https://doi.org/10.26749/rstpp.113.99

Papers and Proceedings of the Royal Society of Tasmania, Volume 113, 1979

(ms. received 9.1.1979)

OBSERVATIONS ON SOME TASMANIAN FISHES : PART XXV

by E.O.G. Scott
Launceston

(with six tables)

ABSTRACT

SCOTT, E.O.G., 1979 (20 vii): Observations on some Tasmanian fishes : Part XXV. *Pap. Proc. R. Soc. Tasm.*, 113: 99-148. ISSN 0080-4703. 82 Penquite Road, Launceston, Tasmania, Australia.

Five species are for the first time recorded from Tasmania; in each case some observations are made on the material, the chief points commented on here noted in parentheses.
CHAULIODIDAE - *Chauliodus sloani* (dentition, general features): IDIACANTHIDAE - *Idiacanthus fasciola* (specimen from gut of *Hyperoglyphe antarctica*); *I. niger* (type locality of synonymic *I. aurora*, Macquarie Island, part of a Tasmanian municipality): EMBIOTOCIDAE - *Diretmus argenteus* (juvenile characters): CARANGIDAE - *Trachurus mccullochi* (key to Tasmanian carangids): ANTHIIDAE - *Hypoplectrodes nigrorubrum* (additions to, revision of, published accounts, key to Tasmanian anthiids).

Observations are made also on the following species:-
MACROURIDAE - *Coelorinchus mortoni* (new material of little-known species); *Lepidorhynchus denticulatus* (food of *Rexea solandri*, abnormal spinous structure); *Macruronus novaezelandiae* (fluviatile example): SYNGNATHIDAE - *Solegnathus fasciatus* (sex dimorphism, relative growth, table of dimensions); *Stigmatophora argus* (comparison with published data). *Syngnathus phillipi* (proportions): SPHYRAENIDAE - *Austroluzza novaehollandiae* (food of seal, proportions): SCOMBRIDAE - *Gasterochisma melampus* (additional Tasmanian record): ANTHIIDAE - *Anthias pulchellus* (second Tasmanian record, extension of extant accounts). *Caesioperca rasor* (examination of 11 examples, table of dimensions); *Caesioperca lepidoptera* (additions to published accounts); *Callanthias allporti* (additions to, revision of, published descriptions): ECHENEIDAE - *Remora remora* (comparison with larger examples reported on earlier).

In the case of several species the existence of one or both of two interesting form patterns has been examined: (a) length of head, length to vent, standard length are found to be collinear in a loglog plot on integral numbers, (b) the lengths of spines and rays, in one or more sets, are found to yield a linear graph when plotted on a loglog grid against their serial (or reverse serial) numbers.

INTRODUCTION

This paper follows the general plan of others in the series. Linear measurements are given throughout unless otherwise specified in millimetres, the name of the unit commonly being omitted. The symbols *Ls*, *Lt*, *TLs*, *TLt* denote standard length, total length, thousandths (permillages) of standard length, thousandths of total length, respectively. Registration numbers denoted by Q.V.M. are those of the Queen Victoria Museum and Art Gallery, Launceston. Certain other conventions are noted in earlier contributions.

Observations on some Tasmanian Fishes : Part XXV

FAMILY CHAULIODIDAE

No representative of this group of deep-sea fishes has hitherto been met with in Tasmanian waters, the sole account in the literature of an Australian form being based on *Endeavour* material taken off the coast of Victoria, described by McCulloch (1916) as an indigenous species, *Chauliodus dannevigi*, now generally regarded as synonymic with the long-known extralimital *C. sloani* Bloch & Schneider, 1801, a species now added to our local list.

Genus *CHAULIODUS* Bloch & Schneider, 1801

Chauliodus Bloch & Schneider, 1801, SYST. ICHTHYOL., p.430. Type-species, *Chauliodus sloani* Bloch & Schneider.
Leptodes Swainson, 1839, NAT. HIST. CLASSIF. FISH. AMPHIB. REPT. (CABINET CYCLOPAEDIA, 2), p.298. Type-species, *Leptodes sloanii* (Bloch & Schneider).

Chauliodus sloani Bloch & Schneider, 1801

Chauliodus sloani Bloch & Schneider, 1801, SYST. ICHTHYOL., p.430.
Chauliodus dannevigi McCulloch, 1916, BIOL. RES. ENDEAVOUR, 4(4), p.179, pl.52. Type locality: Off Cape Everard, Victoria.
Chauliodus dannevigi: Munro, 1957, HANDBK AUST. FISH., 7, p.30, fig.210.

Tasmanian record

A partly digested specimen of a *Chauliodus* in two pieces was collected, 1-17 December 1977, by Mr John Head 27 km east-south-east of Tasman Island from the stomach of a deep-sea trevalla (this species appears in almost all Australian texts as *Hyperoglyphe porosa* (Richardson, 1845); however the synonymization of Richardson's fish with *H. antarctica* (Carmichael, 1818) proposed by Haedrich (1967) is now increasingly becoming accepted), taken in 460-550 m. Accompanying this specimen were two myctophids (forwarded to Dr J.R. Paxton, the Australian Museum Sydney, who has published on the Myctophidae, and is at present researching the Australian representatives), together with two unidentified and probably unidentifiable fragments.

Specific status

In his review of the Chauliodidae Baird (1973, p.279) concluded that of more than a dozen nominal species of *Chauliodus* only six are valid, *C. sloani* Bloch & Schneider, 1801, *C. macouni* Bean, 1890, *C. pammelas* Alcock, 1892, *C. barbatus* Garman, 1899, *C. danae* Regan & Trewavas, 1929, *C. schmidti* Ege, 1948. In describing *C. dannevigi* McCulloch (1916, p.179, pl.52) noted some minor differences between his material, a specimen 'nearly 200 mm' in length, taken by the *Endeavour* in 330-440 m 50 km south of Cape Everard, Victoria and the descriptions of the first three of these species (and of two nominal species). However, *C. dannevigi* is now regarded as a junior synonym of *C. sloani*.

While the present specimen is not in a sufficiently good state of preservation to permit of definitive specific determination, it would appear rather clearly to be identical with the fish described by McCulloch as *C. dannevigi*, i.e., *C. sloani;* on the available morphological evidence, reinforced by geographical considerations it is here referred to that species, the only one reported from our region (Munro, 1957a).

Description

(i) General. The recovered material comprises (a) head and anterior part of trunk ending in the vicinity of the pelvic base, total length 82 mm, from tip of upper jaw 76; (b) a second portion apparently continuous or subcontinuous with the first, 68 mm long, extending beyond the base of the rayed anal by approximately the length of the base.

Only scattered vestiges of the black integument remain intact, virtually the whole surface in both sections being stripped to the off-white flesh. There are thus lacking all photophores, on the number and distribution of which the key to species provided by Baird is mainly based. No fins are present. However, the locations of the dorsal and the rayed anal are made evident by what are clearly the persistent remnants of their bases. As figured by McCulloch (1916, pl.52) the dorsal base is distinctly elevated above the immediately adjacent profile: no fin rays remain but about half a dozen rounded prominences apparently represent the ends of the pterygiophores. The length to the base from tip of upper jaw (23 mm) is 1.9 times length to preopercular border (12), the base (6.5) being 3.5 in length to its commencement; both ratios being about equal to the corresponding values as estimated from McCulloch's plate. The base of the anal (all of the fin that remains) like that of the dorsal is elevated: about 12 rather stout subcylindrical projecting pterygiophores can be counted. The length of the base (11) is 1.1 (in good agreement with about 1.2 in McCulloch's illustration) times length from tip of upper jaw to preopercular border; or 10.0 (*cf.* McCulloch's figure about 11.5) in length to base. Six, possibly seven, short fine processes occupying the ventral profile between 64 and 67 mm from tip of upper jaw probably represent the bases of the pelvic rays; their distance from presumed dorsal termination is 1.25 (*cf.* about 1.32) times length from tip of upper jaw to dorsal termination. The hind portion of the head and the region immediately beyond it have been subject to some local displacement; however, a curved gelatinous ridge consisting of about a dozen vertically elongate segments and rather more than an eye diameter in length, located on the right side below and behind the operculum, is very probably the right pectoral base; a similar structure with its origin at a corresponding point on the left side, but dislodged so as to extend across the midventral line and to terminate almost in contact with the right-hand structure, would seem clearly to represent the left pectoral base. No trace can be found of either the adipose dorsal or the adipose anal. The somewhat ridged obscurely crenulate triangular posterior end of the second segment of the fish may represent the base of the caudal.

(ii) Proportions. McCulloch noted several body ratios for the type-specimen of *C. dannevigi*. Seven items for which an estimate for our specimen can be made (two relative ray lengths omitted) are here noted (McCulloch's values in parentheses). Head from premaxillary symphysis to end of operculum 9 (7.6) in *Ls.* Greatest depth of head 1.1 (almost equal to) head length. Depth of body anterior to dorsal 1.7 (1.4) in head. Eye 1.04 (equal to) snout, 3.2 (4.2) in head. Pectoral-ventral interval 0.9 (1.5) in ventral-anal interval, 3.1 (2.7) in length from end of operculum to hypural. Base of anal 1.5 (1.6) in head. The most marked discrepancies involve the relatively greater anal-ventral interval in the *Endeavour* fish: possibility that a short section between the two segments of our fish is missing cannot be dismissed.

(iii) Dentition. While the large anterior teeth present a more or less constant pattern, the other teeth exhibit some variation on the two sides of the jaw. Premaxillary fangs four on each side; four evenly spaced, first a little longer than fourth, slenderest, subcylindrical except proximally, here expanded vertically and compressed laterally, with a shallow groove in proximal one-third of inner surface; second longest, somewhat flattened, sabre-like, with a short downwardly and forwardly oblique elongated triangular element constituting tip; third and fourth much like second but smaller, fourth the longer, somewhat more backwardly directed: additional teeth on left side, one situated somewhat internad of, and anterior by less than its own width to, second normal tooth; one very small curved about midway between second and third fangs but inserted somewhat externad of these; two small teeth or tooth-like projections arising from a small bony lamella near base of third fang: on right side an additional tooth arising at base of fourth fang, subequal in length to this but much more slender, directed backward at an angle of about 60° to it so that it comes to lie along anterior portion of the row of small maxillary teeth with which it is nearly in contact. Anterior edge of maxilla almost wholly occupied by a row of

closely set very small backwardly directed teeth; on left side 31, increasing in length backward to the last half dozen, odd-numbered teeth (counting from most anterior) distinctly shorter than even-numbered; on right side a similar but less well preserved series, in the anterior portion the distinction in size between alternate teeth somewhat less pronounced than on left.

Mandibular series on left side of six, first very large almost twice length of longest premaxillary fang, approximating total length of head, second less than one-third as long, third strongly recurved, about twice length of second, rest small weak decreasing in size backward, last less than 1 mm; similar series on right side together with a microscopic seventh tooth.

On right side three small recurved teeth, their heights a little greater than the intervals between them, occur on the floor of the mouth at the level of the hinder part of the maxillary tooth-line, together with one large erect tooth slightly in advance of level of fourth fang; on the left side, which is somewhat crushed, only the isolated anterior tooth is detectable.

Family IDIACANTHIDAE

The family Idiacanthidae (including Stylophthalmidae, Stylophthalmoidae based on the remarkable stalk-eyed larval form originally described as a distinct species) is represented by a single cosmopolitan genus, *Idiacanthus* Peters, 1876, usually found at great depths. Of a small number of species described at most three probably only two are valid (Smith 1970), *I. niger* Regan, 1914, *I. fasciola* Peters, 1876, *I. atlanticus* Brauer, 1906, the third not improbably a synonym of the second. The Handbook (Munro 1957a, p.300, fig.212) lists *I. fasciola* from off Northern Australia and (p.301, fig. 213) *Stylophthalmus paradoxus* Brauer, 1903, 'presumably the larval form of the preceding species' from oceanic depths off New South Wales: Dr J.R. Paxton informs me the Australian Museum has recently taken adult *I. fasciola* off southern New South Wales. There have been no formal records for Tasmania of an idiacanthid (see, however, note below on a record of *I. aurora* Waite, 1916, a synonym of *I. niger* Regan, 1914, from Macquarie Island).

Genus *IDIACANTHUS* Peters, 1876

Idiacanthus Peters, 1876, *Monatsb. Akad. Wiss.* Berlin, p.846 [dated 1877, issued December 1876]. Type-species, *Idiacanthus fasciola* Peters.
Bathyophis Günther, 1878, *Ann. Mag. Nat. Hist.*, (5), 2, p.181. Type-species *Bathyophis ferox* Günther.

Idiacanthus fasciola Peters, 1876

Idiacanthus fasciola Peters, 1876, *Monatsb. Akad. Wiss.* Berlin, p.846. Type locality: northward of Australia, 117°E, and New Guinea, 136°E, 104'S (2 specimens, both at surface).
Bathyophis ferox Günther, 1878, *Ann. Mag. Nat. Hist.*, (5), 2, p.181. Type locality: middle of North Atlantic, *Challenger* Station 63, 2750 fathoms (3520 m).

Tasmanian record

An example of approximate total length 155 mm from the stomach of a deep-sea trevalla, or bream trevalla, *Hyperoglyphe antarctica* (Carmichael, 1818) — appears in the Handbook and in most Australian texts as *Hyperoglyphe porosa* (Richardson, 1845), of which *Eurometopus johnstonii* Morton, 1888, with Tasmania as type locality, is a synonym — taken 30 km east-south-east of Wineglass Bay (Thouin Bay), east coast, 12 July 1978 by Mr John Head; Q.V.M. Reg. No. 1978/5/33.

Specific determination

In view of the circumstances of its collection the specimen is expectably not in very good condition. Part of the head including almost the whole of the upper jaw in advance of the eye is lacking; the caudal fin is missing and it is possible there is some further loss in this region, though the general form, the sectional vertebral counts and the relative positions of the insertions of the fins combine to suggest that if such is the case the loss is a minor one; the dorsal and anal fins have suffered considerable damage. Throughout the length of the fish the flesh is closely adherent to the vertebrae, the outlines and in parts the actual surfaces of which are evident; however, this condition is not wholly attributable to the effects of digestive processes, it having been noted by Günther (1887, p.216) of the *Challenger* specimen of the synonymic *I. ferox* that it had "the muscular system so little developed that in its present preserved state the vertebral column appears to be merely covered by the skin, with the outlines of the vertebrae clearly visible."

Though the dorsal fin is imperfect and its forward extension somewhat doubtfully determinable, it would seem to be traceable for two possibly three vertebrae in advance of the well preserved ventrals – the sole criterion employed by Smith (1970, p.101) in his key to the genus *Idiacanthus* to distinguish *I. fasciola* and *I. atlanticus* together from *I. niger*, in the last-named ventral origin being in advance of dorsal origin. The distinction between *I. fasciola* and *I. atlanticus* rests on the number of photophores of the VAV series extending from ventral origin to vent (15-18, 22); unfortunately few of the photophores are here recognizable. In view of the reasonably likely exclusion of *I. niger* by the dorsal-ventral relation, of the dubious systematic status of *I. atlanticus* and its limited established distribution (west coast of South Africa), and of the known occurrence of *I. fasciola* in most, including Australian, seas, the specimen is here provisionally ascribed to the last-named species.

General observations

Extremely attenuate, band-shaped, the head relatively large and deep, its length equalling or exceeding that of trunk immediately behind, trunk thereafter decreasing slowly in height posteriorly, a process continued throughout length of tail. Ventrals preserved but locations of dorsal and anal origins somewhat conjectural: as measured, the origins at 323, 338, 667 *TLt* units from tip of lower jaw; approximate corresponding values estimated from the illustration by Günther (1887, pl.52, fig.D) of his *I. ferox (= I. fasciola)* 340, 340, 640. Ventrals inserted on 20th (Günther 22nd) vertebra behind head, vertebrae between ventral and anal origins 16 (17), remaining vertebrae 19 (20), total 55 (59). The count of 19 preventral vertebrae has been made from level of obvious end of inferior profile of head; however, in a curious extension the vertebral column extends forward of this point constituting present dorsal profile for 12 mm in the form of 9, possibly 10, compressed centra, reaching to within 2-3 mm of eye or about to level of middle of intact lower jaw. Vertebrae of trunk hourglass-shaped, anteriorly about twice as long as deep, posteriorly somewhat shallower. Dorsal and anal rays simple, very slender, each inserted at the anterior end of a vertebra, subequal in length to it; no remaining traces of fin membranes. A series of short stout slightly recurved spines, one in front of each dorsal ray, modally inserted on elevated ring at junction of adjacent vertebrae and then immediately at base of ray, occasionally at some little distance from junction. Ventral with 6 simple rays, relatively elongate, slender, length about 12 mm, extending over two and a half centra.

Ventral profile of head descending abruptly near middle of jaw and extending well behind level of gape as a pronounced subhorizontal ridge, its maximum depth about twice that of jaw proper. Barbel originating on knob at anterior end of keel, as preserved 68 *TLs* (18 mm) long, filamentous. Teeth mostly large or largish, slender, straight or slightly suddenly recurved distally, depressible. In lower jaw on left side 22 main teeth in 4 sets as follows, 5 increasing in size backward, last 3 mm about five times

first, 6 increasing in size backward last 4 mm, 4 increasing very slowly backward to third 1.5 mm, followed after a short diastema by 4 very small decreasing in size backward, largest 0.3 mm last minute: inserted externad of first set 2 very small, of second set 5 small, of third set 2 very small. A generally similar arrangement on right side with, from front, primary sets of 5, 4, 3, 4, together with 6 small teeth set outside the rest.

Whole fish including inside of mouth black, ventral rays black, dorsal and anal rays dark brown proximally lighter distally; exposed vertebrae whitish or yellowish.

Idiacanthus niger Regan, 1914

Idiacanthus niger Regan, 1914, *Ann. Mag. Nat. Hist.*, (8), 15, p.14. Type locality: New Zealand *(Terra Nova)*.
Idiacanthus aurora Waite, 1916, *Sci. Rept Aust. Antarct. Exped.*, 3(1), *Fish.*, p.53, pl.5, fig.1 and text fig.11. Type locality: Off Macquarie Island, 145-636 fathoms (2650-1160 m).

Remarks

From time to time writers have included in New Zealand faunal surveys fish collected at such subantarcitc localities as the Campbell Islands, Auckland Islands, Macquarie Island; such is the case with the present species in the shape of the synonymic *I. aurora* described by Waite (1916) from the last-named locality, a record entered in the check-list of fishes recorded from the New Zealand region by Whitley (1968, p.21). Situated in 158.58 E, 59.29 S, Macquarie Island is zoogeographically in the subantarctic region; at the same time it is in terms of political geography part of Tasmania being included in the municipality of Esperance. It is perhaps appropriate to draw attention here to the ambivalent locality-status of *Idiacanthus niger*.

For a note on a similar situation involving the sleeper shark, *Somniosus antarcticus* Whitley, 1939, known only from Macquarie Island, see Part XXII (1976, p.160).

Family MACROURIDAE

The family name Macrouridae is here adopted in line with the recommendation of Greenwood *et al.* in their general classificatory scheme (1966); common alternatives that have been employed in Australian texts are Macruridae, Macruroididae, Coryphaenoididae. The Australian species were keyed in Part XI (1953, p.150). Species credited to Tasmania in the Handbook (Munro 1957 b, c) are *Macruronus novaezelandiae* (Hector, 1871), *Lepidorhynchus denticulatus* (Richardson, 1846), *Coelorinchus australis* (Richardson, 1839), *C. fasciatus* (Günther, 1878), with *C. innotabilis* McCulloch, 1907, from Bass Strait; in Part XVII (1970) the writer suggested the rehabilitation of *C. mortoni* Ogilby, 1897, with Tasmania as type locality, early sunk in synonymy.

Genus *COELORINCHUS* Giorna, 1809

Coelorinchus Giorna, 1809, *Mem. Acad. Sci. Turin* (1805-1809), p.179. Type-species *Coelorinchus laville* Giorna. Variably spent by authors *Coelorhynchus*, *Coelorynchus*, *Coelorhincus*.

Coelorinchus mortoni Ogilby, 1897

Coelorhynchus mortoni Ogilby, 1897, *Pap. Proc. R. Soc. Tasm.* (1896), p.83. Type locality: Estuary of the Derwent River, Tasmania. Type destroyed (McCulloch, 1929, p.127).

Coelorhinchus australis: McCulloch, 1929, *Mem. Aust. Mus.*, 5(1), p.127, *partim*. Not *Lepidoleprus australis* Richardson, 1839 (type locality: Port Arthur, Tasmania).
Coelorhynchus mortoni: Scott, 1970, *Pap. Proc. R. Soc. Tasm.*, 104, p.38, fig.1.

Status

The history of Ogilby's species, described in this journal (1897), has largely been one of taxonomic neglect or rejection. Not noticed in the local lists of Lord (1923, 1927) and Lord & Scott (1924) and not represented in the key to the Australian and New Zealand species of the (relevant) subgenus *Paramacrus* as these are interpreted in the *Endeavour* Report it was relegated by McCulloch (1911, p.38) to the synonymy of *C. australis* (Richardson, 1839), a position maintained in the check-list (1929), and adopted also in the Handbook by Munro (1957 c). In Part XVII (1970) reasons were advanced for its recognition as a valid species, detailed descriptions of two complete specimens and a head being provided, together with figures (general view, dorsal surface of head, scale). No illustration was given by Ogilby.

Additional material

In June 1978 the Queen Victoria Museum received from Mr Shane Downe a specimen 396 mm in total length, slightly imperfect posteriorly, estimated intact length 410 mm (Reg. No. 1978/5/82). This species is readily recognizable by the presence of some eight or ten conspicuous white lines on the side, the middle three or four extending unbroken from shortly behind head to end of tail; these stripes are not found in *C. australis*, the only significant marking of which is a pair of oblique dark bars, one in front of first dorsal, the other below beginning of second dorsal. Mr Downe informs me it is not uncommon round about St Helens, east coast, even being exploited commercially there. The quantitative data on the earlier specimens given in table 3 in Part XVII are here supplemented by the meristic characters and principal dimensions of the present specimen. The relative lengths of the primary regions head trunk tail are also examined, and some length-number relations of fin rays are specified.

Meristic characters

D. II, 10; *ca* 79. A. *ca* 79. V. 7. P. 17. L. lat. *ca* 100 (imperfect distally). L. tr., from origin of first dorsal 4/1/15, from origin of second dorsal 4/1/9.

Dimensions as *TLs*

The estimated standard and total lengths of 405 410 are here and elsewhere adopted. Total length 1012. Length to origin, termination of first dorsal 249, 316, origin of second dorsal 353, origin of anal 338. Length to origin of pectoral 215, total length of fin 135, length of longest (3rd) ray 115. Length to origin of ventral 225, total length of fin 109, longest ray ('spine') 101 (for other rays see below). Length to middle of vent 331. Both dorsal spines damaged (for other first dorsal rays see below). Rays of second dorsal, 1st, 2nd, 3rd, middle, last preserved 22, 24, 25, 16, 17. Anal rays, 1st, 2nd, 3rd, middle, last preserved 56, 64, 67, 62, 62, 22. Head 212. Snout 62. Eye, horizontal diameter 67, vertical 49. Interorbital 63. Length to front, back of mouth 46, 53, width of mouth 96. Depth (width) at front of upper lip 75 (81), front of eye 86 (89), back of mouth 121 (107), back of eye 128 (111), operculum 153 (114), anal origin 133 (99); maximum 163 (114). Direct distance genal ridge to eye 23, to nostril 15; nostril to eye 5. Internarial 59. Interpelvic 52.

These relative dimensions are in general in good agreement with those recorded for the specimens in table 3 in Part XVII (1970), the present example showing somewhat greater values for length of pectoral, width of mouth.

Proportions

Values for 1970 specimens, *Ls* 508, 509, in parentheses. Maximum depth 6.1 (6.6, 6.6), depth at anal origin 6.8 (7.4, 7.6) in *Ls*. Head 4.7 (5.3, 4.8) in *Ls*. Snout 3.4 (3.3, 3.1) in head. Length to mouth 4.6 (5.3, 5.9), width of mouth 2.2

(3.0, 2.8) in head. Eye 1.1 (1.0, 1.0) snout, 1.1 (1.0, 1.1) interorbital. First dorsal base 15 (18, 15) in *Ls*, 3.2 (3.3, 3.2) in head. Pectoral 8.3 (9.3, 9.1) in *Ls*, 1.6 (1.7, 1.9) in head. Ventral 9.2 (11.0, 10.5) in *Ls*, 2.0 (2.1, 2.2) in head.

Ventral fin

While all the 7 ray elements of the ventral are conventionally regarded as rays, the preaxial element is of a somewhat anomalous nature, being in respect of its location the analogue of the spine in the modal, and probably basic, type of fin. Apart from its position it is here distinguished from the remaining elements in being somewhat more rigid (especially briefly proximally), unbranched, more or less ivory in color (rest of fin greyish), all spine-like attributes; on the other hand it is unspinelike in being the longest element of the series, its length being such as clearly to exclude it from the quite definite length-number pattern presented by the 6 other rays (all branched, modally with two successive divisions).

It is found these 6 elements increase exponentially in length with their serial number (extreme postaxial ray counted, in accordance with convention adopted in Part XIX (1974) as first, thus yielding, as for comparable formulations for other fins, a line with a positive slope). With lengths as millesimals of accepted standard length in a loglog plot on 1 2 3 4 5 6:

Log L = 0.2821 log N + 1.722; t = 11.522***; predicted (observed) lengths 53 (51) 64 (67) 72 (74) 78 (78) 83 (81) 87 (86).

In view of the recognition of this length-number pattern in the present specimen the comparable equations for the two 1970 examples have also been calculated, the parameters being 0.1615, 0.1973 and 1.7215, 1.6902, t 19.189***, 13.918***; percentage difference between given and estimated values being in specimen (a) 0.6 - 1.5 mean 0.7, in (b) 2.2 - 5.6 mean 3.9.

First dorsal

The 2 spines are imperfect and their length cannot be determined; in the 1970 examples the first is only 0.06, 0.05 of the second, the latter subequal to first ray. The 10 rays of the first dorsal decrease regularly in height backward, and it is found that when the logarithms of their lengths are plotted in reverse order of the rays on logs 1-10, a significant first degree equation is obtained. It has been thought of interest to carry out also for the dimensions of the earlier specimens given in table 3 of Part XVII (1970, p.43) the calculations made on Mr Downe's fish. The results are subjoined; all dimensions millesimals of standard length (405, 509, 508 mm): in 1970 (b) there is no entry for shortest (10th) ray (imperfect).

1978. Log L = 0.8195 log N^1 + 1.3088; t = 31.413***; calculated (measured) lengths 20 (22) 36 (35) 51 (49) 63 (59) 76 (73) 88 (83) 100 (104) 112 (117) 123 (132) 134 (136).

1970 (a). Log L = 0.8215 log N^1 + 1.3552; t = 32.818***; 23 (21) 40 (41) 56 (62) 71 (72) 85 (83) 99 (99) 112 (117) 125 (125) 138 (131) 150 (144).

1970 (b). Log L = 0.8677 log N^1 + 1.2676; t = 31.157***; - (-) 34 (34) 48 (51) 62 (57) 75 (73) 88 (85) 100 (104) 113 (116) 125 (128) 137 (133).

Head, head + trunk, head + trunk + tail

In a loglog plot these dimensions are found to be linear on 1, 2, 10. The recognition of this relation here has prompted the making the comparable calculations for the earlier specimens for which data are recorded in Part XIII (1970, table 3). For the present example the estimated standard length of 405 mm has been adopted (other lengths 509, 508). Length-number specifications are set out below, all lengths being in *TLs* units (given dimensions in parentheses).

1978. Log L = 0.6700 log N + 2.3222; t = 49.117*; 210 (212) 336 (331) 996 (1000).

1970 (a). Log L = 0.6858 log N + 2.3112; t = 40.387*; 205 (208) 329 (322) 999 (1000).

1970 (b). Log L = 0.7291 log N + 2.2701; t = 170.743**; 186 (187) 309 (307) 998 (1000).

Genus *LEPIDORHYNCHUS* Richardson, 1846

Lepidorhynchus Richardson, 1846, ZOOL. VOY. EREBUS AND TERROR, FISH., p.53. Type-species, *Macruronus vel Lepidorhynchus denticulatus* Richardson.
Optonurus Günther, 1867, REPT VOY. CHALLENGER, ZOOL., 22(57), pp. 124, 127. Type-species, *Optonurus denticulatus* (Richardson).

Lepidorhynchus denticulatus Richardson, 1846

Macruronus vel Lepidorhynchus denticulatus Richardson, 1846, ZOOL. VOY. EREBUS AND TERROR, FISH., p.53, pl.32, figs 1-3. Type locality : South Australia.

Remarks

This species does not rate a formal entry in either of the lists of Johnston, though in the addenda to the first (1883, p.143) in proposing his *Coryphaenoides tasmaniae (= C. novaezelandiae* Hector, 1871*)* he observes 'It is very probable that *C. denticulatus* Rich., which is found on the South Australian and New Zealand coasts, also inhabits Tasmanian waters'. In the lists of Lord and Lord & Scott it is referred to Günther's genus *Optonurus;* rather curiously the last-named work provides no express Tasmanian record, remarking only 'Specimens have been secured by trawlers in Bass Strait.'

A specimen obtained near St Helens, east coast, in September 1978 by Mr. Shane Downe (Q.V.M. Reg. No. 1978/5/98) is of some special interest on two counts, the circumstances of its collection and its possession of an unusual structure.

The fish, approximately 465 mm in total length, was found in the mouth of a *Rexea solandri* (Cuvier, 1832), taken at a depth of about 440 m. *R. solandri* (referred in the lists of Johnston to *Thyrsites* Cuvier, 1832, in later lists to *Jordanidia* Snyder, 1911), which appears in Australian works under various names, chiefly hake, king barracouta, kingfish (Tasmania; applied elsewhere to *Cybium commerson* Lacépède 1800, *Seriola grandis* Castelnau, 1872), now has the official vernacular name gemfish by decision of the Commonwealth Standing Committee on Fisheries (Anon. *in Australian Fisheries*, 1975, p.18), the use of any other name in merchandising being illegal in New South Wales. Though somewhat crushed, particularly about the head, the macrurid as recovered was intact overall, but it was not in good enough condition to permit of satisfactory detailed measurement.

The fish possesses an unusual structure in the shape of a strong supernumerary double spine at the front of the dorsal fin. This consists of two subparallel blade-like bony processes, compressed laterally, sharply pointed distally, directed backward and upward, their total length 10 mm, their bases about 1 mm apart set in two contiguous protuberances. The normal spines, of which there is the regular complement of 11, are also divided, their moities being side by side instead of as usual one behind the other.

Macruronus novaezelandiae (Hector, 1871)

Coryphaenoides novae-zelandiae Hector, 1871, *Trans. N.Z. Inst.*, 3, p.136, pl.18, fig.1. Type locality: Off Ward Island, Port Nicholson, New Zealand.
Coryphaenoides tasmaniae Johnston, 1883, *Pap. Proc. R. Soc. Tasm.* (1882), p.143. Type locality: Kangaroo Bluff, Tasmania.

Remarks

Johnston's species is undoubtedly conspecific with Hector's, with which his account suggests he was unacquainted. It occurs seasonally in schools on the west coast (Johnston, Lord & Scott *fide* Rodway), and is known at times to enter the Derwent

and Tamar rivers on the south and north coasts. Three examples, *Lt* 527 530 545 from Strahan, west coast, were examined in some detail in Part VI (1953, p.153). That account noted also an example, *Lt* 346, from the Tamar River at Beauty Point; a further example, *Lt* 425, taken much further up the river was dredged in 50 - 80 m at Deviot some 25 km from the sea on 16 September 1978 by Mrs Suitor (Q.V.M. Reg. No. 1978/5/102).

In meristic characters and in general form this fish exhibits no notable departures from the 1953 material; there are, however, some minor differences in proportion. There are here noted for the four ratios reported in the Handbook (Munro 1957) the present values followed in parentheses by the range for our earlier specimens and the single-value Handbook entires. Depth in total length 7.33 (7.07, 6.34 two examples only, 7.5). Head in total length 5.67 (6.06-6.39, 5.6). Head in trunk 1.63 (1.58-1.64, 1.6). Interdorsal in base of first dorsal 4.07 (4.89-6.17, 5.6).

Head, head + trunk, head + trunk + tail

As with *Coelorinchus mortoni* these dimensions are here linear in a loglog plot with three natural numbers. However, reflecting the noticeable differences in the relative locations of the three points the vent here comes closer to 5 than to 2, the equation with abscissal values 1,5,10 reaching formal significance (t = 19.179) for this specimen but falling fractionally short of it (12.633) for the geometric mean of the three 1953 examples. The best fit is on 3,4,5 with t = 129.243**, 28.702*; slopes 3.3880, 3.5437, intercepts 0.6301, 0.5143, predicted (measured) values 176(177) 468(464) 996 (1 000) and (geometric means) 166(163) 444(429) 978 (1 000), all dimensions as *TLs*.

Family EMBIOTOCIDAE

In their provisional teleost classification Greenwood *et al.* (1966) recognize the Embiotocidae (sometimes rendered Ambiotocidae) as embracing Diretmidae Hysterocarpidae and Holconotidae. If the first of these is accepted as being of family status — as it is in the Handbook (Munro 1958 a) and as it continues to be by some overseas authors working on the group, e.g., Woods & Sonoda (1973), Post & Hecht (1972) — the fish here reported on is to be referred to it. No member of the Embiotocidae has previously been recorded from Tasmania, and the present species is the only Australian representative listed in the Handbook and the Check-list (McCulloch 1929). I am indebted to Dr John R. Paxton, Australian Museum Sydney for assistance in determination of the specimen and in the provision of literature not available in Tasmania.

Genus *DIRETMUS* Johnson, 1863

Diretmus Johnson, 1863, *Proc. zool. Soc. Lond.*, p.403. Type-species, *Diretmus argenteus* Johnson.
Discus Campbell, 1879, *Trans. N.Z. Inst.*, 2, p.297. Type-species, *Discus aureus* Campbell. Not *Discus* Fitzinger, 1833, Lesson, 1837.
Gyrinomene Vaillant, 1888, EXPED. 'TRAVAILLEUR' ET 'TALISMAN', POISS., pp. 18, 355. Type-species *Gyrinomene nummularis* Vaillant *nom. nud.* Also *Gyrinonemus auct.*
Campbellina Fowler, 1958, *Not. Nat.*, 310, p.15 (new name to replace *Campbellina*, preocc. in Mollusca).

Diretmus argenteus Johnson, 1863

Diretmus argenteus Johnson, *Proc. zool. Soc. Lond.*, p.403, pl.36, fig.1. Type locality: Madeira.
Diretmus argenteus: Günther, 1887, REPT CHALLENGER, ZOOL., 22(57), p.45: McCulloch, 1909, *Rec. Aust. Mus.*, 7(4), p.320: Woods & Sonoda, 1973, *Mem. Sears Found. Mar. Res.*, 1(6), p.20 (references and synonymy).

Tasmanian specimen

A juvenile example *Ls* 21.0 *Lt* 25.0 + (caudal imperfect) was found in the gut of a deep-sea trevalla, *Hyperoglyphe antarctica* (Carmichael, 1818) between 1 and 17 December 1977, taken in 460-550 m, by Mr John Head 27 km east-south-east of Tasman Island; Q.V.M. Reg. No. 1978/5/1.

Meristic characters

D.27 (species range (Woods & Sonoda 1973) 27, 28, rarely 26 or 29). A. 22 (21, 22, rarely 20 or 23). V.I, 6. C. *ca* 14 (fin damaged). Neither scales nor abdominal scutes are obvious, though there is some suggestion the latter may number about 11 + 11.

Dimensions as *TLs*

In this paragraph comparative ranges reported by Woods & Sonoda for 4 small specimens 48-92 mm and for 4 large specimens 212-262.5 are given in parentheses; their values as percentages (with one decimal figure), here rendered as millesimals. Greatest depth 776 (570-626, 457-460). Caudal peduncle, least depth 95.2 (92.6-117, 99.0-106), length 152 (125-163, 127-141). Head 433 (365-404, 352-378). Snout 85.7 (66.4-96, 6.95-90.4). Eye 195 (175-194, 158-195). Interorbital 66.7 (56.5-83.4, 47.2-5.95). Length of upper jaw 319 (250-294, 222-251). Length of pectoral 381 (337-385, 262-328). Length of ventral 238 (318-41.4, 290-340). The Tasmanian specimen is seen to lie outside the published ranges in three instances — whether these differences (all of greater magnitude) reflect possible influence of geographical or age factors or are attributable to mere individual variability remains unclear. However, the progressive decrease of depth with age in the three specifications above is expectable; Smith (1970, p.150) noting depth in length 1½ in juveniles to 2 in adults.

Other dimensions. Length between parallels to origin, termination of dorsal 400, 862, of anal 924, 952; oblique lengths of fin bases 490, 381. Length to pectoral, front of base 419, insertion of most anterior (uppermost) ray 433. Length to ventral 438. Length to insertion of outer rays of caudal 981, of middle rays 1 014. Depth at front of eye 286, at back of eye 600, at opercular border 714, at origin of ventral 714, midway between the last two points 776 (maximum), at vent 524. Greatest width of maxilla normal to long axis 148, obliquely 157.

Proportions

For the 4 proportions for which ranges are given in the Handbook (Munro 1958a) the values are: depth 1.29 (1.4-2.2), head 2.31 (2.5-2.9) in standard length; snout 5.51 (3.7), eye 2.22 (1.5-2.7) in head. From these data the snout would appear noticeably shorter in our fish than normal. However, the figure for head in snout as calculated from the means of the ranges for these two dimensions as given by Woods & Sonoda stands midway between the present and the Handbook values, being for the smaller examples 4.74, for the larger 4.57.

General observations

Both the currently accepted species, *D. argenteus* and *D. pauciradiatus* Woods, 1973 — the question of a separate genus for the latter has been mooted by Post & Hecht (1972), who, on the basis of otolith studies, further suggest this species may include two taxa — are decidedly variable in morphometric characters, the latter undergoing a series of changes in shape by allometric growth during ontogenesis (Post 1976), while *D. argenteus* is said to keep the disc shape of the juvenile. At the same time the constancy of shape thus implied for the present species would appear to be subject to some qualification. Our specimen — which at *Ls* 21 is less than half the length of the smallest example examined by Post & Sonoda, about one-fourth the nominal length of 3½ inches (90 mm) given by the Handbook, and about one-seventh the length attained by the species (itself about 0.4 that reached by *D. pauciradiatus*) — exhibits some distinct variations in outline when compared with Johnson's figure reproduced in the Handbook (Munro 1958a, fig. 543). The dorsal profile, depicted as overall a more or less

symmetrical moderately convex curve, here slopes up from eye to highest point near dorsal origin in two subequal approximately linear segments, the anterior at a much more acute angle; under the base of the dorsal the outline is again virtually linear. Little difference is apparent in the anterior half or more of the ventral profile but along the base of the anal the outline, figured as rather strongly convex, is close to straight and at the same time rises decidedly more steeply, resulting in a noticeable decrease in the longitudinal extension of the fin relative to its total oblique length, the former being only one-fifth of the latter.

Mouth cleft highly oblique. Maxilla with strong striae radiating up and back from point near middle of inferior border; reaching to below 0.9 (Handbook middle) of eye. Whole operculum striated, ridges tending to be stronger in upper half. Some spines along lower preopercular margin and bordering interoperculum. In front of dorsal two median protuberances, posterior as far from fin as from anterior, a distance equal to that occupied by five dorsal rays. No dorsal rays preserved, but their number and location clearly indicated by rounded pterygiophores together forming a continuous low crenulate ridge decreasing evenly in altitude backward. Only a few anal rays present, slender, simple, length about equal to diameter of pupil; pterygiophores clearly visible in a more or less pellucid palisade. Caudal damaged and terminally imperfect, rays as far as intact unbranched, some stout. Pectoral rays slender unbranched, 3rd longest little more than 1st and 2nd; fin base virtually horizontal. Ventral when adpressed fitting along a short backwardly and upwardly oblique straight segment of profile terminated behind by front of anal a trifle in advance of tip of ventral.

Coloration

The Handbook specification is 'uniform brownish. Fins grey. Inside of mouth black'. Our specimen though clearly at a quite early stage of overall pigmentation yet presents one large very striking marking, which, however, is probably not superficial (see below).

Ground color of trunk and tail uniform pale yellowish. A small brownish pennon, widest and darkest anteriorly, extending from behind head along dorsal part of body, close to profile, to level of first one-third of dorsal base; a very slender blackish line bordering dorsal base, surmounted by the whitish or pearly ridge of pterygiophores; below this and extending forward to top of head a longitudinal line of some thirty small brownish chromatophores, anterior half an eye diameter from, posterior virtually on, dorsal profile, continuous behind with a patch covering more than half caudal peduncle; from end of anal base a double series of about a score obliquely forward and downward for about an eye diameter. The only conspicuous large-scale marking on the trunk a sharply demarcated curved bar of uniform dark bluish, approaching blackish, extending from just above pectoral base to barely short of ventral profile immediately in advance of anal origin, widening downward to an eye diameter, ending in a straight line parallel to profile. Head in part darker than body; dorsum variably brownish; maxilla, operculum, preoperculum silvery or whitish; a subtriangular very dark brown spot above and behind eye near border of head at 2 o'clock (left side viewed); ventral surface partly silvery partly dusky, a median dark spot between ends of maxillae; an extension across head towards eye and mouth of the dark curved bar on the trunk, which appears to underlie the operculum and which may well represent the alimentary canal visible through the integument. Anal, caudal rays off-white, pectoral and ventral silvery white.

Distribution

The example noted by McCulloch (1909) was taken in deep water south-east of Cape Howe (near border of Victoria and New South Wales, leading some overseas writers to cite latter State); this is the only locality recorded in the Handbook. The species has been obtained in New Zealand, Campbell's material (the description of which led him

to propose his genus *Discus*) coming from Hokitika beach: the distribution indeed is world wide in tropical and temperate waters but is mainly eurytropic.

Family SYNGNATHIDAE

Genus *SOLEGNATHUS* Swainson, 1839

Solegnathus Swainson, 1839, NAT. HIST. CLASSIF. FISH. AMPHIB. REPT, 2, p.333. Type-species, *Solegnathus hardwickii* Gray.
Solegnathus: McCulloch, 1929, *Aust. Mus. Mem.*, 5(1), p.94 (references and synonymy).

Solegnathus fasciatus Günther, 1880

Solegnathus fasciatus Günther, 1880, REPT VOY CHALLENGER, ZOOL., 1(6), p.30, pl.14, fig.B. Type locality: Off Twofold Bay, New South Wales.

Recent material

A series of 7 specimens, (a) ♀ *Lt* 142, (b) ♀ 264, (c) ♂ 305, (d) ♀ 319, (e) ♀ 344, (f) ♂ 355, (g) ♂ 361, collected by Mr Shane Downe on 10 June 1978 in 110 m off St Helens Point, east coast (Q.V.M. Reg. No. 1978/5/83) provides some additional information on this species.

Meristic characters

D. 36 (2 individuals), 37 (3), 38 (2). P. 24 (3), 25, 26 (2), 27. Annuli 24, 25 (3), 26 (3) + 56 (2), 57 (3), 58, 60. Subdorsal annuli 0.9 of 1st; 0.0, 0.4, 0.5, 0.6 (2), 0.7 of 2nd (counting fractions cephalad) + 0.8, 0.9 (2) of 11th; 0.4, 0.5 (3) of 12th. Brood pouch: (c) incipient or regressed, traceable through 17 caudal annuli, (f) in 2 rows on 17 annuli, (a) in 2 rows on 19 annuli. Prehensile caudal annuli 28, 29, 30 (4), 31.

Dimensions

Table 1 records for each of 25 dimensions, expressed as millesimals of total length, range, mean with standard error, coefficient of variation with standard error. The inclusion of the coefficient of variation provides a useful indication of the taxonomic value of the variate. For a tolerably homogeneous sample such as the present it may broadly be taken that values of V of > 5, of > 5 < 10, of > 10 suggest the variate is likely to be of considerable, of fair, of little value, respectively, as a systematic criterion; however, this assessment is not necessarily valid in the case of a dimension exhibiting allometric or other differential growth.

Proportions, conspectus values

Eye in snout, range 2.8-4.6, mean 3.72±0.606, coefficient of variation 43.1 ± 19.7. Snout in head 1.7-2.0, 1.79±0.0319, 4.7±1.3. Head in trunk 2.0-2.1, 2.04 ± 0.0185, 2.4±0.6. Trunk in tail 1.1-1.2, 1.16±0.0504, 4.5±1.2.

In the conspectus of Part X (1961) the available published values for these 4 ratios were collated, as ranges, for all Tasmanian syngnathids. There here follow for each ratio in this species conspectus range, range of 3 individuals noted in Part XI (1963), range of present 7 examples. Eye in snout 4.0-5.0, 4.0-5.6*, 2.8*-4.6, snout in head 1.6-1.7, 1.6-1.7, 1.7-2.0*, head in trunk 2.0, 2.0-2.4*, 2.0-2.1, trunk in tail 1.1, 1.0*-1.1, 1.1-1.2*. The 1961 synoptic range is thus extended for 6 values (asterisked), of which 3 are provided by the present material.

Meristic ranges specified in the conspectus are here transgressed by trunk annuli 24-26 (*cf.* 25-28) and caudal annuli 55-60 (*cf.* 51-56). Pectoral rays are not noted in the conspectus: no counts are given by Munro (1958c) or by Scott *et al.* (1974), while this species is not dealt with in the review of the South Australian lophiobranchiates

TABLE 1

Solegnathus fasciatus Günther, 1880. Dimensions of 7 specimens from off St Helens Point, east coast, Tasmania (Mr Shane Downe). First line, total length, mm, all other lines millesimals of total length.

Dimension	Range	$\bar{x}$	V
Total length, mm	142-361	298.6 ±28.994	25.7 ± 9.6
Length to pectoral origin	190-203	196.3 ± 1.784	2.4 ± 0.6
Length to dorsal origin	552-590	571.7 ± 5.148	2.4 ± 0.6
Length to dorsal termination	664-702	682.1 ± 5.202	2.0 ± 0.5
Length to vent	541-581	559.1 ± 5.528	2.6 ± 0.7
Head	178-189	182.1 ± 1.557	2.3 ± 0.6
Snout	97-108	102.7 ± 1.503	3.9 ± 1.0
Eye	23- 35	26.2 ± 1.655	16.7 ± 4.6
Interorbital	7- 12	10.4 ± 0.612	15.6 ± 4.3
Depth at front of eye	12- 28	19.6 ± 2.104	28.4 ± 8.2
Depth at opercular border	31- 36	33.2 ± 0.611	4.9 ± 1.3
Depth at front of vent	33- 64	45.6 ± 3.985	13.1 ± 6.5
Depth at back of vent	30- 34	31.9 ± 0.506	4.2 ± 1.1
Maximum depth	46- 82	57.2 ± 4.485	21.5 ± 6.0
Dorsal base	96-126	110.4 ± 3.673	8.8 ± 2.4
Length of pectoral, total	22- 41	28.1 ± 2.502	23.5 ± 6.6
Length of longest pectoral ray	19- 28	22.7 ± 1.388	16.2 ± 4.4
Pectoral base, oblique	26- 35	29.9 ± 1.074	9.5 ± 2.6
Tail	419-459	440.9 ± 5.528	3.3 ± 0.9
Trunk	363-399	376.9 ± 5.422	3.8 ± 1.0
Width at front of eye	14- 20	16.1 ± 0.982	16.2 ± 4.4
Width at opercular border	20- 28	22.1 ± 1.092	13.1 ± 3.6
Width at front of vent	26- 32	29.6 ± 0.868	8.6 ± 2.3
Width at back of vent	26- 33	29.8 ± 1.062	9.4 ± 2.5
Maximum width of head	24- 32	27.8 ± 0.678	8.9 ± 2.4
Maximum width of body	32- 44	37.8 ± 1.646	11.5 ± 3.1

by Waite & Hale (1921). Pooled counts for the present material and the 1963 specimens are 24 (3), 25 (3), 26 (3), 27.

Size classes

Specimen (a), *Lt* 142, is evidently the sole representative of one age group. Specimens (c) - (g), *Lt* 305-361 would appear very probably to be coeval with each other. The status of (b), *Lt* 264, is uncertain. If it is included with the 5 other specimens, the pooled V of 11.6 is somewhat high for a homogeneous group, and exclusion of the male leaves V for the resultant sample virtually unchanged at 11.7 : if it is tested, in accordance with the procedure recommended by Simpson & Roe (1939) for the comparison of a single individual with a small series, against the standard deviation (df = n-1) of (c) - (g), t comes out at 3.031, somewhat below the 3.162 required for P 0.05. On the balance of probabilities (including circumstances of collection), (b) is perhaps best tentatively included with the larger individuals, a course that would receive some support from the fact it is a female.

Sex dimorphism

Differences in proportion between the sexes have been reported or suggested for several features; some addition is here made to the information currently available. There are some complicative indications that some ratios are size-determined.
(i) Depth of trunk. In the 1963 ♂ (*Lt* 343) maximum depth of trunk in length of trunk is 6.0, in the ♀♀ (*Lt* 353.5, 387.5) 5.0, 4.3 or in *Lt* ♂ 15.2, ♀♀ 12.6, 10.8. In the

present sample the values are, in trunk ♂♂ 6.3, 10.2, 5.2, ♀♀ 9.0, 7.1, 6.2, 4.5, or in *Lt* 16.9, 28.0, 13.1 and 24.5, 18.9, 16.7 11.5. The mean values, depth in trunk length ♂♂ 7.1, ♀♀ 6.7, depth in *Lt* 19.3, 17.9, are thus in agreement with the suggestion afforded by the (very small) 1963 sample that the trunk in males is relatively shallower: it is to be noted, however, first that there is very considerable variation, leading to intersection of the two sex sets, secondly that among females at least the values of both ratios decrease (tolerably regularly) with increase in size of fish. A shallower trunk in males has been noted by Waite (1894, p.22) in specimens identified by him as *S. hardwickii* Gray, 1830 (type locality China : Australian records are now generally discounted (McCulloch 1929, Munro 1958c), Waite's material being referred by Whitley (1927) to *S. dunckeri* Whitley 1927).

(ii) Length of head. In the 1963 material ♂ head in trunk is 2.35, ♀♀ 2.20, 2.45, or, in *Lt* 6.02 and 5.57, 5.34. In the present material the ♂ values are, in trunk 1.96, 2.05, 2.04, in *Lt* 5.30, 5.64, 5.64 and the ♀ in trunk 2.00, 2.07, 2.03, 2.13, in *Lt* 5.46, 5.51, 5.50, 5.38. Thus in the present sample mean male head (2.01 *v.* 2.06) is slightly longer relative to trunk but is slightly shorter (5.53 *v.* 5.46) relative to total length, the latter result being compatible with the figures for both the in-trunk and in-*Lt* ratios of the 1963 specimens, while the former is in conflict with both the 1963 situations.

(iii) Length of snout. While in Part XI it is correctly noted that the snout of the male is shorter relative to *Lt* than those of the females (9.80 *v.* 9.06, 9.23), examination of the dimensions there recorded shows this difference does not hold when snout in head is calculated, the male value 1.63 being equal to the value of one female, (a), though less than that of (b), 1.73. In the present material the snout in *Lt* is ♂♂ 9.53, 9.86, 10.1 (mean 9.90), ♀♀ 10.07, 9.36, 9.38, 9.83 (mean 9.06), in head ♂♂ 1.80, 1.75, 1.83 (mean 1.79), ♀♀ 1.84, 1.70, 1.71. 1.83 (mean 1.77) — there is thus no significant difference here between the sexes in respect of this feature, though the mean values of the ratios are marginally larger in the male.

(iv) Width of tail immediately behind vent. It is noted of the 1963 material 'Though the male (c) is 10.5 mm less in *Lt* than the smaller female (a), the width of the ventral surface of the tail immediately behind the vent is more than one-fourth as great again.' Marked sexual dimorphism in relative size and in form of early tail scutes has been reported by Waite (1894) in the Australian pipefish identified by him as *S. hardwickii*, and Whitley states of the same form, his *S. dunckeri*, the sides of the tail rings are 'much expanded.' No marked difference in form is found here, though the ventral surface of the tail in about a score of annuli back from the vent appears to be somewhat flatter and smoother in males. Total width just behind vent, as *TLt* here is ♂♂ 29.5, 31.0, 31.9, ♀♀ 25.4, 26.2, 31.7, 32.6, there thus being in both sexes some relative increase with increase in size of fish.

(v) Length of body. A 'relatively longer body' in the female has been reported by Whitley (1945, p.223) for *S. spinosissimus* (Günther, 1870), a species first described from this State. No significant difference is apparent in our material of the present species; with 'body' interpreted as trunk the male, female *TLs* means being 384.8, 383.3, or interpreted as head plus trunk 556.8, 566.2.

Relative growth

The frequently large ranges in values found for relative lengths of head, trunk, tail, iterns customarily reported in specific diagnoses of syngnathids, suggests the probability that these are not solely attributable to individual variation but involve as a component differential growth of the regions concerned. Data for the present material afford evidence of a positive correlation of relative length of trunk and a negative correlation of length of tail with total length, length of head remaining significantly constant. With the regions as millesimals of total length the

results are: trunk r + 0.699 (z 0.866), t 2.187, tail r − 0.723 (z 0.914), t 2.342, head r + 0.172 (z 0.174).

Length of head, length to vent, total length.

Notwithstanding the conclusions noted in the preceding paragraph, the antero-posterior extensions of the three primary regions of the fish, head (h), trunk (b) and tail (t) are such overall that the three points with coordinates (log h, log 1), (log $(h+b)$, log 2), (log $(h+b+t)$, log 3) are significantly collinear. Each of the sub-joined statements sets out for one of the 7 specimens (arranged in order of ascending magnitude of total length) the equation of the regression of length, mm, L on natural number, N : t, with indication of significance : values of the variate as predicted by the equation (measured values in parentheses).

Log L = 1.5496 log N + 1.4179 : 54.914* : 26.2(26), 76.6(76), 143.6(142).
Log L = 1.5606 log N + 1.6849 : 34.159* : 48.4(47.9), 142.8(147), 268.9(264).
Log L = 1.5235 log N + 1.7629 : 34.493* : 57.9(57.5), 166.6(170), 308.9(305).
Log L = 1.5572 log N + 1.7670 : 43.884* : 58.5(58), 172.1(170), 323.6(319).
Log L = 1.5430 log N + 1.8144 : 19.189* : 65.2(64), 190.1(200), 355.3(344).
Log L = 1.5775 log N + 1.8108 : 65.272* : 63.4(63), 189.1(192), 358.4(355).
Log L = 1.5733 log N + 1.8214 : 18.779* : 66.3(65), 197.3(208), 373.3(361).

It will be seen the fits are satisfactory. Percentage deviations of the 21 predicted lengths from measured lengths range from 0.6 to 5.2 with mean 1.91±0.273, while the means for individual specimens range from 1.0 to 3.5. It should be noted the sum of the squares of the deviations from the mean in the equation is that of the logarithmic values, while the deviations recorded above are back-calculated to the arithmetic deviations, given here in preference to the formally more appropriate logarithmic deviations as being likely to be of more immediate interest to the practising systematist.

No correlation of the slope of the graph with the length of the specimen is evident. On the contrary the value of the slope is sufficiently stable to render evident on inspection an expectable increase in magnitude of the intercept with increase in size of fish: r + 0.990 (z 2.628), t 6.388***.

Examination of the data for 3 specimens dredged by Mr B.C. Mollison in 11-18 m in D'Entrecasteaux Channel, off Middleton, and noted in Part XI (1963, p.17, fig.6) reveals the same pattern in this material. Specifications as before:

Log L = 1.6455 log N + 1.7629 : 20.836* : 57.9(57), 181.2(191), 353.2(343).
Log L = 1.5750 log N + 1.8110 : 19.391* : 64.9(63.5), 214.3(228.5), 398.4(382.5).
Log L = 1.5294 log N + 1.8706 : 15.096* : 74.2(72.5), 214.3(228.5), 398.4(382.5).

For this material the percentage deviations of predicted from measured lengths range from 1.6 to 6.2, with mean 3.65±0.523. The correlation of intercept and total length is r + 0.971 (z 2.127), which though a large value is below that (0.997) required for significance at P 0.05. For these 3 individuals the slope decreases with increase in length of fish, but the correlation r − 0.926 (z 1.629) is not formally singificant.

Coloration

The only notices of coloration in the original account of the species (Günther 1880, p.41) are 'the back of the trunk ornamented with seven narrow blackish cross-bars', 'the preanal region is blackish'. In a postscript to a general account of *Solegnathus* Waite (1894, p.227) affords what may well be regarded as a classic instance of the rationale of Museum systematics 'I have purposely avoided giving particulars of colouration, but have pointed out such characters as will enable anyone to determine the three species either from dry or spirit specimens'. Indeed, not only are accounts in the literature meagre but they exhibit some confusion, particularly

in regard to the coloration of the immediately preanal segments. The following notes provide a summary of fairly detailed observations on Mr Downe's seven specimens made shortly after they were received from him.
General color.- Trunk: delicate pale pink with a hint of underlying silver; a little lighter on dorsal surface. Tail: lateral and dorsal surfaces much like those of trunk; ventral surface of first 10-12 annuli very pale almost white, sharply demarcated from next 15-20, which are pinkish or deep yellow with pinkish tinge; prehensile pads white. Head: anterior half or so of snout in some specimens almost colorless on side, in others yellow with very narrow pinkish line along each ventrolateral border; hind half yellowish, pinkish or pinkish yellow; operculum mainly purplish, in some specimens the striae yellowish, each with some deeper dots tending to form about six arcs; rest of head very much like trunk, sometimes rather more yellowish on chin and throat.

Chief markings.- Trunk: (a) lateral surface, on upper half or more a well-defined bar of bright slightly greenish yellow at junction of scutes, the upper extremity pointed, bars ending evenly along a line running forward from upper part of vent; (b) dorsal surface, on each annulus a reddish brown lozenge, its external points meeting the lateral bars, interspace about two-thirds anteroposterior axis of marking, also, very well developed in 1 specimen, fairly well in 2, poorly in rest, a series of 6-7 medium or dark green more or less hourglass-shaped markings, in one specimen occurring on rings 2, 7-8, 13-14, 16-17, 21-22, 24-25; (c) ventral surface, along midventral ridge a rich yellow or orange line, either continuous of about even width throughout or with a more or less rounded expansion on each segment; on last trunk annuli a very conspicuous subrectangular patch of bright red (in one individual some very dark green approaching black in lower part), extending up on to lateral surface to reach bottom of yellow bars there. Tail: (a) lateral surface, a continuation or partial continuation of the series of yellow bars of the trunk, exhibiting considerable variation, occasionally even petering out posteriorly; (b) dorsal surface, some traces of a continuation of the hourglass-like trunk markings, here tending to become pinkish; (c) ventral surface, without pronounced markings.

Dorsal fin pinkish or pale orange. Pectoral with a very narrow proximal arc of deep pink, thence to about middle of length yellowish green, thereafter pale pink.

Genus *STIGMATOPHORA* Kaup, 1853

Stigmatopora Kaup, 1853, *Arch. Naturges.*, 19(1), p.233. Type-species, *Syngnathus argus* Richardson.
Stigmatophora Kaup, CAT. LPHOBR. FISH. BRIT. MUS., p.52; *emend.*

Stigmatophora argus (Richardson, 1840)

Syngnathus argus Richardson, 1840, *Proc. zool. Soc. Lond.*, 8, p.29. Type locality : not specified, = Tasmania, *fide* McCulloch (1929).
Stigmatophora argus : McCulloch, 1929, *Aust. Mus. Mem.*, 5(1), 1929, p.93 (references and synonymy): Waite & Hale, 1921, *Rec. S. Aust. Mus.*, 1(4), p.308, fig.48.

Recent material

Three examples (a) ♂ *Lt* 196, (b) ♀ 225, (c) ♀ 255, collected by Mr Shane Downe in a sardine net off St Helens Point, east coast, on 10 July 1978 (Q.V.M. Reg. No. 1978/5/89), make possible some extension of current knowledge of the species.

Meristic characters

D. 61, 51, 61. P. 17, 16, 16. Annuli 19 + 85, 20 + 76, 20 + 80. Subdorsal annuli 0.9, 0.7, 0.3 of 11th trunk (counting fractions cephalad) to 0.4, 0.9, 0.6 of 12th caudal. Brood pouch, (a), 0.6 of last trunk annulus to 0.9 of 19th caudal.

Dimensions as *TLs*.

Length to origin of pectoral 16.8, 182, 173, origin of dorsal 296, 317, 299, termination of dorsal 514, 541, 529. Length to vent 385, 413, 422. Head 162, 170, 162, snout 112, 123, 113, eye 16.8, 13.8, 16.1, orbit 19.9, 17.8, 21.6, interorbital 6.1, 5.8, 7.5. Depth (in parentheses width) at front of eye 12.8, 15.1, 13.3 (12.8, 13.8, 9.4), operculum 15.3, 17.8, 15.7 (17.9, 15.6, 20.0), vent 14.8, 17.8, 15.7 (18.9, 22.2, 23.4); maximum 16.8, 22.7, 20.8 (20.4, 28.4, 27.1), some signs of dorsoventral collapse after preservation.

Conspectus values

Meristic characters above are in agreement with the synoptic counts of the conspectus in Part X (1961, p.61) as revised for this species in Part XI (1963, p.19); however, in the case of the subdorsal annuli on the trunk the present specifications, while covered by the datum 0.2 of the 11th annulus (counting fraction cephalad) of the 1963 individual, transgress the original (1961) specification of 7-10 annuli.

For the 4 morphometric entries in the conspectus the values here are: eye in snout 6.6, 8.9, 7.0 (*cf.* 6.0-9.3, 1963 5.6), snout in head 1.5, 1.5, 1.4 (1.4-1.6), head in trunk 1.37, 1.43, 1.61 (1.3-1.7), trunk in tail 2.76, 2.41, 2.27 (1.7-2.8), i.e., all are covered by the synoptic ranges, with one value, trunk in tail, standing on the conspectus maximum.

Comparison with published data

In their review of the lophobranchiate fishes of South Australia Waite & Hale (1921) have provided what may well be regarded as the definitive account of this species. The following comparisons with their specifications with data from the present material reveal some variations and afford some quantification of statements of a general nature. Snouth with "a low median crest which terminates in advance of the eyes" : in (a) 0.7 eye diameter before eye, a little closer to nostril than latter is to eye; (b), (c) 0.8, 1.1 eye diameter. "The supraorbital ridges commence on the posterior third of the snout, but do not extend to behind the eyes" : originate at 0.72, 0.72, 0.79 of snout, cease at about 0.9 eye, continuous with lateral occipital ridge, which extends back to level of first third of operculum. "A lateral ridge from the angle of the mouth to the lower part of the front edge of the eye" : (a) just reaches orbit at 9 o'clock (left side viewed) after bending upward slightly, (b) at level of posterior nostril dips down slightly, becomes continuous with orbital ridge at first third of eye, (c) reaches orbit at 9 o'clock. "Low ridges define the lower margins of the snout, one on each side of a median ventral ridge, which bifurcates below the front margins of the eyes" : (a) bifurcates at front of eye, extends to 1.1 eye, (b) at 0.4 eye, to 1.1 eye, its width here a little greater than distance from profile, (c) at 0.5 eye in advance of eye, to 1.2 eye; in (a), (b) lateral ridges just meet ends of divided median slowly curving in to it from level of front of eye, in (c) end a little externad of ends of divided median. "A feeble opercular ridge in young examples" : (a) on left 0.5 length of operculum, on right full length though low in hind half, (b) left 0.95, right 0.45, (c) strong, full length on both sides. "Upper and lower ridges continuous, much more distinct on the tail" : ridge starts (a) barely behind level of operculum, (b), (c) at four-fifths of distance from end of operculum to ridge of pectoral base. "The lateral ridge extends on to about the sixth caudal scute or terminates in the skinny folds of the brood pouch" : (a) continues on left to 10th, on right to 9th scute followed by a short separate segment, (b) left 20th, right 23rd, (c) on left ceases on last body scute, on right to 1st caudal — for continuation of the median trunk ridge beyond the 6th caudal scute see also Part XI (1963, p.20). Mid-ventral trunk ridge starts (a) below first third of pectoral, (b) slightly behind level of end of operculum, (c) below first fourth of pectoral; in all continuous to vent. Median ventral caudal ridge in (a) fully continuous for first third of tail, (b) barely indicated through 11 segments, (c) continuous from end of pouch about to middle of tail.

Coloration

(i) Females. General dorsal and lateral surfaces olivaceous, lower trunk pale yellowish green; tail with first third greyish with some greenish tinge, tending to become bronzy, markedly so in last half. From shortly behind head upper lateral ridges becoming increasingly reddish brown posteriorly, strongly so in last two-thirds of tail. Operculum silvery with very minute black dots on upper half. On dorsum of trunk and of first 25 annuli of tail small paired dark dots between annuli in dorso-lateral ridges. In (a) basal half of pectoral golden.

(ii) Male. General color olivaceous above and on sides; ventral surface of trunk and tail (apart from pouch) greyish; first half dozen trunk annuli with midventral stripe of pale yellowish green including numerous melanophores; some scattered melanophores also on rest of trunk. First 30 caudal annuli with dorsal ridges light grey with ever increasing series of dark dots, behind these annuli ridges continuous dark lines. Pectoral silvery with minute dark punctulations. The coloration of the pouch is striking and handsome. Ground color pale silvery grey with some delicate gradation; a pronounced fairly wide median stripe of purplish divaricating anteriorly to embrace the light yellow anal papilla, again divaricating some 45 mm further back; a narrow purplish line on either side just inside lateral border of tail; between these and mid-ventral stripe two somewhat irregular purplish lines, that on right about two-thirds length of median stripe, that on left about half; narrow lateral strips outside lateral lines dark green.

Genus *SYNGNATHUS* Linné, 1758

Syngnathus Linné, 1758, SYST. NAT., ed. 10, p.336. *Ex* Artedi. Type species, *Syngnathus acus* Linné.

Syngnathus phillipi Lucas, 1891

Syngnathus phillipi Lucas, 1891, *Proc. R. Soc. Vict.* (n.s.), 3, pp. 8,12. Type locality: Port Phillip Heads, Victoria.
Corythoichthys phillipi: McCulloch, 1911, ZOOL. RES. ENDEAVOUR, 1, p.26, fig.10, and 1929, *Aust. Mus. Mem.* 5(1), p.85.
Parasyngnathus phillipi: Whitley & Allan, 1958, THE SEAHORSE AND ITS RELATIVES, p.8: Whitley, 1969, *Proc. Linn. Soc. N.S.W.*, 89(1), p.36.

Remarks

This species has been the subject of somewhat detailed investigation in Part XXIII (1977). As there pointed out the dichotomy found by Herald (1953) between intertidal and deepwater forms in the Marshall and Marshall Islands with division of the two habitats at 3-5 m does not hold good for *Syngnathus phillipi*, which on the one hand is abundant in intertidal rock pools and along estuary shores on our northern coast and (Scott *et al.* 1974) in shallow weedy areas in the South Australian Gulfs, and on the other hand has been dredged (Scott 1963) in 16-24 m, with a possibility that the material collected in Tasmania by the *Endeavour* was obtained at still greater depths (McCulloch 1911). It is of some interest to note the finding of a specimen, *Ls* 116.0, *Lt* 117.1, in the stomach of a flathead (Platycephalidae; species undetermined) taken in Schouten Passage, east coast, in 4 m in April 1978 by Mr John Head (Q.V.M. Reg. No. 1978/5/66). The fish was quite intact showing little if any indication of having undergone digestion.

Proportions

In respect of the proportions recorded in the conspectus in Part X (1961, p.59), all of which were single values not ranges, all those of the present specimen are in disagreement; however, they fall within the rather wide ranges given in Part XXXIII (1977, p.130). Eye in snout 3.65 (2.63-3.68), snout in head 1.97 (1.7-2.58), head in

trunk 1.92 (1.69-2.42), trunk in tail 2.72 (2.1-2.9). Meristic figures also fall within the 1977 ranges. Annuli 18 + 44 (18-20 + 40-44), subdorsal annuli 0 + 1-6 (0-1.4 + 5.0-6.1), brood pouch annuli 0.9-16.8 (0.1 + 15-18), dorsal rays 25 (20-28).

Body regions

The lengths of head, head plus trunk, head + trunk + tail are collinear (t = 79.672**) in a loglog plot on 1,2,4 (contrast 1,2,3 for *Solegnathus fasciatus*):

Log L = 1.5111 log N + 1.1617; predicted (measured) lengths, mm, 14.5 (14.4), 41.4 (42.0), 117.8 (117.1).

The finding of this relation for this specimen has prompted the making of a comparable calculation for the material examined in Part XXIII: the formulation is valid for this also: for the 2 examples from Dianas Basin, east coast, t = 46.228*: 21.348* (smaller specimen first): with as primary data the geometric means of the relevant lengths in the sample of 24 from Kelso and Low Head, Tamar estuary, north coast and with the equation treated as having d.f.1, t = 26.278* (measured lengths back-calculated from geometric means)

Log L = 1.5241 log N + 1.1026; 12.7 (12.5), 36.4 (37.4), 104.8 (103.4).
Log L = 1.5452 log N + 1.1661; 14.7 (14.8), 42.0 (42.8), 126.5 (125.0).
Log L = 1.5068 log N + 1.1113; 12.9 (12.6), 36.7 (38.4), 104.3 (102.0).

Family SPHYRAENIDAE

Genus *AUSTROLUZZA* Whitley, 1947

Austroluzza Whitley, 1947, *Aust. Zool.*, 11(2), p.136. Type-species, *Sphyraena novae Hollandiae* Günther, 1860.
Sphyraena: McCulloch, 1929, *Aust. Mus. Mem.*, 5(1), p.121, *partim*. Not *Sphyraena* Bloch & Scheider, 1801.

Austroluzza novaehollandiae (Günther, 1860)

Sphyraena novae Hollandiae Günther, 1860, CAT. FISH. BRIT. MUS., 2, p.335. Type locality: Hobson's Bay, Victoria.

Food of seal

A Tasmanian Fur Seal, *Arctocephalus doriferus* Jones, 1925, about 2 m in length stranded at Kelso, Tamar estuary, north coast, on 6 November 1978 was found to have in its stomach a complete example of this species, *Ls* 417 *Lt* 472, length to end of middle caudal rays 447. The fish had been swallowed whole and was quite without tooth marks. Some dissolution was apparent in the head and some skin was missing as far back as the first dorsal, behind which the body was firm and lacked any sign of damage.

Proportions

Four proportions are noted in the Handbook (Munro 1958d); values for this specimen fall outside these limits in three cases. Depth in total length 11.51 (Munro 9-11), head in total length 4.03 (4-4.5). Eye in head 8.67 (6-7). Eye in snout, tip of lower jaw 4.67. tip of upper jaw 4.30 ('about 3').

Family SCOMBRIDAE

In their provisional classification of living teleosts Greenwood *et al.* (1966) combine in the wide group Scombridae six or eight groups recognized by most Australian authors as representing distinct families. The species here noted, the butterfly mackerel, *Gasteroschisma melampus* Richardson, 1845, was placed by McCulloch (1922) in Scombridae, later (1929) in Scomberomeridae, where it was accommodated also by Whitley (1962); however in the Handbook (Munro 1958e) it is referred to Gasteroschismatidae

(rendered Gasterochismidae by Greenwood *et al.* in their synonymy).

Genus *GASTEROCHISMA* Richardson, 1845

Gasterochisma Richardson, 1845, *Ann. Mag. Nat. Hist.*, 15, p.346. Type-species, *Gasterochisma melampus* Richardson.
Lepidothynnus Günther, 1889, ZOOL. VOY. CHALLENGER, 31(78), p.15. Type-species, *Lepidothynnus huttoni* Günther.

Gasterochisma melampus Richardson, 1845

Gasterochisma melampus Richardson, 1845, *Ann. Mag. Nat. Hist.*, 15, p.346. Type locality: Port Nicholson, New Zealand.
Lepidothynnus huttoni Günther, 1889, ZOOL. VOY. CHALLENGER, 31(78), p.15, pl.6, figs A, A'. Type locality : Lyttleton, New Zealand.

Tasmanian occurrence

In including this species in his first catalogue Johnston (1883, p.118) noted the recent capture of an example in the Derwent; the same individual is presumably that mentioned by Lord & Scott (1924, p.79) as being taken 'in Storm Bay, at the entrance to the Derwent'. There appear to be no other published primary records of the species in our waters, where it is evidently rare. On 14 November 1978 Mr Peter McQueeney found a specimen, *Ls* 372, dead or dying at the tide line at Falmouth, east coast, and by the good offices of Mr Tim McManus this was secured for the Queen Victoria Museum (Reg. No. 1978/5/107). No counts or measurements of local material being available the opportunity is here taken to record some basic data on the present fish. It may be remarked that while the species is recorded also from Queensland, New South Wales, Victoria, it has not hitherto been met with in South Australia; it is an oceanic form, occasionally coming ashore.

Meristic characters

D. XVI; I, 9; 8 finlets. A. II, 10; 8 finlets. P. 22. L. lat. 72. L. tr. 7 + 21. The Handbook states gill rakers are absent. While there are no elongate rodlike structures, the anterior arch bears 11 small spinulose mounds, placed about their own diameter, 2 mm, apart at the middle of the series, closer together at the ends.

Dimensions as *TLs*

Length to tip of upper caudal lobe 1231, tip of lower caudal lobe 1204, end of middle caudal rays 1054. Length to origin, termination of first dorsal 253, 556, of second dorsal 594, 719, of anal 632, 723. Length to vent (middle) 613. Length to origin of pectoral 250, of ventral 250. Total length of pectoral 151, of ventral 349. Outer caudal rays inserted well in advance of median rays, length to upper origin of fin 949, lower 962. Head 242. Snout 92.7. Eye, horizontal diameter 29.8, vertical 32.5. Interorbital 67.2. Depth (in parentheses width) at front of eye 153 (83), back of eye 188 (91), opercular border 263 (108), vent 245 (99); maximum 277 (118); caudal peduncle 37.6 (47).

Proportions

Greatest depth 3.61 (Handbook 3.9-4.1), head 4.13 (4-4.1) in standard length. Depth of caudal peduncle 6.43 in head. Eye, horizontal 8.11, vertical 7.44 (5.5-7.4, presumably horizontal) in head. Eye, horizontal 3.11, vertical 2.85 in snout, 2.25, 2.07 in interorbital. Pectoral 6.64 in standard length, 1.61 in head. Ventral 2.87 in standard length, 1.44 head. First dorsal base (to last spine) 3.29, second dorsal base (to last ray) 8.00, anal base (to last ray) 10.94 in standard length.

General observations

Ventral a very large black fan: this fin regularly of great size in the young —

in Richardson's figure about one-third total length, here 3.52 in total length — but assuming normal dimensions in the adult — in figure by Günther (1889, pl. 6, fig.A) of a 65½ inch (1.66 m) example of his synonymic *Lepidothynnus huttoni* fin contained about 10 times in total length, here 3.52 times. Fin wholly depressible into a deep smooth groove extending in present specimen from fin origin (accommodating part of its base) for 360 *TLs* units, slightly longer than fin, 349; on being subject to slight pressure in this region shortly after receipt the fish split neatly open along middle of whole groove. Spinous dorsal and anal also capable of being received into grooves. Dorsal fins known to be united basally in young widely separated in adult — in Günther's large fish interdorsal (from figure) about half first dorsal base or about 120 *TLs* units; in present specimen 0.13 dorsal base or 38 *TLs* units; in Richardson's figure the two dorsals very nearly united. Finlets subtriangular, but prolonged behind to form a pennon; most anterior bushy, not or barely separate from main fin; highest dorsal finlet 1.7 in eye (horizontal). Dorsal spines slender, flexible, some strongly recurved distally. Longest dorsal spine (6th=7th) 2.1, dorsal ray (4th) 3.1, anal ray (1st=2nd) 3.3, pectoral ray (1st=2nd) 1.9 in head. Maxilla to 0.5 eye, its maximum width 1.9 in eye (horizontal) or 1.2 its shortest distance from orbit. Lower lip projecting slightly; mouth cleft sharply turned down posteriorly. No keel on caudal peduncle.

Scales on whole of trunk and tail not extending on to fins; head with scales continuing from nape on to dorsum to level of middle of eye; a patch of scales on preoperculum but rest of head naked. Teeth in jaws all small, varying in bulk by a factor of about 10, mainly uniserial, exceptionally 2 side by side; 27, 29 in two sides of upper jaw, 20, 30 in lower jaw. General color bluish grey, lighter tending to whitish below line from pectoral base to vent. Head in general much like body, ivory in most of operculum. Dorsal dark grey, finlets off-white. Anal light grey, finlets greyish or off-white. Pectoral pale olivaceous. Ventral black. Caudal mainly pale olivaceous, darker approaching black across base and for some distance up outer rays.

As has been found to be the case in a number of fishes the lengths of the primary regions head, head + trunk, head + trunk + tail are specifiable as linear on three early natural numbers, here 1, 2, 3.

Log L = 1.2970 log N + 1.9578; t = 22.805*; predicted (measured) lengths, mm, 91 (90), 223 (228), 377 (372).

Family CARANGIDAE

Four species currently recognized as valid are known to occur in Tasmania, though twice this number of names appear in the lists of Johnston (1883, 1891), Lord (1923, 1927), Lord & Scott (1924); in the following sorting out of their synonymy these lists are denoted by J_1, J_2, L_1, L_2, L & S, respectively.

1. *Naucrates ductor* Linné, 1758. In all lists thus, in J_1 J_2 in Scombridae.

2. *Seriola grandis* Castelnau, 1872. J_1 thus, plus, with reservation, *Seriola Lalandii* Cuv. and Val. (= Cuvier, 1833), 'Doubtful. I have not seen any specimens', this species No. 365 in Macleay (1881b), not noticed in the Check-list (McCulloch 1929). J_2 both these species listed without comment. L_1, L_2, L & S. as here.

3. *Trachurus declivis* (Jenyns, 1841). J_1, J_2 *Trachurus trachurus* Cuv. and Val. (= *Scomber trachurus* Linné, 1758), i.e., identification of the Australian with a European species. L_1 *Trachurus declivis* Jenys [sic], plus (the synonymic) *Trachurus nouae-zelandiae* Rich. L_2, L & S same two species.

4. *Usacaranx nobilis* (Macleay, 1881a). J_1, J_2, L_1, L & S *Caranx georgianus* Cuv. and Val. (= Cuvier, 1883; second binomen with initial capital in J_1, J_2). L_2 *Longirostrum georgianum* Cuv. and Val. All local lists include a misidentification that continued to be accepted in the Check-list (McCulloch 1929, p.188), in which Macleay's species is treated as a synonym of Cuvier's. It is now established — as recognized in the Handbook (Munro 1960, p.126) — these are separate species,

Usacaranx nobilis (Macleay, 1881a), type locality Port Jackson, New South Wales, being an eastern form, occurring in that State, Queensland, Victoria and Tasmania, while *Usacaranx georgianus* (Cuvier, 1833), type locality King Georges Sound, Western Australia, is restricted to that State and South Australia.

5. *Trachurus mccullochi* Nichols, 1920 is here added to the Tasmanian list.

KEY TO CARANGIDAE RECORDED FROM TASMANIA

1. Dorsal fin continuous. Dark bars (5-7) on body . . . . . *Naucrates ductor*
   Dorsal fins separate. No dark bands on body 2
2. Lateral line without keeled scutes. Pectoral about half head . . *Seriola grandis*
   Lateral line with keeled scutes. Pectoral subequal to or longer than head 3
3. Keeled scutes < 40 (20-26), in hind part of lateral line only. .*Usacaranx nobilis*
   Keeled scutes > 40 (68-85), along whole length of lateral line . 4
4. Keeled scutes 74-85, lateral line curving slowly down behind pectoral, P. 1,24. Gill rakers on lower anterior arch 30. Dark greenish blue above . . . . . *Trachurus declivis*
   Keeled scutes 68-73, lateral line curving abruptly down behind pectoral, P. 1,21. Gill rakers on lower anterior arch 38. Yellowish green above . . . . . *Trachurus mccullochi*

Genus *TRACHURUS* Rafinesque, 1810

Trachurus Rafinesque, 1810, CARATT. N. GEN. SICIL., p.41. Type-species, *Trachurus saurus* Rafinesque = *Scomber trachurus* Linné.

Trachurus mccullochi Nichols, 1920

Trachurus mccullochi Nichols, 1920, *Bull. Amer. Mus. Nat. Hist.*, 42, p. 479. New name for *Trachurus declivis:* McCulloch, 1915; not *Trachurus declivis* Jenyns, 1841. Type locality: Mouth of Wide Bay, Queensland, Investigator Strait, South Australia *(Endeavour).*

Material

An example, *Ls* 283 *Lt* 335, Tamar estuary, north coast, 26 February 1978, Mr M. Watson, Q.V.M. Reg. No. 1978/5/63. First record for Tasmania.

Meristic characters

D. I (procumbent), VIII; I 33 (31+2). A. II, 29 (27+2). V. I, 5. P. I, 21. C. 20 (main rays). Lateral line scutes 27+7+38=72. Gill rakers on lower anterior arch 38. Where relevant these counts fall within the extremes of the ranges for 10 specimens in McCulloch's rather brief account of the *Endeavour* material on which Nichols (1920) without giving other details, based his species. The Handbook (Munro, 1960) notes two procumbent dorsal spines; only one was here detected.

Dimensions as *TLs*

Total length 1184, length to end of middle caudal rays 1078. Length to origin, termination of first dorsal 343, 481, of second dorsal 527, 926, of anal 541, 926. Length to pectoral origin 283, total length of fin 300, length of longest (5th) ray 256. Length to ventral origin 318, total length of fin 159 (for lengths of rays and spine see below). Head 283, snout 99, eye 67, interorbital 67. Length to vent 505. Depth at opercular border 212, at first dorsal origin 219, at vent 219; maximum depth 219; depth of caudal peduncle 36.

Proportions

Several proportions usually cited in specific diagnoses extend outside accepted limits as represented by the ranges given in the Handbook, here shown in parentheses.

Depth in length to end of middle caudal rays (caudal fork) 4.92 (4-4.4), or 4.56 in *Ls* or 5.40 in *Lt*. Head in length to caudal fork 3.81 (3.7-3.9), or 3.54 in *Ls*, or 4.19 in *Lt*. Eye 4.21 (3-3.4) in head, or 1.47 (1-1.4) in snout, equal to interorbital. Scutes 2.88 (3-3.4) in depth of body. First dorsal base 7.26 in *Ls*, or 2.90 in second dorsal base, or 4.87 in anal base. Pectoral 3.33 in *Ls*, or 1.06 head, or 1.89 ventral.

Head, length to vent, length to caudal base (*Ls*)

In a loglog plot these three basic dimensions are significantly linear (t = 21.948*) on 1,2,4.

Log L = 0.9114 log N + 0.4257; predicted (measured) lengths, mm, 79 (80), 148 (143), 278 (283).

Dorsal spines

The spines increase in length to the 3rd then they become progressively shorter. Formulations for length and serial or inverse serial numbers are set out below, the plotting being loglog.

A = {1-3}. Log L = 0.2285 log N + 1.5321. Predicted (measured) lengths, mm, 34.1 (33.7), 39.9 (40.1), 43.8 (43.0). With t = 5.185 the line is not formally significant, failing to reach P 0.10 (6.314).

B = {8-4}. Log L = 0.8912 log N^1 + 1.0015; t = 23.954***; 10.0 (10.0), 18.6 (18.1), 26.7 (27.9), 34.5 (35.9), 42.1 (42.0).

Ventral rays and spine

The ventral rays are somewhat unusual in increasing in length from 1st — farthest from spine, see Part XIX (1974) — to 5th; in a more common pattern 4th exceeds 5th. The loglog length-number graph is highly significant at t = 20.411***.

Log L = 0.3229 log N + 1.4121; predicted (measured) lengths, mm, 25.9 (25.9), 32.3 (31.7), 36.8 (37.5), 40.4 (41.0), 43.4 (42.7).

Location of fins

The locations of the dorsal and anal fins and their terminations (at the same level), together with caudal origin are satisfactorily specifiable by the first degree equation resulting from the graphing on a loglog grid of the lengths to these points against the integral values 3,5,9 (one entry for two fins), 10.

Log L = 0.8959 log N + 1.5592; t (d.f.2) 100.530***; predicted (measured) lengths, mm, 97 (97), 153 (153), 259 (262), 285 (283).

Family ANTHIIDAE

In their provisional classification of living teleosts Greenwood *et al.* (1966) subsume Anthiidae and no fewer than 18 other nominal families in Serranidae. As remarked in Part XXII (1976) in some observations on a Tasmanian example of *Acanthistius serratus* (Cuvier, 1828) the Serranidae as thus recognized with about 600 species constitutes an unwieldy assemblage, and there would seem to be tenable grounds for some subdivision of it. The acceptance here of Anthiidae is in line with its use by most Australian authors, e.g., Munro (1961, 1967), Whitley (1962), Scott *et al.* (1974): Marshall (1964) recognizes five Australian subfamilies of Serranidae, placing several species noted below in Hyperplectroninae.

The number of species included in Tasmanian faunal lists and incidental additions to these has now grown from two to six. In both his catalogues Johnston (1883, 1891) listed (a) *Callanthias allporti* Günther, 1876, (b) *Caesioperca rasor* (Richardson, 1839) (as *Anthias rasor*). Lord (1923, 1927) added (c) *Caesioperca lepidoptera* (Bloch & Schneider, 1801) (rendered *lepidotera* in later list), and these three species occur also in Lord and Scott (1924). Species (d) *Lepidoperca tasmanica* Norman, 1937, 'off Tasmania', placed by its author in Serranidae (1937) is probably to be considered an anthiid (it was apparently so regarded by Whitley, who in his Australian name-list (1964) entered it between species of *Anthias* and *Callanthias*). The Tasmanian occurrence of (e) *Anthias pulchellus* Waite, 1889 was reported by Olsen (1958); an additional record is noted below. Species (f), *Hypoplectrodes nigrorubrum* (Cuvier, 1828) is here added to the local list, the species on which are keyed below.

KEY TO ANTHIIDAE RECORDED FROM TASMANIA

1. Dorsal rays < 12 (10-11). Dorsal spines 10; regularly increasing in length backward. Spinous dorsal base ≥ 2 soft base. Anal base ≥ head. Lateral line exceptionally high, its distance from dorsal profile at level of vent < 1/10 (about 1/15) depth of body there; posterior portion close to dorsal profile of caudal peduncle . . . . . *Callanthias allporti*
   Dorsal rays > 12 (16-22). Dorsal spines 10, rarely 11; not regularly increasing in length backward. Spinous dorsal base < 2 (about 1-1½) soft base. Anal base < (about 1/3-2/3) head. Lateral line not exceptionally high, its distance from dorsal profile at level of vent > 1/10 (about 1/6-1/8) depth of body there; posterior portion close to middle of caudal peduncle .2
2. Dorsal deeply notched. Caudal convex. Body with dark subvertical bands . . . . . *Hypoplectrodes nigrorubrum*
   Dorsal not deeply notched. Caudal truncate or emarginate. Body without dark subvertical bands 3
3. Dorsal rays < 18 (16-17). Lateral line < 46 (36-44). Pectoral reaching beyond anal origin. Eye about 3 in head. .4
   Dorsal rays > 18 (19-22). Lateral line > 46 (49-70). Pectoral not reaching beyond anal origin. Eye about 4 in head 5
4. Dorsal spines 3rd - 7th subequal; 10th spine subequal to 4th. Caudal emarginate. Small dark spot on spinous dorsal; ovoid black spot on soft dorsal present or absent; no spots on spinous dorsal. . . . . *Anthias pulchellus*
   Dorsal spines 3rd - 7th noticeably decreasing in length backward; 10th spine about half 4th. Caudal truncate. Numerous small dark spots on spinous dorsal, no ovoid black spot on soft dorsal . . . . . *Lepidoperca tasmanica*
5. Dorsal spines 10. Pectoral rays < 16 (13-15, modally 14). Lateral line < 60 (49-55). Posterior portion of preorbital border convex. Black vertical bar at or near pectoral tip, about below end of spinous dorsal, present or absent; no black spot behind pectoral tip. Head with 3 blue bars above, to, below eye . . . . . *Caesioperca rasor*
   Dorsal spines 10 or 11. Pectoral rays ≥ 16 (modally 16). Lateral line > 60 (65-70). Posterior portion of preorbital border concave or straight. No black vertical bar at or near pectoral tip; a more or less rounded black spot behind pectoral tip. No blue bars on head near eye..*Caesioperca lepidoptera*

Genus *HYPOPLECTRODES* Gill, 1863

Hypoplectrodes Gill, 1863, *Proc. Acad. Nat. Sci. Philad.* (1862), p.238. Type-species, *Plectropoma nigro-rubrum* Cuvier.

Hypoplectrodes nigrorubrum (Cuvier, 1828)

Plectropoma nigro-rubrum Cuvier, 1828, HIST. NAT. POISS., 2, p.402. Type locality: King George's Sound, Western Australia (Quoy & Gaimard).

Hypoplectrodes nigrorubrum: McCulloch, 1929, *Aust. Mus. Mem.*, 5(2), p.154: Scott Glover & Southcott, 1974, MAR. FRESHW. FISH S.AUST., p.256, fig. on p.256.

Material

Two examples, providing the first records of the species in Tasmanian waters, were received at the Queen Victoria Museum, Launceston from widely separated localities within a few weeks of one another: (a) *Ls* 146 *Lt* 179, Banks Strait (between the north-eastern mainland of Tasmania and Clarke Island and Cape Barren Island), 2 February 1978, Mr B. Bensemann, Reg. No. 1978/5/44, (b) *Ls* 181 *Lt* 219, south-west of Port Davey, south-west coast, in 7 m, 10 April 1978, Mr J. Head, Reg. No. 1978/5/69.

Meristic characters

In this and succeeding sections where two data are given, the first is for the smaller individual (a). D. X, 17 (in (a) last divided to base). A. III, 8 (last divided to base). P. 13/13, 14 (left)/13. V. I, 5. L. lat. 56, 58. L. tr. 4 + *ca* 25. Gill rakers 1-2 + 6. Br. 7.

Dimensions as *TLs*

Length to origin, termination of first dorsal 397, 392, 651, 660, of second dorsal 671, 691, 911, 934, of anal 685, 677, 836, 890. Length to pectoral 384, 370, total length of fin 360, 285. Length to ventral 370, 359, total length of fin 257, 227. Length to vent 671, 657. Head 459, 464. Snout 151, 138. Eye 70, 75. Interorbital (between supraorbital ridges) 35, 25. Depth at front of eye 192, 171, back of eye 247, 227, opercular border 349, 326, vent 329, 315; maximum depth 356, 343, depth of caudal peduncle 133, 125.

Proportions

Head 2.18, 2.15 (*cf.* Munro (1961) 2.6), depth 2.81, 2.92 (Munro 2.75-3) in standard length. Snout measured from most advanced point 3.05, 3.36 in head, 2.16, 1.85 eye; measured from anterior margin of preorbital 5.93, 6.32 in head, 1.11, 0.99 eye (Munro eye 'slightly less than snout'). Eye 6.38, 6.22 in head. Interorbital 2.0, 3.0 in eye (Munro 'eye twice interorbital'). Spinous dorsal base 1.12, 1.10 soft dorsal base, 1.68, 1.54 anal base. Pectoral 1.28, 1.63 in head, 2.78, 3.51 in standard length. Ventral 1.79, 2.05 in head, 3.89, 4.41 in standard length. The relative lengths of the three primary regions head, head plus trunk, head plus trunk plus tail are adequately specified (t = 19.185*, 37.084*) by a loglog plot of them on logs 1,2, 5; with lengths in mm the slopes are 0.4814, 0.4760, the intercepts 1.8334, 1.9272; predicted differ from measured lengths for (a) by a mean of less than 2 mm, for (b) of less than 1 mm.

General observations

No systematic Australian account of this species is noticed by Waite (1921, p.93); some synoptic data are, however, provided in the Handbook (Munro, 1961). The following observations, summarized from a tolerably full account of our material, supplement or emend extant descriptions.

Dorsal profile, described by Scott *et al.* as "evenly arched from the snout to the caudal peduncle", presenting a pronounced hump (evident in the standard figure by Quoy & Gaimard (1824) reproduced by them) followed just in advance of eye by a dip occasioned by a transverse furrow extending laterally to or below level of lower (anterior) nostril and subcontinuous behind with a groove running into supraorbital region, profile here provided by rather strong supraorbital ridges; between eye and first dorsal spine profile gently sigmoid, the posterior convex segment somewhat the longer; thereafter to caudal peduncle in two subequal segments, that under spinous dorsal the flatter. Ventral profile to shortly in advance of pelvics not far from straight; thereafter to caudal peduncle virtually a single sweep, rate of curvature increasing caudad.

Maxilla to 0.2, 0.4 eye (Munro middle; Scott *et al.* 'almost to posterior border', as depicted in figure). Subvertical portion of border of preoperculum with small

stout acute spinules, about two score in (b), fewer in (a); somewhat sinuous inferior border with three obscurely pointed angles, each the site of an antrorse spine, only the anterior one conspicuous and projecting. Operculum with two spines, upper larger pointed obliquely upward, its tip failing to reach border of fleshy lobe by about length of spine, lower pointed obliquely downward barely reaching border.

Trunk and tail covered with ctenoid scales, most rather large, somewhat smaller on ventral surface particularly in advance of ventrals, still smaller on nape. Snout, lips, whole under surface of head naked, most of remainder with small or very small scales. Small scales extending on to first dorsal, most notably as a digitiform set 2-3 wide at base on proximal one-third or half of spine; covering lower one-third of soft dorsal, briefly contiguous proximally then continuing as separate subvertical series modally of 6-8 scales; continuing briefly on to base of anal; forming a backwardly convex patch on basal one-sixth or one-fifth of caudal; extending on to pectoral base, apparently absent on concealed under surface.

A scale from near middle of flank subelliptical, diverging from subrectangular mainly as result of difference in outline between lateral borders, one much more rounded posteriorly, so coming to lie at one end of the major axis, length exceeding that of minor axis by about one-sixth of latter. Sinuous asymmetrical hind border with a band, subequal in width throughout most of its length, of mostly ovoid or subrectangular platelets, arranged in 1-3 rows, modally in 2 rows and then disposed alternately close together or even contiguous; along the border about three score tolerably stout subconical recurved spinules, typically arranged (some irregularity may occur laterally) in two alternate rows of two sizes, the larger arising from the interval between the members of the outer row of plates, the shorter (unlike the secondary spines in *Anthias pulchellus* not differing greatly in bulk) arising shortly externad of this, near level of proximal one-fourth or one-fifth of larger spine, their bases thus in line with members of inner row of platelets.

General course of lateral line close to parallelism with dorsal profile, swinging away from it slightly in advance of first dorsal and posteriorly below second dorsal, closest approach to profile about an eye diameter from it; on caudal peduncle parallel with superior border, in (a) a little nearer to it than to inferior border, in (b) equidistant from profiles. Tubules simple, variable in length modally extending about half length of scale.

Numerous small pores covering lateral surface of head in front of level of hind border of orbit, and in a broad band extending back from eye not far short above of dorsal profile and continuing forward into interorbital, bounded below by a line at level of inferior orbital border; ceasing on operculum in vicinity of bases of spines; much more conspicuous in (b) than in (a).

Teeth in upper jaw in a narrow band, villiform, in hinder part of jaw; anteriorly 2 patches of moderate size, briefly disjunct at the symphysis, small externally in general increasing markedly in size inward, the largest, a number of which are depressible, many times as long as the smallest. Teeth in lower jaw much as in upper with the addition of several stout somewhat recurved canines near middle of jaw; in (a) 4 left, 3 right, in (b), 3, 3. Vomerine teeth in a V-shaped band of some 5-7 rows; in (a) much larger in side of jaw, subequal to middle-sized anterior jaw teeth; in (b) noticeably smaller than this. Palatine teeth rather small, anteriorly mainly in 2 series, posteriorly in 3 or 4.

Dorsal fin originating above hinder part of operculum, about at level of upper insertion of branchiostegal membrane, shortly behind pectoral origin, the latter barely behind ventral origin. Anal originating below first or second dorsal ray. Pectoral extending to anal origin, ventral to as far in advance of vent as anal origin is behind vent.

Rays and spines

(i) Character. Dorsal spines long, rather slender, acute, recurved (somewhat less so than in standard figure); membrane between them moderately excavate. First two and last dorsal rays simple, others divided for about half their length, the ramal tips acute, slender, almost filamentous. Anal rays divided more than once, at least 4 modally 8 branches, tip more or less spatulate. All pectoral rays other than simple first — i.e., uppermost, see Part XIX (1974, p.218) — flattened through most of their length and noticeably expanded distally; greatest width of middle ray about half an eye diameter, at about that distance from tip; this ray bilaterally symmetrical throughout its length, rays flanking it expanded distally more on outer than on inner border, this expansion more extensive on lower 8th-12th rays than on upper 3rd-6th. The ventral rays exhibit an interesting departure from the modal perciform pattern. The ray next to the spine (in our notation 5th) instead of being elongate, slender, ending in a single point or a small number of points, is unusually wide and is sheared off on the preaxial side in such a way as to present an oblique combined lateral and terminal border, being lateral inasmuch as it accounts for the whole free margin beyond the spine tip or about half total length of the ray, being terminal inasmuch as it is constituted by the tips of the 6-8 rami, the branches being virtually parallel and closely apposed throughout their length. A similar but less extensive sheared off lateroterminal border, one-fifth or one-sixth of total length, is presented by the adjoining ray on its preaxial side, continuous with that of its neighbour. In other rays the terminal elements, modally 8, decrease in height postaxially in the usual fashion. Primary bifurcation of caudal rays modally followed by two divisions; uppermost and lowermost of the major rays showing some resemblance to 5th and 4th ventral rays in having a rounded oblique externodistal border, about one-sixth length of ray, contributed to by all branches.

(ii) Size. In fish possessing 3 anal spines there appear to be two common length patterns — in one the successive spines exhibit marked increments (length frequently specifiable by $L = bN^k$, where L is length, N serial number), while in the other the second spine (sometimes noticeably stouter than others) either exceeds the third, as in the present species, or is but little shorter than it. Lengths, mm, of spines in (a) 10.4, 19.1, 18.1, in (b) 11.0, 19.0, 18.8.

The lengths of the dorsal spines, dorsal rays, anal rays present a similar overall pattern, comprising in a loglog plot of length and serial number a linear ascendant set with the sequence number N increasing caudad or in pectoral downward, followed by a descendant set with the sequence number N^1 increasing cephalad or in pectoral upward. Such sets may intersect. Usually the set $\{N\}$ includes fewer members than $\{N^1\}$, but in the pectoral they here, with intersection, include the same number. It has been noted in earlier contributions that in a number of species the ventral rays 1-4 — first ray defined in Part XIX (1974, p.248) as that furthest from spine — are such that their logarithmic values give a linear graph when plotted on logs 1-4. In species examined earlier it was found that while in some cases a plot of ray 5 on log 5 and spine on log 10 gave a tolerable approximation to linearity when taken with ray 4 on log 4 as before, in other instances the point for ray 5 regularly stood above a line joining ray 4 and spine. On a basis of symmetry a trial has been made using the present data with rays 4, 5 on logs 4, 5 and with the abscissal coordinate for spine arithmetically as far beyond log 4 as log 4 is beyond log 1, i.e., at log 16: for both specimens $P < 0.02$.

The relevant regression equations $\log L = k \log N$ (or N^1 or N^*) + $\log b$ with associated data are set out in table 2: damage to some ray elements precluding measurement renders some sets incomplete. The symbol N^* denotes an arbitrary (other than sequential) integral number or set of numbers.

TABLE 2

HYPOPLECTRODES NIGRORUBRUM (CUVIER, 1828). LENGTH-POSITION PATTERNS OF FIN SPINES AND RAYS

Series	Specimen	Set	Log L	t	Predicted (measured) lengths, mm
Dorsal spines	(a)	A={1-3}	0.9731 log N + 0.8709	23.162*	7.4(7.5), 14.6(14.2), 21.6(22.0)
		B={10-4}	0.2618 log N^1 + 1.1574	33.955***	14.4(14.3), 17.2(17.5), 19.2(18.8), 20.7(20.9), 21.9(22.0), 23.0(22.8), 23.9(23.9)
	(b)	B={10-4}	0.4277 log N + 1.1002	33.159***	12.6(12.5), 16.9(16.9), 20.2(20.5), 22.8(23.0), 25.1(24.6), 27.0(27.9), 29.0(28.2)
Dorsal rays	(a)	A={1,2,4,5}	0.2159 log N + 1.2308	35.176***	17.0(16.9), 19.8(20.0), 22.9(22.9), 24.1(24.0)
		B={17-14}	0.2232 log N^1 + 1.1724	15.725**	14.9(15.0), 17.3(17.1), 19.0(18.9), 20.3(20.5)
	(b)	A={1-5}	0.2219 log N + 1.2942	17.338***	19.7(19.8), 23.0(22.5), 25.1(25.0), 26.8(27.0), 28.1(27.9)
		B={17-14}	0.3050 log N^1 + 1.2348	21.569**	17.1(17.2), 21.2(21.0), 24.0(24.4), 26.1(26.0)
Anal rays	(a)	A={1-3}	0.0832 log N + 1.4148	44.843*	26.0(26.0), 27.5(27.5), 28.5(28.5)
		B={8-4}	0.3329 log N^1 + 1.2099	18.563***	16.2(16.2), 20.1(19.9), 23.0(22.7), 25.4(25.0), 27.3(28.1)
	(b)	A={1-3}	0.0805 log N + 1.4332	50.173*	27.1(27.1), 28.7(28.7), 29.6(29.6)
		B={8-4}	0.2444 log N^1 + 1.3336	41.436***	21.6(21.4), 25.5(25.6), 28.2(28.0), 30.3(30.0), 31.9(32.3)
Pectoral rays	(a)	A={1-7}	0.3549 log N + 1.3514	52.124***	22.5(22.5), 28.7(28.9), 33.2(33.1), 36.7(36.1), 39.8(39.5), 42.4(43.1), 44.8(44.9)
		B={13-7}	0.5033 log N^1 + 1.2360	52.008***	17.2(17.0), 24.4(24.8), 29.9(29.5), 34.6(35.0), 38.7(38.4), 42.4(43.1), 45.9(44.9)
	(b)	A={1-7}	0.3393 log N + 1.3687	50.246***	23.4(23.5), 29.6(29.1), 33.9(33.9), 37.4(38.0), 40.4(40.5), 42.4(43.0), 45.2(44.8)
		B ={13-7}	0.5360 log N^1 + 1.2075	50.709***	16.1(16.2), 23.4(23.2), 29.1(29.0), 33.9(33.8), 38.2(38.4), 42.1(43.5), 45.8(44.6)
Ventral	(a)	A= {1-4}	0.4458 log N + 1.2286	38.793***	16.9(16.9), 23.1(23.0), 27.6(28.0), 31.4(31.1)
		B={4,5, spine}	− 0.3542 log N*+1.7078	57.252*	31.1(31.1), 28.9(29.0), 19.1(19.1)
	(b)	A={1-4}	0.4770 log N + 1.2543	44.884***	18.0(18.0), 25.0(25.0), 30.3(30.0), 34.8(35.1)
		B={4,5, spine}	− 0.4096 log$N$*+1.7948	42.194*	35.3(35.1), 32.2(32.5), 20.0(20.0)

L = length of element, mm, N = serial number of element counting caudad in dorsal, anal, towards spine in ventral, from uppermost ray in pectoral, N^1 = serial number counting in reverse direction, N* = arbitrary enumeration (see text). Specimen (a) standard length 146 mm, Banks Strait (Mr B. Bensemann), (b) standard length 181 mm, south-west of Port Davey (Mr J. Head).

Coloration

After preservation in formalin ground color of both examples ranging from ivory to pale yellow, the larger with most of scales above midlateral line (other than those involved in cross bars) with a largest dark grey spot, making this region overall decidedly darker than lower part. Specimen (b): characteristic pattern of 5 cross bars evidently having experienced some fading but still better preserved than in (a); indication of short oblique bar from near first dorsal origin, good dark bar to midlateral line from just behind middle of spinous dorsal, two fairly persistent bars below soft dorsal extending about three-quarters down flank, moderately well preserved narrow bar across caudal peduncle; upper half of head moderately deep brown, continued down as a curved bar bordering mouth; a darker rounded spot, a little smaller than eye, immediately behind orbit; indications of three longitudinal series of darkish spots (when first seen approaching orange) across soft dorsal, two or three transverse lines of spots across caudal, several scattered darkish spots on anal, some dappling proximally on spinous dorsal produced by ungual spots of microscopic greyish punctulations on invading scales (markings on fins not noticed by Munro or by Scott *et al.*). Specimen (a): bars less distinct; no markings visible on fins; dark brown spot somewhat smaller than eye just behind eye.

Genus *ANTHIAS* Bloch, 1792

Anthias Bloch, 1792, NAT. AUSL. FISCHE, 6, p.97. Type-species, *Labrus anthias* Linné.

Anthias pulchellus Waite, 1899

Anthias pulchellus Waite, 1899, *Aust. Mus. Mem.* 4(1), p.77, pl.12. Type locality: Bungaree Norah to Wollongong, New South Wales; 68-143 m.

Tasmanian occurrence

This species does not appear in any local catalogue, and the Check-list (McCulloch 1929, p.155) gives New South Wales only. A single example trapped in a net-covered craypot attached to a long line in 370 m west of King Island reported, without comment on the specimen, in this journal by Olsen (1958, p.157) affords the only published primary record for this State. A specimen *Ls* 156 *Lt* 194 taken off Eddystone Point, east coast, in 140 m by Mr Shane Downe in August 1978, Q.V.M. Reg. No. 1978/5/94, is here noted.

Meristic characters

Br. VII. D. X, 16. A. III, 8. V. I, 5. P. 16. C. 17 (8+1+8) main rays. L. lat. 45. L. tr. 5/15. Gill rakers on lower limb of anterior arch 24.

Dimensions as *TLs*

Length to origin, termination of first dorsal 314, 641, second dorsal 654, 881, anal 638, 881. Length to pectoral origin 308, to ventral origin 333. Total length of pectoral 397, of ventral 275. Length to vent 619. Head 353. Snout 96. Eye 109. Interorbital 93. Depth at front of eye 199, back of eye 321, opercular border 397 (maximum), vent 391; depth of caudal peduncle 115.

Proportions

Data in parentheses are those for the type material (Waite, 1899); no ranges are given in the Handbook (Munro 1961, p.172), entries for proportions merely being Waite's values rounded to first decimal place. Head 2.84 (2.8), depth 2.52 (2.47) depth of caudal peduncle 8.67 in *Ls*. Snout 3.67 (4.6), eye 3.24 (3.6) in head. Interorbital 1.17 (1.2) in eye, 3.79 (3.75) in head. Measured between parallels, spinous dorsal base 1.44 (from Waite's figure about 1.3) soft dorsal base, or 1.34 (figure about 1.6) anal base. Pectoral 1.13 in head ('longer than head by one tenth'), ventral 1.28 (1.4) in head.

General features

A good general account and an illustration have been provided by Waite, but the species does not appear to have been the subject of further investigation; the following observations report some additional data or render extant information more precise, and call attention to some differences exhibited by our material.

Upper profile of head decidedly more concave overall than in figure, and particularly so above hinder part of eye. Lower jaw projects beyond upper by full antero-posterior extension of its lip. Fully scaled almost square-ended maxilla reaching to below 0.4 eye (Waite first fourth of orbit), its distal breadth twice its shortest distance from eye. Posterior nostril, contrasted with anterior with 'a skinny rim' as 'a simple opening', here with a distinctly elevated rim bordering all but its anterior one-third where a small fold is drawn across the aperture. Only two of the three opercular spines described and figured here recognizable; at site of uppermost only a small obscure skinny process. Along whole length of hind border of preoperculum a series of approximately three score small, contiguous or closely set, somewhat upwardly directed, acute processes, increasing regularly in size downward; along whole inferior border projections, a score or more, in the form of stout subconical spines, many two-cusped, the largest strongest, near the angle, up to 1.5 mm long, length and bulk decreasing regularly forward ("Both limbs of preopercle finely serrated, those at the angle not enlarged"). Serrations not mentioned in Waite's text but more or less clearly traceable in his figure comprising in our specimen an arc of about 15 moderate-sized spines along whole of exposed suboperculum, and a series of some two score, smaller, decreasing in size forward, along border of interoperculum, ceasing at same level as spinules of preoperculum, slightly in advance of middle of eye. The 24 (26) gill rakers on lower limb of anterior arch long slender minutely spinulate along upper border.

Teeth in upper jaw subconical, minute behind increasing in size forward, in somewhat irregular double series anteriorly, becoming uniserial. Inside jaw, separated at symphysis by short edentulous interspace, two mounded areas each bearing several smallish teeth and one very strong, subconical, recurved, acute canine directed slightly inward distinctly backward. Viewed from above, outline of upper jaw comprising paired convex lateral segments and a median concave segment, its arc about one-third eye; at either junction of latter with former a stout subconical canine, subequal to that within mouth, placed quite external of mouth cleft, directed forward and somewhat downward, and when jaws are closed extending over lower lip; round its base a few small teeth. On either side of mandible a subtriangular cluster of teeth in several rows, small internally, minutely tuberculate in front and laterally; behind this some small or very small teeth in 2 or briefly 3 rows extending to middle of jaw, here two recurved canines followed by very small teeth in 1 row. Outside of jaw 2 well separated canines, directed forward and upward, fitting inside external pair in upper jaw. Vomerine teeth minute, in two lateral lobes and one shorter, basally broader forwardly directed lobe, all sides of the figure concave, angles rounded. On each palatine small teeth in a broad band somewhat wider in its anterior half, 5-6 rows here; length some five times width, latter exceeding shortest distance from vomerine series.

Anal base ending level with (figure in advance of) dorsal base. (Some difference in relative lengths of spinous dorsal, soft dorsal anal noted earlier in Proportions). Longest, 4th, dorsal spine 2.0 (2.1) in head, 1.90 (twice) 1st; 2nd 1.4 (1.4) in 4th; 4th 1.1 (almost equal to) 3rd; spines 5th-8th, 26.5, 25.2, 24.5, 22.9 mm (subequal); 9th, 10th 21.1, 18.6 (somewhat shorter). Soft dorsal higher than posterior spines (ditto); longest, 4th (11th) 0.98 (does not exceed) 4th spine. Longest anal spine, 2nd, 1.0 (as long as) 3rd dorsal. Anal rays: longest, 2nd, 1.09 longest dorsal ray, mean length 1.11 mean of dorsal rays (anal rays much longer). Ventral spine 0.95 (slightly longer than) 4th dorsal spine; longest ventral ray (second preaxial, in our notation 4th, in Waite's 2nd) 1.41 (1.4) in head; fin reaching to anal base (failing

to reach vent). Longest pectoral ray, 9th (8th); whole fin 0.96 head (longer than head by one-tenth), reaching to base of 1st (3rd) anal spine.

Scales on whole trunk, tail, head, including branchiostegals, except small area on chin, part of anterior end of maxilla (entire head scaled); extending on to both dorsals to form a sheath reaching on an average about one-third height of fin, but rising higher on some anterior spines; similar but somewhat less extensive sheath on anal with prolongations up the rays; pectoral, ventral scaly in basal one-third or less; in a basal arc on caudal, about a dozen on middle rays (the presence of these scales is in possible contravention of one diagnostic feature of the Anthiidae as recognized by Munro (1967, p.279) namely "Fins without basal scale sheaths"). Waite provides no indication as to presence or absence of an axillary process between ventrals (stated by Munro not to occur in Anthiidae) : in our specimen no definitive process developed, but several somewhat elongated scales forming a small subtriangular group overlapping bases of inner ventral rays on either side and extending briefly backward into interval between fins. Scales on body largest under pectoral, about half an eye diameter, at level of vent two-thirds on caudal peduncle one-third this. On operculum little if at all smaller than on trunk nearby, others on head smaller, on lateral surface decreasing fairly evenly forward, on dorsal surface suffering a rather sudden diminution at level of hind orbital border.

A scale from near middle of flank subquadrangular, dorsoventral extension a little greater than anteroposterior, hind border moderately convex somewhat sinuous, front border barely rounded, rather gently, simply or sinuously curved, approximating backward; posterior field heavily armoured externally with a conspicuous band of three-sided or four-sided platelets or flat spines, disposed in oblique rows in varying numbers, a medial row with 3-6; arising from between outer borders or tips of outer row a series of some 40-60 rather stout, acutely or bluntly pointed recurved spines, their basal widths subequal to their interspaces, their length regularly increasing mediad; the numerous fine wavy striae in the anterior field divided by 11-14 strong radial striae or ridges, the series not extending to anterolateral angles of scale.

Spines and rays

(i) Character. Dorsal spines of moderate length, longest shorter than in *Callanthias allporti*, longer than in *Caesioperca rasor*, rather stout, pungent, in our specimen noticeably more recurved than in Waite's plate. Dorsal rays all divided, last with 2, others modally with 4 but up to 8 sharply pointed rami. Anal rays in general similar to dorsal rays. Pectoral with first and last rays unbranched, pointed; remainder begin to branch near middle of fin, from this point widening, at the same time flattening and becoming further divided, these features becoming increasingly evident with increase in size, longest (9th) ray about 1 mm wide at base with subterminal width of 3 and with 8 rami: fin almost bilaterally symmetrical, with, however, highest ray the 9th; slope of upper border between tips of first and last members 5.0 mm per ray interval, that of lower border 6.3. Ventral rays already divided and redivided at or before middle of their length, distad of this continuing to divide, somewhat irregularly, terminating in a dozen or more fine tips forming a wide fan. Anal spines large stout, basal diameter of largest, second, about one-third eye.

(ii) Size. In most cases spine lengths, in one or more series (often intersecting) in a fin, yield in a loglog plot a linear graph on their serial numbers as abscissal values. Metrical data are set out in table 3. The dorsal rays exhibit a quite unusual feature. In the set {16-5} of the 12 members 3 near the middle of the series (8, 9, 10) are of equal height, those before and behind them descending in height caudad. It is found by trial a very good straight line (t = 44.902***, see table) results when these 3 rays are treated as a single variate with a single abscissal coordinate (log 7) — a circumstance clearly of some, if at present undetermined, significance in the causal interpretation of these widespread length-number patterns.

TABLE 3

ANTHIAS PULCHELLUS WAITE, 1899. LENGTH-POSITION PATTERNS OF FIN SPINES AND RAYS

Series	Set	Log L	t	Predicted (measured) lengths, mm
Dorsal spines	A = {1-4}	0.4746 log N + 1.1625	22.907**	14.5(14.5) 20.2(20.1) 24.5(25.1) 28.1(27.6)
	B = {10-4}	0.2007 log N^1 + 1.2665	373.810***	18.6(18.5) 21.2(21.1) 23.0(22.9) 24.4(24.5) 25.5(25.2) 26.5(26.5) 27.3(27.6)
Dorsal rays	A = {1-4}	0.9761 log N + 1.3710	19.357**	23.5(23.5) 25.1(25.2) 26.2(26.0) 26.9(27.0)
	B = {16-11 (8 9 10) 7-5}	0.3108 log N^1 + 1.0810	44.902***	14.9(15.0) 16.9(17.1) 18.5(18.0) 19.8(19.8) 21.0(20.5) 22.0(22.0 rays 8 9 10) 23.0(23.1) 23.8(24.0) 24.6(25.0)
Anal spines	A = {1 3 2}	0.4259 log N^* + 1.2127	61.959*	16.3(16.3) 21.9(22.0) 26.1(26.0)
Anal rays	A = {5-2}	0.2085 log N^1 + 1.3532	92.040***	22.6(22.6) 26.1(26.1) 28.4(28.0) 30.1(30.1)
	B = {8-5}	0.1717 log N^1 + 1.2608	15.217**	17.8(17.0) 20.1(19.8) 21.5(21.7) 22.6(22.6)
Pectoral rays	A = {2-9}	0.4046 log N + 1.3579	28.626***	22.8(23.4) 30.2(30.0) 35.6(34.2) 40.0(39.1) 43.7(43.8) 47.1(47.0) 50.1(52.0) 52.9(53.0)
	B = {15-9}	0.5937 log N^1 + 1.2338	59.080***	17.1(17.0) 25.9(26.0) 32.9(32.6) 39.0(39.8) 44.5(45.5) 49.6(49.9) 54.4(53.0)
Ventral rays	A = {1-4}	0.4621 log N + 1.2708	21.066**	18.7(18.9) 25.8(25.1) 31.0(30.8) 35.4(36.0)
	B = {4,5, spine}	− 0.2314 log N^*+1.6951	41.594*	36.0(36.0) 34.2(34.1) 26.1(26.1)

L = length of element, mm, N = serial number of element counting caudad in dorsal, anal, towards spine in ventral, from uppermost ray in pectoral, N^1 = serial number counting in reverse direction, N^* = arbitrary enumeration (see text). Specimen standard length 156 mm, off Eddystone Point, east coast (Mr Shane Downe).

Among the ventral rays it is found the relevant length is not, as is usual, that of the longest ramus but that of the middle ramus (or mean of two medial rami). It is of some interest to observe that this value is not necessarily identical with the mean length of the two outermost branches, since to conform with the general broad curve of the outspread fin the degree of obliquity of the ray tip, relative to main antero-posterior axis of fin, varies from ray to ray. In the formulation for ventral rays 4, 5 and spine number ordinates are 4, 5, 16.

Lengths of body regions

The dimensions head, head + trunk, head + trunk + tail that in some other species are linear in a loglog plot on 1,2,3 here yield a satisfactory straight line (t = 35.818*, better than P 0.02) on 1,2,4, the slope being 0.7519, intercept 1.7441; predicted (measured) lengths, mm, 55 (55), 93 (95), 157 (156).

Coloration

On being thawed out after receipt in a frozen state the fish was an almost uniform reddish orange, varied only by some indeterminate yellowish areas on the head. After preservation in alcohol the whole specimen is pale cream in ground color. Each of the scales of three or four rows above the lateral line bears a more or less rounded dusky spot. The large black blotch occurring on anterior half of soft dorsal and just encroaching on spinous dorsal delineated in Waite's figure and stated by him to be present only in some individuals is here absent.

Specific status

While there seems little doubt the present specimen is referable to *Anthias pulchellus*, several differences from the definitive description of that species are worthy of notice. The most striking is the more forward position of anal relative to dorsal in our specimen, in which first anal spine originates virtually below (< 1 mm behind) insertion of last dorsal spine, whereas Waite's figure shows it below second dorsal ray. From the third backward dorsal spines as figured are virtually straight; here they are noticeably recurved. Waite discussed the relations between *A. pulchellus* and *A. hypselosoma* Bleeker, 1857 — equating with the latter a specimen washed up on the beach at Lord Howe Island described by Ogilby (1888) as *A. cichlops*, a reidentification later being made formally by him (Waite 1904a) and maintained in his Lord Howe catalogue (1904b) — and *A. pleurotaenia* Bleeker, 1857, the former being noted as being recorded from Lord Howe Island, the latter from "the north-east coast of Australia": of these only *A. pleurotaenia* appears in the Check-list (McCulloch 1929, p.155) and in the name-list of Whitley (1964, p.42). It may be noted in passing that in the recent annotated check-list of the fishes of Lord Howe Island (Allen *et al.* 1976, the Serranidae by Hoese) includes (p.395) an entry for *Pseudanthias* sp., in the synonymy of which are placed both *Anthias cichlops* : Ogilby, 1888 (non Bleeker) and *Pseudanthias hypselosoma* : Waite, 1904 (*non* Bleeker).

Some half dozen differences enumerated by Waite as distinguishing his species from *A. hypselosoma* as interpreted by him are valid also for our specimen. However, the preopercular spines present some difficulties. In his general description he expressly observes 'those at the angle not enlarged' and in his discussion differentiates *A. pulchellus* by "the sub-equal character of the preopercular serrations". As reported above in the Tasmanian specimen the projections on the preopercular margin are noticeably larger near the angle than elsewhere, being here quite stout spines of moderate size. While 3 opercular spines are reported for *A. pulchellus*, 2 only are clearly identifiable in the present fish.

E.O.G. Scott

Genus *CALLANTHIAS* Lowe, 1839

Callanthias Lowe, 1839, *Proc. zool. Soc. Lond.*, 7, p.76. Type-species, *Callanthias paradisaeus* Lowe.
Anogramma Ogilby, 1899, *Proc. Linn. Soc. N.S.W.*, 24(1), p.179. Type-species, *Callanthias allporti* Günther.

Callanthias allporti Günther, 1876

Callanthias allporti Günther, 1876, *Ann. Mag. Nat. Hist.* (4), 17, p.390. Type locality: Tasmania.
Callanthias platei australis Ogilby, 1899, *Proc. Linn. Soc. N.S.W.*, 24(1), p.173. Type locality : Sydney Market and Port Jackson.
Callanthias platei : Waite, 1899, *Aust. Mus. Mem.*, 4(1), p.80 (not *Callanthias platei* Steindachner, from Chili).

Remarks

This elegant species, based on material forwarded from Hobart to the British Museum over a century ago by Morton Allport (compiler of the first local list of fishes; still in ms) is seldom encountered in this State, though not infrequently trawled off the southern mainland coast. Its specific status, in particular its relation to *Callanthias platei* Steindachner, 1898 from Chile, has received more attention from Australian quthors — e.g., Waite (1894, 1899), Ogilby (1899), McCulloch (1911), the last-named calling attention to variations in proportion with overall size — than has the general delineation of the species, no good general account of it apparently being available in the local literature. Some morphometric data not elsewhere recorded are here provided and extant notices are extended and/or emended in respect of several features; some consideration is given also to length-number patterns of fin rays and spines.

Material

Two examples, (a) *Ls* 157 *Lt* 200, off Eddystone Point, east coast, 140 m, August 1978, Mr Shane Downe, Q.V.M. Reg. No. 1978/5/95, (b) *Ls* 195 *Lt* (including prolonged caudal rays) 250.5, Binalong Bay, east coast, 3 January 1977, Mr D. Wright, Q.V.M. Reg. No. 1977/5/1.

Meristic characters

In this and succeeding sections where two data are recorded the first is that for the smaller individual (a). D. XI, 10; XI, 11, last divided to base. A. III, 10; III, 11, last divided to base. V. I, 5. P. 21. C. 17 (8+1+8) main rays. L. lat. 46, 43. L. tr. 4-5/16-18. The counts of 11 dorsal rays and 11 anal rays in (b) exceed those given in the original description (Günther, 1876) and in recent Australian catalogues by Munro (1961), Scott *et al.* (1974).

Dimensions as *TLs*

Length to origin, termination of first dorsal 264, 226, 592, 557, of second dorsal 618, 577, 841, 866, of anal 551, 510, 850, 840. Length to pectoral origin 287, 237, to ventral origin 299, 278. Length, total, of pectoral 239, 237, of ventral 280, 222 (hence in (a) ventral in (b) pectoral the longer). Length to vent 532, 485. Head 274, 237. Snout 48, 52. Eye 95, 80. Interorbital 88, 88. Depth at front of eye 185, 144, back of eye 287, 260, opercular border 354, 330, vent 357, 309; maximum depth 363, 330; depth of caudal peduncle 159, 129.

Proportions

Entries in parentheses are those for the type material. Head 3.65, 4.22 in (one-third of), depth 2.75, 3.03 in (one-fourth of) standard length. Snout 5.73, 4.56 in, eye 3.07, 2.97 in (two-sevenths of) head. Interorbital 1.01 in, 0.91 of eye or

3.12, 2.71 in head. Maximum depth of caudal peduncle 1.72, 1.84 in head. Spinous dorsal base 1.47, 1.14 soft dorsal base, 1.10, 1.00 anal base, measured between parallels, or 1.41, 1.06 and 1.09, 1.01 measured with dividers. Pectoral 1.15, 1.00 ventral 0.87 of, 1.07 in head, or 4.19, 4.22 and 3.57, 4.51 in standard length.

General features

The following observations supplement Australian treatments of the species.

Dorsal profile with a markedly more concave segment than that depicted in the standard figure by Waite (1894, pl.2) extending from about midway between upper lip and eye about to level of middle of orbit. Lower jaw projecting slightly. Preorbital narrow, its least width subequal to that of upper jaw. Opercular, preopercular, preorbital borders entire. Operculum with two acute spines, lower about at level of middle of eye, twice or more as long as upper. On account of truncation of snout premaxilla more or less L-shaped; scaleless, dentigerous throughout its entire length. Maxilla wholly squamous, extending to below 0.4, 0.3 eye.

Head with numerous pores (not noticed in original description), variably developed in the two specimens, at times on two sides of same individual, including (a) about a dozen mostly small behind and upwards from upper part of hind border of orbit, (b) a circumorbital ring of about a score, very variable in size, in specimen (a) two very large on preorbital at about 6 o'clock (left side viewed), (c) two or three pairs on dorsum of snout in advance of middle of eye, (d) a series along preopercular border including three large on lower limb and one large shortly above angle, (e) four on each mandible. Nostrils apparently represented by a pair of small short tubular structures somewhat nearer to level of front of upper lip than to level of front of orbit, and a pair of apertures just outside orbit, left at about 10 o'clock (left side viewed).

Teeth in upper jaw in an elongate linguiform band widest in front, about 8 rows there, cardiform; externad of this band a single row of some 10-20 (number varying on right and left sides) of much larger though still small conical or peglike teeth inserted on lip near its inner border; on squared-off front of snout in (a) 4 large and several smaller teeth in lip, slightly outside mouth cleft, directed upward and forward, in (b) a similar set but teeth considerably smaller. In lower jaw on either side of symphysis a subtriangular patch of cardiform teeth followed by a single series variable in size and including 3 or 4 canines; near either end of the transverse anterior segment of the jaw 1 or 2 large externally set teeth directed upward and forward. (Only the forwardly pointing teeth of the lower jaw are mentioned by Günther). Vomerine teeth in a forwardly convex arc, almost all in a single row, in (a) of at least two sizes, the larger very large; subcontinuous on each side with a series, single or very briefly double anteriorly, of smaller, in (a) very much smaller, palatine teeth. Tongue edentulous.

Scales covering whole of body, whole of head except lips; most large, exposed hind border under base of pectoral 0.6 eye; on head decreasing in size forward, elsewhere decreasing backward; not extending on to fins other than caudal, there forming a conspicuous basal arc and extending up rays almost to tip.

A scale from the middle of the flank is subquadrangular, the hind border moderately the front barely rounded, lateral borders almost straight slightly diverging forward. The exposed border bears about four score stout straight pungent spines, about their own basal diameter apart; along the whole or most of the array a smaller spine, from a quarter to a third as wide, is intercalated between each pair of primary spines, originating near the middle of their lengths, terminating about on a level with them; in the anterior field the wavy concentric striae very numerous closely set in short transverse series separated by some two dozen strong radial striae, the series

extending just round the anterolateral angles; each band of concentric striae surmounted externally by a hyaline lunule, the whole anterior border thus being crenulate.

The unusual course of the lateral line at once distinguishes this species from other anthiids occurring in our waters; shorter anterior segment of 6-7 scales slightly proconcave or slightly proconvex, rising at an overall angle of about 50° from near upper attachment of operculum to below 3rd or 4th dorsal spine, posterior of some 35-40 scales following course of base of dorsal only 3-4 scales from it to end of fin, continuing parallel with dorsal border of caudal peduncle, distant from it by one-sixth or one-seventh of depth here. In the preserved material the line appears to consist of a series of shallow grooves commonly filled with gelatinous-looking material; at the hind end of each scale an opening, in (a) large slitlike, length usually from a third to half interspace, in (b) smaller, more rounded.

A marked difference in the relative lengths in (a) and (b) of the two dorsals has been recorded above in section headed "Proportions", ratio of longer base (spinous) to shorter being 1.3 times greater in former. In (b) anal origin about below antepenultimate, in (b) below penultimate dorsal spine. Soft dorsal in (a) much more elevated than in (b), longest ray about twice, more than thrice in total dorsal base (in standard illustration about two and a half times); a similar discrepancy characterizes the two anal fins. (This situation is in direct contrast to that reported for *Endeavour* material by McCulloch (1911, p.52), who found height of vertical fins increasing with size of fish, specimens less than 1.3 cm to about 23 cm in length having longest anal ray 7.3, 5.04, respectively, in length of fish). In (b) laid-back dorsal just fails to reach origin of uppermost caudal ray, in (a) extends beyond it by a little more than half depth of stout peduncle. Rounded pectoral to level of vent; obtuse ventral to 1st anal spine or 1st anal ray. Lower caudal lobe slightly longer than upper; in (a) both lobes ending in a normal point, in (b) 3rd ray from uppermost and 3rd ray from lowermost of those attaining hind border of fin produced in a filamentous process, the longer (upper) half length of head.

Between ventral bases a well developed elongated triangular axillary process, widest and thickest anteriorly where it is somewhat cushion-like, reduced to a flattish membrane in its distal one-third; thickly sheathed in front with scales, in places in more than a single layer. This structure has not previously been reported for this species: indeed, an axillary process is stated by Munro (1967, p.279) not to occur in Anthiidae.

Rays and spines

(i) Character. Dorsal spines long, tolerably stout, pungent; the membrane between them barely excavate reaching almost to their tips. All dorsal rays divided nearly to base; secondary division not beginning till 3rd (a) or 4th (b) ray, then only in posterior ramus; division more active throughout in posterior portion of ray field, an earlier branch either not dividing at all (with resultant odd number of terminals) or dividing higher than corresponding later branch. Anal spines long, slender; in (b) tip surmounted by short lanceolate fleshy process (lost in (a) by mutilation?). In anal rays division greater and/or earlier in the hinder rami; only one division in 1st and 2nd rays, with a third ramus arising from the second in 3rd, 4th, also in (a) 5th ray, the anterior ramus not dividing till 6th, 5th ray, 8 terminals being developed only near end of fin. In ventral terminals, starting from ray furthest from spine, 8, 10, 10, 6, 4 in (a), 6, 10, 8, 6, 4 in (b).

(ii) Size. With lengths, mm, (a) 11.7, 22.0, 28.1 (b) 12.0, 20.1, 24.0, the 2nd and 3rd anal spines are of noticeably greater absolute length in the smaller individual; while the ratio of 2nd to 3rd is significantly the same in (a) and (b), the ratio of 1st to 3rd is numerically much greater in (a) 1:2.05 than in (b) 1:1.68.

The dorsal spines, dorsal rays, anal rays and ventral rays in general exhibit an exponential relation between length and serial number of insertion, $L = bN^k$. In three sets the coordinates for one or more terminal or subterminal elements fail to fall on the linear loglog plot for the remaining elements (always by excess magnitude). These elements, met with only in (a), are first dorsal spine, first and last dorsal rays, last two anal rays. In (a) dorsal spine 4 is imperfect. Data for the length-number patterns found are set out in table 4.

Coloration

The original description notes merely 'uniform reddish (in spirits)', and this account has not been greatly amplified in local texts, Scott *et al.* (1974, p.257) for instance stating 'colour reddish in spirit, probably bright reddish in life'. The following is a summary of some observations made on specimen (a) immediately after its being defrosted on receipt at the Museum. General color of dorsal and lateral surfaces more or less uniform pale yellow with some touch of orange or reddish; in some areas a silvery tinge, this becoming the prevailing color on ventral surfaces of trunk and tail. From eye back across head and on to pectoral base reddish purple; two rounded silver spots at front of dorsal surface of truncate snout, diameter subequal to interspace; upper jaw greenish yellow; lower jaw pale yellowish with some rosy tinge, a median silvery spot at symphysis; isthmus white. Both spinous and soft dorsals light yellow, the last few rays with some rose; a pink oval spot, major axis longitudinal, near the bases of nearly all spines and rays; a few very short longitudinal reddish dashes at outer border of both fins, these not forming a regular linear series. Anal much like dorsals but somewhat brighter; a small amount of pinkish between last two rays; an oval or rounded pinkish spot at bases of spines and rays; very narrow imperfect distal border of reddish. Pectoral bright slightly greenish yellow. Ventral yellowish, deeper than pectoral. Caudal pale greenish yellow; an extensive whitish lunule covering tips of all rays except two or three upper and two or three lower, its medial extension about one-fourth of middle rays.

In the 1977 specimen the details of the pattern were more fully preserved and color as a whole was more intense. General color of trunk and tail below about midlateral line pearly white fading to white below. Above about midlateral line below soft dorsal and posterior one-third of spinous dorsal orange, below rest of dorsal (and extending on to head) approaching magenta with orange spots; a large ovoid spot of deep magenta between eye and dorsal profile; pupil black; iris yellowish with some white, surmounted by magenta crescent. On hind half of caudal peduncle a more or less hemispherical region of grey extending forward from caudal base; at back of this area a median longitudinal patch of chrome yellow; vertically above this at upper profile two pairs of small grey spots; vertically below at lower profile, partly extending on to fin, an irregular patch of grey. Ventral surface whitish or pearly, posteriorly with yellow spots. Dorsal fins yellowish; soft dorsal with chrome yellow or orange blotches, narrowly margined with magenta. Anal mostly white, last four rays with orange spots, narrow magenta distal border. Pectoral white, some tinge of orange. Ventral white proximally, with pink flush in distal half. Caudal largely pink; most of hind portion from shortly in advance of level of end of middle caudal rays orange red; set in this one longitudinally oval of chrome yellow near upper border and one near lower; extending back from middle three-quarters of fin base an irregular splash of chrome yellow narrow behind to a point at a little more than halfway to end of middle caudal rays.

TABLE 4

CALLANTHIAS ALLPORTI GÜNTHER, 1876. LENGTH-POSITION PATTERNS OF FIN SPINES AND RAYS

Series	Specimen	Set	Log L	t	Predicted (measured) lengths, mm				
Dorsal spines	(b)	A={1-4}	0.5278 log N + 1.0303	27.638*	10.7(10.6)	15.6(15.8)	19.4(19.2)	22.6(22.0)	
		B={11-5}	0.0905 log N^1 + 1.4300	49.035***	26.9(26.7)	28.7(28.9)	29.7(29.8)	30.5(30.8)	31.1(31.0)
					31.7(31.5)	32.1(32.0)			
	(a)	B={10,9,7,5}	0.2712 log N^1 + 1.3364	18.966**	21.7(21.8)	29.2(29.0)	33.5(33.0)	35.3(36.0)	
Dorsal rays	(b)	A={1-4}	0.0911 log N + 1.4915	13.341*	31.0(31.0)	33.0(33.0)	34.3(34.4)	35.2(35.1)	
		B={11-5}	0.1604 log N^1 + 1.3933	13.224*	24.7(25.4)	27.6(27.2)	29.5(29.0)	30.9(31.0)	32.0(31.8)
					33.0(33.2)	33.7(34.2)			
		B={11-4}	0.1640 log N^1 + 1.3921	16.800*	24.7(25.4)	27.7(27.2)	29.5(29.0)	31.0(31.0)	32.1(31.8)
					33.1(33.2)	34.0(34.2)	35.1(34.7)		
	(a)	B={9-3}	0.3901 log N^1 + 1.3336	18.078***	48.5(47.0)	46.0(46.5)	43.4(44.5)	40.4(41.4)	37.0(35.9)
					33.1(33.2)	28.2(28.2)			
Anal rays	(b)	A={1-4}	0.1060 log N + 1.4649	4.701*	29.2(29.3)	31.4(31.0)	32.8(33.0)	33.8(33.8)	
		B={11-4}	0.1144 log N^1 + 1.4239	53.256***	26.5(26.5)	28.7(28.9)	30.1(30.0)	31.1(31.1)	31.9(31.9)
					32.6(32.4)	33.2(33.2)	33.7(33.8)		
	(a)	A={1-3}	0.0927 log N + 0.3412	19.238*	33.7(33.9)	35.9(35.2)	37.2(37.7)		
		B={4-9}	0.2676 log N^1 + 1.5059	12.926**	24.3(24.7)	27.3(26.3)	29.3(29.0)	31.1(31.1)	
					32.7(33.0)	34.0(34.3)			
Ventral rays	(b)	A={1-4}	0.4379 log N + 1.3212	56.118***	20.9(21.0)	28.4(28.5)	33.9(33.2)	38.4(39.0)	
	(a)	A={1-4}	0.3386 log N + 1.2861	65.727***	19.3(19.1)	24.4(25.0)	28.0(28.1)	30.9(30.5)	

L = length of element, mm, N = serial number of element counting caudad in dorsal, anal, towards spine in ventral, N^1 = serial number counting in reverse direction. Specimen (a) standard length 157 mm, off Eddystone Point, east coast (Mr Shane Downe), (b) standard length 197 mm, Binalong Bay, east coast (Mr D. Wright).

Observations on some Tasmanian Fishes : Part XXV

Genus *CAESIOPERCA* Castelnau, 1872

Caesioperca Castelnau, 1872, *Proc. zool. acclim. Soc. Vict.*, 1, p.49. Type-species, *Serranus rasor* Richardson.

Caesioperca rasor (Richardson, 1839)

Serranus rasor Richardson, 1839, *Proc. zool. Soc. London*, p.95. Type locality: Port Arthur, Tasmania (Lemprière).

Material

Eleven examples: (a) *Ls* 125, Bell Bay wharf, Tamar estuary, north coast, 1978, R. McBain, Queen Victoria Museum Reg. No. 1978/5/54; (b) *Ls* 125, Sandy Beach, Tamar estuary, 19 March 1978, C. Curtis, Reg. No. 1978/5/64; (c) (d) (e), *Ls* 161, 168, 170, Low Head, north coast, 16 February 1975, R.L. Askeland, Reg. No. 1975/5/24; (f) *Ls* 172, Croppies Point near Bridport, north coast, 28 December 1973, scuba divers, Reg. No. 1974/5/145; (g) *Ls* 173, south of Orford, east coast, 8 May 1977, D.M. Wood, Reg. No. 1977/5/19; (h) *Ls* 176, Binalong Bay, east coast, 1 August 1977, Wright, Reg. No. 1977/5/36; (i) *Ls* 176, 1.2 km off Low Head, north coast, 2 March 1974, P.M. Hart, Reg. No. 1974/5/101; (j) *Ls* 192, George Town, Tamar estuary, in graball net, shallow water, 18 July 1968, Cannon, Reg. No. 1968/5/30, (k) *Ls* 200, Sidmouth, Tamar River, 1 July, 1967, A.P. Perkins, Reg. No. 1967/5/13.

Remarks

This species, based on material from Port Arthur sent to the British Museum from Tasmania by J.J. Lemprière (1796-1852), one of the Colony's early collectors and since encountered in Victoria (where the examination of the only example to come under his notice led Castelnau (1872, p.49) to institute his genus *Caesioperca*) and South Australia, is more common, at any rate in the northern parts of the State than the rather similar but more widely ranging *C. lepidoptera* (Bloch & Schneider), which extends northward to New South Wales and westward to Western Australia. Johnston (1891, p.24) rated it as common during the winter season. Lord & Scott (1924, p.58) set the length at 200-250 mm, the upper extreme being adopted also by Scott *et al.* (1974, p.258), while the Handbook (Munro 1961, p.172) gives a somewhat lower maximum, 215 mm: our largest individual, (k) has a total length of 250 mm. It is stated by Scott *et al.* to be taken in depths of 55-75 m, while the Handbook puts the range deeper at 85-110 m; however, most of our material has been collected in quite shallow water, one specimen (k) being caught 15-20 km from the sea.

Examination of the material listed above makes apparent the existence of considerably more variation in some meristic and morphometric values than has hitherto received recognition, the figures here found transgressing at one or both extremes all the ratios for which synoptic values are given in the Handbook, as well as two counts there given.

Meristic characters

D. X, 20 (1 specimen), 21 (8), 22 (2). A. III, 8 (1), 9 (10), last ray divided to base. V. I, 5. P. 13/14 (3), 14/14 (4), 15/15 (4); outside Handbook range 14-15, Castelnau 13. L. lat. 49 (1), 50 (1), 52 (2), 55 (3), 56 (2), 57 (1); outside Handbook range 49-56, Castelnau 56. C. 16 (1), 17 (10); Castelnau 15.

Dimensions as *TLs*

The principal dimensions are set out in table 5, in which the first line, standard length, is recorded in millimetres, all other entries being in millesimals of standard length.

TABLE 5

Caesioperca rasor Richardson, 1839. DIMENSIONS OF 11 TASMANIAN EXAMPLES

Dimension	Range	$\bar{x}$	V
Standard length, mm	125-200	167.1± 7.078	14.0 ± 3.1
Length to tip of upper caudal lobe	1227-1284	1256.3± 5.481	1.4 ± 0.3
Length to tip of lower caudal lobe	1210-1273	1240.2± 5.803	1.6 ± 0.3
Length to tips of middle caudal rays	1131-1197	1158.8± 5.474	1.6 ± 0.3
Length to first dorsal origin	267-341	305.1± 6.207	6.7 ± 1.4
Length to first dorsal termination	560-665	595.5± 9.163	5.1 ± 1.1
Length to second dorsal origin	575-672	611.2± 8.695	4.7 ± 1.0
Length to second dorsal termination	853-898	872.8± 4.325	1.6 ± 0.4
Length to anal origin	630-723	662.7± 8.102	4.1 ± 0.9
Length to anal termination	800-864	822.6± 6.256	2.5 ± 0.5
Length to vent	595-694	627.0± 7.852	4.2 ± 0.9
Length to pectoral origin	276-304	289.9± 4.225	4.2 ± 0.9
Length to ventral origin	278-368	325.8± 7.052	7.2 ± 1.7
Length of pectoral, total	300-375	327.6± 6.658	6.1 ± 1.3
Length of ventral	185-239	205.5± 4.728	7.6 ± 1.6
Head	270-304	290.6± 3.131	3.5 ± 0.8
Snout	68.2-93.8	78.0± 2.550	10.8 ± 2.3
Eye	60.5-78.4	67.4± 1.713	8.4 ± 1.8
Interorbital	83.9-102	91.0± 1.769	6.4 ± 1.4
Depth at front of eye	163-239	208.4± 7.940	12.6 ± 2.7
Depth at back of eye	238-318	284.1± 5.774	6.7 ± 1.4
Depth at opercular border	335-381	351.8± 4.560	4.3 ± 0.9
Depth at vent	202-364	318.2±13.118	13.7 ± 3.0
Maximum depth	342-403	370.9± 6.327	5.7 ± 1.2
Depth of caudal peduncle	114-131	123.8± 1.757	4.7 ± 1.0

First line standard length, mm, all other lines permillages of standard length.

Proportions

Each of the following entries comprises range, mean with standard error, coefficient of variation with standard error.

Head 3.26-3.70, 3.43±0.0397, 3.8±0.8 in standard length (Munro 3.5, Castelnau three and a half in total length). Greatest depth 2.48-2.95, 2.71±0.0487, 5.7±1.2 in standard length (M. 2.6-2.8, C. three and one-third in total length). Depth at vent 2.75-3.40, 3.06±0.0595, 6.4±1.4 in standard length. Depth of caudal peduncle 7.59-8.74, 8.09±0.114, 4.7±1.0 in standard length; 2.21-2.66, 2.36±0.0413, 5.8±1.1 in head. Snout 3.17-4.27, 3.77±0.103, 9.1+1.9 in head. Eye 3.88-4.75, 4.38±0.0811, 6.1±1.4 in head (Munro 4-4.5, Castelnau four times); 1.02-1.50, 1.17±0.0443, 12.5±2.8 snout (Munro eye equal to snout). Eye 1.13-1.53, 1.37±0.0403, 9.8±2.1 in interorbital (Munro eye less than interorbital). Pectoral 2.89-3.25, 3.06±0.0349, 3.6±0.8 in standard length; 1.04-1.20, 1.12±0.0139, 4.1±0.9 head (Munro 1.2-1.3).

Coloration

After preservation much of the original color has been lost, most of the specimens being overall not far from uniform brownish, regularly darker however in the upper one-fourth or one-third. The spots on the individual scales of the lower half of the flank persist as well defined darker areas in most of the larger examples, but are wholly missing in the smallest, (a) and (b) which are noticeably lighter than the rest and virtually immaculate. Traces of the scattered spots below and in advance of the pectoral are recognizable in several individuals, as also are the markings on the caudal and anal fins (not apparent in the illustrations reproduced in the South

Australian catalogues of Waite (1921) and of Scott (1962). The Handbook mentions only two blue streaks near the eye, but the three bars beginning near the tip of the snout, one extending above, one below the eye, the other ceasing at the orbit near the middle of its anterior border that are noted and figured in Scott *et al.* are present in all our examples save the smallest two. The facultative black bar (not shown in either of the standard figures) occurs on both sides in 7 examples and on one side (and there only on 2 scales) in 1. Castelnau's description of it as 'lozenge-shaped' is generally apt. It varies considerably in extent in different individuals, sometimes to some degree on the two sides, involving 1-3, modally 2 scales horizontally, 2-12 vertically: the pectoral may just fail to reach it, partly or wholly overlap it or occasionally extend briefly beyond it.

Scales

The extensive invasion by scales of the vertical fins has been adequately described by Castelnau. Scales are found also on the pectoral base, extending in a single series of from about a dozen to about a score up the middle rays for as much as one-third their length, but usually being restricted to fewer than half a dozen on the lateral rays; a similar row sheaths the basal half of each of the ventral rays and the spine. A short broad somewhat linguiform axillary process, not noted in available accounts, is present, consisting of several large scales, the hinder median much enlarged, subtriangular; total length about two-thirds eye diameter. The Handbook states "Head including maxilla and mandible scaly"; scaleless areas are the lips, most if not all of the preorbital, the branchiostegal (but as in allied species not the rays), the contrast of its smooth forward extension flanking the isthmus and the strongly scaled tumid course of the latter being very striking.

A scale from the midflank is of the same general type as that described above for *Hypoplectrodes nigrorubrum*; about three score strong spines in a single series on each side, in two alternate series in middle half or more of posterior border; 12-13 strong radial ridges, outermost just failing to reach anterosuperior and anteroinferior angles; at base of spines 3-4, occasionally 5 rows of platelets or incipient truncate spines, set alternately; very shallow lunules lacking the fine closely set wavy striae constituting crenulate overall nearly straight anterior border.

Comparison with other accounts

Attention has been drawn above to notable discrepancies between some published meristic and morphometric variates and those found in the present material. Some additional differences call for comment. Maxilla "reaches below hind half of eye" (Handbook); in our material it never reaches even to middle of eye, modally to one-third or less, in some individuals barely reaching orbit. "The denticulations of the praeoperculum very fine on its outer edge, but becoming much larger towards the angle; the lower edge is also crenulated" (Castelnau), "preoperculum finely serrated behind and below, without antrorse spines" (Handbook). In the present specimens the upper four-fifths of the hind border is beset with between two and three score very small almost contiguous tolerably acute spines; in the lower fifth progressively increasing in size to angle and round it on to hind one-third or somewhat more of inferior border, the rest of this wholly lacking spines, either bluntly wavy throughout or including in its hinder part several broad subtriangular subspinous crenulations. "Praeorbital strongly ciliated" (Castelnau): conventionally this is to be interpreted as referring to the free inferior border. This border is not ciliated; it exhibits in its posterior half some 6-10 strong flutings that continue down to the margin to end in a scalloped curve. However, the upper border and indeed the whole arc of the lower half of the orbital margin is minutely denticulated with fleshy pointed processes. Scott *et al.* report "a single weak opercular spine", the Handbook "2 strong spines". Normally two fairly strong spines are present, upper larger at base of soft dorsal lobe, lower below it by about a pupil diameter; one or both sometimes ending bluntly or in 2-3 small points; however, in several specimens lower spine is quite rudimentary,

detectable with some difficulty.

Lengths of primary regions

For the geometric means of the 11 individuals length of head, length to vent, length to caudal base (standard length) are significantly linear (t = 60.875*) in a loglog plot on 1,2,3.

Log L = 1.1213 log N + 1.6812; predicted lengths (measured lengths back-calculated from geometric mean) 48.0 (48.2), 104.4 (103.1), 164.5 (165.6).

Relative lengths of vertical fin bases

Striking increases in the lengths of the second dorsal base and anal base relative to length of first dorsal base are found. In the smallest two individuals the soft dorsal is 1.65, 1.36 in the spinous, in the largest two 0.96, 0.91: for the whole series r = 0.809 (z = 1.125), t = 4.135**. In the smallest two specimens anal base is 2.26, 2.21, in the largest two 1.86, 1.47 in first dorsal base; r = 0.700 (z = 0.867), t = 2.941*.

Caesioperca lepidoptera (Bloch & Schneider, 1801)

Epinephalus lepidopterus Bloch & Schneider, 1801, SYST. ICHTH, p.302. *Perca lepidoptera* Forster, Ms. Type locality: New Zealand - South Island, *fide* Whitley 1968, p.53.

Anthias richardsonii Günther, 1869, *Proc. zool. Soc. Lond.*, p.429. Type locality: Tasmania.

Scorpis hectori Hutton, 1872, CAT. FISH. N.Z., pp. 4, 106, pl.1, fig.4. Type locality: Milford Sound.

Material

Two examples: (a) *Ls* 183, Swan Island, Bass Strait, August 1975, C. Dallas, Q.V.M. Reg. No. 1975/5/204, (b) *Ls* 208, Eaglehawk Neck, south-east coast, 1 March 1975, P. Last, Reg. No. 1975/5/46.

Remarks

This species is not to be found in either of the first two published Tasmanian lists (Johnston 1883, 1891). Lord & Scott (1924, p.53) comment, "Johnston (P. & P. Roy. Soc. Tas., 1882 [= 1883], p.109) drew attention to the similarity between *C. rasor* and *S. hectori* of Hutton. Hutton's species has since been shown to be identical with *C. lepidoptera*, which Johnston apparently confused with the following species, as he omitted *C. lepidoptera* from his list." It seems probable Johnston was following the lead of Macleay, who in his Australian catalogue (1881a, p.312) more than hinted at the identity of Günther's species, which has Tasmania as type locality, with *C. rasor* (not with *C. lepidoptera*, which he fails to mention); in his first list Johnston consistently refers to Macleay's work, citing that author's species number. The present species thus first appears in a local publication in Lord's first list (1923: second binomen spelt *lepidotera* in 1927 list). The butterfly perch, recorded from all Australian States other than Queensland (and New Zealand, type locality), is usually taken by trawling. It reaches a length of about 300 mm.

Meristic characters

Here and elsewhere smaller individual cited first. D. X, 21. A. III, 9, III, 10, in both last ray divided to base. V. I, 5. P. 17/17, 16/16. C. 18. L. lat. 65, 67. Gill rakers on lower anterior arch 30, 28. The data of the Handbook (Munro 1961, p.171) are here extended by the higher number of pectoral rays in one specimen (17, *cf.* 16).

Dimensions as *TLs*

Length to tip of upper caudal lobe 1240, 1264, to tip of lower lobe 1273, 1250, to end of middle caudal rays 1148, 1159. Length to origin, termination of first dorsal 257, 257, 615, 587, of second dorsal 623, 625, 907, 889, of anal 678, 640, 852, 832. Length to vent 612, 615. Length to origin of pectoral 261, 278, of ventral 322, 313. Total length of pectoral 399, 409, of ventral 240, 243. Head 273, 289. Snout 65.6, 62.5. Eye 76.5, 67.3. Interorbital 76.5, 67.3. Depth at front of eye 150, 159, back of eye 265, 260, opercular border 383, 388, vent 377, 370; maximum depth 388, 394; depth of caudal peduncle 121, 120.

Proportions

The synoptic values of the Handbook, several of which are here transgressed, are given in parentheses. Head 3.66, 3.47 (3.3-3.6), maximum depth 2.58, 2.54 (2.25-2.5), depth at vent 26.5, 27.0 in standard length. Depth of caudal peduncle 8.24, 8.32 in standard length, 2.44, 2.40 in head. Snout 4.17, 4.62 (3-3.5) in head, 1.17, 1.08 in eye (eye slightly greater than snout). Eye in interorbital 1.00, 1.00 (equal). Pectoral 1.46, 1.42 (contrast subequal to) head. Ventral 1.14, 1.19 in head.

General observations

Dorsal contour of head much more sinuous than as depicted in either the figure in the Handbook or that in Scott *et al.* Maxilla to 0.7, 0.3 eye (Handbook hind half), its greatest width about twice its shortest distance from eye. Pectoral to first, to second anal spine; extending to, slightly beyond, front of characteristic dark spot at level of second, third dorsal ray, involving 7, 9 scales longitudinally, 3-5 vertically. Anterior nostril with a large irregular fleshy flap arising from hind half of margin; posterior larger, with low rim. A scale from midflank of same general type as one from same site of *C. rasor*, but proportionally longer and with lateral borders virtually straight, parallel instead of convex, approximating posteriorly; spines on posterior border rather smaller; outer bounding radial striae straight, instead of swinging upward or downward posteriorly. "Preoperculum finely serrated behind and below, without antrorse spines" (Handbook): spinules numerous, very small at upper end of hind border, increasing downward, rather suddenly so in lowest one-fourth, one-third and in hind half of inferior border, there directed strongly backward, rest of inferior border without spines.

As in *C. rasor* there are indications of increases in the lengths of the second dorsal and anal bases relative to the length of the first dorsal base with increase in size of fish, the first-named being (a) 1.31 (b) 1.25, the second (a) 2.05 (b) 1.71 in the third. In a loglog plot length of head, length to vent, length to caudal base (standard length) are significantly linear (t = 95.385**, 130.005**) on 1, 2, 3; slopes of graphs 1.1791, 1.1274, intercepts 1.6977, 1.7754, predicted (measured) lengths, mm, 50(50),113(112), 182(183), 69(60), 130(228), 206(208).

As noted above there was some early confusion between this species and *C. rasor*, a confusion that Scott (1962, p.229) observed still persists in South Australia in some quarters. The two forms are usually separated by (a) greater number of lateral line scales in present species (54-65, *cf.* 49-55), (b) general color pattern, (c) constant instead of facultative occurrence in *C. lepidoptera* of a dark mark on flank, and the location of this beneath the front of the second dorsal in that species instead of beneath the end of the first dorsal (the sole criterion given by Macleay (1881a, p.312) for the separation from *C. rasor* of Günther's *Anthias richardsonii*); (d) consistent presence in present species of 10 dorsal spines, some examples of *C. rasor* having 11.

Additional differences, to some of which attention does not seem to have been called previously, include the following (*C. lepidoptera* noted first): (e) more pectoral rays (16-17, 13-15), (f) eye equal to (less than) interorbital, (g) preoperculum squamous (wholly or mainly scaleless), the free border not (rather strongly)

bowed near middle, its hind half straight or slightly concave (convex), (h) lowest point of hind border of preoperculum behind (at or in advance of) level of hind border of orbit, (i) opercular and subopercular borders entire (some denticulation on opercular angle and on suboperculum), (j) horizontal section of lateral line on caudal peduncle beginning in advance of (at or behind) insertion of last dorsal ray; there are also differences, noted above, in the scales.

Coloration

As preserved (a) mainly tolerably even yellowish, some areas somewhat silvery, lateral line anteriorly purplish, traces of three orange stripes, lowest best preserved about one-third eye diameter in width, following ventral profile about a snout length above it, vertical fins beyond more or less orange basal scaly sheath whitish, pectoral briefly orange proximally, thereafter whitish, ventral very pale yellowish, caudal pale orange in proximal two-thirds, distally white; (b) darkish brown above, yellowish below with most scales with a small brown spot, vertical fins beyond yellowish basal sheath somewhat dusky, second dorsal darkest, pectoral rays greyish darkening distally, membrane yellowish, ventral very pale yellowish, darkening domewhat distally, caudal rays whitish or yellowish, membrane somewhat greenish yellow: no discrete markings on the fins in either specimen.

Abnormal structure.

The smaller individual presents on its left side a quite exceptional structure in the form of an almost straight line of some 15 smallish almost contiguous tubules (suggestive of a lateral line, though not of that of this species), extending backward and somewhat downward from the tip of the soft opercular lobe, two-thirds of an eye diameter below the origin of the lateral line proper, for a distance of a little less than length of head.

Head, length to vent, length to caudal base

In this species with the lengths of the primary regions head, head + trunk, head + trunk + tail as ordinates the loglog plot is linear (t = 95.385**, 130.005**) on the integers 1, 2, 3, the best straight lines having slopes 1.1791, 1.1208, intercepts 1.6977, 1.7754; predicted (measured) lengths, mm, 50(50), 113(112), 182(183); 60(60), 130(126), 206(208).

Family ECHENEIDAE

Genus *REMORA* (Linné, 1758)

Echeneis remora Linné, 1758, SYST. NAT., ed. 10, p.260. Type locality: In Pelago Indico.

Material

Three examples, *Ls* (a) 83 (b) 87 (c) 98 mm, collected 30 km east-south-east of Wineglass Bay (Thouin Bay), east coast, between 12 and 17 January 1978 by Mr John Head (Q.V.M. Reg. No. 1978/5/32), from about a score accompanying a shark: 'families' of juveniles or adults accompanying a single host appear to be not uncommon (Cressy and Lachner, 1970).

Remarks

Two examples, *Ls* 341, 355, taken at a depth of 460 m 40 km east of Eddystone Point, east coast, on 5 February 1976, attached to a luth, *Dermochelys coriacea* (Linné, 1776) were the subject of fairly extensive observations in Part XXIII (1977, p.164). The present specimens, only about one-fourth as long, exhibit several interesting differences in proportion and other features.

TABLE 6

DIMENSIONS OF *Remora remora* (Linné, 1758)

Dimensions of three specimens from 30 km east-south-east of Wineglass Bay (Thouin Bay), east coast, between 12 and 17 January 1978 (Mr John Head) and two specimens from 40 km east of Eddystone Point, east coast, 5 February 1976 (Mr A.W. Yeats) : first line standard length in millimetres, all other lines as millesimals of standard length.

Dimension	1978			1976	
	(a)	(b)	(c)	(a)	(b)
Standard length, mm	83	87	98	341	355
Total length	1162	1149	1164	1205	1231
Length of disc between free margins	361	366	367	321	327
Width of disc between free margins	169	174	168	138	133
Width of lamina series	133	116	133	92	94
Pectoral, length to origin at front of base	264	246	265	251	259
Pectoral, length to insertion of median ray	286	269	286	273	273
Pectoral, length of fin (1976 longest ray)	169	168	172	170	165
Length to origin of ventral	264	253	280	279	262
Length of ventral (1976 longest ray)	164	172	163	145	148
Length to origin of second dorsal	614	575	592	693	611
Length to termination of second dorsal	867	931	908	924	887
Length to origin of anal	608	598	598	592	606
Length to termination of anal	880	897	899	908	896
Length to vent	583	574	572	548	566
Head	273	264	270	252	251
Snout, from tip of lower jaw	120	115	108	112	125
Snout, from tip of upper jaw	83	93	86	99	106
Eye	48	54	51	26	27
Interorbital, across dorsal surface of head	146	151	148	166	166
Interorbital, across ventral surface of head	118	116	107	-	-
Width at front of disc	84	79	82	111	107
Width at front of eye	148	149	163	161	158
Width at opercular border	169	174	173	185	180
Width at back of disc	157	152	153	161	166
Width at vent	123	115	112	141	132
Width, maximum	171	174	174	176	179
Depth of caudal peduncle	62	57	54	72	68

Meristic characters

P. 28. C. about 20 main rays. The thickness of the membrane of the vertical fins makes an accurate ray count a matter of some difficulty even in the best circumstances (Strasburg 1964, Scott 1977): in the present instance the fish are in a rigid condition with the fins wholly collapsed (at some stage unduly dehydrated?) and a count is not feasible. All three have 18 disc laminae (earlier examples 18, species range 16-20).

Dimensions

A series of dimensions as millesimals of standard length is set out in table 6, the corresponding entries for the larger individuals being noted also for comparison. The smaller fish exhibit, in relative terms, much larger eye, narrower interorbital, marginally larger head, noticeably lesser depth at vent and at caudal peduncle, shorter caudal, wider disc, wider lamina series.

Head, length to vent, length to hypural joint

It was found for the 1977 examples that on a loglog plot these three regions are significantly collinear (t 18.57*, 14.2*) on the integral coordinates 1, 2, 3. This relation obtains here; dimensions below as millesimals of standard length (1977, in mm); measured lengths in parentheses :

(a) Log L = 1.1838 log N + 2.4252; t = 20.610*; 260(270), 605(583), 1020(1000).
(b) Log L = 1.2014 log N + 2.4159; t = 14.214*; 261(264), 599(576), 975(1000).
(c) Log L = 1.1676 log N + 2.4287; t = 14.299*; 268(273), 603(572), 968(1000).

It will be observed the plotted (measured) value for length to vent is systematically somewhat lower than the predicted value; this is so also in the earlier specimens. The mean slope here, 1.1843, is less than that, 1.2448, found before.

Relative lengths of disc and pectoral

It has been shown by Maul (1956) and Strasburg (1964) the length of the sucking disc relative to that of the pectoral is diagnostic — greatest in *Remoropsis brachypterus* (Lowe, 1839), least in *Rhombochirus osteochir* (Cuvier,); large in present species — but, as the latter author has shown its systematic significance is qualified by differential growth in the two features. The increase with age of the relative excess of pectoral over disc length in *Remora remora* is indicated by the following data (percentage of standard length) : *Ls* 83, 87, 89 (present sample) 2.4, 2.6, 2.6; *Ls* 240, 6.4 (one specimen, calculated from Strasburg's fig.1); *Ls* 341, 3.55 (1977 material) 6.7, 6.5. Further, Strasburg's scatter diagram shows that for about a score of individuals with an approximate *Ls* range of 50-150 mm the excess is about 0-2.5 mm, modally around 1.5; for the present fish it is 2.0, 2.3, 2.5.

Relative lengths of pectoral, ventral

While in specimens (b), (c) the pectoral extends slightly beyond the ventral, by 0.3, 0.8 mm — in qualitative agreement with the 1977 material, though the extension there, at half, one-third eye diameter, is greater — in (a) the ventral reaches further back by 1.5.

Head in plan

As with the earlier material, the outline of the head (total outline viewed in plan) is adequately specified by a second degree polynomial. For the largest individual the equation calculated from 10 measurements of width taken at equal intervals along the anteroposterior axis is as follows (N = decile number, proceeding caudad).

$W = 7.4900 + 2.5947\ N - 0.14470\ N^2$; calculated (measured) widths, mm, 9.9 (9.9), 12.1 (11.9), 13.9 (14.0), 15.6 (15.9), 16.8 (17.0), 17.8 (18.0), 18.6 (18.3), 19.0 (18.6), 19.1 (19.0), 19.0 (19.3). R = 0.99991. The third degree equation provides no significant increase in precision of prediction; R = 0.99996.

Outline of disc

Like that of the head the outline of the disc is well represented by a curve in N^2; the subjoined parameters are those of specimen (b), in which the symmetry of the disc is most satisfactorily preserved.

$W = 5.9133 + 3.1315\ N - 0.25758\ N^2$; 8.8 (9.0), 11.1 (11.0), 13.0 (13.1), 14.3 (14.8), 16.1 (15.0), 15.2 (15.2), 15.2 (15.5), 14.5 (15.0), 13.2 (13.2), 11.5 (11.5). R = 0.99967. As for disc outline in the 1977 material (and as for head in plan in both samples) the addition of a cubic term gives no significant gain (here altering only the second decimal places of the constant and the term in N and the third decimal place of the term in N^2, leaving R as given above unchanged).

Length-number pattern of laminae

It was found for the 1977 material that with the lengths of the disc laminae from the most anterior back to the longest (9th, 11th) denoted by L and their serial numbers by N (proceeding caudad), and with the lengths of the remaining laminae denoted by L_1 and their serial numbers (counting cephalad from the hindmost) by N_1,

the following relationships subsist, $L = bN^k$, $L_1 = bN_1^k$, the equations on rectification yielding t for (a) 49.33***, 25.88***, for (b) 143.27***, 11.90***. Comparable calculations have been made here in the case of the largest individual. The two sets intersect at the longest, 11th, lamina, while earlier they had been treated as disjunct.

Log L = 0.3625 log N + 0.7247; t = 15.336***; predicted (measured) lengths, mm, 5.3(5.0), 6.4(7.1), 7.9(8.0), 8.8(9.0), 9.5(9.7), 10.2(10.0), 10.7(10.5), 11.3(11.0), 11.8(11.5), 12.2(12.0), 12.7(13.0).

Log L_1 = 0.3635 log N_1 + 0.7868; t = 10.368***; 6.1(5.9), 7.9(8.1), 9.1(9.4), 10.1(10.4), 11.0(11.0), 11.7(11.7), 12.4(12.0), 12.9(13.0).

For the larger fish of 1977 the gradients are much greater: (a) 20.5223, 12.6108, (b) 24.0869, 12.7766.

It is to be observed that while the dimensions recorded represent lengths direct between right and left ends of the lamina and thus serve to define the overall form of the lamina set, they do not necessarily measure the transverse extent of the comblike teeth, the anterior and the posterior laminae comprising right and left moities set at a wide obtuse angle, whereas towards the middle of the series the two segments approximate to a single straight line, the terminal laminae thus having a somewhat greater dentate extension relative to end-to-end length of the medial laminae.

The denticles are modally set in two well formed continuous lines, one along the anterior one along the posterior border of the lamina; however, some laminae near the middle of the series may include an additional brief or almost complete intercalated line. The fact that in the considerably larger fish examined previously there are modally four linear series of denticles suggests their number may well be a function of age. Denticles along the anterior border here, numbering up to about three dozen, are small, closely set, mamilliform, those along the posterior border longer, distinctly spinose, acute, less numerous.

Coloration

Trunk, tail virtually uniform gunmetal grey; head mostly similar, somewhat lighter more or less brownish on operculum (particularly posteriorly), lighter also on mandible, preorbital. Disc dark greyish briefly margined behind with lighter. Dorsal and anal apparently concolorous with body, Pectoral: (a) blackish in basal one-third, merging into yellowish lightest at tip, (b) mostly very dark grey, lowermost ray somewhat brownish, the extreme tips of some rays touched with yellowish, (c) intermediate between (a) and (b). Ventral blackish, a little lighter distally and along outer margin. No specimen shows any indication of the white lines and spots found in the larger of the 1977 specimens.

REFERENCES

Anon., 1975: In *Aust. Fisher.*, 34(5): 18; article, Hake now Gemfish.

Allen, G.R., Hoese, D.F., Paxton, J., Randall, J.E., Russell, B.C., Stark, W.A. II, Talbot, F.H. and Whitley, G.P., 1976: Annotated checklist of the fishes of Lord Howe Island. *Rec. Aust. Mus.*, 30(15): 365-454, figs 1,2.

Baird, R.C., 1973: Chauliodidae. In FISHES OF THE WESTERN NORTH ATLANTIC. *Mem. Sears Found. Mar. Res.*, 1(6).

Castelnau, F.N., 1872: Contribution to the ichthyology of Australia. No. 1. The Melbourne fish market. *Proc. zool. acclim. Soc. Vict.*, 1: 29-242.

Cressey, R.F. and Lachner, E.A., 1970: The parasitic copepod diet and life history of Diskfishes (Echeneidae). *Copeia*, 1970, 2: 310-318.

Greenwood, P.H., Rosen, D.E., Weitzmann, S.H. and Myers, G.S., 1966: Phyletic studies of teleostean fishes, with a provisional classification of living forms. *Bull. U.S. Nat. Mus. Nat. Hist.*, 131(4): 330-456, pls 21, text figs 1-9, charts 1-32.

Günther, A., 1876: Remarks on fishes, with descriptions of new species in the British Museum, chiefly from Southern Seas. *Ann. Mag. Nat. Hist.*, 17: 389-402.

_____, 1880: Report on the shore fishes ... *Rept Zool. Challenger*, 1(6): 1-74, pls.

_____, 1887: Report on the deep-sea fishes ... *Rept Zool. Challenger*, 22(57): 1-268, pls.

_____, 1889: Report on the pelagic fishes ... *Rept Zool. Challenger*, 31(78): 1-47, pls.

Haedrich, R.L., 1967: The stromateoid fishes: systematics and classification. *Bull. Mus. Comp. Zool.*, 135(2): 31-139, 56 figs.

Herald, E.S., 1953: Family Syngnathidae: pipefishes, 231-278, figs 36-44. In FISHES OF THE MARSHALL AND MARIANAS ISLANDS, L.P. Schultz & Collaborators, *U.S. Nat. Mus. Bull.* 202(1): I-XXXII + 1-685, pls 1-74, figs 1-90.

Johnston, R.M., 1883: General and critical observations on the fishes of Tasmania; with a classified catalogue of all known species. *Pap. Proc. R. Soc. Tasm.* (1882): 54-144.

_____, 1891: Further observations on the fishes and fishing industries of Tasmania; together with a revised list of indigenous species. *Pap. Proc. R. Soc. Tasm.* (1890): 22-46.

Lord, C.E., 1923: A list of the fishes of Tasmania. *Pap. Proc. R. Soc. Tasm.* (1922): 60-73.

_____, 1927: A list of the fishes of Tasmania. *J. pan-Pac. res. Inst.*, 2(4): 11-16.

_____ and Scott, H.H., 1924: A SYNOPSIS OF THE VERTEBRATE ANIMALS OF TASMANIA. Oldham, Beddome & Meredith, Hobart.

McCulloch, A.R., 1909: Studies in Australian fishes. No. 2. *Rec. Aust. Mus.*, 4(4): 315-321, pls 90, 91, text fig. 18.

_____, 1911: Report on the fishes obtained by the F.I.S. 'Endeavour' on the coasts of New South Wales, Victoria, South Australia and Tasmania. Part 1. *Zool. res. Endeavour*, 1(1): 1-87, pls 1-16, text figs 1-20.

_____, 1916: Report on some fishes obtained by the F.I.S. 'Endeavour' on the coasts of Queensland, New South Wales, Victoria, South and Southern Australia. Part 1. *Biol. res. Endeavour*, 4(4): 169-199, pls 44-48, text figs 1,2.

_____, 1922: Check-list of the fish and fish-like animals of New South Wales. Part 3. *Aust. Zool.*, 2(3): 86-130, pls 25-43.

_____, 1929: A check-list of the fishes recorded from Australia. *Aust. Mus. Mem.*, 5(1-4): (part 4, Index, 1930), I-X + 1-534.

Macleay, W., 1881a: Descriptive catalogue of the fishes of Australia. Part 1. *Proc. Linn. Soc. N.S.W.*, 5(3): 302-444.

_____, 1881b: Descriptive catalogue of the fishes of Australia. Part 2. *Proc. Linn. Soc. N.S.W.*, 5(4): 510-629.

Marshall, T.C., 1964: FISHES OF THE GREAT BARRIER REEF AND THE COASTAL WATERS OF QUEENSLAND. Angus & Robertson, Sydney.

Maul, G.E., 1956: Monografia dos peixes do Museu Municipal do Funchal. Ordem Discocephali. *Bol. Mus. Mun. Funchal*, 9(23): 5-75. (n.s.)

Munro, I.S.R., 1957, 1958, 1960, 1961: Handbook of Australian Fishes; issued serially in *Fisheries Newsletter* (now *Australian Fisheries*), published monthly, 1956-1961. Parts here cited. 1957a: part 7, pp. 29-32; vol. 16, part 1. 1957b: 14, 57-60, 16(8). 1957c: 15, 61-64; 16(9). 1958a: 19, 77-80; 17(1). 1958b: 20, 81-84; 17(2). 1958c: 22, 89-92; 17(4). 1958d: 26, 105-108; 17(8). 1958e: 27, 109-112; 17(9). 1958f: 30, 121-124; 17(12). 1960: 31, 125-128; 19(4). 1961: 42, 169-172; 20(12).

_____,1967: THE FISHES OF NEW GUINEA. Department of Agriculture, Stock and Fisheries, Port Moresby.

Nichols, J.T., 1920: A key to the species of *Trachurus*. *Bull. Amer. Mus. Nat. Hist.*, 42.

Norman, J.R., 1937: British, Australian and New Zealand Antarctic Research Expedition: Fishes. *B.A.N.Z.A.R.E.* Rept B, 1(2): 49-88, text figs 1-11.

Ogilby, J.D., 1888: Exhibition of a second specimen of a rare percoid fish, *Anthias (Pseudanthias) cichlops* Bleeker, from Lord Howe Island. *Proc. Linn. Soc. N.S.W.*, 3(2): 741.

_____, 1897: Some Tasmanian fishes. *Pap. Proc. R. Soc. Tasm.* (1896): 69-85.

_____, 1899: Contribution to Australian ichthyology. *Proc. Linn. Soc. N.S.W.*, 24(1): 154-186.

Olsen, A.M., 1958: New fish records and notes on some uncommon Tasmanian species. *Pap. Proc. R. Soc. Tasm.*, 92: 155-159.

Post, A., 1976: Ergebnisse der forschung des F.F.S. 'Walther Herwig' nach Südamerika, 42. *Diretmus* Johnson, 1863 (Beryciformes, Berycoidei, Diretmidae), 2. Morphologie, entwicklung, verbreitung. *Arch. Fisch Wiss.*, 26(2/3): 87-114.

_____ and Hecht, J., 1977: Results of the research cruises of the F.R.V. 'Walther Herwig' to South America, 49. The otoliths of *Diretmus* Johnson (Osteichthyes, Beryciformes, Diretmidae). *Mitt. Hamburg. Zool. Mus. Inst.*, 74: 165-170, figs 1-3.

Quoy, J.R.C. and Gaimard, P., 1824: Remarques sur quelques poissons de mer; descriptions des poissons. In Freycinet, L., VOYAGE AUTOUR DU MONDE DES CORVETTES 'l'URANIE' ET LE 'PHYSICIENNE' PENDANT LES ANNEES 1817-1820, zool., 2: 182-401.

Scott, E.O.G., 1934-1978: Observations on some Tasmanian fishes. Parts I-XXIV; in this journal (except Part XVI, *Aust. Zool.*, 15(2): 160-177, figs 1,2). Contributions here cited. 1953, VI, 141-165, figs 1-4. 1961, X, 49-65, figs 1-3. 1963, XI, 1-31, figs 1-8. 1970, XVII, 33-50, fig. 1. 1974, XIX, 247-292, figs 1,2. 1976, XXII, 157-217, pl. 1. 1977, XXIII, 111-180, figs 1-8, 1978, XXIV, 289-356, figs 1-3.

Scott, T.D., 1962: THE MARINE AND FRESH WATER FISHES OF SOUTH AUSTRALIA. Government Printer, Adelaide.

_____, Glover, C.J.M. and Southcott, R.V., 1974: THE MARINE AND FRESHWATER FISHES OF SOUTH AUSTRALIA. Government Printer, Adelaide.

Simpson, G.G. and Roe, A., 1939: QUANTITATIVE ZOOLOGY: NUMERICAL CONCEPTS AND METHODS IN THE STUDY OF RECENT AND FOSSIL ANIMALS. McGraw Hill, New York.

Smith, J.L.B., 1970: THE SEA FISHES OF SOUTH AFRICA. 5th ed. (1965), 2nd impression (1970). Central News Agency, Cape Town.

Strasburg, D.W., 1964: Further notes on the identification and biology of echeneid fishes. *Pac. Sci.*, 18(1): 54-57.

Waite, E.R., 1894: New or rare fishes from Maroubra, New South Wales. *Proc. Linn. Soc. N.S.W.*, second series, 9(2): 215-227, pl. 17.

_____, 1899: Scientific results of the trawling expedition of H.M.C.S. 'Thetis', introduction and fishes. *Aust. Mus. Mem.*, 4: 1-132, pls 1-30, text figs 1-10.

_____, 1904a: Additions to the fish fauna of Lord Howe Island, No. 4. *Rec. Aust. Mus.*, 5(3): 135-186.

_____, 1904b: Catalogue of the fishes of Lord Howe Island. *Rec. Aust. Mus.*, 5(3): 187-230.

_____, 1916: Fishes of the Australasian Antarctic Expedition, science reports, series C, 3(1). *Aust. Antarctic Exped.*, (c), 3(1): 5-82, pls 1-5, text figs 1-16, 2 maps.

_____, 1921: Illustrated catalogue of the fishes of South Australia. *Rec. S. Aust. Mus.*, 2(1): 1-208, pl. 1, 293 text figs.

_____ and Hale, H.M., 1921: Review of the lophobranchiate fishes of South Australia. *Rec. S. Aust. Mus.*, 1(4): 293-324, figs 39-56.

Whitley, G.P., 1927: Studies in ichthyology. No.1. *Rec. Aust. Mus.*, 15(8): 289-304, pls 24, 25, text fig. 1.

_____, 1945: New sharks and fishes from Western Australia. Part 2. *Aust. Zool.*, 11(1): 1-42, pl. 1, text figs 1-15.

_____, 1962: MARINE FISHES OF AUSTRALIA. 2 vols. Jacaranda Press, Brisbane.

_____, 1964: Name-list of the fishes recorded from Australia. Presidential address, appendix B. *Proc. Linn. Soc. N.S.W.*, 89(1): 31-60 (list), 11-127 (address).

Whitley, G.P., 1968: A check-list of the fishes recorded from the New Zealand region. *Aust. Zool.*, 15(1): 1-102, figs 1,2.

Woods, P. and Sonoda, P.M., 1973: Diretmidae. In FISHES OF THE WESTERN NORTH ATLANTIC. *Mem. Sears Found. Mar. Res.*, 1(6): 290-296, figs 12, 13.