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OBSERVATIONS ON SOME TASMANIAN FISHES—Part XVIII

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(one text figure)

ABSTRACT

Two new forms are described: *Nannoperca australis flindersi subsp. nov.* (Nannopercidae), from Flinders Island; *Kyphosus diemenensis sp. nov.* (Kyphosidae), from the north coast of Tasmania (figured).

One species is added to the local list: *Crapatalus arenarius* McCulloch, 1915 (Leptoscopidae).

Some miscellaneous observations are made as follows. Haplochitonidae: *Lovettia sealii* (Johnston), 1883, specification of a sample, general remarks on whitebait. Syngnathidae: *Urocampus carinirostris* Castelnau, 1872, supernumerary opercular ridges, records of pipefish breeding seasons; *Leptoichthys fistularius* Kaup, 1853, regeneration of caudal extremity, scute development; *Lissocampus caudalis* Waite & Hale, 1921, disposition of ova in marsupium. Nannopercidae: general remarks on family, descriptions of small samples of *Nannoperca australis australis* Günther, 1861 and *N.a. tasmaniae* (Johnston), 1883, with some results at variance with published specifications, data on 2 undetermined specimens from King Island, new subspecies as above. Kyphosidae: key to Australian members of family, new species as above (first Tasmanian kyphosid). Xiphiidae: *Xiphias gladius* Linné, 1758, dimensions of an East Coast example, taxonomic status of the Australian broadbill swordfish. Ophidiidae: *Genypterus microstomus* Regan, 1903, large examples, key to Tasmanian members of family. Tetraodontidae: *Tetraodon armilla* McCulloch & Waite, 1915, notes on a specimen, remarks on the family.

INTRODUCTION

This paper follows the general plan of others in the series. Attention may be drawn to, in particular, the following conventions. Linear measurements are given, unless otherwise stated, in millimetres, the name of the unit commonly being omitted. The abbreviations *Ls, Lt, TLs, TLt* denote standard length, total length, thousandths of standard length, thousandths of total length, respectively. Standard derivations are calculated with *n* degrees of freedom, and coefficients of variations are computed from values thus obtained. Certain other conventions are noted in earlier contributions.

Family HAPLOCHITONIDAE

The spelling Aplochitonidae is favoured by most Australian authors—*e.g.* McCulloch (1915, 1929), Blackburn (1950), Munro (1957), Whitley (1968): however, the family name is rendered as Haplochitonidae by Günther (1880), Berg (1940), Greenwood, Rosen, Weitzman & Myers (1966), and others.

Two Australian species: *(a) Prototroctes* Günther, 1864, (1) *P. maraena* Günther, 1864; *(b) Lovettia* McCulloch, 1915 (2), *L. sealii* (Johnston) 1883. The former has been recorded from New South Wales, Victoria, Tasmania, the latter is endemic to Tasmania. [The 'N and E. Tas.' of Munro (1957:30) is to be interpreted as including such rivers as the Esperance (county Kent) and Huon (Kent/Buckingham), which, though, strictly speaking, on the east coast of the Island, are generally spoken of as southern rivers (and are so treated in Blackburn's definitive paper (1950) on *Lovettia sealii*)]. In that paper the specific trivial name is rendered *seali*, a proceeding not in accordance with Opinions of the International Commission on Zoölogical Nomenclature. The genus *Lovettia* is represented only by the Tasmanian fish: however, *Haplochiton* [*Aplochiton*] Jenyns, 1842, in which it was originally placed by Johnston, includes 2 species from South America and nearby islands. A distinction between *Lovettia* and *Haplochiton* unknown to McCulloch when he established his genus has been noted by Blackburn; the genital opening and the anus being quite differently located in males and females of the former, but not in those of the latter, genus. *Prototroctes* is represented in New Zealand by *P. oxyrhynchus* Günther, 1870.

Key to TASMANIAN HAPLOCHITONIDAE

Body with scales. Lateral line on scales in hinder part of body only. Ventral orginating in advance of middle of standard length. No anal papilla. Depth $<$ 6 (about 4-4.5) in standard length; which is $>$ 100 mm (reaching about 250) - *Prototroctes maraena*

Body naked. Lateral line a series of pores in a linear depression, extending along most of body. Ventral originating at, or behind, middle of standard length. Anal papilla present; near origin of anal fin in female, in advance of ventral fin (commonly near pectoral fin) in male. Depth $>$ 6 (about 8-10) in standard length; which is $<$100 mm (seldom, if ever, exceeding 75) - - - - - - - - - - - - - *Lovettia sealii*

Genus LOVETTIA McCulloch, 1915

Lovettia sealii (Johnston), 1883

Haplochiton sealii Johnston, 1883, *Pap. Proc. Roy. Soc. Tasm.* (1882): 128. Type locality, Derwent R., Tasmania.

Lovettia sealii McCulloch, 1915, *Proc. Linn. Soc. N.S.W.*, XL, 2: 259, pl. xxxv, fig. 2.

Whitebait. The term whitebait is used differently in different countries, designating a variety of small fishes, usually from salt or brackish waters. McDowall (1964) quotes Graham (1956) as stating that in England the name is applied broadly to a mixed catch, made up mostly of young sprats, together with the young of shad, herrings, sticklebacks, and including even shrimps; in Japan to the young of the sea perch; in Germany and Italy to the young of various sea fishes: an editorial note in *Australian Fisheries Newsletter* of April, 1965 observes 'In U.S.A. it is used to describe *Meridia beryllina* in Atlantic coast States.' In New Zealand, while a number of conflicting opinions as to the nature of the

local whitebait have been advanced from the time of Powell (1869) onwards, 'there has long been general agreement among ichthyologists that whitebait are simply the juveniles of *Galaxias attenuatus*' (McDowall, 1964). He notes, however, 'in some parts of the country and at different times of the year, usually towards the close of the whitebait season, the whitebait run includes the young and adults of *Retropinna, Gobiomorphus,* and, during the last century, reputed *Prototroctes*. A second-class whitebait is sold on the Auckland fish market, and this is obtained from the sea. It includes the young of pilchards and other marine fishes and also juvenile *Retropinna*.' Recent investigations have shown species of *Galaxias* other than *G. attenuatus* are often represented in significant numbers, Woods (1963:29) defining whitebait as 'the transparent free-swimming and shoaling juveniles of at least five species of galaxias'; while, in the paper just cited, McDowall observes (p. 145). 'The "whitebait" of fishermen is thus primarily *G. attenuatus,* with *G. fasciatus, G. postvectis, G. brevipinnis* and probably *G. argenteus* making up a small proportion of the catch.' Earlier, Woods (1963:29) had included *G. campbelli* in the list, and McDowall (1966) confirmed his earlier (1964) conclusion that *G. argenteus* also has a marine whitebait stage in its life history. An account of the New Zealand whitebait fishery has been given by McDowall (1968). See also important papers by McDowall (1965) on the composition of the New Zealand whitebait catch of 1964, and by Woods (1968) on growth characteristics, pigmentation, and the identification of whitebait—on identification see further Scott (1968:5). For a general treatment see Whitley (1935).

Tasmanian whitebait in 1934. In Tasmania 'whitebait' is characteristically and traditionally applied to the haplochitonid *Lovettia sealii* (Johnston), 1883; though Johnston himself (1883:62) stated (apparently mistakenly; perhaps having in mind another run) the local whitebait consists essentially of the fish now known as *Retropinna tasmanica* McCulloch, 1920, accompanied in varying numbers by *G. attenuatus* (Jenyns), 1842 and *Atherina* spp. The composition of a sample of 200 individuals, caught in the Tamar River, Devon/Dorset, in September 1934, was noted in Part III (1936:113) as being 192 *Lovettia sealii* (*Lt* 41.5.-56.4), 7 *Galaxias attenuatus,* 1 *Galaxias* sp., probably *G. truttaceus* (58); while that of a second sample of the same size, taken in the Mersey River, near Latrobe, Devon, in the same month was 172 *L. sealii* (55-65), 23 *G. attenuatus* (38.5-52), 2 *G. sp.,* probably *G. truttaceus* (49-65). This apparently represents the first recognition of *G. truttaceus* in our whitebait.

Tasmanian whitebait, 1941-46. The effective fishery dates from 1941, procurement earlier usually being occasional and relatively small. In response to requests from a canning firm and from a Tasmanian organisation of professional fishermen, a comprehensive study was initiated by the C.S.I.R.O. (now C.S.R.O.); leading to the publication of the admirable paper of Blackburn (1950). Blackburn recorded that in 95 samples of whitebait totalling 79,958 specimens, taken from 14 rivers during 1942-46, the numbers of *G. truttaceus* (Cuvier), 1816, *G. attenuatus* (Jenyns), 1842, *Retropinna tasmanica* McCulloch, 1920, *Tasmanogobius lordi* Scott, 1935, *Ctenogobius tamarensis* (Johnston), 1883, *Atherinosoma tamarensis* (Johnston), 1883 were 1311, 204, 25, 30, 4, 1, or in all 1575 variants (2%); the variants predominating over *Lovettia* in only 2 of the samples, and being altogether absent in 57 samples. Of the 2 galaxiids, *G. truttaceus* was relatively more numerous in northern samples, at 20.25 per thousand as against 11.5; while *G. attenuatus* was relatively more abundant in southern samples, at 49.8, *cf.* 1.10. The scarce retropinnid stood at 0.60, 0.15 per thousand in southern, northern samples, respectively. The 3 other species, clearly adventitious, were met with only in northern material, *Tasmanogobius* occurring in 2 samples only. Blackburn noted 'statements by north coast buyers indicate that *Galaxias truttaceus,* the principal variant, does not run until late in the whitebait season'; and concluded 'it can safely be said that over 95 per cent. of the Tasmanian fish marketed as whitebait are *Lovettia*.'

Tasmanian whitebait, 1964. In 1964 the writer determined for the Inland Fisheries Commission upwards of 9000 fish in a number of samples from rivers in north-western Tasmania. Lynch (1966) has discussed changes in the species composition indicated by some of those data. His tabulation of 9 samples, 1 each from the Duck, Emu, Inglis, Rubicon, Leven, 2 each from the Forth, Mersey rivers, taken between August and November 1964, works out, by species, as follows: *Lovettia sealii* represented in 3 samples, 559 individuals (540 in one sample), 24.7% of total; *Galaxias attenuatus* 5, 1002, 44.3%; *G. truttaceus* 9, 358, 15.8%, *G. weedoni* 3, 340, 15.0%; *Retropinna tasmanica* 1, 5, 0.2%. Lynch records (p. 15) 'In the 1964 fishing season in the Forth River no whitebait *(Lovettia seali)* was taken in the catch up to the end of October. More than 90 per cent. of the catch by numbers was the fry of mountain trout (*Galaxias weedoni* Johnstone)'. [The proposal here advanced, to remove from the widely distributed *Galaxias truttaceus*—one of the two Tasmanian galaxiids commonly recognized by name by non-specialists—its genuinely vernacular and almost universally used title of mountain trout, and transfer this to the relatively unknown (and apparently rather local) *G. weedoni* would seem to invite confusion, and to have little likelihood of general acceptance.]. The emergence in the catch in significant numbers of *G. weedoni* Johnston, 1883 (a species inadequately collected and recognized since Regan's (1906) revision of the family; and, at the present time, better known in the juvenile than in the adult stage), not represented in the extensive 1942-1946 material of Blackburn, is a circumstance of much interest. McCulloch's species *Retropinna tasmanica* is inadvertently attributed in the paper cited to Johnston [who (1891) listed our smelt as *R. richardsoni* Gill—a synonym not noted in the Check-List (McCulloch, 1929:46).].

The rise in the commercial catch of Tasmanian whitebait from 1941 (in northern rivers, 1943) when the fishery was effectively initiated, to a peak in 1947 probably largely reflected increased interest in, and efficiency of, the industry. Total annual catches for these 7 years were (in thousand lb) 53, 46, 206, 206, 357, 774, 1,065. Then 1948, with a drop to 348, saw the beginning of a decline, probably largely attributable to overfishing, that continued till in 1956 the catch stood at 4 (increasing in 1963 to 12). The observations noted above would seem clearly to indicate that the period of decline was one, not only of absolute, but also of relative decrease in the abundance of *Lovettia.*

Tasmanian whitebait, 1964-1969. Since 1963 the industry has experienced a notable revival, the yearly catches from 1964-5 to 1968-9, as recorded in the March issue of *Australian Fisheries* for the years 1966-1970 [in 1966, title *Australian Fisheries Newsletter*] being (here given to nearest thousand lb) 41, 71, 95, 55, 82, respectively. It seems probable the increase is due, at any rate in part, to a significant regeneration in the *Lovettia* stock.

Tasmanian whitebait sample, 1970. No detailed investigation of the 1970 run has been undertaken: however, the presence in the market, at any rate upon occasion, of a pure or virtually pure supply of *Lovettia* may profitably be recorded—all fish in a (5-cent) sample of 128 individuals purchased in a greengrocery store in Devonport, Devon on 9 August 1970 proving to be the haplochitonid.

Despite its small size (largest reported individual a female of *Ls* 70) Lovettia is readily sexed, exhibiting marked sexual dimorphism in *(i)* the anatomy of the alimentary and urinogenital systems, observable externally [first recognized independently, by Professor V. V. Hickman and Mr A. V. G. Paddon; further investigated and figured by Blackburn (1950: 157, fig. 1)]; *(ii)* size of pectoral fin [Blackburn (p. 159)]; *(iii)* size of ventral fin [here reported from our material]. Sexual dimorphism in vertebra number was noted by Blackburn; he drew attention to reports by other workers of the existence of this very unusual condition in three osmerids; several of which exhibit also sex differences also in the size of some fins.

(i) In the female the urogenital papilla is median, and is located well back, in the customary position, either being partly embraced by the tips of the adpressed ventrals, or lying immediately behind in the short interval between them and the origin of the anal fin; the most conspicuous element is a tongue-like process, rather, or decidedly, longer than wide (clearly seen in Blackburn's photographs, pl. 1, figs 1, 2); this process is more or less tumid basally behind, the free portion being received, when laid back, in a subtriangular pit, bordered, in some individuals, with low ridges traceable back nearly to, to, or occasionally slightly past the anal origin; immediately in advance of the process is an elevated region that may perhaps be regarded as constituting the papilla proper, varying in form and development in our material (probably enlarging as oviposition approaches) from a compact mamilliform mass to an elongated ovoid mass or inflated ridge, and ranging in longitudinal extent from less than one-third to more than one eye-diameter: the minute urinary pore is located on the large process very close to its base, the larger genital opening lies against a median concavity in the outline of the base of the process, while the anus is just anterior to the rounded papilla or set on the forward elevated continuation of it: in our specimens the whole structure ranges from slightly less than one to more than two eye-diameters. In the male the urogenital papilla is median, and is placed well forward, characteristically between, or partly behind, the pectoral bases (Blackburn notes that it may occasionally occur further back, at various positions up to the pelvic girdle); it usually presents itself as a subtriangular process, often ending in two points; it in fact consists of two subtriangular lobes, commonly closely apposed (in the preserved material); a narrow groove wholly or partly separates their bases: the urinary opening lies at the base of the hinder flap, the genital opening in the groove, the vent in the anterior half of the front flap—there has thus come about the curious arrangement in which the intestine, after a short backward course, curves forward, to open beneath the stomach at a point anterior to its own beginning.

(ii) Blackburn describes the length of the pectoral fin in males as equal to the distance from snout tip to posterior margin of operculum; in females as equal to distance from snout tip to posterior margin of eye. In some of our males length of pectoral slightly exceeds length of head.

(iii) A third point of external difference between the sexes, not hitherto reported, but found in our material, is afforded by the greater size of the ventral fin in the male. Typically, in these specimens, length of ventral in females is equal to interval from opercular border about to, or a little beyond, middle of eye; in males from the same origin to about midway between eye and snout tip, at times almost reaching the latter. It is not possible to make a satisfactory comparison between the sizes of pectoral fins in Blackburn's photographs of 3 females (pl. 1) and 3 males (pl. 2); though the latter are perhaps a little longer. The standard figure of the species, that provided by McCulloch (pl. xxxv, fig. 2) in the paper in which he established the genus *Lovettia,* is of a female, the external genitalia being clearly depicted. It shows length of pectoral as exceeding distance from snout tip to end of eye, but shorter than distance from snout tip to margin of preoperculum: the length of the ventral as depicted is equal to distance from opercular border to a point below eye.

Of our 128 fish, 19 (14.9%) are females—*cf.* 30.99, 30.34 for Blackburn's 48090 northern, 30293 southern, examples.

Most of our females are in the first of the 4 stages of gonad development recognized by Blackburn in the classification of his material — the filling stage, with ovaries extending forward to region of stomach, but occupying only about two-thirds of body cavity; the eggs, as preserved, white, opaque, ranging in diameter from about 0.5 to about 1.0 mm. A positive correlation between number of large eggs (about 100-200) and size of fish was reported by Blackburn (table 5). In the present sample 3 females of Ls 47.9, 50.0, 52.0 bore 129,138,138 ova, respectively.

Of the females of the present sample, 4 are in the first of the 5 stages of pigmentation recognized by Blackburn ('no spots on the body, or less than 10 on the posterior part of the back'), 15 in the second stage ('spots numerous on the back, but not extending right to the head'): of the males, 1 is in the first stage, 39 in the second, 69 in the third ('spots on the back extending to the head, but less than 5 on the posterior end of each lateral line'). Within these broad classes there occurs of course considerable variation; thus, in the second stage the spots may be confined to the caudal peduncle, or may extend quite close to the head, and in the third stage there exist considerable differences in number, size, and intensity of the chromatophores. It should be observed that in both the first and second stages, with chromatophores on the back of the body absent or not

extending forward to head, the head itself is constantly spotted, often quite strongly, thus representing a separate site of pigmentation. Being concerned only with broad classes for the ready recognition and specification of degree of pigmentation, Blackburn devoted no attention to separate markings. One very conspicuous pigmentation pattern, well developed in all our females, has the form of two linear series of dark markings, each consisting of a number, modally about a score, of short black dashes (or dashes in association, usually anteriorly, with dots) that begin from, or near, a common point, about at level of opercular border, rapidly diverge, and run back, more or less parallel, but often with some approximation posteriorly, to about level of ventrals: anterior to its initial point of divergence, the marking may continue forward, as a median line of several segments or dots, on to the under surface of the head, between the branchiostegal membranes, reaching, as a maximum extension, to the point at which the membranes become contiguous, below the eye. In males this marking may be similar, but it is often less clearly developed, and not infrequently obsolescent or obsolete. No pigmentation on the lateral line is found in our material. On the head pigmentation varies considerably in disposition and amount: there are indications that pigmentation on the occiput may precede pigmentation elsewhere on the dorsum of the head. Lips experience pigmentation early, and there is commonly a cluster of chromatophores on the chin. Most individuals exhibit a regular line of 10-15 dots flanking the anal base on either side, the pigmentation often continuing caudad as two lines, a single line, or irregularly. Discrete internal pigmentation, clearly apparent through the body wall, is a noticeable feature of most females, the usual pattern being that of two longitudinal lines of melanophores, one on the lower part of each flank, modally beginning a head-length, or more, behind the operculum, and extending, with little or no interruption, to vent; each line is usually uniserial, but either or both may be biserial or, at least in part, triserial. Dissection shows these melanophores are located in the peritoneum. Internal melanophores can be detected in our males only by careful searching, in contrast to their conspicuous character in females: moreover, they originate at about level of pectorals, and usually extend back for a distance less than the distance of their origin from snout tip, *i.e.*, they are confined to the anterior half, or so, of the coelom occupied by the alimentary canal. However, in spite of an externally less obvious deposition of discrete pigmentation in males in the region traversed by the alimentary canal, the peritoneum in males tends, as noted by Blackburn, to be on the whole darker than in females; males in the present sample often having this whole region dark bluish. A dusky bar at caudal base is found in some individuals of both sexes. Of several minor instances of pigmentation found in some individuals the most constant is an arc of several melanophores outling part of the border of the operculum.

As preserved in alcohol, our specimens are largely dead white, touched here and there with yellow (exceptionally with yellow and some orange). The yellow occurs most commonly along the lateral line (either throughout its entire length or confined to its posterior part; the line of colour usually being in the former case more intense, and somewhat wider, posteriorly); on the occiput, and on other parts of the head, particularly the opercle, on base of caudal.

In Blackburn's material for which mean standard length by sexes is recorded the female value exceeds the male in all 44 northern samples (by 0.83 - 5.03 mm: mean (unweighted) 3.25), while in the southern material the female value is less than the male in 2 samples (by 1.04, 0.28), exceeding it in the remaining 22 samples (by 0.12 - 2.49; mean (unweighted) 1.17). In our sample female *Ls* exceeds male by 2.69, or by 5.7% of latter; $t = 2.10^{*}$. An interesting indication of the greater length of the female is afforded by the fact that of the 28 individuals in our sample of *Ls* $\geq$ 50, no fewer than 12 are female: however, the largest male, *Ls* 56.8, is longer than the largest female, 54.0.

Frequency distribution in 15 1-mm classes (42.0-42.9 . . 56.0-56.9): males 2, 6, 7, 19, 11, 25, 12, 11, 6, 7, 1, 0, 1, 0, 1; females 0, 0, 0, 1, 2, 1, 2, 1, 7, 2, 2, 0, 1, 0, 0.

Specification of standard length: 109 males, 42.2-56.8, $\bar{x}$ 47.28 $\pm$ 0.44, σ 4.57 $\pm$ 0.31 *V.* 9.7 $\pm$ 0.7; 19 females, 45.0 - 54.0 $\bar{x}$ 49.97 $\pm$ 1.74 σ 7.55 $\pm$ 1.23 V 15.1 $\pm$ 2.5. The male median is 47.1, the female 50.1.

Family SYNGNATHIDAE

Genus **UROCAMPUS** Günther, 1860

Urocampus carinirostris Castelnau, 1872

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

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

Series data. As remarked earlier in these studies, treatment in the literature of Australian syngnathids is in general confined to description of one or a few individuals, data based on a series of specimens rarely being available. Some first steps to fill the lack, based on samples ranging from small to moderate, have been taken in these observations—*e.g.*, *Mitotichthys tuckeri* (Scott), 1942, (1960: 87; 1964: 93), *Stigmatopora argus* (Richardson), 1840 (1963: 19), *Urocampus carinirostris* Castelnau, 1872 (1965: 58), *Syngnathus curtirostris* Castelnau, 1872 (1964: 85; 1966: 93). Some specifications are here given of a sample of 15 specimens of *Urocampus carinirostris* netted by Mr C. H. Rittmann in April 1970 at Hillwood, Tamar River, Dorset.

Standard length. The *Ls* range is 38.3-93.5, mean 68.89 $\pm$ 3.66, standard deviation 14.2 $\pm$ 2.6, coefficient of variation 20.6 $\pm$ 3.9; within $\bar{x} \pm \sigma$ there occur 11 entries (expected in normal distribution, 10).

Head, trunk tail as TLs. For head we find $\bar{x}$ 8.2 $\pm$ 1.4, σ 5.6 $\pm$ 1.0, *V.* 6.9 $\pm$ 1.3; for trunk, $\bar{x}$ 185.6 $\pm$ 17.8, σ 17.8 $\pm$ 3.2 *V.* 9.6 $\pm$ 1.8; for tail $\bar{x}$ 733.7 $\pm$ 4.9, σ 19.1 $\pm$ 3.5, *V.* 2.6 $\pm$ 0.5. For these dimensions the numbers of entries lying within the range $\bar{x} \pm \sigma$ are, respectively, 10, 10, 8 (expected, 10). The large coefficient of variation for trunk — more than one-third as great again as that for head, and well over thrice that for tail — is noteworthy.

Brood pouch. A brood pouch is present, or indicated, in 5 individuals as follows (specimens lettered in ascending order of magnitude of *Ls*). Specimen *(d)*, *Ls* 61.0, not fully developed, a groove along the first 7 caudal

rings; *(f), Ls* 69.5, slit for 9.3 rings (1st ring half only), extending 10 mm; *(m), Ls* 90.3, pouch 18 long, on 8.2 rings, with 12 pairs of embryo eyes visible; *(n), Ls* 91.0, 23 long, on 11.5 rings (very shallow on last ring), with 19 pairs of eyes visible; *(o), Ls* 93.5, 23 long, on 11.7 rings *(i.e.,* here, as in *(n),* about to level of base of dorsal).

Breeding season. Though little published information is available concerning the breeding season of Australian pipefishes it would seem, at any rate in some species, to cover a wide period. Some data on some Tasmanian forms are here summarized. *(i) Syngnathus phillipi* Lucas, 1891: pouch present, perhaps not fully developed 23 July (Part XI, 1963: 17, fig. 5); ovigerous, November, January, February (unpublished). *(ii) Syngnathus curtirostris* Castelnau, 1872: low pouch ridges on 1 of 9 examples, 4-5 August (XIV, 1966:95); ovigerous, November, January, February (unpublished). *(iii) Stigmatopora argus* (Richardson), 1840; ovigerous, January (XI, 1963: 20, fig. 7). *(iv) Lissocampus caudalis* Waite & Hale, 1921: ovigerous, November, January (unpublished). *(v) Ichthyocampus cristatus* McCulloch & Waite, 1918: pouch not fully formed, or in early regression, 20 July (XVII, 1970:36). *(vi) Mitotichthys tuckeri* (Scott), 1942: ovigerous, 4 November 1957 (IX, 1960: 88), ovigerous, November 1965 (unpublished). *(vii) Solegnathus spinosissimus* (Günther), 1870; ovigerous, 4 March, Maroubra, N.S.W., (Waite, 1895: 223). *Solegnathus fasciatus* (Günther), 1870: ovigerous, latter part of November (McCulloch, 1911: 27); ovigerous, 25 June (XI, 1963: 18, figs 6 *a, b, c). (ix) Urocampus carinirostris* Castelnau, 1872, pouch present or indicated in 5 of 15 specimens, April (above). For hippocampids, see Whitley & Allan (1958).

Opercular ridge. In view of the general constancy, through a wide range of species of the presence or absence (and, where present, the nature) of an opercular keel—with a few species, *e.g., Stigmatopora argus* (Richardson), 1840, exhibiting in juveniles a keel that is lost [normally: however, see Part IX (1960: 90)] in adults—and the significance accordingly attached to this feature as a specific criterion, it is indeed surprising to encounter in the present sample no fewer than 12 atypical keels, involving 8 individuals; the abnormality taking the form of a secondary keel (in one instance two such keels), arising as a branch from the primary, usually proceeding caudad (in 3 opercula cephalad), and swinging down away from it. An instance of two supernumerary keels has been reported (Scott, 1966: 93) for *Stigmatopora nigra* Kaup, 1853. For each case in the present material there are noted below, first, the point of origin of the branch, secondly, its approximate length (a gradual lapse to extinction renders difficult a precise determination of the end of some ridges), thirdly, the approximate distance between the terminations of the ridges—each value being expressed as an estimated decimal fraction of the length of the definitive keel, taken as unity.

Specimen *(d), Ls* 61.0, left operculum 0.5, 0.5, 0.3; right 0.6, 0.4, 0.3: *(f),* 65.5, left 0.7, 0.5 *(i.e.,* ending behind primary ridge), 0.25: *(i),* 69.0, left 0.3 (not quite in contact), 0.6, 0.2 (slightly sinuous, net direction almost horizontal): *(j),* 69.5, left 0.5, 0.65, 0.25; right 0.4, 1.0 ('branch' stronger than 'main ridge', the latter slightly convex upward), 0.5: *(k),* 70.4, right 0.5, 0.4, 0.25 (running forward; not strongly developed): *(l),* 75.9, left 0.5, 0.6, 0.3, a short second horizontal ridge 0.55, 0.3, 0.15; right 0.4, 0.35, 0.2 (running forward): *(m),* 90.3, left 0.3, 0.5, 0.3: *(o),* 94.1, left 0.7, 0.3, 0.2 (secondary ridge not well developed); right 0.4, 0.45, 0.25 (running forward; not strongly developed). An operculum 'with two distinct keels which join immediately behind the eye' has been described for *Syngnathus flindersi* (Scott), 1957, from South Australia: no instructed comment is possible without examination of specimens: however, inspection of the figure (1957, fig. 2) would seem to raise a question as to whether the upper ridge may perhaps represent, wholly or in part, an elevated delimitation of the superior border of the opercular plate.

While the typical course of the definitive keel — a downwardly convex curve with its posterior end about level with, or somewhat above, its anterior end — is exhibited, with tolerably fidelity, by 11 opercula, no fewer than 7 variants are to be found in the other 19 opercula, as follows: *(i)* downwardly convex, with anterior end the higher, 7 [*(c)* right; *(e)* right; *(g)* left; *(h)* left; *(k)* right *(l)* right; *(o)* right]; *(ii)* downwardly convex, posterior end unduly high, 5 [*(d)* left; *(f)* left; *(i)* left; *(j)* left; *(m)* left]; *(iii)* virtually straight ,sloping steeply down and back, 1 [*(f),* right]; *(iv)* virtually straight, virtually horizontal, 3 [*(c)* left; *(g)* right; *(n)* right]; *(v)* more or less straight and horizontal for most of length, turning down sharply posteriorly, 1 [*(b)* left]; *(vi)* more or less straight and horizontal for most of length, turning up sharply posteriorly, 1 [*(l)* left]; *(vii)* curving up sharply (convex upward), anteriorly, then running more or less straight and horizontal for most of length, 1 [*(j)* right].

Relative growth. Like the 1965 sample, the present material offers no unequivocal evidence concerning relative growth of head, trunk, tail — such as has been demonstrated in *e.g., Syngnathus curtirostris* Castelnau, 1872, *Mitotichthys tuckeri* (Scott), 1942 (see Scott, 1964: 86; 1965: 59, 1966: 94) — the correlations for lengths of these regions, expressed as millesimals of standard length, with standard length not exhibiting statistical significance ($r = 0.285, 0.012, 0.442$, respectively, all positive; $z = 0.293, 0.012, 0.475$).

Values of Conspectus items. Items of the Conspectus (Scott, 1961: 58) recorded for the present material are: trunk rings 9 (6 specimens), 10 (9); head in trunk 1.91 2.89*, $\bar{x}$ 2.29 $\pm$ 0.07, trunk in tail 3.28*-5.02, $\bar{x}$ 3.96 $\pm$ 0.14: previously recorded ranges of the two body-ratios noted were (1965: 58) 1.58-2.29, 3.42-5.34, respectively, the asterisked values thus extending each of the known ranges at one extreme. A count of 10 trunk annuli, here modal, does not appear to have been recorded for non-Tasmanian material (Munro, 1958: 88). For comparison with Munro's entry, combined head and trunk in tail 2-3, we have here 2.43-3.31, $\bar{x}$ 2.77 $\pm$ 0.07.

Genus **LEPTOICHTHYS** Kaup, 1853

Leptoichthys fistularius Kaup, 1853

Leptoichthys fistularius Kaup, 1853, *Arch. Naturg.* xix, 1:223 *(ex Typus fistularius* Bibron MS). Type locality, King George's Sound, Western Australia.

Regeneration, scute formation. A beach-dried specimen from Tomahawk Island, off Dorset, collected by Miss D. Cassidy in December 1969 (Q.V.M. Reg. No.

1970.5.26) provides an interesting case of what is apparently fin and segment regeneration after injury, and affords some evidence on the probable course of synthesis of the exoskeleton from primary elements here termed, for convenience of exposition, scutella.

In a normal individual of this species the caudal is long (longer, both relatively and absolutely, than in any other Tasmanian — possibly any other Australian — pipefish), its length being twice, or more, that of postorbital head, and subequal to that of the long dorsal base; and the last caudal annulus is longer than any other. In the present example, the caudal, which has the usual 8 rays, is 11, or about seven-tenths of postorbital head (15.5), and a little less than a quarter of dorsal base (44.5); the last complete caudal annulus is 4, the penultimate and antepenultimate being 8, 9, respectively.

In the fully developed exoskeleton each segment has the form of four sides of a box, fused with the preceding and following segments. On the ventral surface the tail appears to be constituted of two (or parts of two; see below) scutella, fused along the median line, the junction being indicated in the anterior half of the tail by a groove, in the posterior half by a ridge, which becomes progressively more distinct caudad: on the trunk there is present an additional scutellum, intercalated between the others, its width exceeding, in places being about double, their combined width; near the middle of its length this median scutellum is briefly expanded on each side in a rounded flap, giving here, and, perhaps less markedly, elsewhere, some indication of the scutellum overlapping its neighbours. On the dorsal surface of both trunk and tail two scutella meet in the midline of each segment, the anterior border of each forwardly convex, the posterior border forwardly concave, the line of junction being traceable, more or less clearly, usually as a shallow groove, at times as a slight ridge. On the lateral surface, the tail, as far forward as the scute immediately behind the base of the dorsal, presents two scutella, lying side by side: however, the dorsal is set on an elevated base, and the region cephalad of the fin termination, comprising 5 caudal rings and all those of the trunk (24), takes on a new character by the introduction of an azygous scutellum, fused above, in rather inconspicuous junction, with the almost straight lower border of the upper scutellum, apparently overlapped below by the strongly upwardly convex upper border of the lower scutellum. Ventrolateral and dorsolateral ridges demarcate the four faces, the former trenchantly developed through the whole postcephalic length of fish; the latter strong on tail, obsolescent on much of trunk. All four surfaces of the tail are more or less flat (the ventral completely so), at least forward to level of dorsal termination, in advance of which lateral and dorsal surfaces exhibit slight rounding. In the trunk the ventral surface is flat, the other surfaces tending towards flatness mesially, but having their borders rounded.

Inspection of the fully established exoskeleton leaves unresolved the question as to whether the angles along which the four surfaces meet represent lines of coalescence of adjoining scutella, or whether the change of direction of the face (enhanced visually by the presence of the ventrolateral and dorsolateral ridges) occurs more or less along the midline of a single scute, each half, or so, of which exists in a different plane. In other words, is the complete annulus a synthesis, on the one hand, in the trunk of 10 scutella [dorsal (1 + 1), lateral 2 (1 + 1 + 1), ventral (1 + 1] and in the tail of 8 [dorsal (1 + 1), lateral 2 (1 + 1), ventral (1 + 1)], or on the other hand, in the trunk of 6 scutella [dorsal ($\frac{1}{2}$ + $\frac{1}{2}$), lateral 2 ($\frac{1}{2}$ + 1 + $\frac{1}{2}$), ventral ($\frac{1}{2}$ + $\frac{1}{2}$)], and in the tail of 4 [dorsal ($\frac{1}{2}$ + $\frac{1}{2}$), lateral 2 ($\frac{1}{2}$ + $\frac{1}{2}$), ventral ($\frac{1}{2}$ + $\frac{1}{2}$]? Light is cast on the matter by an examination in the present specimen of the regenerating region just anterior to the caudal fin, where the development of the definitive scute is to be seen in progress. On the left lateral aspect two leaflike scutella, each about 4 long, rather less than one-third as wide, lie side by side longitudinally, their inwardly convex borders separated by a fontanelle occupied by a deep depression, the greatest width of which, at either end, approximates the greatest width (as exposed on ventral surface) of a single scutellum. This depression continues forward very briefly, partly to separate the rounded posterior ends of the scutella of the adjoining segment, the upper being overlapped by the upper scutellum of the developing segment, the lower being more or less fully fused with its partner. On the right lateral aspect the position is similar, except that here the ends of both scutella of the penultimate segment are overlapped. On the dorsal surface, what are clearly extensions (dorsad and mediad) of the developing scutella of the lateral surface curve inward from lateral ridge, but fail to meet in the mesial line, where their margins, only slightly convex inwards, are separated by a deep steep-sided groove, the width of which is, at the middle of their length, a trifle greater, at their ends a trifle less, than the width of the groove on the ventral surface. On the ventral surface, the margins of the scutella have wholly fused, though indications of their existence remain in the form of closely apposed ridges, extending for almost their entire length; again there are no signs of scutellum division at the tail angles.

The evidence afforded by these regenerating elements that scute synthesis in the tail is of the form ($\frac{1}{2}$ + $\frac{1}{2}$) receives support from still smaller rudiments lying behind those already described. Adjoining each of the latter, and extending back on to actual caudal base, there is at each interface angle an incipient scute, subtriangular or pyriform, which, on close examination, is found to have part of its small area in the lateral surface and part on either the dorsal or the ventral surface. In all these rudiments the course of the ventrolateral or dorsoventral ridge can be traced; with, however, some change of direction, coming to lie more on the lateral than on the dorsal or ventral face, possibly being pushed aside by the expanded bases of the uppermost and lowermost caudal rays, which extend between, and well cephalad of, them. In spite of their small size these scute elements are strongly sculptured, bearing the interfacial ridge and several longitudinal curved striae, separated by grooves. In the larger developing scutella just in front of them the general sculpture pattern of the normal lateral scute — an intricate system of grooves, striae (either continuous lines, or, more commonly, made up of closely set, or contiguous, or basally confluent minute mounds), and small mammilliform elevations — is almost fully established.

This specimen provides the second published record of this species in Tasmania, the first, based also on a beach-dried example, having been noted in Part IV of these Observations (1939).

Present length, with most of snout missing, 398; trunk 191; tail 172; eye 6.7; postorbital head 44.5; caudal 11. Annuli 24 + 20; suborsal 3.0 + 4.6. D.36. P.21/22. C.8. A.4, minute.

Genus **LISSOCAMPUS** Waite & Hale, 1921

Lissocampus caudalis Waite & Hale, 1921

Lissocampus caudalis Waite & Hale, 1921, *Rec. S. Aust. Mus.*, 1, 4: 306, fig. 46. Type locality, Kangaroo Island, South Australia.

Locality record. The first record for Tasmania (Scott, 1961: 61) was based on 3 specimens from Fisher Island, Bass Strait, collected by Mr B. C. Mollison: the species has not hitherto been formally recorded from the Tasmanian mainland, but now may be, 2 examples having been collected by Mr R. H. Green at Green's Beach, Devon, in January, 1969.

Disposition of ova. Though the brood pouch of this species has been figured by the writer (1961, fig 3 d), no account of the disposition of the ova appears to be available. In the smaller individual the marsupium extends over the first 15 caudal rings, occupying 0.28 length of tail. Viewed from the left side, it presents a proximal row of 13 pronounced bulges, of which 2 at either end are free, the remaining 9 being capped by a distal row of 12: of the 2 anterior separate bullae, the second rises much higher than the first, reaching well above level of base of external series; the 2 posterior free items are subequal in height, a little taller than the first of the anterior pair. On the right side the arrangement, proceeding caudad, is: low free bulla; high free bulla, reaching to halfway up the distal row; 9 proximal, surmounted by 11 distal; one very high, extending right to outer margin of distal row; a pair of moderate-sized proximal bulges, capped by a pair of equal-sized distal ones; a single moderate proximal item. The ova, modally about 1.7 long, with modal transverse extent as they lie close together in pouch of about 1.2, number 43. In the bottom (internal) layer they are arranged thus: 1 + 1 + 9 (2) + 1 + 1 = 22; in the top layer 0 + 10 (2) + 1 = 21. Embryo white, yolk sac yellow. Total length of embryo, straightened out, about 4; head 1.1; eye 0.4, about twice length of snout, which is relatively very wide, moderately pigmented.

Counts, dimensions. The ovigerous individual is cited first. Annuli 11 + 54; 11 + ?55. Subdorsal annuli: from 0.9 of penultimate body ring to 0.2 of second caudal ring = 2.3; from 0.0 of last body to 0.2 of second caudal = 2.2. D. about 11; 12. C. 10; 10. P. 5/6; 6/6. A. not seen; short, broad, 3 lobes, each with a ray. Head 5.5; 7.0. Snout 2.0; 2.5. Eye 1.0; 0.9. Interorbital 0.9; 1.1. Length of pectoral 1.6; 1.7. Length to dorsal origin 18.4; 21.0, base 2.0; 1.9. Length to vent 19.1; 21.5. Length to front of pouch 19.8, to end 37.4. *Ls* 75.0; 76.1. *Lt* 76.2; 77.8.

Synopsis entries. The material provides values that represent one or more new extremes for 4 of the 11 items recorded in the Synopsis of Tasmanian syngnathids (1961:58), as follows: annuli now 11-12 + 54-60 (formerly 12 + 56-60); subdorsal 1.1 + 2.0 (0.2 + 2.0); snout in head 2.7-3.4 (2.7-3.1); head in trunk 2.1-2.6 (2.2-2.6).

Comparison with Fisher Island material. While it is not proposed here to institute a comprehensive comparison of the metrical characters of the earlier sample and the present one, half a dozen dimensions, calculated as thousandths of total length, may profitably be collated. Entries below are arranged with specimens in ascending order of *Lt* (for Fisher Island specimens, *Lt* 100.5 (male), 91.0, 68.0). Trunk 163, 179, 186, 180, 165. Length to dorsal origin 232, 241, 270, 241, 222. Dorsal base 29, 26, 24, 29, 28. Length of pectoral 21, 21, 22, 20, 19. Length of caudal 21, 16, 22, 23, 19. Length of brood pouch 231, 259.

Family NANNOPERCIDAE

The small endemic Australian freshwater fishes now generally placed by local authors—*e.g.*, Munro (1961), Scott (1962) — in the family Nannopercidae have been (and continue to be) moved round among a number of families, for example, Percidae (Johnston, 1891), Centrarchidae (McCulloch & Waite, 1918; Waite, 1921), Kuhlidae (McCulloch, 1927; Greenwood, Rosen, Weitzman & Myers, 1966), Hyperlectrodidae (McCulloch, 1929), Serranidae (Lord, 1923; Lord & Scott, 1924; Berg, 1940), Nannatherinidae (Whitley, 1960).

Of the general *Nannoperca* Günther, 1861, *Paradules* Klunzinger, 1872, *Microperca* Castelnau, 1872, *Edelia* Castelnau, 1873, the first and last only are now generally recognized (Whitley, 1960; Munro, 1961); the former of these having the preorbital rounded and entire, the latter with it angular and serrated.

Four species, all referred to *Nannoperca*, are recognized in the Check-List (McCulloch, 1929): (1) *N. australis* Günther, 1861, type locality, Murray River (synonyms, *Paradules leetus* Klunzinger, 1872 — emended in 1879 by Klunzinger to *P. laetus* — type locality, Murray River; and ? *N. riverinae* Macleay, 1881, type locality, Murrumbidgee River); (2) *N. tasmaniae* (Johnston), 1883, type locality, River Esk, Tasmania; (3) *N. obscura* (Klunzinger), 1872, type locality, Yarra lagoon, Victoria (synonym, *Microperca yarrae* Castelnau, 1872, type locality, Lower Yarra River, Victoria); (4) *N. vittata* (Castelnau), 1872, type locality, freshwater, interior of Western Australia (synonym *Edelia viridis* Castelnau, type locality, freshwater, interior of King George's Sound, Western Australia).

In their review of the family, McCulloch & Waite (1918) treat *Nannoperca* and *Edelia* as subgenera (of *Nannoperca*). *N. australis* and *N. tasmaniae* are regarded as specifically distinct; but are not distinguished between in their key (p. 45). Waite later (1921) listed Johnston's species as a queried synonym of Günther's: short notices by the present writer (1935: 66; 1942: 48) failed to provide any criteria for differentiating between them. In their 1918 paper Waite & Hale remark 'Günther's original account of *Nannoperca* included some important errors which have caused some confusion: he observed no lateral line, whereas his figure shows a very distinct canal, which, however, is quite different from what is actually found in the genus'.

Referring (3) and (4) to *Edelia*, Munro (1961) recognized in *Nannoperca* two species: *N. oxleyana* Whitley,

1940, range, fresh waters on Moreton Island, Queensland, and Richmond River, northern New South Wales; *N. australis* with two subspecies, *N. australis australis* Günther, 1861, Murray-Darling system, New South Wales and South Australia, and coastal streams, southern Victoria, and *N. australis tasmaniae* (Johnston), 1883, Tasmania and King Island. [While King Island and Flinders Island are each, politically, part of the State of Tasmania which is itself politically part of Australia, the convenient convention is here adopted by speaking of Tasmania, King Island, (county of same name), Flinders Island, county of Flinders, and Australia, without qualification, as four distinct and independent localities. The Flinders Island here mentioned is the largest island of the Furneaux Group, in Bass Strait, off the northeastern corner of the island of Tasmania: a second, much smaller Flinders Island lies off the west of Eyre Peninsula, South Australia]. Species (3) and (4) of the Check-List series are referred to *Edelia*.

The present paper reports the results of an examination of 7 specimens of *N. australis,* 15 specimens of *N. tasmaniae,* 2 fish from King Island *(N. tasmaniae?),* and 4 fish from Flinders Island — the last-named being nominated as the types of *Nannoperca australis flindersi subsp. nov.*

Genus **NANNOPERCA** Günther, 1861

Nannoperca australis Günther, 1861

Nannoperca australis flindersi subsp. nov.

Description. Body oblong, compressed. Greatest depth 2.8-2.9, depth at vent 3.3-3.6, head 2.8-2.9, in standard length. Eye 3.6-3.9 in head; greater than, 1.16-2.29, snout; equal to, or less than (0.92-0.98), interorbital. Jaws equal. Maxilla with supplemental bone; fails to reach level of eye by 0.1-0.15 eye-diameter. Narrow bands of villiform teeth in jaws and on vomer. Preorbital entire, rounded. Preoperculum entire. Operculum with a double spine or two closely apposed spines; flat; not projecting beyond membranous border. Anterior nostril a short tube, its diameter exceeding its height, the opening subcircular; about equidistant from orbit and preorbital border. Posterior nostril a simple oblique elliptical opening, close to orbit at, or slightly behind, level of front of pupil. Open pores on top of head, along upper part of operculum, around preoperculum, on mandible. D. vii; i; 10; a deep notch, extending down almost to trunk, between spinous and soft portions; length to origin of fin 454-470 *TLs;* length to termination of spinous portion 599-630, of soft portion 767-791; 2nd spine longest (1.02-1.12 3rd, 2.1-2.5 spine of second dorsal, 2.2-2.5 in head). A. iii, 8; originating at 640-673, terminating at 807-824 *TLs;* 3rd spine slightly longer than (1.02-1.06) 2nd, 1.7-2.0 1st, 3.1-3.4 in head. Pectoral 11-12; inserted in advance of ventrals, at 0.85-0.89 of length to latter; longest ray (6th) 1.9-2.2 in head; longer than 3rd dorsal spine. V. i, 5; inserted at 380-390 *TLs;* whole fin, longest (2nd) ray, spine 1.7-1.9, 1.9-2.3, 3.1-3.5, respectively, in head. Caudal with 17-18 main rays; rounded; its length, from hypural joint, 5.1-5.4 in rest of fish. Scales ciliated; covering whole of body, operculum, cheek, dorsum of head from level of first pair of pores caudad of posterior nostrils to a variable point between pores and nostrils Scales from shoulder to hypural joint 30-31; 2-3 on caudal base. Transverse scales $2\frac{1}{2}$ + ($9\frac{1}{2}$-$10\frac{1}{2}$). Predorsal scales becoming smaller and confused on dorsum of head; *ca.* 18-21. Lateral line represented by two series of tubules, upper terminating near, lower originating near, level of dorsal notch; but pattern may differ on the two sides of the fish, and part, or all, of a series may be missing; upper line with 0-8, lower with 0-6 tubules (in types, means 5.1, 3.6). Gillrakes on anterior arch (2 + 8-9).

Coloration, after preservation in alcohol. Lateral surface of trunk and tail above the general sense of a line from pectoral base to near end of anal dark olivaceous brown, tending to be darker anteriorly, darkening also near the superior profile to merge with the dorsal surface, which approaches black; numerous irregular dark patches and mottling of various sizes, one constant dark area occurring above pectoral base; no clear indication of presence of dark horizontal bands on body (or head): flank below the olivaceous brown, belly, throat pale yellowish, immaculate or with a few small dusky smudges: some 6-12 heavily pigmented scales at base of caudal, modally forming a rather distinct dark spot, at times reduced to a somewhat obscure darkish bar. The light yellowish of the lower flank continuing forward over the head, increasing in vertical extent to reach about lower border of orbit; variably mottled with brownish and blackish, the most discrete markings a series of 4-6 spokes at border of operculum; above light region, darkening more or less rapidly to become black or bluish black on dorsum of head; lower lip dark mesially, lightening, usually very markedly, laterally; upper lip with more extensive, and in general rather deeper, darkening. First dorsal rather dark olivaceous or brownish, the spines slightly darker than the membrane. Rays of second dorsal varying from light to dark brownish; first ray, or first few rays, sometimes also distal half, or so, of some succeeding rays darker than the rest; membrane ranging from colourless to pale brownish and/or bluish. Anal proximally whitish, distally brownish, usually becoming, especially in anterior part of fin, black: in 3 individuals most anal rays ranging, after brief proximal whitish portion, from black to blackish brown posteriorly, membrane mostly brownish; in 1 individual (female?) the same colour pattern appears but the coloration is very much less intense. Pectoral pale, the rays outlined very slenderly with blackish; base with yellowish and pale brownish areas, variable in extent, either region with or without brownish punctulations. Ventral briefly whitish basally, whitish to a variable extent on inner rays, otherwise dark brown and/or black; in largest specimen (? female) white, with faint duskiness along one or two inner rays. Caudal rays pale greenish or yellowish green, with darker, brownish borders, finely peppered with reddish; membrane hyaline, with minute reddish punctuations, best developed in a strip along the middle, or in two strips along the sides, of each interradial membrane slip.

Affinities. The Flinders Island fish differs trenchantly from *N. oxleyana* Whitley, 1940, from Queensland and New South Wales *(i)* in possessing a lateral line, *(ii)* in having 30-31, instead of 25, scales in longitudinal series, *(iii)* in lacking the conspicuous orange-edged black ocellus at caudal base. It is clearly to be regarded as a subspecies of *N. australis.*

It is readily distinguishable from both *N. a. australis* Günther, 1861 and *N. a. tasmaniae* (Johnston), 1883 by the fact that the maxilla (which possesses the characteristic supplemental bone) fails to reach level of orbit (by 0.1-0.15 eye-diameter), while extending in the other forms beyond orbit. With the dimensions length to termination of first dorsal, length to origin of anal expressed as millesimals of standard length, we find *(i)* in *N. a. australis* the mean of the former is significantly greater ($t = 2.23$*) than the mean of the latter (means are recorded in table 1); *(ii)* in *N. a. tasmaniae* the means are equal (their exact equivalence being of course a sampling accident); *(iii)* in *N. a. flindersi* the mean of the latter is significantly the greater ($t = 4.45$**). In the 2 fish from King Island (referable, on current views — cf. Munro (1956: 155)—to the Tasmanian subspecies) the position is as in the Australian subspecies, but the means are not significantly different ($t = 2.84$), nor is there a significant difference between the anal origin means of the King Island and Tasmanian samples ($t = 1.12$).

A number of proportional differences between the Flinders Island specimens and the examined material from other sources are summarized in table 2. This records a series of features for each of which there exists a significant difference between the mean values in one pair, or more than pair, among the four samples (taking into account all six two-locality combinations); t values and their significance being reported, and an indication being given as to which sample has the higher mean in each locality pair. Of the 13 characters, the first 7 are calculated from *TLs* values, the remainder (all ratios) are calculated directly from measurements (mm). It will be seen that statistically acceptable differences between the Tasmanian and Flinders Island sample means are found in 11 instances; between the Australian and Flinders Island sample means in 5.

N. a. australis is described by Munro as having '2 distinct horizontal bands, lower continued on to snout', and *N. a. tasmaniae* as having 'irregular dark patches scarcely forming two horizontal bands except on head' (in our Tasmanian material there is usually a tolerably clear indication of one band, more or less continuous or considerably interrupted, extending from eye back along head, and along flank at least to a point somewhere below dorsal base, not infrequently continuing on to caudal peduncle). No such markings are apparent in the Flinders Island fish. The dark spot or bar at caudal base in this subspecies, described above, is detectable in most of the Australian and Tasmanian specimens, but in a more diffuse decidedly less conspicuous form.

Dimensions as TLs. A series of dimensions for the sample of *N. a. flindersi*, expressed as thousandths of standard length, is set out, along with the corresponding entries for the samples of *N. a. australis* and *N. a. tasmaniae* (together with the values for the 2 King Island fish) in table 1, range, mean, standard deviation and coefficient of variation, the last three accompanied by their standard errors, being reported (standard deviation calculated from $\sigma = \sqrt{\frac{\Sigma (x - \bar{x})^2}{N}}$

Types. Described from 4 specimens, standard lengths 44.9, 49.1, 33.2, 37.4 mm, from Lackrana, Flinders Island Furneaux Group, Bass Strait, collected by Masters P., R., and C. Rhodes, 1 September 1969. The second largest individual is designated as holotype, the others as paratypes. Holotype and one paratype deposited in the Queen Victoria Museum, Launceston (Reg. No. 1970.5.25). One paratype will be offered to the British Museum (Natural History), London, one to the Australian Museum, Sydney.

The subspecific name is in honour of Matthew Flinders (1774-1814), who made a survey of the Furneaux Islands in 1798.

Nannoperca australis australis Günther, 1861

Nannoperca australis Günther, 1861, *Proc. Zool. Soc. Lond.*: 116, pl. xix, fig. 2. Type locality, Murray River.

Material. The material used in the present investigation has been made available by courtesy of the Director, South Australian Museum, Adelaide, through the kind offices of Mr C. J. M. Glover, Ichthyologist at that institution. The data on the labels may be summarized as follows. Specimen *(a)*, *Ls* 52.1, *Lt* 63.7; locality, Narrandera, Murrumbidgee River, N.S.W.; November 1919; Reg. No. F. 573 (originally Aust. Mus. I. 13593, part); a second label, also giving the Aust. Mus. number, notes 'Figured specimen' [probably that depicted in the illustration (pl. II, fig. 1)] accompanying the synoptic account of *Nannoperca* by McCulloch & Waite (1918), who note (p. 46) 'The specimen figured is 65 mm. long and was taken near Narrandera, on the Murrumbidgee River, New South Wales'. Specimens *(b)*, *(c)*, *Ls* 47.2, 43.9: South Australia; collector Geisler; 14/8/17; Reg. No. F.446; a second label records 'placed in upstairs aquarium Aug. 14th 1917. Died Dec. 5th 1918'. Specimens *(d)-(g)*, *Ls* 35.0, 34.9, 32.0, 29.6: Murray River, South Australia; collector P. A. Geisler; 1915. Reg. No. F.57. All primary labels record the determination is by C. J. M. Glover. Throughout the present investigation this material is designated simply as Australian.

Dimensions as TLs. These are recorded in table 1.

Comparison with other material examined. See tables 1, 2; also discussion above on affinities of *N. a. flindersi*.

Comparison with Handbook diagnosis. Comparison of specifications of the material here examined with the diagnosis of the subspecies given in the Handbook (Munro, 1961: 154, fig. 941 [figure reproduced from McCulloch & Waite, 1918]) reveals in general good agreement. However, some differences are found, as follows (Handbook diagnosis first, followed, after semicolon, by specification of present sample). Depth in *Ls* 3.2-3.6; 3.0-4.4, $\bar{x}$ 3.45 $\pm$ 0.13. Head in *Ls* 3; 2.8-3.0, $\bar{x}$ 2.96 $\pm$ 0.03. Eye in head 3.8-4; 3.4-4.0, $\bar{x}$ 3.66 $\pm$ 0.08. 'Eye slightly greater than snout'; snout 1.0-1.4 $\bar{x}$ 1.23 $\pm$ 0.05 in eye. 'Eye less than interorbital'; eye ranging from less than (0.93) to greater than, 1.32), averaging greater than (1.08 $\pm$ 0.05) interorbital: see discussion of this ratio below. D. vii; i, 8-9; D. vi-vii; i, 9-10 (4 specimens with vii; i, 9: 1 each with vi; 1, 9: vi; i, 10). Maxilla reaches 'to below front of pupil'; to 0.05-0.2 $\bar{x}$ 0.15 $\pm$ 0.02 of eye.

Additional specifications. A. iii, 6-8 (in agreement with Handbook), 2 examples with 6 rays, 3 with 7, 2 with 8. With both dimensions expressed as *TLs,* mean length to anal origin is in this material significantly less than mean length to last spine of first dorsal (see above, discussion of affinities of *N. a. flindersi);* and the former dimension is here less (table 1), and significantly less (table 2) than in the Tasmanian, the Flinders Island, and the King Island samples.

Nannoperca australis tasmaniae (Johnston), 1883.

Microperca tasmaniae Johnston, 1883, *Pap. Proc. Roy. Soc. Tasm.* (1882): 110 Type locality, R. Esk, Tasmania.

Material. 15 examples from a series collected by Mr R. H. Green and Mr R. Vogelpoel on 21 January 1962 in a swamp about 2 miles south-west of Tullendena.

Dimensions as TLs. See table 1.

Comparison with other material examined. See tables 1, 2; also discussion above on affinities of *N. a. flindersi.*

Comparison with Handbook diagnosis. Comparison of the specifications of the material here examined with the diagnosis of the subspecies given in the Handbook (Munro, 1961; 154, fig. 942) — figure, rather poor, a sketch by R. M. Johnston of his *Microperca tasmaniae,* reproduced by Whitley (1929, pl. III, fig. 1) in his redaction of Johnston's notebooks — reveals general agreement: certain differences are noted below (Handbook diagnosis first, followed, after semicolon, by present data). Depth in *Ls* 3.4-3.5; 2.8-3.3, $\bar{x}$ 3.03 $\pm$ 0.03. Head in *Ls* 3-3.4; 2.9-3.2, $\bar{x}$ 3.08 $\pm$ 0.03. Eye in head 3-3.5; 3.3-3.8, $\bar{x}$ 3.61 $\pm$ 0.01. Eye 'greater than snout'; eye 1.2-1.5, $\bar{x}$ 1.33 $\pm$ 0.004 snout. Eye greater than interorbital; eye less than (0.80-0.99, $\bar{x}$ 0.92 $\pm$ 0.02) interorbital: see discussion of this ratio below. Maxilla reaches 'to below front of pupil'; to 0.2-0.3, $\bar{x}$ 0.22 $\pm$ 0.03 of eye, or from about half to end of prepupillary eye. D. vii-viii; i, 7-9; D. vi-viii; i, 9-10, the distribution being vi; i, 9 (7 specimens), vi; i, 10 (5), vii; i, 9 (2), vii; i, 10 (1). A. iii, 7-8; A. iii, 7-10, the distribution being iii, 7 (5), iii, 8 (9), iii, 10 (1).

Additional specifications. With both dimensions expressed as *TLs,* mean length to anal origin is equal to mean length to last spine of first dorsal (use of raw measurements gives their ratio as 0.99): contrast *N. a. australis* (first dimension the lesser) and *N. a. flindersi* (first dimension the greater). For a note on coloration in this subspecies, see discussion, above, of affinities of the Flinders Island form.

Relative growth. Predictably, there exists a significant negative correlation ($r = -0.79$, $z = 1.08$, $t = 4.65^{**}$) between relative diameter of eye *(TLs)* and *Ls.*

Of the 8 simple dimensions *(TLs)* appearing in table 2, 2 exhibit a significant correlation, in each case a negative one, with *Ls,* namely, length to termination of first dorsal ($r = -0.60$, $z = 0.69$, $t = 2.71^{*}$), and length to origin of anal ($r = -0.67$, $z = 0.81$, $t = 3.23^{**}$): the two dimensions are themselves positively correlated at $r = +0.60$, $z = 0.69$, $t = 2.69$.* Differences between sample *Ls* means are not large — the means being Australia 39.2, Tasmania 44.99, Flinders Island 38.65, King Island 32.0. The unfortunate numerical smallness of the samples precludes the drawing of a wholly satisfactory conclusion: on the available evidence, however, the differences in relative positions of first dorsal termination and anal origin to which attention has earlier been called may well represent a genuine point of distinction.

Distribution. The distribution of Johnston's fish was originally noted as rivers in northern Tasmania, this species (like *Gadopsis marmoratus* Richardson, 1845, of the strictly Australian family Gadopsidae) occurring, in this State, only in waters discharging into Bass Strait. Some five years after its description, however, Johnston himself (1888: 74) reported it from King Island also (Yellow Rock Creek). King Island examples are treated in the Handbook as *N. a. tasmaniae.* Two specimens from King Island, collected at Pass River on 13 March 1970 by Mr M. T. Templeton, that came to hand after the present investigation was begun exhibit some differences from the fish of our Tasmanian sample that seem worthy of being reported.

King Island specimens. Inspection of table 2 shows that, of the 13 features dealt with, there are 4 for which the mean values of the Tasmanian and King Island samples are significantly different. The King Island values for these are: interorbital, as *TLs,* 72-86, $\bar{x}$ 79.0 $\pm$ 4.70 (*cf.* Tasmania 87-108, $\bar{x}$ 99.0 $\pm$ 1.6); interorbital in eye 1.3-1.3, $\bar{x}$ 1.29 $\pm$ 0.02 (cf. 0.80-0.99 $\bar{x}$ 0.92 $\pm$ 0.02); eye in head 3.1-3.2 $\bar{x}$ 3.19 $\pm$ 0.02 (*cf.* 3.3-3.8, $\bar{x}$ 3.61 $\pm$ 0.01); maximum depth in *Ls* 3.2-3.6, $\bar{x}$ 3.41 $\pm$ 0.12 (*cf.* 2.8-3.3 $\bar{x}$ 3.03 $\pm$ 0.03). With both dimensions expressed as *TLs,* mean length to anal origin exceeds length to first dorsal termination (Tasmania; these dimensions equal), but the difference between them is not statistically significant ($t = 2.84$); nor is the difference of the means of either of these dimensions, as between the examples from the two localities significantly large ($t = 1.22$, 0.83, respectively). The difference of *TLs* means of length of snout in King Island and Tasmanian samples is highly significant ($t = 3.14^{**}$). Differences in length of some fin rays and spines in table 1 are probably to be regarded as of little, if any, diagnostic significance

In coloration the King Island fish differ from our Tasmanian fish in having anterior one-third, or rather more, of spinous dorsal, tips of rays of soft dorsal, anterior one or two anal rays and tips of the others, wholly black, the Tasmanian examples examined having these regions either pale and uniform with the other parts of the fin, or distinguished from them by being somewhat darker, olivaceous or brownish, without trace of black. In the larger individual the whole dorsal surface and the upper half of the sides of the snout, the lips, the interorbital, and the occiput are black; in the smaller the black is confined to the lower lip and to a narrow region bordering the orbit, forming a band, about one-fifth as wide at its maximum as total interorbital width, and continuing, progressively narrowing, round most of eye: this black is not present in the Tasmanian material.

It is evidently desirable that a detailed comparison should be made of long series of specimens from King Island and Tasmania; the material from each source preferably including subseries from different localities: till this is done the status of the King Island *Nannoperca* must remain uncertain.

SUBSPECIFIC DIFFERENTIAE: INTERPRETATION OF PRESENT RESULTS

Some consideration needs here to be given to the significance to be attached, first to certain characters employed as subspecific differentiae; secondly, to the results, some somewhat unexpected, of the present inquiry.

Factors that call for comment are *(i)* degree of extension of the maxillary; *(ii)* eye relative to interorbital; *(iii)* number of dorsal spines and rays; *(iv)* relative location along anteroposterior axis of fish of termination of first dorsal and origin of anal; *(v)* coloration. *(i)* McCulloch & Waite, who treated the Australian and Tasmanian fish as distinct species (without, however, separating them in their key), note of both (1918: 45) 'maxillary reaching to below orbital margin', and their figure (of *N. australis*) shows it reaching about halfway to pupil; the Handbook specifies for each of the two subspecies recognized by Munro 'to below front of pupil'; in all our Australian examples it reaches past orbital margin from one-sixth to half the distance to pupil; in our Tasmanian material from about one-third of distance to pupil right to front of pupil. Also, in *N. oxleyana* Whitley it extends 'to below anterior part of eye.' It would seem, therefore, the failure of the maxilla in the Flinders Island fish to reach as far as orbital margin (by at least 0.1 eye-diameter) satisfactorily differentiates this form at the suggested subspecific level. *(ii)* Günther's original description of *N. australis* as given in Macleay (1881: 392), states 'The eye is much wider than the interorbital space'. Apart perhaps from coloration, the feature, diameter of eye relative to width of interorbital, provides, in the Handbook diagnoses, the only trenchant difference between *N. a. australis* and *N. a. tasmaniae,* the former being described as having eye less than, the latter greater than, interorbital: however, in our Australian material eye ranges from less than (0.93) to greater than (1.32), averaging greater than (1.08 ± 0.05) interorbital, while in our Tasmanian sample eye, instead of being greater than, is less than (0.80-0.99, $\bar{x}$ 0.92 ± 0.02) interorbital. It may be observed that in *N. riverinae* Macleay, 1881 (type locality, Murrumbidgee River) the eye is reported as less than distance between orbits. McCulloch & Waite (1918: 341) state 'Macleay later regarded his *N. riverinae* as synonymic with *P. laetus*', adding 'although according to his scale counts ['L. lat. about 24'] the identity would seem improbable: since however, the type of his species is not now to be found his opinion must be accepted.' Both Macleay's and Klunzinger's species are read by them as synonyms of *N. australis* (Macleay's with a question mark), a course followed in the Check-List: they are now conventionally subsumed definitively in Günther's species (*cf.* Munro, 1961; Whitley, 1960, 1964). [In passing, could Macleay's species, with its lateral line count of 'about 24', possibly be *N. oxleyana* Whitley, with 25?]. The marked differences in respect of the eye-orbit ratio here disclosed must raise the important issue of the significance to be attached to this criterion: is some difference in measuring procedure involved; or is the character less constant than hitherto assumed, varying perhaps in different localities within the presumed subspecific region? *(iii)* Though the Handbook gives dorsal formula for *N. a. australis* as vii, i, 8-9, and that for *N. a. tasmaniae* as vii-viii; i, 7-9, McCulloch & Waite earlier gave a minimum count for first dorsal of vi; while our counts for the two subspecies, recorded above, are vi-vii; i, 9-10 and vi-viii, respectively; for *N. a. flindersi* we find D. vii; i, 10, and for the 2 King Island fish D. vii; i, 9-10. *(iv)* The differences here found in relative length, as *TLs,* between termination of first dorsal and origin of anal — values equal in *N. a. tasmaniae,* mean length to anal origin the lesser value in *N. a. australis,* the greater in *N. a. flindersi* — are in part of statistical validity only. The greater value for length to first dorsal termination occurs in 6 of 15 Tasmanian fish; in 5 of 7 Australian fish (with values equal in one specimen); in no one of the 4 Flinders Island fish, the feature thus in this instance being a constant one *(v).* In general, coloration in the samples here examined conforms with the brief accounts in the Handbook; attention may be called, however, to some points of difference between the Tasmanian and King Island specimens, noticed above in account of the latter.

It will have been observed that the samples here dealt with are decidedly small numerically; and the statistical procedures to which they have been subjected may well seem on the face of it to be unduly elaborate: it is possible indeed that such is the case. However, it was early found that tests of significance of difference of means of several characters commonly regarded as of diagnostic value yielded statistically significant results. Calculations covering a number of other features were accordingly made: in view of the consistency of these and the earlier computations, it has been thought expedient to report the data in full; the more so that attempts to secure additional material have remained hitherto unsuccessful.

An instructive indication of the approximation to the normal frequency distribution (a condition for the appropriate employment of the statistical methods adopted) exhibited by the features studied is afforded by an examination of the number of variates lying within the range $\bar{x} \pm \sigma$ (in normal distribution 68%). Taking the 33 *TLs* entries in table 1, we find for 7 Australian specimens the number of cases within $\bar{x} \pm \sigma$ is 3 (2 cases), 4 (10), 5 (16), 6 (1), with an average of 4.6 (expected, 4.8) [29 items only in this sample based on 7 specimens: of the remaining 4 entries including one or more imperfect individuals, 2 have 3 (expected, 4), 1 has 4 (expected, 4), 1 has 3 (expected, 3)]: for 15 Tasmanian specimens we find 8 (1), 9 (6), 10 (10), 11 (10), 12 (5), 13 (1), with an average of 10.5 (expected, 10.3); for 4 Flinders Island specimens 2 (12), 3 (20), 4 (1), with an average of 2.7 (expected, 2.7).

It is evident that though this inquiry is tolerably intensive, it remains, unavoidably, far from being extensive. In view of the fact that some of the results arrived at are not consonant with those already in the literature, the present contribution is not to be regarded as being in any respect a definitive treatment of the problem of subspecies of *Nannoperca australis,* but as essentially a basis for further investigation carried out with large samples, preferably from several localities within each presumed subspecific region. However, as observed above, the distinctness of *N. a. fllindersi* would appear to be valid.

TABLE 1

Nannoperca australis Günther, 1861. Statistics of certain dimensions, expressed as millesimals of standard length of 4 samples: A, Australia, *N.a. australis* Gunther (7 specimens); B, Tasmania, *N.a. tasmaniae* (Johnston), 1883 (15); C, Flinders Island, *N.a. flindersi subsp. nov.* (4); D, King Island, *N.a. tasmaniae* (Johnston), 1883? (2).

Feature	Sample	Range	Mean	Standard deviation	Coefficient of variation
Standard length	A	29.6-52.1	39.24±2.97	7.85±2.10	20.0±5.4
	B	35.1-55.8	44.99±1.22	4.73±0.86	10.5±1.9
	C	32.4-44.9	38.65±2.93	5.86±2.07	15.2±5.5
	D	29.0-35.0			
Total length	A[1]	1203-1250	1227.3±7.1	17.5±5.0	1.4±0.4
	B	1206-1311	1247.0±7.3	28.4±5.2	2.3±0.4
	C	1225-1247	1237.3±4.0	8.1±2.9	6.5±2.3
	D	1230-1240			
Length to origin of first dorsal	A	453-496	471.0±5.4	14.3±3.8	3.0±0.8
	B	450-508	477.8±4.2	16.4±3.0	3.4±0.6
	C	454-470	459.8±3.3	6.6±2.3	1.4±0.5
	D	455-460			
Length to termination of first dorsal	A	605-647	626.9±5.7	15.2±4.1	2.4±0.6
	B	618-681	643.8±4.3	16.8±3.1	2.6±0.5
	C	599-630	615.0±6.3	12.5±4.4	2.0±0.7
	D	631-640			
Length to origin of second dorsal	A	622-659	641.3±5.4	14.2±3.8	2.2±0.6
	B	645-701	667.2±4.1	15.8±2.9	2.4±0.4
	C	619-654	637.5±6.8	18.5±4.8	2.1±0.7
	D	657-657			
Length to termination of second dorsal	A	733-794	760.6±6.9	18.2±4.9	2.4±0.4
	B	744-804	775.7±4.3	16.5±3.0	2.1±0.4
	C	767-791	780.0±4.9	9.9±3.5	1.3±0.4
	D	786-797			
Length to origin of anal	A	596-625	610.6±3.6	9.4±2.5	1.5±0.4
	B	605-670	643.8±3.7	14.2±2.6	2.2±0.4
	C	640-673	662.3±6.7	13.5±4.8	2.0±0.7
	D	655-657			
Length to termination of anal	A	746-811	773.7±7.8	20.7±5.5	2.7±0.7
	B	753-813	784.5±4.6	17.7±3.2	2.3±0.4
	C	807-824	813.8±3.2	6.4±2.3	0.8±0.2
	D	810-811			
Length to origin of ventral	A	364-392	373.4±3.3	8.8±2.3	2.3±0.6
	B	325-398	364.3±5.0	19.5±3.6	5.3±1.0
	C	380-395	389.0±2.9	5.8±2.1	1.5±0.5
	D	381-400			
Length to origin of pectoral	A	315-363	336.4±5.3	14.1±3.8	4.2±1.1
	B	289-332	313.3±3.0	11.8±2.2	3.8±0.7
	C	333-347	339.5±2.8	5.5±2.0	1.6±0.6
	D	480-503			
Length to vent	A	567-605	587.3±4.7	12.4±3.3	2.1±0.6
	B	576-652	621.1±4.3	16.8±3.1	2.7±0.5
	C	610-641	631.0±6.1	12.3±4.3	1.9±0.7
	D	617-629			
Head	A	328-353	337.7±3.3	8.6±2.3	2.6±0.7
	B	303-348	324.1±3.2	12.5±2.3	3.9±0.7
	C	339-351	343.3±2.4	4.7±1.7	1.4±0.5
	D	486-517			
Snout	A	68-87	75.7±2.5	6.5±1.7	8.6±2.3
	B	61-77	68.3±1.0	3..8±0.7	5.5±1.0
	C	66-87	74.3±2.7	5.5±1.9	7.3±2.6
	D	75-80			

TABLE 1 (continued)

Feature	Sample	Range	Mean	Standard deviation	Coefficient of variation
Eye	A	86-100	92.7±1.6	4.3±1.2	4.7±1.2
	B	82-100	90.5±1.3	5.0±0.9	5.5±1.0
	C	88-94	91.8±1.4	2.3±0.8	2.4±0.9
	D	100-109			
Interorbital	A	72-102	85.4±3.5	9.3±2.5	10.9±2.9
	B	87-108	99.0±1.6	6.2±1.1	6.3±1.2
	C	90-100	94.3±1.8	3.6±1.3	3.9±1.4
	D	72-86			
1st dorsal spine	A	61-119	90.9±6.9	18.3±4.9	20.2±5.6
	B	75[27]-111	87.1±5.3	20.4±3.7	23.4±4.5
	C	65-91	79.3±5.2	10.4±3.7	13.1±4.6
	D	86-86			
2nd dorsal spine	A	144-206	176.1±7.0	18.5±4.9	10.5±2.8
	B	90-186	150.5±1.6	29.5±5.4	19.6±3.8
	C	139-160	153.0±4.1	8.2±2.9	5.4±1.9
	D	138-156			
3rd dorsal spine	A	144-203	173.1±6.6	17.4±4.6	10.0±2.7
	B	120-180	153.5±4.8	18.7±3.4	12.2±2.2
	C	123-156	144.0±6.3	12.6±4.4	8.7±3.1
	D	131-172			
Spine of second dorsal	A	54-90	69.1±4.2	11.1±3.0	16.0±4.4
	B	50-87	63.8±3.6	10.2±2.5	15.9±3.0
	C	60-68	63.8±1.9	3.8±1.3	5.9±2.1
	D	51-71			
1st dorsal ray	A	116-146	133.4±4.3	9.7±3.1	7.3±2.3
	B	101-151	125.0±3.7	13.7±2.5	11.0±2.0
	C	113-149	129.5±6.4	12.8±4.5	9.9±3.5
	D	105-114			
Longest dorsal ray	A[2]	144-220	178.3±8.5	22.5±6.0	12.6±3.4
	B	150-186	171.7±2.8	10.8±2.0	6.3±1.2
	C	166-197	176.8±6.1	12.3±4.3	6.9±2.5
	D	183-189			
1st anal spine	A	64-90	76.6±4.0	10.6±2.8	13.8±3.7
	B	48-83	64.9±2.7	10.6±1.9	16.4±3.1
	C	54-59	56.3±0.9	1.8±0.6	3.2±1.1
	D	67-71			
2nd anal spine	A[1]	96-168	135.8±8.3	20.4±5.9	15.0±4.4
	B	100-144	116.5±4.0	15.5±2.8	13.3±2.5
	C	96-111	102.0±2.8	5.5±2.0	5.4±1.9
	D	101-109			
3rd anal spine	A	96-141	128.2±5.3	14.1±3.8	11.0±3.0
	B	100-143	117.9±2.7	10.6±1.9	9.0±1.7
	C	99-113	107.0±2.6	5.1±1.8	4.8±1.7
	D	87-103			
Longest anal ray	A	169-216	193.9±6.4	17.0±5.0	8.8±2.4
	B	139-198	169.3±3.5	13.6±2.5	8.0±1.5
	C	171-203	183.5±6.0	11.9±4.2	6.5±2.3
	D	172-200			
Ventral (whole fin)	A	168-206	190.6±5.3	13.9±3.7	7.3±2.0
	B	178-227	198.9±3.7	14.2±2.6	7.2±1.3
	C	181-204	189.8±4.3	8.7±3.1	4.6±1.6
	D	184-205			
Ventral spine	A	97-137	120.4±4.8	12.8±3.4	10.6±2.8
	B	102-140	116.7±3.0	11.7±2.1	10.0±1.8
	C	96-111	105.8±3.1	6.1±2.2	6.0±2.1
	D	97-113			

TABLE 1 (continued)

Feature	Sample	Range	Mean	Standard Deviation	Coefficient of variation
	A	156-186	175.7±3.5	9.3±2.5	5.3±1.4
	B	151-210	176.9±4.0	15.3±2.8	8.7±1.6
	C	146-177	161.8±6.2	12.3±4.4	7.6±2.7
Longest ventral ray	D	166-189			
	A[1]	168-213	192.0±5.4	14.4±3.8	7.5±2.0
	B	172-211	196.3±3.0	11.5±2.1	5.9±1.1
	C	189-220	204.8±7.2	14.3±5.1	7.0±2.5
Pectoral (whole fin)	D	186-207			
	A	159-188	173.0±3.9	9.6±2.8	5.5±1.6
	B	153-189	171.3±2.6	10.2±1.9	5.9±1.1
	C	155-179	167.5±3.1	8.6±3.0	5.1±1.8
Longest pectoral ray	D	160-174			
	A	212-314	274.3±13.3	35.2±9.4	12.8±3.5
	B	284-347	307.9±4.1	15.8±2.9	5.1±0.9
	C	297-329	311.3±5.7	11.5±4.0	3.7±1.3
Depth at opercular border	D	278-286			
	A	228-334	294.3±13.1	34.8±9.3	11.8±3.2
	B	300-351	329.9±3.6	14.1±2.6	4.3±0.8
	C	338-356	350.0±3.6	7.2±2.5	2.1±0.7
Depth at first dorsal origin (maximum)	D	279-309			
	A	217-287	256.3±7.5	19.8±5.3	7.7±2.1
	B	263-322	291.0±3.7	14.3±2.6	4.9±0.9
	C	252-306	284.3±10.7	21.4±7.6	7.5±2.7
Depth at vent	D	259-283			
	A	120-170	140.1±5.5	14.6±3.9	10.4±2.8
	B	138-177	156.1±6.9	10.8±2.0	6.9±1.3
	C	152-181	160.5±6.0	11.9±4.2	7.3±2.6
Depth of caudal peduncle	D	138-154			

Footnote to table 1. [1]6 specimens only; [2]5 specimens only.

TABLE 2

Nannoperca australis Günther, 1861. Value of *t* and significance of *t* for tests of differences of means for certain dimensions and proportions in samples from Australia (7 specimens), Tasmania (15), Flinders Island (4), King Island (2). The six ratios calculated directly from measurements (mm), the seven other features calculated from millesimals of standard length. Single asterisk denotes $P_{0.05}$, double asterisk $P_{0.01}$. H, L indicate the first mentioned locality of the locality pair has the higher, lower, mean value, respectively.

Feature	*t* and significance of *t* for locality pairs: relative magnitude of value for first-named locality					
	Tasmania-Australia	Tamania-King Island	Tasmania-Flinders Island	Australia-King Island	Australia-Flinders Island	King Island-Flinders Island
Length to origin of first dorsal			2.14* H			
Length to termination of first dorsal	2.16* H		3.03**H			
Length to origin of anal	5.37**H		2.20**L	5.60**L	6.79**L	
Length to termination of anal			3.07**L	20.68**L	3.41**L	
Length to origin of ventral			2.38* L		2.88* L	
Head			2.84* L			
Interorbital	7.71**H	3.96**H				2.95* L
Length to origin of anal in length to termination of first dorsal			3.90**L	2.69* H	5.85**H	3.41* H
Head in standard length	3.71* H			2.55* L		
Interorbital in eye	4.67**L	8.91**L	2.18* L			9.78**H
Eye in head		13.76**H	2.45* L	2.64* H	4.93**L	4.77**L
Snout in eye			10.26**H			2.42* H
Maximum depth in standard length	3.25**L	4.26**L	3.14**H			4.77**H

Family KYPHOSIDAE

The Check-List includes 6 species: *(a) Kyphosus* Lacépède, 1802, (1) *K. indicus* Cuvier, 1831, (2) *K. cinarescens* (Forskal), 1775, (3) *K. sydneyanus* (Günther), 1866, (4) *K. gibsoni* Ogilby, 1912; *(b) Dioidyxodon* Thominot, 1881, (5) *D. australis* Thominot, 1881; *(c) Tilodon* Thominot, 1881, (b) *T. australis* Thominot, 1881. Entries (5), (6) formally record material from 'Australie' (Verreaux; descriptions *ex* Guichenot MS): neither has since been recognized from our waters, and both are now dropped by Whitley (1964) from the Australian list. There are, however, now to be added: (7) *K. vaigiensis* (Quoy & Gaimard), 1825, Queensland and widely *extralimital,* (8) *K. cornelii* (Whitley), 1944, Western Australia (Pelsart Island, Houtmans Abrolhos); (9) *K. diemenensis sp. nov.,* the first kyphosid recorded from Tasmania.

In the latest Australian list (Whitley, 1964), (1), (3), (7), (8) are referred to the genus *Segutilum* Whitley, 1931 [(1) as *S. klunzingeri* Whitley, 1931]; (2) to *Opisthistius squamosus* (Alleyne & Macleay), 1877; (4) to *Leptokyphosus* Whitley [originally established (1931: 370) as a subgenus of *Segutilum*].

Hitherto no member of the family has been reported from Tasmania, though *K. sydneyanus* is known from South Australia and New Zealand. Species (1) [as Cuvier's species, not as Whitley's, the latter being Western Australian], (2), 7 range extralimitally.

A provisional key [the observation by Schultz (1953: 565) 'The kyphosids of the Indo-Pacific are in need of further careful study' has current relevance in terms of the Australian scene] to species (1)-(4) (7)-(9) is here offered. The species appearing in the Check-List as *K. indicus* Cuvier presents special difficulty. Cuvier's account, ex Kuhl & Van Hassett MS, cites no locality (the Check-List suggests 'probably Java'); while the specimen described under this name by Klunzinger (1879: 357, pl. vii) came from King George's Sound, Western Australia. In a survey of the family McCulloch (1920: 56) headed his account of the Australian fish '*Kyphosus indicus* (Cuv. and Val.?), Klunzinger', and again expresses his uncertainty in his synonymy with '(perhaps not *P. indicus,* Cuv. and Val.)' [the section of vol. vii of *Histoire Naturelle des Poissons* in which the species is treated of is by Cuvier]. He remarks, 'The identity of the specimen from King George's Sound, characterised and figured by Klunzinger remains uncertain. He counted about 66 scales on the lateral line, but this figure shows only 55 pierced scales; it also shows about 54 rows between the supraclavicle margin and the hypural joint. The illustration was prepared by Eduard Konopicky, however, whose work is notable for its accuracy, which suggests that Klunzinger may have counted the scales incorrectly. The specimen is possibly a rather slender example of *K. sydneyanus* Günther, which species has been recorded from Western Australian waters'. Commenting on this last sentence, Whitley (1931: 320) remarked 'it is unlikely that this restricted New South Wales species recurs in Western Australia', and renamed Klunzinger's species *Segutilum klunzingeri,* with, as type, the specimen figured on Klunzinger's plate by Konopicky. The position regarding the lateral line count remains unresolved; the best that can here be done is to adopt the expedient forced on McCulloch in the construction of his key, namely, to work on the basis of Klunzinger's text and accept, provisionally, his specification of 66 lateral line scales. With regard to (2), Whitley observes 'the species from northern Australia called *Kyphosus cinarescens* by

KEY TO AUSTRALIAN KYPHOSIDAE

1	Anal rays 14. Dorsal rays 15-16	*K. cornelii*
	Anal rays 11-13. Dorsal rays 12-15	2
2	Base of soft dorsal $<$ base of spinous dorsal	3
	Base of soft dorsal $\geq$ base of spinous dorsal	6
3	Anterior dorsal rays $>$ longest spine	*K. cinarescens*
	Anterior dorsal rays $\leq$ longest spine	4
4	L. lat. $>$ 60. L. lat. 66 (Klunzinger)	*K. klunzingeri*
	L. lat. $<$ 60	5
5	Pierced scales of l. lat. $\doteq$ 55 ($\doteq$ 5 past hypural joint). Scales between posterior margin of supraclavicle and hypural joint $\doteq$ 52. Second dorsal base shorter relative to first dorsal base, $\doteq$ 1.8 in it measured between parallels, or $\doteq$ 1.5 measured point to point. Ventral originating below, or barely behind, pectoral base. Head $\doteq$ 3.6 in standard length. Eye $\doteq$ 3.9 in head, $\doteq$ 1.7 in interorbital	*K. sydneyanus*
	Pierced scales of l. lat. $\doteq$ 45 ($\doteq$ 2-6 past hypural joint). Scales between posterior margin of supraclavicle and hypural joint $\doteq$ 43. Second dorsal base longer relative to first dorsal base, $\doteq$ 1.4 in it measured between parallels, or $\doteq$ 1.2 measured point to point. Ventral originating behind pectoral base by about longitudinal extension of oblique pectoral base. Head $\doteq$ 4.0 in standard length. Eye $\doteq$ 4.6 in head, $\doteq$ 2.4 in interorbital	*K. diemenensis*
6	Dorsal rays 14-15. Caudal shallowly and evenly excavate. Head $\doteq$ 3.5-3.7 in standard length. Eye $\doteq$ 3.0-3.6 in head	*K. vaigiensis*
	Dorsal rays 13. Caudal moderately forked. Head $\doteq$ 4.0 in standard length. Eye $\doteq$ 4.3 in head	*K. gibsoni*

Australian authors would be better known as *Opisthistius squamosus* (Alleyne & Macleay)'. Alleyne & Macleay's *Pachymetopon squamosum,* and their *Scorpis vinosa,* treated (it would seem correctly) in the Check-List as synonymous with it, collected by the *Chevert* in Hall Sound, New Guinea and at Darney Island, respectively, are figured (1877, pl. ix, figs 1, 2) in the report on the expedition's ichthyology. As Forskal's species has a wide extralimital range, including Red Sea (type locality), Japan, East Indies, the suggestion for the adoption of Alleyne & Macleay's name is no doubt based on a probability of an Australian and ad-Australian species being distinct from one ranging well into the northern hemisphere. Alleyne & Macleay's figures are poor: in preparing the key reference has been made to the standard figure of *K. cinarescens* in Bleeker (1877, pl. cccIxiv, fig. 4), reproduced in, *e.g.,* Munro (1967).

Kyphosus diemenensis sp. nov.

(Fig. 1).

Description, D. xi, 12. A. iii, 11. P. 19/18. V. 1, 5. C. 18 (1 + 16 + 1). Pierced scales of lateral line 45, of which 2 are beyond hypural joint, followed by 4 scales unpierced, but bearing shortish tubules. About 54 rows of scales above lateral line between its origin and hypural joint, the anterior ones irregular; 43 rows between posterior margin of supraclavicle and hypural joint. Scales between origin of dorsal fin and lateral line 10; about 21 more to ventral surface. Predorsal scales, from occiput, about 58.

Depth before ventrals 2.38, at vent 2.22, maximum depth 2.18, depth of caudal peduncle 8.03, in *Ls.* Breadth at pectoral base 2.01 in depth there. Head 3.96 in *Ls.* Eye shorter than (1.24 in) snout, 2.38 in interorbital, 4.59 in head. Snout 3.71, interorbital 1.98 in head. Depth of caudal peduncle 1.13 in its length, 2.05 in head. Sixth dorsal spine 2.20, longest (5th) spine 2.09, 2nd dorsal 3.90, longest (8th) dorsal ray 2.23, longest (1st) anal ray 2.21, longest (5th) pectoral ray 1.60, pectoral (whole fin) 1.36, in head.

Body broadly elliptical, compressed, dorsal and ventral profiles almost evenly, and almost equally, arched. Head obtuse; its depth at front of eyes 1.28, at back of eyes 0.98, at opercular margin 0.68, in its length; snout very convex to level of posterior nostril; profile then barely convex about to level of middle of pupil; thereafter, with marked increase in general sense of slope, in gently convex, almost even, arc to origin of dorsal. Eye wholly in anterior half of head; its highest point below dorsal profile by about two-thirds eye-diameter; interorbital convex both transversely (markedly) and anteroposteriorly. Preorbital, dorsum of snout to level of anterior nostril, chin to same level, lips, naked; these regions covered with minute vermiculate elevations, and, except for lips, sprinkled with small pores. Preorbital striated; about a score of points along lower half of border. Preopercular margin corrugated and serrated; about a score of crenulations along hinder four-fifths of inferior border; ridges becoming larger and farther apart along lower two-thirds of exposed vertical border, rest of border without noticeable ridges. Nostrils approximate, interval between them less than distance of posterior nostril from eye; the anterior a subcircular opening ringed with low membranous tube, its distance from its fellow subequal to its distance from middle of eye, or 0.56 interorbital; the posterior elliptical (major axis slightly oblique to anteroposterior axis of fish), fringed with skinny lips, a groove running beneath it and extending behind opening by about length of latter. Maxillary with small subtriangular patch of scales at its posterosuperior border, which just reaches level of anterior orbital margin; jaws equal; lips broad, with the characteristic generic form; a line from upper border of upper jaw to base of last dorsal ray passes across middle of eye. Teeth in jaws in a single row, about 25 in upper, about 30 in lower; variable in form, the anterior ones higher, subconical, height subequal to base, with or without indications of 1 or 2 secondary cusps, the hinder ones lower, compressed, tending to present, in frontal aspect, a more or less rectangular outline, the free margin usually with 3, or fewer, low cusps. Minute teeth on vomer in a transversely elliptical patch; on each pterygoid in a longitudinal ellipsoidal patch, its length subequal to diameter of eye, rather more than twice its own length; on the anterior part of each palatine in a very small patch. Tongue damaged, its tip missing; intact portion edentulous. Gillrakers on anterior 6+14; those on lower limb long, slender, subcylindrical, pointed, length of longest 7 mm, about half length of gill filament, subequal to space occupied by bases of 5 rakers, last (lowest) shorter than rest, about half length of penultimate; those on upper limb much shorter, stouter, with blunt, or even slightly clubbed ends, except the lowest 2, which are similar to, but somewhat more compressed than rakers of lower limb. Body covered with ctenoid scales, which extend on to most of head (see above), also over greater part of all paired fins, forming conspicuous sheaths at the bases of the anal and the soft dorsal, but occurring only in a narrow proximal strip on spinous portion of dorsal. Whole of pectoral base and more than half fin covered with small scales. Lateral line following more or less closely curve of back, its direct distances from bases of first dorsal spine and last dorsal ray equal; proceeding along middle of caudal peduncle: each pierced scale with, towards its posterior border, a low chimney of gelatinous appearance, conspicuously white against brownish olivaceous body and black rim of scale; the last 4 lateral line scales not thus pierced, but bearing a shortish longitudinal tubule. Posttemporal bone with about a dozen serrations.

Dorsal commencing behind insertion of ventral by about half snout-length; margin evenly arched; longest (5th) spine 2.26, 1.87, 1.64, 1.07 length of 1st, 2nd, 3rd, 8th (longest) ray. With both measured between parallels, soft dorsal base 0.56 spinous base; measured directly, with dividers, 0.72. Soft dorsal margin very slightly convex; rays increasing to 8th, which is 2.12 1st; thereafter decreasing to penultimate, 12th being 1.08 11th, which is 2.32 in head. Anal originating in advance of soft dorsal, its 1st ray about below 1st ray of that fin; terminating briefly in advance of dorsal, the fin bases equal; 3rd spine 1.03 2nd, 1.67 1st, which is 6.50 in head; 1st ray longest, probably decreasing to 5th (3rd, 4th imperfect), then increasing to 8th, decreasing to last, which is 1.41 in 1st, 3.11 in head. Pectoral short, broad, rounded; to below 4th dorsal spine, its total length equal to head without snout; first 2 rays unbranched; longest (5th) ray 1.60

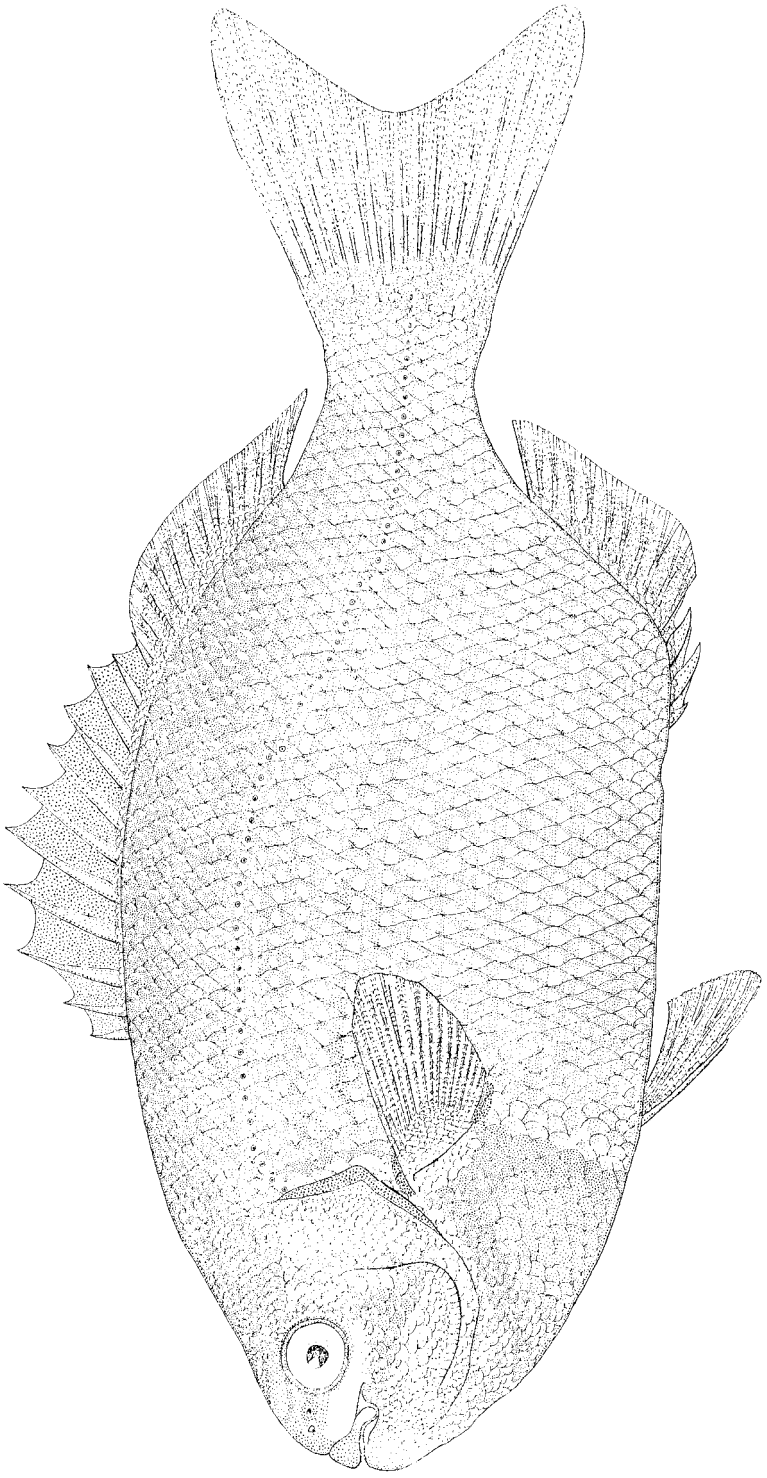

Fig. 1.—*Kyphosus diemenensis sp. nov.* Holotype, total length 387 mm, standard length 307 mm; north coast of Tasmania; Queen Victoria Museum Reg. No. 1967.5.26 : x $\frac{1}{2}$.

in head, a trifle longer than middle ventral ray. Ventral originating behind pectoral base by a distance subequal to anteroposterior extension of the oblique pectoral base; or by 0.9 eye; extending 0.74 of distance to middle of vent; longest (2nd) ray 1.46 in head, 1.66 spine. Caudal subequal to head; deeply emarginate, the outer rays extending behind median rays by about one-third of fin; lobes bluntly rounded.

The above description, while somewhat more detailed than the account given by McCulloch (1920: 56) of K. *sydneyanus* Günther, is drawn up to be directly comparable with it. The statement in that account (p. 57) that the scales form sheaths at the bases of 'the dorsal and anal spines' is doubtless to be read with 'rays' substituted for 'spines'. 'Anal a little farther back than the soft dorsal' — this apparently refers to the rayed portion of the anal; the figure (pl. XII, fig. 2) showing 1st anal spine well in advance of 1st dorsal ray.

Lateral surface of body brownish olivaceous, lightening ventrally, and below about midlateral line showing an increasingly silvery tinge. Almost all scales with a lighter area; above lateral line mostly reduced to a spot, or short subvertical bar, of greyish (on a few scales just above lateral line near head, warm brownish) at front of scale, posteriorly most scales lighter, modal pattern being light greyish marked with pale chestnut, the latter sometimes constituting anything from a single diffuse patch to a central anteroposterior stripe, sometimes occurring in two diffuse patches, separated, with varying degrees of distinctness, by a median area of greyish or whitish; below lateral line a conspicuous deep yellow, or castaneous, mark on all scales, except most of those of caudal peduncle, which are mainly greyish or silvery grey, the marking varying from a diffuse patch, sometimes extending over most, or whole, of front part of scale, but always being most prominent round anteroposterior axis of scale, where its greater intensity may sometimes result in its presenting more or less the appearance of a longitudinal stripe: most scales, both above and below lateral line, bearing, in addition to markings described above, a darker, commonly brownish, area on hind margin; and being largely or wholly outlined by dark membranous fringes. The presence of the yellowish spots results in the formation of a series of lateral stripes, conspicuous over most of flank; least development on caudal peduncle, above lateral line, and near ventral profile, between which latter two limits about a dozen stripes are immediately obvious, with several others more or less clearly traceable. A small black subrectangular marking, its height a little less than half its length, the latter half an eye-diameter, is apparent at lower angle of pectoral base: when pectoral is lifted away from trunk, the marking is seen to continue upwards, as a bar, several millimetres across, to level of upper pectoral rays of fin when adpressed, *i.e.*, for a distance of about one-third head-length, fringing for the whole of its exposed vertical extent the hind border of a bone (coracoid?) of the pectoral girdle. An obscure darkish bar immediately posterior to the free border of the supraclavicle, lying a little behind, and subparallel with, vertical limb of operculum. Lateral line a series of subcircular openings, conspicuously rimmed with white. Dorsal surface tending to be darker than upper lateral, anteriorly approaching black, the lighter scale markings here obsolete. Ventral surface ranging from dark flesh to pale yellow, this ground color extending up briefly on to flank.

Lateral surface of head chiefly dark olivaceous, becoming lighter on lower cheek and chin, which are mostly pale brownish. Preorbital with a wide border of light brown and dark fawn; below and behind this a dark longitudinal pennon, running back beneath eye almost to preorbital margin, broadening as it goes, and finally curving upward to occupy most of area between orbit and preopercular border. A narrow circumorbital ring of dark brown. Membrane bordering vertical limb of operculum presenting a black and blackish bar, with somewhat sinuous hind margin; its anteroposterior extent from about one-fifth to about one-third an eye-diameter, its vertical subequal to length of postorbital head. Lower lip dusky, upper dark. General dorsal surface of head blackish; ventral surface more or less concolorous with lower lateral surface.

First dorsal olive black. Sheath of second dorsal, extending over more than two-thirds length of rays, very dark brown; free tips of rays a trifle lighter. Small scales sheathing base of anal light brown, faintly purplish, darkening distally; exposed rays dark brown, extreme tips ashen. External surface of pectoral base pale brownish; fin pale brownish and dusky, proximally, ashen distally, the lighter region accounting for about one-sixth of length of upper rays, broadening below to cover about four-fifths of lowest rays: inner surface of fin proximally black and blackish up to the inner limit of distal ashen area of outer surface. Ventral spine whitish; outer 4 rays whitish proximally, darkening distally, most extensively so in 2nd and 3rd; inner ray faintly dusky; membrane dark, between outer rays black. Caudal mainly very dark grey, with some brownish; the outer 2-3 rays, both above and below, olivaceous basally, the colour in upper lobe continuing to tip, the lower lobe darkening distally; distal one-third or so of the inner rays lighter than their bases; tips of all rays, except those of the fin lobes, briefly ashen.

Dimensions as TLs. The following dimensions are expressed as millesimals of the standard length, 307 mm. Vertical fins are treated as originating and terminating at relevant spine or ray, terminal membranes, if any (here, only between spinous and soft dorsals) being disregarded.

Length to origin, termination of spinous dorsal 375, 632; of second dorsal 656, 844; of anal 629, 821. Length to, length of pectoral 235, 187; to, of ventral 300, 184. Length to middle of vent 588. Head 254; snout 68; eye 55; interorbital 135; internarial (anterior nostrils) 75. Depth (in parentheses, width) at: front of eyes 199 (133), back of eyes 261 (163), pectoral origin 365 (174), opercular margin 371 (176), ventral origin 420 (171), vent 450 (156); maximum 459 (179); caudal peduncle 124 (47).

Length of ventral spine 105; of rays 1-5, 167, 174, 150, 124, 101. Lengths of dorsal spines I-XI, 33, — 101, 118, 120, 116, 106, 102, 96, 67, 46. Lengths of dorsal rays 1-12, 54, 65, 79, 91, 95, 101, 101, 114, 104, 101, 101, 109. Lengths of anal spines I-III, 39, 64, 65; of rays 1-11 115, 107,

—, —, 86, 95, 98, 101, 98, 94, 82. Lengths of pectoral rays 1-15, 68, 121, 133, 154, 159, 151, 110, 104, 92, 81, 71, 65, 55, 97, 37.

Material. Described and figured (fig. 1) from the unique holotype, 307 mm in standard length, 387 in total length, collected on the north east of Tasmania in January 1967 (Q.V.M. Reg. No. 10.10.67): gutted.

The specific trivial name, *diemenensis,* derives from the locality of the type (Van Diemen's Land, the original name of Tasmania).

Affinities. Apart from *K. cornelii* (Whitley), 1944 (not hitherto appearing in a family key) in which the relative lengths of soft and spinous dorsals cannot be satisfactorily determined from the photograph of the type (1944, fig. 3) (? subequal) — but which appears, in any case, to stand clear of all other Australian species in having 14 (*cf.* 11-13) anal rays, 15-16 (*cf.* 11-15) dorsal rays — the primary separation in current keys (McCulloch, 1920; Marshall, 1964) turns on whether base of soft dorsal is less than, or greater than (or subequal to) base of spinous dorsal.

The existence of a longer spinous base in the present species at once separates it from *K. vaigiensis* (Quoy & Gaimard), 1875 and from *K. gibsoni* Ogilby, 1912. Among the remaining species, *K. cinarescens* (Forskal), 1775 is ruled out by its having anterior dorsal rays (much) longer than longest spine. There thus remain for consideration *K. klunzingeri* Whitley, 1931, *K. sydneyanus* (Günther), 1886, and the present species. The problem presented by the imperfectly known *K. klunzingeri* has been considered above: if Klunzinger's lateral line specification of 66 is to be relied on, this feature differentiates it clearly from the present species with a count of 45.

The nearest ally of *K. diemenensis* would appear to be *K. sydneyanus.* From that species it is distinguished by the following characteristics (specifications of Günther's species in parentheses): *(i)* lateral line with 45 (about 55) pierced scales; *(ii)* scales between posterior margin of suprascapular and hypural joint about 43 (about 52); *(iii)* ventral orginating further back, behind pectoral base by about longitudinal extension of pectoral base, or by more than an eye-diameter (below, or barely behind, pectoral base), in this feature resembling *K. cinarescens, K. vaigiensis, K. gibsoni; (iv)* second dorsal base longer relative to first dorsal base, 1.4 (about 1.8) in it, measured between parallels, or 1.2 (about 1.5) measured with dividers; *(v)* head smaller 4.0 (3.6) in standard length; *(vi)* eye smaller, 4.6 (about 3.9) in head; *(vii)* perhaps rather wider interobital, 1.92 (2.1) in head. McCulloch's figure of *K. sydneyanus* (pl. XII, fig. 2) would appear to depict a fish with a greater difference in height between the dorsals than our specimen, the longest spine there being perhaps 1.25 the longest ray, as against 1.02 in our example. McCulloch apparently found in his *K. sydneyanus,* a young specimen, 245 mm long (the stuffed type is 30 inches), 6th dorsal spine the longest; in ours it is 5th, which is 1.05 6th. There may well be some differences in coloration in these two species.

In addition to the major differences mentioned above, *K. diemenensis* differs from *K. vaigiensis* in having fewer pierced scales (45; *cf.* 56-58); fewer dorsal rays (12; *cf.* 14-15); fewer anal rays (11; *cf.* 12-13), fewer gillrakers (20 *cf.* 30); from K. gibsoni in having fewer pierced scales (45; *cf.* 59), one fewer ray each in dorsal and anal; greater depth before ventrals (2.38 in *Ls; cf.* 2.6); from *K. cinarescens* in having fewer pierced scales (45; *cf.* 48-56), fewer gillrakers (20: cf. 26-30): from *K. cornelii* in having fewer pierced scales (45; *cf.* 50+6), deeper body (greatest depth 2.18 in *Ls; cf.* 3.0).

Family XIPHIIDAE

Genus **XIPHIAS** Linné, 1758

Xiphias gladius Linné, 1758

Xiphias gladius Linné, 1758, *Syst. Nat.,* ed. 10:248. Type locality, in Oceano Europae.

Tasmanian examples. This species does not appear in any local faunal list, but is recorded for Tasmania (and all other Australian States) in the Handbook (Munro, 1958: 115, fig. 766). The measurements reported below — taken with a steel tape marked in inches, and here converted to millimetres (largest dimensions should be acceptable to nearest centimetre) — were made on 17 April 1969 on a specimen caught by Mr T. Pyke of Bicheno, Glamorgan, and placed on a display in a Launceston sports store. The weight was stated to be 230 lb. A photograph (unfortunately not very suitable for reproduction here) appeared in the Launceson *Examiner* of this date. Earlier, that newspaper had reported, on 13 March, that Mr Keith Jessup of Launceston had hooked, but not caught, a large broadbill swordfish off Schouten Island, Glamorgan. It quoted Mr Jessup as stating he had the fish hooked for more than ten minutes. 'In that time he tail-walked several times and I could see he was about 12 ft long and would weigh more than 200 lb.' Munro observes 'not yet taken in Australian waters by game anglers', and the hooking of an example by Mr Jessup may be the first time this has been achieved.

Dimensions. Total length 3102; length to end of middle caudal rays 2686; standard length 2638. Tip of upper jaw to middle of anterior border of forwardly concave rictal membrane 1036: top of upper jaw had apparently suffered damage during life, with bilaterally asymmetrical healing, the portion presumably missing probably not exceeding a few centimetres in length. Length of lower jaw (tip intact) to rictal membrane as before 198. Head 1265; snout 933; eye 68, with lid 87; interorbital 62. Length to origin, termination of first dorsal 1025, 1415; of second dorsal 2210, 2242; of first anal 1978, 2204; of second anal 2412, 2437. Length to middle of vent 1938. Length of pectoral 403. Oblique length of upper caudal lobe 551, of lower, 542; spread of caudal 777. Length of caudal keel 218. Width of upper jaw at angle of gape 160; depth there 161. Depth at origin of first dorsal 372, at vent 306; maximum depth 403; depth of caudal peduncle 84.

The small second dorsal and small second anal are more or less L-shaped; the shorter limb erect; the longer limb horizontal (dorsal) or subparallel with body profile (anal).

Comparison with Handbook Specifications. Comparison with the values for 5 ratios given by Munro (1958: 115) yields the following results (our data in parentheses): upper jaw 3.8 (4.71) lower jaw; depth 5.2 (6.55) in *Ls;* head with spear 1.8 (2.09) in *Ls;* elevated lobe of first dorsal 1.1 (1.45) in body depth; pectoral 1.3 (1.00) in body depth. Inspection of the figure in Munro and the press photograph of Mr Pyke's specimen

shows good overall agreement (including eye-mouth relations: see remarks on taxonomy, below), the most notable differences being the occurrence in the latter of a longer first anal, and of a more caudad location of second anal relative to second dorsal.

Taxonomis status. Xiphias gladius Linné, 1758 [variant spellings include *Xiphius, Ziphias, Ziphius; gladias*] is generally regarded as being cosmopolitan; thus Briggs in his paper on fishes of worldwide distribution observes (1960: 177) 'Herre (1953: 256) [Herre, A W. 1953. Check list of Philippine fishes. *U.S. Fish and Wildl. Serv. Res. Rept*, No. 20: 1-97] and almost all previous authors list this species for all tropical and temperate seas'.

The broadbill swordfish found in Australian and New Zealand seas has in general been regarded as being Linné's species — *cf.*, for example, Hutton (1904), Waite (1921), McCulloch (1929), Munro (1958), Scott (1962), Parrott (1959). However, Phillipps, after having published in 1926, under the name of *Xiphias gladius*, a drawing by F. E. Clarke of a swordfish washed ashore on Hakitaka beach, and having observed of this figure (pl. 91) 'It appears to agree very well in all essential features with Cuvier's figure of the species, reproduced by Jordan and Evermann (1903, *loc. cit.*)' [*Bull. U.S. Fish. Com.*, 23: 168, fig. 61], in a subsequent paper (1932) named the same specimen as type of a new species, *X. estara*.

Phillipps states (p. 138) 'The main point of difference between the New Zealand and Atlantic swordfishes is to be found in the position of the eye, which in our species is relatively larger and placed farther forward than in the *gladius*. It will be seen that the angle of the mouth is far behind the eye and the tip of the lower jaw a little in front of the eye in the New Zealand fish, while the reverse is the case in the Atlantic species'. In his work on the fishes of South Australia Scott (1962) reproduces the figure in Phillipps' 1962 paper, labelling it *Xiphias gladius*, a course adopted also by Parrott (1959: 179). While accepting Phillipps' name of *X. estara*, Whitley (1962: 187, and unnumbered fig. on that page) presents a figure, 'Modified after Phillipps', in which the postocular extension of the mouth appears to be less than in the original. Apart from Clarke's drawing or modifications of it, figures of the broadbill swordfish at hand, whether purporting to depict the fish as it occurs in the northern or in the southern hemisphere, show the angle of the mouth located behind the eye [if behind it at all — a crude figure in an 1859 English edition of *Régne Animal* (marked *Xiphias clodius; sic*) has mouth ending in advance of middle of eye] by a distance less than, at most subequal to, the distance between level of front of eye and tip of lower jaw — thus suggesting the diagnosis of *X. estara* is not applicable to the common broadbill sword fish of the southern hemisphere. Linnés species apparently being, as it is generally held to be, a cosmopolitan one.

In the present example the diameter of the eye is 60 (with lid 87); the mandible extends 95 in advance of eye, the mouth 43 behind eye.

Some points of comparison between Phillipps' account of *X. estara* and the present fish, additional to those concerning relationships of eye, mouth-angle, mandible-tip already discussed, may be noted (our specifications in parentheses). Head [*i.e.*, from tip of lower jaw] approximately 5 (4.21) in length from tip of mandible to tip of caudal. Depth at opercular edge nearly 6 (4.84; depth at dorsal origin) in length as before. Tip of spear to eye approximately equal to distance between origin of pectoral and origin (first one-third of base) of first anal. Mandible ½ (0.46) head. Eye 6.80 (7.1) in head. First dorsal rising to a height almost equal to (vertically 0.65, obliquely 1.16) length of head. Length of pectoral approximately equal to (1.08) depth at opercular margin (at dorsal origin). First anal 'sometimes originates' at a point a little (decidedly) nearer to operculum than to tip of caudal.

Family LEPTOSCOPIDAE

The Check-List (McCulloch, 1929: 334) records two species: *(a)* genus *Crapatalus* Günther, 1861, *C. arenarius*, McCulloch, 1915 (Queensland, New South Wales, South Australia); *(b)* genus *Leptoscopus* Gill, 1860, *L. macropygus* (Richardson), 1846 (New South Wales). The second species occurs also in New Zealand — a neozealandic subspecies, *L. m. Luttoni* Haast, 1873, is recognized by Whitley (1968: 67); in New Zealand Günther's genus is represented by *C. novaezelandiae* Günther, 1861 and *C. angusticeps* (Hutton), 1874. No member of the family has hitherto been reported from Tasmania.

Genus **CRAPATALUS** Günther, 1861

Crapatalus arenarius McCulloch, 1915

Crapatalus arenarius McCulloch, 1915, *Proc. Linn. Soc. N.S.W.*, xl, 2: 269, pl. xxxvii, fig. 1. Type locality, Narrabeen, near Sydney, N.S.W.

Leptoscopus macropygus Ogilby, 1912, *Mem. Qld Mus.*, 1: 57 *(non Uranoscopus macropygus* Richardson, 1846).

Tasmanian record. This species — to the distribution of which is given in the Check-List (see above) Western Australia is added in Scott (1962) — can now be added to the Tasmanian list, an example, *Ls* 75.9, *Lt* 85.6 having been secured by Mrs J. M. Wright at Green's Beach, Devon, on 20 January 1970 (Queen Victoria Museum Reg. No. 1970.5.24). The fish, which appeared sluggish, was caught by hand in 2-3 feet of water as Mrs Wright was getting into a boat. A second example, seen at the time by some children, was not captured.

Counts, proportions as TLs. D. 34. A. 37. P. 21/21, V. i, 5. C. 10. L. lat. 47; l. tr. obliquely backward at dorsal origin 5/1/8, at middle of tail 5/1/5.

Length to origin, termination of dorsal 352, 964, of anal 291, 964; length to ventral origin 138, to pectoral origin 191. Head 224, snout 40, eye without lid 32 with lid 40, interorbital 38, internarial (anterior nostril's) 51. Length of ventral fin 125, of pectoral 240; longest (4th) ventral ray 105, ventral spine 40, longest (8th) pectoral ray 211, longest (about 7th) dorsal ray 69, longest (about 7th) anal ray 66. Depth (in parentheses, width) at back of eye 99 (132), at operculum 124 (137), greatest depth, occurring at dorsal origin, 132 (greatest width, occurring at middle of postorbital head, 182). Total length 1128.

Comparison with McCulloch's description. McCulloch (1915: 269) gives certain proportions for his figured specimen, 85 mm long, as follows (our values in parentheses). Head in *Ls* 3.5 (4.47); depth at vent in *Ls* 7.4 (7.91), in head 2.1 (1.77). Eye in head 7.0 (without lid 7.25, with lid 5.67). Depth of caudal peduncle in head 5.2 (4.86) Seventh dorsal ray in head 3.3 (3.27) seventh

anal ray 3.3 (3.40). Longest pectoral ray in head 1.1 (1.06), longest ventral ray 2.3 (2.13), caudal fin 1.9 (1.75).

In general our specimen is in good agreement with his account. However, several points of difference are to be noted. *(i)* 'Head entirely naked. Body covered with large cycloid scales extending to above the operculum on the back, and to behind the pectoral and ventral fins on the lower surface.' Scales on the dorsal surface certainly extend forward of the front of the operculum, and appear to continue, though in a somewhat more deeply embedded condition, over the whole interorbital region to, or almost to, the upper lip. There are also indications of the probable existence of a band of scales across the upper part of the operculum and the preoperculum to the eye, then continuing forward as a single row beneath the orbit. *(ii)* 'Lateral line almost straight from the suprascapular along the middle of the body to the base of the caudal'. While the overall sense of the line is rectilinear, the anterior portion, back to the level of the posterior one-fifth of the adpressed pectoral, is somewhat sigmoid, and runs steeply upward and forward. *(iii)* In the described specimen the maxillary reaches just past the eye, but in the two other examples it 'does not reach quite so far': in the Tasmanian fish it extends to below the middle of the eye. *(iv)* Between the tips of the two small spines on the breast (which are less developed than seems to be suggested by the figure) there occurs a small orifice that while possibly a mutilation presents no obvious indication of being such.

Additions to original account. Labial cirri olivaceous, slender, distally acute; set for their whole, or almost their whole, length in a whitish gelatinous matrix; about 34 in the upper lip, about 48 in the lower. Anterior nostril a subcylindrical process of gelatinous appearance; rounded, and somewhat expanded, distally; with small circular terminal opening; encircled basally by a low thin gelatinous ring; situated about equidistant from anterior border of preorbital and orbital rim; internarial distance a trifle more than half as great again as interobital. Posterior nostril smaller than, but apparently similar to, anterior; located just externad of it, hard against orbit. About 15 cirri, similar in shape, and size to those of lips, and, like them, largely set in gelatinous material, fringing upper angle of operculum, about two-thirds of them on superior border; so disposed as to lie convex outwardly. Tubules of lateral line extending across all, or almost all, exposed length of scale; each a slender tube, bifurcating briefly at posterior end.

Coloration. Body: general colour olivaceous, lightening, without abrupt change, to pale greyish or whitish ventrally; delicately mottled with greyish over all the back, half down the flank anteriorly, down to ventral profile in last one-third of tail; most scales bordering either side of anal base with a small sharply defined subcentral black spot; at 2 scale-rows higher a similar line of dots, extending forward to level of pectoral base, but becoming obsolescent at about the middle of the length; lateral line tubules whitish. Head: in general more or less concolorous with body, but somewhat darker on dorsal surface; a dark bluish blotch on dorsum, a little closer to eyes than to end of head; a light immaculate area on lower half of preoperculum flanked, behind and above at posterior preopercular border, by an obscurely delimited dark bar; labial cirri dusky, in whitish matrix; opercular cirri colourless, in hyaline or faintly opalescent matrix; anterior nostril white, posterior largely hyaline. Fins: dorsal rays greyish, punctulated on their anterior surface with pale brown, the peppering varying in intensity along the length of the ray, giving the effect, especially in anterior part of fin, of a system of faint cross bars, membrane whitish; anal rays and membrane pale, both lacking punctulations; pectoral pale, with faint yellowish tinge distally, a few small scattered melanophores at base; ventral colourless; caudal rays mostly pale yellowish, several whitish, all rendered somewhat dusky basally by a sparse sprinkling of chromatophores. The coloration would seem in all respects admirably adapted to a sand-dwelling habit such as that reported for this fish by McCulloch.

Reduced trunk length. Crapatolus arenarius is one of the few fishes with the anal fin originating far forward, anterior to dorsal origin; the unusually cephalad location of the vent reducing the length of the formal trunk to a small fraction of the length of the fish. In the specimen, head, trunk, tail account for 22, 6, 71 per cent, respectively, of the standard length.

Family OPHIDIIDAE

All three Australian members of the family — *(a) Genypterus Philippi,* 1857 (1) *G. blacodes* (Bloch & Schneider), 1801, (2) *G. microstomus* Regan, 1903; *(b) Dannevigia* Whitley, 1941, (3) *D. tusca* Whitley, 1941— occur in Tasmania: however, though (2) has this State— as one of its type localities (Tasmania, Dunedin, Stewart Island) it has missed inclusion in any published Tasmanian list.

KEY TO TASMANIAN OPHIDIIDAE

1	Dorsal with < 125 rays (about 103). Anal with < 100 rays (about 8). Lateral line < 150 (about 100)	*Dannevigia tusca*
	Dorsal with > 125 rays (about 150-160). Anal with > 100 rays (about 123-126). Lateral line > 150 (about 290-300)	2.
2	Maxillary extending well beyond orbit. Eye much smaller than snout; 6.9-9.6 in head. Body pinkish, purplish, or whitish; with irregular dark brown or blackish mottlings of different sizes; markings extending on to head. Dorsal and anal fins without white external margins	*Genypterus blacodes*
	Maxillary extending to, or barely beyond, end of orbit. Eye subequal to, or larger than, snout; 5.4-6.8 in head. Body yellowish; with rather indistinct, usually angled brown bars; markings not extending on to head. Dorsal and anal fins with broad white external margins.	*Genypterus microstomus*

The above key follows conventional lines in adopting mouth size as a differentia. However, McCulloch (1914: 159) noted that Regan's specification for his species that the maxillary does not extend beyond hind margin of eye is not applicable to 5 of 8 *Endeavour* specimens; while in 1 of his examples of *G. blacodes* the maxillary ended below end of eye. McCulloch was inclined to allow more weight to *(i)* coloration, *(ii)* size of eye, *(iii)* size of interorbital. Regarding (iii), he reported that in his material of *G. blacodes* bony interorbital was 7.5-8.6 in head, about equal to eye; in *G. microstomus* 9.1-10.9 in head, not more than two-thirds eye: however, in the specimen of the latter species discussed below it is only 6.7 in head, and is 0.92 eye (with soft interorbital slightly exceeding eye).

Genus **GENYPTERUS** Philippi, 1857

Genypterus microstomus Regan, 1903

Genypterus microstomus Regan, 1903, *Ann. Mag. Nat. Hist.*, 7 (XI): 599. Type localities, Tasmania, Dunedin, Stewart Island.

Large examples. This species is noted by Scott (1962: 172) as reaching a length of 16 inches. Two much larger examples, secured in deep water off the continental shelf on the East Coast, were displayed in a Launceston fish shop in August 1970. The head of the smaller individual was preserved. Some of its dimensions are: weight 3 lb. 6 oz.; length 280 mm, length to preopercular border 208; greatest depth 130; snout 60; eye 45.5; iris 29; mouth 106; interorbital, bony 42, soft 47; barbel 133. Branchiostegals number 5.

Specifications of normal maximum length of the common ling, *G. blacodes* (*e.g.*, McCoy, 1879; Stead, 1906; Lord & Scott, 1924; Scott, 1962) centre round about 3 feet; McCulloch (1914) notes 'a very large specimen' 1125 mm long; Scott mentions an example 29 inches long that weighed 4 lb. 1 oz. However, fish reaching 5 feet, or more, and weighing 15-20 lb are said to be taken in Cook Strait and southward of it along the New Zealand coasts.

While *G. microstomus* is essentially a deep-water form — Scott (1962) notes that the record for South Australia is based upon specimens trawled in 350-450 fathoms in the Bight — *G. blacodes* is met with in quite shallow water, examples having been secured on our northern coast even in intertidal rock pools.

Family TETRAODONTIDAE

Some general observations on the Tasmanian members of this family, with key, are given in Part XI (1963), and in Part XIII (1965), which adds to the local list *Tetraodon firmamentum* Temminck & Schlegel, 1850, and notes the attribution to Tasmania by Scott (1962: 297) of *Sphaeroides glaber* (Freminville), 1873 (the relationship of which with *S. liosomus* Regan, 1909, is not altogether clear). The genus here rendered *Sphaeroides* appears in the Check-List (McCulloch, 1929: 429) as *Spheroides* Duméril, 1806, the reference being to *Zool. Analyt.*, 1806, index, p. 342, where it occurs as the latinized form of *Les Sphéroïdes* found on p. 108 of the same publication: the Check-List shows both as being preceded by the vernacular *Les Sphéroïdes* of Lacépède, *Hist. Nat. Poiss.*, ii. 1800: 22 However, Scott uses the spelling *Sphaeroides*, which is accepted also by Whitley (1968: 90), who attributes it to Anon., in *Allg. Lit. Zeit.*, Sept. 24, 1798: 676 *ex* Lacépède vernac.

An interesting record, from the west coast of King Island, of a member of the order Tetraodontoidea, *Lagocephalus lagocephalus* (Linné), 1758, new to Tasmania (and to Australia) has recently been made by Andrews (1970). The familial relationships of, on the one hand, *Tetraodon* Linné, 1758 [appearing as *Tetrodon* in the 12th ed., 1766], and, on the other hand, *Lagocephalus* Swainson, 1839 (together with the genera grouped round each of these by authors who refer them to separate families) are differently regarded in different quarters, there being three main treatments adopted: (i) one family, Tetraodontidae, is recognized, *e.g.*, by McCulloch (1929), Greenwood, Rosen, Weitzman & Myers (1966), Berg (1940) [as Tetrodontidae]; (ii) one family, Lagocephalidae, is recognized, *e.g.*, by Whitley (1968); (iii) two families are recognized, Tetraodontidae and Lagocephalidae, *e.g.*, by Schultz & Stern (1944), Munro (1955), Munro (1967) [as Tetrodontidae]. In both works cited Munro keys the Lagocephalidae as having 2 nostrils on each side, the Tetraodontidae (Tetrodontidae) as having 1 nostril on each side, or nasal sac open, appearing as 2 tentacles, the latter specification being expanded in the 1967 text (p. 552) to 'A single nostril on each side of snout and may have the form of a simple pit, a non-perforated cavity with a fringed rim sometimes produced into two fleshy flaps, a simple tube with a pore at its end, or a pair of thick tentacle-like flaps without opening'.

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.

Counts, proportions. This midwater or deepwater species (the 12 described specimens, 22-140 fathoms; several localities) is rarely encountered in Tasmania: an example stranded at East Devonport, Devon has been recorded in Part XI (1963: 26). Examination of a specimen collected at Porky Beach, King Island, on 4 July 1970, by Mr M. T. Templeton (Q.V.M. Reg. No. 1970.5.21) yields some proportions differing from those given in the original account of the species.

Specifications of our fish are given in parentheses. D. 11-12 (12) [Scott (1962), 10-11]. A. 9-11 (9). P. 21 (21). C. 9+2 (9+2) Head 2.6-2.9 (2.84) in *Ls*. Snout 1.6-1.7 (2.11) in head. Eye 2.4-3.5 (1.88) in snout, 4.2-5.6 (3.96) in head. Largest dorsal ray 2.7-2.9 (2.59), caudal 1.2-1.4 (1.30) in head.

Some dimensions as TLs. Lengths to origins of dorsal, anal 765, 790. Dorsal base, between parallels 75, direct 84; anal 64, 73. Length to origin of pectoral 383, length of fin 160. Caudal 272. Longest dorsal ray 136, longest anal ray 109. Head 352. Snout 167. Eye 89. Interorbital 167. Length to vent 778. Depth (in parentheses, width) at gillslit 383 (370), at vent 235 (185); maximum 432 (346); caudal peduncle 110 (52). *Ls* 81, *Lt* 103 mm.

Coloration. Trunk above about midlateral line light brownish, except for a lighter saddle, extending from dorsal profile, behind to middle of pectoral, in front to middle of incomplete suprapectoral ring; this characteristic sharply delimited black line, in the form of about five-eighths of a circle, originates just in advance of upper part of gillslit, and arches high over pectoral base its chord 156 *TLs*, its height 105; rest of flank

whitish or white. Snout dark brown back to a line running from middle of lower border of orbit obliquely down to just behind lower lip; a subtriangular patch of brown bordering the light saddle on trunk, between this and eye another short light saddle; a short green spur backward from middle of posterior border of orbit; rest of lateral surface of head whitish or white. Ventral surface of head, trunk, tail wholly white, save for slight duskiness on caudal peduncle. Dorsal pale greenish, rays darker than membrane. Anal white. Pectoral colorless, except that about proximal one-sixth of uppermost 3 rays is dark brown, about proximal one-twelfth of remaining rays is dusky greenish. Lower 5 rays of caudal dark brownish, the lowest 2 throughout their length, the other 3 in distal half, or less; other rays touched distally with light brownish. The specimen is a female, the male having blue bars below and in front of eye, blue spots on head and flank, and a thin blue line outside the blue suprapectoral marking.

Spines. The only region without the small spines is the caudal peduncle; but very few occur on rest of tail.

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