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STUDIES IN AUSTRALIAN SHARKS, WITH DIAGNOSIS OF A NEW FAMILY.

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(Plate iv.)

HEMISCYLLIUM MODESTUM, *Günther.*

Chiloscyllium modestum, Günther, Proc. Zool. Soc., 1871, p. 654, pl. liv.

(Plate iv., fig. 1; and Fig. 9).

ON the 7th September last, the Trustees received from Mr. E. C. Haviland seven fœtal Sharks, removed from one female. The parent was not forwarded with the young, but Mr. Haviland has since supplied the following particulars:—During a holiday, spent at Port Macquarie, New South Wales, he caught three 'dog-fishes' off the rocks on the ocean side; they were taken with a line among rocks and sea-weed in about five fathoms, and he understood that the species was common in the locality.

One of them, on being opened, was found to contain the seven young ones sent to the Museum; these, when placed into a rock-pool, swam about quite freely until a boy, despatched for a bottle, returned.

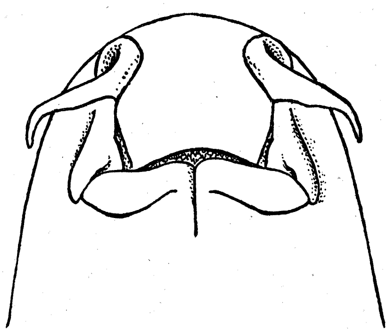

Fig. 9.

I am able to identify these young Sharks with *Hemiscyllium modestum*, Günth., and find that, in common with many of the Selachii, they possess a more ornamental colouration than the adults.

Günther's type, described under the name *Chiloscyllium modestum*[1] was a dried skin, his figure, therefore, though recognisable, is not wholly satisfactory; this applies more especially to the under side of the head, which is correctly represented in the accompanying diagram (Fig. 9).

1 Günther—Proc. Zool. Soc., 1871, p. 654, pl. liv.

The head is wide, and strongly depressed with an even curved profile from above the pectoral fin. The eyes are small and oval, about one-third larger than the spiracle, which is situated about its own diameter behind and below the eye; it has a complete thickened margin. The length of the snout is five-sixths the interorbital space or rather less than the width of the nasal flap. The nostrils are nearer the end of the snout than the mouth, each is bounded externally by a raised semi-circular flap and the inner margin is produced into a falcate cirrus having a broad base; when depressed it reaches to, or nearly to, the end of the upper labial fold; this fold is triangular in shape, extending from the nasal opening to the external angle of the mouth, where it is widest. The lower labial fold is also large, but does not reach the symphysis, indicated by a deep sinus.

The teeth in both jaws are similar and tricuspid, the median cusp being comparatively large; there are about four rows of teeth in function.

The four anterior gill-openings are oblique, the fifth less so, larger and closer; the last three are above the pectoral.

The posterior insertion of the first dorsal fin is midway between the end of the snout and that of the tail. The second dorsal is similar in character and extent, and is separated by a space little more than half its base; the angles are not produced. The pectoral is inserted midway between the end of the snout and the origin of the ventral; the latter arises generally, but not wholly, in advance of the first dorsal. The anal is well developed, and has a long base which originates behind the posterior insertion of the second dorsal; it is subcontinuous with the caudal.

The caudal is continued in the line of axis of the body; its lower lobe is long and deep, rendering the fin deeper than any part of the tail, that is, behind the ventrals.

A depressed lateral line begins on each side, above the spiracle, and passes along the upper portion of the side to the caudal. Above it and nearer to it than to the median line is a series of pores, arranged rather irregularly two or three deep. A single line of pores passes backwards and upwards from the spiracle and becomes lost in an irregular series above the gill-slits.

Colours.—The general colour of the body above and on the sides is a coffee-brown, with or without markings; the fins are greyer. The under part of the head and anterior parts of the body are yellow, the rest of the body brown, though much lighter than above, while the tail is uniformly brown throughout.

The young Sharks sent by Mr. Haviland are greyer in colour than the adults, and have eleven well defined darker cross bands which do not, however, reach the ventral surface. The first is across the occiput; the second and third in advance of, and the fourth and fifth at the base of the first dorsal; the sixth and seventh at the base of the second dorsal, the eighth above the anal, and the remainder on the caudal fin. The bands, ground colour, and fins are alike ornamented with scattered white spots, some of which have a dark ring around them. All the examples have the yolk-sac attached, its position and character being represented in the accompanying illustration (Pl. iv., fig. 1).

These coloured cross-bands, and even the spots, sometimes persist to adult life, in fact, I believe, if sought for, traces of the bands at any rate could be found in the majority of fresh examples. Specimens showing such markings, were described by Macleay under the name *Chiloscyllium furvum.*[2] This author gives Port Jackson as a habitat, but I do not think the species has been taken within the harbour; it is only found on the coast in rocky situations and is never caught excepting with hook and line. It is taken by fishermen when angling for Groper *(Achærodus)*, the bait being either a Shore Crab *(Grapsus variegatus*, Fabricius), or the Ascidian locally known as Cungeboy *(Cynthia præputialis*, Stimpson).

Hemiscyllium modestum is commonly used for demonstration purposes in the Biological Department at the Sydney University, hence it is made one of the types in Parker and Haswell's Text-book of Zoology. The authors have used Macleay's name, rendering *Chiloscyllium furvum* as *C. fuscum.*[3] With regard to the shell gland mentioned (and figured) as a slight swelling, Prof. Haswell replies to me as follows:—"I do not think that the presence of a functional shell-gland necessarily implies oviparity; a good many of the viviparous forms develop a shell, though it is thin and is soon thrown off."

Being a source of small revenue to the fishermen, they are in the habit of placing their captures in rock-pools, whence they cannot escape. The Sharks have been thus kept alive for several days, and fed upon fishes entrails and other food thrown to them. As ascertained by opening the stomachs of individuals caught, the food in a natural state is rather varied. I have found portions of Crabs and small Fishes *(Lophonectes ?)*. Of two examples in the Sydney University, examined by the kindness of Mr. J. P. Hill, F.L.S., one had swallowed a Sepia, the other an Anemone *(Actinozoon)* and two Macrurus Crustaceans which Mr. Whitelegge believes to be *Galathea.*

Though appearing in literature as the Dusky Dog-fish or Brown Cat Shark, it is universally known to the fishermen as Blind Shark, this, though of course a misnomer, is applied on account of the comparatively small eyes and the habit of the Shark in

2 Macleay—Proc. Linn. Soc. N.S.W., vii., 1882, p. 364.

3 Parker and Haswell—Text-book of Zoology, ii., 1897, p. 135.

retracting them and closing the eyelids when it is removed from the water.

It was originally described from Queensland, but does not appear to have been since noticed there. On our coast, in addition to the metropolitan area, it is now known to be common at Port Macquarie, and is doubtless numerous in suitable situations all along the coast; so far we have not received it from localities south of Botany Bay.

The fœtus figured, of natural size, measures 162 mm. in length.

The following are the principal dimensions of an adult specimen, a male, obtained at Lillipilli, near Maroubra Bay, on 3rd March, 1901:—

	mm.
Total length	620
Length of head to 1st gill-slit	83
" " 5th "	118
Width of head	90
Snout to eye, front margin	40
Diameter of eye	12
Snout to spiracle	52
Diameter of spiracle	10
Snout to mouth	30
Width of mouth	48
Length of cirrus	24
Circumference of body (behind pectorals)	233
Height of body	60
Length of snout to vent	270
Snout to 1st dorsal fin	270
Length of 1st dorsal fin (base)	58
" " front margin ...	86
" " posterior margin ...	53
Snout to 2nd dorsal fin	368
Length of 2nd dorsal fin (base)	49
" " front margin ...	80
" " posterior margin ...	47
Intradorsal space	40
Snout to pectoral fin	110
Length of pectoral fin	85
Width of pectoral fin	65
Snout to ventral fin	240
Length of ventral fin	90
Width of base, ventral fin	55
" margin, ventral fin	68
Snout to anal fin	420
Length of anal fin	57
" base, anal fin	40
" caudal fin	160
Height of caudal fin	48
Length of basal lobe	120

One of the characters of the Scylliorhinidæ, to which family *Hemiscyllium* has been assigned, is that afforded by the method of reproduction. Like members of the Rajidæ, these Sharks are oviparous, laying angular chitinous egg-cases.

Hemiscyllium has been shown to produce its young alive, that is, to be ovoviviparous, and for a similar habit members of the Rhinobatidæ have been separated as a family distinct from Rajidæ.

To maintain uniformity in classification, it is necessary to associate *Hemiscyllium* and *Chiloscyllium* to form a new family, which may be thus characterised :—

Family HEMISCYLLIIDÆ.

Two dorsal fins, similar, without spines, the first wholly, or in part behind the ventrals. Anal fin present, behind the second dorsal and more or less continuous with the caudal. Caudal fin moderate or long with a basal lobe, the tail not keeled, not bent upwards. Spiracles present; no nicitating membrane; gill-openings small, the posterior ones above the root of the pectoral. Mouth moderate, with several rows of small teeth with or without lateral cusps. Nostrils near the snout, confluent with the mouth, provided with cirri.

Young produced alive.

The Hemiscylliidæ thus differ from the Scylliorhinidæ mainly by having the anal fin behind the second dorsal, and in being ovoviviparous.

The following families now constitute the Scyllioidea :—

Scylliorhinidæ............oviparous.
Ginglymostomidæ ......
Hemiscylliidæ............ovoviviparous.
Orectolobidæ ....ovoviviparous.
Pseudotriakidæ ....

ORECTOLOBUS BARBATUS, *Gmelin.*

Squalus barbatus, Gmel., Syst. Nat., i., 1788, p. 1493.

When writing the foregoing article on *Hemiscyllium*, it occurred to me that although I was under the impression that the Wobbegong (*Orectolobus barbatus*) produced living young, I had nowhere seen the habit published. In order to place the matter beyond doubt, I enlisted the kind services of Mr. J. A. Brodie, Chief Inspector of Fisheries, who at once responding, sent to me Inspector William H. Newton, in charge of the Port Hacking District. This officer assured me that the Wobbegong bears its young alive, and that in November last he removed twenty-three young ones from a single female. Some of these, when placed in water, swam about quite vigorously, and were evidently within a few days of being born. Others were thrown on to the beach, and though this took place in the morning, at night they were found to be still alive.

In response to a circular forwarded by Mr. Brodie to all his officers, I have had numerous reports, all agreeing as to the ovo-viviparous habit of the Wobbegong.

In the letter above mentioned, Prof. Haswell also writes:—"I was much interested to hear of your discovery with regard to *Hemiscyllium;* it constitutes another link between it and *Crossorhinus*, to which, rather than to the Scyllidæ, some of the features of the skull, etc , seem to connect it. It has been known to me for a good many years that *Crossorhinus* is viviparous, but I do not know that the fact has been published. Other viviparous forms in our local fauna are: *Urolophus*, *Trygon*, *Myliobatis*, *Hypnos*, *Trygonorhina*, *Rhinobatus*, *Pristiophorus*."

SQUALUS MEGALOPS, *Macleay*.

Acanthias megalops, Macl., Proc. Linn. Soc. N.S.W., vi., 1881 (1882), p. 367.

(Plate iv., fig. 2).

By purchase, the Trustees recently obtained two examples of this species. They were caught by a fisherman on August 24th, 1900, at Neverfail, between Port Jackson and Broken Bay, in sixty fathoms. Both are females in full breeding condition. They measure respectively 565 mm. and 515 mm. in total length, and the smaller example, in addition to five or six large eggs, contained a young one almost ready for birth. It is this fœtus which I have figured on the accompanying plate, of which more below.

Looking first to the adults, the validity of the species claims some attention. It is one of three recorded from Australian waters, the other two being *S. acanthias*, Linn., widely distributed in the Atlantic and identified by McCoy in Victoria, and *S. blainvillii*, Risso, recorded by Günther and Ogilby from Australia. Günther mentions that *Acanthias blainvillii* is scarcely distinct from *A. vulgaris*[4] *(S. acanthias)*, while Ogilby considers that "eventually it is probable that the three will have to be joined together under a common name."[5]

The differences between *S. acanthias* and *S. megalops* are certainly not many, but the most noticeable one, namely, the

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[4] Günther—Brit. Mus , Cat. Fishes, viii., 1870, p. 419.

[5] Ogilby—Proc. Linn. Soc. N.S.W., (2), iii., 1888, p. 1096, and iv., 1889, p. 1 5.

position of the ventral fin is so striking and so constant that I feel compelled to regard the two as distinct, and Mr. Ogilby since tells me that he now holds the same view.

In *S. megalops* the ventral fin occupies a much more forward position, the centre of its fleshy base being exactly midway between the end of the snout and the termination of the upper caudal lobe, while the anterior insertion of this fin is below the middle of the space between the origin of the two dorsals. An examination of any specimen of *S. acanthias*, shows a much more posterior situation of the ventral.

Very many of the examples which I knew so well on the Yorkshire coast under the name "Sea-dog," exhibited white spots; in the young they were generally to be traced. These features are recorded by Day, Yarrell, Couch, and other writers on British Fishes. I have not seen a spotted example of *S. megalops*, and the fœtal specimens above referred to show no trace of such. The point of each dorsal spine in this species is covered by a little knob, a feature referred to in *S. acanthias* by Mr. Robert Ball as follows:—

"Mr. Ball brought under notice of the Academy, as an unobserved fact, a beautiful provision in the fœtus of the Spined Dog-fish (*Acanthias vulgaris*), by which the mother is protected from being lacerated by the spines of the young before birth. He exhibited two perfectly developed young, which he had taken from the mother on the 30th November last; in these the spines were each covered at the point with a small knob of cartilage, fastened by straps of the same material, passing down one on each of the three sides of each spine, in such a manner as evidently to become easily detached at birth, thus allowing the little animal to commence life effectively armed. He mentioned that the female in question contained a large number of eggs, in various states of development, in addition to the two fully-formed young."[6]

The drawing of the fœtal Shark, reproduced by Richardson,[7] evidently represents *Squalus acanthias*, and not *S. megalops*, as indicated not only by the posterior position of the ventral fin but also by the presence of the white spots. On comparing this figure with my illustration, the difference in the comparative size of the eyes is very striking, much more than in the adults, though it was this peculiarity which induced Macleay to bestow upon his species the name *megalops*.

The example figured, of the natural size, measures 162 mm. in length.

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6 Ball—Proc. Roy. Irish Acad., iii., 1847, p. 230.

7 Richardson—Voy. Ereb. and Terr., Fish, 1846, p. 44, pl. xxviii., figs. 1 and 2 (*errore* fig. 5 in text).

ADDENDUM TO HEMISCYLLIUM.

On March 11th, we received from a fisherman at Lillipilli two adult females of *Hemiscyllium modestum*. The larger measures 660 mm. in length, and contained eight young ones in an early stage of growth. All are of about equal size. In one examined the length is 74 mm., the diameter of the egg-sac 34 mm., and the length of the peduncle 16 mm. The dark bands are clearly indicated, those on the head being most conspicuous. A short rather faint band connects the eyes; this is not apparent in the larger examples previously described. The succeeding band, namely that across the occiput, is convex in front, while the next one is very markedly concave.

The most interesting feature of these fœtal examples is the external gills. They are in five clusters, one proceeding from each gill-slit; each cluster consists of about a dozen filaments; these are scarlet in colour, and 18·5 mm. in length.

Branchial filaments also pass from the spiracle; this has been shown to be a modified visceral cleft, and in early embryos indistinguishable from the other clefts.[8]

In the smaller female the ovary was apparently unimpregnated. The only substance found in the stomach was a coralline seaweed (*Corallina*) represented by several pieces.

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[8] Balfour—Embryology, ii., 1881, pp. 50-1.

EXPLANATION OF PLATE IV.

Fig. 1. *Hemiscyllium modestum*, Günther.
Fœtus, natural size.

Fig. 2. *Squalus megalops*, Macleay.
Fœtus, natural size.

[Reproduced from drawings by the author]

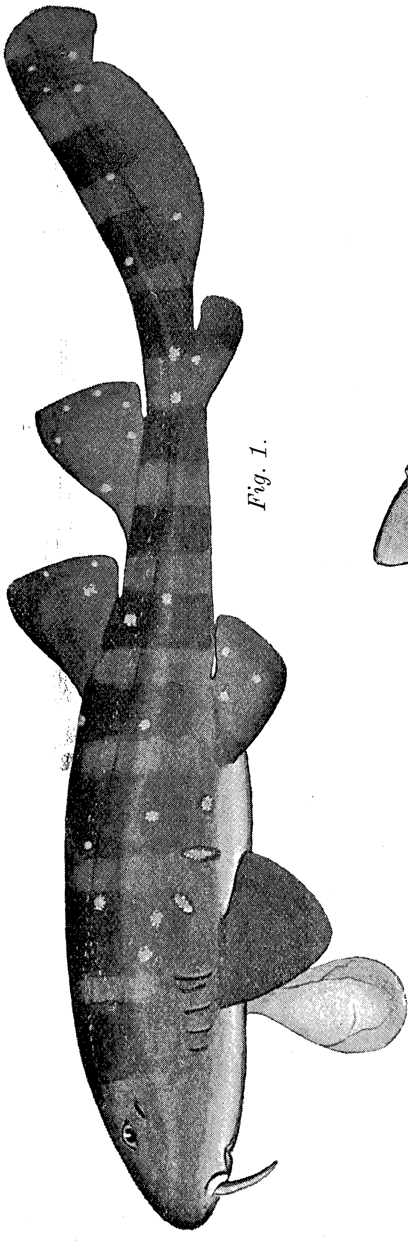

Fig. 1.

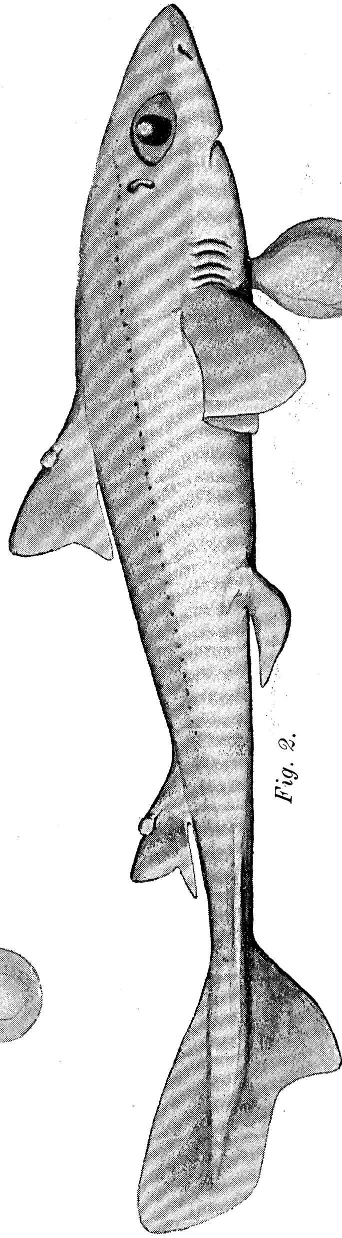

Fig. 2.

EDGAR R. WAITE, Del.