

KEY TO FAMILIES OF LIVING RAYS

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Some ray families (e.g. skates) can be difficult to distinguish based solely on external features. Skeletal characters, particularly details of the claspers, are very important in defining groups but these are usually too complex for general use. However, the key below incorporates at least some technical characters needed to distinguish genera (see figures and the Glossary for further explanation).

1. Posterior margin of pectoral fin well separated from anterior margin of pelvic fin (fig. 1); dorsal fins large and strongly falcate in adults (fig. 4); caudal fin with a long, narrow-based ventral lobe (fig. 3) or as short lobe (fig. 1) 2

Posterior margin of pectoral fin overlapping anterior margin of pelvic fin (fig. 14); dorsal fins, when present, rounded (fig. 5) or angular (fig. 6), but not strongly falcate; caudal fin usually without a distinct ventral lobe (when present, as a low, more or less elongated extension, figs 15, 16) 3

2. Snout modified into an elongate, flattened, saw-like blade with enlarged teeth along lateral margins (fig. 1); cosmopolitan (range reduced) **Pristidae** (5 species; fig. 1, p. 58)

Snout varying from short to relatively long and either broadly rounded (fig. 2) or acutely pointed (fig. 3); Indo-West Pacific and Eastern Atlantic **Rhinidae** (10 species; figs 2, 3, p. 65)

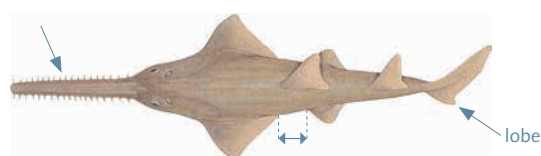


fig. 1



fig. 2



fig. 3



fig. 4
falcate



fig. 5
rounded

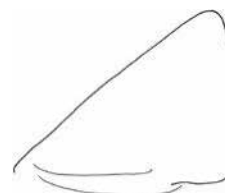


fig. 6
angular

dorsal-fin shapes

3. Body soft, entire disc nearly uniformly thick and rather flabby; large kidney-shaped electric organ on each side usually visible through the skin (fig. 7); body entirely naked (no denticles, thorns or caudal sting on dorsal surface of disc and tail) 4

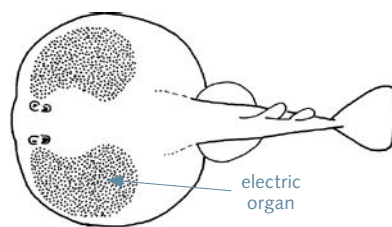


fig. 7

Body rather firm, disc variably thickened medially but progressively thinning toward margin (rarely flabby); no electric organs; denticles and usually thorns present on dorsal surface of disc and tail; caudal sting absent or present (fig. 51) 7

4. Mouth strongly arched with wide gape (fig. 8), without labial folds, grooves and/or cartilages at corners (fig. 8); 2 dorsal fins, first usually distinctly larger than second (fig. 16) 5

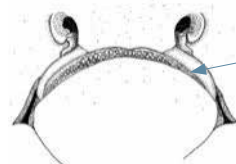


fig. 8



fig. 9

Mouth nearly transverse, with prominent labial folds, grooves and cartilages at its corners (fig. 9); 1 or 2 dorsal fins (occasionally absent); dorsal fins of similar size when 2 are present 6

5. Disc length considerably longer than tail length (fig. 14); pelvic fins extending along most of tail (fig. 14); dorsal and caudal fins about same size (fig. 14); Australia **Hypnidae** (1 species; fig. 14, p. 182)

Disc length about equal to or slightly longer than tail length (fig. 16); pelvic fins extending to about half or slightly more than half of tail length (fig. 16); caudal fin much larger than dorsal fins (fig. 16); cosmopolitan **Torpedinidae** (18 species; fig. 16, p. 184)

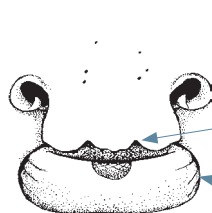


fig. 10

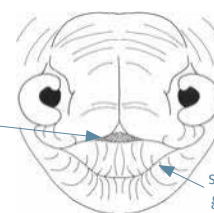


fig. 11

oronasal region

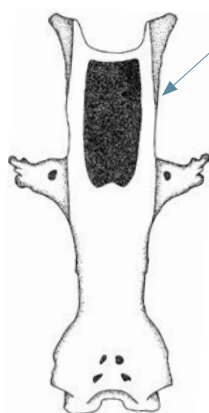


fig. 12

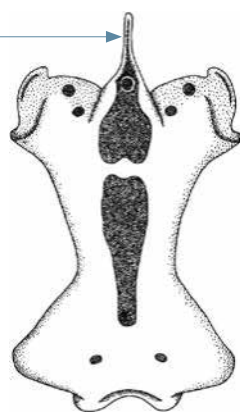


fig. 13

cartilages of cranium

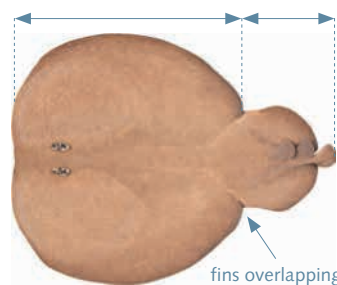


fig. 14

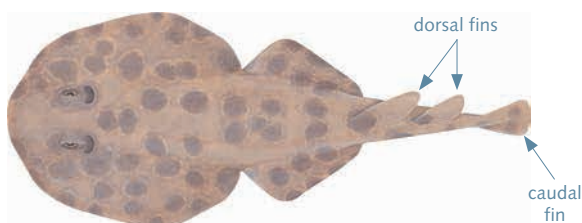


fig. 15

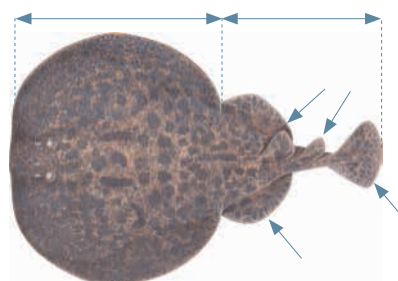


fig. 16

6. Rostral cartilage of snout broad, stiff and shovel-shaped (felt by flexing snout, fig. 12); mouth surrounded by deep groove (fig. 10); teeth mostly visible on outer surfaces of upper and lower jaws (fig. 10); 2 dorsal fins always present (fig. 15); Indo-West and Eastern Pacific and Western Atlantic **Narcinidae** (30 species; fig. 15, p. 137)

Rostral cartilage of snout narrow and rod-shaped (not felt when flexing snout, fig. 13); mouth surrounded by shallow groove (fig. 11); teeth of both jaws not extending onto outer surfaces of upper and lower jaws; tail with 1 or 2 dorsal fins (fig. 17), or fins absent; Indo-West Pacific and Eastern Atlantic **Narkidae** (9 species; fig. 17, p. 170)

7. Pelvic fins single lobed (fig. 18); adult males without a cluster of spiny alar thorns on each side of pectoral fins or disc 8

Pelvic fins moderately to strongly bilobate (except in *Pseudoraja* and *Gurgesiella*), with a narrow anterior lobe and much broader posterior lobe (fig. 19); males with a cluster of alar thorns on each side of disc (except in some species of *Notoraja*) (fig. 20) 23

8. Tail relatively stout, usually broad based and flattened ventrally (figs 21, 27–29); 2 large dorsal fins and a prominent caudal fin (fig. 21); no caudal sting on tail 9

Tail relatively slender, attenuated distally and barely flattened ventrally (figs 37, 48, 51); 1 rather small dorsal fin or none (fig. 37); a lobe-like caudal fin present and well developed (fig. 53), or absent (fig. 36) or rudimentary (fig. 62); caudal sting (figs 52–57) or remnant scar usually present on tail (no sting in some *Urogymnus*, *Aetomylaeus*, *Gymnura* and *Mobula*) 13



fig. 17

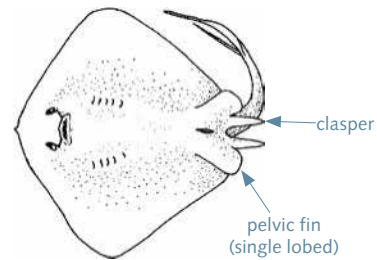


fig. 18

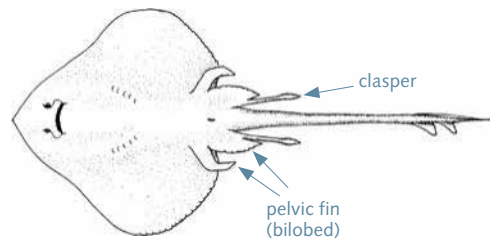


fig. 19

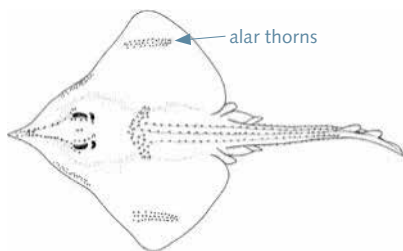


fig. 20

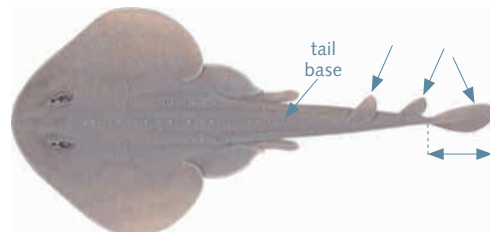


fig. 21

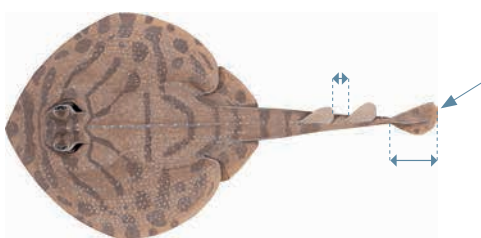


fig. 22

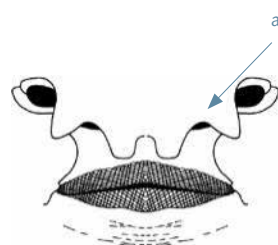


fig. 23

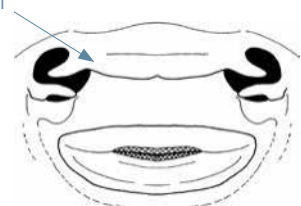


fig. 24

oronasal region

9. Disc broad and rounded, tail demarcated from disc (figs 21, 22); dorsal fins close together, first dorsal-fin origin usually about halfway between pelvic-fin insertion and caudal-fin origin (fig. 22); large and sharp thorns on head, shoulders and along mid-line of body (fig. 21) 10

Disc typically narrow and wedge-shaped, tail not demarcated from disc (figs 28, 29) (disc broadly rounded and tail slightly demarcated from disc in *Trygonorrhina* and *Zapteryx*, fig. 27); dorsal fins usually well separated (by base length of first dorsal fin or more) (fig. 27); first dorsal-fin origin much closer to pelvic-fin insertion than caudal-fin origin (fig. 27); thorns absent or small and blunt (fig. 27) 11

10. Nasal flaps moderately expanded medially, separated by distance greater than twice width of anterior nasal opening (fig. 23); tail much longer than precloacal length (fig. 25); caudal fin relatively elongate (fig. 21); North Pacific and Indian Ocean **Platyrrhinidae** (5 species; fig. 21, p. 127)

Nasal flaps expanded medially, nearly connected (fig. 24); tail about equal to or only slightly longer than precloacal length (fig. 26); caudal fin short and deep (fig. 22); Eastern Central Atlantic **Zanobatidae** (2 species; fig. 22, p. 134)

11. Nasal flaps joined medially to form broad quadrangular curtain (fig. 30), or if well separated (*Aptychotrema*) nostrils orientated almost horizontally and mouth and upper lip distinctly curved (fig. 31); Australia and Western Atlantic **Trygonorrhinidae** (8 species; fig. 27, p. 117)

Nasal flaps not forming a nasal curtain; nostrils relatively oblique and mouth and upper lip almost straight (figs 32, 33) 12

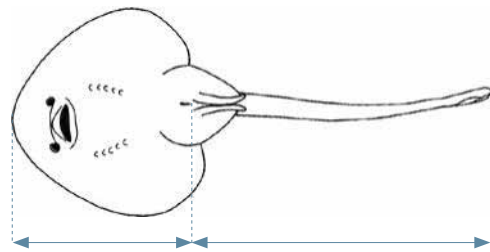


fig. 25

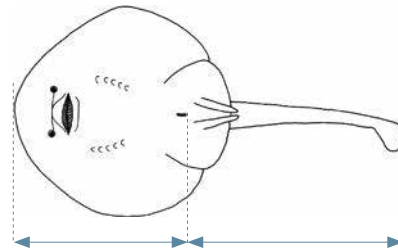


fig. 26

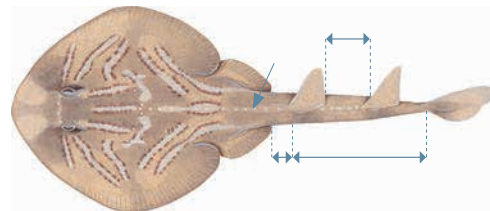


fig. 27

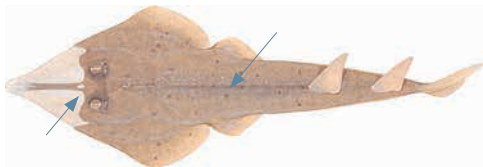


fig. 28

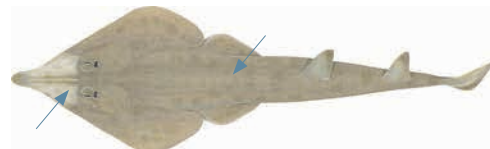


fig. 29

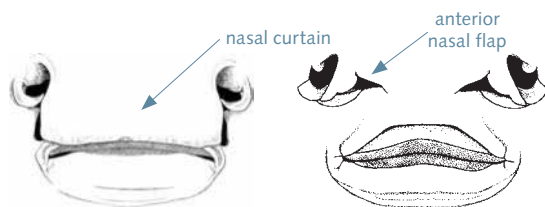


fig. 30

fig. 31

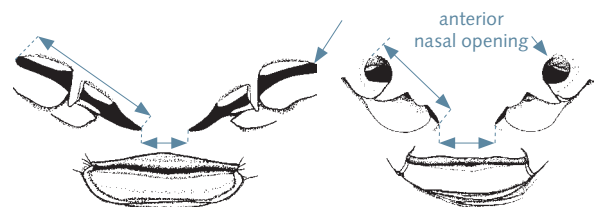


fig. 32

fig. 33

12. Nostrils long and narrow, length greatly exceeding internasal distance (fig. 32); anterior nasal opening rectangular (fig. 32); anterior cranium and base of rostral shaft dark and very sharply demarcated from rest of snout (much paler) (fig. 28); large to very large rays; Indo–West Pacific and Eastern Atlantic
 **Glaucostegidae** (6 species; fig. 28, p. 110)

Nostrils not greatly elongated, length usually moderately exceeding internasal distance (fig. 33); anterior nasal opening circular or oval (fig. 33); snout uniform in colour, or margins separating snout and cranial cartilages diffuse (not sharply demarcated) (fig. 29); small to large rays; cosmopolitan
 **Rhinobatidae** (31 species; fig. 29, p. 77)

13. Head relatively deep, raised from disc and sides demarcated laterally from disc by a deep notch (fig. 34); eyes lateral on head (fig. 34); anterior part of pectoral fins modified at snout tip into single (fig. 34) or paired rostral lobes (figs 36, 37); dorsal fin small, close to or over pelvic-fin bases (figs 36, 37) 14

Head not greatly thickened nor sides demarcated from disc by a deep notch (fig. 35); eyes dorsal or dorsolateral on head, distinctly inward of disc margin (fig. 35); no rostral lobes at snout tip (fig. 35); dorsal fin either absent or very small and usually positioned well behind pelvic-fin bases 17

14. Snout modified into a pair of elongated lobes on each side of head (fig. 36); mouth very broad and nasal curtain absent (fig. 38); jaws covered with very small cuspidate or hexagonal teeth (fig. 40); gills with filter plates
 **Mobulidae** (8 species; fig. 36, p. 741)

Snout formed as a single, convex, lobe-like process (figs 41, 42) or pair of lobes (fig. 39); mouth narrow and nasal curtain present (fig. 39); jaws with broad plate-like teeth (figs 43, 44); gills without filter plates 15

15. Snout with a pair of broad lobes separated by deep notch (fig. 39); forehead expanded anteriorly and overhanging rostral lobes, profile deeply concave when viewed from above (fig. 37); 3 medial rows of broad plate-like teeth in each jaw, with additional 2–5 rows of smaller hexagonal teeth on each side (fig. 43)
 **Rhinopteridae** (8 species; fig. 37, p. 732)

Snout with single, convex rostral lobe (figs 41, 42); forehead rounded and not expanded anteriorly or notched (figs 41, 42); single medial row of broad plate-like teeth in each jaw, with or without 3–5 additional rows of smaller hexagonal teeth on each side (fig. 44) 16

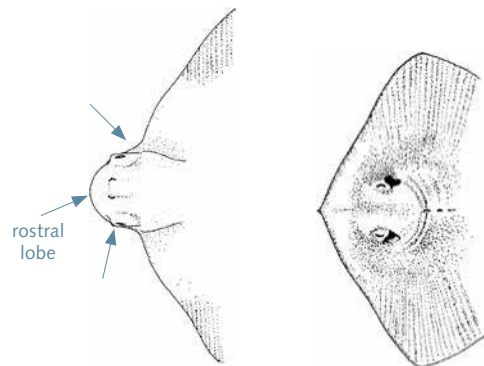


fig. 34

fig. 35

top of head

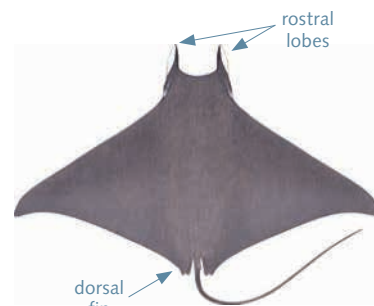


fig. 36

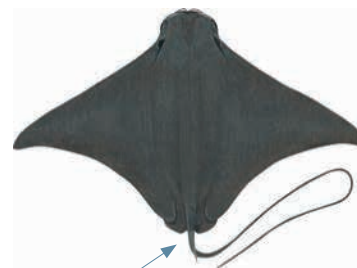


fig. 37

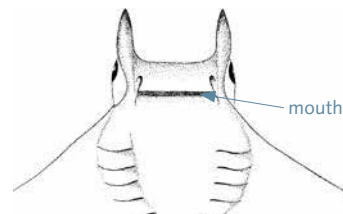


fig. 38

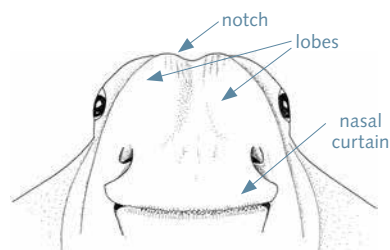


fig. 39

16. Tooth bands in single row in each jaw (fig. 44); upper tooth plate much broader than long (fig. 44); lower plate chevron-shaped, longer than broad (fig. 44) and projecting slightly forward of mouth (fig. 41); internasal flap with deep, v-shaped notch (fig. 41) **Aetobatidae** (5 species; fig. 46, p. 726)

Tooth bands arranged in 6–10 rows in each jaw and fused into hard plate (fig. 45) (except in *Myliobatis goodei*); upper and lower tooth plates similar in shape (fig. 45) and lower plate not projecting forward of mouth (fig. 42); internasal flap not notched, rear margin almost straight (fig. 42) **Myliobatidae** (18 species; fig. 47, p. 706)

17. Six pairs of gill openings on ventral surface (fig. 49); body flabby; spiracles widely separated from eyes (fig. 51); Indo–West Pacific, South-East Atlantic and Eastern Pacific **Hexatrygonidae** (1 species; fig. 51, p. 509)

Five pairs of gill openings on ventral surface (fig. 50); body firm (less so in Plesiobatidae); spiracles close to eyes (fig. 52) 18

18. Disc lozenge-shaped (fig. 48), very broad with pectoral fins laterally expanded, at least 1.6 times as wide as long; tail extremely short and slender (fig. 48); cosmopolitan **Gymnuridae** (10 species; fig. 48, p. 511)

Disc oval to circular (fig. 55) or rhombic (fig. 56), usually less than 1.3 times as wide as long 19

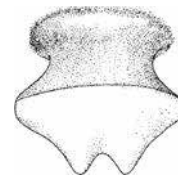


fig. 40

mobulid tooth

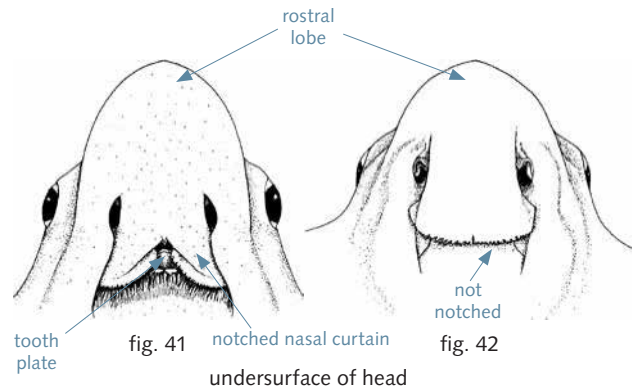


fig. 41

fig. 42

undersurface of head

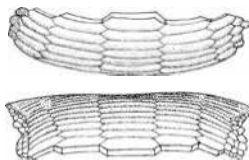


fig. 43

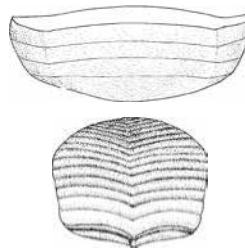


fig. 44

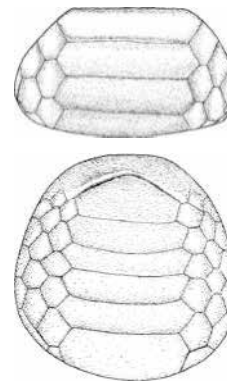


fig. 45

tooth plates (upper and lower jaws)



fig. 46



fig. 47



fig. 48

19. Caudal fin well-developed, elongate and lobe-like (figs 51, 53); tail relatively short and not whip-like (figs 51, 53) 20

Caudal fin absent; tail often with skin folds or fleshy ridges on dorsal and/or ventral surfaces (fig. 56), usually more or less elongated, flexible and sometimes whip-like (fig. 55) 22

20. Snout long and flabby, length exceeding 6 times orbit length (fig. 52); nasal curtain short and broad, not or barely overlapping mouth (fig. 58); no oral papillae on floor of mouth; adults attaining nearly 3 m TL; Indo-West Pacific and Eastern Pacific **Plesiobatidae** (1 species; fig. 52, p. 674)

Snout not flabby, length much less than 6 times orbit length (fig. 53); nasal curtain relatively long and narrow, usually overlapping mouth (fig. 59); oral papillae present (fig. 60); adults smaller than 1 m TL 21

21. Skin entirely naked (without denticles), except in *Spinilophus*; eyes relatively large (fig. 53); Indo-West Pacific **Urolophidae** (28 species; fig. 53, p. 676)

Skin naked or covered with small denticles and/or thorns dorsally; eyes relatively small (fig. 54) (except in *Urobatis*); Eastern Pacific and Western Atlantic **Urotrygonidae** (16 species; fig. 54, p. 656)

22. Tail without ridge-like lateral skin folds; disc oval to circular (fig. 55) or rhombic (fig. 56); tail typically long, often whip-like (fig. 55); species mostly plain coloured (fig. 56); cosmopolitan **Dasyatidae** (89 species; figs 55, 56, p. 522)

Anterior tail with ridge-like lateral skin folds (fig. 57); disc oval to circular (fig. 57); tail typically short (except in *Plesiotrygon*); species mostly with rich colour patterns (fig. 57); Central and South America, largely in freshwater **Potamotrygonidae** (34 species; fig. 57, p. 619)

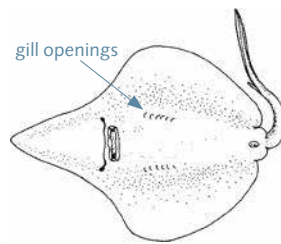


fig. 49

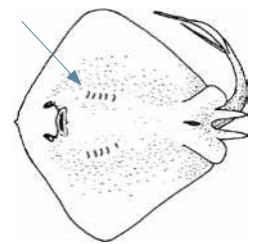


fig. 50

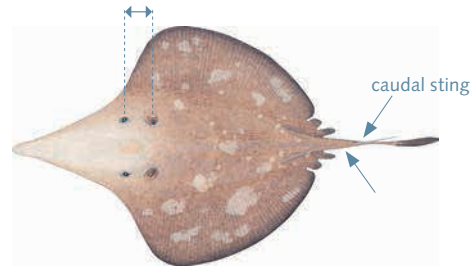


fig. 51



fig. 52



fig. 53

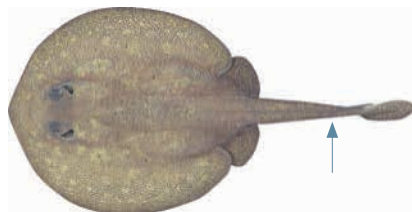


fig. 54

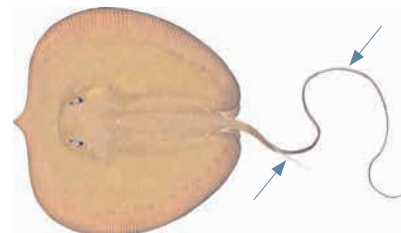


fig. 55



fig. 56

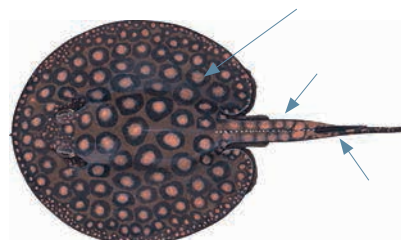


fig. 57

23. Tail filamentous, shorter than disc width and lacking dorsal fins (fig. 61); no thorns or denticles on body (apart from alar thorn patches in adult males); cosmopolitan; Indo-West Pacific and Western Central Atlantic **Anacanthobatidae** (13 species; fig. 61, p. 494)

Tail slender (not filamentous) with 0–2 dorsal fins, when lacking dorsal fins tail length much longer than disc width; thorns and/or denticles usually present somewhere on body 24

24. Rostral cartilage absent or flexible and delicate over most or all of its length (assessed by gently bending snout, fig. 65); rostral base barely extending forward of leading margins of nasal capsules (fig. 65) (except in *Notoraja* and *Brochiraja*); anteriormost part of pectoral-fin skeleton abutting or nearly abutting tip of snout (fig. 65) (not separated from snout tip by wide semi-translucent area; backlighting makes these skeletal structures more visible); ventral terminal clasper cartilage spoon-shaped (fig. 67), without a sharp lateral edge and not forming a shield; cosmopolitan **Arhynchobatidae** (104 species; fig. 62, p. 364)

Rostral cartilage moderately slender to stiff and stout from its base to tip of snout (fig. 66) (except *Breviraja*, *Fenestraja* and *Gurgesiella*); rostral base extending anterior to or forward of leading edges of nasal capsule (fig. 66); anteriormost part of pectoral-fin skeleton separated from tip of snout by semi-translucent area (fig. 66) (except *Breviraja*, *Fenestraja* and *Gurgesiella*); ventral terminal clasper cartilage variably shaped, but with sharp lateral edge forming component shield (fig. 68) 25

25. Pelvic fin single-lobed (much wider than its base width, fig. 70) or very deeply incised with 2 lobes (anterior lobe slender and similar in length to and separated from posterior lobe at its base, fig. 71); Atlantic, South-East Pacific and Indian Ocean **Gurgesiellidae** (19 species; fig. 63, p. 473)

Pelvic fin with 2 lobes, weakly to deeply incised (fig. 69); anterior lobe narrow to rather broad, but generally shorter than posterior lobe (fig. 69); cosmopolitan **Rajidae** (154 species; fig. 64, p. 204)

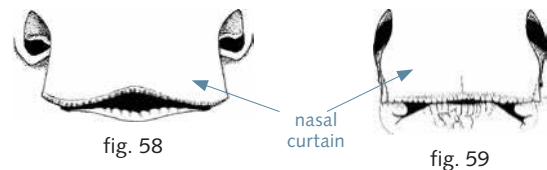


fig. 58

fig. 59

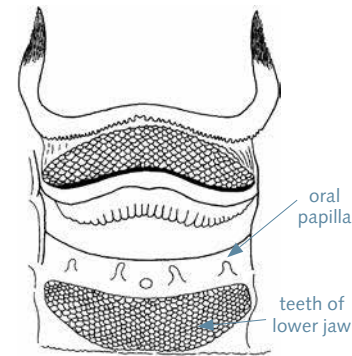


fig. 60

oronasal region

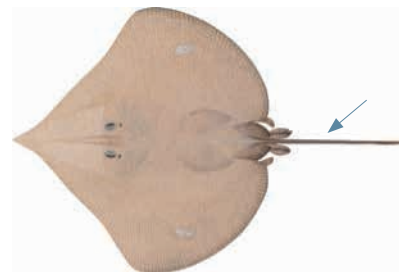


fig. 61



fig. 62



fig. 63



fig. 64

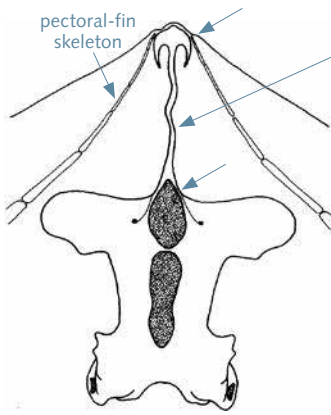


fig. 65

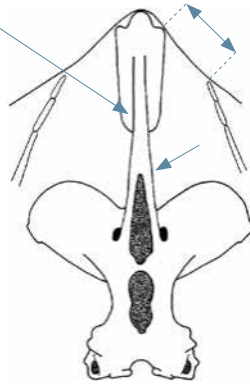


fig. 66

skeleton of head

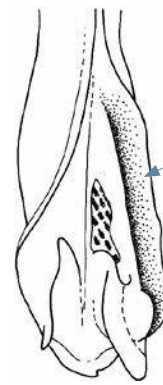


fig. 67

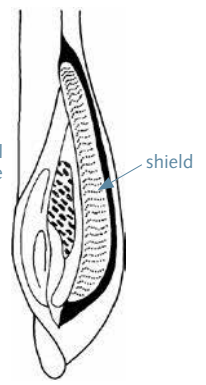


fig. 68

claspers

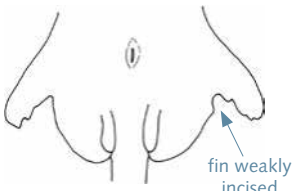


fig. 69

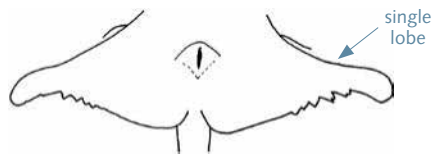
fin weakly
incised

fig. 70

single
lobe

pelvic fins (ventral view)

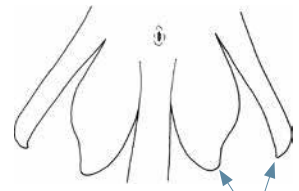


fig. 71

two lobes

McEachran J.D., Last P.R., de Carvalho M.R., Séret Bernard, Stehmann M.F.W.

Key to families of living rays.

In : Last P.R. (ed.), White W.T. (ed.), de Carvalho M.R. (ed.), Séret Bernard (ed.), Stehmann M.F.W. (ed.), Naylor G.J.P. (ed.), Marshall L. (ill.). Rays of the world.

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