

NOTES ON, AND DESCRIPTIONS OF AUSTRALIAN FISHES. NO. 2.

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(Plates xxxvii.-xli. and three Text-figures.)

The following paper is a collection of miscellaneous notes and descriptions similar to that of Part 1, published in These Proceedings, Vol. xl., pp. 260-277. Most of the fishes dealt with have been hitherto insufficiently described and imperfectly known, and are therefore here figured and redescribed in detail. The synonymy of several has been studied, and is presented in a new form, while others are recorded from Australian waters for the first time. One is regarded as a new species.

Family CARCHARHINIDAE.

CARCHARHINUS MACRURUS Ramsay & Ogilby. (Plate xxxvii., figs. 1-4).

Whaler.

? *Carcharias brachyurus*, Günther, Brit. Mus. Cat. Fish., viii., 1870, p. 369—Australian specimen only (*vide* Ogilby, Proc. Linn. Soc. N.S. Wales, (2), iii., 1889, p. 1768).

Carcharias brachyurus, Ramsay, Proc. Linn. Soc. N.S. Wales, v., 1880, p. 96; Macleay, Proc. Linn. Soc. N.S. Wales, vi., 1881, p. 352 (not description); Ogilby, Cat. Fish. N.S. Wales, vi., 1886, p. 1; Waite, Mem. N.S. Wales Nat. Club, ii., 1904, p. 7. (Not *C. brachyurus* Günther).

Carcharias macrurus, Ramsay & Ogilby, Proc. Linn. Soc. N.S. Wales, (2), ii., 1887, pp. 163, 1024; and iii., 1889, p. 1768.

Carcharinus brachyurus, Waite, Rec. S. Austr. Mus., ii., 1, 1921, p. 12, fig. 8. (Not *C. brachyurus* Günther).

Body rather slender, its depth before the dorsal fin 5.6 in the length to the base of the tail; the length from the snout to the front margin of the vent is 1.8 in the total. Head, to the level of the first gill-opening, 2.6 in the trunk, and 5.1 in the total length. Preoral length 0.1 greater than the width of the mouth.

Snout rather long, obtusely pointed in the horizontal plane. Nostrils nearer to the mouth than to the end of the snout, and separated by a space which is equal to the distance of their inner angles from the end of the snout.

Mouth one-third longer than wide, its greatest width 1.1 in the preoral length; a very short groove extends forward on each side near the posterior angle. Eye 1.4 in the width of the third gill-opening, its anterior margin a little farther forward than the front of the mouth. The distance between the front margin of the eye and the end of the snout, measured obliquely, is equal to that from the eye to the first gill-opening. The two posterior gill-openings are above the base of the pectoral, and the last is about three-fourths as wide as the third. Upper teeth triangular, very oblique laterally, and serrated on both edges; their outer edges are more or less notched, the angle being much greater in those on the sides than near the symphysis. Lower teeth narrow, erect, and more or less obscurely serrated. Scales around the shoulder region armed with three points on their hinder margins, from which three ridges extend forward; they are attached by short three-pronged roots.

The dorsal fin is midway between the end of the snout and the base of the tail, and its hinder angle is produced backward as an acute lobe. The space between the two dorsals is more than three times as great as that separating the hinder base of the second dorsal and the base of the tail; the second dorsal is a little smaller than the anal, and is produced into a sharp point posteriorly. Inner angle of the pectoral not quite reaching the vertical of the origin of the dorsal, and the tip of the fin does not attain the vertical of the hinder angle of the dorsal base when laid back. Ventrals subquadrangular, a little nearer the anal than the vertical of the first dorsal. Anal originating slightly in advance of the vertical of the second dorsal, its posterior angle produced. Caudal a little longer than the space between the posterior angles of the bases of the two dorsals; a pit above and below the caudal peduncle.

Colour.—Grey above, with traces of a narrow darker longitudinal stripe on each side above the lateral line; white below. The tips of the second dorsal and the lower caudal lobe are darker than the remainder of the fins.

Described and figured from a female specimen 877 mm. long, from Botany Bay.

Identity.—Though this specimen differs slightly from the original description of *C. macrurus*, a comparison with the holotype in the Australian Museum proves it to be correctly identified. Both specimens are about the same size, and they agree in all details which have not been distorted in the type, which is stuffed.

Status.—Waite (Rec. Aust. Mus., vi., 3, 1906, p. 226) has united this species with *C. brachyurus* Günther, though, as is evident from his remarks, he did not examine either the holotype or any other of the several specimens of *C. macrurus* which were available to him. The two species appear to differ considerably in the length of the snout and the size of the eye. In *C. macrurus*, the preoral length is greater than the width of the mouth, and the eye is much more than half as wide as the gill-opening. In *C. brachyurus*, according to Günther, the preoral length is equal to about two-thirds the width of the mouth, and the gill-openings are at least twice as wide as the eye.

It may be noted here that the specimen figured in Waite's paper (*Loc. cit.*) as *C. brachyurus* differs in several details from the description of that species, and is probably incorrectly identified.

Localities and Distribution.—The specimen described above was taken in a net at Botany Bay, New South Wales, by Mr. J. H. Wright, in February, 1921. Several others, including the holotype, are in the Australian Museum from Port Jackson. As *C. brachyurus*, the species has been recently recorded from South Australia by Waite.

GALEORHINUS AUSTRALIS Macleay. (Plate xxxvii., figs. 5-7).

School Shark.

Galeus canis, Günther (part), Brit. Mus. Cat. Fish., viii., 1870, p. 379 (Tasmanian specimen only); Klunzinger, Arch. Naturg., xxxviii., 1, 1872, p. 45 & Sitzb. Akad. Wiss. Wien, lxxx., 1, 1879, p. 426; Castelnau, Proc. Zool. Soc. Viet., i., 1872, p. 216; Johnston, Proc. Roy. Soc. Tasm., 1882 (1883), p. 137, and 1890 (1891), p. 38.

Galeus sp., McDonald, Proc. Zool. Soc., 1873, p. 312.

Galeus australis, Ramsay, Proc. Linn. Soc. N.S. Wales, v., 1880, p. 96 (*nom. nud.*); Macleay, Proc. Linn. Soc. N.S. W., yi., 2, 1881, p. 354; McCoy, Prodr. Zool. Viet., dec. vii., 1882, Pl. lxiv., fig. 2; Ogilby, Ed. Fish. N.S. Wales, 1886, p. 2, and Proc. Linn. Soc. N.S. Wales, (2), iii., 1889, p. 1769; Lucas, Proc. Roy. Soc. Viet., (2), ii., 1890, p. 42; Waite, Rec. Cantb. Mus. i., 1, 1907, p. 7, and i., 2, 1909, p. 9, Pl. xv.; Zietz, Trans. Roy. Soc. S. Austr., xxxii., 1908, p. 290; Ogilby, Proc. Roy. Soc. Qld., xxi., 1908, p. 23 and Mem. Qld. Mus., v., 1916, pp. 78, 93; McCulloch, Zool. Res. Endeavour, i., 1, 1911, p. 9; Regan, Brit. Antarc. Exped., Zool., i., 1, 1914, p. 14; Waite, Rec. S. Austr. Mus., ii., 1, 1921, p. 13, fig. 12.

Galeorhinus australis, Waite, Mem. Austr. Mus., iv., 1, 1899, p. 34.

Mustelus australis, Waite, Mem. N.S. Wales Nat. Club, No. 2, 1904, p. 7.

Eugaleus australis, Waite & McCulloch, Trans. Roy. Soc. S. Austr., xxxix., 1915, p. 460.

Snout obtusely pointed and depressed, its preoral length 2.4 in the length of the head to the first gill-opening; its lateral edges anterior to the nostrils are moderately sharp. Nostrils much nearer the upper lip than the end of the snout, the space between them 1.44 in their distance from the tip of the snout; the anterior margin of each has a small lobule projecting backward. Anterior margin of the mouth in advance of that of the eye; the width of the mouth is equal to its distance from the end of the snout, and there is a longer upper and a shorter lower labial fold at each angle. Eye with a nictitating membrane, its diameter about 3 in its distance from the end of the snout; the skin above the eye forms an imperfect fold. Spiracle a small slit and placed about half an eye-diameter behind the eye. Gill-openings subequal, the fourth widest and equal to the diameter of the eye; the fifth is placed above the base of the pectoral.

About three series of functional teeth in the upper jaw which are smallest anteriorly and larger laterally. The centre cusp of each lateral tooth is oblique, and there is a sharper angle at its junction with the basal portion posteriorly than anteriorly; both the anterior and posterior edges of the base are serrated, but the former less strongly so than the latter. The teeth of the lower jaw are similar to those of the upper, but are rather less strongly serrated.

The first dorsal fin is situated midway between the anterior bases of the pectoral and ventral fins; its upper angle is obtusely pointed, and its posterior angle is produced into a sharp point. The second dorsal and anal are small, and subequal in size and shape; the latter commences below the middle of the former. Caudal equal to about one-fifth of the total length. Pectoral obtusely pointed, almost reaching the vertical of the middle of the dorsal when laid back.

Colour.—Light grey on the back and sides, lighter below. Fins grey like the body.

Described and figured from an adult male 1525 mm. long, which was taken by the State Trawlers in New South Wales waters.

Family RHINOBATIDAE.

TRYGONORRHINA FASCIATA Müller & Henle. (Pl. xxxviii., figs. 1-2).*Fiddler Ray.*

Trygonorhina fasciata, Müller & Henle, Plagiost., 1838, p. 124, Pl. xliii.; Dumeril, Hist. Nat. Poiss., i., 2, 1865, p. 502; Günther, Brit. Mus. Cat. Fish., viii., 1870, p. 448; Castelnau, Proc. Zool. Soc. Viet., i., 1872, p. 223; Macleay, Proc. Linn. Soc. N.S. Wales, vi., 1881, p. 373; Johnston, Proc. Roy. Soc. Tasm., 1882 (1883), p. 140, and 1890 (1891), p. 39; Haswell, Proc. Linn. Soc. N.S. Wales, ix., 1884, p. 107, Pl. ii., fig. 1-5 (skeleton); Ogilby, Cat. Fish. N.S. Wales, 1886, p. 5; Lucas, Proc. Roy. Soc. Viet., (2), ii., 1890, p. 45; Hill, Proc. Linn. Soc. N.S. Wales, (2), x., 1895, p. 206, pl. xx. (abnormality) Waite, Mem. Austr. Mus., iv., 1, 1899, p. 39, and Mem. N.S. Wales Nat. Club, ii., 1904, p. 9; Zietz, Trans. Roy. Soc. S. Austr., xxxii., 1908, p. 292.

Trigonorrhina fasciata, Garman, Mem. Mus. Comp. Zool., xxxvi., 1913, p. 287; Waite, Rec. S. Austr. Mus., ii., 1, 1921, p. 27, fig. 39.

Skin velvety, with a band of microscopic tubercles on each side of the back between the shoulders and the first dorsal. A row of eighteen spinous tubercles on the median line of the back before the first dorsal, and two more behind it; a double row of tubercles across the shoulders arranged in pairs, and one before and another behind each eye. Pectoral disc very little narrower than long; the snout is very obtusely pointed, and the outer and posterior margins are rounded. Ventrals wholly separate, their length greater than the distance between their bases anteriorly, but less than their combined widths. Preocular length equal to one-fourth the length of the pectoral disc. The length of the eye is $3\frac{1}{2}$ in the interocular width, and 5 in the preocular length. Spiracle a little larger than, and extending forward around the eye; its postero-exterior margin with a projecting fold. Mouth almost transverse, its width almost equal to three-fourths of the preoral length. Nasoral valve emarginate posteriorly, its width subequal to that of the mouth. Each nostril with a broad posterior lobe and an inner valve. Teeth small, flattened, and smooth, and arranged in a broad band in each jaw. Posterior gill-opening well behind the middle of the pectoral disc.

Tail a little longer than the body, its breadth between the posterior insertions of the ventrals equal to the interocular width; a marked fold commences on each side behind the ventrals and is lost at the base of the caudal. First dorsal scarcely larger than the second, the space between the two subequal to their distances from the insertions of the ventral and caudal fins. Dorsals and caudal obtusely pointed terminally.

Colour.—Light brown above, with an elaborate symmetrical pattern of broad lilac fasciae with dark brown borders arranged as in the accompanying figure. Seven less definite darker cross-bands are arranged as follows:—The first across and on each side of the orbital region; the second much broader and covering the shoulders and surrounding area; the third between the posterior insertions of the pectorals; the fourth between the ventrals; the fifth and sixth at the bases of the dorsals, and the seventh across the tail. Some dark spots on each side of the disc anteriorly and before the eyes. Edges of pectorals and ventrals lilac. Lower surfaces white, the margins of the pectorals and ventrals brown.

Described and figured from a young specimen 380 mm. long, from off Sandon Bluff, New South Wales. It differs from a smaller specimen from Port

Jackson only in having the colour-marking on the back more elaborate, the darker markings and the spots being more developed than is usual.

Family DASYATIDAE.

DASYATIS KUHLLI Müller & Henle. (Plate xxxix., figs. 1-2).

Blue-spotted Stingaree.

Trygon kuhlii, Müller & Henle, Plagiost., 1841, p. 164, Pl. li, fig. 1; Day, Fish. India, 1878, p. 739, Pl. exciii., fig. 2; Ogilby, Cat. Fish. Austr. Mus., 1888, p. 19.

Dasyatis kuhlii, Waite, Mem. N.S. Wales Nat. Club, ii., 1904, p. 11.

Dasybatus kuhlii, Garman, Mem. Mus. Comp. Zool., xxxvi., 1913, p. 395; Ogilby, Mem. Qld. Mus., v., 1916, p. 87.

(*Raya*) *Neotrygon trigonoides*, Castelnau, Proc. Zool. Soc. Viet., ii., 1872, p. 121.

Description of a half-grown male, 243 mm. wide (Pl. xxxix., fig. 1). Pectoral disc rhomboid, its anterior and exterior angles obtusely pointed, the posterior angles sharper; the length is 1.27 in the breadth. Snout thick and short, its length less than the distance between the spiracles. Eye large, almost as long as the spiracle, the length of which is equal to half the interspiracle width. Skin smooth except for four flattened spines on the vertebral line which are close together above the shoulder-girdle. Width of the mouth 1.6 in its distance from the end of the snout. Upper dental lamina undulous, forming a median and two lateral prominences; the teeth are mostly tubercular, but there is a series of larger pointed ones on the convex fold of each side: teeth of the lower jaw in a broad band, flattened, and with minute points directed backward. A broad fringe of tentacles behind the upper jaw, and two papillae behind the lower. Nostrils elongate, each with a free postero-interior lobe; nasoral valve with the posterior margin sinuous and fringed. Posterior gill-opening a little before the middle of the pectoral disc. Ventrals rather elongate, obliquely rounded behind; claspers small, not reaching the level of the end of the ventrals. Tail much longer than the body, with two long spines inserted about their own length behind the ventrals; a short fold on the upper surface behind the end of the spines, and a longer one on the lower surface commencing below the insertion of the spines and becoming gradually lost towards the end of the tail.

Colour.—Light pinkish-brown, with numerous large bluish ocelli having indefinite darker margins; numerous blackish spots are scattered irregularly over the back which are most plentiful around the eyes. A darker band crosses the interorbital region, and appears as an ill-defined blotch on each side of the eyes. Tail darker, becoming blackish terminally, with irregular lighter and darker patches. Lower surfaces uniformly coloured.

A young male, 177 mm. wide (Pl. xxxix., fig. 2), only differs structurally in having the snout a little more pointed and the claspers of much larger size; these extend for half their length beyond the ventral margins; there are six vertebral tubercles. The back is rather darker in colour, and has no light bluish ocelli; the black spots are much more numerous, and closely cover the greater part of the pectoral disc. The darker band across the eyes is much more pronounced, and there are other dark patches on the shoulders, on the nape, and across the snout before the eyes.

Variation.—A fine series of twelve specimens, 129-305 mm. wide, shows that this species undergoes the remarkable colour change with growth described above and illustrated on the accompanying plate. The smaller specimens are profusely speckled with rounded blackish spots as in the young male figured,

and the darker areas around the head and shoulders are very definite. As the fish increases in size, the darker spots and bands are gradually lost, and in the largest specimens of the series comparatively few remain; simultaneously large light bluish ocelli appear and gradually become the most striking feature of the back. The degree of maculation and ocellation varies in each specimen, but the series indicates that the change from the one to the other is the normal condition. The vertebral tubercles are wanting in the youngest specimens, and are more numerous and larger in some of the larger examples than in others.

The development of the claspers varies remarkably. In some large specimens they do not attain the margins of the ventral fins, while in others of similar size, structure, and colouration, they are greatly enlarged and reach far beyond the ventrals; similar variation is presented by the smaller specimens. These two forms are exhibited in the specimens figured, the claspers of the smaller specimen being considerably larger than those of the older example.

Locs.—Off Bustard Head, Queensland, 14-20 fathoms.

This species has been recorded from the Parramatta River estuary by Ogilby. One of his specimens is still preserved in the Australian Museum, which though stuffed and without colour-marking, exhibits the general characters of *D. kuhlii*.

DASYATIS BREVICAUDATUS Hutton. (Text-fig. 2—tail).

Dasyatis brevicaudatus (Hutton), McCulloch, Biol. Res. Endeavour, iii., 3, 1915, p. 102, Pl. xv., fig. 1, and Pl. xvii., fig. 1; Waite, Rec. S. Austr. Mus., ii., 1, 1921, p. 31 (? not fig. 44).

Variation.—Several tails of this species have been examined which exhibit considerable variation in the armature of their upper surfaces anterior to the caudal spine. In three from 20 fathoms off Norah Head, New South Wales, one has six large spine-bearing tubercles in a row, another has one, while the third has none. Another from Coffin Bay, South Australia, and lent to me for examination by Mr. E. R. Waite, is quite similar to those from New South Wales; it is armed with five strong spines directly before the caudal spine. All have the subcaudal lobe well developed, commencing below the base and terminating below the tip of the caudal spine. The spinate tubercles on the sides are smaller than those of *D. thetidis*.

The specimen which is figured by Waite (*vide supra*) is evidently distinct from *D. brevicaudatus*, differing in its much longer tail and colour-marking. Mr. Waite informs me it was not an Australian specimen.

Localities.—Off Norah Head, New South Wales, 20-40 fathoms; coll. F. McNeill, June, 1921; off Botany Bay, New South Wales, 40 fathoms; coll. A. Livingstone, September, 1921; Coffin Bay, South Australia. South Australian Museum.

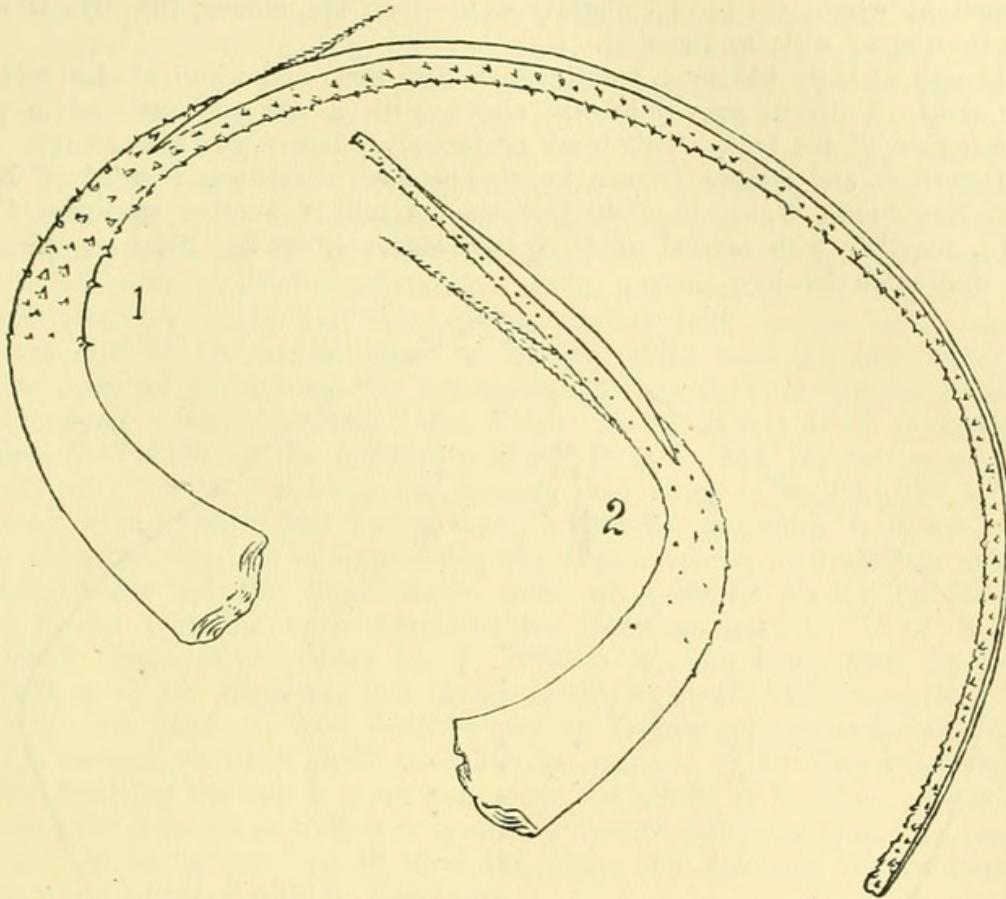
DASYATIS THETIDIS (Ogilby) Waite. (Plate xl., figs. 1-2; Text-figs. 1 and 3).

Black Skate.

Dasyatis thetidis (Ogilby), Waite, Mem. Austr. Mus., iv., 1, 1899, p. 46.

Disk subquadrangular, wider than long, its length from the tip of the snout to the posterior angle of the pectorals 1.23 in the breadth. Snout a little prominent. Anterior margins slightly sinuous, feebly convex on each side of the snout and then very slightly concave; outer angles distinct but rounded. Postero-lateral borders of the disk a little convex, nearly straight, and forming obtuse angles with the inner margins of the pectorals. Ventrals subquadrangular, the edges rounded. A row of seven strong rounded or oval stellate tubercles

along the median line of the back, each of which is armed with a stout depressed spine worn smooth on its upper surface; the first is midway between the eyes and the scapular region; three more are in advance of the scapular region, and three others are close together in the middle of the back. A single small spinate tubercle is present on the right side of the scapular region.



Text-fig. 1. Under surface of the tail of *Dasyatis thetidis*, from off Norah Head, New South Wales, 20-40 fathoms.

Text-fig. 2. Under surface of the tail of *Dasyatis brevicaudatus*, from the same locality.

Tail depressed before, cylindrical behind the spine, its length from the middle of the vent 0.44 longer than the body. A row of tubercles armed with large spines commences on the median dorsal line in advance of the margins of the ventrals, but the rest of the tail is smooth anteriorly; smaller spinate tubercles appear on the sides and upper and lower surfaces well in advance of the spine, and become more and more numerous backwards. A low cutaneous and minutely spicular fold commences slightly in advance of the insertion of the caudal spine, and extends backward to the end of the tail; it is deepest anteriorly where it is about one-fourth as deep as the tail above it, and decreases gradually backward.

Eyes very small, the space between them equal to the greatest width between the spiracles; they are 4.2 in the bony interorbital space, which is slightly more than half the preorbital length. Spiracles very large, longer than broad, their length 1.5 in the interorbital width.

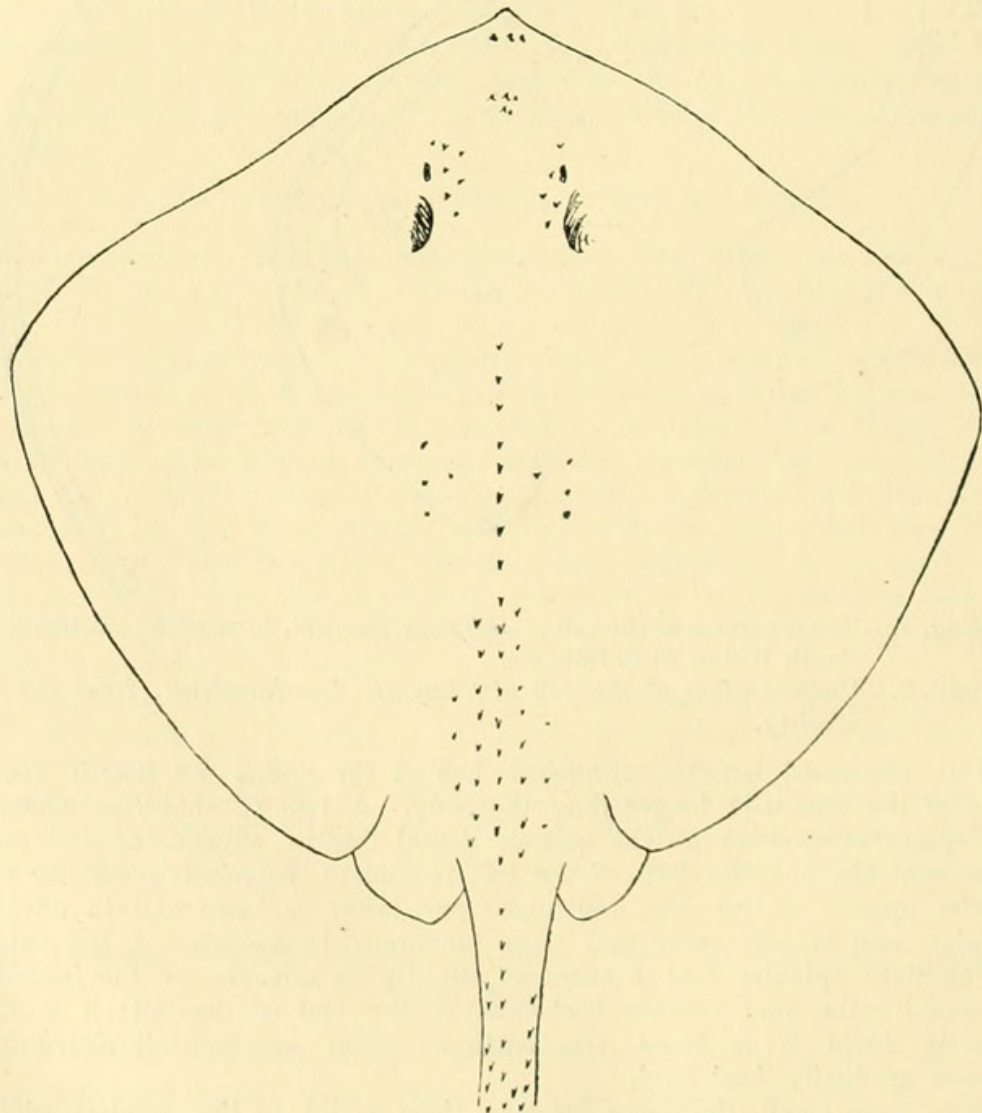
The space separating the nostrils is 1.3 in their distance from the end of the snout. Outer angles of the internasal lobe rounded; a narrow flap is folded

forward from its posterior margin which is minutely lobulated and is divided into two on the median line. Width of the mouth 2.5 in the preoral length. Teeth small without cusps. A broad lobulated flap inside the mouth behind the upper jaw, and five papillae inside the lower one, of which the two outer ones are small and widely separated from the other three. Four anterior gill-slits subequal in width, the second slightly wider than the others; the fifth is about three-fourths as wide as the first.

Length of body 645 mm., length of tail 945 mm., and width of disc 890 mm.

Colour.—Uniform greyish-brown above, with a row of small white pores on each side of the back. Tail black posteriorly. Lower surfaces white.

Described and figured from a female specimen which was trawled off Norah Head, New South Wales, in 20-40 fathoms. A tail of another specimen (Text-fig. 1), together with several of *D. brevipaudatus* (Text-fig. 2), were procured from the same locality.



Text-fig. 3. Sketch of a female *Dasyatis thetidis*, 70 inches wide, from east of Babel Island, Bass Strait, 60 fathoms.

Variation.—The number of the spinate tubercles is apparently very variable in this species. They are few in number in the specimen described, but a strip of skin is preserved in the "Endeavour" collection, which was taken from a

specimen evidently referable to *D. thetidis*, which has an unbroken row of about fifty tubercles between its anterior end and the caudal spine, of which ten are in advance of the scapular region. The accompanying figure (Text-fig. 3) is a sketch I made of a large female, 70 inches wide, which was trawled by the "Endeavour" in sixty fathoms East of Babel Island, Bass Strait, and which was thrown overboard after I had made notes upon it. The disc was smooth above, except along the median portion, where there were several rows of large tubercles bearing spines; a few tubercles were close to the snout, and a few more midway between the snout and the eyes; in front of and above the eyes were others which differed in number on each side; twenty inches behind the snout and well behind the level of the spiracles a median row of tubercles commenced, which was supplemented on the shoulders by some parallel spines; behind the middle of the disc the tubercles were arranged in four irregular rows which were gradually reduced to two at the level of the ventrals. The tail was intensely spiny, and there was a narrow fold on the under surface from the level of the caudal spine to its end, about half an inch wide; the tail was forty-six inches long but incomplete. The teeth were without cusps.

Synonymy.—Garman (Mem. Mus. Comp. Zool., xxxvi., 1913, p. 383) has included *D. thetidis* in the synonymy of his *D. latus* and the two species are certainly very similar. But the tail is more than twice as long as the body in *latus* and is apparently less spiny than in *thetidis*, in which it is not much longer than the disc. It is improbable also that a species occurring in moderately deep water off the south-eastern coast of Australia should be identical with a species from the warm waters of the Hawaiian Islands.

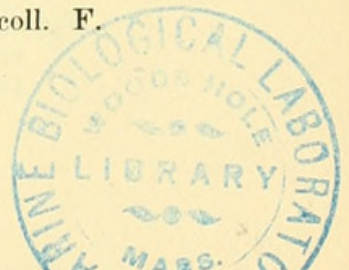
Ogilby (Mem. Austr. Mus., iv., 1, 1899, p. 46, and Proc. Roy. Soc. Qld., xxi, 1908, p. 8) has suggested that the specimen recorded by Günther (Brit. Mus. Cat. Fish., viii., 1870, p. 480) from Sydney as *Trygon tuberculata* is referable to *Dasyatis thetidis*, but it is more probably an example of *D. fluviorum* Ogilby. Günther described the tail as more than twice the length of the disc, and usually provided with a dorsal as well as a ventral cutaneous fold; the spines on the tail were said to be minute. In all these characters the specimen differs from *D. thetidis* while agreeing with *D. fluviorum*.

D. thetidis differs from *D. breviceaudatus* in the following characters:—

- A. Disc with more or less numerous spinate tubercles on the middle of the back. Eyes not closer together than the spiracles. Internasal space shorter than the distance between the nostrils and the end of the snout; outer angles of internasal lobe rounded. Tail longer than the disc; a narrow cutaneous fold on its lower surface extending backward to its tip. Tubercles and spines large *thetidis*
- AA. Disc entirely smooth, without spines on the back. Eyes closer together than the spiracles. Internasal space almost equal to the distance between the nostrils and the end of the snout; outer angles of internasal lobe pointed. Tail shorter than the disc; a cutaneous fold on its under surface which terminates below the end of the spine. Tubercles and spines smaller *breviceaudatus*.

Occurrence.—*D. thetidis* and *D. breviceaudatus* are apparently common in depths down to sixty fathoms off the coast of New South Wales where they are taken by the State trawlers, and find a ready sale as Black Skate. I have also seen them trawled off the eastern coast of Tasmania, one or more occurring in each haul of the net, but the differences between the two not having been recognised, nothing is known as to which species is the most abundant.

Locality.—Off Norah Head, New South Wales, 20-40 fathoms; coll. F. McNeill, June, 1921.



UROLOPHUS BUCCULENTUS Macleay. (Plate xli., fig. 1-3).

Sandy-backed Stingaree.

Urolophus bucculentus, Macleay, Proc. Linn. Soc. N.S. Wales, ix., 1885, p. 172;

McCulloch, Biol. Res. Endeavour, iv., 4, 1916, p. 177.

Trygonoptera bucculenta, Waite, Mem. Austr. Mus., iv., 1, 1899, p. 44, Pl. v.

Breadth of the disc 0.4 greater than its length from the end of the snout to the end of the pectoral fins. Tail, measured from its end to the middle of the vent, 1.4 in the length from the same point to the end of the snout, and slightly shorter than its distance from the mouth. Interocular and interspiracle widths subequal, 1.4 in the preocular portion of the head. Internasal width 2, and width of mouth 2.1 in the preoral length.

Breadth of the disc much greater than its length from the end of the snout to the tip of the ventral fins. Snout imperfect—forming a sharp and slightly projecting angle in the type. Anterior pectoral margins almost straight, the outer angles rounded; posterior-lateral margins convex, their junction with the inner margins rounded. Eyes prominent, rather large, their length less than half the interocular width. Intero-superior margin of the spiracle almost straight without any angular projection. Nostrils without free lobes posteriorly and separated by a wide space from the angle of the mouth. Posterior margin of the internasal valve minutely lobulate but not fringed; the postero-external angles form lobes which lie in grooves outside the lips. Teeth uniformly tessellate in the female. A fimbriated velum behind the upper teeth, and a row of about sixteen papillae behind the lower teeth some of which are paired.

Tail depressed, with a well developed fold on each side extending backward to the origin of the spine; its width at the base is slightly less than that of the mouth. The spine is inserted at the middle of its length, and in front of its base is a well developed dorsal fin. Caudal fin large and rather narrow; it originates below the hinder third of the spine on the upper surface, and extends forward as a ridge to beneath the anterior third below.

Colour.—Light pinkish tan above, the posterior portions of the pectorals and ventrals lighter. Whitish spots and short lines are distributed over the back and greater portion of the disc, but the snout and a broad pectoral margin are unmarked; the spots are very small and close together on the outer portion of their area but become larger interiorly and change into short vermiculating lines on the branchial regions and back. Ventral fins with small white spots. Tail with one median and two supero-lateral light stripes; the lateral folds white. Vertebral region of the caudal fin white marbled.

Described and figured from a female example 600 mm. wide. The snout, end of the caudal fin, and portion of the ventrals being damaged in this specimen, these details have been completed from the types.

Identity.—The cotypes of this species have been skinned and are in a very imperfect state of preservation. But a comparison of them with the specimen described and figured leaves no doubt that the latter is correctly identified.

Locality.—East of Botany Bay, New South Wales, 60 fathoms; May, 1920.

Family NARCOBATIDAE.

Genus HYPNARCE Waite.

Hypnos, Dumeril, Rev. Mag. Zool., (2), iv., 1852, p. 279—Orthotype *H. subnigrum* Dum. (Not *Hypna* Hubner, 1816); Günther, Brit. Mus. Cat. Fish., viii., 1870, p. 453; Macleay, Proc. Linn. Soc. N.S. Wales, vi., 1881, p. 374; Ogilby, Mem. Qld. Mus., v., 1916, pp. 83, 92.

Hypnarce, Waite, Rec. Austr. Mus., iv., 5, 1902, p. 180—substitute name; Garman, Mem. Mus. Comp. Zool., xxxvi., 1913, p. 303; Jordan, Gen. Fish., ii., 1919, p. 250.

HYPNARCE SUBNIGRA Dumeril. (Pl. xxxviii., figs. 3-4).

Numbfish.

Hypnos subnigrum, Dumeril, Rev. Mag. Zool., iv., 1852, p. 279, Pl. xii., and Hist. Nat. Poiss., i., 2, 1865, p. 520; Günther, Brit. Mus. Cat. Fish., viii., 1870, p. 453; Macleay, Proc. Linn. Soc. N.S. Wales, vi., 1881, p. 374, and vii., 1882, p. 12; Woods, Fish & Fisher. N.S. Wales, 1882, p. 100; Haswell, Proc. Linn. Soc. N.S. Wales, ix., 1884, p. 104, Pl. xi., figs. 6-9 (skeleton); Ogilby, Cat. Fish. N.S. Wales, 1886, p. 5; Fritsch, Elektrisch. Fische., ii., 1890, p. —, and Sitzb. Akad. Wiss. Berlin, 1895, pt. xxi., p. 423; Howes, Proc. Zool. Soc., 1890, p. 669, Pl. lvii. (visceral anatomy); Waite, Mem. Austr. Mus., iv., 1, 1899, p. 42, and Mem. N.S. Wales Nat. Club, ii., 1904, p. 10; Zietz, Tr. Roy. Soc. S. Austr., xxxii., 1908, p. 292; Ogilby, Mem. Qld. Mus., v., 1916, p. 83, and vi., 1918, p. 104.

Hypnarce subnigra, Waite, Rec. Austr. Mus., iv., 1902, p. 180; Garman, Mem. Mus. Comp. Zool., xxxvi., 1913, p. 304.

Skin perfectly smooth, flesh soft and flabby. The width of the pectoral disc is subequal to its length. Anterior margin of the snout thick and almost straight, a slight notch at its junction with the pectoral on each side; pectoral margins evenly curved and thin. Ventrals much longer than broad, united below the tail, and together forming a disc which is broader than long; claspers reaching a little beyond their margins. The distance between the eyes and the anterior margin is equal to about twice the width of the interocular space. Spiracles directly behind and slightly larger than the eyes, their margins surrounded by coarse papillae. Mouth forming three parts of a circle, its front margin a trifle in advance of that of the eyes; its width is less than the preoral length. Nostrils with thick raised margins which form narrow lobes posteriorly; nasoral valve square cut, its posterior margin sinuous. Posterior gill-opening behind the middle of the pectoral disc. Each jaw with a broad band of small flattened and acutely tricuspid teeth, the median cusp of which is much longer than the others. Dorsals leaf-like, the first commencing well before the centre of the ventral disc, and not much smaller than the second which is immediately behind it. Caudal as broad as long, rounded, and just overhanging the margin of the ventral disc. Tan-brown above, white below.

Described and figured from a beautifully preserved specimen, 353 mm. long, from off Cape Hawke.

Variation.—Eight specimens 126-440 mm. long, exhibit but little variation. The relative size of the dorsal fins is a little variable, the first being sometimes markedly smaller than the second, and the eyes are sometimes a little nearer the end of the snout than in the specimen described. The general proportions of all appear to be very similar. Most are light brown in colour on the upper surface, but the smallest specimen has small light spots closely distributed over the back, while two others are darker, one being almost chocolate brown above.

Habits.—In September, 1919, I saw a living female of this species in shallow water at Port Stephens, New South Wales, which was about twenty inches long, and of a clear tan colour above and white below. When disturbed it buried itself with great rapidity beneath the sand, and though only covered by a few inches of water, completely hid itself from view. In throwing it out onto the beach with a wet board, I received a sharp shock which resembled a blow on the biceps. After stranding it, I and others received about fifty successive shocks in a space of about ten minutes before we killed it by severing its spine. The shocks were intense at first though not painful, and could be felt through one's whole body, but they gradually became weaker; the last dis-

charge was a feeble one, and was produced after the fish had been eviscerated and was apparently dead. Each discharge appeared to be associated with a convulsive contraction of the disc, the edges of the pectorals being turned over towards the middle of the back, and distinct shocks were felt from all parts of the body, including even the ventral fins. By placing a foot upon the disc when the charges were somewhat reduced in power, we felt the shock simultaneously in the same muscles in both legs. A remarkable feature of the electric discharge was that it could be conveyed from the water up a wet stick, or while the fish was lying upon the wet sand; the specimen was finally killed with a knife tied to a dried stick, which conveyed no shocks.

The stomach of this specimen contained nothing but a bright coloured fluid. The small mouth suggests that the species feeds upon smaller animals, but a lobster-fisherman recently assured me that he had taken a large specimen from one of his pots which had curled itself through the opening, and which contained a large Flathead (*Platycephalus*) several inches of which protruded from its mouth.

Locs.—Four specimens are preserved in the "Endeavour" collection from the following localities:—Six miles East of Cape Hawke, New South Wales, 47-60 fathoms, 21st June, 1910; Great Australian Bight, edge of bank, 80-120 fathoms, April, 1913.

These have been compared with four others from Port Jackson and the Clarence River Estuary, New South Wales, and Rottnest Island, Western Australia.

Family SERRANIDAE.

EPINEPHELUS CAERULEOPUNCTATUS Bloch.

Holocentrus caeruleopunctatus, Bloch, *Ausl. Fische.*, iv., 1790, p. 94, Pl. cexlii., fig. 2.

Serranus hoevenii, Bleeker, *Verh. Bat. Gen.*, xxii., 1849, p. 36.

Epinephelus hoevenii, Bleeker, *Atlas Ichth.*, vii., 1875, p. 63, Pls. cclxxxii., cclxxxvi., and cexe.

Epinephelus caeruleopunctatus, Boulenger, *Brit. Mus. Cat. Fish.*, i., 1895, p. 246 (synonymy).

Colour variation.—Two specimens 56 and 215 mm. long, from off Cape Bedford, Queensland, represent the colour varieties figured by Bleeker as *E. hoevenii* on plates 286 and 282 respectively. A third from Palm Islands, 120 mm. long, is nearer the variety figured on plate 290, its whole head, body and fins being closely covered with small white spots; it is similar to a specimen of about the same size from Batavia which was identified by Bleeker as *E. hoevenii*. Another specimen 120 mm. long, from off Cape Bedford, is somewhat intermediate between the two varieties, having many smaller spots intermingled with the larger ones.

Localities.—This species has not hitherto been recognised from Australian waters. Specimens are in the Australian Museum from North-western Australia; Two Islands, off Cape Bedford, Queensland, coll. Hedley and Briggs, Aug., 1916; Palm Islands, Queensland, coll. E. H. Rainford, 1921; New Hebrides; New Caledonia; Bougainville Island; Batavia.

Family APOGONIDAE.

APOGON TRIMACULATUS Cuvier & Valenciennes.

Apogon trimaculatus, Cuvier & Valenciennes, *Hist. Nat. Poiss.*, ii., 1828, p. 156, Pl. xxii; Castelnau, *Res. Fish. Austr.* (Vict. Offic. Rec. Philad. Exhib.), 1875, p. 9.

Amia trimaculata, Bleeker, Atlas Ichth., vii., 1875, p. 80.

? *Amia rhodopterus*, Bleeker, *Ibid.*, 1876, p. 81, Pl. cccxii., fig. 1.

? *Amia koilomatodon*, Bleeker, *Ibid.*, 1876, p. 81, Pl. cccvii., fig. 1; Jordan & Seale, Bull. U.S. Fish. Bur., xxv., 1906, p. 240, fig. 34.

Four specimens in the Australian Museum indicate that *A. rhodopterus* and *A. koilomatodon* are merely colour variations of *A. trimaculatus*. Three of them agree with Jordan and Seale's figure quoted above in the disposition of their colour markings, and particularly in having a small dark spot on each side of the tail; this feature was considered by Bleeker to be characteristic of *A. rhodopterus*. The fourth specimen is quite similar to the others, but has an additional dark spot across the upper part of the caudal peduncle, disposed as in Cuvier & Valenciennes' figure of *A. trimaculatus*.

Localities.—This species has been recognised from Cape York by Castelnau. A fine specimen, 147 mm. long, is in the Australian Museum from Palm Islands, Queensland, which was collected by Mr. E. H. Rainford. Also two others from the New Hebrides, and one from Singapore.

APOGON SAVAYENSIS Günther.

Amia savayensis (Günther), Jordan & Seale, Bull. U.S. Fish. Bur., xxv., 1906, p. 239, fig. 33 (synonymy).

Localities.—This species has not hitherto been recorded from Australian waters. Specimens are in the collection from the following localities:—Murray Island, Torres Strait, coll. Hedley & McCulloch, October, 1907; Palm Islands, and Holborn Island, off Port Denison, Queensland, coll. E. H. Rainford, 1921.

CHEILODIPTERUS MACRODON Lacepède.

Cheilodipterus lineatus, Lacepède, H. N. Poiss., iii., 1802, p. 539, Pl. xxxiv., fig. 1 (Not *Perca lineata* Forskal).

Centropomus macrodon, Lacepède, *Ibid.*, iv., 1802, p. 252, 273.

Paramia macrodon, Bleeker, Atlas Ichth., vii., 1876, p. 105, Pl. cccv., fig. 2 (synonymy).

A fine specimen, 170 mm. long to the end of the middle caudal rays, which was collected at Palm Islands, Queensland, by Mr. E. H. Rainford, enables me to add this species to the Australian list.

Family NEMIPTERIDAE.

SCOLOPSIS TEMPORALIS Cuvier & Valenciennes. (Plate xl., fig. 3).

Scolopsides temporalis, Cuvier & Valenciennes, Hist. Nat. Poiss., v., 1830, p. 341; Lesson, Voy. Coquille, 1826-30, Poiss. Pl. xxvi.

Scolopsis temporalis, Günther, Brit. Mus. Cat. Fish., i., 1859, p. 360; Bleeker, Atlas Ichth., viii., 1876, p. 12; Macleay, Proc. Linn. Soc. N.S. Wales, vii., 1882, p. 239.

D.x/9-10; A.iii/7-8; P.19; V.i/5; C.17 L. Lat. 46+2; 5½ scales between the lateral line and the origin of the dorsal fin, and 18 more to the origin of the anal.

Depth at the ventrals 2.7 in the length to the hypural joint; head 3.1 in the same. Eye 3.2 in the head and 1.1 in the snout, which is 2.8 in the head; interorbital width 1.2 in the eye. Fourth dorsal spine 2.7, seventh dorsal ray 2.1, and pectoral fin 1.2 in the head. Third anal spine 3.2 and first anal ray 2.6 in the head.

Body moderately elevated anteriorly, the profile from the back to the snout slightly convex. Snout rather sharp, the jaws subequal. Scales extend forward on the upper part of the head almost to the level of the posterior nostril; six

rows on the cheek, excluding those on the lower limb of the preoperculum. Maxilla not quite reaching the vertical of the anterior margin of the eye. Preorbital more than half as wide as the eye, and armed with a strong spine, below which are several denticulations. Hinder margin of the preoperculum serrated, its angle projecting a little backward and coarsely denticulated. Operculum armed with a single spine. A band of fine teeth in front of each jaw, which changes to a single row on each side; vomer and palatines toothless.

Lateral line arched anteriorly, then running parallel with the curve of the back until below the end of the dorsal fin, where it descends to the middle of the caudal peduncle. The scales above it are parallel with it, but are arranged in oblique rows on the side of the body. There are four scales between the lateral line and the middle of the spinous dorsal.

The fourth to the tenth dorsal spines are subequal in length, and are shorter than the rays, which increase slightly in length to the seventh; the margin of the fin is not excised between the spinous and soft portions, and is rounded posteriorly. Anal spines increasing in length backward, but the third is shorter than the anterior ray. First ray of the ventral filamentous, reaching beyond the vent. Caudal forked, the upper lobe produced beyond the lower.

Colour.—The general colour appears to have been bright yellow, with violet stripes between each row of scales; these are longitudinal above the lateral line and oblique below it. The dorsal profile between the nape and the end of the fin is dark violet. Head yellow, darker above, with broad blue stripes; two of these cross the snout between the eyes, and a third extends from the upper lip to the lower margin of the eye, and terminates in an expansion on the upper part of the preoperculum; another band passes obliquely across the cheek to the operculum, where it bends sharply downward and forms an acute angle. Spinous dorsal with a yellow margin, followed by a pale violet submarginal band, beneath which the membrane is iridescent with yellow and violet; second dorsal and anal colourless. Pectoral with a dark brown streak across its base. First ventral ray yellow, the rest of the fin white. Caudal yellow, with a violet stripe on each lobe, the upper of which is separated from the outer margin; a violet border posteriorly.

Described and figured from a specimen 172 mm. long to the end of the middle caudal rays.

This example is apparently referable to *S. temporalis*, though it differs in several details from Lesson's rather crude figure quoted above. I have compared it with two specimens recorded by Macleay under the same name from Port Moresby, and find it identical. The species has not hitherto been recognised from Australian waters.

Locality.—Palm Islands, Queensland, coll. E. H. Rainford.

Family LABRIDAE.

INIISTIUS PAVONINUS Cuvier & Valenciennes.

Xyrichthys pavoninus, Cuvier & Valenciennes, Hist. Nat. Poiss., xiv., 1839, p. 63.
Iniistius pavoninus Jordan & Evermann, Bull. U.S. Fish. Comm., xxiii., 1, 1905,

p. 329, fig. 139, and pl. xlii. (synonymy).

Iniistius cacatua Waite, Rec. Austr. Mus., iv., 1, 1901, p. 41, Pl. vii.

Synonymy.—A comparison of the holotype of *I. cacatua* with a smaller Hawaiian specimen which is evidently *I. pavoninus* shows them to be similar in all details except the position of the anterior dorsal spine. This is a little farther back in the larger example, but is not so far back as is illustrated in

Waite's rather crude figure, which is inaccurate in other details, such as the backward extension of the mouth and the relative length and depth of the head.

Localities.—Lord Howe Island; holotype of *I. cacatua*. Honolulu, Hawaiian Islands.

Subfamily ELEOTRINAE.

PARIGLOSSUS RAINFORDI, n.sp. (Plate xli., fig. 4).

D.v/17; A.16; P.18; V.i/4; C.15. Depth at the ventral fins 5.2 in the length to the hypural joint; head 4.5 in the same. Eye 3.5 in the head. Depth of the caudal peduncle 1.7 in the head. Third dorsal spine a little longer than the head. Sixth dorsal ray 1.7, eighth anal ray 1.5, and pectoral fin 1.4 in the head.

Body rather elongate, compressed; head compressed, much deeper than broad. Snout tumid, the mandible in advance of the premaxillaries. Mouth nearly vertical, the maxilla not reaching the vertical of the anterior margin of the eye. Head entirely naked, with several pores above the eye and on the preopercular margin. No barbels. Gill-opening lateral and vertical, a little wider than the base of the pectoral; gill-membranes broadly united with the isthmus. Tongue broad, spatulate, its anterior margin rounded. Eye in the anterior half of the head, its diameter much greater than its distance from the end of the snout and equal to the interocular space, which is convex. Premaxillaries with a row of about seven large outer teeth on each side of the symphysis which increase in size backwards; inside these is a narrow band of minute teeth on each ramus. Mandible with a pair of large canines on each side; a narrow band of minute teeth anteriorly, and a single row of still smaller ones on each side.

Body largely covered with minute imperfect scales which extend forward to the shoulder, but leave the nape naked; they are rudimentary on the abdominal surface. No lateral line. A minute genital papilla.

First dorsal originating just behind the vertical of the middle of the pectoral; its third spine is longest and filamentous, and together with the fourth, reaches beyond the origin of the second dorsal when adpressed. Margin of the second dorsal somewhat rounded, the last rays reaching backward to the hypural joint. Anal opposite and similar to the second dorsal. Pectorals rather short, rounded. Ventrals close together, but separate, composed of one spine and four rays; the inner ray is simple and filamentous, but does not reach the vent. Caudal rounded.

Colour-marking.—General colour light green, with a dark bluish-black marking on the base of the caudal fin. A violet brown band usually extends along the middle of each side, but may be indistinct. A brown spot behind the eye, and several pale blue ones on the cheek and operculum. First dorsal pinkish, its prolonged rays white; second dorsal dark violet basally, then yellow, with a broad pink border. Anal bright yellow, bordered with pink. Caudal with two broad oblique bars and the median rays pink, the intermediate colour yellow; the upper and lower edges white.

Described and figured from a specimen 43½ mm. long. Four others 34-44½ mm. long, exhibit but little variation, but show that a sixth dorsal spine may be developed, and there may be only sixteen rays.

Affinities.—This species apparently differs from *P. taeniatus* Regan (Trans. Linn. Soc., Zool., (2), xv., 2, 1912, p. 302) in its colour marking, the dark marking on the tail being undeveloped in that species. Its proportional details also appear to be different.

Locality.—The five specimens referred to above were collected at Bowen, Queensland, by Mr. E. H. Rainford, who found them in a log which was honey-combed by Cobra, *Calobates*, in the empty tunnels of which they were dwelling. He later secured many others at the same locality.

EXPLANATION OF PLATES XXXVII.-XLI.

Plate xxxvii.

- Fig. 1. *Carcharhinus macrurus* Ramsay & Ogilby. A female, 877 mm. long, from Botany Bay, New South Wales.
- Fig. 2. Under surface of the head of the same specimen.
- Fig. 3. Upper and lower teeth of the same specimen.
- Fig. 4. A scale from the shoulder of the same specimen.
- Fig. 5. *Galeorhinus australis* Macleay. An adult male, 1525 mm. long, from the coast of New South Wales.
- Fig. 6. Under surface of the head of the same specimen.
- Fig. 7. Upper and lower teeth of the same specimen.

Plate xxxviii.

- Fig. 1. *Trygonorrhina fasciata* Muller & Henle. A young specimen, 380 mm. long, from off Sandon Bluff, New South Wales.
- Fig. 2. Nasoral region of the same specimen.
- Fig. 3. *Hypnarce subnigra* Dumeril. A male specimen, 353 mm. long, from off Cape Hawke, New South Wales, 47-60 fathoms.
- Fig. 4. Nasoral region of the same specimen.

Plate xxxix.

- Fig. 1. *Dasyatis kuhlii* Muller & Henle. A half grown male, 243 mm. wide, from off Bustard Head, Queensland, 20 fathoms.
- Fig. 2. *Dasyatis kuhlii*. A young male, 177 mm. wide, from the same locality.

Plate xl.

- Fig. 1. *Dasyatis thetidis* (Ogilby) Waite. A female specimen, 890 mm. wide, from off Norah Head, New South Wales, 20-40 fathoms.
- Fig. 2. Nasoral region of the same specimen.
- Fig. 3. *Scolopsis temporalis* Cuvier & Valenciennes. A specimen 172 mm. long to the end of the caudal rays, from Palm Islands, Queensland.

Plate xli.

- Fig. 1. *Urolophus bucculentus* Macleay. A female specimen 600 mm. wide, from off Botany Bay, New South Wales, 60 fathoms.
- Fig. 2. Nasoral region of the same specimen.
- Fig. 3. Buccal papillae of the same specimen.
- Fig. 4. *Pariglossus rainfordi*, n.sp. Holotype, 43½ mm. long, from Bowen, Queensland.



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