single row of prominent spines on tail .. *R. mamillidens* Alc. (text-fig. 14a).
4. More than one row (*i.e.*, 3) of prominent spines on tail *R. reversa* (Lloyd).
5. A single row of spines on tail: second dorsal fin situated away from the tip of the caudal fin by a distance equal to bases of both the dorsals .. *R. johannis-davisi* Alc. (text-fig. 15a)
6. More than one row of spines on tail (*i.e.*, 3): second dorsal fin situated nearer to tip of caudal fin by a distance equal to or less than the base of the first dorsal fin .. .. . 7.
7. Interdorsal space equal to base of first dorsal fin: no prominent rostral spine .. .. *R. powelli* Alc.
8. Interdorsal space half of the base of first dorsal fin: prominent rostral spine present .. .. *R. andamanica* (Lloyd).

### Family TRYGONIDAE.

#### *Key to genera of family TRYGONIDAE.*

1. Tail shorter than the length of disk: disk twice as broad as long .. .. Genus **Gymnura** Kuhl.
2. Tail as long as or much longer than the length of disk: disk not twice as broad as long .. .. 3.
3. Serrated caudal spine present: body not profusely covered with tubercles .. .. 5.
4. Serrated caudal spine absent: body profusely covered with tubercles .. .. Genus **Urogymnus** M. H.
5. Disk oval .. .. Genus **Taeniura** M. H.
6. Disk quadrangular .. .. Genus **Dasyatis** Rafinesque.

#### Genus **Taeniura** M. H.

Disk rounded with head not distinct from it. Tail compressed, longer than body, with midcaudal serrated spines and without any lateral folds. Mouth with buccal processes<sup>1</sup>. No rostral cartilage. Nostrils slightly oblique. Spiracles wide, behind the eyes. 5 pairs of gill-openings on the ventral side. Dorsal fins absent. Rayed portion of the pectoral fins united anteriorly. Anal fin absent. Subcaudal rayless, below terminal end of tail. Teeth small, tessellate, grooved transversely.

*Distribution.*—Zanzibar, Mozambique, Mauritius, Red Sea, Arabia, India, Ceylon, Malay Peninsula, East Indies, Siam, Philippines, Australia, Melanesia, Polynesia.

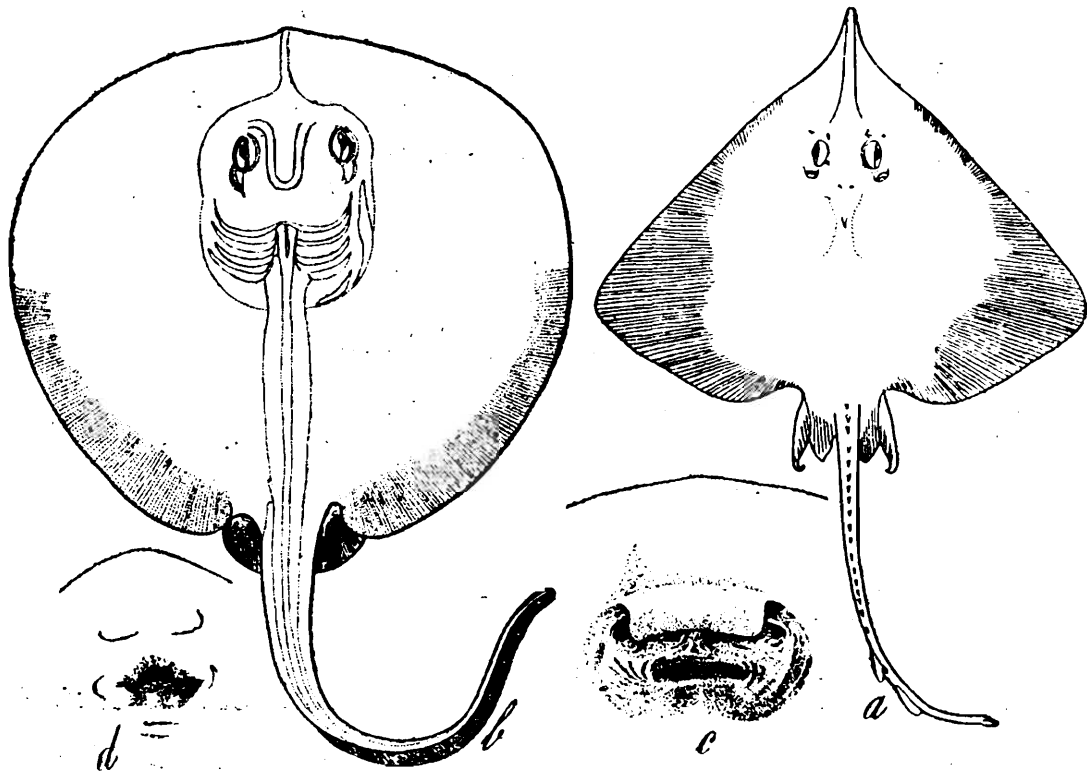
#### *Key to the species.*

1. Mouth straight: 5 buccal processes .. .. *T. meyeri* M. H. (text-fig. 15b-c).
2. Mouth curved: 2 buccal processes .. .. *T. lymma* (Forsk.) (text-fig. 15d.)

<sup>1</sup> There are small flaps of skin across the floor of the mouth of sting rays.

Genus **Dasyatis** Rafinesque.

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



TEXT-FIG. 15.—*a*. Dorsal view of *Raja johannis-davisi* (after Alcock); *b*. Dorsal view of *Taeniura meyeri*; *c*. Mouth of same (after Müller & Henle); *d*. Mouth of *Taeniura lymma* (after Müller & Henle).

united anteriorly. Anal fin absent. Teeth flattened, or with a central point or transverse ridge.

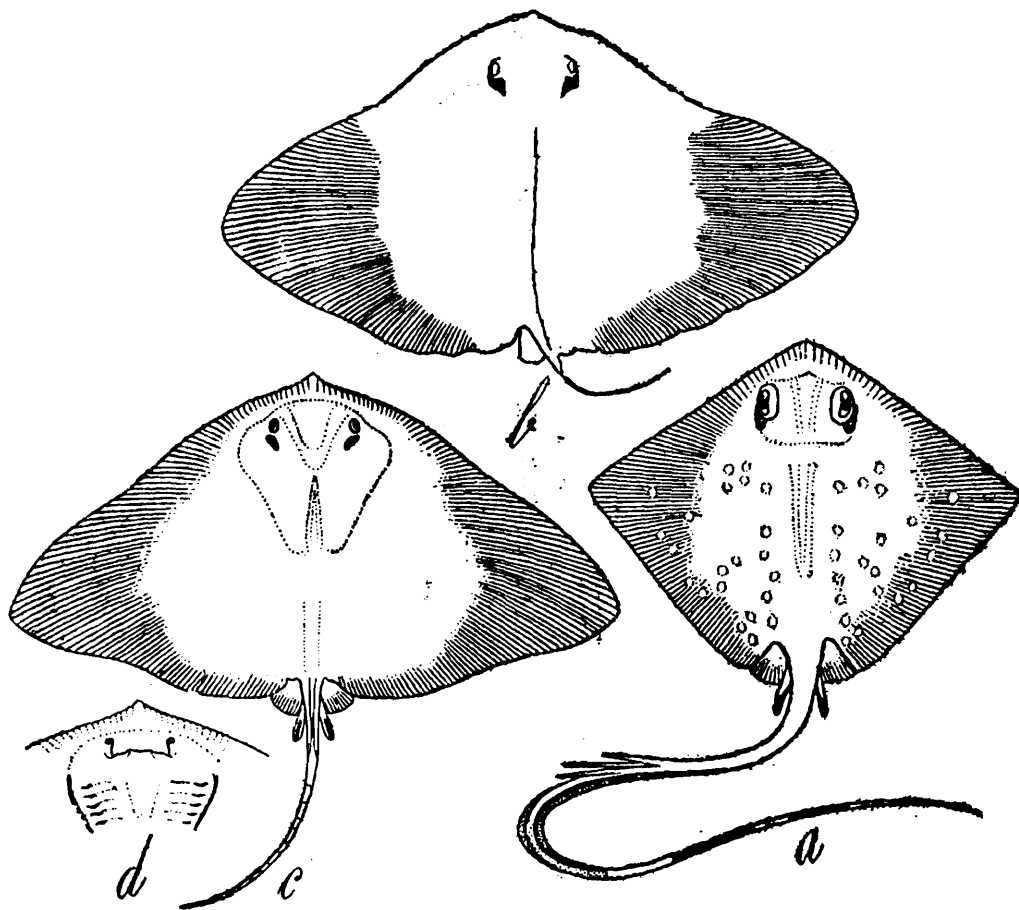
*Distribution*.—Atlantic Ocean, Cape of Good Hope, Natal, Zanzibar, Red Sea, Arabia, India, Ceylon, Burma, Malay Peninsula, Malay Archipelago, Siam, Cochin-China, China, Formosa, Japan, Philippines, Australia, Melanesia, Micronesia, Polynesia, Hawaii.

Key to subgenera of genus **Dasyatis**.

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

*Key to the species.*

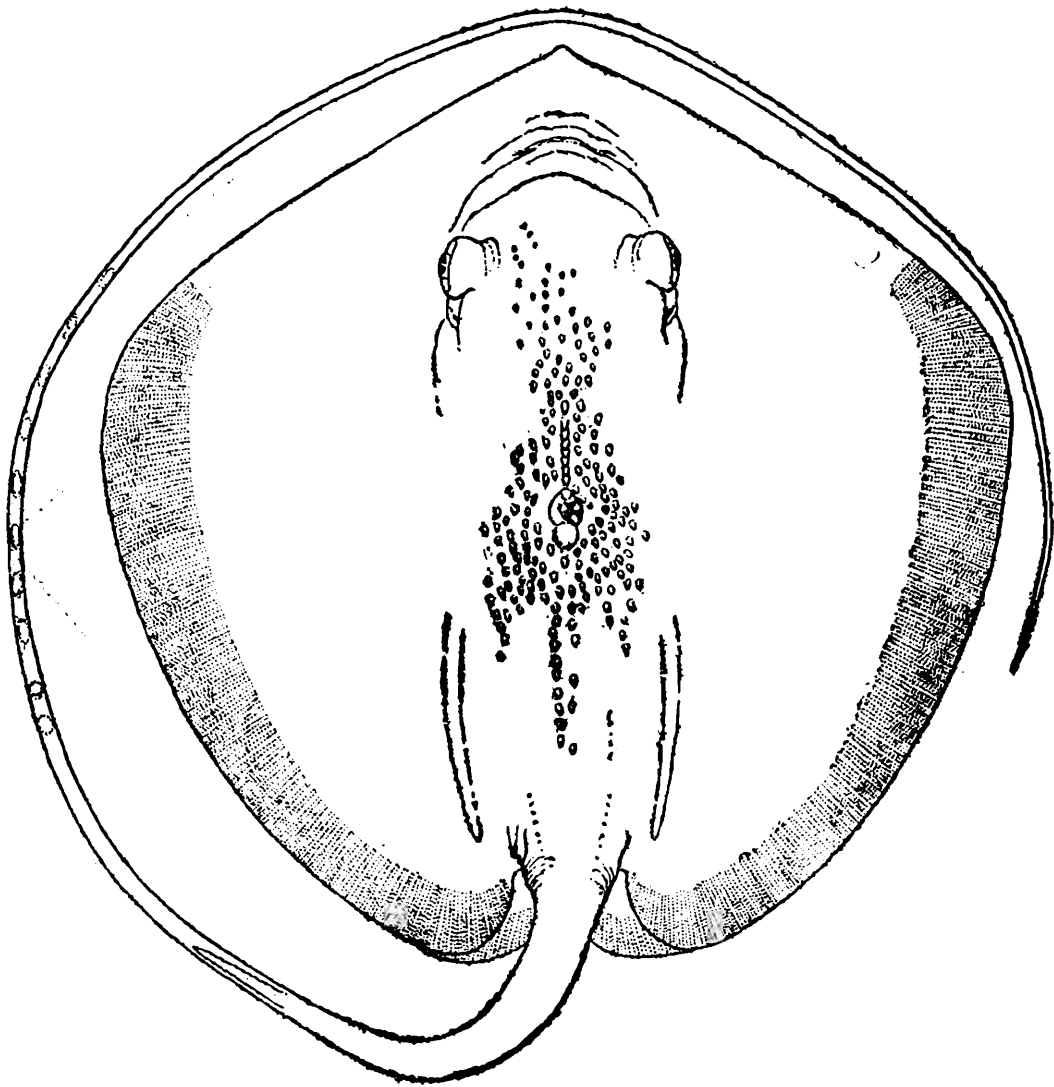
- |  |   |
|--|---|
| 1. Tail with cutaneous folds .. .. .                       | 3.                                      |
| 2. Tail without cutaneous folds .. .. .                    | 17.                                     |
| 3. With either dorsal or ventral cutaneous fold on tail .. | 5.                                      |
| 4. With dorsal and ventral cutaneous folds on tail ..      | 9.                                      |
| 5. With a ventral cutaneous fold on tail .. .. .           | 7.                                      |
| 6. With a dorsal cutaneous fold on tail .. .. .            | <i>D. (Dasyatis) pastinaca</i><br>(L.). |



TEXT-FIG. 16.—*a.* Dorsal view of *Dasyatis* (*Amphotistius*) *kuhlii* (after Day); *b.* Dorsal view of *Gymnura* (*Aetoplatea*) *tentaculata* (after Annandale); *c.* Dorsal view of *Gymnura* (*Gymnura*) *poecilura*; *d.* Ventral view of head of same (after Day).

- |  |  |
|--|--|
| 7. Cutaneous fold on tail well developed (broad and 4 times the length of caudal spine) .. .. .  | <i>D. (Pastinachus) sephen</i><br>(Forsk.).                  |
| 8. Cutaneous fold on tail not well developed (narrow and about as long as caudal spine). .. .. . | <i>D. (Pastinachus) bennetti</i><br>(M.H.). (text-fig. 14b). |
| 9. With 2-4 buccal processes .. .. .   | 11.  |
| 10. Without buccal processes .. .. .   | <i>D. (Amphotistius) zugei</i><br>(M. H.).                   |

- |  |    |  |
|--|----|--|
| 11. With 4 buccal processes .. ..                  | .. | <i>D. (Amphotistius) jenkinsii</i> (Ann.).               |
| 12. With 2 buccal processes ..                     |    | 13.  |
| 13. Tail short, scarcely as long as length of disk |    | <i>D. (Amphotistius) imbricata</i> (Sehn.).              |
| 14. Tail long, exceeding the length of disk ..     | .. | 15.  |
| 15. Without ocelli on dorsal surface of disk       | .. | <i>D. (Amphotistius) marginatus</i> (Blyth).             |
| 16. Blue ocelli on dorsal surface of disk ..       | .. | <i>D. (Amphotistius) kuhlii</i> (M. H.) (text-fig. 16a). |



TEXT-FIG. 17.—Dorsal view of *Dasyatis (Himantura) uarnak* : X  $\frac{1}{2}$ .

- |  |    |   |
|--|----|---|
| 17. With 2 buccal processes ..                   | .. | 19.                                     |
| 18. With 4 buccal processes                      |    | 21.                                     |
| 19. Tail more than 3 times the length of disk .. |    | <i>D. (Himantura) bleekeri</i> (Blyth). |
| 20. Tail less than twice the length of disk ..   |    | <i>D. (Himantura) favius</i> (Ann.).    |
| 21. Tail short, nearly as long as length of disk |    | <i>D. (Himantura) microps</i> (Ann.).   |

22. Tail long, exceeding the length of disk .. 23.
23. Tail banded .. .. 25.
24. Tail not banded .. .. *D. (Himantura) alcocki*  
(Ann.).
25. Teeth 25-38 rows in both jaws .. .. *D. (Himantura) uarnak*  
(Forsk.) (text-fig. 17).
26. Teeth 13 rows in upper and 23 in lower jaw .. .. *D. (Himantura) gerrardi*  
(Gray).

#### Genus *Urogymnus* M. H.

Disk subcircular and profusely tuberculated. Tail feeble, about as long as disk length; without caudal spine. Nasoral grooves rudimentary; cirri present. Rostral cartilage absent. Spiracles large, close behind eyes. 5 pairs of gill-openings on the ventral side. Rayed dorsal fins absent. Rayed portion of the pectoral fins united anteriorly. Anal fin absent. Teeth tessellated, flattened, rhomboid.

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

*Urogymnus africana* (Schn.), text-fig., 18a, is found in India and Ceylon.

#### Genus *Gymnura* Kuhl.

Disk much wider than long. Tail short, slender, with serrated spine. Rostral cartilage absent. Nasoral grooves present. Spiracles large, close behind eyes. 5 pairs gill-openings on the ventral side. Rayed dorsal fins absent. Rayed portion of the pectoral fins united anteriorly. Anal fin absent. Teeth, minute, numerous, in broad bands, each tooth with one to three cusps.

*Distribution.*—S. Africa Natal, Red Sea, India, Ceylon, Burma, Singapore, Malay Archipelago, Siam, China, Japan, Korea, Philippines, Australia, Polynesia.

#### *Key to subgenera of genus Gymnura* Kuhl.

1. A small dorsal cutaneous fold on tail .. .. Subgenus **Aetoplatea**  
M. H.
2. No dorsal cutaneous fold on tail .. .. Subgenus **Gymnura** Kuhl.

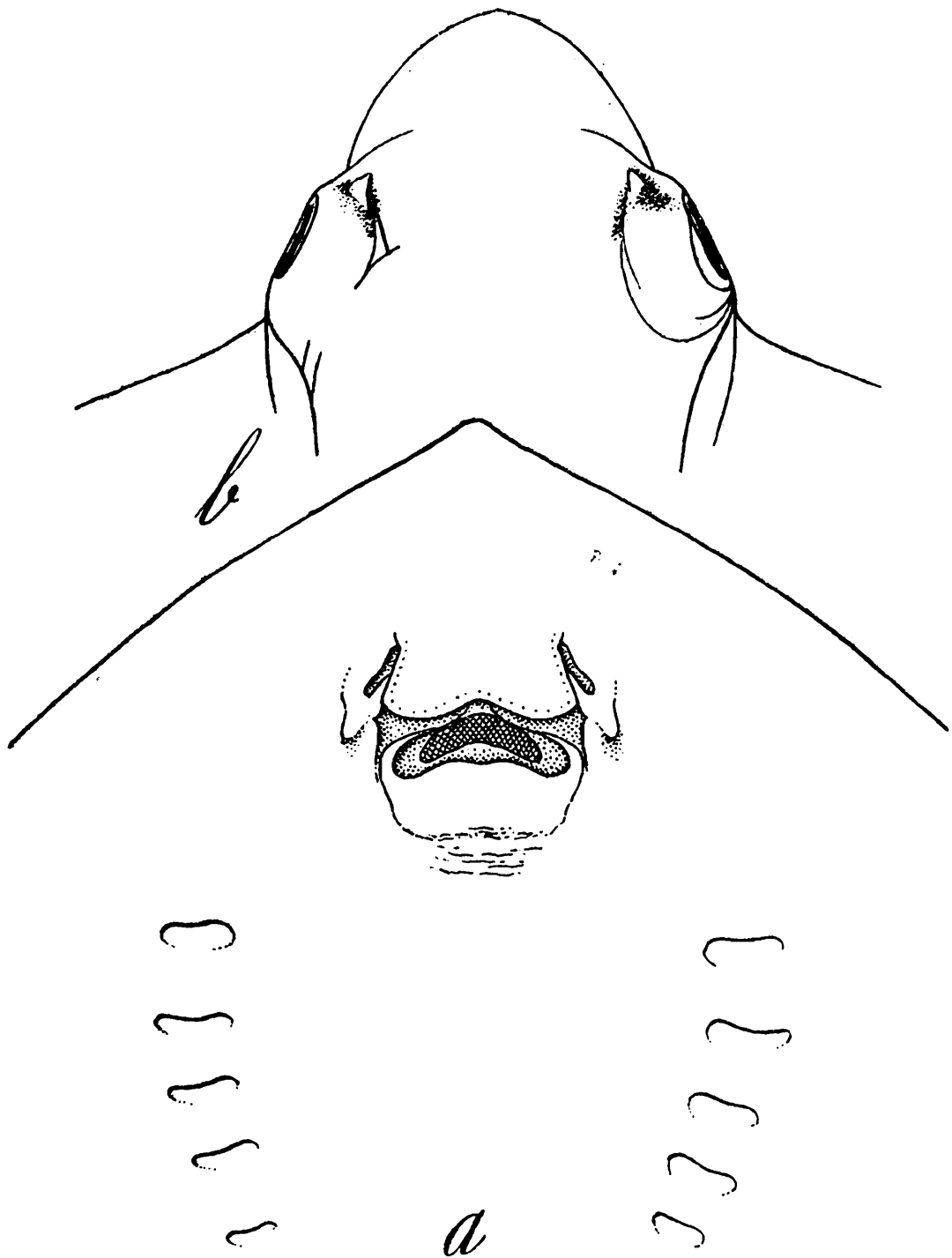
#### *Key to the species.*

1. A small dorsal cutaneous fold on tail .. .. 3.
2. No dorsal cutaneous fold on tail .. .. 5.
3. Tentacles behind spiracles .. .. *G. (Aetoplatea) tentaculata*  
M. H. (text-fig. 16b).
4. No tentacles behind spiracles .. .. *G. (Aetoplatea) zonurus*  
Blkr.
5. Tail about as long as length of disk .. .. *G. (Gymnura) peocilura*  
(Shaw) (text-fig 16c-d).
6. Tail less than half the length of disk .. .. *G. (Gymnura) micrura*  
(Schn.).

## Family MYLIOBATIDAE.

## Key to genera of family MYLIOBATIDAE.

1. Teeth on several rows of which the lateral ones are narrower than the central : caudal spine absent .. Genus **Aetomylaeus** Garman.



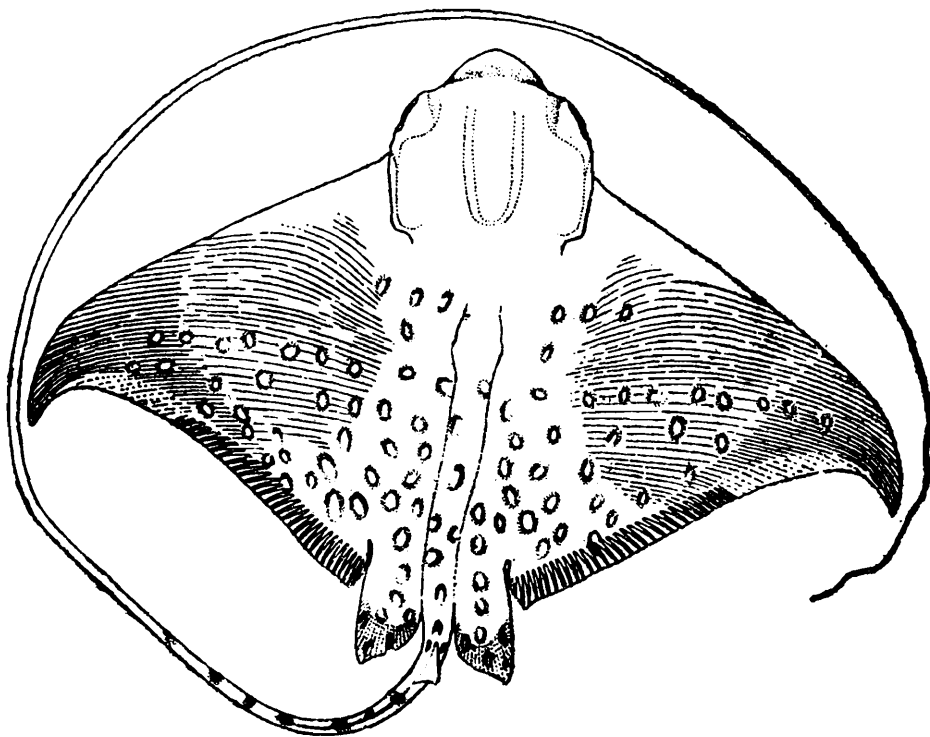
TEXT-FIG. 18.—*a*. Ventral view of head of *Urogymnus africana* :  $X \frac{2}{5}$  ; *b*. Dorsal view of head of *Aetomylaeus nichofii cornifera* (after Annandale).

2. Teeth in single broad series : caudal spine present .. Genus **Aetobatus** Blainville.

Genus **Aetomylaeus** Garman.

Disk lozenge-shaped about twice as broad as long. Tail whip-like, much longer than disk and without caudal spine. Head moderately conspicuous, rostral fins forming a unilobed snout. Eyes lateral. Nasoral grooves present. Spiracles large, behind eyes. 5 pairs of gill-openings on the ventral side. First dorsal fin small, situated at basal part of tail; the second dorsal and anal fins absent. Rayed portion of the pectorals, falciform and extending only upto the posterior region of the orbit. Teeth in 3 rows of which the lateral narrower than the central ones.

*Distribution.*—Red Sea, India, Ceylon, Burma, Malay Peninsula, Malay Archipelago, Siam, Cochin-China, China, Japan, Philippines, Australia.



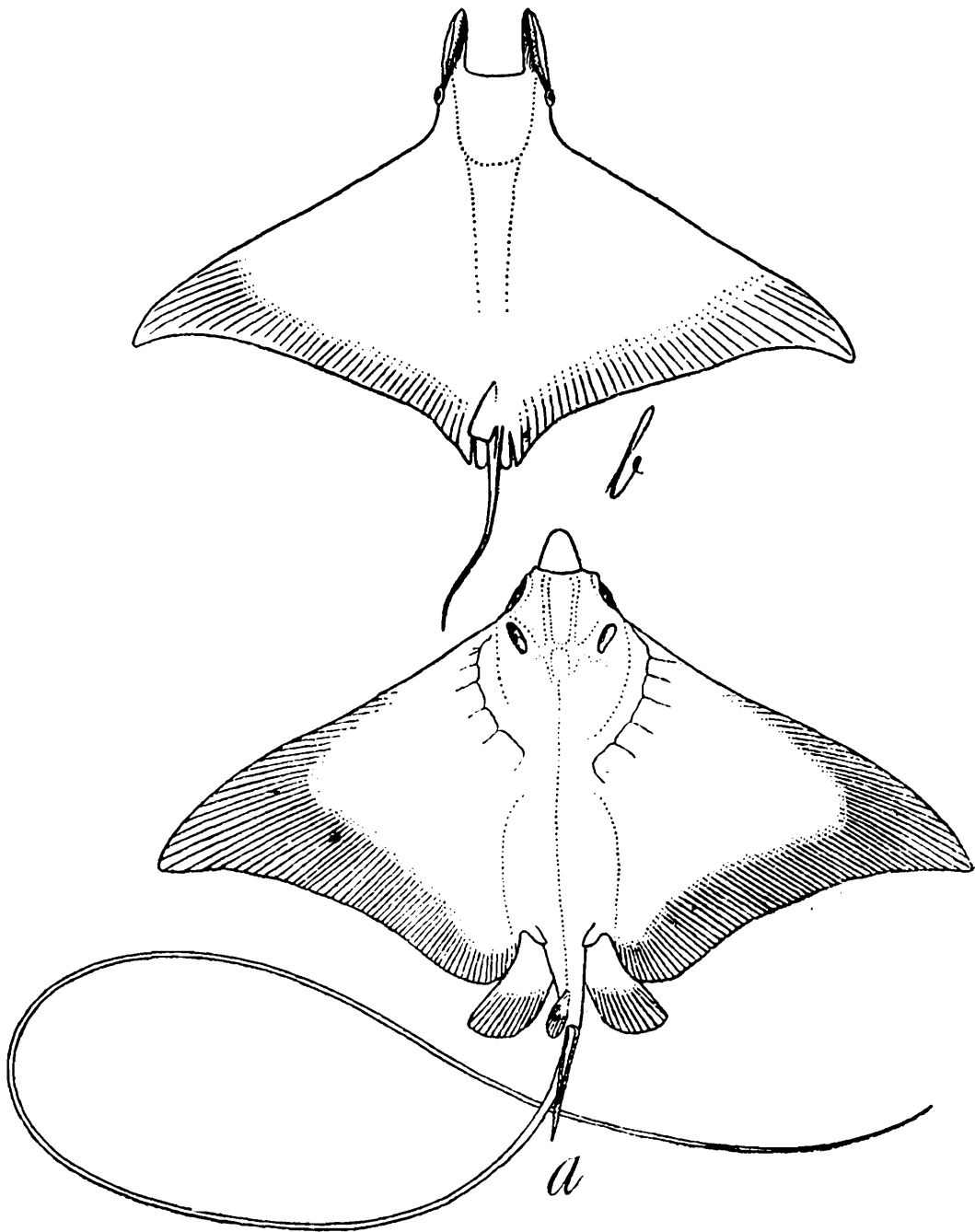
TEXT-FIG. 19.—Dorsal view of *Aetomylaeus milvus*: X  $\frac{7}{8}$ .

*Key to the species.*

- |  |   |
|--|---|
| 1. Origin of dorsal fin behind ends of pelvic bases  | <i>A. maculatus</i> (Gray).                             |
| 2. Origin of dorsal fin opposite ends of pelvic bases                                      | 3.  |
| 3. Orbital horns present   | <i>A. nichofii cornifera</i><br>(Ann.) (text-fig. 18b). |
| 4. Orbital horns absent .. .. .  | 5.  |
| 5. About 5 blue cross bands on hind part of disk : spiracles twice eye                     | <i>A. nichofii</i> (Schn.).                             |
| 6. Green brown-edged ocelli on hind part of disk : spiracles about the size of eye .. .. . | <i>A. milvus</i> (M.H.) (text-fig. 19).                 |

Genus *Aetobatus* Blainville.

Disk lozenge-shaped about twice as broad as long. Tail whip-like, larger than the length of the disk and with a serrated caudal spine. Head conspicuous, rostral fins forming a unilobed pointed snout. Eyes lateral. Nasoral grooves present. Spiracles large about twice eye diameter and laterally situated about an eye-diameter and a half behind eyes. 5 pairs of gill-openings on the ventral side. First dorsal fin small, situated at basal part of tail; second dorsal and anal fins absent. Rayed portion of the pectorals falciform extending upto the anterior margin of the spiracles. Teeth in a single row.



TEXT-FIG. 20.—*a*. Dorsal view of *Aetobatus narinari* (after Day); *b*. Dorsal view of *Mobula diabolus* (after Day).

*Distribution*.—Tropical Atlantic Ocean, Natal, Red Sea, Arabia, Seychelles, India, Ceylon, Burma, Malay Peninsula, Malay Archipelago, Siam, Cochin-China, China, Philippines, Melanesia, Polynesia, Micronesia, Hawaiian groups.



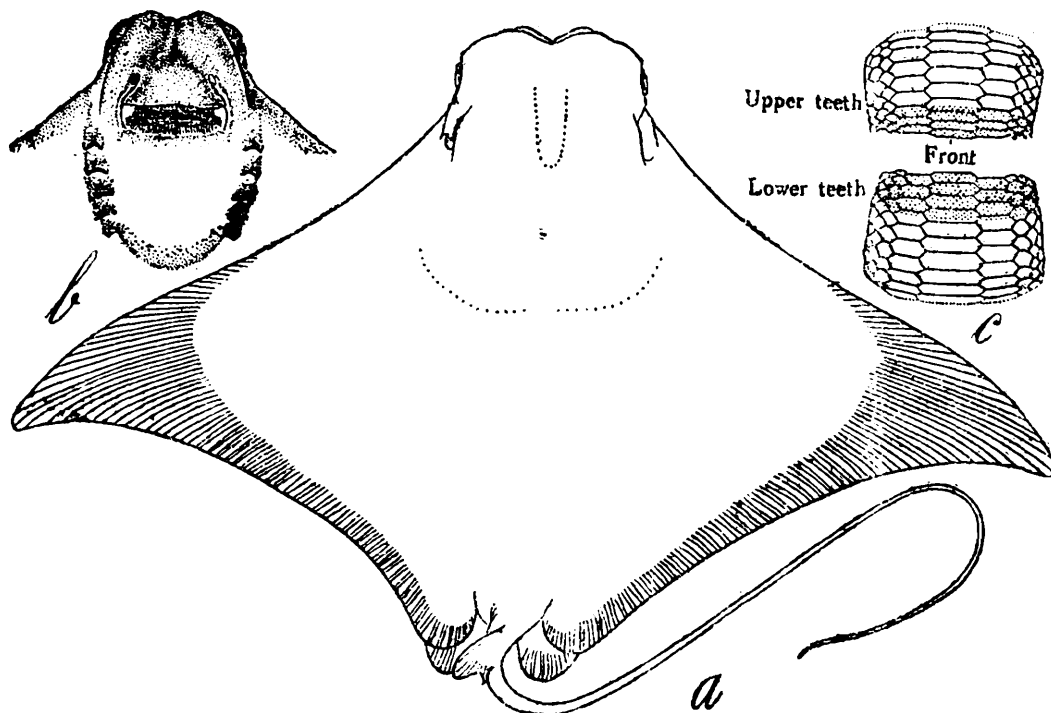
*Aetobatus narinari* (Euphrasen), text-fig. 20a, is the only species of the genus found in India, Burma and Ceylon.

### Family RHINOPTERIDAE.

#### Genus *Rhinoptera* C.

Disk lozenge-shaped about twice as broad as long. Tail whip-like, longer than disk, with basal serrated spine. Head somewhat conspicuous, rostral fins forming a bilobed snout. Eyes prominent, lateral. Nasorial grooves present. Spiracles large, behind eyes, open laterally. 5 pairs of gill-openings on ventral side. First dorsal fin above basal part of the tail. Second dorsal and anal fins absent. Rayed portion of the pectorals falciform and not joined with the rostral fins in the front. Teeth wide, angular, flat, in pavement, median row widest.

*Distribution.*—Mediterranean, Africa, Arabian Sea, Muscat, India, Ceylon, Malay Peninsula, Java, Siam, China, Philippines, Australia, Brazil, Lower California.



TEXT-FIG. 21.—a. Dorsal view of *Rhinoptera sewelli*; b. Ventral view of head of same; c. Dentition of same (after Misra).

#### *Key to the species.*

- |  |   |
|--|---|
| 1. Teeth in 9 rows in upper jaw .. ..                | 3.  |
| 2. Teeth in 7 rows in upper jaw .. ..                | <i>R. javanica</i> M. H.                        |
| 3. Teeth in 9 rows in lower jaw .. ..                | .. <i>R. sewelli</i> Misra. text, fig. 21 a-c). |
| 4. Teeth in 7 rows in lower jaw .. ..                | 5.  |
| 5. Teeth in median row 8 times as wide as long .. .. | <i>R. jayakari</i> Blgr.                        |
| 6. Teeth in median row 3 times as wide as long .. .. | <i>R. adpersa</i> M H.                          |

## Family MOBULIDÆ.

*Key to genera of family MOBULIDÆ.*

1. Mouth inferior well behind the head : dental plate in both jaws or at least in the upper jaw : cephalic horns curled .. .. . Genus **Mobula** Rafinesque.
2. Mouth terminal in front of head : dental plate usually on lower jaw and sometimes in both jaws : cephalic horns rarely curled .. .. . Genus **Manta** Bancroft.

Genus **Mobula** Rafinesque.

Disk, lozenge-shaped about twice as broad as long. Tail short whip-like, in the young  $1\frac{1}{2}$  times the length of the disk, and in the adults a little more than half the disk length ; with or without serrated spine. Head conspicuous, broad and flat with two, curled, cephalic horns. Mouth inferior, well behind the head, Eyes large, lateral. Nasoral grooves present. Spiracles moderate, behind eyes. 5 pairs of gill-openings on the ventral side. First dorsal fin small, triangular above and between pelvics. Second dorsal and anal fins absent. Rayed portion of the pectorals falciform extending upto the postorbital region. Teeth small, numerous in both jaws or at least in the upper jaw.

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

*Mobula diabolus* (Shaw), text-fig. 20*b*, is the only species of the genus found in India and Ceylon.

Genus **Manta** Bancroft.

Disk lozenge-shaped about twice as broad as long. Tail whip-like about as long as disk length ; without serrated caudal spine. Head greatly depressed, broad and flat with two cephalic horns, rarely curled. Mouth large, terminal in front of head. Eyes prominent, lateral. Nasoral grooves present. Spiracles moderate, behind eyes. 5 pairs of gill-openings on ventral side. First dorsal fin small, above and between pelvics. Second dorsal and anal fins absent. Rayed portion of pectorals falciform extending upto the postorbital region. Teeth small, numerous, in pavement usually on lower jaw and sometimes on both jaws.

*Distribution*.—Atlantic Ocean, S. Africa, Red Sea, India, Malay Peninsula, Malay Archipelago, Melanesia, N. and S. America, Galapagos Islands, West Indies.

*Manta birostris* (Walbaum), is the only species of the genus found in India.

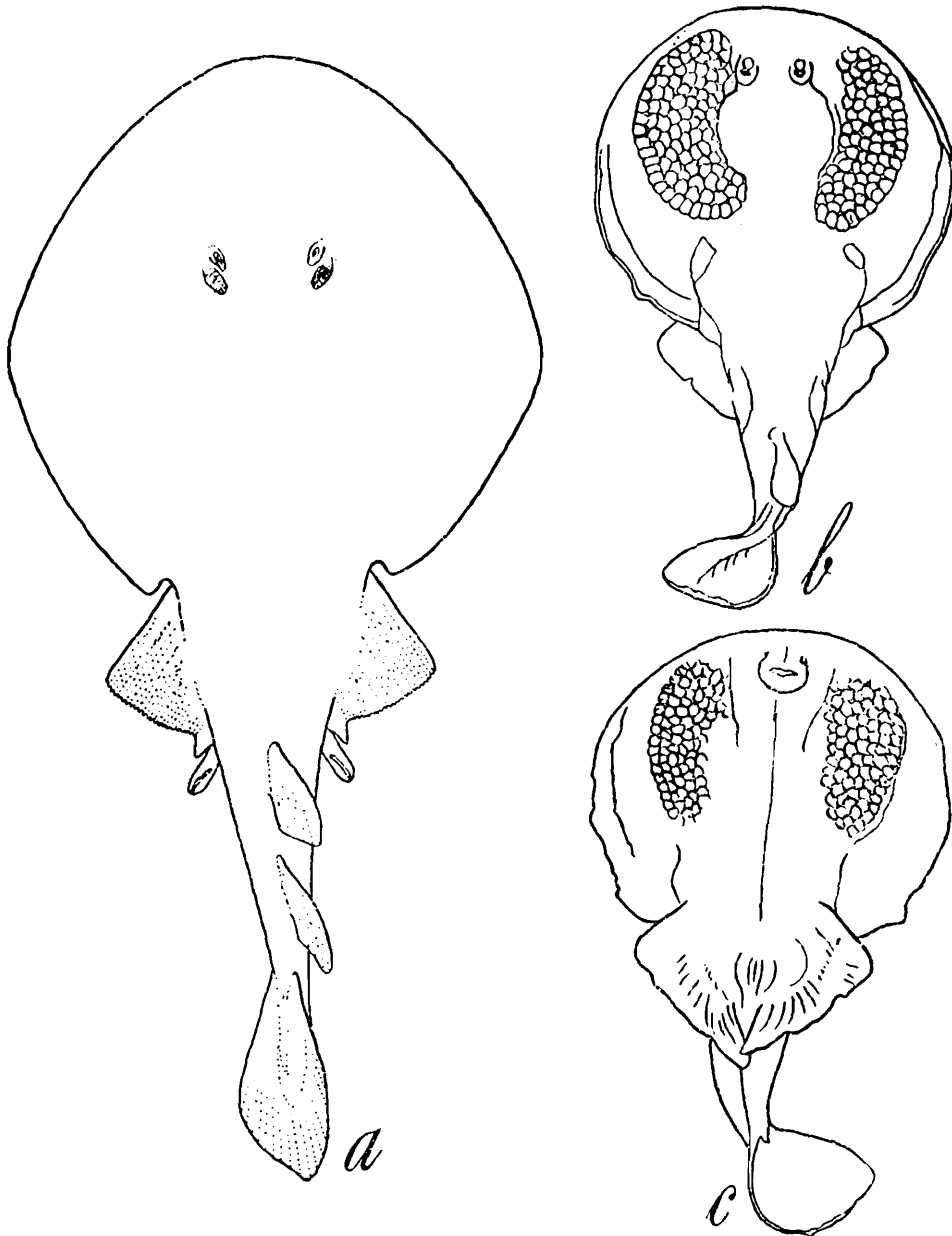
## Order TORPEDINIFORMES.

## Family TORPEDINIDÆ.

*Key to genera of family TORPEDINIDÆ.*

1. Two dorsal fins .. .. . 5.
2. One dorsal fin .. .. . 3.

- |   |                                    |
|---|------------------------------------|
| 3. Pectorals, pelvics and eyes poorly developed         | .. Genus <b>Bengalichthys</b> Ann. |
| 4. Pectorals, pelvics and eyes well developed           | .. Genus <b>Narke</b> Kaup.        |
| 5. Origin of first dorsal fin opposite pelvics          | .. 7.                              |
| 6. Origin of first dorsal fin distinctly behind pelvics | .. Genus <b>Narcine</b> Henle.     |
| 7. Disk elongate : eyes rudimentary                     | .. Genus <b>Benthobatis</b> Alc.   |
| 8. Disk broad and subcircular : eyes well developed     | Genus <b>Torpedo</b> Houttuyn.     |



TEXT-FIG. 22.—a. Dorsal view of *Narcine brunnea* : X  $\frac{2}{3}$  ; b. Dorsal view of *Narke cipterygia* ; c. Ventral view of same (after Prashad).

#### Genus **Narcine** Henle.

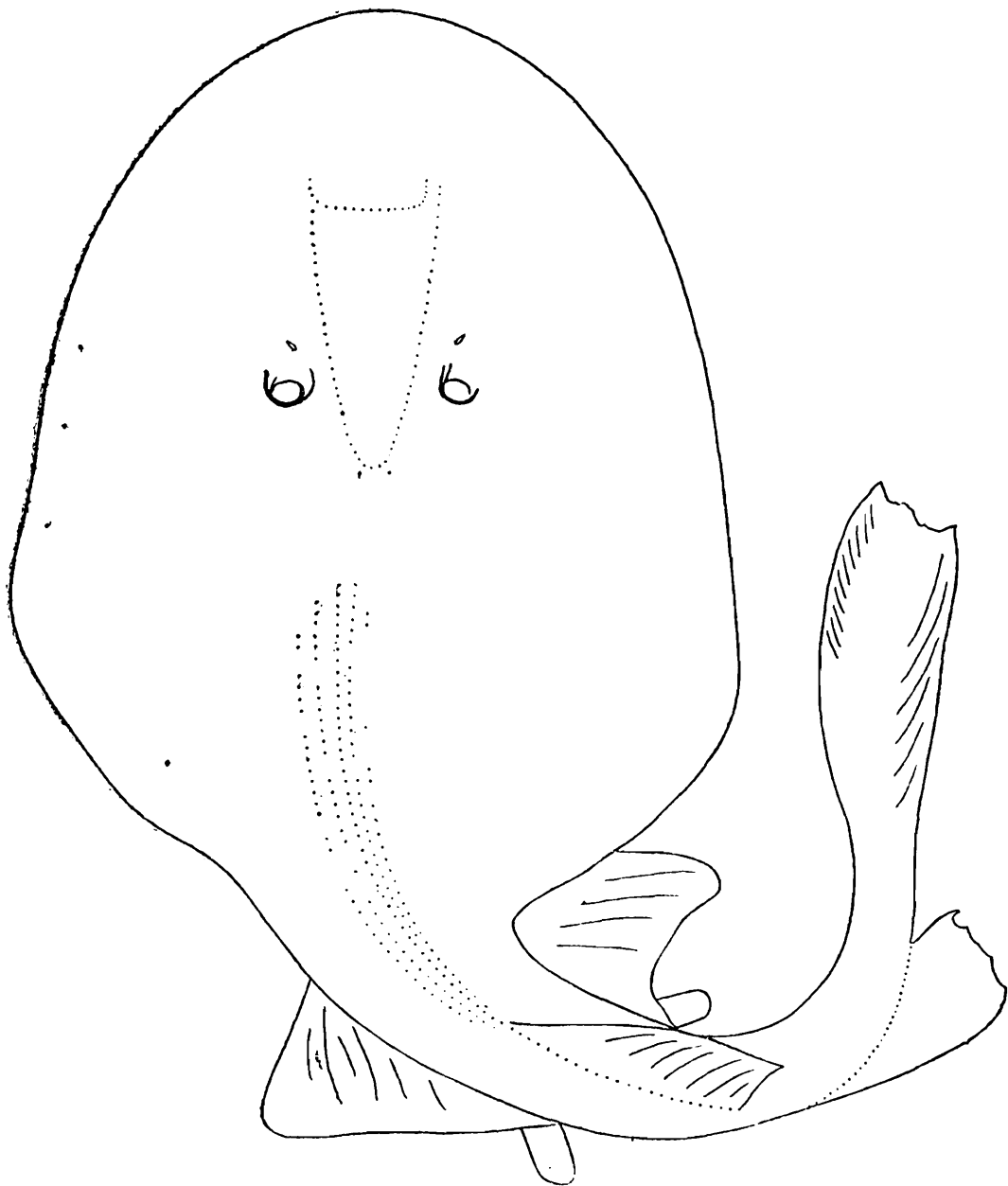
Disk subcircular with head not distinct from it. Tail with lateral folds, slightly shorter than the length of disk and without serrated caudal spine. Snout broadly rounded, twice the interorbital distance. Rostral cartilage present. Nasoral grooves present. Spiracles large, situated

close behind the small eyes. 5 pairs of gill-openings on the ventral side between the electric organs. Two spineless dorsal fins on tail. Anal absent. Pelvics well developed. The rayed portion of the pectorals continued to the orbital region. Teeth in narrow bands.

*Distribution.*—India, Ceylon, Malay Archipelago, China, Japan, Philippines, Australia, Tasmania.

*Key to the species.*

- |  |  |   |  |
|--|--|---|--|
| 1. Brown-spotted above                                   |  | 3.                                      |  |
| 2. Uniform brown above .. ..                             |  | <i>N. brunnea</i> Ann. (text-fig. 22a.) |  |
| 3. Teeth in 27 rows in upper jaw and 26 in the lower jaw |  | <i>N. indica</i> Henle.                 |  |
| 4. Teeth in 23 in upper jaw and 21 in the lower jaw      |  | <i>N. timlei</i> (Schn.).               |  |



TEXT-FIG. 23.— Dorsal view of *Benthobatis moresbyi* (after Alcock).

Genus **Benthobatis** Alc.

Disk oval with head not distinct from it. Tail without lateral folds, slightly longer than disk length and without serrated caudal spine. Snout

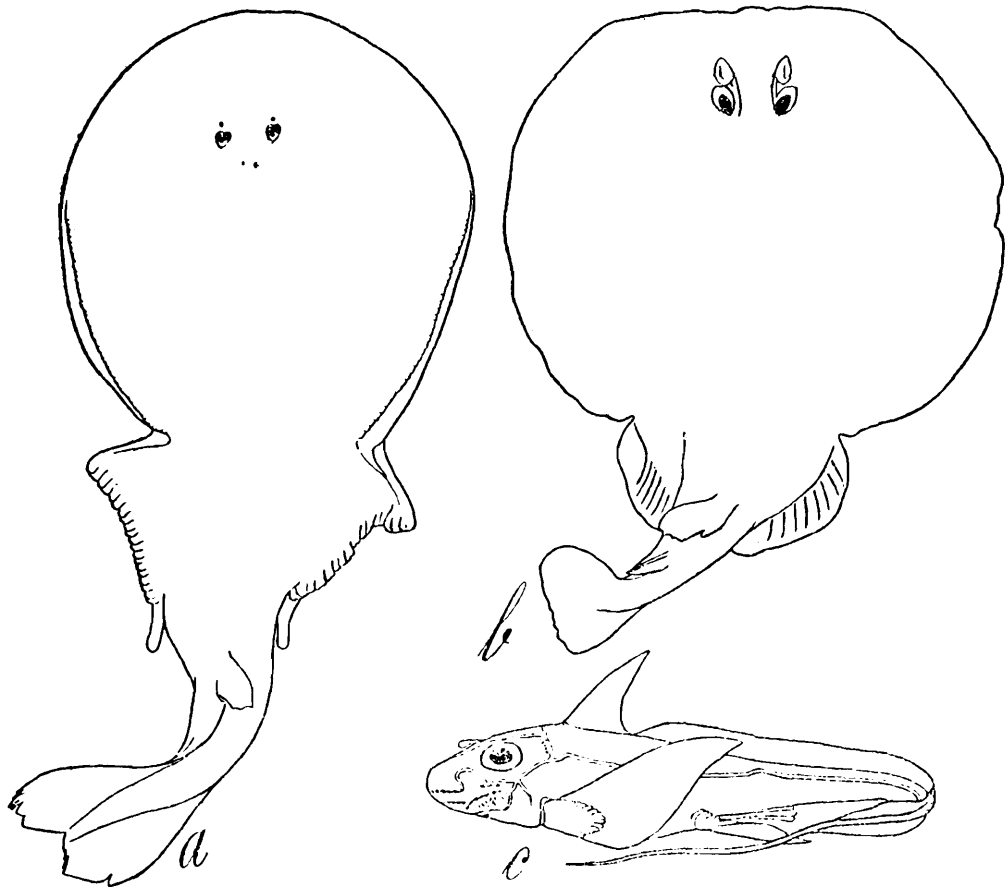
broadly rounded, about twice the interorbital distance. Rostral cartilage present. Nasoral grooves present. Eyes obsolete, as two unpigmented spots. Spiracles moderate, close behind the eye spots. 5 pairs of large gill-openings on the ventral side between the electric organs. Two spineless dorsal fins on tail. Pelvics well developed. The rayed portion of the pectorals extends only to the orbital region. Anal fin absent. Teeth small as rhomboidal plate with the crown strongly and acutely produced.

*Distribution.*—Arabian Sea, India.

*Benthobatis moresbyi* Alc., text-fig. 23, is found in India.

#### Genus *Torpedo* Houttuyn.

Disk widely circular with head not distinct from it. Tail very short with lateral folds and without serrated caudal spine. Snout broadly rounded and equal to interorbital distance. Rostral cartilage present, but reduced. Nasoral grooves present. Eyes well developed. Spiracles moderate, close behind eyes. 5 pairs of gill-openings on the ventral side between the electric organs. Two spineless dorsal fins on tail. Pelvics well developed. The rayed portion of the pectorals extends to the orbital region. Anal fin absent. Teeth small, in pavement, irregularly rhomboidal with the crown obliquely pointed.



TEXT-FIG. 24.—a. Dorsal view of *Bengalichthys impennis*: X  $\frac{1}{4}$ ; b. Dorsal view of *Torpedo marmorata* (after Annandale); c. Lateral view of *Chimaera monstrosa* (after Boulenger).

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

*Key to the species.*

- |   |    |   |
|---|----|---|
| 1. Body speckled with small, light blotches : teeth in 18 rows                          | .. | T. <i>marmoratus</i> Risso<br>(text-fig 24b). |
| 2. Body variably speckled with irregular large and small, dark spots : teeth in 20 rows | .. | T. <i>sinus-persici</i> Olfers.               |

Genus **Narke** Kaup.

Disk circular with head not distinct from it. Tail slightly shorter than the disk length, with lateral folds and without serrated caudal spine. Snout broadly rounded and about one and a quarter times the interorbital distance. Rostral cartilage present, but reduced. Nasoral grooves present. Spiracles large, close behind eyes. 5 pairs of gill-openings on the ventral side. One spineless dorsal fin. Pelvic and pectoral fins well developed. The rayed portion of the pectorals extends to the orbital region. Anal fin absent. Teeth in narrow band, small, quadrangular, with the crown not strongly produced.

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

*Narke dipterygia* (Schn.), text-fig. 22b-c, is found in India and Ceylon.

Genus **Bengalichthys** Ann.

Disk oblong. Tail slightly shorter than the disk length, with lateral folds and without serrated caudal spine. Snout broadly rounded and one and a quarter times in the interorbital distance. Rostral cartilage present, but reduced. Nasoral grooves present. Eyes minute. Spiracles moderate, close behind eyes. 5 pairs of small gill-openings between the electric organs. One spineless dorsal fin. Pectoral and pelvic fins not well developed. The rayed portion of the pectorals extends only up to the orbital region. Anal fin absent. Teeth roughly quadrangular, small, with the crown not much produced.

*Distribution.*—India.

*Bengalichthys impennis* Ann., text-fig. 24a, is found in India.

## Class HOLOCEPHALI.

## Subclass CHIMAERAE.

## Order CHIMAERIFORMES.

*Key to families of order CHIMAERIFORMES.*

- |   |                          |
|---|--------------------------|
| 1. Claspers simple : with proboscis or beak           | Family RHINOCHIMAERIDAE. |
| 2. Claspers trifid or bifid without proboscis or beak | Family CHIMAERIDAE.      |

## Family CHIMAERIDAE.

Genus **Chimaera** L.

Body elongate and shark-like in form tapering posteriorly to a point at tail. Head large, compressed and without proboscis or beak. Eyes large or moderate, lateral. Mouth inferior. Nasoral grooves present. Spiracles absent. One gill-opening on either side of pharynx containing four gill-slits and four gills covered over by a skinny operculum. Two dorsal fins, the first dorsal with a strong spine anteriorly; the second dorsal long and low. Pectorals large, free and low. Pelvics abdominal, many rayed. Anal fin small, distinct or not distinct from subcaudal. Mature males with trifold or rarely bifid claspers. Skin naked, devoid of placoid scales. Teeth united to form bony plates, laminae or tritors; 4 tritors in the upper jaw; 2 tritors in lower jaw.

*Distribution.*—S. Africa, India, Sumatra, China, Korea, Japan, Philippines, Australia, Hawaiian groups, North and middle Atlantic Ocean.

*Chimaera monstrosa* L., text-fig. 24c, is the only species of the genus found in India.

## Family RHINOCHIMAERIDAE.

*Key to genera of family RHINOCHIMAERIDAE.*

1. Snout compressed: upper caudal edge spinose egg-capsule black, patch of byssus large (14.0 sq. mm.) .. Genus **Rhinochimaera** Garman.
2. Snout depressed: upper caudal edge not spinose: egg-capsule, pale bottle-green, patch of byssus small (7.5 sq. mm.) .. Genus **Harriotta** G. B.

Genus **Harriotta** G. B.

Body elongate tapering to a long tail with a filamentous tip. Head with long rostral proboscis. Snout depressed. Eyes moderate, lateral. Mouth inferior. Spiracles absent. One gill-opening on either side of pharynx, containing four gill-slits and four gills covered over by a skinny operculum. Two dorsal fins with a spine anteriorly; second dorsal low. Pectorals large, free. Anal small and distinct from subcaudal. Supra-caudal moderately high, upper edge without spines. Mature male with a simple clasper. Teeth with tritors.

*Distribution.*—Gulf of Aden, Bay of Bengal, Japan, Atlantic Ocean.

*Harriotta* (?) *indica* (Garman), is the only species of the genus found in India.

Genus **Rhinochimaera** Garman.

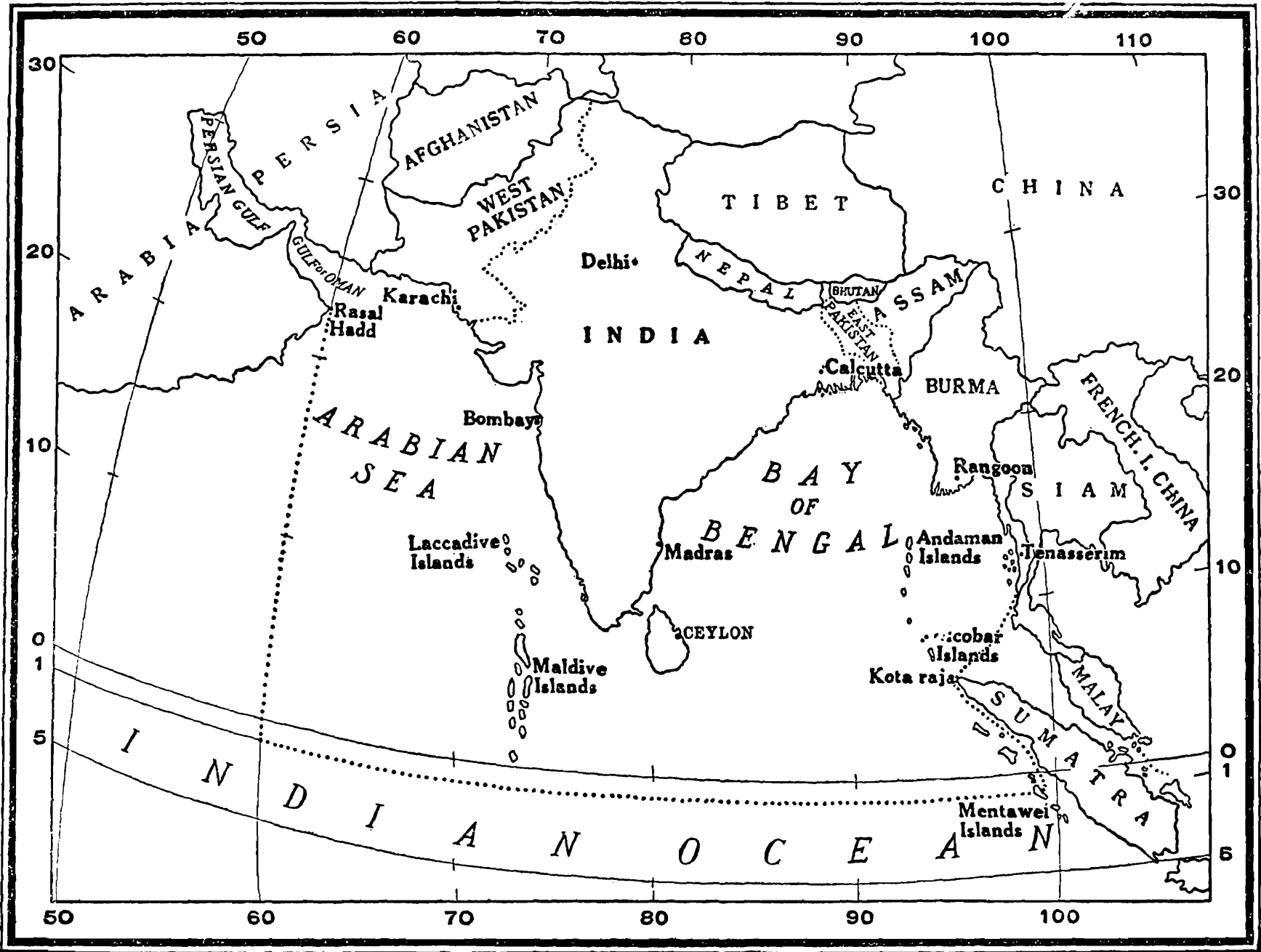
Body elongate tapering posteriorly to the long tail with a filamentous tip. Head with long rostral proboscis. Snout compressed. Eyes moderate. Mouth inferior. Spiracles absent. One gill-opening on either side of pharynx containing four gill-slits and four gills covered over by a skinny operculum. Two dorsal fins; first dorsal with spine

anteriorly; second dorsal low. Pectorals large, free. Anal small not distinct from subcaudal. Supracaudal low, upper edge armed with spines. Mature male with a simple clasper. Teeth united to form grinding plate.

*Distribution.*—India, Japan.

*Rhinochimaera* sp. has been recorded from Arabian Sea, off Travancore Coast.





TEXT-FIG. 25.—Map demarcating the boundaries of India, Burma and Ceylon by dotted line for marine fishes.