

OBSERVATIONS OF SOME TASMANIAN FISHES: PART XIII

By

E. O. G. SCOTT

(With one text figure.)

ABSTRACT

Gymnothorax leecote sp. nov. [Muraenidae], the first member of the family recorded from Tasmanian waters, is described and figured. Other additions to the State list are *Petraites heptaolus* Ogilby, 1865 [Clinidae], *Ophiclinus gabrieli* Waite, 1906 [Ophiclinidae], *Callogobius hasseltii* (Bleeker), 1851 [Gobiidae], *Tetraodon firmamentum* Temminck & Schlegel, 1850 [Tetraodontidae].

Miscellaneous observations are made on *Muraenichthys tasmaniensis* McCulloch, 1911 [Echelidae] (description of a specimen from Green's Beach, Devon); *Urocampus carinirostris* Castelnau, 1872 [Syngnathidae] (meristic and other metrical data; relative growth of body segments); *Clinus perspicillatus* Cuvier & Valenciennes, 1836 [Clinidae] (general observations; proportions in sample from Tarooma, Buckingham); *Ophiclinus greeni* Scott, 1936 [Ophiclinidae] (new material; status of species).

Specifications of standard length of populations of some of the above-mentioned species as sampled in the course of routine collection are noted and commented on. Some data on catches made at a Fishing Competition at George Town, Dorset in December 1963 are reported.

Keys are provided covering the Tasmanian members of the Echelidae, Ophiclinidae.

INTRODUCTION

This paper follows the general plan of others in the series. The symbols *Ls*, *Lt* denote standard length, total length, respectively; *TLs*, *Tlt* signify thousands of standard, of total, length. All linear dimensions are in millimeters, the name of the unit commonly being omitted.

Family ECHELIDAE

All the 3 Tasmanian members of the family—*Muraenichthys breviceps* Günther, 1867, *M. australis* Macleay, 1881, *M. tasmaniensis* McCulloch, 1911—have at various times been the subject of comment in these Observations (1936, 1953, 1957, 1961, 1963). However, in well over a quarter of a century only one specimen of *M. tasmaniensis* has come under notice: the receipt of a second individual is the immediate occasion of the notes below.

As pointed out in 1961, the transposition of 2 clauses renders a key provided in 1957 self-contradictory. A redrafted key is here offered. (Schmidt's
$$\text{index. } S = \frac{a-d}{t}$$
 where a = length to vent, d = length to origin of dorsal, t = total length).

KEY TO ECHELIDAE RECORDED FROM TASMANIA

- | | | |
|---|---|--|
| | Dorsal originating in advance of vent; i.e., <i>S</i> positive [16-23]. Teeth in the jaws biserial <i>M. breviceps</i> | |
| 1 | Dorsal originating behind vent; i.e., <i>S</i> negative [(-6)-(-8)]. Teeth in the jaws uniserial 2 | |
| | Interval between anal and dorsal origins > 3 (\pm 5-7) in head. <i>S</i> = (-1)-(-3) <i>M. australis</i> | |
| 2 | Interval between anal and dorsal origins < 3 (\pm 1-2) in head. <i>S</i> = (-6)-(-8) <i>M. tasmaniensis</i> | |

Genus **MURAENICHTHYS** Bleeker, 1865

MURAENICHTHYS TASMANIENSIS McCulloch, 1911

Muraenichthys tasmaniensis McCulloch, 1911, Zool. Res. *Endeavour*, 1: 19, fig. 5. Type locality: Oyster Bay [Pembroke], Tasmania.

Record.—A specimen found alive under wet sand above low-water mark at Green's Beach, Devon on 28th December 1963 by Mr Henry King (Queen Victoria Museum Reg. No. 1964:5:3) is much longer (*Lt* 265) than the holotype (170) and the Deviot specimen noted in the 1961 contribution: however, Munro, whose distribution includes Western Australia, gives 11 inches as overall length for this species.

Proportions.—For the ratios recorded in the description of the holotype (the values for which are noted in parentheses) we here find: depth 2.9 (3.3) in head; head 13.3 (12.3) in *Lt*, and 4.8 (4.3) in space between gill opening and vent; eye 4.0 (3.2) in snout; snout 5.7 (4.8) in head; cleft of mouth 4.1 (2.7) in head; preanal length 1.3 (1.4) in postanal length; dorsal origin 4 mm nearer to tail-tip than to snout-tip ('a trifle nearer the tip of the snout than the tail'); distance from dorsal origin to vent 0.93 head ('equal to the length of the head').

Some proportions, as *Tlt*, for comparison with those of the Deviot fish (values in parentheses) may be noted. Length to: vent 438 (414), anal origin 460 (424), dorsal origin 508 (480). Length of: eye 3.4 (4.0), snout 13 (15), head 75 (81), mouth-cleft 25 (27). Depth at: back of eye 15 (10), middle of branchial sac 17 (23), gill opening 20 (21), vent 24 (20). Width at the same four points 11, 15, 19, 21 (10, 13, 15, 20). *S* = -6.79 (-6.60).

The maximum depth, occurring at about 75-80 behind snout-tip, is 26 *Tlt*, the width there being 22 *Tlt*. Interorbital 2.0 eye.

Coloration.—The living fish was noted as being pale yellow, lighter below; head with a pink flush.

In the preserved specimen the trunk above the lateral line is yellowish, faintly greenish, with closely spaced dark chromatophores; except for

about the first 20 of the ventral surface, which is reddish golden, all below the lateral line is immaculate, yellowish. Just behind the vent the chromatophores begin to extend below the lateral line, and continue increasingly to do so caudad, virtually reaching midventral line at tail-tip; at the same time they become smaller, deeper in color, more sharply defined. A narrow band of very closely set chromatophores, much smaller than those on upper side of trunk, embraces the sunken dorsal. Dorsum of head anteriorly ivory, with small brownish chromatophores, most numerous in advance of hind margin of eye; posteriorly like upper part of lateral surface of trunk, but with warm brownish flush. Side of snout above mouth cleft somewhat greenish with abundant minute brownish vermiculation; side of lower jaw dark, anteriorly almost black; backward from snout side of head successively deep ivory, yellowish, slatey (branchial sac). Under surface of head pale brownish to just behind level of end of oral groove, thereafter yellowish immaculate.

Preal and postanal length in three species.—An inspection of the measurements of the specimens of three Tasmanian species of *Muraenichthys* recorded in these Observations suggests the preanal-postanal length ratio may be diagnostic; however, data are available for 1 specimen only of *M. australis* and for 2 only of *M. tasmaniensis*; though the mean for 9 examples of *M. breviceps* is highly significant ($t = 119.7^{**}$). Expressed as *Tlt* the preanal length is: *M. australis* (1936) 336, *M. breviceps* (1953, 1957, 1963) 357-384, mean 374.2 ± 4.00 , *M. tasmaniensis* (1961, present paper) 438-414, mean 426.0 ± 8.49 . The standard deviation (using $n-1$; elsewhere in these calculations n is used) for *M. breviceps* is 12.73; thus the value for *M. australis* differs from the mean for *M. breviceps* by 3.0σ , and from that for the lower value for *M. tasmaniensis* by 3.1σ , indicating the three series of *Tlt* are indeed probably distinct.

In *M. breviceps* relative precaudal length is positively correlated with total length: for the 9 specimens $r = +0.791$, $z = 1.074$, $t = 3.42^*$. As an indication of the order of magnitude of the quantities involved it may be noted that for the greatest *Lt* (283, shared by 2 specimens) length to vent, expressed as *Tlt*, is 377, 384, mean 380.5, while for the least *Lt* (234.8) it is 364 (N.B., larger than the value, 357, for the next smallest individual, of *Lt* 313.5); the corresponding predicted values calculated from the second regression given below are 379, 348—i.e., over the relevant *Lt* range the value of length to vent, as *Tlt*, varies about 1%. For the 6 individuals of 1957 the regression equation of length to vent (*Lv*) on *Lt* is found to be

$$Lv = 0.3982 Lt - 10.06,$$

with $t = 57.29^{**}$ (1957: Table II). For the 9 fish it is

$$Lv = 0.4004 Lt - 12.33,$$

with $t = 12.93^{**}$. A comparison of values of *Lv* predicted by this last equation with actual values shows divergences of 0.4-7.9, mean 2.2, mm; or 0.2-4.5, mean 1.6, %.

Family MURAEINIDAE

Of the 27 members of the family accepted as Australian in Munro (1957), 14 are referred to

Gymnothorax Bloch, 1795—other genera being *Arndha* (1 species), *Siderea* (2), *Echidna* (2), *Fimbrinares* (1), *Uropterygius* (4), *Notorabula* (1), *Thyrsoidea* (1), *Muraena* (1). *Gymnothorax* is characteristically a warm-water genus, all our described species save 1 (?2) occurring in Queensland; 4 being reported from Western Australia (1 restricted to the tropics); with on the east coast 3 only extending as far south as New South Wales, one of these, *G. prasinus* (Richardson), 1848, reaching Victoria: there are no records for South Australia or Tasmania.

The family now first appears in the Tasmanian list, a moray eel from the East coast referable to *Gymnothorax*, but not agreeing with any known Australian species, being described below.

Genus **GYMNOTHORAX** Bloch, 1795

GYMNOTHORAX LEECOTE sp. nov.

(Fig. 1)

Diagnosis.—Length of head and trunk together slightly exceeding length of tail. Head about 9-10, maximum depth about 15, in total length. Fins low. Anal origin behind vent by about combined eye and snout. Dorsal originating in advance of gill slit by less than length of that opening, which is level horizontally with eye. Snout convex; head rising sharply behind middle of eye. Anterior nostril a simple tube, when depressed not reaching lip-border. Posterior nostril in front of, shortly below level of top of, eye; an oblique slit, with free cutaneous fringe. Mouth not closable; upper jaw projecting; cleft about half postorbital head. Maxillary and dentary teeth biserial; intermaxillary teeth include 3 median, of which first and last are partly depressible fangs; vomer edentulous. Brown, with darker mottling and vermiculation on head and anterior part of trunk; all markings small, closely set, modal diameter of the rounded ones about one-sixth that of eye; fins concolorous with body. Total length (holotype) 815 mm.

Description.—Principal dimensions expressed as *Tlt*, (actual measurements, mm in parentheses) are as follows: Length to: origin, termination of dorsal (76.5, 812) 94, 996; origin, termination of anal (430, 809) 528, 993; gill slit (85) 104; middle of vent (410) 515. Depth at: front of eye (25) 31; back of eye (30), 37; gill slit (55) 67; midway between gill slit and vent (46) 56; vent (42) 52; midway between vent and tail-up 40. Thickness at the same points: (14.5) 18; (16) 20; (21) 26; (23.5) 29; (21) 26; (16) 20—but the plastic and 'lumpy' nature of the trunk and tail make measurements of thickness, other than those of the head, somewhat unreliable.

Some dimensions in head (85 mm.): snout (15.5) 5.4; eye (5.5) 15.5; interorbital (9.6) 8.9; mouth cleft (34) 2.5; gill slit (9.1) 9.3; internarial, anterior nostrils (7.5) 11.3; internarial, posterior nostrils (7.9) 10.8; rictus to eye (20) 42.5.

Dorsal profile almost evenly convex to level of middle of eye, thereafter rising in a single sweep to shortly before level of gill slit; descending in a slow convex segment for about $1\frac{1}{2}$ head-lengths; continuing more or less straight throughout most of its length; finally curving down, through about

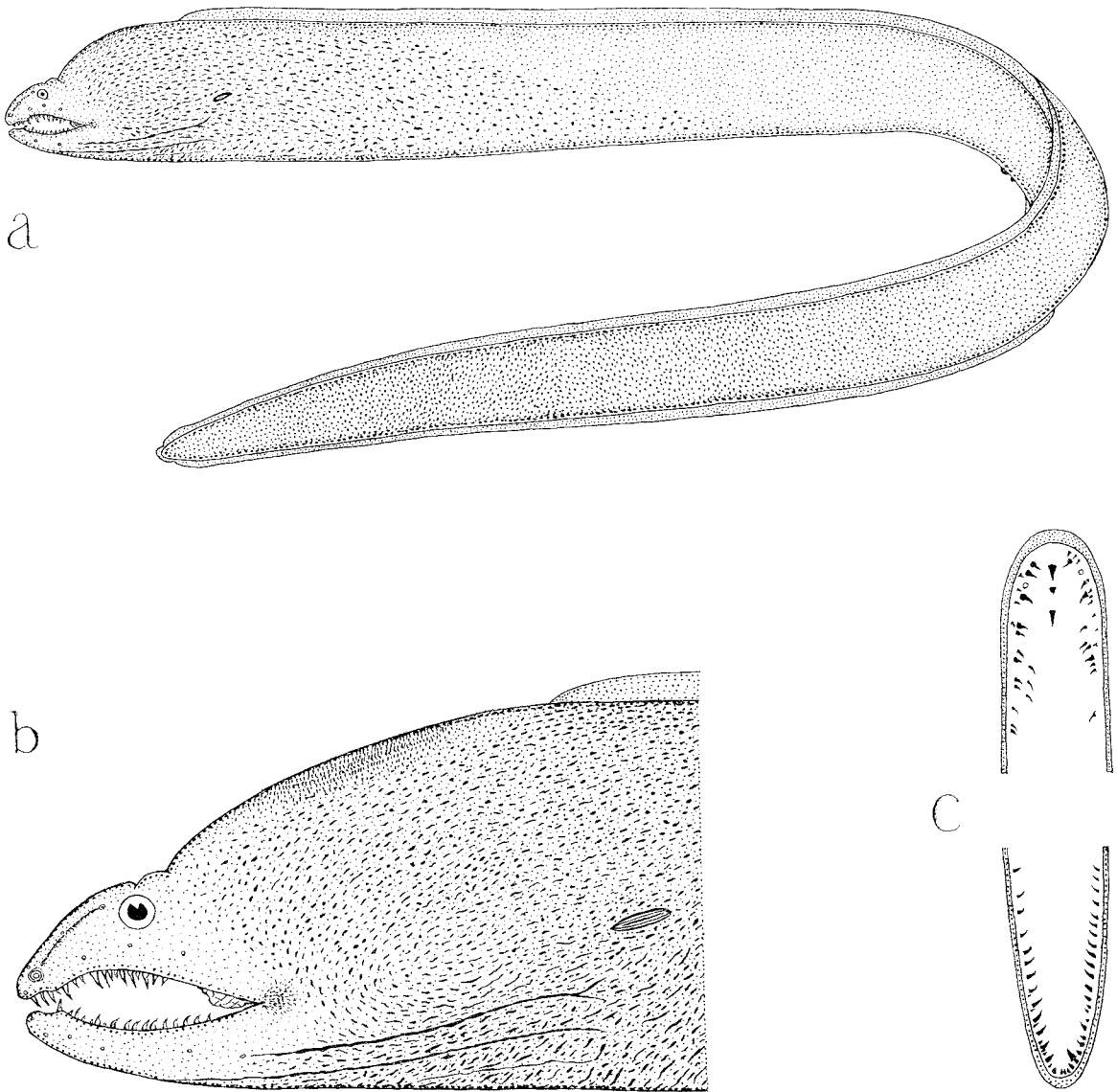


FIG. 1.—*Gymnothorax leecote*, *sp. nov.* Holotype, total length 815 mm, from off George Rock near St Helens, Cornwall, Tasmania (in Crayfish net set at 10 fathoms; Mr John Lipsius). *a.*—Lateral aspect; \times about 7.20. *b.*—Head; about nat. size. *c.*—Dentition; about nat. size.

1 head-length, to the rounded tail-tip. Ventral profile almost linear throughout, curved up at lower jaw.

The origin of the dorsal fin is not readily located, a superficial examination suggesting the fin (which anteriorly is very low) runs forward to the point of inflexion in dorsal profile at level of middle of eye; however, a slight dissection fails to disclose the presence of fin rays anterior to a point situated $1/10$ head-length in advance of level of gill slit. Owing to its fleshy nature the fin is not sharply delimited basally from the body, making precise measurement of its altitude, which is nowhere great, a matter of difficulty: approximate heights at hind end of gill slit, midway between gill slit and vent, at vent, midway between vent and tail-tip are 3, 6, 6, 5 respectively, or 5, 13, 14, 15 % of depth of body at these points. Fin ceases within 1 mm of level of end of fleshy tail, a decrease in height here marking its confluence with the caudal. Anal low, fleshy; its origin, near which it is barely elevated above fleshy part of tail, behind vent by a distance equal to that from tip of snout to middle of eye, or rather more than twice length of gill slit. Throughout most of its extent its height is less than (at its middle about half of) that of dorsal opposite it, but in its last $\frac{1}{2}$ head-length, or so, its height more closely approximates that of the other fin: at about $\frac{2}{3}$ of an eye-diameter in advance of (fleshy) tail-tip, at which point its height exceeds $\frac{1}{2}$ an eye-diameter, it lapses to confluence with the much lower caudal. Caudal has superior, inferior lengths of 3, 6; extends behind fleshy tail-tip by about 2.

Eye rather small, 2.8 in snout; middle about over middle of gape; about twice as far from upper lip as from dorsal profile; 1.8 in interorbital. Mouth does not close; upper jaw (tip of which exceeds tip of mandible by 1.5, or 0.4 eye-diameter) with upwardly convex, lower jaw with upwardly concave, profile. With jaw-tips opposed, vertical distance between bases of upper and lower teeth, at maximum near middle of mouth-cleft, is 8, or a trifle more than $\frac{1}{2}$ snout-length; the lacuna between tips of teeth is about half this. Contact of the jaws anteriorly is brief, free space occurring between them through an anteroposterior interval of 25, or $\frac{1}{2}$ distance between rictus and gill slit.

The dentition (fig. 1c) presents some irregularities: differences between the two sides are clearly due in part to injury, but appear to be in some degree intrinsic. Intermaxillary with (a) an outer row of about 5-7 on each side, small to minute, mostly rather blunt but one or two on each side tolerably sharp; (b) a row, just inside (a), of about 9-11 on each side, the first 4 (right side) closely set, smallish, subequal, bluntly subulate, the remainder spaced, the first 2 (left side) of moderate size, the tips shouldered or with incipient lateral cusps, the others more nearly conical, more sharply pointed, the whole series increasing in length backwards to the last (right) or antepenultimate (left) tooth: (c) immediately inside the 3 more anterior of the 4 closely set group of (b), a single tooth, about twice the size of those in front of it, base bulbous, tip rather compressed with shoulders or rudimentary horizontal cusps (tooth present only on right; some indications of possible

former presence of a fellow on left): (d) 3 median teeth, 1st, shortly behind level of 2nd spaced tooth of (b), a large conical, recurved, partly depressible fang; 2nd, about at level of 3rd spaced tooth of (b), and inserted about its own length behind base of 1st median tooth, small, triangular, antero-posteriorly compressed, wholly depressible; 3rd, about at level of 4th spaced tooth of (b), largest tooth in mouth, similar to, a trifle slenderer, but longer, than 1st median. Each maxillary with (a) an outer row of about 8, the first few of moderate size, stoutish, rather blunt, the remainder increasingly smaller, more recurved, slenderer, sharper: (b) an inner row of 3 (? more), starting at, or just behind, beginning of outer row, finer and a shade longer than teeth of that series. No teeth on vomer. Each dentary with (a) an outer row of 9-11, extending back somewhat beyond middle of jaw, two or three among the anterior ones small, stout, subulate, blunt, those behind decreasing more or less regularly to minute, and becoming progressively more conical, relatively more slender, sharper: (b) an inner row of about 20, the 1st and 2nd subequal, of moderate size, the 3rd, 4th, 5th large, subequal (on right, 4th is slightly larger than 3rd, 5th the largest in the jaw; on left, where only 4th and 5th remain, the former exceeds the latter, being as large as 5th of right); others decreasing tolerably evenly in size backwards, those in the right jaw tending to become sharper and more recurved posteriorly, those in the left being sharpest and most recurved near the middle of the series. Several teeth on the intermaxillary show a small number of minute serrations on the posterior border and in 2 of the 4 closely set teeth of series (b), on right, these are present on both posterior and anterior surfaces: similar serrations or asperities occur on the posterior surface of several maxillary teeth of series (a) and of a few dentary teeth of series (b).

Broadly, the pattern appears to resolve itself to this. Intermaxillary: 3 peripheral and 1 median row (peripheral: outer, 5-7 teeth, anterior $\frac{2}{3}$ of bone; middle, 9-11, whole length; inner, 1, near tip of jaw—all on each side. Median: 3, of which 1st and 3rd are fangs). Maxillary: biserial (outer row, about 8, whole length; inner, 3 (or more?)), opposite front half of outer—on each side). Dentary: biserial (outer row, 9-11, front half of jaw; inner, about 20, whole length—on each side). Vomer edentulous.

Anterior nostril lies in a subcircular depression, the diameter of which (3) is about twice its distance from lip-border; from a low subspherical basal sac, 1.7 in diameter, nostril extends upwards as simple tube (left, subconical; right, somewhat compressed obliquely forwards and outwards) terminating in a simple transverse slit, set obliquely, its inner termination in advance of its outer; when depressed forwards tube does not reach beyond border of nasal basin; distance (dividers) of middle of slit from tip of upper jaw about $3\frac{1}{2}$ in its distance from eye; internalia (middles of slits) 7.5, about 3 in combined eye and snout. Posterior nostril an oblique slit, sloping forwards and downwards; its length 1.5, a trifle less than basal diameter of anterior nostril; edge in the form of thin, flattened continuous fringe of integument that can

be withdrawn from the cavity and folded back over the adjoining snout-skin, the outer reflected margins along sides of slit then being about 2 apart; about $\frac{1}{3}$ eye-diameter in front of eye, on horizontal level with upper $\frac{1}{4}$ of eye; least distance from eye 2.8, half shortest distance from eye to border of upper lip; internarial (middles of slits) 7.5, rather less than shortest distance from nostril to border of upper lip.

Six pairs of pores observed on head above mouth, disposed on each side thus: (a) below, just internad of, anterior nostril, about equidistant from nostril base and lip-border; (b) above anterior $\frac{1}{4}$ - $\frac{1}{3}$ of anterior nostril on rim of a dark annulus more or less coinciding with narial depression; distant from nostril by rather less than $\frac{1}{2}$ basal diameter of latter; (c) on superolateral surface of snout, lying on an arc, subparallel with dorsal profile, from anterior to posterior nostril; a shade closer to (b) than to posterior nostril; (d), (e), (f) in a line above, parallel to, upper lip; intervals between (d) and (e) and (e) and (f) equal, also equal to distance of (e) from anterior nostril and to its distance from eye; (e) below first $\frac{1}{4}$ - $\frac{1}{3}$ of eye; direct distance of (f) from hard angle of mouth slightly exceeds its distance from (d). Six pairs were found also on lower jaw, the first (g) almost at tip of jaw, about below (a), the last (l) vertically below, or a trifle in advance of the level of, angle of mouth; the intervals between pores increasing backwards; the hinder five (h)-(l) approximately in a linear series, their distance from lip-border increasing backwards, that of (h) being $\frac{1}{3}$, that of (l) $1\frac{1}{2}$, eye-diameter; on account of the upturn of the jaw-tip (g) lies somewhat above the horizontal level of the rest.

Gill opening a simple longitudinal slit, or elongate ellipse, directed forward and slightly downward; about on horizontal level with bottom of eye, from anterior border of which it is distant two mouth-lengths; nearer to ventral than to dorsal profile; its length a little less than interorbital width.

An aperture (urinary pore?) lies just behind vent; interval between middles of the openings (each of which perforates a low protuberance) 5, subequal to diameter of vent.

Head with warm brown ground color, almost uniform, but a trifle lighter on under side of lower jaw, and, on left side, on cheek; an elongated median darkish patch on middle one-third of dorsum; except on sides and on anterior one-third of ventral surface of lower jaw, abundantly dappled and vermiculated with darker brownish, the markings small and rather faint on the cheeks, elsewhere larger, clearer, and somewhat darker; on the lower surface, beginning about at level of eye, there run back one narrow median blackish stripe, best developed anteriorly but traceable as a slender line to level of gill opening, and two pairs of blackish lines diverging posteriorly, the outer the more conspicuous, traceable on right side close to, on left side to, level of gill opening, its termination being about equidistant from the opening and the termination of the median stripe; at rictus a small blackish patch, somewhat different in form on the two sides; a darkish stripe joining anterior nostril with posterior, the former lying in a small

dark narial basin, the skinny fringe surrounding the opening of the latter black; some interorbital duskiness. Gill opening narrowly margined with blackish; internally, whitish above, greyish minutely and abundantly punctuated with brownish below.

The anterior one-fourth of the trunk does not differ greatly from the head, save for a progressive deepening posteriorly of the ground color. Behind this the dappling, the dark elements of which now become rounder and more clearly separate than on side of head, begins to become indistinct above the midlateral line and to be restricted, in an increasing degree, to lower part of lateral, and to ventral, surface: the dark spots, which are closely set, do not exceed 1 mm in diameter. In the last one-fourth of the trunk no markings are apparent, and, except narrowly along the midventral line where it remains deep warm brown, the ground color, as the result of a progressive deepening, becomes very dark brown, approaching black.

The dark to very dark brown tail lacks markings. The ground color is lightest on the sides of the anterior one-fourth, flanking the bases of the fins for much of the length, and generally in the distal 35 or so.

The dorsal, anal and caudal fins, which are feebly developed, are in general concolorous with the body near them; but on the trunk the dorsal fin is narrowly margined intermittently (in all for about two-thirds of its preanal length) with blackish.

Material.—Described and figured (fig. 1) from the unique holotype, Lt 815 (Queen Victoria Museum Reg. No. 1964:5:15). The specimen was obtained by Mr John Lipsius of St Helens and brought to the Museum for identification by Dr H. S. Blackburn.

Locality.—Captured in July 1963 in a crayfish pot set in 10 fathoms off George Rock, north of St Helens, Cornwall, Tasmania: the latitude of St Helens is $41^{\circ} 20' S$. It may be remarked that the Eastern Australian Current extends southward along the east coast of Tasmania, its distance offshore being subject to seasonal variation. Of the few sea snakes recorded from Tasmania most were obtained in this region (e.g., *Laticauda laticaudata* Linné, 1758, Scamander (Lord, 1920), St Helens (Scott, 1932); *Hydrophis ornatus ocellatus* Gray, 1849, captured at St Helens (Scott, 1932), though generally regarded as a northern Australian species and not previously reported (Kingham, 1929: 112) south of the Hawksbury River, New South Wales, where an example was caught in 1925). These were clearly stray individuals, and it is possible our moray may be a current-following visitor from warmer waters.

Name.—The fish is reported to have fought viciously when brought to the surface, a circumstance commemorated in the trivial name *leecote*, a Tasmanian aboriginal word signifying *rage* in the dialect of the 'tribe about Mount Royal, Brune [now usually Bruni, or Bruny] Island, Recherche Bay, and the South of Tasmania' (see Joseph Milligan's vocabulary in Ling Roth (1899).

Affinities.—The 14 species of *Gymnothorax* Bloch recognized in Munro's Handbook (1957) are (prefixed numbers his list-numbers): 351* *G. cribroris*

Whitley, 1932; 352 *G. woodwardi* McCulloch, 1912; 353* *G. melanospilus* (Bleeker), 1805; 354* *G. margaritophorus* Bleeker, 1865; 355 *G. undulatus* Lacépède, 1803; 356* *G. chilospilus* Bleeker, 1865; 357* *G. petelli* (Bleeker), 1856; 358* *G. boschi* (Bleeker), 1853; 359* *G. flavimarginata* (Ruppell), 1828; 360* *G. pseudothyroidea* (Bleeker), 1852; 361* *G. longinquus* Whitley, 1948; 362 *G. prionodon* Ogilby, 1895; 363 *G. favagineus* Bloch & Schneider, 1801; 364 *G. prasinus* (Richardson), 1848. Species here marked with an asterisk are known only (in respect of their Australian distribution) from Queensland (or Queensland and Torres Strait); while No. 363 is listed from Queensland and tropical Western Australia. It would seem unlikely any of these 10 forms should be met with in Tasmania; however, the possibility of the present fish being one of these species has not been dismissed, and they are further considered below.

Of the 14 species listed, 6—Nos 351, 352, 354, 356, 357, 361—differ sharply from the St Helens fish in two features, each of them having the postanal region longer than the preanal, and in possessing teeth on the vomer: 2 other species, Nos 358, 359, which more closely approach our specimen in having the postanal only slightly longer than, or equal to, the preanal length are ruled out by having vomerine teeth (as well as by other details of dentition), by the much higher fins, and by coloration. Of the remaining 6 species, 3 not known south of Queensland and tropical Western Australia—Nos 353, 360, 363—include 2 (360, 363) with vomerine teeth, the former being further distinguished by the very high fins, the latter by the single series of teeth in the lower jaw and the characteristic coloration; while No. 353, in which tail is equal to, or longer than, trunk, has the teeth in single series in both jaws.

The 3 species still to be noticed, the only ones reported in eastern Australian waters south of Queensland, call for special consideration. From No 355, *G. undulatus* (W.A., N.T., Qld, Torres Strait, North N.S.W.) *G. leecote* differs in having combined head and trunk longer than tail (*cf.* tail equal to, or $\frac{1}{2}$ head longer than, head and trunk together), very much lower fins, in lower jaw two rows (*cf.* one row) of teeth, much more convex snout, coloration (dark spots, where they occur, not in longitudinal rows, and much smaller than eye in *G. leecote*). From No. 362, *G. prionodon* (N.S.W.), which it resembles somewhat in its general ground color and in having dark streaks on the throat, also in having at least indications of serration on teeth of the upper jaw, it differs in having trunk 1.25 (*cf.* 1.12) in tail and length of gill slit 1.7 (*cf.* less than) eye, in possessing biserial, instead of uniserial, teeth in both jaws and in lacking the 7 teeth on the palate, in lacking the gristle-like rounded or oblong, white or pale blue spots on the skin, and perhaps in larger size (815; *cf.* 322 of type; Munro, who normally records extreme length commonly encountered, gives 12 $\frac{3}{4}$ inches). From No. 364, *G. prasinus* (N.S.W., Vict., W.A., ?Qld, ?N.T.) it differs in having head and trunk longer (*cf.* less) than tail, head 3.8 (*cf.* 2.3-2.6) in trunk, dorsal origin further caudad, fewer mesial intermaxillary teeth.

Information as to whether or no the mouth can be completely closed (not closable in *G. leecote*) is not readily available for most of the species considered above, though the figures would perhaps suggest complete closure is possible in many, if not most, of the forms: this capacity is expressly noted in the account of No. 362 (Ogilby, 1895: 720).

Family SYNGNATHIDAE

Genus UROCAMPUS Günther, 1870

Urocampus carinirostris Castelnau, 1872

Urocampus carinirostris Castelnau, 1872, *Proc. Zool. Acclim. Soc. Vict.*, 1: 200. Type locality: Melbourne Markets.

Urocampus coelorhynchus Günther, 1873, *Journ. Mus. Godef.*, 1, 2: 103. Type locality: Sydney.

Tasmanian status.—This species is not credited to Tasmania in the Check List (McCulloch, 1929: 92), though, as pointed out in these Observations (1939), it had been listed earlier by Lord & Scott (1924: 39) on specimens secured at Table Cape [Wellington], Tasmania: in the Handbook (Munro, 1958: 88, fig. 615) it is recorded for all States except South Australia.

Material.—The present notes relate to (a) 12 specimens (1 distally imperfect), *Lt* 66.0-80.3, \bar{x} 71.65 \pm 1.21, σ 4.03 \pm 0.86, *V* 5.6 \pm 1.2; (b) 5 separately bottled, more heavily pigmented individuals, *Lt* 67.4-80.2, \bar{x} 73.72 \pm 1.82, σ 4.08 \pm 1.29, *V* 5.5 \pm 1.8—all dredged, as one collection, on 4th May 1963 by Mr B. C. Mollison in Carlton River, Pembroke among *Zostera sp.* For (a) and (b) pooled we find *Lt* 66.0-80.3, \bar{x} 72.29 \pm 1.00, σ 4.00 \pm 0.71, *V* 5.5 \pm 0.98.

For both (a) and pooled (a) and (b) the *Lt* distribution approximates the normal, the number of individuals lying within the range $\bar{x} \pm \sigma$ being 7, 10, respectively (expected 7.5, 10.9).

Values for conspectus items.—A conspectus of Tasmanian syngnathids (Scott, 1961: 58) recorded, for the listed species, the known ranges for 4 meristic features and 4 body ratios; the maximum total length; character of rostral crest; presence or absence of opercular keel; and as fresh data for various forms become available they are being noted in these contributions. For the present material the entries are as follows (values as set out in conspectus in parentheses). Total rings 9-10 + 53-59 (8-9 + 49; but an overlooked count by McCulloch (1910: 317) gives '50-53 (rarely 43)'), \bar{x} 9.29 \pm 0.11 + 55.62 \pm 1.01. Subdorsal rings, dorsal beginning at from 0.9 (*i.e.*, at 9/10 of anteroposterior extension, starting from front of annulus) of 6th to 0.7 of 8th caudal ring; ending at from 0.8 of 10th to 0.6 of 12th ring (caudal 6th or 7th-caudal 11th or 12th). Brood rings, no data (subcaudal). Dorsal rays 12-14 (12-14), \bar{x} 13.71 \pm 0.14. Eye in snout 1.90-2.30 (1.3), \bar{x} 2.07 \pm 0.026. Snout in head 2.83-3.33 (2.8-3.3), \bar{x} 3.01 \pm 0.029. Head in trunk 1.58-2.29 (1.5-2.5), \bar{x} 1.96 \pm 0.049. Trunk in tail 3.42-5.34 (3.3-3.7), \bar{x} 4.10 \pm 0.23. The rostral crest is as described in the conspectus: the opercular keel extends from about $\frac{2}{3}$ of, to the full, length of the opercle. No obvious explanation

presents itself for the curiously high values for eye in snout among the present material, the below-average size of most of the specimens of which would suggest the probability rather of a divergence in the opposite sense.

The frequency distribution of the trunk annuli is 9 (12 specimens), 10 (5); of the caudal 53 (1), 54 (3), 55 (5), 56 (3), 57 (1), 58 (2), 59 (1); of the dorsal rays 12 (1), 13 (3), 14 (13), with, it is to be noted, classes below, but not above, the mode. For these three counts the coefficients of variation, V , are 4.9 ± 0.85 , 2.9 ± 0.51 , 4.2 ± 0.71 , respectively—for some discussion of the magnitude of V expected in linear body measurements of biologically homogeneous samples see Part VI of these Observations (1953: 143), and references there to results reported by Simpson & Roe (1939) and Haldane (1952): the present figures suggest the possibility that comparable magnitudes of V (Simpson & Roe found the great majority of their entries lay between 4 and 10, with 5 or 6 as 'good average values') may characterize meristic data from reasonably homogeneous (possibly all) populations. (See also below, under *Clinus perspicillatus*, where V 's of TL s are examined.)

It will be seen the present data transgress the conspectus ranges for body rings, caudal rings, eye in snout, trunk in tail, in all cases at the upper extreme; and extend the recorded spread of subdorsal rays by one annulus caudad for the origin, and by one annulus cephalad for the termination, of the series.

Relative growth of certain regions.—Data previously presented (1964, Table I) for a small sample of *Syngnathus curtirostris* Castelnau, 1871 indicate that in that pipefish preanal length, expressed as a fraction of total length, tends to decrease with increasing overall size; the values of length to vent, as Tlt , for 7 individuals of Lt 58.4–100.0, with specimens arranged in ascending order of magnitude of Lt , being 360, 353, 347, 346, 343, 342, 341. These values yield $r = 0.994$ (z 2.903), t 20.93.** For the two segments of preanal length—trunk length, head length—we find $r = 0.965$ (z 2.014), t 21.96**; $r = 0.870$ (z 1.333), t 3.95*, respectively. The same tendency for the precaudal region to account, as the fish continues to grow, for a progressively smaller proportion of the total length appears to be manifested in a very small sample of 4 specimens of *S. tuckeri* Scott, 1942, of Lt range 95.6–137.9 (1964, Table III), though only the whole preanal length yields a correlation statistically significant ($r = 0.992$, z 2.759, t 11.22**), the values for head, trunk being $r = 0.771$, z 1.023, t 1.71, $r = 0.880$, z 1.366, t 1.89, respectively. Rather surprisingly, an investigation of sample (a) (11 specimens) of the present series shows a positive correlation between Lt and each of the three dimensions, preanal length, trunk length, head length, as Tlt , the first two being formally significant: the relevant magnitudes are $r + 0.613$, z 0.682, t 2.33*, $r + 0.662$, z 0.797, t 2.65*; $r + 0.406$, z 0.431, t 1.38.

For sample (a) the regression equation of preanal length, Y , on total length, X (both dimensions in mm) is

$$Y = 0.4753 X - 14.74; t = 4.02**.$$

That for trunk length on total length is

$$Y = 0.4387 X - 18.59; t = 4.86**.$$

That for head length on total length is

$$Y = 0.05146 X + 2.80; t = 2.85*.$$

Family CLINIDÆ

Seven species are known to occur locally: (a) *Tripterygion* Risso, 1826, (1) *T. clarkei* (Morton), 1887; (b) *Gillias* Evermann & Marsh, 1900, (2) *G. macleayanus* (Lucas), 1891; (c) *Cristiceps* Cuvier & Valenciennes, 1836, (3) *C. australis* Cuvier & Valenciennes, 1836; (d) *Petraites* Ogilby, 1885, (4) *P. forsteri* (Castelnau), 1872, (5) *P. johnstoni* (Saville-Kent), 1886; (e) *Clinus* Cuvier, 1816, (6) *C. perspicillatus* Cuvier & Valenciennes, 1836, (7) *C. puellarum* Scott, 1955.

Species (1) appears in the Check List under *Gillias*, (4) under *Cristiceps*, and, as a separate entry, under *Petraites incertus* McCulloch, 1915, (5) under *Clinus*—for present generic attributions see Scott (1939). Whitley (1956: 261) suggests (7) is identical with *Clinus marmoratus* Klunzinger, 1872, of which latter species he earlier gave the first figure (1941, fig. 25): whether or no this identification be accepted, the name *C. puellarum* stands, since, as Whitley points out, Klunzinger's name is preoccupied by *Clinus marmoratus* Castelnau, *Mem. Poiss. Afr. Austr.*, 1861, p. 52, from Table Bay, South Africa.

Another species, (8) *Petraites heptaeolus* Ogilby, 1885 is here added to the Tasmanian fauna. Species (1)–(7) have been keyed in an earlier contribution (1955: 137). The newcomer enters that key at section D, which includes species (4) and (5). From these it is readily separated by the lower dorsal count, iii, xxv–xxvi, 1 + 2 (cf. iii, xxviii–xxix, 4–5 for (4) and ii–iii, xxxii–xxxiv, 5–6 for (5)) and smaller number of soft anal rays, 17–20 (cf. 23–24, 25–27); also at sight by the presence near the posterior ends of the dorsal and anal of 2 oppositely placed particularly wide interradial spaces, the interval, filled with clear membrane, occurring in both fins between the antepenultimate and penultimate rays, an arrangement in sharp contrast to that found in the other species in both of which the (more numerous) dorsal soft rays and anal soft rays near the termination of the fin are inserted at subequal distances from one another.

Genus **PETRAITES** Ogilby, 1865

Petraites heptaeolus Ogilby, 1885

Petraites heptaeolus Ogilby, 1885, *Proc. Linn. Soc. N.S.W.*, x: 225 [as *nom. nud.* on p. 10]. Type locality: Port Jackson.

Cristiceps wilsoni Lucas, 1890, *Proc. Roy. Soc. Vict.* (n.s.), iii: 10, pl. iii, fig. 1. Type locality: Port Phillip, Victoria.

Record.—First record for Tasmania provided by 2 specimens, (a) Ls 44.7, Lt 53.9, (b) Ls 50.1, Lt 60.2 obtained at Green's Beach, Devon by Mr R. H. Green on 14th January 1962 (Queen Victoria Museum Reg. No. 1962: 5: 4). In dimensions and counts below (a) is cited first: entries in parentheses relate to Ogilby's type 3 3/10 inches in length.

Fin counts.—D. iii, xxvi, 1 + 2; iii, xxvii, 1 + 2. A. ii, 21; ii, 21. P. 11; 11. V. 3; 3. C. 10; 10. The original description gives V 1/3, an evident error (Lucas correctly has V. 3). The outer two pelvic rays exhibit a closer approximation to equality than those of most local clinids; the innermost ray extends beyond the level of point of bifurcation of the other two, a condition encountered also in *Petraites forsteri* and *Petraites johnstoni*, but not in *Clinus perspicillatus*, *Clinus puellarum*, or *Cristiceps australis*. Ogilby's account has A. 2/18-2, this notation being devised to call attention to the notably wide membranous interval separating the last two rays from the rest: the occurrence of oppositely placed spacings in the soft dorsal and anal rays in this form appears not to be paralleled in any common Australian clinid.

Proportions.—Head 4.1, 4.1 (5.2); caudal 5.9, 6.0 (6.6); height 4.1, 4.1 (4.6); length to vent 2.8, 2.8 (—); in total length. Eye 4.4, 4.5 (3.8); pectoral 1.3, 1.4 (1.4); ventral 1.6, 1.7 (1.4); in head. Snout 0.6, 0.6 (half) eye; or 7.3 7.5 (about 7.2) in head. Interorbital 0.6, 0.6 (0.4) eye. Middle spine of first dorsal 1.9, 2.1 (—); longest (last) spine of second dorsal 1.9, 1.8 (—); longest (antepenultimate) anal ray 1.9, 1.9 (—); in head.

Remarks.—In his revision McCulloch states 'There seems to me to be little doubt that *Cristiceps wilsoni*, Lucas, must be included under this heading, the only apparent difference lying in a greater range of variation in the number of spines and rays in the dorsal and anal (D. iii, xxiv-xxviii; 1 + 2. A. ii; 17-21) of the Victorian species, than in any I have seen from New South Wales'. McCulloch's own counts are D. iii, xxv-xxvii; 1 + 2. A. ii, 17-20; his upper extremes being the numbers found in the type specimen. Our specimens fall within McCulloch's dorsal range; but both transgress his upper anal limit, equalling the highest value recorded by Lucas (1891: 10) for his species.

There are about 25 contiguous tubules in the subhorizontal initial segment of the lateral line, 5-6 in the descending segment, and about 26-28, set progressively further apart, in the segment along middle of flank. An auriform membranous lobe, with subparallel marginal and inframarginal ridges, is attached superiorly to upper angle of operculum, inferiorly to base of uppermost pectoral ray; a backward extension of the branchiostegal membrane, enclosing tips of 5th and 6th branchiostegal rays, partly overlies it.

The original descriptions of Ogilby and Lucas and the account by McCulloch (1908: 41) all fail to provide a satisfactory picture of the tentacles—structures of diagnostic significance in this group. The rostral tentacle ('fringed, and widened out at the tip', Ogilby; 'small, jointed', Lucas; 'branched', McCulloch) follows a pattern found in most other species: it consists of a cylinder (whose height is here about twice its diameter), from the hind part of the rim of which rises a single leaf-like lobe, subequal in height to the cylinder, and of somewhat variable form, usually obovate or lanceolate, occasionally somewhat panduriform. The orbital tentacle ('single, simple, small', Ogilby; 'simple', Lucas; 'broad, fringed', McCulloch) is quite different from that of any other local clinid. In our specimens it is a simple much-

flattened pointed lobe, about thrice as long as wide, rather broadly attached, the inner half of paper-thinness, with a more or less evenly convex border, the outer half somewhat thickened, largely owing to the presence (in its most pronounced form basally) of a longitudinal ridge, somewhat suggestive of the midrib of a leaf, but placed somewhat asymmetrically being further from the inner than from the outer margin of the lamina, the latter of which is convex throughout most of its length but briefly incurved basally: this tentacle is between two and three times as long as that on the snout, or about $\frac{2}{3}$ an eye-diameter.

Genus *CLINUS* Cuvier, 1816

Clinus perspicillatus Cuvier & Valenciennes, 1836

Clinus perspicillatus Cuvier & Valenciennes, 1836, Hist. Nat. Poiss., xi: 372. Type locality: Westernport, Victoria (Quoy & Gaimard).

Clinus despiciellatus Richardson, 1839, Proc. Zool. Soc. Lond.: 97. Type locality: Port Arthur, Tasmania.

Fin counts.—The total number of rays (including the 2 spines) in the anal, as hitherto reported, appears to be 25-28 (*cf* Scott, 1962: 253). One specimen in a series of 11 collected by Cameron Scott at Tarroona, Buckingham in December 1963 falls well below the recognized minimum with 23: totals for the other individuals are 25 (1), 26 (3), 27 (6). The accepted figures for the dorsal are iii, xxxii-xxxiv, 3-5. In the present sample we find iii, xxxii, 5 (2); iii, xxxiii, 4 (5); iii, xxxiv, 4 (2); iii, xxxiv, 5 (1); iii, xxxv, 4 (1), the last entry exceeding by one the recorded number of spines in the second dorsal.

The number of pectoral rays is usually given as 11-12; but here 1 fish has 13, 6 have 14, 3 have 15 (in all 10 cases in both fins), while 1 has 13 in left fin, 14 in right. Caudal rays number 12 (2), 13 (1), 14 (8).

Proportions.—Some proportions, expressed as *TLs*, are set out in Table I. As a contribution towards an answer to the question, what order of variability can be looked for in such values, the coefficient of variation, *V*, has been calculated for those 9 dimensions the *TLs* entries for which disclose no obvious sign of correlation with *Ls*. It will be seen the values for the 8 items other than *Lt* range from 5.2 to 12.2 (mean 7.10). It is of interest to note that these values are closely comparable with those that may be expected for absolute linear measurements of organs and morphologically significant body regions in populations homogeneous for age (and, if relevant, for sex)—*cf.* discussion on magnitude of *V*'s for meristic characters under *Urocampus carinirostris*, above. Higher values for raw measurements would of course be expected in the present sample, which, with an *Ls* range of 31.0-137.8 (\bar{x} 97.88 \pm 8.74) is a decidedly heterogeneous one: it is found that, for *Ls*, $V = 29.6 \pm 6.32$; while for the 8 entries noted above $V = 27.8-35.8$, $\bar{x} = 31.02$.

Quick tests point to the likelihood of the distribution of the population in respect of *Ls* being approximately normal. Within the range $\bar{x} \pm \sigma$

there occur 8 individuals (expected 7.5). Again, an estimate of the standard deviation for a random sample of the relevant size ($n = 11$) is 33.66, with 29.00 found.

Inspection of Table I suggests the existence in the cases of eye and length of ventral of a significant correlation between organ size and overall length; and correlation coefficients have been calculated for these two features. For diameter of eye and L_s we find $r = 0.843$, $z = 1.232$, $t = 4.71^{**}$; for

length of ventral and LS , $r = +0.908$, $z = 1.522$, $t = 6.50^{**}$.

For the 19 specimens of this species incidentally noted below as being collected, by the rotenoning of two rock pools at Green's Beach, in association with *Ophiclinus gabrieli*, the L_s specification is: range 37.9-71.8, $\bar{x} = 57.26 \pm 2.09$, $\sigma = 9.09 \pm 1.47$, $V = 15.9 \pm 2.6$. The number of individuals within the range $\bar{x} \pm \sigma$ is 13, which is the number expected in a normal distribution.

TABLE I

Clinus perspicillatus Cuvier & Valenciennes, 1836. Dimensions expressed as thousands of standard length (TLs), together with coefficient of variation (V) of TLs values, of 11 specimens (standard length 31.0-137.8 mm) from Taroona, Buckingham, Tasmania

Dimension	TLs											V (of TLs)
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	
	31.0	72.0	81.0	88.5	90.6	104.9	106.6	107.7	125.5	131.1	137.8	
Total length	1165	1164	1178	1162	1129	1152	1160	1162	1181	1159	1137	1.3
Head: total; soft	291	242	235	249	270	253	251	252	255	248	257	5.6
Head: without opercular flap; hard	245	221	199	214	238	217	219	221	208	221	216	5.6
Snout	42	40	42	46	50	44	47	45	54	46	47	8.2
Eye	94	62	56	59	65	56	56	57	57	53	52	
Interorbital	35	28	26	27	30	27	23	27	31	34	33	12.2
Length to vent	465	469	467	419	397	418	453	409	441	465	472	6.0
Length of pectoral	190	168	184	171	196	172	173	181	174	192	171	5.2
Length of ventral	194	167	168	168	172	154	150	149	146	157	147	
Depth at anal origin	171	171	198	192	188	219	197	176	207	198	192	7.4
Depth of caudal peduncle	61	60	53	59	54	61	56	59	49	54	55	6.5

Family OPHICLINIDAE

Two species of *Ophiclinus* Castelnau, 1872 (emended in 1873 by Castelnau to *Ophiclinus*) appear on the State list: (1) *O. greeni* Scott, 1936 (type locality: Lady Lucy Beach, Low Head [Dorset], Northern Tasmania); (2) *O. gracilis* Waite, 1906 (type locality: Long Bay, near Sydney, New South Wales; recorded for Tasmania by Olsen (1958), who notes it is a common food for small sharks in George Bay, Dorset/Cornwall). Another species, (3) *O. gabrieli* Waite, 1906 (type locality: Victoria; and in the Check List not noted from any other State) is here added.

Whitley (1941) identifies (2) with *Sticharium dorsale* Günther, 1867, the Ophiclinidae thus becoming the Stichariidae. *Sticharium* is either identical with or closely allied to *Ophiclinus*. Difficulties in the way of identifying it with Castelnau's genus include: 'naked or with scarcely a trace of scales' (in *O. gracilis*, a suggested synonym of the type species of *Sticharium*, scales are readily observable—a statement not true, by the way, of all species of *Ophiclinus*); 'palate apparently toothless' (vomer toothed); dorsal fin 'formed by pungent spines only' (one jointed ray at posterior end). As regards the possible identity of Waite's species with Günther's, it is to be noted (a) the former has D. xliii + 1, A. iii, 29, the

latter D. xli, A. ii, 36; (b) ventrals are equal to, or a trifle shorter than pectorals, as against Günther's 'ventrals much longer than the pectorals': such divergences do not appear readily reconcilable—though of course the pertinent question arises, if *S. dorsale* is not *O. gracilis*, what is it? (possibly some other species at present attributed to *Ophiclinus*; e.g., *O. gabrieli*?) Günther's entry 'a broad white band runs along the upper surface of the head and back' describes well the condition found in many examples of *O. gracilis*; however, a light-colored middorsal stripe is encountered in some other species of the genus.

KEY TO OPHICLINIDAE RECORDED FROM TASMANIA

- 1 } Dorsal beginning above end of operculum. Dorsal origin not well defined, a triangular membrane leading up to 1st spine; first few spines progressively increasing noticeably in length, height of 1st $< 2/3$ ($\approx \frac{1}{2}$) that of 4th. D. li-liii, 1. Anal composed solely of soft rays *O. gabrieli*
- 1 } Dorsal beginning in advance of end of operculum (the latter about below 3rd dorsal spine). Dorsal origin well defined, no triangular membrane leading up to 1st spine; first few spines progressively increasing only slightly in length, height of 1st \geq that of 4th D. xliii-xlix, 1. Anal with 3 small spines 2

- D. xliii, 1. Lateral line strongly arched; markedly bent down posteriorly, its tip about on the horizontal line joining upper border of eye and upper angle of caudal peduncle *O. gracilis*
- 2 D. xlvi-xlix, 1. Lateral line nearly straight; not, or scarcely, continued obliquely downwards posteriorly, its tip equidistant from dorsal profile and the horizontal line joining upper border of eye and upper angle of caudal peduncle *O. greeni*

All Tasmanian species belong to the group in *Ophiclinus* possessing a well-defined lateral line and having pectoral longer than eye; and to the section of this group in which the vomerine teeth are pointed and in rows.

Genus **OPHICLINUS** Castelnau, 1872

Ophiclinus gabrieli Waite, 1906

Ophiclinus gabrieli Waite, 1906, *Rec. Aust. Mus.*, vi. 3: 208, pl. xxxvi, fig. 7 (in legend of plate appears as fig. 6). Type locality: Victoria.

Record.—Two examples, (a) *Ls* 45.5, *Lt* 51.2, (b) *Ls* 54.1, *Lt* 61.1, (Queen Victoria Museum Reg. No. 1964: 5: 16) are among 40 fish obtained by Mr R. H. Green by the rotenoning of two rock pools at Green's Beach, Devon, on 13th September 1964. The other items in the collection are *Clinus perspicillatus* Cuvier & Valenciennes, 1836 (19 specimens—see further under that species), *Pictiblenius tasmanianus* (Richardson), 1849 (12 specimens: *Ls* specification, range 24.9–58.0, \bar{x} 42.27 \pm 2.60, σ 9.00 \pm 1.84, *V* 21.3 \pm 4.4), *Alabes rufus* (Macleay), 1881 (7: *Lt* specification, range 46.0–31.5, \bar{x} 62.17 \pm 4.28, σ 11.33 \pm 3.03, *V* 18.23 \pm 4.9).

Proportions.—In general these examples agree well with the original description. Our specimens are, however, smaller than Waite's—2 females carrying young and an adult male, the largest 102 in length—and exhibit some differences in proportion. For ratios noted by him the values for (a), (b), and, in parentheses, the Victorian fish (for which no ranges are recorded) are as follows. Head 4.6, 4.3 (5.3); depth at origin of anal 8.8, 8.3 (7.5); caudal 8.0, 7.7 (8.0): in total length. Eye 4.8, 4.6 (4.2); middle pectoral rays 2.4, 2.4 (2.4); ventral 1.5, 1.7 (a little less than twice): in head. Depth of caudal peduncle 2.0, 2.2 (2.5) in depth of body. Interorbital 1.8, 2.0 (twice) snout or 1.3, 1.2 (less than twice) in eye. Length to vent 2.3, 2.3 (from figure 2.5) in total length.

Fin counts.—D. (a) lii, 1; (b) lii, 1 (cf li + 1 in type). A. 36, 35 (36). P. left 11, right 12; 12, 12 (12). V. 2, 2 (2). C. 3 + 11 + 3, 2 + 11 + 3 (11 + 4).

Coloration.—A narrow (in (a) very narrow) stripe of warm brownish (a) or deep salmon (b) borders either side of the dorsal fin which is concolorous with it: this continues forward, increasing somewhat in width as it advances, to level of hind border of eye. Between this stripe and a line joining lower border of eye and upper end of caudal base dark, virtually uniform brown (tip of lateral line is situated in the upper one-fourth or one-third of this band); below this line lighter brown mottled with darker. Anteriorly the darkest

of the three regions can be regarded as a dark band passing backwards from eye, its width here being an eye-diameter. Dorsal warm brownish (a) or deep salmon (b), microscopically punctulate, but otherwise save for a discontinuous very narrow external border of deep flesh color. Anal somewhat darker than dorsal, with some lighter mottling, particularly in the posterior half. Pectoral with basal half (a), or one-third (b), dark brownish with one or two small lighter spots: rest of fin brownish with small whitish spots (a) or ashen with some dusky marbling (b). Pelvics white or flesh color, with some duskiness up to the bifurcation of the rays.

Ophiclinus greeni Scott, 1936

Ophiclinus greeni Scott, 1936, *Pap. Proc. Roy. Soc. Tasm.* (1935): 114, fig. 1. Type locality: Lady Lucy Beach, Low Head [Dorset], Northern Tasmania.

New material.—Three examples, (a) *Ls* 77.4, *Lt* 83.0, (b) *Ls* 78.1, *Lt* 85.1 (male); (c) *Ls* 82.0, *Lt* 89.9 (male) (Queen Victoria Museum Reg. No. 1964: 5: 18) are included in a small collection of fish secured by Mr R. H. Green in December 1963 in rock pools on the reef at Green's Beach, Devon: this beach and the type locality lie near the mouth of the Tamar estuary, on the west and east side, respectively. Other fish collected at the same time comprise *Callogobius hasseltii* (Bleeker), 1851 (3 specimens, dealt with elsewhere in this paper); *Aspasmogaster tasmaniensis* Günther, 1861 ((a) *Ls* 60.0, *Lt* 70.0; (b) *Ls* 67.9, *Lt* 78.1); *Clinus perspicillatus* Cuvier & Valenciennes, 1836 (*Ls* 83.3, *Lt* 97.0); *Pictiblenius tasmanianus* (Richardson), 1849 ((a) *Ls* 49.0 *Lt* 58.1; (b) 52.7, *Lt* 63.8; (c) *Ls* 54.9, *Lt* 66.0).

These provide some interesting meristic and other metrical data for comparison with the known magnitudes based on the 1936 type material (holotype, *Ls* 40.5, *Lt* 44.6; 2 paratypes, *Ls* 31.9, 34.3 *Lt* 45.5, 49.8) and 2 larger individuals, *Ls* 56.5, 68.0, *Lt* 62.0, 75.0 from the mouth of the Currie River, in the same county as the type locality (Scott, 1939): their color patterns show features not previously encountered.

Fin counts.—The known range for the dorsal now becomes xlvi-xlix, 1 (previously xlviii-xlix, 1); for the anal iii 29-32 (iii 31-32): ventral is invariable at 2, and caudal at 13 main rays (with minor rays ranging from 1 to 3 both superiorly and inferiorly); and pectoral range remains unchanged at 11-12.

Proportions.—In this paragraph the present specimens are arranged in ascending order of magnitude of *Ls*: for the first 8 items entries in parentheses represent range of the 1936 and the 1939 specimens pooled, while for the remaining 6 items the range is that of the type material only. Depth 7.8, 8.0, 8.2 (7.1-8.8) in *Lt*; 7.2, 7.4, 7.5 (6.4-8.1) in *Ls*: depth at 1st anal ray 8.3, 8.5, 8.5 (7.7-9.3) in *Lt*; 7.7, 7.7, 7.8 (6.9-8.4) in *Ls*. Head 5.0, 4.7, 4.9 (4.9-6.4) in *Lt*; 4.6, 4.3, 4.4 (4.4-5.8) in *Ls*. Eye 6.7, 7.2, 7.1 (5.3-6.5) in head; 1.4, 1.6, 1.5 (1.2-1.5) in snout; 1.4, 1.3, 1.2 (1.1-1.2) times interocular distance. Head and trunk 1.1, 1.4, 1.3 (1.1-1.3) in tail without caudal fin. Pectoral 1.9,

1.9, 2.1 (1.7-1.9); pelvic 1.9, 1.8, 1.6 (1.4-1.8): in head. Caudal 3.0, 2.6, 2.3 (1.9-2.1) in head; 13.8, 11.1, 9.8 (8.8-10.6) in *Ls*.

Specimen (*a*) presents the same general color pattern as the holotype. In (*b*) the dorsal and anal are wholly white (except for a row of 5 dark basal spots about 1 mm in diameter on the former) to about a head-length caudad of the vent, being behind this almost uniform brown: a narrow white band on the back borders either side of the white anterior $\frac{2}{3}$ of the dorsal. In (*c*) the whole dorsal is an even off-white, minutely punctulated with brownish throughout; with, in its last one-third, three or four brownish bars, increasingly deeper in color and more sharply defined caudad: a narrow whitish stripe runs along either side of the anterior $\frac{2}{3}$ of base of fin.

In the largest and smallest individuals the penis is extruded—a whitish subcylindrical organ with wide simple transverse slit at the downwardly and forwardly directed tip.

Status.—This species is closely allied to, and may possibly be identical with, *O. gracilis*. Of the chief differences from Waite's species noted as characterizing the type material (holotype, *Ls* 40.5, *Lt* 44.6, and 2 paratypes, *Ls* 31.9, *Lt* 45.5, *Ls* 34.3, *Lt* 49.8)—(*a*) 'consistently greater number of dorsal spines and' (*b*) 'anal rays'; (*c*) 'rather fewer pectoral rays'; (*d*) 'origin of anal below about 20th, instead of 17th, dorsal spine'; (*e*) 'lateral line nearly straight, not, or scarcely, continued obliquely downwards posteriorly'—(*a*), (*c*) (which is probably of little significance), and (*e*) hold good for the present material. At 29-30, anal rays fall below the counts for the types (31-32), and overlap the count (29) for *O. gracilis*. As regards (*d*): the anal originates in these specimens below the 19th, 18th, 19th dorsal spine. The lateral line is in all 3 cases nearly straight and almost exactly conformable with that described for all the type material and figured for the holotype—the situation is in marked contrast to that in *O. gracilis*, in which the lateral line is described as 'strongly arched' and is clearly so depicted (Waite, 1906, pl. xxxvi, fig. 6) in the illustration of the holotype. In *O. gracilis* the last few tubules turn down sufficiently to reach to or slightly beyond, the light-colored lower portion of the flank: in *O. greeni* the last tubule is nearer to the dorsal profile than to the line of junction between the upper dark and lower light zones of the flank. It is possible the character of the lateral line, together with the more numerous dorsal rays in the Tasmanian fish (in *O. greeni*, including the present material, which has extended the range downward, 46-49; in *O. gracilis* 43), may significantly differentiate the two forms.

Family GOBIIDAE

In Part XI of these Observations (1936) 6 gobies were listed from Tasmania (No. 1 in the enumeration below doubtful) and keyed: (*a*) *Rhinogobius* Gill, 1859, (1) *R. lateralis* (Macleay), 1881; (*b*) *Stigmatogobius* Bleeker, 1874, (2) *S. poecilosoma* (Bleeker), 1849; (*c*) *Nesogobius* Whitley, 1929, (3) *N. hinsbyi* (McCulloch & Ogilby), 1919; (*d*) *Arenigobius* Whitley, 1930, (4) *A. bifrenatus* (Kner), 1865, (5) *A. tasmaniensis* (Johnston), 1883; (*e*)

Tasmanogobius Scott, 1935, (6) *T. lordi* Scott, 1935. Of these the Check List (McCulloch, 1929) gives as Tasmanian (1), (3), (5), together with *Gobius tasmanicus* Whitley, 1929 [ex Johnston MS], which last species the present writer in a review of the Tasmanian gobies then known (1935) considered should be regarded as a synonym of (5).

An additional species, (*f*) *Callogobius* Bleeker, 1874, (7) *C. hasseltii* (Bleeker), 1851, hitherto known from New South Wales, Victoria, South Australia, Western Australia (McCulloch, 1929: 377), Queensland (Koumans, 1953: 99), and a wide range of extralimital localities (including India, Indonesia, Japan), is here recorded for this State. It may be distinguished at sight from all the species in the 1963 key by the presence on head and body of conspicuous crenulated ridges formed of confluent papillae.

Genus GALLOGOBIUS Bleeker, 1874

Callogobius hasseltii (Bleeker), 1851

Eleotris Hasseltii Bleeker, 1851, *Nat. Tijdschr. Ned. Indië*, 1: 253. Type locality: Anjer, Java.

Gobius mucosus Günther, 1872, *Proc. Zool. Soc. Lond.* (1871): 663, pl. lxiii, fig. A. Type locality: Adelaide.

Gobius depressus Ramsay & Ogilby, 1886, *Proc. Linn. Soc. N.S.W.* (2), 1, 1: 4. Type locality: Bottle and Glass Rocks, Port Jackson.

Callogobius hasseltii var. *mucosus* Günther. McCulloch & Ogilby, 1919, *Rec. Aust. Mus.*, xii, 10: 217, pl. xxxii, fig. 4.

Callogobius mucosus (Günther). McCulloch, 1929, *Aust. Mus. Mem.* V 111: 377. *Id.* Scott, 1962, *Mar. and Fresh Water Fishes of S. Aust.*: 240, unnumbered fig. on p. 240.

Callogobius hasseltii (Bleeker). Koumans, 1953, *Fish. Indo-Aust. Arch.* (Weber & De Beaufort), X: 98, fig. 20.

Record.—Three specimens, (*a*)-(*c*), *Ls* 66.0, 67.6, 68.0, *Lt* 81.3, 85.3, 85.6, respectively, were collected by Mr R. H. Green at Green's Beach, Devon in December 1963 (Queen Victoria Museum Reg. No. 1964: 5: 17): for other species secured at the same time see above under *Ophioclinus greeni*.

Fin formulae.—In their review of Australian Gobiidae McCulloch & Ogilby have for this species, which they treat as *C. hasseltii* var. *mucosus*: D. vi/11; A. 9; P. 16; V. i/5; C. 16. As for most other species their definitive description is based on a single individual (though they examined upwards of a hundred specimens from 4 Australian States), and no indication of variation in fin-counts is supplied. Koumans (1953: 98) gives D. VI; D. I. 9-10; A. I. 7-8; P. 16-18.

Of our specimens (*a*) and (*c*) have in second dorsal 12 rays (in (*a*) last split to base, the rami adherent), (*b*) 11; while (*a*) and (*c*) have 9 anal rays, (*b*) 10 (last divided nearly to base). Pectoral rays: (*a*) 14 (left), 16 (right); (*b*) 18; (*c*) 17. Caudal: all 16, plus several rudimentary rays above and below.

Comparative proportions.—Values in our material—sequence (a), (b), (c)—for those proportions recorded by McCulloch & Ogilby (their values in parentheses) are as follows. Depth 6.6, 6.4, 6.1 (5.7); head 3.6, 3.6, 3.4 (3.9) in *Ls*. Eye 1.7, 1.6, 1.5 in snout ('slightly shorter than snout'); snout 3.2, 3.6, 3.2 (3.5) in head. Interorbital 3.4, 3.3, 3.6 (about 4) in eye (this is bony interorbital; interocular 1.7, 1.1, 2.05). Breadth between pectorals 1.2, 1.0, 1.1 (equal to) depth there. Depth of caudal peduncle 3.0, 3.0, 2.9 (2); length of pectoral 1.2, 1.3, 1.4 (1) in head. Space between gill openings 2.1, 2.2, 1.7 (twice) eye. Fifth dorsal spine 1.1, 1.4, 1.1 (subequal to) postorbital head. Addressed pectoral failing to reach vent, extending to level of end of 1st dorsal, origin of 2nd dorsal, last spine of 1st dorsal ('not quite reaching vertical of the vent'). Ventrals reaching 0.59, 0.59, 0.59 ('about two-thirds') of their distance from vent.

Coloration.—McCulloch & Ogilby observe 'the southern specimens are very dark with their markings obscurely defined, while those from Port Jackson and South-west Australia are often lighter and more or less conspicuously banded'. Comparable variation here occurs within the sample, (c) alone exhibiting the second type of coloration. The second dark cross-band below the anterior dorsal rays is represented in our material only by a dark spot in (b). Pelvics wholly whitish, except for basal interspinous membrane, which is more or less dusky; other fins all light-margined, the anal most extensively and conspicuously so.

Remarks.—Koumans makes no mention of, nor does the figure by Weber (1913, fig. 98) reproduced by him show, the characteristic chiefly subvertical crenulated (occasionally comb-like) ridges on the body; these are well depicted, however, in the figure (pl. xxii, fig. 4) in McCulloch & Ogilby (1919).

Family TETRAODONTIDAE

Four species are known to occur in Tasmania: (a) *Tetraodon* Linné, 1758, (1) *T. armilla* McCulloch & Waite, 1915; (b) *Spheroides* Duméril, 1806, (2) *S. richei* (Fréminville), 1813, (3) *S. liosomus* Regan, 1909, (4) *S. hamiltoni* (Gray & Richardson), 1843. A key to these local species is given in Part XI of these Observations (1963: 26); in which contribution reasons are advanced for the inclusion in our faunal list of (4), not treated as Tasmanian in the Check List (McCulloch, 1929: 430). It may be noted that in his recent work on South Australian fishes Scott (1962) refers (2) to the genus *Contusus* Whitley, 1947, and apparently treats (3) as a synonym of *Gastrophysus glaber* Fréminville, 1873.

An additional species, (5) *T. firmamentum* Temminck & Schlegel, 1850—the distribution of which, as recognized in the Check List, is New South Wales, Victoria, New Zealand, Japan—is here recorded for this State. It is a rare form, occurring in deep water.

No new key to Tasmanian species seems called for, *T. firmamentum* being tenchantly separated from the 4 other species by its large number of dorsal and anal rays, 14 in each fin—a maximum of 11 in the dorsal being recorded for (1), (3), and

one of 9 for (2), (4); with the anal total exceeding 9 only in (1), in which the normal count is 9-11.

Genus TETRAODON Linné, 1758

Tetraodon firmamentum Temminck & Schlegel, 1850

Tetraodon firmamentum Temminck & Schlegel, 1850, Faun. Japan Poiss.: 280, pl. cxxvi, fig. 2. Type locality: Japan.

Tetraodon gillbanksii Clarke, 1897, *Trans. N.Z. Inst.*, xxix: 245, pl. xiv. Type locality: Taranaki, New Zealand.

Record.—An example, *Ls* 237, *Lt* 302, was found washed up on the sand after a storm at Green's Beach, Devon by Mr J. Squires in July 1964 (Queen Victoria Museum Reg No. 1964: 5: 14).

Remarks.—The specimen, which is in a good state of preservation, agrees well with the original figure, reproduced by McCulloch (1927, pl. xliii, fig. 369f), the chief differences being: spines on the throat here extend further forward (to midway between levels of eye and snout-tip); the ventral silvery area does not curve upward beneath the eye, and is somewhat less clearly defined on the caudal peduncle than in the figure; the caudal bears, across the upper $\frac{2}{3}$ in the last $\frac{1}{3}$ of its length, an asymmetrically placed forwardly convex whitish cross-bar that is perhaps a purely individual variation.

The spines, which on the under surface and on much of the sides and backs are normally sheathed in, or distally project from, white fleshy vesicles, attain their greatest exposed length on the belly in the anterior $\frac{2}{3}$ of the interval between the levels of insertion of the pectoral and the anal. They are more nearly erect medially on the dorsum of the body and in a patch above the pectoral base than elsewhere. On the lower surface they wholly cease before the vent, and on the lateral surface only a scattered few extend behind the dorsal fin termination, and these are restricted to the anterior $\frac{1}{3}$ of the upper $\frac{2}{3}$ of the caudal peduncle. Spineless areas occur also immediately surrounding the other fin bases, encircling the eye, and near the tip of the snout.

SOME DATA ON CATCHES AT A FISHING COMPETITION AT GEORGE TOWN, DORSET, IN DECEMBER 1963

Catch records of Californian shark derbies by Herald, Schneebelli, Green & Innes (1960)—and earlier by the first author alone or jointly (references in the paper here cited)—bring to notice the interest attached to large-scale data provided by fishing competitions in general. The following notes made by the writer at a fishing competition held at George Town, Dorset on 7th December 1963 (the day fine and calm; official contestants about a hundred) record the range of species observed, along with some linear dimensions (mm) and weights (lb., oz.).

Prizes were offered for the heaviest specimen of: (a) 'bluehead', *Pseudolabrus tetricus* (Richardson), 1840 (1st *Ls* 392, *Lt* 468, wt 4 lb. 14 oz.; 2nd *Ls* 405, *Lt* 458, wt 4 lb. 2 $\frac{1}{2}$ oz.); (b) 'parrot fish', *P.*

fucicola (Richardson), 1840 (1st Ls 365, Lt 440, wt 3 lb. 8 $\frac{3}{4}$ oz.); (c) 'gurnard' *Ruborolga ergasilorum* (Richardson), 1842 (1st wt 1 lb. 11 $\frac{1}{4}$ oz., 2nd 1 lb. 7 oz.); (d) 'blackback salmon', *Arripis trutta* (Bloch & Schneider), 1801 (1st wt 2 lb. 6 oz.; 2nd 1 lb. 11 $\frac{3}{4}$ oz.); 'leatherjacket' of any species (1st *Meuschenia hippocrepi* (Quoy & Gaimard) 1821, wt 1 lb. 12 oz.; 2nd, another species, Ls 322, Lt 387, wt 1 lb. 11 $\frac{3}{4}$ oz.).

Sharks caught included: (a) gummy, *Mustelus antarcticus* Günther, 1870 (Lt 1253, wt 13 lb. 12 $\frac{1}{2}$ oz.; Lt 1230, wt 13 lb. 9 $\frac{1}{2}$ oz.); (b) Port Jackson shark, *Heterodontus portusjacksoni* (Meyer), 1793 (Lt 1098, wt 22 lb.); (c) 3 swell sharks, *Cephaloscyllium isabellae laticeps* (Duméril), 1853 (not measured; subequal; estimated Lt 850-950: 7 adults previously noted in these Observations (1963: 4) have Lt 885-961, \bar{x} 913.0 \pm 9.16, showing the small coefficient of variation of 2.7).

Other fish submitted included short-finned eel, *Anguilla australis occidentalis* Schmidt, 1928; barracouta, *Leionura atun* (Euphrasen), 1791; one specimen of butterfly perch, *Caesioperca lepidoptera* (Bloch & Schneider), 1801.

First and second prizes for the largest bag were won with 257 and 213 fish, in each case almost exclusively *Pseudolabrus fucicola* (here is reason to believe each entry represented the pooled catch of several anglers).

REFERENCES

- CASTELNAU, F., 1872.—Contribution to the Ichthyology of Australia. No. 1. The Melbourne Fish Market. *Proc. Zool. Acclim. Soc. Vict.*, 1: 29-242.
- GUNTHER, A., 1867.—Additions to the Knowledge of Australian Reptiles and Fishes. *Ann. Mag. Nat. Hist.* (3), xx: 45-67.
- HALDANE, J. B. S., 1952.—Variation. *New Biol.*, 12: 9-26.
- HERALD, E. S., SCHNEEBELLI, W., GREEN, H. & INNES, K., 1950.—Catch Records for Seventeen Shark Derbies held at Elkhorn Slough, Monterey Bay, California. *Calif. Fish and Game*, 46, 1: 59-67.
- KINGHORN, J. R., 1929.—*Snakes of Australia*. Sydney (Angus & Robertson).
- KOUMANS, F. P., 1953.—Gobiidea in *The Fishes of the Indo-Australian Archipelago*. M. Weber & L. F. De Beaufort, vol. X, Leiden.
- LING ROTH, H., 1899.—*The Aborigines of Tasmania*: 2nd ed. Halifax (England).
- LORD, C. E., 1920.—On the Occurrence in Tasmania of *Hydrus platyrus*. *Pap. Proc. Roy. Soc. Tasm.* (1919): 22.
- , & SCOTT, H. H., 1924.—*A Synopsis of the Vertebrate Animals of Tasmania*. Hobart (Oldham, Beddome & Meredith).
- LUCAS, A. H. S., 1891.—On the Occurrence of Certain Fish in Victorian Seas, with Descriptions of some New Species. *Proc. Roy. Soc. Vict.* III (N.S.): 8-14, pl. iii.
- MCCULLOCH, A. R., 1908.—Studies in Australian Fishes: No. 1. *Rec. Aust. Mus.*, VII, 1: 36-43, pl. x-xi.
- , 1910.—Studies in Australian Fishes: No. 2. *Rec. Aust. Mus.*, VII, I: 315-321, pl. xc-xci, text-fig. 8.
- MCCULLOCH, A. R., 1915.—Notes on, and Descriptions of Australian Fishes. *Proc. Linn. Soc. N.S.W.*, XL, 2: 259-277, pl. xxxv-xxxvii.
- , 1927.—*The Fishes and Fish-like Animals of New South Wales*: 2nd edition; with additions by G. P. Whitley. Sydney.
- , A Check List of the Fishes recorded from Australia. *Mem. Aust. Mus.*, V, 1-III (IV, Index, 1930).
- , & OGILBY, J. D., 1919.—Some Australian Fishes of the Family Gobiidae. *Rec. Aust. Mus.*, XII, 10: 193-291, pl. xxxi-xxxvii.
- , & WAITE, E. R., 1918.—Some New and Little-known Fishes from South Australia. *Rec. S. Aust. Mus.*, I, 1: 39-78, pl. ii-vii, text-figs 26-31.
- MUNRO, I. S. R., 1956 +.—*Handbook of Australian Fishes*—currently appearing serially in *Fisheries Newsletter* (issued monthly by the Commonwealth Director of Fishes, Department of Primary Industry, Canberra). Here cited: No. 12: 45-48 (*F. N.*, 16, 5, May 1957); No. 13: 49-52 (*F. N.*, 16, 6, June 1957). No. 21: 85-88 (*F. N.*, 17, 3, March 1958).
- OGILBY, J. D., 1885.—Descriptions of New Fishes from Port Jackson. *Proc. Linn. Soc. N.S.W.*, X, ii: 225-230.
- , 1895.—Description of a New Australian Eel. *Proc. Linn. Soc. N.S.W.* (2), IX, iv: 720-721.
- OLSEN, A. M., 1958.—New Fish Records and Notes on Some Uncommon Tasmanian Species. *Pap. Proc. Roy. Soc. Tasm.*, 92: 155-159.
- SCOTT, T. D., 1962.—*The Marine and Fresh Water Fishes of South Australia*. Adelaide (Government Printer).
- SCOTT, E. O. G., 1932.—On the Occurrence in Tasmania of *Hydrophis ornatus* var. *ocellatus*; with a note on *Pelamis platurus* (= *Hydrus platurus*). *Pap. Proc. Roy. Soc. Tasm.* (1931): 111.
- , 1935.—Notes on the Gobies Recorded from Tasmania with Description of a New Genus. *Pap. Proc. Roy. Soc. Tasm.* (1934): 47-62, pl. iv, text-figs 1-2.
- , 1936.—Observations on Some Tasmanian Fishes. Part III. *Pap. Proc. Roy. Soc. Tasm.* (1935): 113-129, text-figs 1-3.
- , 1939.—*Ibid.*: Part IV. *Pap. Proc. Roy. Soc. Tasm.* (1938): 139-159, text-figs 1-2.
- , 1953.—*Ibid.*: Part VI (in printed title: Part V). *Pap. Proc. Roy. Soc. Tasm.*, 87: 141-166, figs 1-4.
- , 1955.—*Ibid.*: Part VII. *Pap. Proc. Roy. Soc. Tasm.*, 89: 131-146, pl. 1.
- , 1957.—*Ibid.*: Part VIII. *Pap. Proc. Roy. Soc. Tasm.*, 91: 145-156.
- , 1961.—*Ibid.*: Part X. *Pap. Proc. Roy. Soc. Tasm.*, 95: 49-64, figs 1-3.
- , 1963.—*Ibid.*: Part XI. *Pap. Proc. Roy. Soc. Tasm.*, 97: 1-31, figs 1-8.
- , 1964.—*Ibid.*: Part XII. *Pap. Proc. Roy. Soc. Tasm.*, 98: 85-106, fig. 1.
- SIMPSON, G. G., & ROE, A., 1939.—*Quantitative Zoology; Numerical Concepts and Methods in the Study of Recent and Fossil Animals*. New York (McGraw Hill).
- WAITE, E. R., 1906.—Descriptions of and Notes on some Australian and Tasmanian Fishes. *Rec. Aust. Mus.* VI, 3: 194-210, pl. xxxiv-xxxvi.
- WHITLEY, G. P., 1929.—R. M. Johnston's Memoranda relating to the Fishes of Tasmania. *Pap. Proc. Roy. Soc. Tasm.* (1928): 46-88, pl. ii-vi.
- , 1941.—Ichthyological Notes and Illustrations. *Aust. Zool.* X, 1: 1-50, pl. ii, text-figs 1-32.
- , 1956.—Ichthyological Notes. *Aust. Zool.* XII, 3: 251-261, figs 1-7.

