PAPERS AND PROCEEDINGS OF THE ROYAL SOCIETY OF TASMANIA, VOLUME 97

OBSERVATIONS ON SOME TASMANIAN FISHES: PART XI

By

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(With eight text figures)

ABSTRACT

New records for Tasmania are *Girella elevata* Macleay, 1881 (with comparison of Tasmanian and New South Wales examples); *Stigmatogobius poicilosoma* (Kner), 1865 (with notes on life colors). Reinstated on local list is *Spheroides hamiltoni* (Gray & Richardson), 1843 (earlier displaced in favour of *S. liosomus* Regan, 1909: both species occur here). Confirmatory records are given for *Ophisurus serpens* (Linné), 1758 (description of Tasmanian specimen; dentition figured); *Tetraodon armilla* McCulloch & Waite, 1915.

General observations (chief topic(s) in parentheses) are made on *Heterodontus portusjacksoni* (Meyer), 1793 (omission of Tasmania in Handbook localities, biometric data on 7 females); *Heterodontus galeatus* (Günther), 1870 (Tasmanian ?); *Cephaloscyllium isabella laticeps* (Duméril), 1853 (biometric data on 7 adults and a foetus, egg-case, description and figure of foetus, which carries 2 dorsal rows of enlarged denticles); *Myliobatis australis* Macleay, 1881 (sexual dimorphism, study of dentition); *Gonorhynchus greyi* (Richardson), 1841 (published figures reviewed)*, *Muraenichythys breviceps* Günther, 1876 (figure of head); *Leptonotus semistriatus* Kaup, 1856 (coloration)*; *Syngnathus philippi* Lucas, 1891 (figure of brood pouch, coloration, depth record)*; *Solegnathus fasciatus* (Günther), 1880 (eggs and their attachments)*, *Stigmatopora argus* (Richardson), 1840 (description and figure of brood pouch)*; *Phylloptexyx taeniolatus taeniolatus* (Lacépède), 1840 (eggs); *Nesogobius hinsbyi* (McCulloch & Ogilby), 1919 (localities, depth record); *Arenigobius bifrenatus* (Kner), 1865 (locality, coloration); *Spheroides richei* (Freminville), 1813 (dimensions, coloration, comparison with *S. hamiltoni*). In the species marked with an asterisk proportions and counts here noted extend the known range as given in the Handbook (Munro 1956 +) and, in the case of syngnathids, as set out in the conspectus (Scott, 1961).

Keys are provided covering the Tasmanian members of the families Heterodontidae, Scyliorhinidae, Girellidae, Gobiidae, Tetraodontidae.

INTRODUCTION

This paper follows the general plan of earlier contributions in this series. All linear dimensions are in millimetres; except where its absence might lead to confusion, the name of the unit is omitted. Standard length and total length are denoted by *Ls* and *Lt*; while *TLs, TLt,* used in recording proportions, signify thousandths of standard, thousandths of total, length. Locality records include, where practicable, the county name.

Basic data has been compared with that presented in the Handbook of Australian Fishes (Munro, 1956 +), and attention has been called to any divergences encountered.

Family HETERODONTIDAE

Only one Australian genus is usually recognized, *Heterodontus* Blainville, 1816, with 2 species: (1) *H. portusjacksoni* (Meyer), 1793, (2) *H. galeatus* (Günther), 1870; but Günther's species is sometimes referred, as in the Check List, to *Gyropleurodus* Gill, 1862, or to *Molochophrys* Whitley, 1931.

The claims to inclusion in the Tasmanian list of these 2 species are discussed below; and some dimensions of (1) are tabulated.

KEY TO AUSTRALIAN SPECIES OF HETERODONTIDAE

A. Posterior border of supraorbital ridge more nearly horizontal than vertical, lapsing tolerably evenly and gradually into general profile of head. Enlarged lateral teeth not carinate. Origin of anal slightly ($\leq \frac{1}{2}$ anal base) behind termination of second dorsal. With black or blackish harness-like markings on trunk .... *H. portusjacksoni*

AA. Posterior border of supraorbital ridge more nearly vertical than horizontal. Enlarged lateral teeth distinctly carinate. Origin of anal well ($=$ anal base) behind termination of second dorsal. Without black or blackish harness-like markings on trunk .... *H. galeatus*

HETERODONTUS PORTUSJACKSONI (Meyer), 1793

Squalus portusjacksoni Meyer 1793, Zool. Entdeck.: 71. (Based — *fide* Whitley, 1934: 181— on the Port Jackson Shark figured in Philipps' *Voyage*: 166, pl. 42).

Squalus philippi Bloch & Schneider, 1801, Syst. Ichth.: 134, Type locality: 'New Holland' [= Port Jackson, *fide* McCulloch (1929:4)].

Heterodontus portusjacksoni (Meyer), 1793. Whitley, 1934, *Mem. Qld Mus.*, x, iv: 181.

Claim to inclusion in Tasmania list.—This species has been regularly included in all locally compiled Tasmanian faunal lists—Allport [unpublished: *fide* Johnston (1883)], Johnston (1883:139; 1891:39), Lord (1923:61), Lord & Scott (1924:5, 18): it is credited to Tasmania also in the Check List (McCulloch, 1929:4), and in the survey of Australian sharks and rays by Whitley (1940:72). It is indeed by no means uncommon in our waters, and I have examined a number of specimens from the north, east, and south of the Island. It hence seems expedient to draw attention to the fact that in

the latest synoptic account of Australian fishes, the valuable Handbook of Australian Fishes (Munro), currently in serial publication in the *Fisheries Newsletter*, the localities given comprise all States except Tasmania.

Dimensions.—Some important dimensions of 3 Tasmanian females, in *TLt*, are set out in Table I.

HETERODONTUS GALEATUS (Günther), 1870

Cestracion galeatus Günther 1870, Cat. Fish. Brit. Mus., viii: 416. Type locality: 'Australia' [= New South Wales, *fide* McCulloch (1929:4)].

Claim to inclusion in Tasmanian list.—This species is not included in any local list, nor is it credited to Tasmania by the Check List or the Handbook. However, Whitley (1940:73) notes, 'It has been dubiously recorded from Tasmania.'

I have received reports from several careful observers that suggest it may occur along our northern coast; but I have seen no specimens.

TABLE I

Heterodontus portusjacksoni (Meyer), 1793. Three Tasmanian females: (*a*) Deviot, Devon, February 1941, (*b*) Coles Bay, Glamorgan, 4th November 1958, (*c*) Low Head, Dorset, 25th January 1934. Actual dimensions in millimetres in first line: all other dimensions as thousandths of total length.

Dimension	Specimen								
	a			*b*			*c*		
Total length (mm)	724			896			962		
Snout	88			95			84		
Eye: horizontal diameter, interorbital distance	29	73		29	69		—	—	
Mouth: length to most anterior point, length to most posterior point, width	14	41	90	16	55	106	—	58	—
Gillslits I-V: lengths to slits	170	188	203	174	190	204	165	—	—
	217	229		217	229		—	—	
Gillslits I-V: lengths of slits	61	58	55	68	64	59	—	—	—
	46	26		51	37		—	—	
Pectoral: length to origin, base, greatest width	181	104	156	191	170	152	190	—	—
Pectoral: length of anterior border, outer border, inferior border	220	192	76	246	192	76	225	122	—
Pectorals: total spread of 2 fins	552			592			—		
First dorsal: length to origin, base, vertical height	276	84	99	271	83	95	276	81	—
First dorsal: length of anterior border, outer border, inferior border	146	104	59	134	85	57	125	92	63
Spine of first dorsal: total length, exposed length	83	32		65	20		47	35	
Second dorsal: length to origin, base, vertical height	554	70	83	553	69	73	555	67	—
Second dorsal: length of anterior border, outer border, inferior border	116	86	49	109	85	50	93	78	49
Spine of second dorsal: total length, exposed length	76	30		63	20		63	34	
Anal: length to origin, base, vertical height	624	48	—	628	49	50	624	56	—
Anal: length of anterior, outer border, inferior (inner) border	95	58	35	102	45	50	110	52	32
Pelvic: length to origin, base, total spread of 2 fins	417	86	214	428	84	227	425	—	—
Pelvic: length of anterior border, outer border, inner border	98	86	48	103	104	61	—	—	—
Caudal: length to inferior origin, superior origin	—	791		785	789		781	—	
Vent: length to middle	477			484			—		
Spiracle: length to anterior border, diameter, interspiracular distance	116	4.6	99	121	4.5	—	—	—	—
Spiracle: distance from middle of posterior border of orbit	—			22			22		
Nostril: length to anterior border, length of aperture, internarial distance	73	19	10	69	19	13	—	—	—
Height: at top of supraorbital ridge, maximum (at gillslit V)	131	—		—	—		124	114	
Distance between supraorbital ridges (to outer edges)	91			—			85		

Family SCYLIORHINIDAE

Only two species, (1) *Cephaloscyllium isabella* (Bonnaterre) 1788—dealt with below as *C. i. laticeps* (Duméril) 1853—and (2) *Halaelurus analis* (Ogilby), 1865, are credited to Tasmania in the Check List. The first occurs in southern New South Wales, Victoria and South Australia; the second in these States and in Western Australia.

There have since been added both the 2 species previously known from the southern mainland States, thus leaving of the 6 Australian members of the family only 2 unreported from Tasmania, namely, *Halaelurus labiosus* (Waite), 1905 from Western Australia, 'also doubtfully recorded from Queensland and Northern Territory' (Munro, 1956:6), and *Atelomycterus macleayi* Whitley, 1939, from Queensland, Northern Territory, Western Australia. Species added to our list since 1929 are: (3) *Galeus boardmani* (Whitley), 1923, a female (previously males only known), *Lt* 503, caught in 300 fathoms off Maria Island on 2nd July 1952, recorded by Olsen (1958:156); (4) *Halaelurus vincenti* (Zeitz), 1908, a specimen, *Lt* 462, caught in a graball net in George Bay, near St. Helens, Dorset/Cornwall, in May 1951, recorded by Olsen (1958:156). In reporting (4) Olsen gives some valuable comparative comparative measurements of two examples of (2) and one of *Parascyllium ferrugineum* McCulloch, 1911 (in text species inadvertently attributed to Waite), the last-named being in the same paper recorded for the first time from our waters [Tasmanian species of Orectolobidae keyed in a paper in the present series (1961)].

KEY TO SCYLIORHINIDAE RECORDED FROM TASMANIA

1 { A series of enlarged denticles along upper edge of caudal, and a series along lower edge of caudal peduncle. Base of second dorsal $>$ base of first dorsal .... *Galeus boardmani*
Neither of two such series of enlarged denticles present. Base of second dorsal $\leq$ base of first dorsal 2

2 { Two gillslits over pectoral base. Base of first dorsal partly ($=$ $\frac{1}{2}$) over pelvic base; interdorsal $<$ $1\frac{1}{2}$ (0.7 — 1.1) base of first dorsal. Anal base $\leq$ (0.7 — 1.0) first dorsal base; the fin ending under posterior half of second dorsal base. With large dark bars and blotches on dorsum and upper half of lateral surface; and with smaller dark spots. *Cephaloscyllium isabella laticeps*
One gillslit over pectoral base. Base of first dorsal wholly (or virtually wholly) behind pelvic base: interdorsal $>$ $1\frac{1}{2}$ (2-3) base of first dorsal. Anal base $>$ (1.5-2) first dorsal base; the fin ending under anterior half of second dorsal base. Without large dark bars and blotches on dorsum or upper half of lateral surface; with smaller spots only 3

3 { Anal base about 2 first dorsal base. Length from end of second dorsal base to end of caudal about $1\frac{1}{2}$ in length from tip of snout to origin of first dorsal (or twice the first distance equal to distance from tip of snout to about middle of interdorsal). Pelvics of male connected by a membrane behind the claspers. Light brown with widely spaced dark rusty spots *Halaelurus analis*
Anal base about $1\frac{1}{2}$ first dorsal base. Length from end of second dorsal base to end of caudal about 2 in length from tip of snout to origin of first dorsal (or twice the first distance equal to distance from tip of snout to about first dorsal base). Pelvics of male in contact behind the claspers. Dark brown with numerous small white spots .... *Halaelurus vincenti*

Genus **CEPHALOSCYLLIUM** Gill, 1862

CEPHALOSCYLLIUM ISABELLA LATICEPS (Duméril), 1853

(Fig. 1)

Squalus isabella Bonnaterre, 1788, Tabl. Encycl. Meth., Ichth.: 6. Type locality: La mer du Sud.

Scyllium laticeps Duméril, 1853, *Rev. et Mag. Zool.* (2), v: 11 and 84, pl. iii, fig. 2 (head). Type locality: Coasts of New Holland (Verreaux) [= Tasmania, *fide* Whitley (1940)].

Cephaloscyllium isabella (Bonnaterre). McCulloch, 1929, *Mem. Aust. Mus.*, v, 1: 9.

Cephaloscyllium laticeps (Duméril). Whitley, 1940, Fish. Aust., pt i: 92, fig. 8, 1.

? Cephaloscyllium laticeps forma *nascione* Whitley, 1932, *Rec. Aust. Mus.*, xviii, 6: 323, fig. 2, 1. Type locality: off Montagu Island, New South Wales.

Cephaloscyllium isabella laticeps (Duméril). Munro, Handbk Fish. Aust., 3: 6, fig. 38 [in *Fisheries Newsletter*, xv, 7, July 1956: 18, fig. 38].

Remarks.—The Australian Swell Shark is now generally regarded as distinct—either specifically, as, for example, by Whitley (1940), or subspecifically, as, for example, by Munro (1956)—from the New Zealand form, the latter being said to have anal base equal to distance between anal termination and origin of lower caudal lobe, whereas in the Tasmanian shark the fin base exceeds the other dimension. Again, New Zealand examples are said to be larger, reaching 8 feet, with a mean length of about 3 feet; while for the Australian form Whitley notes 'Length usually about one foot, but a Tasmanian specimen measured 38 inches': all adults I have seen were about 3 feet in total length, none reaching 4. Within the Australian species or subspecies, a forma, *nascione*, based on an example from New South Wales (Whitley, 1932) has been described: this is noted as being lighter-colored and as exhibiting differences in form and position of fins, shape of nostrils, and other features.

The type locality of Duméril's species, recorded, *teste* Verreaux, simply as Coasts of New Holland, has been more precisely located (Whitley, 1932) as Tasmanian waters. As a contribution to our

knowledge of this species, for local (and it now appears, topotypical) examples of which no detailed dimensions seem to be available, some measurements of 3 adult males and 4 adult females, and one young with egg-sac attached are here offered, together with some general observations.

Material.—The 7 adults, arranged in descending order of *Lt*, are: (*a*) female, *Lt* 961, found dead on beach by writer, Ulverstone, Devon, 4th August 1933; (*b*) female, *Lt* 930, George Town, Dorset, Mr C. Andrews, July 1939; (*c*) female, *Lt* 919, caught, with bare hands, by Dixon Hinch among rocks of breakwater, Ulverstone, Devon, 19th May 1960; (*d*) female, *Lt* 907, speared, at moderate depth, off rocks at lighthouse point, Low Head, Dorset, by Mr J. Turner, 3rd November 1957; (*e*) male, *Lt* 895, same history as (*b*); (*f*) male, *Lt* 894, speared by Mr R Lee in about 10 feet of water, hidden in weed with only the region behind the second dorsal exposed, Low Head, Dorset, 1st December 1957; (*g*) male, *Lt* 885, caught by Mr W. J. Beaumont at Penguin, Devon, in a graball net about 40 yards from the beach, very close to the rocks, 18th June 1933. The material is, it will be observed, rather restricted geographically, being confined to a stretch of our northern coast extending, in a direct line between the eastern terminal at Low Head and the western at Penguin, for less than 40 miles: except for George Town, about 4 miles inside the wide estuary of the Tamar, localities are on the open coast.

The egg-case containing a young shark, *Lt* 115.5 with yolk sac attached, was found among seaweed on the beach at Falmouth, Cornwall, by Miss Joanne Benson on 1st November 1959. When received, the specimen, after several days' exposure, was somewhat desiccated: however, the embryo had suffered a rather suprisingly small amount of general degeneration, perhaps the most marked effects being some considerable drying-out of the caudal and the loss of the contents of the yolk sac. On receipt, the embryo was removed from the egg-sac, and both were placed in alcohol.

Weight.—Specimen (*d*) immediately after capture weighed 10 lbs.

Proportions, Tlt.—A number of proportions of the 8 specimens are set out in Table II.

In view of the diagnostic significance of the relative sizes of anal base and distance of anal from lower caudal origin the actual dimensions may profitably be recorded. Anal base, 72, 62, —, 71, 68, 67, 66, foetus 9.0; termination of anal to origin of lower caudal lobe 46 57, —, 44.5, 45, 51, 37, foetus 7.5. Thus in the 6 adults for which data are available the base is 1.1-1.7, mean 1.47, times the other dimension: in foetus 1.2.

The *Lt* range of adults is too small to provide reliable evidence of systematic variation of size of regions and structures relative to overall size of shark, if such variation exists. It will be seen from the table that the great majority of variates are tolerably constant in value. For the important morphological items, lengths to origins of pectoral, pelvic, first dorsal, anal, second dorsal, lower caudal lobe the coefficients of variation of the absolute dimensions (not proportional values in table) are 4.5 ± 1.2, 4.1 ± 1.1, 3.4 ± 0.9, 3.2 ± 0.8, 2.6 ± 0.7, 2.8 ± 0.8—which are of the expected order of magnitude for an adult sample in which (as appears to obtain here) there is no marked sexual dimorphism. Compared with adults the foetus has a relatively smaller pectoral and first dorsal; and does not exhibit the high values for girth between pectoral and pelvic that are so characteristic of the adult Swell Shark.

Teeth.—In (*a*) the teeth in the lower jaw are in up to 6 rows: in the median anteroposterior line are 5 very small teeth; laterad, those of the next line fairly small; third line with largest teeth; thereafter regularly decreasing in size laterad: in upper jaw 5 or 6 rows; the median line largest, the rest gradually and regularly decreasing in size laterad. Two typical examples of the larger teeth of this specimen are shown in fig. 1. It will be seen they differ noticeably from those of the Tasmanian example and of the forma *nascione* as depicted by Whitley (1940, fig. 85, 1b, 2b); particularly by the presence here in the tooth from the upper jaw of an additional pair of cusps. Specimen (*f*): in upper jaw teeth in about 5 rows; curved dentigerous band on either side with a maximum anteroposterior extent of 9 mm and a chord of 66.9; the two bands just contiguous mesially (though the most closely approximated teeth here are 3 mm apart); in lower jaw in 4 rows, the chord 59.6, the slightly elevated platforms of the dentigerous zones failing by 5 to meet mesially. Specimen (*d*): in about 4 rows in either jaw; maximum width (anteroposterior) of band in upper jaw 5; toothed regions fail to meet in upper by 2, in lower jaw by 6. Immediately behind the tooth-bearing band there lies, in either jaw, a somewhat similarly shaped, but rather wider, frenum covered with numerous closely-set low white mounds, rather larger in lower jaw, where they mostly exceed in size the largest tooth. Unlike the dentigerous arcs, the frenum is wholly continuous across the middle line; though there are present, in the lower jaw only, two small ovoid patches devoid of the mounds—these lie behind the most internal teeth, their posterior borders constituting part of the hind margin of the frenum. The floor of the mouth is smooth; the palate almost smooth, with some faint transverse ridges. Tongue white, smooth below; upper surface with some projections that tend to assume the form of small knobs anteriorly, of ridges posteriorly.

Dermal denticles.—Their degree of development shows considerable variation in different individuals and in different parts of one individual. In some specimens there is a pronounced shagreen feel: in others, for instance (*f*), the general surface of the shark is surprisingly smooth, and in most portions of the animal much the same sensation is felt whether the hand is passed backwards or forwards along the skin; the nearest approach, in (*f*), to anything in the way of erect or suberect projections being met with on the side of the throat. The denticles vary markedly also in form, and elongate somewhat curved spines such as those figured for this species (Whitley, 1940, fig. 85, 1c, 2c) may be wholly lacking. It seems evident the whole matter of denticles calls for further study. For pattern of enlarged denticles in embryo, see below.

Egg-case.—There was for some time confusion as to which of the egg-cases commonly found cast up on the shore was rightly associated with this shark. A smooth case, narrowest at about one-sixth of its length, figured by Whitley (1940, fig. 29, No. 8) as '*Cephaloscyllium* (?) from Tasmania' does not belong to this species; the '"laminated" egg from Victoria' illustrated in fig. 30, No. 30 does: elsewhere in this volume the matter is cleared up by the entry (p. 92), 'Mr H. M. Hale records "laminated" eggs as having been laid by South Australian specimens in March, 1929'. Confirmatory Tasmanian records were obtained in 1939 when eggs of this type (for which, it may be remarked in passing, 'laminated' does not seem to be a happy term: the notable feature is the presence of well-developed wavy obliquely-set ridges on the case) were taken from specimen (*b*).

The following notes were made when 2 ova, in their cases, were dissected-out from specimen (*d*). Wall of oviduct, when cut through, appeared to consist of two layers that tended readily to separate. Egg-cases were opened and an unsuccessful attempt made to 'pour' yolks into formalin (fixation should have been carried out *in situ*). Case filled with pale yellow yolk and colorless, fluid but viscous albumen. As the case was being removed from oviduct, the tendril or byssus continued to be released as an uncoiled thread that appeared to extend right up to the oviducal gland; on exposure to air it soon assumed a helical form. Color of cases, deep cream. Egg-case (α): tendrils at both ends of case very pale yellow; at broader end 1670 long; at pointed end one tendril 820, other 669 (but elastic): length of case 112, maximum width 50, width at wider end 31: ridges number 31 on one face, 33 on other, with some anastomosis, particularly near wider end. Egg-case (β): tendrils pale yellow at broad, very pale at narrow, end; at broad end 1750 long, at other end 870, 930 (but all elastic): ridges number 31, 33, with some anastomosis terminally: length 111, maximum width 49, width at wider end 31. On being placed in formalin, the cases became bluish.

The case from which (*h*) was taken is of the usual dark yellowish horn color: length 111, maximum width 48.5, width at wider (squarer) end 33.5, at narrower end 15: on either face 24 ridges of which 19 are continuous in an undulating oblique course from one longitudinal border to the other, the rest failing to extend uninterruptedly from one side to the other either merely because they are too short, or else because they become fused (typically about midway between the borders) with an adjoining ridge, the former situation commonly arising near the ends, the latter near the middle of the length, of the egg-case. At either lateral margin the longitudinal bounding strip of the case appears as a convex band, with a maximum width of about 4, on one surface and as a groove on the other surface; the two convex bands being on different surfaces. From the narrow end this strip continues as a coiled tendril, some 400 long when roughly straightened out; basally, where it is somewhat depressed, it is about 2 wide: distally, becoming more nearly circular in section, it tapers to a fine point. Of this pair of tendrils, one bears 5, the other 2, greyish subcylindrical hydroid incrustations, of which the longest measures 12, the shortest 4. No tendrils remain at the broad end of this specimen.

Testes.—The testes of (*f*) were whitish, with red mottlings. One measured 110 x 45 x 20, the other 110 x 47 x 27.

Stomach contents.—The stomach contents of (*d*) were the beak of a squid, with portion of the muscle of the mouth region attached, and parts of a fish skeleton. In (*f*) the only recognizable items were 2 sets of smallish cephalopod beaks.

Foetus.—Some notes on the foetus from Falmouth (fig. 1), the circumstances of the finding of which have already been noted, are given below.

(*i*) *General form.*—The great width of the head that characterizes this species is very evident, the maximum width (19.4) occurring, as usual, between spiracle and first gillslit. This is the greatest width of the specimen, the usual expansion of the early part of the trunk not being developed, width at end of pectoral base (12.5) being only 0.6 of maximum width of head (contrast about 1.1 in adult). Behind head, width decreases rapidly and evenly to become at origin of first dorsal about one-third of initial value; thereafter more slowly, being at origin of upper caudal lobe about half value at first dorsal. (*ii*) *Fins and finfold.*—Much-dwindled remnants of the finfold are traceable. On ventral surface: anteriorly as a low ridge, rapidly decreasing in height cephalad, from anal base for a distance subequal to base of fin, *i.e.*, about halfway to anterior border of vent; immediately behind anal, disappearing for a distance of rather less than half fin-base, and, on reappearance, quickly developing to form a triangular flap, slightly more than 1 mm deep, immediately prior to origin of lower caudal lobe. On dorsal surface: first becoming evident at a point less than length of first dorsal base behind that fin, and continuing to origin of second dorsal; beginning again less than 2 behind that fin and continuing backward uninterruptedly to become confluent with upper caudal lobe—quite low throughout its length, reaching its greatest height as it approaches caudal. The outlines of vertical fins do not differ greatly from those of adult: however, the caudal, the posterior two-fifths of which is sharply upturned, presents, anterior to the notch, a ventral profile having a single boldly convex sweep, instead of being constituted of two line segments meeting at an obtuse angle. (*iii*) *Denticles.*—A most interesting feature of the specimen is the presence on the back of paired series of enlarged denticles not found in the adult (enlarged denticles along mid-dorsal and mid-ventral lines, behind dorsals are, it may be recalled, a normal character of *Galeus boardmani* (Whitley), 1928). Beginning a little to right of median line of dorsum, at level of 5th gillslit, a row of 32 denticles extends back for 32 mm to end a trifle beyond first dorsal origin: at an equal distance to left of median line is a series of 34, one in advance

of first of right row, and one behind last of that row. Anteriorly the rows are 4.1 mm apart, posteriorly 3.1, with a closest approximation, at about 22nd pair of denticles, of 1.9. Denticles are of almost uniform size, about 0.6 long, sloping backwards, outwards at about 45° to anteroposterior axis of animal, and slightly upward. From above each is more or less oval in outline, the proximal end the wider, but the distal not sharply pointed; external surface fairly convex transversely: anterior two-thirds opaque white, rest translucent. Viewed laterally, denticle presents, first a white broadly attached base, the upper profile of which is strongly convex; secondly, a distal blade, with straight or slightly concave upper profile. Some of the denticles are seen to be provided with (and possibly all possess) an elongate, slender, distally expanded pedicel (fig. 1 *d*), lying partly, or wholly, embedded in the integument, cephalad of the exposed portion. About two-thirds of first dorsal base behind that fin, are found, on right, 2 similar denticles: on left, 3 occur behind the fin, second in line, transversely, with first of right-hand series, third at one normal interval behind level of second on right. Near tip of caudal are found, on left surface, two rows of small nodular, or obscurely stellate, denticles closely flanking the notochord; upper row, extending forward from fin-top for 6 mm, consists of 20, lower row, which is slightly shorter, of about 15: on right surface each row consists of about 17.

[The above notes were written in 1961. While in Rome in 1962 I observed street fish-stalls often carried a shark broadly similar in general facies to, but somewhat larger than, our Swell Shark: examination of unskinned specimens revealed the presence along the midline of the dorsum of about a score of specialized denticles of the same general form as those of the present embryo, but arranged in a single row, and of course considerably larger. (This shark, the *plombe* of the dealers, was sold in slices at 100-150 lire per etto, approximately 6/4-9/6 a lb). All the evidence would suggest the presence of these denticles involves retention of a primitive feature.]

(*iv*) *Yolk sac.*—At its insertion the yolk stalk develops a longitudinal fold some 5 long, its anterior insertion being level with first gillslit: at a few millimetres distant from the body it contracts to become a thin cylinder, about 1.5 in diameter, and is, in all, 22 long. The yolk sac, which has become somewhat shredded and shrivelled and has lost part of its walls and virtually all its contents, has, as preserved, a length (at right angles to ventral surface of foetus) of about 25, and a width of about half this. Walls thin, smooth, translucent, not macroscopically structured: at base of bag a few yellow granular masses of yolk. (*v*) *Coloration.*—Ground color on ventral surface in advance of pelvics white, behind pelvics pale yellowish brown: on dorsal surface of head chiefly yellowish brown; of trunk warm yellowish brown: on dorsal surface of head (except region of gills, which is white) yellowish brown; of trunk mostly whitish, somewhat darker above. Pigmentation is already well advanced. On dorsal surface are well-marked paired postorbital blotches; and more or less complete saddles, of from moderate to dark (at times almost blackish) brown, on occiput, at level of adpressed pectoral, flanking each dorsal base, and at upper origin of caudal. All these extend, to a greater or lesser extent, on to lateral surface; which also bears its own separate markings, in particular a strong patch above and behind gills, another, smaller, shortly behind it, some subvertical brownish streaks (on right only) between last marking and level of pelvic origin, small spot above pelvic base. Pectoral with a dusky blotch covering most of left fin, outer and hinder half of right. First dorsal almost wholly dusky. Second dorsal obscurely clouded, least so externally; a dark smear along base. Anal unpigmented. Caudal briefly dark at upper origin; mostly more or less uniformly greyish, with some darker clouding in basal two-thirds of lower lobe in its anterior one-third, or more. Pelvic with dark blotch near middle. (*vi*) *Sex.*—There are no signs of claspers.

Behaviour.—Whitley (1940:92) observes of this shark, 'It can live more than one day out of water'. Specimen (*a*) netted at night was forwarded next day by train to the Queen Victoria Museum Launceson. While the teeth were being examined at about 4 p.m., the mouth on two occasions closed tightly and remained so for a short time. Water was then dashed on the head and the shark began to breathe. On being placed in a tank of water it continued to exhibit breathing movements while left there (for a quarter of an hour), and also moved caudal and pectoral: it did not, however, fully recover.

Mr. Lee reported the general behaviour of (*f*) was sluggish: after being speared in the spine it offered no resistance. Specimen (*d*), secured during an excursion of the Northern Tasmanian Subaqua Club, was placed, still alive, in a rock pool. While lying partly on its side, with the tip of the snout at times projecting out of water, it expelled water from the gills about 28 times per minute, the current being traceable over some two-thirds of the pectoral base.

Breeding season.—As already noted, H. M. Hale's record of egg-laying by this species is for March; this is the month in which our foetus (*h*) was collected. On the other hand, egg cases were taken from (*b*) in July and from (*d*) in November. While this paper was in course of compilation, Michael Horne forwarded to the Queen Victoria Museum, Launceston, a fresh egg-case, with contained ovum, found washed up on Grant's Beach, Devon, on 24th September 1961. Like those taken from (*d*), it is cream colored, noticeably different from the characteristic horn color of beach-dried specimens.

A similar wide range of dates is recorded for another member of the family, *Halaelurus vincenti* (Zeitz), 1908, Whitley (1940) noting (*a*) a male foetus trawled by the *Endeavour* in the Great Australian Bight in March, and (*b*) two shelled ova taken by H. M. Hale from a specimen caught in St Vincent Gulf, South Australia, in September.

TABLE II

Cephaloscyllium isabella laticeps (Duméril), 1853. Eight Tasmanian adults and one foetus (localities in text). Actual dimensions in millimetres in first line: all other dimensions expressed as thousandths of total length

Dimension	Adults							Foetus
	a ♀	*b* ♀	*c* ♀	*d* ♀	*e* ♂	*f* ♂	*g* ♀	*h* ♀ ?
Total length (mm)	961	930	919	907	895	894	885	115.5
Eye:								
Length to eye	47	55	—	56	48	48	62	74
Diameter of eye	32	40	—	25	32	30	38	33
Length to anterior margin of orbit	—	—	—	48	—	44	—	62
Length to posterior margin of orbit	—	—	—	82	—	81	—	99
Mouth:								
Length to midpoint of free margin of upper lip	31	36	37	34	32	35	49	43
Length to midpoint of upper margin of lower lip	—	—	—	45	—	43	—	51
Length to angle of gape	—	87	93	86	85	—	—	97
Width inside lips	115	118	—	121	115	76	—	72
Width including labial fold	—	132	—	128	130	85	135	82
Nostril:								
Length of anterior margin	—	28	26	25	22	16	—	25
Length of posterior margin	—	35	36	33	34	32	—	35
Total oblique extension	—	19	—	—	20	—	—	18
Internarial	31	33	—	35	32	23	—	18
Shortest distance, nostril to mouth	—	7.5	—	—	8.9	—	—	8.7
Spiracle:								
Length to anterior margin	—	86	—	85	87	84	—	105
Length	5.2	6.5	—	8.0	8.5	7.0	5.6	7.8
Interspiracular	89	94	—	100	92	96	97	120
Shortest distance, spiracle to orbit	11	11	—	12	12	12	5.6	5.2
Gillslits:								
Length to I	148	141	—	144	144	141	144	161
Length to II	—	155	—	—	158	—	—	—
Length to III	—	165	—	—	168	—	—	—
Length to IV	—	175	—	—	178	—	—	—
Length to V	—	184	—	193	189	178	—	217
Length of I	—	32	—	35	37	38	—	—
Length of II	—	34	—	34	35	28	—	—
Length of III	—	30	—	33	34	26	—	—
Length of IV	—	28	—	30	33	23	—	—
Length of V	—	22	—	19	22	18	—	—
Pectoral:								
Length to origin	184	168	171	180	170	175	142	203
Length	142	180	—	—	172	—	160	123
Base	87	97	—	—	104	—	107	78
Length of border, anterior	—	—	—	181	—	179	—	122
Length of border, outer	—	—	—	145	—	157	—	104
Length of border, posterior	—	—	—	73	—	65	—	43
Maximum width	137	151	—	—	142	—	132	104
Width at middle of length	—	123	—	—	101	—	—	97
Total spread of 2 fins	376	—	—	458	—	465	452	312
First dorsal:								
Length to origin	503	516	515	491	525	493	512	476
Base	78	96	99	100	79	90	78	60
Length of border, anterior	—	118	—	126	107	110	—	69
Length of border, outer	—	70	—	71	61	65	—	48
Length of border, posterior	—	24	—	26	23	25	—	35
Vertical height	—	73	—	79	69	77	—	61

TABLE II—*Continued*

Dimension	Adults							Foetus
	a ♀	*b* ♀	*c* ♀	*d* ♀	*e* ♂	*f* ♂	*g* ♀	*h* ♀ ?
Second dorsal:								
Length to origin	669	669	690	667	686	671	683	618
Base	55	57	60	62	55	58	56	62
Length of border, anterior	—	—	—	69	—	67	—	69
Length of border, outer	—	—	—	43	—	39	—	39
Length of border, posterior	—	27	—	28	25	25	—	30
Vertical height	—	39	—	42	37	41	—	36
Anal:								
Length to origin	649	654	655	640	643	635	662	608
Base	75	67	—	78	76	75	75	78
Length of border, anterior	—	—	—	96	—	95	—	82
Length of border, outer	—	—	—	41	—	39	—	34
Length of border, posterior	—	—	—	25	—	25	—	22
Vertical height	—	—	—	—	—	—	—	39
Pelvic:								
Length to origin	438	481	473	464	465	439	498	423
Base	91	94	—	—	89	—	85	70
Length of border, anterior	—	81	—	72	85	78	—	43
Length of border, outer	—	—	—	88	—	97	—	87
Length of border, inner	—	41	—	28	63	41	—	36
Vertical height	—	53	—	—	61	—	—	36
Total spread of 2 fins	—	—	—	152	—	169	—	95
Caudal:								
Length to origin of lower lobe	772	782	787	767	780	767	769	750
Length to origin of upper lobe	—	798	810	788	799	788	—	796
Maximum depth of fin	81	96	—	96	89	96	90	95
Distance from (lower) origin to level of maximum depth	—	—	—	88	—	96	—	74
Depth at notch	37	45	—	41	40	40	44	61
Distance of notch from tip	—	63	—	68	61	55	—	48
Maximum depth behind notch	58	—	—	65	—	69	69	78
Direct distance from lower origin to lowest point	—	113	—	—	114	—	—	87
Direct distance from lowest point to notch	—	102	—	—	104	—	—	147
Length of terminal border	—	65	—	—	69	—	—	65
Vent:								
Length to origin	—	473	528	507	498	480	—	448
Length	—	—	22	—	—	15	—	27
Claspers:								
Length; external border (from basal fold)	—	—	—	—	79	81	—	—
Length; internal border	—	—	—	—	127	106	—	—
Diameter at base	—	—	—	—	70	—	—	—
Girth at specified level:								
Front of mouth	—	—	—	—	—	213	—	—
Front of orbit	—	230	—	288	232	244	—	176
Back of orbit	—	—	—	369	—	341	—	372
Gillslit I	—	—	—	397	—	373	—	336
Pectoral origin	—	387	—	413	340	394	—	—
End of pectoral base	—	—	—	430	—	405	—	260
End of adpressed pectoral	—	—	—	436	—	369	—	—
Pelvic origin	—	—	—	303	—	277	—	199
Middle of first dorsal base	—	185	—	—	187	—	—	—
First dorsal termination	—	—	—	179	—	173	—	165
Anal origin	—	—	—	147	—	152	—	—
Second dorsal termination	—	—	—	111	—	103	—	114
Origin of lower caudal lobe	—	94	—	95	84	97	—	107

TABLE II—*Continued*

Dimension	Adults							Foetus
	a ♀	*b* ♀	*c* ♀	*d* ♀	*e* ♂	*f* ♂	*g* ♀	*h* ♀ ?
Width (first entry) and depth (second entry) at specified level:								
Front of nostril	—	68	—	—	70	—	—	85
	—	—	—	—	—	—	—	20
Front of mouth	—	—	—	79	—	78	—	94
	—	—	—	52	—	32	—	29
Front of orbit	—	—	—	127	—	106	—	90
	—	—	—	44	—	44	—	27
Middle of eye	—	114	—	—	122	—	—	121
	53	48	—	—	45	—	57	35
Back of orbit	—	174	—	171	154	148	—	147
	—	—	—	55	—	55	—	50
Gillslit I	—	—	—	171	—	157	—	156
	—	—	—	77	—	81	—	68
Pectoral origin	—	—	—	176	—	154	—	134
	—	—	—	88	—	97	—	71
Gillslit V	—	—	—	176	—	151	—	130
	—	—	—	92	—	110	—	72
Middle of pectoral	—	—	—	—	—	—	—	129
	145	—	—	—	—	—	93	87
End of pectoral base	139	232	—	187	200	160	236	123
	—	95	—	86	88	115	—	80
End of adpressed pectoral	—	—	—	165	—	117	—	113
	—	—	—	105	—	101	—	71
Pelvic origin	83	—	—	110	—	87	116	85
	—	—	—	57	—	86	—	63
First dorsal origin	—	58	—	—	61	—	—	53
	84	77	—	—	86	—	76	59
Middle of first dorsal base	—	—	—	—	—	—	—	43
	—	—	—	—	—	—	—	52
End of pelvic base	61	—	—	—	—	—	57	43
	—	—	—	—	—	—	—	55
End of first dorsal base	—	—	—	57	—	59	—	39
	—	—	—	51	—	48	—	54
Anal origin	—	—	—	47	—	47	—	35
	—	—	—	36	—	43	—	51
Second dorsal origin	—	—	—	—	—	—	—	33
	55	—	—	—	—	—	45	50
End of second dorsal base	—	—	—	34	—	35	—	25
	—	—	—	—	—	27	—	43
Origin of lower caudal lobe	—	24	—	28	25	29	—	20
	—	30	—	33	29	26	—	42

Family MYLIOBATIDAE

The Check List and Handbook each give (*a*) *Myliobatis* Cuvier, 1816; (1) *M. australis* Macleay, 1881; (2) *M. hamlyni* Ogilby, 1911: (*b*) *Aetobatus* Blainville, 1816; (2) *A narinari* (Euphrasen), 1790. Whitley (1940) includes (1) and (2); replaces (3), the type locality of which is Brazil, by *A. punctatus* (Mikluoho-Maclay & Macleay), 1881, the type locality of which is the Admiralty Islands; includes (while noting it as a New Zealand form) *M. tenuicaudatus* Hector, 1877.

It is generally recognized that the three nominal species of *Myliobatis* in Australia and New Zealand are closely allied and difficult to distinguish. *M. hamlyni*, based on a unique holotype, may well be a juvenile of *M. australis*. The mesial dental plates of *M. australis* are stated to be fewer (about 11-12, as against 14) and relatively longer (*i.e.*, anteroposteriorly) than those of *M. tenuicaudatus*. See, *e.g.*, McCulloch (1914:86, fig. 3); and Whitley (1940), who brings together figures of dentition after Roughley, McCoy, Waite, McCulloch, and provides a reconstruction for *M. hamlyni*.

Genus **MYLIOBATIS** Cuvier, 1816

MYLIOBATIS AUSTRALIS Macleay 1881

Myliobatis australis Macleay, 1881, *Proc. Linn. Soc. N.S.W.*, VI, 2:380. Type locality: Port Jackson, New South Wales.

Material.—The 16 individuals here noted—1941: 1, 2, 3 (♂♂), 4, 5, 6, 7 (♀♀); 1952: 1, 2, 3 (♂♂), 4, 5 (♀♀); 1954: 1 (♂) 2, 3 (♀♀); 1958: 1 (♀)—were found lying on the beach in a fresh state in late December or in January—most (possibly all) having been netted and cast aside by holiday seiners. Specimen 1958: 1 came from Scott's Beach, at the mouth of the Clayton Rivulet, near Ulverstone, Devon; the rest from Ulverstone.

Sexual dimorphism.—In an earlier contribution (1942) it was suggested, on the evidence of measurements of disc-width in 7 individuals, that in this species, following the general trend among rays, females are larger than males. Data for 7 males and 9 females set out in Table III support this conclusion. It will be observed that among the four major measurements of length and width recorded in no case does the maximum male value equal the minimum female correlate, and the female means are all at least one-fourth again as great as the male. For the dimension for which all 16 values are available (disc-width) the difference of the means is highly significant ($t = 5.44$).

Color pattern.—It is usually stated that the greenish, olive, or sandy ground color of the dorsal surface of the disc is patterned with pronounced or indistinct blue blotches. Of the 16 individuals noted in Table III (and several other Tasmanian examples examined) only one, 1958:1, a female from Scott's Beach, near Ulverstone, Devon, showed any clear sign of blue. In this example each pectoral carried some two dozen bright blue irregular, mostly more or less ovoid blotches (major axis 10-105, minor 10-31; the largest blotch 105 by 30, the smallest (two) 12 by 10); though rather irregularly disposed, they included an adnumbration of three imperfect transverse proconvex arcs: the ground color was greenish dark putty, largely bronzed. The middle of the hinder half of the disc was occupied by a large subtriangular area of brownish, through the posterior half of which ran a median line of about ten partly confluent white spots.

Ventral surface chiefly dead white: at left angle a large subtriangular region of yellowish, narrowly margined externally in its anterior half with whitish; along left border, from near front of head to level of first gill slit, a narrowish dark brown band, extending over on to the dorsal surface; on right half of disc extensive blotching and mottling along most of, and just internal to, the margin; a mesial patch of pale yellowish on throat.

The tail is colored thus. Ventral surface: white for about 260 from base (length of tail from its dorsal origin 705, from its ventral origin 700); then for about 180 white, with dusky pale-purplish smudges becoming increasingly prominent; smudges then replaced by small dark brown marks, set in depressions in integument; last 100 or so very dark, with terminal 35 almost black. Lateral surface: mainly white as far back as ventral surface is, but superior portion anterior to level of spear (length to spear 107; length of spear 98, of which 77 is free, rest adnate) with some large greyish purple smudges; caudad of spear, superior half at first greyish purple with numerous punctate blackish depressions (0.2-1 in diameter), inferior half lighter; beginning to darken at same level as ventral surface. Dorsal surface bronzed purplish from origin to spine, thereafter at first following color of upper lateral surface, but darkening early, being almost black for terminal 200 or more.

Jaws.—Table IV presents some data on 4 Tasmanian examples. Jaw *A* is from specimen 1952:4 (♀); jaws *B, C, D* from 1952:1, 2, 3, respectively (♂♂). These jaws show considerable range in size (for intercondylar width $V = 22.8$); but the largest 3 individuals constitute a tolerably compact size-group (for intercondylor width $V = 8.2$). It will be seen there is good correlation between the cube of the intercondylar width and the weight, the value of the ratio of the latter to the former being, for the 3 complete jaws, almost constant, but showing a slight systematic decrease with decrease in jaw-size.

Mesial dental plates.—In Table IV the mesial dental plates are numbered from behind forwards: the loss of a plate at the hinder (internal) end of the series is usually obvious, whereas anteriorly such a loss, particularly if accompanied by a lateral breakaway, is not always readily and surely determinable. Points of special interest regarding these plates include the following. (*a*) The number (10-12) is on agreement with published accounts. (*b*) The absolute lengths (anteroposterior measurement) vary considerably in the one specimen; the greatest divergence usually occurring near the ends of the series (the total range for all plates being, for the 4 specimens, 1.6, 1.0, 1.5, 1.4 times the range of the middle 6 plates): between individuals the range is great, the largest mean being 2.04 times the smallest (however, with specimen *D* excluded, this value drops to 1.15: and the coefficient of variation for the remaining 3 specimens, $V = 6.5$, is probably a value expectable within a single year-class). (*c*) As might, indeed, be predicted from the morphological set-up, widths exhibit less relative variation than lengths ($V = 2.1$-3.0; against 8.6-20.8); here again the greatest divergence is found near the ends of the series (the range for all plates being, in the 4 specimens, 3.2, 4.0, 2.6, 3.1 times the range exhibited by the middle 6 plates).

Lateral Plates.—(*a*) *Conventions of specification.*—Let *A, B, C, D* be the 4 specimens specified in Table IV: let *a, b, c, d* denote 1st-4th plate row, counting outwards from mesial strip: let *r, l* mean right, left side of jaw: let i, ii, iii . . . xi be the within-row rank number, *i.e.*, the number in sequence of the plate, counting from before backwards: let *h, p, q, t* denote *h*exagonal, *p*entagonal, *q*uadrilateral, *t*riangular plates (or, in appropriate context, 6, 5, 4, 3 sides). Symbols in combination are used in the order in which they are listed above.

(*b*) *Number of rows.*—All specimens show 3 rows on each side (*D l* missing); except *A* which has *d r* (a quite exceptional arrangement).

(*c*) *Number of plates.*—The total number of lateral plates (including several that obviously have been present but are now missing) are: *A r* 39, *A l* 32; *B r* 24, *B l* 24; *C r* 27, *C l* 27; *D r* 29; mean 28.9 per side. There are most plates in *a* (*A, r, l* 11, 11; *B* 9, 9; *C* 10, 10; *D* 10, —). In

TABLE III

Myliobatis australis Macleay, 1881. Comparative measurements (mm) of 7 males and 9 females. Specimen 1958: 1 from Scott's Beach, at mouth of Clayton Rivulet, near Ulverstone, Devon; other specimens from Ulverstone

Dimension	Males								Females									
	Specimen							Mean (No. of specimens in parentheses)	Specimen									Mean (No. of specimens in parentheses)
	1941: 1	1941: 2	1941: 3	1952: 1	1952: 2	1952: 3	1954: 1		1941: 4	1941: 5	1941: 6	1941: 7	1952: 4	1952: 5	1954: 2	1954: 3	1958: 1	
Width of disc	814	780	850	870	838	819	840	830.1 (7)	1022	1050	975	866	1149	1105	1095	1200	975	1048.6 (9)
Total length	—	—	—	889	997	946	911	935.8 (4)	—	—	—	—	1213	—	1190	1111	1294	1202.0 (4)
Length to vent	—	—	—	470	470	432	442	453.5 (4)	—	—	—	—	673	—	635	573	515	599.0 (4)
Length to dorsal fin	—	—	—	597	559	537	604	575.8 (4)	—	—	—	—	774	—	762	689	705	732.5 (4)
Base of dorsal	—	—	—	48	35	35	47	41.3 (4)	—	—	—	—	58	—	59	48	45	52.5 (4)
Spread of pelvics: pulled taut	—	—	—	267	298	286	—	283.7 (3)	—	—	—	—	413	—	—	—	320	366.5 (2)
Spread of pelvics: as they lie	—	—	—	—	—	—	260	260.0 (1)	—	—	—	—	—	365	350	315	260	322.5 (4)

A and in *D r*, $b = a$; but in *B* and *C*, *b* starts at ii; while *c* starts always at *iii*, except for *A c l* and *D c r*, which start at ii (*A d r* extends from iii to x). In the present state of the material *A l* xi is missing in *a*, *b*, *c*; also missing is *B c r* ix; imperfect plates are *D b r* i and *D c r* ii.

Number of sides.—In comparisons in this section we shall normally consider only *a*, *b*, *c* in each specimen, express mention being made where appropriate of the inclusion in the discussion of *A d r*. In considering the 4 types of small lateral plates represented, as specified by the number of sides (6, 5, 4, 3), we shall look at the distribution of *h*, *p*, *q*, *t* first by specimens, secondly by rows, thirdly within rows.

For the 4 specimens pooled cases of *h*, *p*, *q*, *t* number 38, 58, 78, 22, respectively: mean number of sides 4.57. Individual entries range from 0 (*D t*) to 30 (*A q*); specimen means being 4.54, 4.00, 4.80, 5.19: the mode is *q* in *A* (30) and *B* (27); and *p* in *C* (23) and *D* (16).

The mean number of sides in a breakdown by rows shown an interesting pattern, decreasing progressively from *a* through *c* (and *d*), the sequence being maintained in each specimen: for pooled material we find 4.91, 4.61, 4.25, 3.50. This pattern holds good, not only for *r* and *l* pooled, but also (except in the one case of *C r*) for *r* and *l* considered separately. In view of the interest attachable to this state of affairs, regression equations of mean number of sides (*Y*) on row number (*X*) have been calculated. In each of the following 5 paragraphs are recorded these items: specimen letter: mean number of sides in *a*, *b*, *c* (with, in parentheses, values predicted by the regression equation): the regression of *Y* on *X*: *t*.

A : 5.19 (5.19), 4.66 (4.65), 4.11 (4.11) : $Y = -0.540\ X + 5.73 : t = 94.80^{**}$.

B : 4.39 (4.38), 3.94 (3.96), 3.54 (3.53) : $Y = -0.425\ X + 4.81 : t = 30.24^{**}$.

C : 4.85 (4.87), 4.83 (4.79), 4.69 (4.71) : $Y = -0.080\ X + 4.95 : t = 2.31$.

D : 5.40 (5.43), 5.22 (5.17), 4.88 (4.81) : $Y = -0.260\ X + 5.69 : t = 5.62^{*}$.

A, B, C, D pooled : 4.91 (4.98), 4.61 (4.59), 4.25 (4.26) : $Y = -0.330\ X + 5.25 : t = 19.05^{**}$.

A, B, C, D, with *r* and *l* plotted separately (for *a*, *b*, *c*) and with *A r d* incorporated : 4.97 (5.00), 4.88 (5.00); 4.48 (4.55), 4.70 (4.55); 4.13 (4.13), 4.35 (4.13); 3.50 (3.68) : $Y = -0.435\ X + 5.42$: $t = 7.45^{**}$.

In dealing with the distribution, within rows, of *h*, *p*. *q*, *t* we consider, first, the size of runs of plates having the same number of sides, secondly, the distribution along the anteroposterior extension of the row of plates of a given number of sides. First, in *A* runs of *h*, *p*, *q*, *t* are 5, 3, 4, 3 (*r*) and 5, 2, 4, 2 (*l*); in *B* 1, 2, 7, 3 and 1, 2, 8, 3;

TABLE IV

Myliobatis australis Macleay, 1881. Counts, dimensions and proportions: lower jaw and teeth of 4 individuals from Ulverstone, Devon, Tasmania. Linear dimensions in millimetres, weight in grams

Count, dimension, proportion		Specimen A	Specimen B	Specimen C	Specimen D
Serial numbers of mesial plates present (numbered from behind forward)		1 — 12	2 — 10	1 — 11	1 — 12
Total weight of jaw with teeth		105.50	77.35	68.69	(15.00) (imperfect)
Intercondylar width		122.5	110.0	105.5	62.0
Ratio of cube of intercondylar width to weight		174.2	172.1	170.9	(158.9) (imperfect)
Total width of tooth series (at middle) in intercondylar width		2.3	1.9	2.2	1.6
Width of middle mesial plate		31.0	40.2	30.3	21.1
Combined width (at middle of series) of 2 sets of lateral plates		23.0	16.9	17.5	17.4
Combined width (at middle of series) of 2 sets of lateral plates in width of middle mesial plate		1.4	2.4	1.7	1.2
Lengths of mesial plates	Range	5.0 — 8.1	6.9 — 9.0	5.9 — 8.0	2.6 — 4.9
	$\bar{x}$	6.98 ± 0.26	8.01 ± 0.26	7.03 ± 0.21	3.92 ± 0.23
	σ	0.88 ± 0.18	0.69 ± 0.18	0.77 ± 0.15	0.80 ± 0.16
	v	12.7 ± 2.6	8.6 ± 2.6	11.0 ± 1.8	20.8 ± 4.2
Widths of mesial plates	Range	28.5 — 32.0	38.2 — 41.0	28.1 — 31.0	19.2 — 21.1
	$\bar{x}$	31.03 ± 0.27	40.38 ± 0.28	30.15 ± 0.23	20.54 ± 0.16
	σ	0.93 ± 0.19	0.84 ± 0.20	0.77 ± 0.17	0.55 ± 0.11
	v	3.0 ± 0.6	2.1 ± 0.5	2.5 ± 0.5	2.7 ± 0.5
Length of mesial plate in its width	Range	3.8 — 5.7	4.5 — 5.8	3.8 — 5.1	4.2 — 7.4
	$\bar{x}$	4.52 ± 0.16	5.08 ± 0.13	4.34 ± 0.14	5.46 ± 0.31
	σ	0.55 ± 0.11	0.40 ± 0.10	0.45 ± 0.10	1.08 ± 0.22
	v	12.1 ± 2.5	8.0 ± 1.9	10.5 ± 2.2	19.9 ± 4.1

in *C* 2, 3, 3, 1 and 6, 7, 2, 1; in *D r* 4,7,2,0. It will be seen that in *A* and *B*, *r* and *l* are much the same; while in *C*, *l* exhibits a much greater frequency of high side-numbers than *r*. The maximum run in a specimen is held once each by *h* and *q*, twice by *p*. *A* has altogether 57 (or 51 for *a*, *b*, *c*) plates participating in runs: for *a*, *b*, *c*, *B* has 39, *C* 40, *D* (*D r* only) 27. In any one specimen the largest (or an equal largest) run number occurs for the same side-value of plate in each lateral half of jaw (maximum in *A* is *h*, in *B q*, in *C l p* and in *C r p* and *q* jointly). Secondly, on examining the position within the row in which plates with various number of sides occur we note the following points. The modal rank numbers for *h*, *p*, *q*, *t* are v, vi, ix, i, respectively. However, probably a more significant formulation of the position is obtained by disregarding the 2 cases of xi represented in the material as preserved and grouping i with ii, iii with iv, and so on. This yields the following frequency distribution for the 5 classes so constituted: *h* 10, 13, 11, 4, 0; *p* 0, 13, 20, 19, 6; *q* 8, 15, 9, 14, 30; *t* 7, 3, 4, 7, 1. It will be observed that *h* has its mode in the second of these classes, *p* in the third, *q* in the fifth; with *t* bimodal at the first and fourth classes. Broadly, the pattern is: *t* appears 8 times (36% of its total occurrences) in the initial position (*i.e.*, at the beginning of the row; which is not necessarily, and in *c* never is, i) being in 7 of these occurrences solitary, in the other one of a pair; its frequency then decreases, increases behind middle of row, again decreases: *h* tends to occur early (has i = 3; while of the 8 cases in which *t* is initial, *h* immediately follows it in 3); *p* tends to occur later than *h*, and *q* (particularly in respect of its second, and main, massing) later than *p*. Formulating the position in terms of rank numbers we have, for all values pooled, h < t < p < q (mean rank number per plate 3.9, 4.8, 6.1, 6.8) *i.e.*, six-sided plates register a higher proportion of appearances in the anterior portion of the rows than other plates. This overall pattern is presented in both the individuals *A* and *B*; the same sequence for *h*, *p*, *q* is maintained in *D* (in which there are no *t* entries); while in *C* we find *h* and *t* transposed (there being, however, only 2 entries, both initial, for *t*; whereas there are 11, 23, 18 for *h*, *p*, *q*).

Family GONORHYNCHIDAE

Only one species, *Gonorhynchus greyi* Richardson, 1845; recorded from all Australian States and from New Zealand.

Genus **GONORHYNCHUS** Scopoli, 1777

GONORHYNCHUS GREYI Richardson, 1845

Rhynchana greyi Richardson, 1845, Ichth. Voy. *Erebus & Terror*: 44, pl. xxix, figs 1-6 and one text fig. Type locality: W. Australia.

Gonorynchus greyi Richardson. McCulloch, 1929, *Mem. Aust. Mus.*, v, 1: 52 (synonymy).

Gonorhynchus greyi Richardson. Munro, 1956, Handbk Aust. Fish.: 28, fig. 196 [in *Fisheries Newsletter*, xv, 12, December, 1956: 18, fig. 196].

Remarks.—Appears—*fide* Johnston (1883)—in Allport MS. Apparently not uncommon; but seldom reaches market. A specimen, *Ls* 324, *Lt* 366, from George Town, Dorset, shows some meristic values outside those commonly accepted and some proportions transgressing the limits of the Handbook specifications, namely: D.10 [*cf.* 12-14], A.8 [9], 1. lat. 180 [145-175]; depth in *Ls* 7.5 [9-14.8]; head in *Ls* 4.9 [5-6.3].

None of the readily accessible figures—provided by Stead (1906), Waite (1921) [reproduced in Waite (1923)], McCulloch (1927) [reproduced, somewhat reduced, in the Handbook (Munro, 1956)]—gives a wholly satisfactory representation of the fish. General form: Stead's figure is too deep in postorbital part of head, and it exaggerates the concavity of the dorsal profile behind the dorsal fin (which is perhaps insufficiently indicated in the other illustrations); the preanal ventral profile is rather more characteristic in Waite's than in McCulloch's figure; Waite's fish has supraorbital contour unduly convex. Opercular margin, best depicted in McCulloch. Pectoral: in McCulloch fin inserted a trifle high; the oblique down and back trend of the fin base is most clearly seen in Stead (too nearly vertical in McCulloch), but the anterior border of the base is proconvex, not proconcave. Fleshy suprapectoral lobe: probably delineated but not certainly recognizable in Waite; in Stead shown shorter than is characteristic, and originating unduly far cephalad. Pelvic: inserted too high on flank in McCulloch; much too rounded at postero-external angle, and not straight enough along posterior border, in Stead. Fleshy suprapelvic lobe; unrecognizable in Waite, doubtfully represented in Stead, well shown in McCulloch. Dorsal: Stead shows external border of fin convex, Waite almost straight, McCulloch excavate, with last ray exceeding penultimate—our specimen (in which longest, 3rd, ray is 35 mm, 9th 16.5, 10th, last, 15) agrees best with McCulloch's figure. Anal: Stead has a pointed fin, which is certainly astray; Waite represents length of last ray as less than one-third, McCulloch as about two-thirds, length of longest ray—in our fish last (13 mm) is 0.45 of longest (3rd, 29), so that, with fin extended (artificially) as in McCulloch's figure, the posterior border comes in our specimen to approach much nearer to verticality than in the figured example.

Proportions, TLs.—In the light of the above remarks the chief proportions of the present specimen may profitably be recorded. Length to origin of: pectoral 201, pelvic 667, anal 832, dorsal 688. Base (between parallels) of: dorsal 88, anal 60. Length of: eye 43 (vertical diameter 32), snout 76, head 207, pectoral 159, pectoral base 37, pelvic 113. Interorbital 49. Depth at vent 83, maximum depth 133, depth of caudal peduncle 57; maximum width 115. Suprapectoral flap: length 94, width 17. Suprapelvic flap: length 74, width 11.

Family ECHELIDAE

All 3 Tasmanian species of *Muraenichthys* Bleeker, 1865 (our only local echelid genus), namely, (1) *M. breviceps* Günther, 1876: (2) *M. australis* Macleay, 1881; (3) *M. tasmaniensis* McCulloch, 1911, have come under notice in papers of this

series. The chief references are: 1936, first Tasmanian record of (2); 1953, key to Tasmanian species (misprint corrected in 1959 paper), description, and figure of head, of (2); 1957, linear regression in (1) of lengths of certain body regions on other regions conventionally treated in diagnosis as independent variables; 1961, account of specimen of (3). Olsen (1958:57) has noted the occurrence of (1) ' along the silty foreshore between Middleton and Gordon, D'Entrecasteaux Channel, where it is recognizable by the reddish brown color it reflects from underwater lights.'

Some observations on two individuals of (2) are made below, and a more satisfactory representation of the head of this species (*cf.* 1953, pl. on p. 164, fig. 2) is provided (fig. 2).

Genus **MURAENICHTHYS** Bleeker, 1865

MURAENICHTHYS BREVICEPS Günther, 1876
(Fig. 2)

Muraenichthys breviceps Günther, 1876, *Ann. Mag. Nat. Hist.* (4), XVII: 401.

Record.—Two specimens: (*a*) Low Head, Dorset; December 1960; Miss Anna Seager; dropped on sand by alarmed silver gull, *Larus novaehollandiae gunni* Mathews, 1912; *Lt* 439; (*b*) Derwent River at Long Point, Sandy Bay, Buckingham; 3rd February 1961; Mr D. H. Hobbs; speared—using 12-foot spear with light—in 6 feet of water; *Lt* 472.5.

Dimensions.—Nine dimensions of each of 6 individuals have been tabulated earlier (1957, Table II). Values of the same variates for the present examples (specimen (*a*) first) are: length to dorsal origin, vent (middle), anal origin 75.5, 164.5, 169.0; 84.5, 178.5, 181.5: head 39, 40.5: snout 7.8, 8.3: eye 2.3, 4.0: interorbital 5.0, 5.0: greatest depth 13.1, 16.1 (in both at middle of branchial basket: specimen (*a*) somewhat shrunken by preservation in too strong alcohol). Some additional dimensions are: oblique length of gillslit 2.8, 2.8; intergill space (direct) 7.9, 9.0; length from tip of upper jaw (which exceeds lower by 1.9, 2.0) to end of gape 13.4, 12.9, to end of oral slit 15.4, 15.3; length of maxilla 19.0, 19.0; depth (in parentheses width) at points specified (specimen (*a*) somewhat shrunken); front of eye 6.0, 7.1 (5.0, 6.9); back of eye 7.0, 8.5 (6.3, 8.1); end of oral slit 8.3, 11.3 (9.0, 8.9); gillslit 12.8, 15.5 (8.5, 11.5); dorsal origin 11.8, 15.5 (8.5, 13.0); vent 10.5, 14.8 (8.5, 13.5); middle of tail 9.1, 12.0 (7.9, 11.1). In (*b*) length of dorsal ray at level of vent is 70, at middle of tail (where it is equal to anal ray) 6.8.

Pores.—In (*b*) midlateral pores on trunk comprise 18 to dorsal origin + 29 to vent: on anterior half of tail 48; behind this point they become increasingly difficult to count, but there are at least 36. Pores of the head are located as shown in fig. 2.

Schmidt's index.—In a sample of 6 fish it has been shown (1957) of Schmidt's index ($S = \frac{Lv - Ld}{Lt} \times 100$, where Lv = length to vent, Ld = length to dorsal origin, Lt = total length) first, that is relatively stable (showing a variation of less than 3 units over an Lt range of 348.5 mm, or 3.07σ: $V = 4.9$, $V' = 5.5$); secondly, that it exhibits significant linear regression on Lt ($S = 0.007424\ Lt + 17.53$: $t = 4.73^{**}$: mean error of values predicted by this equation on observed values being 0.3 index units, or 1.3%). The incorporation of the present examples (for (*a*) $S = 20.27$, for (*b*) 21.16) does not compromise the validity of these two generalizations. Over the same Lt range as before the extremes of the index differ by 2.78 units, or 3.42σ: $V = 4.0$, $V' = 4.2$. The regression equation now is $S = 0.007531\ Lt + 17.47$: $t = 6.26^{**}$: mean error of predicted on observed values 0.2 units, or 1.2%.

The most direct of all metrical specifications of the relative location of insertion of dorsal, namely, length to dorsal origin as a function of total length, is given, for the 8 fish, by the equation $Ld = 0.1645\ Lt + 1.25$; $t = 30.66^{**}$: mean error of estimated values 1.4 mm, or 1.9%—*cf.*, for sample of 6, $Ld = 0.1605\ Lt + 2.07$; $t = 23.06^{**}$: mean error 0.8 mm, or 1.1%.

Coloration.—The following observations are based on (*b*). (*i*) *Tail.*—Except for posterior 60-65, which is more or less uniformly dark greyish brown, at times somewhat olivaceous, tail is sharply bicolor, the line of demarcation being the pore-row, here equidistant from dorsal and ventral profiles. The light areas are golden: at vent numerous minute brownish punctulations descend from the midlateral line for rather less than half the distance to the midventral line (the whole lower surface thus being immaculate); at middle of tail, area with punctulations has increased to become subequal on each flank to total ventral unpigmented area; finally, punctulations reach midventral line at about 60-65 in advance of tail-tip. (*ii*) *Trunk.*—Dark color (which is approximately the same dark greyish brown, tending towards olivaceous, as ground color of upper tail) descends below lateral line (which continually approaches dorsal profile cephalad) to an increasing extend cephalad: at gillslit we have from dorsal profile to pore-row 4 mm, thence to lower border of dark region 5.5, thereafter 6 light to ventral profile. Light color of lower flank and ventral surface is silvery in anterior one-third; behind which it passes first into ivory, then into pale yellow. (*iii*) *Head.*—Light color of lower flank continues forward to angle of gape, with some clouding on posterior part of branchial sac. In advance of posterior border of eye dark dorsal and upper lateral regions are somewhat lighter, more greyish, than corresponding parts of postorbital head. Whole lower jaw and inferior surface of rest of head whitish, in parts somewhat silvery. (*iv*) *Fins.*—Anal pale, ivory, immaculate. Dorsal almost white; a barely perceptible duskiness produced by rather sparse microscopic brownish punctulations.

In (*a*) the color pattern is susceptible of less satisfactory examination: so far as can be determined, it does not appear to differ radically from that of (*b*). However, the light ground color—except on the branchial sac, which remains yellowish—here closely approaches orange; while the dark ground colour is a shining warm reddish brown. Fins pale orange: anal immaculate, dorsal with microscopic dark pepperings as in (*b*).

Family OPHICHTHYIDAE

Of 11 members of the family recorded from Australia 2 only are known to occur outside Queensland, Northern Territory and Western Australia: (1) *Malvoliophis pinguis* (Günther) 1873 (in Check List referred to *Bascanichthys* Jordon & Davis, 1892), from southern Queensland, New South Wales, Lord Howe Island; (2) *Ophisurus serpens* (Linné), 1758, from New South Wales, Western Australia, Tasmania.

Genus **OPHISURUS** Lacépède, 1880

OPHISURUS SERPENS (Linné), 1758

(Fig. 3)

Muraena serpens Linné, 1758, Syst. Nat., ed. 10: 244 (ed. 12, 1766: 425). (Based on Artedi, gen. 24, syn. 41). Type locality: Southern European seas.

Ophisurus serpens Linné. Lord, 1923, *Pap. Proc. Roy. Soc. Tasm.*, 1922: 64. McCulloch, 1929, *Mem. Aust. Mus.*, V, 1: 68 (synonymy). Munro, 1957, Handbk Aust. Fish.: 47, fig. 330 [in *Fisheries Newsletter*, XVI, 5, May, 1957: 17, fig. 330].

[?] *Ophisurus novae-zelandiae* Hector, 1870, *Tr. N.Z. Inst.*, 2: 34, pl. iii. Type locality: Poverty Bay, New Zealand.

[?] *Leptognathus novaezelandiae* (Hector). Parrott, 1960, The Queer and the Rare Fish. of N.Z.: 58, fig. 16.

Occurrence in Tasmania.—At the end of a paper giving a general account of seven species of fish found in Tasmania Ogilby (1897 *a*) remarked, 'A specimen of eel forwarded for identification belongs to the restricted genus *Ophisurus*, but it is in such bad condition that the species cannot be determined. It may, however, be included in the Tasmanian catalogue as *O. serpens*.' Later he appears fully to have accepted the specific determination, stating in a footnote to a paper on a N.S.W. larval teleost (1897 *b*: 159), '*Ophisurus serpens* has been recorded once from Port Jackson, and it is found as far south as Tasmania, when I have recorded a specimen in very bad condition.' The first local list in which the eel appears is that of Lord (1923). Lord & Scott (1924: 37) observe 'As regards the right of this species to appear upon the Tasmanian faunal list, we know of no further records or specimens beyond the reference [*i.e.*, 1897 *a*] made by Ogilby'. In the Handbook (Munro, 1957), Tasmania is given, along with N.S.W., W.A., without comment.

In August 1956 the Queen Victoria Museum, Launceston, received for identification an ophichthyid, *Lt* 1144, secured in a lagoon near the mouth of the George River (lower portion of river constitutes part of boundary between Dorset and Cornwall). The specimen is pretty clearly the eel appearing in Australian lists as *O. serpens*.

Whether this Australian form is conspecific with the European *O. serpens*, or only closely allied to it, is a question to which, with the literature at my command, I am not in a position to return a definite answer. As a possible useful step towards arriving at a satisfactory conclusion, a general account of the present specimen—including a description and figures of the dentition—is given below.

General features.—Anal rays about 320, dorsal (count more reliable than that for anal) 490, of which 163 occur in advance of anal origin. Posteriorly dorsal and anal fan-out, forming what is in effect a substitute caudal fin: at about 35-40 rays (about 60-70 mm) from end of fin, dorsal rays, here 7 long, begin to increase in length, at first slowly, then more rapidly, reaching at about 13 rays (about 22 mm) from end of base a maximum length of 11, behind which they decrease rapidly in a bold, even curve. A similar, but less pronounced, change in size and shape of anal occurs opposite that in dorsal. Tail extends 16.5 behind dorsal, 15 behind anal, as stout stiff subconical (somewhat compressed; at anal termination 8.5 high, 7.5 wide) free tip, ending rather bluntly. Pectoral 11 (first, and last, ray unbranched); fully spread, its width 0.8 its length, the upper and lower borders linear for half length of fin, beyond which margin is evenly rounded: upper end of base level horizontally with upper end of gill opening, lower end level with about middle of vertical extent of gill opening. Gill opening restricted to side, the lower border continued back, almost horizontally, in a shallow curve, for about 10, its termination being almost vertically under posterior end of the downwardly and backwardly oblique pectoral base. Snout markedly convex anteriorly, flattening somewhat posteriorly. Interorbital gently convex. Eye without free border. Posterior nostril in upper lip, at half an eye-diameter in advance of eye. Anterior nostril apparently a short tube, nearly as wide as long; 12 from tip of snout, that is, opposite third large vomerine tooth, that is, in advance of posterior nostril by a distance subequal to that by which latter is in advance of eye; distance from border of upper lip subequal to its own length.

Proportions, TLt.—Length to: pectoral origin 82; dorsal origin and termination 133, 986; anal origin and termination 407, 987; vent (middle) 363. Length of: head (to gill opening) 76, snout 20, mouth cleft (from tip of upper jaw, which exceeds lower by 2.8 mm) 41, pectoral 17. Eye 6.6, interorbital 8.0. Depth (and in parentheses width) at: front of eye 12 (9.6), back of eye 16 (14), middle of head, 26 (24), vent 17 (17).

Dentition.—Dentary teeth: just inside lip, which is 3.5 mm behind tip of ovoid platform of under surface of upper jaw, 2 large subconical teeth, directed backward and slightly outward; 3 mm further back, a pair, rather stouter, pointing backward and outward; after an interval of 5 mm, a line, 26.5 long, extending back to angle of gape, of 43-44 small teeth, with bulbous base and sharp point, directed backward and slightly outward, the largest, occurring at about anterior one-third of the series, about twice size of hindmost. Premaxillary teeth: one small median; a pair, just inside lip, 2 mm from jaw-tip, slender, about 1 long, directed slightly backward (left missing); 3 mm back, a pair, about 1.2 long, stouter than preceding pair, 3 mm apart transversely, curved first outward then inward. Maxillary teeth: on each side a line, 23 mm long, of 41 teeth, beginning 8 mm behind last premaxillary tooth, largest near

middle of series, smallest at either end, base slightly swollen, curved, directed backward, and vertically down or slightly inward. Vomerine teeth: series beginning 2 mm behind level of end of maxillary set; comprising, first, in a distance of 14 mm, 6 spaced teeth, the anterior 2 small, closely set, all 6 conical, stout, the largest about 2.5 long and largest in mouth, directed backward; secondly, beginning 3 mm. behind last tooth of preceding set, 14 small teeth in 15 mm (unless mouth is flattened by pressure, these lie hidden where 2 palatal folds meet in a pronounced median groove).

Coloration.—Head: dorsum dark brown, darkest anteriorly; laterally, below level of eye mostly dark grey with some brownish punctulations, above this more or less uniform dark brown in anterior half of postorbital extent, with posterior half crossed by about a dozen narrow, slightly sinuous longitudinal streaks of dark brown, subequal in width to their biscuit-colored interspaces; lower jaw dark greyish near gape, elsewhere greyish with considerable (anteriorly, very marked) brown; under surface dirty brownish grey. Trunk: back and upper sides dark olivaceous brown with coppery lights, the color passing, on lower flank, fairly rapidly, but without any sharp line of demarcation, into the rather lighter brown, with some silvery sheen, of the ventral surface; usually a distinct narrow darkening along pore-line. Tail: in general much like trunk, but, proceeding caudad, the dark olivaceous brown of the flanks extends progressively lower, finally leaving no noticeable difference between ground color of lateral and ventral surfaces; general color tends to darken caudad, but becomes somewhat lighter (with some patches of distinctly lighter brown on midflank) in last 60-70 mm. Dorsal and anal rather pale brownish grey, darkening somewhat in outer one-fourth, the outer one-sixth with a conspicuous dark, almost black band: towards posterior end of fin, membrane tends to become increasingly punctulated with with brown. Pectoral dark olivaceous brown.

Family SYNGNATHIDAE

Since the publication in contribution X of this series (1961) of a key to, and conspectus of, Syngnathidae recorded from Tasmania, which set forth a synoptic account of available knowledge on the local members of this family, several additional items of data have come to light: these are noted below.

Genus **LEPTONOTUS** Kaup, 1853

LEPTONOTUS SEMISTRIATUS Kaup, 1856

(Fig. 4)

Leptonotus semistriatus Kaup, 1853, *Arch. Naturges.*, xix, 1: 233—*nomen nudum.*

Leptonotus semistriatus Kaup, 1856, Cat. Lophobr. Fish. Brit. Mus.: 48. Type locality: 'Origin not noted' = S. Australia [*fide* McCulloch (1929: 85)].

Leptonotus verreauxianus Duméril, 1870, Hist. Nat. Poiss., ii: 573. Type locality: Tasmania (Verreaux).

Remarks.—Though Johnston (1882) and Lord & Scott (1924) observe this pipefish is not uncommon, I could not in 1939 find an example in a Museum collection, and in providing a re-description and figure of the species was obliged at that time to resort to a Victorian specimen. In a later contribution (1953) a specimen, *Ls* 161.8, *Lt* 164.5, from Low Head, Dorset, was briefly described, and the first illustration in Australian literature of the brood pouch was given (1953, fig. 3).

Counts and Dimensions.—A dried specimen from Bellerive Beach, Monmouth, collected by Mr G. Cramp, yields the following counts and dimensions. D.37. P. 11. C. 5. A.? Annuli, total 20 + 48, subdorsal 3.0 + 6.0. Length to origin of pectoral 42, of dorsal 106; to termination of adpressed pectoral 47, of dorsal 137; to vent 117; *Ls* 267.5; *Lt* 272. Head 41, snout 26.5, eye 4.1, interorbital 1.9. Maximum depth 18, maximum width 6.5. The general features of this individual (including location of termination of ridges) agree closely with those of the Victorian example, *Lt* 216, described and illustrated previously.

Variation.—For each species in the 1961 conspectus 9 numerical items are recorded. In one proportion, snout in head, the present specimen exhibits a value, 1.5, falling outside the range previously recorded (1.6-1.8). The recorded number of dorsal rays (inadvertently omitted from the conspectus) has hitherto stood at 38: this specimen has 37.

Coloration.—There are present some elements of pattern not seen in the Victorian specimen. *Head.*—The most striking features are these: (*a*) beginning close to the inferior profile of the snout at a point about two eye-diameters in advance of eye, a slender white line, narrowly margined above and below with black, runs back to orbit at 8 o'clock (left side), leaves hinder orbital border at 4 o'clock, and extends backwards and slightly downwards across operculum near its middle, thereafter continuing briefly to middle of pectoral base [in the Victorian example this element is represented by a white line, not bordered with black, from eye to pectoral base]: (*b*) a darker elongated subrectangular area on hinder half of snout, bounded below by the white line just noted and above by a longitudinal ridge whose posterior portion forms upper boundary of narial basin: (*c*) a dark mesial strip on dorsum of head, originating anteriorly just in advance of level of nostril and becoming continuous posteriorly with the less-sharply defined dark mesial line on upper surface of trunk: (*d*) flanking the last-named element on either side on the head is a lighter region, which is delimited externally by a thin white line apposed to a thin black line, the latter extending caudad on to the trunk, immediately laterad of the superolateral body ridge, being clearly developed at least as far as origin of dorsal. *Trunk.*—(*a*) at about the anterior one-fifth of each scute a thin, even, slightly proconvex bar runs unbroken from inferolateral to mediolateral ridge, where it often ends in a white dot, ringed with black: (*b*) on each scute, between superolateral and mediolateral ridges, are scattered (in parts rather closely crowded) small white black-annulated spots of several sizes, the number per scute ranging from half a dozen anteriorly to a maximum of a couple of dozen near middle of trunk.

Genus **SYNGNATUS** Linné, 1758

SYNGNATHUS PHILLIPI Lucas, 1891

(Fig. 5)

Syngnathus phillipi Lucas, 1891, *Proc. Roy. Soc. Vict.* (n.s.), iii: 8, 12. Type locality: Port Phillip Heads, Victoria.

Corythoichthys phillipi (Lucas). McCulloch, 1929, *Mem. Aust. Mus.*, v, 1: 87.

Tasmanian status.—The Check List gives Victoria and South Australia only: but, as pointed out in these studies (1939), this species was reported from Western Australia by Waite & Hale (1921: 398), while earlier McCulloch (1911: 26) had noted 4 *Endeavour* specimens from Oyster Bay [Glamorgan], Tasmania. Mr B. C. Mollison has submitted for examination a male *Lt* 97.5, dredged in 9-13 fathoms off Verona, D'Entrecasteaux Channel, Buckingham, on 23rd July 1961.

Proportions.—Following the Handbook (1958: 83), which follows Waite & Hale (1921: 297), the conspectus (1961: 59) gives: snout in head 1.9, head in trunk 2.0, trunk in tail 2.4. By computation from the dimensions of the 4 specimens of the original material, it is found that these single-value entries can be extended to the following ranges: 1.7-2.0, 1.9-2.4, 2.3-2.9. With eye 2.1, snout 6.5, head 13.0, trunk 23.5, tail 61.0, length to dorsal origin 35.0, dorsal base 9.1, *Lt* 97.5, length without caudal 93.8; annuli, total 18 + 44, subdorsal 0.9-5.7, brood caudal I-XVI; D.22, P.10, A.3, C.5 (Waite & Hale, 10), Mr Mollison's specimen conforms in general to the specifications of the conspectus (as broadened above) but yields eye in snout 3.1 (*cf.* 3.4), and extends range of head in trunk numerically downwards to 1.8. Greatest depth of trunk, 3.8, exceeds greatest width, 2.9, and is 1.9 eye (*cf.* Waite & Hale, twice eye), or one-sixth of trunk-length (*cf.* Lucas, in males one-fifth).

Ridges.—These agree with the account given by Waite & Hale, except that the median nuchal ridge in our specimen extends, as reported by Lucas, only to level of insertion of pectoral (*cf.* Waite & Hale, to posterior end of body scute). The discontinuity between this ridge and the median occipital ridge, as noticed by Lucas, obtains. Lucas describes the extension of the supraorbital ridges to form nuchal lateral ridges as being continuous with upper lateral trunk ridges, but in the present specimen there is, as reported by Waite & Hale, a break here, the former, after a very brief turn-down, terminating shortly in advance of, and slightly below level of, origin of latter. The 'marked tetrahedral prominence on the ventral surface of the head, just behind the level of the eyes' noted by Lucas as present in males alone is perhaps merely the inter-ramal triangle of the normal jaw structure adventitiously swung down (as so often happens), but, by coincidence in this case, only in male examples.

Brood pouch.—The location, and extension in terms of rings involved, are recorded by Lucas and by Waite & Hale, but no indication of its character is given. In this specimen, in which it has perhaps not attained its full seasonal development, it is a very simple structure (fig. 5), consisting, on either side, of an integumentary fold devoid of supporting plates. Anteriorly the inner borders are narrowly separated by the interposition of the minute anal (less than 1 mm long); they then diverge rapidly to end of caudal II, where the distance between them is one-third width of ventral surface of tail here: proceeding caudad the folds progressively become narrow to extinction on caudal XVI. A needle can readily be introduced between the folds and the main mass of the tail throughout most of their length, but over the terminal few segments it appeared this could not be done without risk of injury.

Coloration.—Accounts by Lucas and by Waite & Hale call attention to variation in coloration with sex. Comparison of our specimen with the latter, more detailed description yields some noticeable differences: white mottlings on head other than snout few and indeterminate; no actual dots along opercular ridge (careful observation shows, on left side only, three very vaguely defined patches somewhat lighter than immediate neighbourhood); dorsum of trunk with indications of two longitudinal series of lightish areas, but no actual white spots developed; trunk-scutes, between TM and TU, tend, especially in hinder half of trunk, to be lighter at their lateral sutures, but little or no impression is gained of the presence of a full series of bars; about 5 whitish spots, between TM and TL, decreasing in size backwards, on trunk-annuli; ventral ridge on trunk, as noted in both accounts, black: subcaudal scutes behind termination of brood pouch greyish, with one or more narrow darkish areas near each lateral margin; caudal dusky. Waite & Hale observe, 'Brood pouch whitish, streaked with brown': in our example the folds are almost wholly brownish, concolorous with exposed surface of tail between them; laterally, however, along the line of adhesion, there is some darkening, more developed on right than on left fold.

Depth.—See general remarks on depth-records below, under *Solegnathus spinosissimus*.

The 4 type specimens and 3, or 4, examples discussed by Waite & Hale are noted as being dredged; the 4 *Endeavour* specimens from Oyster Bay, [Glamorgan], Tasmanian were probably secured in this way: however, no depth-data are given. The present record, 9-13 fathoms, clearly characterizes *S. phillipi* as a 'deepwater' form in Herald's sense of the term.

Genus **SOLEGNATHUS** Swainson, 1839

SOLEGNATHUS FASCIATUS (Günther), 1880

(Fig. 6)

Solenognathus fasciatus Günther, 1880, Rept. Voy. *Challenger* Zool., 1, 6: 30, pl. xiv, fig. B. Type locality: Off Twofold Bay, New South Wales.

Solegnathus fasciatus Günther. McCulloch, 1929, *Mem. Aust. Mus.*, V, 1: 94.

Remarks.—Three individuals dredged by Mr B. C. Mollison in 6-10 fathoms in D'Entrecasteaux Channel, off Middleton, Buckingham, on 25th June 1961, provide some interesting data on general proportions, possible sexual dimorphism, eggs and their attachment, prehensive pads, coloration, bathymetrical level.

Counts and dimensions.—Some counts and dimensions of specimens (*a*) female, (*b*) female, (*c*) male, in this order: total annuli 27 + 55, 28 + 56, 25 + 56; subdorsal annuli caudal 2.1—caudal 13.1; 0.3-10 (end of ring),2.1-12 (end); dorsal rays 37, 35, 37; pectoral rays 25, 25, 25; eye 7, 8, 6.5; snout 39, 42, 35; head 63.5, 72.5, 57; interorbital 5, 5, 3.5; trunk 140, 156, 134; tail 150, 159, 152; length to dorsal origin from end of operculum 143, 157, 137.5; dorsal base 37, 38.5, 38.5; depth (in parentheses width) at dorsal termination 8.0 (7.8), 11.0 (9.5), 9.0 (8.5); maximum depth 28, 36, 22.5; *Lt* 353.5, 387.5, 343.

Proportions.—Ranges of proportions given in the conspectus (1961) are transgressed by these specimens in three instances: eye in snout now 4.0-5.6 (*cf.* 4.0-5.0), head in trunk 2.0-2.4 (*cf.* 2.0), trunk in tail 1.0-1.1 (*cf.* 1.0)

Possible sexual dimorphism—In the male maximum depth in length of trunk is 6.0 (females (*a*), (*b*) 5.0, 4.3), or in *Lt* 15.2 (12.6, 10.8): head in trunk 2.4 (2.2, 2.2), or in *Lt* 6.0 (5.6, 5.3): snout in *Lt* 9.8 (9.1, 9.2). It is possible the relatively shallower trunk, shorter head, shorter snout of the male here represents genuine sex differences, the first having been noted as such (Waite, 1895: 222) in specimens identified by him as *S. hardwickii* Gray. Though the male (*c*) is 10.5 mm less in *Lt* than the smaller female (*a*), the width of the ventral surface of its tail immediately behind the vent is more than one-fourth as great again: marked sexual dimorphism in size and form of early tail-scutes has been reported in another species (Waite, 1895: 221); and in *S. dunckeri* Whitley, 1927, the sides of the tail-rings are 'much expanded' in males.

Eggs and their attachment.—Following the Handbook, the conspectus notes simply (as a generic character) 'eggs large, isolated, in open cells on tail.' In dealing with a collection of fishes made in Maroubra Bay by Thomas Whitelegge, Waite (1895) notes Günther's remark 'All the specimens in the British Museum are unfortunately dried, so that the sexes cannot be ascertained; but although some of them must be of the male sex, there is no trace of a pouch or other receptacle for the ova', and proceeds to give (for *S. spinosissimus*) what is apparently the first account of the ova and their mode of attachment in this genus: the observations on this species are accompanied by two figures (unfortunately missing in the copy to which I have access). In dealing later with *Endeavour* material of *S. fasciatus*, McCulloch (1911) observes of the eggs, 'they are very similar to those of *S. spinosissimus* as described by Waite, but are in a less advanced stage of development, and are arranged in about five very irregular rows commencing directly behind the vent and occupying thirteen tail rings'.

In Mr Mollison's specimen the brood annuli are caudal I-XX, extending over 100, or rather more than half length from tip of snout to dorsal origin.

The term 'isolated' as applied to the ova is to be interpreted as meaning they are placed in separate cells: each is attached, however, to its neighbour for more than half its height.

Waite's ovigerous example of *S. spinosissimus* was taken on 4th March, *Endeavour* males of *S. fasciatus* with eggs in a less advanced stage were collected in the latter part of November, while the present specimens were dredged on 25th June.

To follow the disposition of the egg-mass it is necessary to recall the arrangement of the ridges in the relevant area. At level of vent mediolateral trunk ridge (TM) is a trifle nearer to ventral than to dorsal profile. Behind vent it continues caudad on to tail, following much the same course but exhibiting some upward curvature posteriorly, for a dozen annuli, beyond which it then becomes the superolateral ridge of rest of tail (CU), constituting the main dorsal profile. From tip of tail cephalad to level of dorsal termination the mediolateral tail ridge (CM) runs approximately equidistant from dorsal and ventral profiles: from this point it continues forward, without interruption but in a slightly less developed state, to level of vent (beyond which it continues as a line of spinous bosses midway between TM and TL), being in this portion of its course subparallel to TM, its distance below which is from half to two-thirds its distance from ventral profile.

From vent to level of end of dorsal base, the whole ventral surface as far up as TM is wholly covered with a smooth, fairly thick, leathery white integument: behind dorsal termination this integument is less clearly developed, apparently being present, first in a tolerably continuous sheet (thinner than near vent) reaching up to (left), or above (right), level of CM through 7 (left) or 5 (right) post-dorsal annuli, thereafter dropping to ventral profile, and, secondly, in patches that may extend upwards as far as CU. Speaking of this structure in an ovigerous specimen of *S. spinosissimus*, Waite observed, 'It occurred to me this skin might be but the remnants of an egg-case, but as all the male specimens in the Museum, both dry and in spirits, possess it, and as it is scarcely likely that they were all taken during the breeding season, I am led to consider it as part of the animal.' Cells in which the eggs, now detached, have lain vary in shape, ranging from approximate circles or broad ellipses to irregular triangles (rare), quadrilaterals, pentagons, hexagons. Their modal fore-and-aft dimensions (lying in general along, or at a small angle to, anteroposterior axis of tail) is about 3.8, their transverse extent about 2.8. The cell wall, which is a simple fairly thin gelatinous ridge, ranging from virtually colorless to pale yellow, rises (as preserved) to a maximum of about 0.3, with a good deal of the system, however, not more than half this height. The great majority of cells are contiguous, each (except of course those at the periphery of the series) sharing a common wall with (most commonly 5) others: in a few instances only about one-tenth of the total wall-length of a cell may bound that cell only. Ventrally the egg-cells cover the whole of caudal annuli 1-XX, in about 3 rows anteriorly, in 2 posteriorly. On left side annulus I carries no cells (though the specialized integument extends up to TM); one cell appears on II; by VII the cellular area extends, with cells in about 2½ rows, to TM; immediately behind dorsal termination it reaches (as its maximum) nearly to dorsal profile, still in about 2½

rows, thereafter dropping with increasing speed, towards ventral profile, reached at XIX. On right side, I and II lack cells: greatest height of cellular region, comprising 2 rows, is reached at X, beyond which its upper border drops, reaching zero at middle of XVIII.

The jar in which the pipefish were preserved contains 62 eggs. This must be the full complement or very close to it. Speaking of two *Endeavour* males with eggs, McCulloch (1911: 27) remarks, 'The most perfect of these bears forty-five eggs, and it would seem that only a very few are missing.' He records that they occupied thirteen tail-rings: it is possible, therefore, that the posterior end of the series was missing. Of the loose ova, largest block, comprising 16, consists of 4 rows of 4 each, in echelon; lengths of rows 14.5, 15, 16.5, 16; width of block, normal to anteroposterior axis, 14.5. The typical egg is pyriform, 6.3 high, with fore-and-aft and transverse diameters each 4.0: attached to its neighbours for about 4, the vertical extent of the unattached portion being slightly greater at the wider (outer?) than at the narrow end. General color yellowish flesh; the more obtuse end with a polar cap (usually sharply delimited) of opaque white that extends from nearly down to point of attachment of contiguous egg to well below that level, modally for a vertical distance of about 1.5 mm (in some eggs this cap is set obliquely to the major axis, in which case it may reach down below equator); at pointed end (and often elsewhere) some scattered areas of opaque white. With superficial moisture dried off 16 ova weighed 0.855 gm. There is nothing in the material as preserved to suggest the eggs are disposed otherwise than in a single layer.

In specimen (*a*) a single ovum 4.0 long was partly projecting through the vent.

Prehensive pads.—The prehensive pads present on the under side of the hinder caudal segments, which appear in dried specimens as low mounds, often collapsed in such a manner as to suggest the occurrence on each annulus of a pair of lateral rounded swellings separated by a median valley, are in the formalin material well elevated, clearly consisting (caudad of the first 3-4, which tend to present separate lateral moities) of a continuous transverse semi-cylindrical roll of white leathery integument up to 2 mm high. They occur in (*a*) on 29, (*b*) 30, (*c*) 29 annuli (thus in all cases there are more tail rings with than without pads; though the longitudinal extent of the padded region of the tail is only about half that of the unpadded).

Coloration.—The original description (Günther, 1880) reads, 'the back of the trunk ornamented with seven narrow blackish cross-bars. Also the praeanal region is blackish'. No sign at all of cross bars can be detected in (*b*): in (*a*) some 4 or 5 darkish areas can just be made out on upper half of trunk (with a darker region covering the 4 immediately post-dorsal annuli): in (*c*) about 7 indistinct bars, of variable width, occur. It was, however, only some considerable time after removal from formalin that any specimen gave any indication of being (apart from the preanal pigmentation) otherwise than unicolorous. In *S. spinosissimus* the trunk also usually has 7 blackish bands: 2 or 3 rings immediately anterior to vent are here bright orange, but this normally changes to blackish shortly after death. It seems evident that coloration, to which Günther attached importance in establishing *S. fasciatus*, is decidedly variable and not of great systematic value. The darkening of the immediately preanal segments, however, is in these examples conspicuous and well-defined against the overall whitish, pale yellowish, or silvery. In (*a*) on right side the last 4 trunk annuli are blackish from ventral profile up to TM; on left side only the last 3 are thus marked: in (*b*) on right the penultimate and antepenultimate rings are dark brown up to TM, and there are 2 small pigmented patches on next ring cephalad; on left only two annuli are marked, the color, which is more intense than on right, ending sharply at TM: in (*c*) on right the last 4 annuli are involved, all being wholly pigmented up to TL, above which, to TM, most of the last 2, but only half of the other 2, are blackish; on left the ultimate trunk ring is wholly dark up to TL, then to TM only in anterior half, penultimate up to TM, antepenultimate very nearly to TM, while some medium pigmentation extends forward on to the posterior one-fifth of the preceding annulus between ventral profile and TL.

Depth.—Herald (1953) has pointed out that pipefishes taken in the Marshall and Marianas Islands in Operation Crossroads in 1946 seem to be clearly divisible into intertidal and deepwater forms, with the demarcation between the two habitats at 10-15 feet. Attention has been called earlier (Scott, 1961) to the general paucity of information on the depth at which our syngnathids occur: in the Handbook, indeed, the only bathymetrical data noted are: 25 fathoms for *Syngnathus mollisoni* Scott, 1955 and an entry 'shelf waters' for the present species and two other members of the genus (*S. spinosissimus* and *S. robustus*).

Solegnathus is essentially a deepwater genus; some depth-records being *S. fasciatus*, type, 120 fathoms, present material 6-10 fathoms; *S. robustus*, 37 fathoms; *S. spinosissimus*, 16 *Endeavour* examples, 15-45 fathoms.

Genus **STIGMATOPORA** Kaup, 1853

STIGMATOPORA ARGUS (Richardson), 1840

(Fig. 7)

Syngnathus argus Richardson, 1840, *Proc. Zool. Soc.* (Lond.), xiii: 29. Type locality: not stated [= Tasmania, *fide* McCulloch (1929: 93).]

Stigmatopora argus (Richardson). McCulloch, 1929, *Mem. Aust. Mus.*, V, 1: 93 (synonymy).

Remarks.—Three specimens, (*a*) *Lt* 53.0, (*b*) *Lt* 76.0, (*c*) *Lt* 144.8, netted in fairly shallow water (entangled in net let down to a maximum depth of about 25 feet) at Verona Sands, Buckingham, in January 1961 by Mr D. Ll. Scott yield some metrical variates lying outside accepted ranges; while (*b*), which carries eggs, and (*c*) provide some information on the brood pouch.

Counts and dimensions.—D. *ca* 54, *ca* 44 (probably imperfect), 63. Annuli 19 + 94, 18 + 101, 19 + 88 (tail imperfect). Subdorsal annuli 10 + 12, 11.2 + 7.0 (probably imperfect), 9.6 + 11.6. Brood annuli —, front of 1 caudal to caudal 14.8 (first 11 with eggs), front of 1st caudal to end of 19th caudal. Length to origin of pectoral 13.8, 21.5, 26.0, of dorsal 23.5, 32.3, 42.8; to termination of adpressed pectoral 14.8, 23.8, 28.5, of dorsal 42.5, 58.8, 74.6; to vent 32.3, 47.0, 58.0. Head 12.5, 19.0, 24.0; snout 7.8, 12.9, 16.1; interorbital 0.6, 1.0, 1.0. Maximum depth (head, trunk) 2.8, 2.5; 2.0, 1.9; 1.6, 1.5. Maximum width (head, trunk) 1.6, 1.4; 2.1, 2.4; 2.9, 4.0.

The number of brood rings in (*b*), 14.8, is less than the 16 given as the lower limit in the conspectus. Total tail rings for (*b*), 101, is the highest recorded: the entry of 94 of (*a*) also exceeds the previous highest total (90). The highest number of preanal subdorsal annuli hitherto recorded is 10: (*b*) has 11.2. Specimen (*c*) has 5 more dorsal rays than the highest count noted in the conspectus—giving for this species the wide recorded range of 43-63 (for a sample of 8, using n in calculation, $\bar{x} = 55.25 \pm 1.50$, range $/\sigma = 4.71$, $V = 7.7$; or, using n—1, range $/\sigma = 4.40$, $V^1 = 8.2$).

Proportions.—All proportions given in the conspectus can be calculated from the measurements above. One, 5.6 for eye in snout (*c*), extends downwards the range (6.0-9.3) in the conspectus.

Ridges.—TM in (*a*) extends to at least caudal XVI; in (*b*) is lost in folds of brood pouch; in (*c*) continues on to caudal XXII (*cf.* conspectus 1961: 61). Median dorsal ridge on snout 'terminates in advance of the eyes' [Waite & Hale (1921: 309)]: in our specimens at level of anterior nostril. Median ventral on snout bifurcates 'below the front margins of the eyes' (Waite & Hale): in (*a*) more than an eye-diameter in advance of eye, in (*b*) at level of anterior nostril, in (*c*) at middle of eye.

Brood pouch.—Readily available information on the ovisac and its contents is more or less limited to the location, longitudinal extent, and color of the pouch folds. Thus Waite & Hale note 'brood annuli 0 (1) + 18-20 (16)'—the entries in parentheses being higher or lower values recorded by other writers; and observe 'brood pouch whitish, or pink when containing young, with longitudinal black streaks': the Handbook (Munro, 1958: 90) gives "Brood pouch (males) subcaudal, eggs protected by skin folds': Whitley & Allan (1958: 56) cite Hedley (1915), 'the males carry the incubating eggs in a pouch on the tail.'

In (*b*) the brood pouch, which is slightly wider than the end of the trunk before it and distinctly wider than the tail immediately behind it, extends over 23 mm, or 14.8 caudal annuli, and carries eggs in the anterior 18 mm, or 11 annuli. Viewed from below the ovigerous region presents, on each fold, an outer series of 26 subspherical bulges (the first and last the smallest), each marking the position of an ovum. Internal to this series is a second shorter series (about equally curtailed at either end), in which the bulges, 17 on left flap, 18 on right, are somewhat less prominent. Since eggs are in a single layer (their vertical diameter being greater than their longitudinal or transverse), the total number is thus 26 + 17 + 18 + 26 = 87. They are pale orange. Viewed as they sit in the pouch, those of the outer row tend to be rectangular or irregularly pentagonal; most of the remainder have 5 or 6 sides. The free border of the flap, which is even in outline (*i.e.*, not undulating in correspondence with the bulges), is in the form of a narrow cord-like, but somewhat depressed, rim or rolled hem. When the specimen was received, the inner margins of the flaps were virtually in contact for about the first half of their length, behind which they were 0.2-0.3 mm apart, disclosing portions of 2 rows of eggs. When the flaps are pinned back, it is seen that there is, internal to general integument of the fold, a thin wrapping wall, having somewhat the appearance of a sheet of cellophane, embracing the dorsal half, or more, of the outer row of ova; with adjoining ova separated by septa of the same mesentery-like tissue. When the fish is viewed from the side, the outer row of egg-chambers is clearly visible, the number of bulges being readily countable: the lower margin descends noticeably below the general profile of the adjoining trunk and tail, while the upper border extends about half way between the level of the ventral profile on either side of the ovigerous region and the actual dorsal profile above it. The brood folds are wholly skinny or membranous, and devoid of special stiffening plates. Lateral aspect of fold (except in the first 3-4 compartments, which are lighter than rest) is darkish brown, darker than flank above it, which is here medium brown with numerous dark punctulations. Below, in its anterior three-quarters, where it embraces the eggs, fold is lighter than on sides, mostly much-punctulated brownish; a narrow inframarginal band (rather better developed on left fold) of orange minutely spotted with dark brown borders the rolled hem of the free margin, which is (especially in its posterior half) distinctly darker than any other part of fold, approaching black: in its posterior 5 mm, where it is closely applied to the inferior surface of the tail, making no appearance on the lateral surface, the fold is chiefly brownish, somewhat ashen internally.

For the anterior 4 of their last 5 mm the inner borders of the folds are virtually in contact; thereafter diverging slightly so that at the point of termination they are separated by about one-sixth of width of lower surface of tail here. Anteriorly they originate as distinct folds immediately behind the vent; but there is some indication of the continuation of an anchoring strip of muscle on either side of vent.

In (*c*) the brood pouch folds, extending over 33 mm or 19 annuli, are loosely open anteriorly, adherent to the tail posteriorly. Though they first project as actual folds beyond the general body level on the first caudal ring, their anterior insertions clearly extend forward to embrace the vent. When pinned back the fold is seen to be connected to the body by a set of transverse fleshy dissepiments, with the formation of a linear series of cells, of which 10 occur in 10 mm. At its outer edge the septum is attached to the thickened free border of the fold; at its inner edge (which tends to be somewhat lower than the outer) to a thin, fairly high, very flexible membranous wall: in the first few members of the set the septa of the two folds

join the common median wall directly opposite each other; further back the points of attachment usually alternate, but occasionally come into coincidence again. The whole of the inside of the ovisac is dull, pale, rather dingy yellow. Externally the folds are dirty whitish, with a well-defined narrow dark stripe along the whole length of the outer border of the fold where it arises from the flank [no such marking in (*b*)]: near the middle of the length a second longitudinal band develops and runs close to, and mostly parallel with, the fold's inner border. No eggs in this individual.

Markings.—The dotted back from which the species derives its name is stated by Waite & Hale to be a fairly constant feature of the female, but to occur also, though more rarely, in the male. In our only female, the small (*a*), *Lt* 53.0, the marking is already represented by a well-defined bar across the dorsum of each annulus from the 1st to about the 25th, the marking progressively fading out over the next half dozen rings: anteriorly the total width of the bars, which are diffuse along their sides, is subequal to their interspaces, while if only the central more deeply pigmented portion be taken into account, the width is from half to one-third as much: posteriorly the bars tend to become somewhat less diffuse and show some indication of breaking up at either extremity into a spot. No spots in (*b*). In (*c*) they are conspicuous: a pair on the dorsum of each trunk annulus and on the tail rings to about end of dorsal fin, beyond which for some 10 annuli they increasingly tend to become bars, one-tenth, or less, as wide as their interspaces. From front of trunk to about origin of dorsal the spots (which are here somewhat smaller, especially the earliest) are joined by a narrow dark line. It would thus seem possible the ontogenetic pathway of these markings on the dorsum is from broad diffuse transverse bands, through narrower bars that are at first without, later with, terminal condensation, to discrete well-rounded spots in pairs. In (*c*) (only) there occurs a noticeable vertical darkening along the anterior and posterior borders of each trunk ring, extending unbroken from TU to TL, wider and otherwise better developed above than below TM.

Genus **PHYLLOPTERYX** Swainson, 1839

PHYLLOPTERYX TAENIOLATUS TAENIOLATUS (Lacépède), 1804

(Fig. 8)

Syngnatus [*sic*] *taeniolatus* Lacépède, 1804, *Ann. Mag. d'Hist. Nat.*, iv: 211, pl. lviii, fig. 3. Type locality: Bass Strait (Baudin).

Syngnathus foliatus Shaw, 1804, Gen. Zool, (Pisc.), V, 2: 456, pl. clxxx.

Phyllopteryx foliatus (Shaw). McCulloch, Mem. *Aust. Mus.*, V, 1: 95. Waite & Hale, 1921, *Rec. S. Aust. Mus.*, I, 4: 313, fig. 61.

Phyllopteryx taeniolatus taeniolatus (Lacépède). Munro, 1958, Handbk Aust. Fish., 22: 92, fig. 641 (in *Fisheries Newsletter*, xvii, 4, Apr. 1958: 20, fig. 641). Scott, 1961, *Pap. Proc. Roy. Soc.* Tasm., 95: 60.

Taxonomy.—It is now known that Shaw's name, under which the leafy sea-dragon has commonly been spoken of in Australian literature for well over half a century, is antedated by Lacépède's. In treating *Phyllopteryx lucasi* Whitley, 1931 as a Western Australian subspecies, I follow, for convenience, the Handbook (Munro, 1958: 92). Whitley & Allan (1958: 48) observe of *P. taeniolatus* 'found in New South Wales, Victoria, Tasmania and South Australia, where it tends to run to two forms: a slender duller-coloured one (*P. elongatus*) [*i.e.*, *Phillopteryx* [*sic*] *elongatus* Castelnau, 1872] and a deep and brightly coloured one (*P. altus*)' [*i.e.*, *P. altus* McCoy, 1882].

Remarks.—With D.35; P. 23; total annuli 18 + ? (imperfect), subdorsal 1.5 + 7; length to origin of pectoral 71, of pectoral 6; length to origin of dorsal from hind margin of operculum 100; dorsal base 37.5; snout 43, eye 7.3, head 63.5, trunk 108, this specimen yields counts and proportions all within the limits recorded in the conspectus. In trunk maximum depth is 32, maximum width 10. No subrostral tag. Bellerive Beach, Monmouth: Mr G. Cramp.

Eggs.—Of a fair number of specimens that have passed through my hands, this is the first with any considerable number of eggs *in situ* (fig. 8), though several have retained traces of their occurrence. Dried orange ova or empty pale yellow shells occur on the first 10 caudal annuli, with some unoccupied cells reaching back on to the 14th. Published records give brood annuli as being from caudal I to XVII, XVIII, XIX: it is possible the egg-mass in this specimen may have extended caudad of XIV, but there is no definite indication that this is so. Eggs, as preserved, are commonly a trifle over 2 mm along major axis, and 2, or rather less, along the minor axis. They are arranged mostly in 4-5 rows on ventral surface of tail, with (except on first 2-3 rings) an additional row extending on to lateral surface on each side; and, are, as here preserved, in a single layer. (The photograph in Waite & Hale (1921, fig. 51) would seem to suggest only a single layer is present there—at any rate in the posterior part of the series). Some fifty ova, or parts of ova, remain in place, and there are more or less obvious indications of the previous presence of about an additional thirty: but the total number may well have exceeded the eighty thus accounted for. Whitley & Allan (1958: 46) state, 'The eggs are of a beautiful ruby colour and one hundred and twenty of them have been counted on a single male'. The unoccupied cells are bounded by low dark walls of integument concolorous with that of the undifferentiated portions of tail: the walled space, which varies in shape from quadrilateral and pentagonal to oval (long axis along, or oblique to, anteroposterior axis of fish) is unfloored, and is a glistening grey, characteristically traversed by the 3-5 low transverse ridges of the ring.

Family GIRELLIDAE

Seven species are given in the Check List: (*a*) *Girella* Gray, 1835, (1) *G. tricuspidata* (Quoy & Gaimard), 1824, (2) *G. cyanea* Macleay, 1881, (3) *G. elevata* Macleay, 1881, (4) *G. zonata* Günther, 1859 [Australia ?], (5) *G. castelnaui* (Thominot),

1883 [' Australia ']; (*b*) *Tephraeops* Günther, 1859, (6) *T. tephraeops* (Richardson), 1846; (*c*) *Melambaphes* Günther, 1863, (7) *M. zebra* (Richardson), 1846.

Only one species, (1), is credited in the Check List to Tasmania [this appears in the earliest published State list (Johnston, 1881)]. However, (7) was recorded from our East Coast by Lord (1925) prior to the publication of the Check List (McCulloch, 1929): it has since been reported (Scott, 1935) from George Town, Dorset, and the present communication notes a specimen from Green's Beach, Devon.

Girella elevata, (3), is here added to our fauna, being reported from King Island and from Green's Beach, Devon.

KEY TO GIRELLIDAE RECORDED FROM TASMANIA

1 Operculum scaly. Scales in a longitudinal row between scapula and hypural > 70 (about 80); between lateral line and middle of dorsal base > 10 (about 12), excluding those of scaly fin-sheath. Posterior border of preoperculum sloping downwards and backwards. Flank with about 9 dark bands as broad as, or broader than, their interspaces .... *Melambaphes zebra*

Operculum naked. Scales in a longitudinal row between scapula and hypural < 70 (about 50); between lateral line and middle of dorsal base < 10 (about 8), excluding those of scaly fin-sheath. Posterior border of preoperculum vertical or sloping downwards and forwards. Flank either without dark bands or with about 10-12 dark bands narrower than their interspaces 2

2 Dorsal: spines 14-16; spinous base ≐ 2 soft base, the latter < anal base. Operculum with 1 flat spine. Caudal moderately emarginate, the lobes somewhat pointed. About a dozen narrow dark-grey subvertical bands on each flank in life (usually lost in preservation); individual scales without color-pattern of their own .... *Girella tricuspidata*

Dorsal: spines 13; spinous base ≐ 1⅔ soft base, the latter ≐ anal base. Operculum with 2 flat spines. Caudal subtruncate, the lobes not pointed. No dark bands on flank, in life most scales with a bluish area near middle and a well-defined bronze posterior border (pattern sometimes traceable in preserved material) .... *Girella elevata*

Genus **GIRELLA** Gray, 1835

GIRELLA ELEVATA Macleay, 1881

Girella elevata Macleay, 1881, *Proc. Linn. Soc. N.S.W.*, V, 3: 408. Type locality: Port Jackson.

Girella elevata. Stead, 1908, Edible Fish. N.S.W.; 51, pl. XX.

Girella elevata Macleay. McCulloch, 1920, *Rec. Aust. Mus.*, XII, 2: 64, pl. XII, fig. 1. McCulloch, 1929, *Mem. Aust. Mus.*, V, 2: 239.

First Tasmanian records.—Two examples—(*a*) *Ls* 295, *Lt* 375 (caudal clumped) or 367 (caudal fully spread), from Grassy, S.E. King Island; (*b*) *Ls* 228, *Lt* 286 (clumped) or 279.5 (spread), from Green's Beach, Devon—add this species to the Tasmanian list.

Specimen (*a*) was received on 12th November 1960 from Mr H. A. Bartlett, Currie, King Island. Mr Bartlett had been aware for some time of its existence in King Island waters—it is known locally as the Butterfish [a name commonly applied on the Tasmanian mainland to *Psilocranium nigricans* (Richardson), 1850, Cheilodactylidae; in South Australia to *Sciaena antarctica* Castelnau, 1872, Sciaendiae; in New South Wales, and elsewhere, to *Scatophagus multifasciatus* Richardson, 1846, Scatophagidae, and, with the epithet 'spotted', to *S. argus* (Linné), 1766]—and had described it to me several months prior to the receipt of the present example. Specimen (*b*) was received at the Queen Victoria Museum, Launceston, from Mr H. L. von See on 15th February 1961: being accompanied by a specimen, *Ls* 178, *Lt* 233, of *Melambaphes zebra* (Richardson), 1846 and a specimen, *Ls* 193, *Lt* 252, of *Scorpis georgianus* Cuvier & Valenciennes, 1832.

Proportions, TLS.—The value for the King Island specimen is in each case given first. Eye 54, 53; interorbital, at anterior border of eye, 108, 96, at posterior border 125, 114; internarial, anterior 55, 59, posterior 67, 72; snout 78, 88; head, hard 247, 246, soft 261, 257. Length to anterior border of vent 559, 575, to posterior 593, 568. Depth at: nostril, anterior 139, 149, posterior 163, 167; eye, anterior border 197, 202, posterior 261, 268; operculum 366, 351; dorsal, origin 383, 390, termination 186, 184; middle of vent 390, 382; anal termination 207, 187; caudal peduncle 156, 154. Pectoral: length to base, front 251, 230, back 269, 243; length of fin, 271, 228; longest (4th, 4th) ray 241, 219. Ventral: length to origin 298, 300; length of fin 229, 211; extending to within 32, 64 of vent; spine 110, 101; rays 1st-5th, 207, 197; 214, 202; 198, 193; 166, 175; 136, 158. First dorsal: length to origin 271, 203; to end of last spine, 610, 618; spines, I-XIII, 27, 31; 53, 48; 64, 75; 80, 83; 83, 93; 102, 96; 104, 92; 100 (imperfect), 92; 87, 112; 86, 110; 81, 119; 86, 114; 92, 128. Second dorsal: length to first ray 627, 636; to termination 856, 836; rays, 1st-14th, 115, 140; 163, 158; 186, 164; 170,160; 164, 145; 159, 145; 159, 145; 146, 132; 139, 132; 125, 125; 115, 105; 108, 94; 98, 88; 85, 66. Anal: length to origin 627, 671, to termination 824, 829: spines, I-III, 42, 44; 85, 68; 90, 96; rays (to base in sheath), 1st-11th and 1st-12th, 149, 167; 193, 197; 186, 208; 200, 193; 186, 189; 176, 184; 156, 171; 132, 145; 119, 145; 108, 123; 92, 107; no ray, 88.

Remarks.—Both specimens agree well in general with the description and illustration given by McCulloch (1920) and with Stead's (1908) photograph. Several points call for comment. (*a*) McCulloch describes, and figures, both nostrils with fimbriate edges (one of the 3 items of key (p. 60) for separation of *G. cyanea* and *G. elevata* is that in former nostrils are 'scarcely fimbriate', in latter 'markedly fimbriate') no fimbriation is obvious in Stead's photograph, though it could be present but unapparent; no noticeable fimbriation occurs in either of our specimens, though a few striae are found near either nostril, particularly in the King Island example. (*b*) The dermal lobe of anterior nostril noted by McCulloch here covers about upper

half of aperture; in clear contrast to blackish surrounding area, being yellowish green (*a*) or pale yellowish (*b*), minutely punctulated with dark brownish. (*c*) McCulloch's plate shows dorsal and anal each ending at its last ray: in (*a*), last dorsal ray is joined to trunk by a slip of membrane, extending up ray (27.1 long) for 11, and presenting a concave free border that ends 9 caudad of base of ray; while in (*b*) a small triangle, approximately 3 long and 3 high, has on its free border two pointed fleshy lobes, of which the anterior, barely 2 long, is twice the length of the first: in anal (*a*) has a slip similar to, but smaller than, that of dorsal, with corresponding dimensions 8, 3.5 (ray 27 long); while in (*b*) the fin at this point has suffered minor damage and the situation remains obscure: there is a hint of the probable presence of these membranes in Stead's photograph, but the point cannot certainly be determined. (*d*) McCulloch observes of dorsal spines that they 'increase rapidly in length to the fifth, after which they increase very slightly to the last' (in contrast, for *G. tricuspidata* he notes 'spines increasing in length to about the eighth and then decreasing again backwards'): as data given above (see *Proportions*) shows, in (*a*) spines increase to 7th (or 8th), decrease to 11th, increase in next 2; while in (*b*) they increase to 6th, beyond which they exhibit several local rises and falls (smoothed in threes, the values suggest a general pattern of rapid increase to 4th, much less rapid over 5th-7th, and an intermediate rate of increase over rest of fin). (*e*) In upper jaw the larger teeth of the single outer series number 8 + 8 in both specimens, all three-pointed, the middle cusp the largest (especially in respect of breadth), but the difference in size between it and lateral cusps becomes less pronounced, particularly in (*a*), in teeth towards outer end of the tricuspid series, which is followed, to the end of premaxilla, by a row of very small subconical teeth; inner teeth minute, crowded, flattened, tricuspid or subconical in a lunule extending anteroposteriorly for 6, 4 mm in middle line and continued backward as two narrow horns with tips 20, 13 apart: in lower jaw a generally similar arrangement, with 11 + 11, or 7 + 7 large or tolerably large central teeth in a single row (McCulloch, 'about fourteen larger teeth in each jaw'). (*f*) Fin counts: D.XIII/14; A.III/11, III/12; P. 19 (McCulloch, 18): V. I/5; C.18, of which about 15 extend to hind border (McCulloch, 15). (*g*) Scales below lateral line between scapula and hypural 52, 51 (McCulloch, 51); about the same number immediately above it: at middle of dorsal 8-9 scales between lateral line and back, not including scales of sheath. (*h*) Our values for the 11 ratios given by McCulloch (his values in parentheses): depth before ventrals 2.5, 2.6 (2.4) in *Ls;* head (total) 3.8, 3.9 (4.0) in *Ls*: last dorsal ray, 3rd dorsal ray, 2nd anal ray, pectoral fin, ventral fin 2.8, 2.0 (2.7); 1.4, 1.6 (1.5); 1.4, 1.3 (1.2); 1.0, 1.1 (0.9); 1.1, 1.2 (1.1) in total head: snout, interorbital 3.3, 3.0 (3); 2.4, 2.8 (3) in total head: eye in preorbital 0.7, 1.1 (eye 'but little broader than preorbital bone': note here, in (*b*), preorbital exceeds eye). (*i*) Upper rays of pectoral with minute scales covering most of rays and membrane; from about 12th ray onward scales extend outward for about half length of ray, then cease on ray and on membrane between successive rays, but persist for half rest of distance to margin on membrane between ray-branches: on both dorsal and on anal scales continue outward beyond the thick sheath, extending halfway, or more, towards margin of fin.

Capture; behaviour.—Mr Bartlett has supplied the following information about the taking of his specimen. It was caught in a channel in a small headland in about 12 feet of water—offshore, where there is a bed of bull kelp, depth increases rapidly to about 30 feet. Several specimens were swimming near the surface, together with young Sweep, *Scorpis georgianus* Cuvier & Valenciennes, 1832, and when pursued they dived for cover. This fish dived under a large boulder on floor of channel, and continued to swim backwards and forwards beneath it till speared. McCulloch gives a interesting account, based on information from Mr McNeill, of the habit of this species of allowing itself to be carried by a wave over the rocks to procure Sea-Cabbage for food, hurrying back with the receding water. Similar movements were observed by Mr Bartlett among King Island examples.

Distribution.—The fact that about forty years after the discovery of this fish (of which Stead (1908) stated that, though it is but little known, he had good reason for believing it to be quite common), McCulloch (1920: 66) should state it 'is known only from the vicinity of Sydney' makes its collection in King Island in 1960 and in northern Tasmania in 1961 of much interest. Whether we have here a genuine instance of discontinuous distribution, or whether the discontinuity is apparent only, being attributable to lack of information, remains for the present undetermined: migratory behaviour may just possibly be a contributory factor in its being overlooked locally for so long.

Family GOBIIDAE

The Check List credits Tasmania with 3 species: (*a*) *Nesogobius* Whitley, 1929, (1) *N. hinsbyi* (McCulloch & Ogilby), 1919; (*b*) *Gobius* Linné, 1758, (2) *G. tasmanicus* Whitley, 1929, (3) *G. tamarensis* Johnston, 1883. Lord (1923) and Lord & Scott (1924) admit the 2 species then described, namely, (1) and (2), and add (4) *G. lateralis* Macleay, 1881. A later survey of local forms (Scott, 1935) retained (1) and (2) (the latter referred to *Arenigobius* Whitley, 1930); suggested (2)—founded (Whitley, 1929) on a short description of a specimen in Johnston MS—is a synonym of (3); advanced reasons for considering (4) may have been entered on the Tasmanian list in error; and described a new genus, (*c*) *Tasmanogobius,* with (5) *T. lordi,* sp. nov. as orthotype

On this basis our list stood therefore at (1), (3), (5): later, when recording a new locality for (3), opportunity was taken to key these 3 forms (1936). Since that date, (6) *Arenigobius bifrenatus* (Kner), 1865 has been reported (under the circumstances noted below) from our waters; and (7) *Stigmatogobius poicilosoma* (Bleeker), 1849, which appears in the Check List as *Mugilogobius galwayi* McCulloch & Waite, 1918, is here added to the local list.

KEY TO GOBIIDAE RECORDED FROM TASMANIA

(including *Gobius lateralis* Macleay, 1881, probably reported in error)

1 { Body without normal scales. Total rays and spines of vertical fins > 32 (≥ 35). Second dorsal: rays > 13 (15-16); base > 2 (≒ 2½) base of dorsal .... *Tasmanogobius lordi*
Body with well-developed normal scales. Total rays and spines of vertical fins < 32 (≤ 28). Second dorsal: rays < 13; base ≤ 2 base of first dorsal 2

2 { Caudal greatly produced, its length ≒ head + trunk. Anal and second dorsal each with rays, or combined rays and spines = 11. Distance from origin of first dorsal to termination of second dorsal ≥ distance from tip of snout to origin of second dorsal. A bridle of conspicuous dark bands from eye to pectoral base .... *Gobius bifrenatus*
Caudal not noticeably produced, its length < head + trunk (≤ length to pectoral base). Anal and second dorsal each with rays, or combined rays and spines ≥ 10. Distance from origin of first dorsal to termination of second dorsal < distance from tip of snout to origin of second dorsal. No such dark bridle 3

3 { First dorsal with 7 (rarely 6) spines. Scales between axilla and hypural > 40 (≒ 50). Maxilla failing to reach level of anterior border of eye. Interorbital space ridged. *Nesogobius hinsbyi*
First dorsal with 6 (rarely 5) spines. Scales between axilla and hypural < 40 (28-33). Maxilla reaching beyond level of anterior border of eye (to middle or beyond). Interorbital space not ridged; flat or concave 4

4 { Scales between axilla and hypural < 30 (≒ 28). Longest dorsal spine = 1st (filamentous). Eye > snout. Interorbital > 4 (≒ 5.5) eye. Second dorsal base ≒ head .... *Rhinogobius lateralis*
Scales between axilla and hypural > 30 (31-33). Longest dorsal spine not 1st (2nd or 5th). Eye < snout. Interorbital < 4 (≒ 2-3) eye. Second dorsal base < (about ¾) head 5

5 { Operculum with some large rather indistinct scales: scales of dorsum extending forward to eye. Longest dorsal spine = 2nd: 6th spine ≒ ¾ 5th. Caudal rounded. Usually a blue blotch on first dorsal .... *Stigmatogobius poicilosoma*
Operculum naked: scales of dorsum not extending forward to eye (ceasing near level of pectoral base). Longest dorsal spine = 5th: 6th spine ≒ ½ 5th. Caudal pointed. No blue blotch on first dorsal .... *Arenigobius tamarensis*

Genus **NESOGOBIUS** Whitley, 1929

Nesogobius hinsbyi (McCulloch & Ogilby), 1919

[?] *Gobius pictus* Castelnau, 1872, *Proc. Zool. Soc. Vict.*, 1: 124. Type locality: St. Kilda, Victoria. Preoccupied by *G. pictus Malm*, 1865.

Gobius hinsbyi Johnston, 1904, *Pap. Proc. Roy. Soc. Tasm.*: 10 (Abstract). Type locality: Tasmania. *Nomen nudum.*

(*Gobius*) *hinsbyi* McCulloch & Ogilby, 1919, *Rec. Aust. Mus.*, XII, 10: 215, pl. xxxiii, fig. 1. *Ex* Johnston MS.

Nesogobius hinsbyi McCulloch & Ogilby. Whitley, 1929, *Pap. Proc. Roy. Soc. Tasm.*, 1928: 62, Scott, 1935, *Pap. Proc. Roy. Soc. Tasm.*, 1934: 47.

Localities.—Johnston noted of his material simply that it was Tasmanian: the type is preserved in the Tasmanian Museum, Hobart, and was examined by McCulloch & Ogilby (1919), in the course of preparation of their important paper on Australian gobiids. Their excellent description and figure were based on a specimen 86 long noted as being from 'Wedge Bay, Hobart, Tasmania', where it was collected, in 5-10 fathoms, along with 25 other specimens, 33-62 long, by C. Hedley, in April 1907: this locality-entry should read (see Scott, 1935: 47) 'Wedge Bay, Tasman Peninsula [Pembroke], Tasmania'. McCulloch & Ogilby's material included also Victorian specimens from Queenscliff, Port Phillip.

In the review of the Tasmanian species referred to above (1935: 47) it was recorded that this species is abundant in pools between tide-marks at Burnie [Devon/Wellington] and West Ulverstone [Devon]; and observations were given on colors in life and habits. In January 1935 I found this goby in considerable numbers in The Arm, a long narrow inlet, with a river-like facies, in George Bay, St Helens, Dorset, where it occurred, in from a few inches to a fathom of water, in association with *Stigmatogobius poicilosoma* (Bleeker), 1847.

On 23rd July 1961, Mr B. C. Mollison dredged 11 examples, in association with 4 specimens of *Acanthopegasus lancifer* (Kaup), 1861, in 9-13 fathoms off Verona, D'Entrecasteaux Channel, Buckingham. Apart from one individual of *Ls* 60, *Lt* 71.5, these formed a compact size group of *Ls* 41-46.5, mean 43.40 ± 0.59; *V* 4.5 ± 1.0 (in calculation *n* used). Noticeable features of the coloration are the magnitude and intensity of the (almost black) hypural bar; the clear definition in most examples of the narrow brown bars, and, in some individuals, their continuity across the midventral line; and the conspicuous terminal white spot presented by the collapsed caudal. One specimen of this goby, *Ls* 50, *Lt* 59, was dredged also by Mr Mollison in 6-10 fathoms off Middleton, D'Entrecasteaux Channel, Buckingham, on 25th June 1961: in this the precaudal pigmentation is more diffuse and not nearly so dark.

Genus **ARENIGOBIUS** Whitley, 1930

ARENIGOBIUS BIFRENATUS (Kner), 1865

Gobius bifrenatus Kner, 1865, Reise *Novara* Zool, Fische, ii: 177, pl. VII, fig. 3. Type locality: Sydney, New South Wales.

Gobius bifrenatus Kner. McCulloch, 1929, *Mem. Aust. Mus.* V, 1: 370 (synonymy).

Arenigobius bifrenatus (Kner). Olsen, 1958, *Pap. Proc. Roy. Soc. Tasm.*, 92: 158.

Remarks.—Kner's material was obtained in New South Wales; while the type localities of the synonymic *Gobius bassensis* Castelnau, 1872, *G. caudatus* Castelnau, 1873, *G. filamentosus* Castelnau, 1875 were [Bass Strait], Victoria; Victoria; Adelaide, S. Australia, respectively: and up to the

appearance of the Check List (1929) the species was recorded from these 3 States only. Its addition to the Tasmanian list has been described by Olsen (1958) as follows. 'Specimens were collected in 1950 and identified by Mr I. S. R. Munro, C.S.I.R.O. Division of Fisheries and Oceanography. Reference to their occurrence in George Bay [Dorset/Cornwall] was made earlier (Olsen, 1954). Whitley (1954) listed it as a new record for Tasmania from a specimen caught in West Arm, Tamar River' [Devon]. Olsen notes that, together with *Ophiclinus gracilis* Waite, 1906, it forms part of the diet of juvenile school sharks, *Galeorhinus australis* (Macleay), 1831, in George Bay.

Scamander River specimen.—In March 1961 Mr C. Burrows secured an example of *Arenigobius bifrenatus, Ls* 78, *Lt* 114, in the Scamander River, Cornwall. It was caught, with rod and line, about one mile from the river-mouth: its occurrence at this distance from the sea is not unexpected, the material examined by McCulloch & Ogilby including estuarine specimens from New South Wales, Victoria and South Australia.

The original figure of this species, commonly reproduced in Australian catalogues, is of an imperfect specimen (the type), the whole outer border, and the membrane behind the last spine, of the first dorsal being missing. As noted by McCulloch & Ogilby the perfect fin is rounded, with the 4th and 5th spines longest. In our specimen the spines, which towards the tips become quite filamentous, measure, in sequence caudad, 10.5, 12, 12.5, 13, 13, 7; the longest exceeding (McCulloch & Ogilby, equal to) postorbital portion of head, which is here 10. The chord of the moderately proconvex border of the membrane joining the last spine to the dorsum slopes downward and slightly backward, the interdorsal being reduced to 1 mm.

Fin-counts of our specimen agree with those given by McCulloch & Ogilby: absence of some scales of the caudal peduncle makes an accurate count impracticable, but the number along the lateral line is evidently quite close to the reported 37. Some important dimensions (mm) may be recorded. Head 21, snout 5.1, eye 4.8, interorbital 1.4. Length to origin of: pectoral 22.5, first dorsal 24.5, second dorsal 40, anal 42, caudal (procurrent rays) 74. Base of: first dorsal 14.5, second dorsal 22, anal 21. Length to vent *ca* 41. First and last rays of second dorsal 11.5, 18; of anal 8, 18.5. Longest pectoral ray (11th) 24.

Comparison with values given by McCulloch & Ogilby (quoted below in parentheses), which are based on a single specimen, 142 long, from Sans Souci, Botany Bay, reveal some differences. Head 3.7 (4) in *Ls*. Eye 4.4 (4.6) in head, interorbital 3.4 (2.8) in eye. Snout 4.1 (3.8) in head, caudal peduncle 2.6 (2.1) in head. McCulloch & Ogilby give depth in *Ls* 5.1: in our fish part of the ventral half of the trunk is missing and the greatest depth cannot certainly be ascertained; depth at vent in *Ls* is 5.1.

The essential features of the color pattern are present and well-developed. Caudal has 7 or more narrow dark arcs, one of which is basal: an additional bar, with which it is in contact, to upper border of fin about midway between basal bar and the next normal bar. First dorsal with narrow horizontal marking, made up of a series of oblique subrectangular dark blocks, one to each interradius, set in echelon, but giving, broadly, the effect of a single bar: this occurs along basal one-fourth of fin. Similar bar in second dorsal, on same horizontal level as that on first. No other pronounced marking in either dorsal. Other fins without markings: pelvics very dark. Upper bar of bridle, which is somewhat narrower than first, originates (contrast Kner's figure) below level of middle of hind border of eye; but gives off here a short proconcave spur that approximately parallels orbital border. Proconvex bar from back of eye to near rictus. Upper lip blackish. Dark purplish ypsiliform marking on isthmus with the diverging limbs bordering the branchiostegal membranes. Half a dozen compact squarish or roundish markings above anal base (probably extending further caudad, but scales missing here).

The proximal inflation of the outline of the caudal fin is less pronounced than in the standard figure.

Genus **STIGMATOGOBIUS** Bleeker, 1874

STIMGATOGOBIUS POICILOSOMA (Bleeker) 1849

Gobius poicilosoma Bleeker, 1949, Verh Bat. Gen., 22: 31.

[?] *Gobius olorum*, Sauvage, 1880, *Bull. Soc. Philom.* (7), IV, 43. Type locality: Swan River, Western Australia.

Mugilogobius galwayi McCulloch & Waite, 1918, *Rec. S. Aust. Mus.*, I, 1: 50, pl. iii, fig. 1. Type locality: Patawalunga, near Adelaide, South Australia.

Mugilogobius galwayi McCulloch & Waite. McCulloch & Ogilby, 1919. *Rec. Aust. Mus.*, XII, 10: 224. McCulloch, 1929, *Mem. Aust. Mus.*, V, 1: 376.

Stigmatogobius poicilosoma (Bleeker). Koumans, 1953, Fish. Indo-Aust. Arch., X: 119 (synonymy).

Lizagobius olorum (Sauvage). Whitley 1960 Native Freshw. Fish. Aust.; 125, fig. on p. 125.

Remarks.—The Check List gives, for McCulloch & Waite's species, the type locality (South Australia) only. Whitley (1960) gives the range as Victoria, South and Western Australia, northward to the Hill River. For Australia Koumans (1953: 120) notes Lake Illawana! Port Philipi [sic] near Melbourne! Patawalunga! [type locality], Noarlunga! [South Australia]: among extra-Australian localities he lists the following countries and islands (precise localities not here transcribed): Singapore, Simular, Nias, Java, Bali, Flores, Ambon, New Guinea, India, Philippines—in brackish water and river. Koumans' synonymziation of McCulloch & Waite's species with Bleeker's thus gives it a wide extralimital range.

Tasmanian record.—The species is here added to the Tasmanian list, a number of specimens having been taken by the writer in December 1952 and January 1953 in The Arm, George Bay, Dorset, where it occurred abundantly in brackish water, at a depth of from a few inches to a fathom, in association with *Nesogobius hinsbyi* (McCulloch &

Waite), 1919, *Pseudaphritis urvillii* (Cuvier & Valenciennes), 1831, *Atherina microstoma* Günther, 1861, *Gymnapistes marmorata* (Cuvier & Valenciennes), 1829, *Galaxias attenuatus* (Jenyns), 1842, *Usacaranx nobilis* (Macleay), 1881, *Agonostomus fosteri* (Cuvier & Valenciennes), 1836, *Anguilla australis* Richardson, 1841.

A conflation of notes made in the field yields the following observations on coloration in life. Ground color greenish, or greyish green: many scales margined with fawn or pale brown caused by rather closely set chromatophores. Markings on lateral surface and saddles russet or darkish brown: the most characteristic pattern about 5 not very sharply delimited brownish blotches along mid-lateral line (in better agreement with McCulloch & Waite's account and figure than with Koumans' diagnosis). Operculum (which has 4-5 rows of scales) darker, except, perhaps, near its posterior border, than rest of side of head. Neither of the markings of the first dorsal described by McCulloch & Waite as blue are invariably so, being at times blackish. Second dorsal greenish, with about 4-5 russet or brownish cross-bars or rows of spots. Caudal pale greenish with about 8, or more, brownish cross-bars. Anal with some brown on the rays; margin blackish. Pectoral membrane almost colorless or greenish; rays more or less yellowish, sometimes with darker spots. Pelvic pale.

Family TETRAODONTIDAE

Three species are credited to Tasmania in the Check List: (*a*) *Tetrodon* Linné, (1) *T. armilla* McCulloch & Waite, 1915; (*b*) *Spheroides* Duméril, 1806, (2) *S. richei* (Freminville), 1813, (3) *S. liosomus* Regan, 1909.

Our early lists included (4) *S. hamiltoni* (Gray & Richardson), 1943: with the identification by Regan of material in the British Museum, including Tasmanian examples, that had been assigned by Günther (1870) to *S. hamiltoni* as a new species, *S. liosomus*, Gray & Richardson's species has been dropped from our list. It is here reinstated.

Observations are made also on species (1) and (2).

KEY TO TETRAODONTIDAE RECORDED FROM TASMANIA

1 Each nostril a simple or bifid tentacle without distinct openings. A large dark band encircling gill-opening and much, or all, of that part of flank that is covered by adpressed pectoral .... *Tetraodon armilla*

Each nostril with 2 distinct openings, usually in a low tube or papilla. No such dark band 2

2 Body without evident spines (but with numerous pores) .... *Spheroides liosomus*

Body with evident spines 3

3 Dorsal 9. Caudal rounded. Back and upper sides with rounded closely-set dark spots; in lateral view > 20 spots visible, their interspaces mostly < (about ½, or less) their diameter .... *Spheroides hamiltoni*

Dorsal 9-10. Caudal emarginate. Back and upper sides with rounded and longitudinally oval well-separated dark spots; in lateral view < 20 spots visible, their interspaces often > their diameter .... *Spheroides richei*

Genus **TETRAODON** Linné, 1758

TETRAODON ARMILLA McCulloch & Waite 1915

Tetraodon armilla McCulloch & Waite 1915, *Trans. Roy. Soc. S. Aust.*, XXXIX: 475, pl. XV. Type locality: Great Australian Bight.

Remarks:—Though the 12 specimens used in drawing up the original account (the figured example, 200 long, being selected as the type) included material from 'Off Flinders Island, Bass Strait, 40 fathoms', this species does not appear in the Tasmanian lists of Lord (1923) and Lord & Scott (1924): it is however, recorded as Tasmanian in the Check List (McCulloch, 1929).

It is essentially a deepwater form, the original specimens obtained during the 1914 trawling cruise of the *Simplon* being secured at 10-40 fathoms; and no Northern Tasmanian fisherman to whom I have mentioned it seem to be acquainted with it.

On 23rd April 1961 I picked up on a beach at East Devonport, Devon, the remains of a fish that appears pretty clearly to be referrable to this species. The specimen, just deposited by the tide and still wet, consisted of the skull and much of the skeleton enclosed in the otherwise wholly empty skin, from which all flesh had been thoroughly and neatly removed, possibly by the action of sea lice.

Genus **SPHEROIDES** Duméril, 1806

SPHEROIDES HAMILTONI (Gray & Richardson), 1843

Tetraodon hamiltoni Gray & Richardson, 1843, Trav. in New Zealand (Dieffenbach), ii: 226. Type locality: Port Jackson.

Tetraodon hamiltonii Richardson. Günther, 1870, Cat. Fish. Brit. Mus., VIII: 280 (*partim*).

Spheroides hamiltoni Gray & Richardson. McCulloch, 1919, *Mem. Aust. Mus.*, V, 1: 430.

Aphanacanthus hamiltoni (Gray & Richardson). Whitley, 1960, Native Freshw. Fish. Aust.: 127, fig. on p. 127.

Status as a Tasmanian species.—The published lists of Johnston (1883, 1891) and Lord (1923), and —*fide* Johnston—the earlier unpublished catalogue of Allport all give (apart from *S. richei*, which does not enter the present discussion) one species, *S. hamiltoni*. In his account of this latter form Günther (1870: 280) stated, *inter alia*, 'The back and abdomen are covered with minute spines; frequently nothing is visible of the spines, except the pores in which they are lodged and then the entire fish is smooth to the touch, some specimens are entirely spineless'. This sounded suggestive of a composite sample; and in 1909 Regan segregated the samples in the British Museum without spines (and having D. 10-11, A. 9, instead of D. 9, A. 7-8)—'Six specimens, 105 to 150 mm. in total length, from Flinders Island and Port Phillip (Degan), Hobart (Allport), and Melbourne (Krefft)'—as *S. liosomus*; and was led to speak of *S. hamiltoni* as belonging to New South Wales and Polynesia. Accordingly, in Lord & Scott (1924: 94) and in the Check List (McCulloch, 1929: 431) *S. hamiltoni* is dropped from the Tasmanian list and replaced by *S. liosomus*.

(Lord & Scott make this alteration in their text, p. 94; but omit to do so in their systematic list, p. 15, which is perhaps based more or less directly on Lord's 1923 list). However, the distribution of *S. hamiltoni* is now known to extend much further south than Regan was in a position to realize. (Whitley (1960: 127) gives the range: 'South Queensland, New South Wales, Victoria, South and south-western Australia and New Zealand'), and there would seem to be no real reason for surprise at its appearance in this State.

Record.—A toadfish, *Ls* 78, *Lt* 96.5, that the writer found washed up in a fresh state, along with 8 examples of *S. richei*, 2 young garfish, *Hemirhamphus melanochir* Valenciennes, 1846, and a small rock whiting, *Neodax semifasciatus* (Cuvier & Valenciennes), 1840, near Beauty Point, Devon, about 9 miles from the mouth of the Tamar River on 21st May 1959 can be referred to this species; which is thus reinstated on our list.

The water at Beauty Point is still highly saline. However, Johnston (1883: 136) noted of '*hamiltoni*', 'entering fresh water at Cataract Bridge on the Tamar' (*i.e.*, some 40 miles from sea), and Whitley (1960: 127) treats of Gray and Richardson's species in his work on Australian freshwater fishes.

Notes on the specimen.—D. 9. A. 8. P. 16, first and last unbranched. C. 8. The spines are best developed on the flanks, ventral surface of head and trunk, occiput, and anterior half of dorsum of trunk, in all which regions they are visible to the naked eye: not, or feebly, developed on caudal peduncle and on dorsum of trunk in advance of dorsal for a distance subequal to postorbital head. *S. liosomus* is described as having fins pale (other than caudal, which is dusky); the standard figure of *S. hamiltoni* [see, e.g., McCulloch (1927, fig. 370*f*)] shows dorsal with a well-defined dark bar across middle: in our specimen the fin has numerous punctulations along the rays and in a large blotch near base, giving it an overall appearance of dirty, somewhat brownish white; it bears also a narrow dark basal band, centrally very compact, but diffuse peripherally. Pectoral: outer surface pale yellowish, with thickly set dark punctulations at antero-superior angle and some chromotophore-edging of rays: inner surface yellowish, deepest basally; right fin with marked, left with moderate, dusking except at inferoposterior angle; on right fin 3 small, on left 5 smaller, spots at proximal ends of rays, these being part of a small system extending on to fin base and thence to trunk. Anal pale yellow, immaculate. Caudal dark brownish, rays somewhat darked than membrane.

Proportions, TLs.—Some proportions of the present specimen are compared in Table V with those of 8 *S. richei* secured at the same time. The smaller values for eye and interorbital in *S. hamiltoni* may perhaps be significant; as may also be the relatively shorter tail.

SPHEROIDES RICHEI (Freminville), 1813

Tetraodon richei Freminville, 1813, Nouv. Bull. Soc. Philom., III: 250, pl. IV, fig. 2.

Remarks.—The circumstances under which the Beauty Point sample of 8 here discussed was secured are noted above in the observations on *S. hamiltoni*. All the fish there mentioned were stranded on a small strip of sand about 10 yards wide, bordered on either side for some considerable distance by rocks. Local residents state toados are constantly being washed up, and during a visit to the district in May 1959 I saw numerous examples floating near, or stranded on, the shore: most showed signs of being in a state of more or less advanced decomposition, but those collected were quite fresh. Except for the one example of *S. hamiltoni* dealt with above, all toadfish seen were the present form; the difference in color pattern is so marked that specimens of the two species can readily be distinguished at a distance of several yards.

Dimensions and proportions.—Table V gives *Ls*, *Lt*, and 7 proportions, in *TLs*, of the 8 specimens, arranged in descending order of *Ls*. The *Ls* range is fairly wide, being 69% of the lowest extreme, or 3.18 σ: with a coefficient of variation of 18.6, the sample seems unlikely to represent a single age-group. No sure indication emerges from the table of correlation between any of the ratios computed and overall size.

Coloration.—The general coloration, as typically developed (specimen (1), *Ls* 125) is as follows. Below midlateral line on flank silvery: under surface rather sharply demarcated, white: above midlateral line brownish, marked with almost black spots and bars (details below). Dorsal: membrane colorless; rays punctulated with brown basally (overall, pale brownish), lighter distally. Anal: wholly white, membrane milky. Caudal: membrane milky; upper and lower rays lightly peppered with brown to near tip, middle rays white basally, all with virtually colorless tips. Pectoral: membrane milky; rays lightly punctulated with pale brownish, which ceases in middle rays at the bifurcation, but continues in others to end, also a narrow dusky bar across bases of rays. Teeth purplish basally.

The dark spots and bars show some variation, here specified for 7 specimens, with the help of a formula: $A + B + C + D + X$, in which A is number of bars (or imperfect bars, constituted by a set of more or less closely approximated large spots) between tip of snout and origin of dorsal; B, under dorsal base; C on main portion of caudal peduncle; D on caudal peduncle at base of caudal rays: while X denotes spots other than those representing elements of imperfect bars.

Specimen (1). $8 + 1 + 1 + 1 + 4$-5 on each side. A includes 4 on head (1st before nostrils, pale; 2nd between eyes; 3rd just behind eyes; 4th at level of gill-opening). C imperfect, constituted by 2 large approximated spots. X are large.

(2). $8 + 1 + 1 + 1 + 4$ on each side. C imperfect.

(3). $8 + 1 + 1 + 1 + 4$ (2 dorsal, 2 on left). A: 5th short, not reaching sides (and not complemented by lateral spots) 8th imperfect, being one large spot with one larger spot below it on each side. D: nearly perfect. X: between 7th and 8th bars are 2 dorsal spots (with lateral complement on left only).

TABLE V

Spheroides richei (Freminville), 1913 and *S. hamiltoni* Richardson, 1846. Dimensions of 8 specimens of former, 1 of latter species, from near Beauty Point, Devon, Tasmania. Actual dimensions in millimetres in first two lines: all other dimensions expressed as thousandths of standard length.

Dimension	*S. richei*									*S. hamiltoni*
	A	B	C	D	E	F	G	H	Range : Mean	
Standard length (mm)	125.0	95.0	86.0	81.5	79.5	75.5	74.0	74.0	74.0-125.0 : 86.3	78
Total length (mm)	155.0	115.0	107.0	103.0	97.5	93.5	94.0	93.0	93.0-144.0 : 107.2	96.5
Length to vent	688	737	715	742	698	715	682	716	682-742 : 711.0	815
Head	292	305	320	337	296	317	297	318	292-337 : 310.3	314
Snout	88	84	110	92	94	113	95	108	84-113 : 98.0	100
Eye	80	89	102	92	84	93	88	74	74-102 : 87.8	64
Interorbital	188	184	195	182	170	172	182	182	170-195 : 182.0	154
Greatest depth	408	432	465	393	333	384	392	446	333-465 : 406.6	430
Depth of caudal peduncle	90	75	87	90	75	74	78	97	74- 97 : 83.2	93

(4). 8 + 1 + 2 + 0 + 3 (one dorsal). *A*: 8th is 2 confluent spots, with several lesser lateral spots. *C* is 3 spots, 1 being dorsal. *X*: between 7th and 8th bars are 1 dorsal and 2 lateral spots.

(5) 9 + 1 + 1 + 1 + 0. *A*: 5th, 6th bars are chains of 3 or 4 spots; 9th with large complementary spot on either flank. *C*: 3 spots, 1 being dorsal.

(6) 9 + 1 + 1 + 1 + 2. *A*: 5th is only short bar (a 'long spot'); 9th a bar on either side one larger spot. *C*: 3 spots, 1 being dorsal. *X*: 2 spots high on flank, close to 7th bar.

(7). 9 + 1 + 1 + 1 + 0. *A*: 5th is short bar; 8th is 3 small spots, 1 being dorsal; 9th is a very short dorsal bar, and two lateral spots. *C*: 3 spots, 1 being dorsal.

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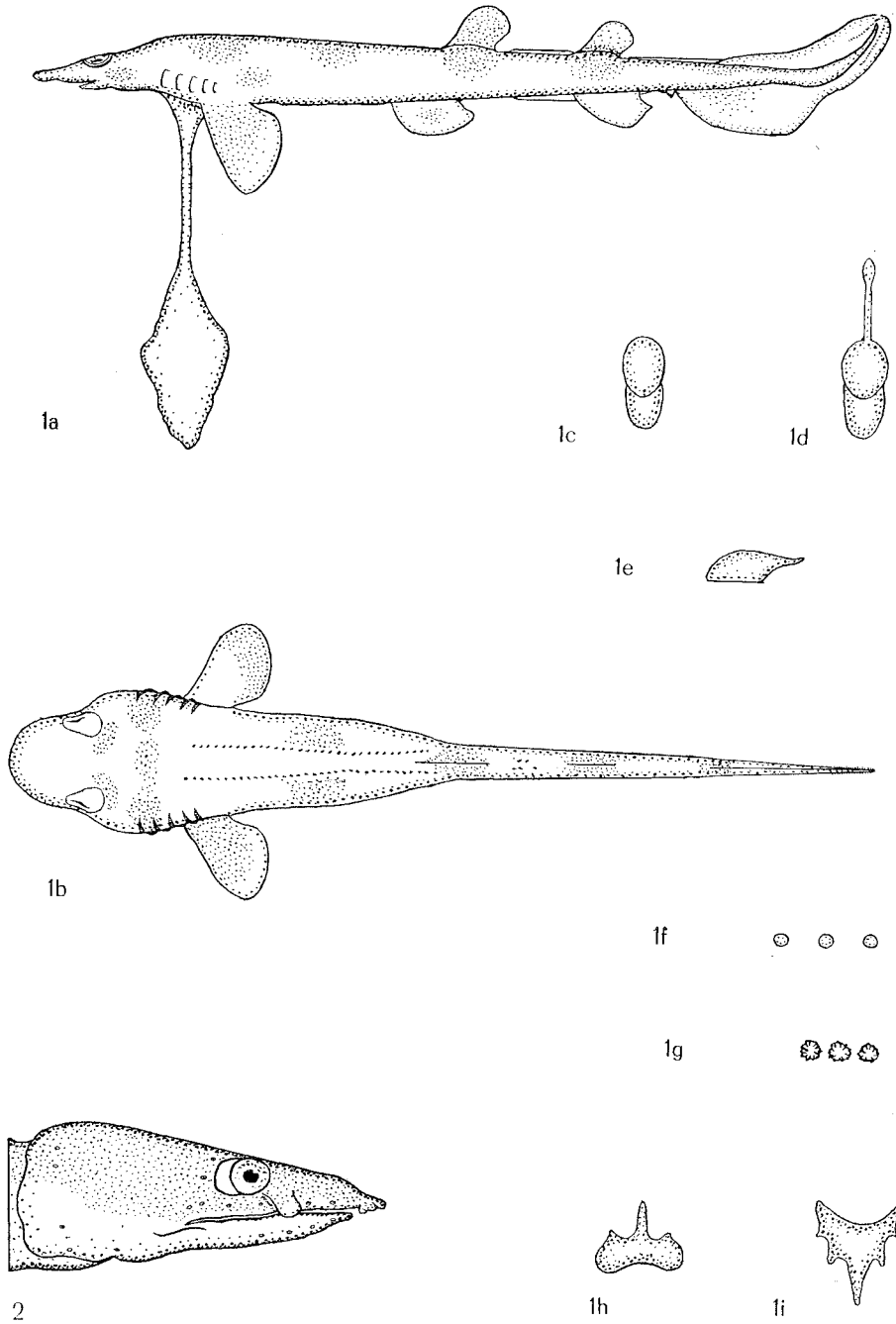
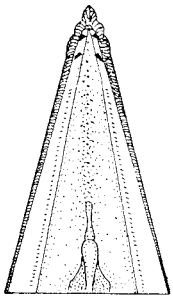


FIG. 1. *Cephaloscyllium isabella* laticeps (Duméril), 1853. *a.-g.*: Embryo, total length 115.5 mm, found, in egg-case, on beach at Falmouth, Cornwall, Tasmania, 1st November 1959. *a.*—Lateral aspect; natural size. *b.*—Dorsal aspect, natural size. *c.*—One of the series of specialized dorsal denticles, viewed from above; × 20. *d.*—Another dorsal denticle, with pedicel, viewed from above; × 20. *e.*—Dorsal denticle, lateral aspect; × 20. *f.*—Three denticles from anterior end of caudal series, viewed from above. × *ca* 10. g.—Three denticles from posterior end of caudal series, viewed from above; × *ca* 10. *h-i.*—Adult female, total length 961 mm, found dead on beach, Ulverstone, Devon, Tasmania, 4th August 1933. *h.*—Tooth, lower jaw; enlarged. *i.*—Tooth, upper jaw, enlarged.

FIG. 2. *Muraenichthys breviceps* Günther, 1876. Lateral view of anterior portion of head of a specimen, total length 439 mm, from Low Head, Dorset, Tasmania, December 1960; × 2.



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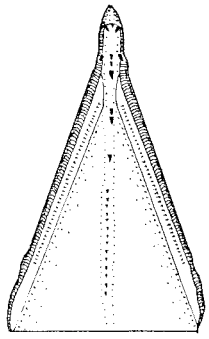

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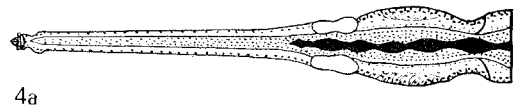

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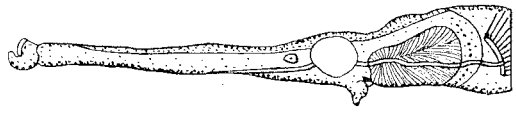

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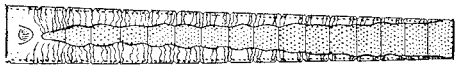

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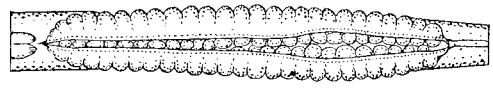

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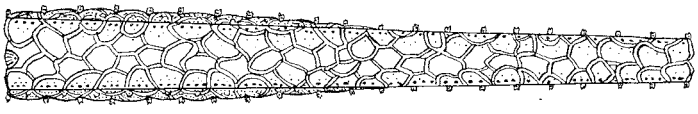

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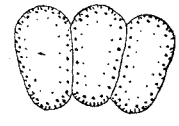

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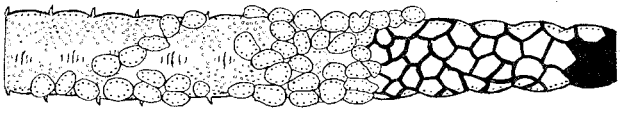

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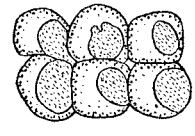

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FIG. 3. *Ophisurus serpens* (Linné), 1758. Specimen, total 1144 mm, from mouth of George River, Dorset/Cornwall, Tasmania, August 1956. *a.*—Lower jaw, internal aspect; natural size. *b.*—Upper jaw, internal aspect. natural size.

FIG. 4. *Leptonotus semistriatus* Kaup, 1856. Dried specimen, total length 272 mm, from Bellerive Beach, Monmouth, Tasmania. *a.*—Head, dorsal aspect; × 1⅓. *b.*—Head, lateral aspect; × 1½. Pattern of striation not shown.

FIG. 5. *Syngnathus phillipi* Lucas, 1891. Male, total length 97.5 mm, dredged in 9-13 fathoms off Verona, D'Entrecasteaux Channel, Buckingham, Tasmania, 23rd July 1961. Brood pouch; × 2½.

FIG. 6. *Solegnathus fasciatus* (Günther), 1880. Male, total length 343 mm, dredged in 6-10 fathoms off Middleton, D'Entrecasteaux Channel, Buckingham, Tasmania, 25th July 1961. *a.*—Empty brood pouch; natural size. *b.*—Three ova, lateral aspect; × 2. *c.*—Six ova, viewed end-on; × 2.

FIG. 7. *Stigmatopora argus* (Richardson), 1840. Male, total length 76 mm, entangled in net let down to about 25 feet, Verona Sands, Buckingham, Tasmania, January 1961. Ovigerous portion of brood pouch; × 3.

FIG. 8. *Phyllopteryx taeniolatus taeniolatus* (Lacépède), 1804. Dried specimen, combined length of head and trunk 171.5 (tail imperfect), from Bellerive Beach, Monmouth, Tasmania. Ventral aspect of anterior part of tail, showing some dried eggs *in situ* and some empty egg-cells; × 1½.