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Eels and Eel-larvae of the *Tui* Oceanographic Cruise 1962, to  
the South Fiji Basin

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*Abstract*

THE collection includes 29 adult eels, referable to *Nemichthys scolopaceus*, *Borodina infans*, *B. gilli*, *Serrivomer bertini*, *Anarchias vermiformis*, *Gymnothorax griffini* and *Muraenichthys australis*. It also includes 12 leptocephali, referable to *Cyema atrum*, *Nemichthys scolopaceus*, *Nettastoma melanurum*, ?*Muraenichthys australis*, *Gnathophis incognitus*, *Ariosoma anago*, *Conger cinereus cinereus* and one other congrid larva, *Leptocephalus stenorhynchus*, the adult of which has not yet been determined. A new species of *Leptocephalus*, unique amongst known eel-larvae in having a conspicuously short eye and probably belonging to the Nemichthyidae, is described.

DURING July and early August, 1962, the H.M.N.Z.F.A. *Tui* undertook a deep-water research cruise in a broadly triangular area bounded by Auckland, Norfolk Island and the Kermadec Islands, an area which includes the southern half of the South Fiji Basin. As part of the biological programme of this cruise trawls were made in midwater depths of up to about 1,100m with a 10ft Isaacs-Kidd trawl as well as on the surface and on the bottom with other gear. Collections were also made with dipnets and handlines. In the large and diverse collection of fishes which resulted were some 43 eels and eel-larvae, the largest collection of the latter yet to be made in New Zealand waters. Of these 43 specimens, 29 are adult or young eels referable to six genera and seven species (only one of these species is a new record for the area) and the remainder are leptocephali referable to nine genera and nine species. Reference may be made to earlier accounts (Castle, 1963, 1964) for detailed treatment of four of these latter species. The present paper reports on the eels and eel-larvae of the *Tui* cruise and describes in detail those species which have not before been recorded from the area.

I am deeply grateful to the Department of Zoology, University of Auckland, and especially to Dr J. B. Gilpin-Brown of that Department, for the invaluable opportunity to participate in the *Tui* cruise (during which I was able to observe leptocephali in the field for the first time) and to later study the above material.

Note.—Station data given below have been taken from the working station list, and will be subject to slight correction with the issue later of the official station list of the *Tui* Oceanographic Cruise 1962.

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## SYSTEMATIC ACCOUNT: ADULTS

## Family NEMICHTHYIDAE

*Nemichthys scolopaceus* Richardson, 1848

1848. *Nemichthys scolopaceus* Richardson, *Voy. "Samarang" 1843-1846*, p. 25.  
 1929. *Nemichthys scolopaceus* Richardson. Roule & Bertin, *Dana Rep.*, 1(4): 4-21 (detailed account and synonymy).  
 1937. *Nemichthys scolopaceus* Richardson, Beebe & Crane, *Zoologica, N.Y.*, 22: 353-366 (description).

**MATERIAL EXAMINED.** Six specimens: 814.0mm total length, *Tui* Station AUZ 050, 34° 00' S, 171° 56' E, 15/7/62, IKMT (10ft), 910m wire out; 624.9mm total length, *Tui* Station AUZ 097, 31° 02' S, 179° 18' E, 25/7/62, IKMT (10ft), 430m-292m wire out; 536.8mm total length (damaged), *Tui* Station AUZ 098, 30° 18' S, 180° 00' E, 26/7/62, IKMT (10ft), 2,000m wire out; 462.5mm total length, *Tui* Station AUZ 115, 30° 40' S, 178° 20' W, 30/7/62, IKMT (10ft), 1,460m wire out; 879.6mm and 931.8mm total lengths, *Tui* Station AUZ 119, 32° 30' S, 178° 56' W, 31/7/62, IKMT (10ft), 1,460m wire out.

**REMARKS.** Amongst the group of deep-sea eels which are sometimes caught abundantly in midwater trawls and which have been referred to collectively as the Nemichthyiformes, a single genus, *Nemichthys* Richardson, 1848, is well characterised in having a filamentous caudal region and very numerous vertebrae (reaching 500 or more). Six of the snipe eels collected on the *Tui* Oceanographic Cruise are immediately referable to this genus; they all have the caudal region drawn out into a remarkable, delicate filament and a vertebral count of between 450 and 500 as well as a lateral line consisting of three rows of minute pores, ethmovomerine teeth in about eight longitudinal rows set in curving transverse rows across the ethmovomer, vent placed close behind level of pectoral and the dorsal origin on the occiput, in advance of pectoral base (see Beebe & Crane, 1937, p. 35). Furthermore, the above specimens have a relatively large eye, contained 2.4-3.7 times in the postorbital length and by this character are identified with *N. scolopaceus* Richardson, 1848, a worldwide species. The other species in the genus, *N. fronto* Garman, 1899, which has been considered valid by Beebe & Crane and which is known from the western coast of North and Central America, has a smaller eye (or larger postorbital length), equal to 3.6-5.3 times in postorbital length.

The present specimens make a notable addition to the known distribution of *N. scolopaceus*. Although the species is relatively abundant in the Central Atlantic, records from the Indo-Pacific are few, but it has been taken from the North Indian Ocean, off South Africa, Japan and New Guinea. In the south-west Pacific the species is known only from two specimens recorded by Munro (1957, p. 18) from off New South Wales, Australia, and by Richardson & Garrick (1953, p. 467) from Cook Strait, New Zealand.

*Borodinula gilli* (Bean, 1890)

1890. *Labichthys gilli* Bean, 1890, *Proc. U.S. nat. Mus.*, 13: 455.  
 1961. *Borodinula gilli* (Bean). Castle, *Zool. Publ. Vict. Univ. N.Z.*, 27: 5-11, figs. 1 and 2 (synonymy and description).

**MATERIAL EXAMINED.** Three specimens: 405.1mm total length, *Tui* Station AUZ 014, 30° 45' S, 173° 51' E, 7/7/62, IKMT (10ft), 1,460m wire out; 257.6mm total length, *Tui* Station AUZ 047, 32° 42' S, 171° 03' E, 14/7/62, IKMT (10ft), 2,200m wire out; 257.6mm total length, *Tui* Station AUZ 078, 33° 17' S, 176° 07' E, 23/7/62, IKMT (10ft), 1,830m wire out.

REMARKS. The three snipe eels included here are distinguished from *Nemichthys* in having an attenuated but non-filamentous caudal, vertebrae numerous but seldom exceeding 230, a single row of lateral line pores and ethmovomerine teeth set in V-shaped transverse rows. They also have the ano-pectoral length long, equal to about seven times the postorbital and thus belong to *Borodinula* Whitley, 1931 (= *Avocettina* Jordan & Davis, 1891) rather than to *Labichthys* Gill & Ryder, 1883, which has a short ano-pectoral length. The specimens are further referred to *B. gilli* (Bean, 1890) in having a relatively low number of dorsal rays (260–289) and anal rays (214–218). The other species known to be present in the area is *B. infans* (Günther, 1878) but this has more numerous dorsal rays (300–350) and anal rays (270–320). Other differences between these two species are discussed elsewhere (Castle, 1961, pp. 4–5). Vertebral counts in the present specimens of *B. gilli* are 188, 182 and 189 respectively. Only three other specimens of *B. gilli* are known from the south-west Pacific (Castle, 1961, p. 5); outside this area the species is known from two specimens taken from off Alaska.

#### *Borodinula infans* (Günther, 1878)

1878. *Nemichthys infans* Günther, *Ann. Mag. nat. Hist.*, 5 (2): 251.

1961. *Borodinula infans* (Günther). Castle, *Zool. Publ. Vict. Univ. N.Z.*, 27: 11 (description and synonymy).

MATERIAL EXAMINED. One specimen: 559.0mm total length, *Tui* Station AUZ 014, 30° 45' S, 173° 51' E, 7/7/62, IKMT (10ft), 1,460m wire out. Part of one other specimen, badly damaged, probably belonging to this species: *Tui* Station AUZ 119, ca. 32° 48' S, 179° 10' E, 1/8/62, IKMT (10ft), 1,460m wire out.

REMARKS. The undamaged specimen listed above has 390 dorsal and 342 anal fin-rays and 212 vertebrae, characters consistent with *B. infans* (Günther, 1878), a cosmopolitan snipe eel which has been recorded from many parts of the world although only once before in the south-west Pacific (Castle, 1961, p. 11).

### Family SERRIVOMERIDAE

#### *Serrivomer bertini* Bauchot, 1959

1959. *Serrivomer bertini* Bauchot, *Dana Rep.*, 48: 132.

MATERIAL EXAMINED. Fifteen specimens: 216mm, 243mm and 312mm total lengths, *Tui* Station AUZ 006, ca. 32° 27' S, 174° 11.5' E 5/75/62, IKMT (10ft), 1,320m wire out; 173.8mm total length, *Tui* Station AUZ 018, 29° 17' S, 169° 05' E, 8/7/62, IKMT (10ft), 730m wire out; 449.0mm total length, and one damaged specimen, *Tui* Station AUZ 048, ca. 32° 10' S, 171° 20' E, 14/7/62, IKMT (10ft), 1,830m wire out; 213.7mm and 221.3mm total lengths, *Tui* Station AUZ 057, 35° 36' S, 176° 20' E, 21/7/62, IKMT (10ft), 1,100m wire out; 280.3mm, 416.2mm, and 493.5mm total lengths, *Tui* Station AUZ 108, 29° 40' S, 177° 27' W, 29/7/62, IKMT (10ft), 1,830m wire out; 522.2mm total length, *Tui* Station AUZ 115, 30° 40' S, 178° 20' W, 30/7/62, IKMT (10ft), 1,460m wire out; 485.0mm and 498.1mm total lengths, *Tui* Station AUZ 118, ca. 32° 30' S, 178° 56' W, 31/7/62, IKMT (10ft), 1,460m wire out; 247.2mm total length, *Tui* Station AUZ 125, ca. 34° 45' S, 176° 20' E, 3/8/62, IKMT (10ft), 1,100m wire out.

REMARKS. Total lengths 173.8mm–522.2mm, vertebrae 165–170. The 15 specimens listed above are immediately referable to *Serrivomer* in having an elongated snout (which, however, is much less elongated than in *Nemichthys* or *Borodinula*), the vomerine teeth pointed and plate-like, disposed in two alternating rows on the roof of the mouth, and a rudimentary caudal fin. The present specimens all have a relatively high number of vertebrae for the genus—of the ten species at present recognised (Bauchot, 1959, pp. 134–135) only *S. bertini* Bauchot, 1959, *S. neocaledoniensis* Bauchot, 1959, and *S. schmidtii* Bauchot-Boutin, 1954, have more than 165 vertebrae. Furthermore, in all of the present

specimens the first branchiostegal ray does not extend in front of the hyoid arch and the dorsal and anal fin-rays are moderate in number, not exceeding 180 and 160 respectively. Following Bauchot's key (1959, p. 135) these characters restrict the identification of the 12 *Tui* specimens to *S. bertini*. Four specimens of this species were recorded from the *Dana* collection by Bauchot (1959, p. 132); these were taken in the northeast Indian Ocean, north-east of Samoa, off eastern Australia and north of the Bay of Plenty, New Zealand.

#### Family MURAENIDAE

##### *Anarchias vermiformis* Smith, 1962

1962. *Anarchias vermiformis* Smith, *Ich. Bull. Rhodes Univ.*, 23: 428, fig. 5 (Western Indian Ocean).

**MATERIAL EXAMINED.** One specimen: total length 116.7mm, *Tui* Station AUZ 026, 12 miles off Steele's Point, Norfolk Island, 9/7/62, beam trawl, 55m.

**DESCRIPTION.** Proportional measurements (in per cent of total length): standard 99.1, head 11.0, snout 1.9, eye 0.9, interorbital 1.3, cleft of mouth 4.5, postorbital 7.7, branchial aperture 0.7, snout-vent 43.9, preanal ca. 96.0, predorsal ca. 90.0, depth just before eye 2.4, at pectoral origin 4.4, at vent 3.9, at midpoint of caudal region 3.8. Lateral line pores before level of branchial aperture 4, before level of vent 42, total ca. 113. Teeth: maxilla, 39 (lateral), 7 (medial); dentary, 37 (lateral), 6 (medial); premaxillary-ethmoid, 4; vomer, 7. Colour in life dull tan over most of body speckled profusely and irregularly with microscopic light spots; light coloured on ventral surface of lower jaw through to vent; 6-8 faint light coloured longitudinal lines on dorsolateral surface of head from occiput to well past branchial aperture; margins of sensory pores light brown; tip of dorsal and anal white; iris brown.

**REMARKS.** This small muraenid eel was taken from the mixed weed and dead coral fragments of a beam trawl made in shallow water off Norfolk Island. It is a delicate specimen immediately referable to the *Anarchias* Jordan & Starks, 1906—*Uropterygius* Rüppell, 1835, group of muraenid eels in having the dorsal and anal fins reduced to short vestiges at the tip of the caudal region. The specimen also has two posterior nostrils set closely together above the eye, the posterior of these two smaller, sunken and separated from the anterior of the two by a very thin septum. The specimen therefore belongs in *Anarchias* since members of the genus *Uropterygius* have only a single posterior nostril. Furthermore, the body colouration is uniform dull tan, a character of the three species, *A. allardicei* Jordan & Starks, 1906, from Samoa and the Marshall Islands, *A. fuscus* Smith, 1962, from the Western Indian Ocean and *A. vermiformis* Smith, 1962, also from the Western Indian Ocean. The four other known Indo-Pacific species, *A. cantonensis* Schultz, 1943, from the Phoenix and Marshall Islands, *A. leucurus* Snyder, 1904, from Hawaii and the Marshalls, *A. knighti* Jordan & Starks, 1906, from Samoa and *A. seychellensis* Smith, 1962, from the Western Indian Ocean are all barred, mottled or reticulated with darker brown markings. In having the vent placed appreciably in front of the midpoint of the body (so that the snout-vent distance is contained 2.3 times in the total length) and in being rather slender (depth 23 times in total) the *Tui* specimen from Norfolk Island is closest to *A. vermiformis* which has similar proportions. *A. allardicei* and *A. fuscus* both have the vent placed in the middle of the body length and the depth contained about 18 times in the total. Table I shows in detail the various proportions and numbers of teeth in the three plain brown species of *Anarchias* and the *Tui* specimen. It is immediately obvious that the separation of specimens of *A. fuscus*

TABLE I  
COMPARATIVE PROPORTIONS AND COUNTS FROM THREE SPECIES  
OF *ANARCHIAS*

	<i>A. allardicei</i>	<i>A. fuscus</i>	<i>A. vermiformis</i>	<i>Tui</i> specimen
Total length:	50mm–113mm	70mm–128mm	125mm	116.7mm
Head in total:	7.5–7.8	6.8–7.5	9.0	9.1
Snout in head:	5.8–6.4	6.7	6.0	5.8
Eye in head:	10–13	12.7	10.0	12
Cleft of mouth in head:	2.9–3.5	3.1–3.6	3.0–3.5	2.4
Snout-vent in total:	2.0–2.1	2.1	2.3	2.3
Depth in total:	16.6–22	15–19	30	23
Inner teeth on maxilla:	6	4–5	3	7
Premax.-ethmoid teeth:	1	2	7–8	3–4
Vomerine teeth:	4	?	?	7

from those of *A. allardicei* would be a difficult task, at least on present known characters. It also shows that although the *Tui* specimen is similar to *A. vermiformis* in proportions it is dissimilar from this species in the number of teeth on the maxilla and premaxillary ethmoid, but in tooth number approaches *A. allardicei*. I am satisfied that, in view of the possibility of a certain degree of variation in the number of enlarged teeth on these bones (a not uncommon variation in moray eels), Smith's *A. fuscus* is very doubtfully distinct from *A. allardicei*. Furthermore, it would be of value if the long tail of *A. vermiformis* (to which the *Tui* specimen is here referred) be confirmed as a reliable character for the separation of this species from *A. allardicei*–*A. fuscus* (and this would be the more convincing if it were supported by a marked difference in vertebral counts).

The distribution of both *A. allardicei* and *A. vermiformis* may be not unlike that of many other species of Indo-Pacific eels, that is, a trans-Indo-Pacific distribution. Further collections among coral rubble and weedy areas throughout the Indo-Pacific for eels of the genus *Anarchias* would undoubtedly add much-needed information on these problems.

#### *Gymnothorax griffini* Whitley & Phillipps, 1939

1927. (non) *Gymnothorax meleagris* (Shaw). Griffin, *Trans. roy. Soc. N.Z.*, 58: 138, Pl. 10.  
 1936. (non) *Gymnothorax meleagris* (Shaw). Griffin, *Trans. roy. Soc. N.Z.*, 66: 19–20.  
 1939. *Gymnothorax griffini* Whitley & Phillipps, *Trans. roy. Soc. N.Z.*, 69: 229.  
 1956. *Lycodontis griffini* (Whitley & Phillipps). Whitley in Graham, *Treas. N.Z. Fish.*, p. 402.

MATERIAL EXAMINED. One specimen: total length ca. 605mm, *Tui* Station AUZ 107, west side of Meyer Island (off Raoul Island), Kermadec Is., 28/7/62, handline.

DESCRIPTION. *Proportional measurements* (in per cent of total length): standard 99.1, head 11.0, snout 2.1, eye 1.0, interorbital 1.8, cleft of mouth 5.3, postorbital 8.3, branchial aperture (length) 1.2, snout-vent 45.3, predorsal ca. 11.0, depth just before eye 3.5, at branchial aperture 6.8, at vent 6.2, at midpoint of caudal region 5.3. Teeth: maxilla, 28 (lateral), 9 (medial); dentary, 25 (lateral), 3 (medial); premaxillary-ethmoid, 3 (uniserial); vomer, 8 (uniserial). Colour in formalin deep brown tinged with purple over most of body, much lighter brown on ventral surface of lower jaw and throat, the whole body except dorsal surface of snout thickly and regularly covered with minute, irregularly-shaped, light brown to cream spots.

REMARKS. The deep brown body colouration speckled with minute, irregular spots makes the moray described above a very distinctive eel. It clearly belongs in *Gymnothorax* in having the dorsal fin originating a little in advance of the level of the branchial aperture and the teeth sharp with some even canine-like. As far as I can determine from the literature there is only one species of *Gymnothorax* with such a colour pattern as shown by the above specimen; this is *G. griffini* Whitley & Phillipps, 1939, from off White Island, Bay of Plenty, New Zealand. Griffin (1927, p. 138) originally described this species from a single specimen under the name *G. meleagris* (Shaw, 1795), but as Whitley & Phillipps (1939, p. 229) point out, the pattern of teeth in Griffin's specimen shows that it cannot be referred to this widespread Indo-Pacific species. I fully support Whitley & Phillipps in their separation of *G. griffini* from *G. meleagris* although I consider the difference in colour pattern between the two to be a much stronger distinction than the tooth pattern. I have examined Griffin's type (Auckland Institute and Museum Acc. No. Ps 29.1) as well as two other specimens from the Kermadec Islands and find that they all have a similar colouration to that described above for the *Tui* specimen.

One other species of *Gymnothorax* is known from the Kermadecs; this is *G. euptera* (Günther, 1870), but this species has a plain brown colouration, and in view of the stability of the colour pattern in *G. griffini*, even after long preservation, I am satisfied that there can be no confusion between these two species.

#### Family OPHICHTHIDAE

##### *Muraenichthys australis* Macleay, 1882

1882. *Muraenichthys australis* Macleay, *Proc. Linn. Soc. N.S.W.* (1881), 6: 272.

MATERIAL EXAMINED. One specimen: total length 188.1mm, *Tui* Station AUZ 029, off Norfolk Island, 9/7/62, cone dredge.

DESCRIPTION. Proportional measurements (in per cent of total length): head 9.5, snout 1.8, eye 0.6, interorbital 0.9, cleft of mouth 3.1, postorbital 6.9, branchial aperture 0.6, branchial interspace 0.6, snout-vent 46.5, predorsal 49.9, depth just before eye 1.1, at branchial aperture 1.7, at vent 1.3, at midpoint of caudal region 1.2. Lateral line pores before level of branchial aperture 9, before level of vent 64, total 152. Teeth uniserial on all bones; on maxilla 10, on dentary 12, on premaxillary-ethmoid 4, on vomer 5. Colour in life generally creamy-white, speckled with brown chromatophores above lateral line, the tail tip tinged with yellow.

REMARKS. Following Gosline (1950, p. 313) with regard to the relationship of *Muraenichthys* to the ophichthid eels I have placed this species in the family Ophichthidae. In having a caudal fin present but nevertheless rudimentary the species is further referable to the subfamily Echelinae (in contrast to the Ophichthinae which have a hard, pointed caudal region with the caudal fin absent). A pectoral fin is absent from the present specimen and this distinguishes it as belonging to *Muraenichthys* Bleeker, 1853, rather than to *Myrophis* Lütken, 1851, which possesses pectorals. There are teeth on the premaxillary-ethmoid and vomer, a distinguishing feature of the subgenus *Muraenichthys*; eels of the subgenus *Schultzidia* Gosline, 1951, lack teeth on this bone. Furthermore, the present specimen conforms well with descriptions of *Muraenichthys* (*M.*) *australis* Macleay, 1882, by Griffin (1936, p. 24) and other authors. The dorsal fin originates clearly behind the level of the vent but the anal-dorsal distance is not outside the range shown for specimens of *M. australis* occurring in the New Zealand region.

## SYSTEMATIC ACCOUNT: LARVAE

## Family CYEMIDAE

*L. Cyema atrum* Günther, 1878 (Text-fig. 1, A-E)

1878. *Cyema atrum* Günther, *Ann. Mag. nat. Hist.*, 5 (2): 251.

1929. *L. Cyema atrum* Günther. Roule & Bertin, *Dana Rep.*, 1 (4): 101–111 (description).

**MATERIAL EXAMINED.** One specimen: 52.2mm total length, Tui Station AUZ 067, 35° 36' S, 176° 20' E, 22/7/62, IKMT (10ft), 1,280m wire out.

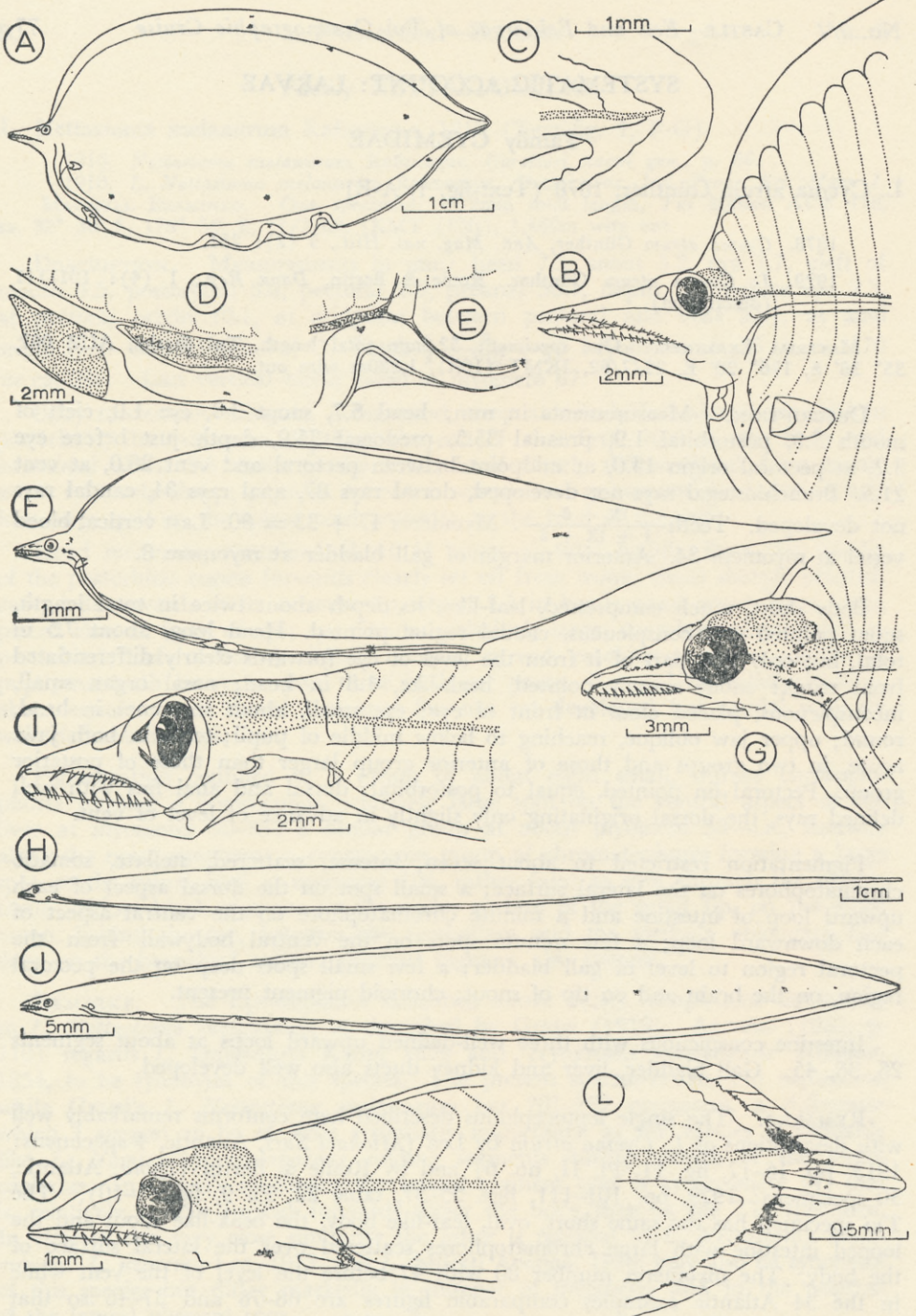
**DESCRIPTION.** Measurements in mm: head 6.7, snout 3.8, eye 1.0, cleft of mouth 3.9, postorbital 1.9, preanal 35.5, predorsal 35.9, depth just before eye 3.2, at pectoral origin 13.0, at midpoint between pectoral and vent 26.0, at vent 21.5. Branchiostegal rays not developed, dorsal rays 87, anal rays 84, caudal rays not developed. Teeth  $\frac{IX + 6}{1 + IX + 5}$ . Myomeres 47 + 33 = 80. Last vertical blood vessel at myomere 34. Anterior margin of gall bladder at myomere 8.

Body short, much compressed, leaf-like, its depth about twice in total length, snout pointed and conspicuous, caudal region pointed. Head long, about 7.5 in total, but only that part of it from the level of eye forwards clearly differentiated from trunk: snout acutely pointed, beak-like, 1.8 in head; nasal organ small, inconspicuous, placed close in front of eye; eye small, about six times in head, round; upper jaw oblique, reaching to below middle of pupil; teeth in both jaws acute, in two groups and those of anterior group larger than those of posterior group. Pectoral fin pointed, equal to postorbital; dorsal and anal fins with well defined rays, the dorsal originating only slightly in advance of level of vent.

Pigmentation restricted to about seven, intense, scattered, stellate, somatic chromatophores on the lateral surface; a small spot on the dorsal aspect of each upward loop of intestine and a minute chromatophore on the ventral aspect of each downward loop; a few minute spots on the ventral bodywall from the pectoral region to level of gall bladder; a few small spots deep on the pectoral region, on the brain and on tip of snout; chorioid pigment present.

Intestine conspicuous with three well-defined upward loops at about segments 26, 36, 45. Gall bladder, liver and kidney ducts also well developed.

**REMARKS.** The single leptocephalus described here conforms remarkably well with descriptions of *L. Cyema atrum* by Lea (*Michael Sars*, Atlantic, 4 specimens: 1913, pp. 16–17, fig. 11, Pl. II, no. 6) and by Roule & Bertin (*Dana*, Atlantic, 30 specimens: 1929, pp. 101–111, figs. 55–57, table 22, Pl. 9, figs. 1–10). The *Tui* specimen has the same short, oval, leaf-like body, the beak-like snout and the looped intestine with large chromatophores scattered over the lateral surface of the body. The myomeres number 80 with 47 before the level of the vent while in the 34 Atlantic examples comparable figures are 68–78 and 37–46 so that there are insignificant differences between the *Tui* specimen and those from the Atlantic. In Lea's four specimens dorsal rays were 83–84 and anal rays 75–77 compared with 86 and 75 respectively in the present specimen. According to Munro (1957, p. 48) adult *Cyema atrum* have been collected in the south-west Pacific area south-east of Tasmania, although the present record is the first for the larvae of this species in this area.



TEXT-FIG. 1.—Figs. A-E: *L. Cyema atrum*, 52.2mm total length, Tui station AUZ 067; Fig. A—Lateral view; Fig. B—Lateral view of head region; Fig. C—Lateral view at level of gall bladder; Fig. D—Lateral view at level of posterior end of kidney; Fig. E—Caudal tip.

Figs. F-G: *L. Nettastoma melanurum*, 88.2mm total length, Tui Station AUZ 118; Fig. F—Lateral view; Fig. G—Lateral view of head region.

Figs. H-I: *Leptocephalus attenuatus* n.sp., Dom. Mus. No. 3385, 144.3mm total length, Tui Station AUZ 084; Fig. H—Lateral view; Fig. I—Lateral view of head region.

Figs. J-L: *L. ?Muraenichthys australis*, 48.1mm total length, Tui Station AUZ 087; Fig. J—Lateral view; Fig. K—Lateral view of head region; Fig. L—Caudal tip.



## Family NEMICHTHYIDAE

L. *Nemichthys scolopaceus* Richardson, 1848

1848. *Nemichthys scolopaceus* Richardson. *Voy. "Samarang", 1843-1846*, p. 25.  
 1929. *L. Nemichthys scolopaceus* Richardson. Roule & Bertin, *Dana Rep.*, 1 (4): 61-100 (description, development).  
 1937. *L. Nemichthys scolopaceus* Richardson. Beebe & Crane, *Zoologica, N.Y.*, 22: 357-366 (description, development).

**MATERIAL EXAMINED.** Five specimens: 167.0mm (damaged) and 208.3mm total lengths, *Tui* Station AUZ 008, 32° 27' S, 174° 10' E, 5/7/62, IKMT (10ft), 91m wire out; 175.9mm total length, *Tui* Station AUZ 052, 33° 59' S, 172° 03' E, 15/7/62, IKMT (10ft), 803m wire out; 165.9mm total length, *Tui* Station AUZ 057, 35° 36' S, 176° 20' E, 21/7/62, IKMT (10ft), 1,100m wire out; 190.5mm total length, *Tui* station AUZ 067, 35° 36' S, 176° 20' E, 22/7/62, IKMT (10ft), 1,280m wire out.

**REMARKS.** Larvae of *Nemichthys scolopaceus* are easily recognisable by their extremely attenuated form, the high number of myomeres, the beak-like snout, pigmentation restricted to the kidney ducts, the spinal cord and conspicuous stellate chromatophores at the level of myomeres 19, 41, 79 and 116. Myomeres in the present five specimens number about 365-470 and the specimens are in all respects similar to those described by Beebe & Crane (1937, pp. 357-366).

*Leptocephalus attenuatus* n.sp. (Text-fig. 1, H-I).

**MATERIAL EXAMINED.** Type specimen: 144.3mm total length (caudal tip broken), *Tui* Station AUZ 084, 32° 00' S, 177° 35' E, 24/7/62, IKMT (10ft), 1,830m wire out; Dominion Museum No. 3385.

**DESCRIPTION.** Measurements in mm: head 5.8, snout 2.3, eye 1.0, cleft of mouth 2.8, postorbital 2.4, depth just before eye 2.4, at pectoral 2.8, at midpoint between pectoral and caudal tip 6.0, maximum depth 7.4. Teeth  $\frac{1 + IV + 5}{1 + X + 1}$ . Myomeres ca. 229. Last vertical blood vessel at myomere 65.

Body attenuated, almost filiform, compressed, its depth about 20 in total length, tapering more gradually behind the mid-point. Head short, about 25 in total, not clearly differentiated from trunk; snout sharply pointed, its dorsal profile slightly concave and contained 2.5 times in head; nasal organ large but as yet poorly differentiated; eye oval, anteroposteriorly compressed, its horizontal diameter three times in postorbital, its vertical diameter 1.5 in postorbital; cleft of mouth slightly oblique, reaching to below anterior margin of pupil; teeth in both jaws acute. Pectoral fin a minute triangular flap; dorsal and anal fins not yet developed.

Pigmentation in the form of a regular, paired series of rounded, somatic chromatophores along the ventral midline, about two spots on each myomere. This series begins at the 11th myomere and continues to the vent, the more posterior chromatophores being more widely spaced. Pigment in the chorioid. Vertical blood vessels and gall bladder difficult to determine; liver very long, reaching as far back as myomere 104. (*L. attenuare* = to make thin.)

**REMARKS.** The compressed eye is the most unusual feature of this larva, and as far as I can determine from the literature no other leptocephalus has this character. The larva superficially resembles that of *Nemichthys scolopaceus* in its attenuated form but has fewer segments and pigment spots in the ventral series, compared with a series on the kidney ducts in the former. In having a regular ventral series of chromatophores the present larva resembles larvae of the Congridae but the minute pectoral, the shape of the snout, and the filiform nature of the body more strongly suggests that *Leptocephalus attenuatus* is the larva of a snipe-eel.

## Family NETTASTOMIDAE

**L. *Nettastoma melanurum* Rafinesque, 1810 (Text-fig. 1, F-G)**

1810. *Nettastoma melanurum* Rafinesque, *Caratteri nuovi gen.*, p. 66.

1910. *L. Nettastoma melanurum* Rafinesque. Grassi, *Soc. Ital. Progr. Sci. Mem. I.*

MATERIAL EXAMINED. One specimen: 88.2mm total length, *Tui* Station AUZ 118, ca. 32° 30' S, 178° 56' E, 31/7/62, IKMT (10ft), 1,460m wire out.

DESCRIPTION. Measurements in mm: head 7.5, snout 3.2, eye 1.7, cleft of mouth 4.5, postorbital 3.0, pectoral 2.0, preanal 50.1, depth just before eye 2.3, at pectoral origin 10.1, at midpoint between pectoral and vent 23.1, at anal origin 17.4. Caudal rays 3 + 3. Teeth  $\frac{0}{1 + \text{VIII} + 3}$ . Myomeres ca. 76 + ca. 170 = ca. 246. Last vertical blood vessel at myomere 67.

Body moderately elongate, compressed, deep anteriorly but almost filamentous posteriorly, the maximum depth at the end of the first third of the body and contained about 3.8 times in the total; head clearly differentiated from trunk, snout relatively sharp; pigment in two inconspicuous groups on the intestine and in a large spot on the spinal cord posterior to the level of the vent.

Head moderate, contained about 11 times in total length, from the middle of the postorbital region forwards clearly set off from trunk; snout sharply pointed, curved downwards at its extreme tip, about 2.5 in head; nasal organ large, oval, placed close in front of eye; eye circular, relatively large, contained about twice in postorbital; cleft of mouth slightly oblique, curved, reaching to below middle of pupil; no teeth in upper jaw, those in lower acute. Pectoral fin relatively long, about equal to eye; dorsal and anal fins not yet developed but caudal with six well defined fin-rays.

Pigmentation confined to a group of about eight small, diffuse chromatophores forming a conspicuous, relatively large spot on the ventral aspect of the liver at myomeres 30-33; a similar group at about myomere 58—i.e., halfway along the opisthonephros: a conspicuous group of chromatophores forming a large spot on the spinal cord at myomere 104, rather faint as seen through the muscle tissue; diffuse black pigment on the under surface of the snout tip, on the nasal organ, behind the eye, between the cerebellum and the medulla oblongata and deep on the branchial arches; chorioid pigment also present.

REMARKS. The leptocephalus described above shows conspicuous similarities to *L. Nettastoma melanurum* as described by Grassi (1910). Ancona (1928, p. 110) regards *L. longirostris* Kaup, 1856 and *Hyoprorus messanensis* Kölliker, 1854, to be synonyms of this species. The present specimen has 246 myomeres, while Grassi's *L. Nettastoma melanurum* has 201-207 myomeres, a difference which I suggest to be of little systematic importance as the species is probably like *L. Nemichthys scolopaceus*, adding segments during growth of the leptocephalus. In Grassi's specimens the lateral pigment spot is at myomere 97, that is, relatively a little further forwards along the body than in the *Tui* specimen. In view of this very close similarity the latter is referred to *L. Nettastoma melanurum*. *L. urosema* Lea, 1913, and *L. bellotti* Ancona, 1928, may also be synonyms of this species but differ markedly in number of myomeres and in the position of the lateral pigment spot.

## Family CONGRIDAE

**L. *Gnathophis incognitus* Castle, 1963**

1963. *Gnathophis incognitus* Castle, *Zool. Publ. Vict. Univ. N.Z.*, 34: 37.

1963. *L. Gnathophis incognitus* Castle, *Zool. Publ. Vict. Univ. N.Z.*, 34: 41.

**MATERIAL EXAMINED.** Two specimens: 40.7mm total length, *Tui* Station AUZ 081, 32° 53' S, 176° 23' E, 23/7/62, 1m cone net, 183m wire out; 101.7mm total length, *Tui* Station AUZ 104, 1/4ml west of Meyer Island (off Raoul Island), Kermadec Islands, 27/7/62, dip net and light, surface.

**REMARKS.** The two specimens of *L. Gnathophis incognitus* conform well with other specimens described elsewhere (Castle, 1963, pp. 43–45) from the waters of eastern Australia. They have myomeres 137 and 142 respectively, well within the range for previous material (134–152), crescentic, black pigment patch below iris and a ventral series of somatic chromatophores from the pectoral region to the vent. The specimen from the inshore waters of the Kermadecs (Meyer Island) is well advanced in metamorphosis, having 56 + 81 muscle segments. As I have already noted (Castle, 1963, p. 37) three elvers (70.0mm–84.3mm total lengths) of this species are already known from Denham Bay, Raoul Island.

### **L. Conger cinereus cinereus** Rüppell, 1828

1824. *Conger cinereus* Rüppell, *Atlas Reise Nörd. Afr., Fische roth. Meers*, 4: 115.

1928. *L. Conger cinereus* Rüppell. Ancona, *Mem. R. Com. talassogr. ital.*, 146: 38–43, Pl. 3, figs. 1–2c.

**MATERIAL EXAMINED.** One specimen: 182.5mm total length, *Tui* Station AUZ 086, 31° 47' S, 177° 44' E, 24/7/62, IKMT (10ft), 730m wire out.

**REMARKS.** This large leptocephalus is similar in shape of body, distribution of ventral pigment and presence of a small, crescentic patch of pigment below the iris to leptocephali of *Gnathophis incognitus* but differs from this species in having a series of midlateral, somatic chromatophores, one on each segment, for the first third of the body. This latter character is a feature of larvae of *Conger cinereus* (see Ancona, 1928, p. 108) although most young larvae of this species have the midlateral series of chromatophores continuing along the whole of the body. However, the present specimen is probably full-grown and about to undergo metamorphosis in which case the lateral chromatophores will gradually be lost. Myomeres in this specimen number 151, and this conforms well with the range of myomeres in the larvae from the Red Sea (Ancona, 1928, p. 108) of 147–152.

### **L. Ariosoma anago** (Temminck & Schlegel, 1842)

1842. *Conger anago* Temminck & Schlegel, *Fauna Japonica*, p. 259.

1964. *L. Ariosoma anago* (Temm. & Schleg.). Castle, *Zool. Publ. Vict. Univ. N.Z.*, 37: 13.

**MATERIAL EXAMINED.** One specimen: 111.1mm total length, *Tui* Station AUZ 045, ca. 31° 15' S, 170° 5' E, 13/7/62, IKMT (10ft), 128m wire out.

**REMARKS.** This larva is readily identifiable with *L. Ariosoma anago* as described elsewhere (Castle, 1964). It has 158 myomeres while the range in the previous 33 specimens from the New Caledonia area is 157–172.

### **Leptocephalus stenorhynchus** Castle, 1964

1964. *Leptocephalus stenorhynchus* Castle, *Zool. Publ. Vict. Univ. N.Z.*, 37: 31.

**MATERIAL EXAMINED.** One specimen: 73.5mm total length, *Tui* Station AUZ 121, 31° 08' S, 178° 47' E, 2/8/62, IKMT (10ft), 375m wire out.

**REMARKS.** This relatively deep-bodied leptocephalus has 142 myomeres (118 preanal), ventral pigment as a series of regularly spaced somatic chromatophores from the pectoral region to the vent and an elongate, beak-like snout, characters which identify it with the congrid larva I have already described (1964) as *Leptocephalus stenorhynchus*.

## Family OPHICHTHIDAE

L. ?*Muraenichthys australis* Macleay, 1882 (Text-fig. 1, J-L).

1882. *Muraenichthys australis* Macleay, *Proc. Linn. Soc. N.S.W.* (1881), 6: 272.

MATERIAL EXAMINED. One specimen: 48.1mm total length, Tui Station AUZ 087, 31° 47' S, 177° 44' E, 24/7/62, 1m cone net, 183m wire out.

DESCRIPTION. Measurements in mm: head 3.7, snout 1.2, eye 0.5, cleft of mouth 1.8, postorbital 1.9, preanal 28.0, predorsal 38.1, depth just before eye 1.2, at pectoral origin 1.8, at anal origin 4.9, maximum depth 5.5. Teeth  $\frac{1 + IV + 5}{VIII}$ . Myomeres  $70 + 85 = 155$ . Last vertical blood vessel at myomere 70.

Body moderately elongate, compressed, its maximum depth just posterior to vent and about 8.5 in total, tapering more gradually in front of vent than behind it; head not clearly differentiated from trunk; intestine with nine pigmented swellings; about eight pigment spots on the lateral line posterior to vent.

Head relatively short, 12.5 in total length, conical; snout acutely pointed, its dorsal profile slightly convex, contained about three times in head; nasal organ oval, midway along snout; eye round, small, 3.5 in postorbital; cleft of mouth slightly oblique, extending to below posterior margin of eye, twice in head; teeth acute. Pectoral fin small, about as long as eye, rounded; dorsal originating midway between level of vent and caudal tip; caudal pointed, reduced.

Pigmentation as two large chromatophores on the ventral aspect of the throat; a group of chromatophores below the pectoral; groups of up to 12-14 stellate, somatic chromatophores on the lateral body wall at the level of each of the nine swellings of the intestine; a large splanchnic chromatophore on the dorsal aspect of each intestinal swelling; six equally spaced groups of chromatophores on the lateral line from the level of the vent to the caudal tip with subsidiary smaller groups midway between them (some of the pigment extending into the grooves between the myomeres); continuous pigment along the bases of the anal and dorsal tips with a patch on the tip of the spinal cord; chorioid pigment present.

Intestinal swellings at myomeres 10, 16, 24, 31, 38, 44, 51, 59, 68.

REMARKS. The leptocephalus described above is referred to the Ophichthidae in having an elongate body which is relatively deep, an intestine which is swollen at various points along its length, groups of chromatophores above these swellings and deep pigment spots below the lateral line posterior to the level of the vent (see Ancona, 1928, p. 114). The pectoral fin is markedly reduced and the caudal, although pointed, retains fin-rays. The larval development of species of ophichthid genera such as *Ophichthus* and *Muraenichthys* has yet to be followed out, and thus it is at the moment a difficult task to correctly identify, even to the generic level, leptocephali of this family. The task is made the more difficult because of inadequate knowledge of generic categories in the adults. It is probable that loss of the pectoral and/or caudal in early larval life occurs quite normally in larvae of this family. I am satisfied that the reduced state of the pectoral in the present leptocephalus suggests ultimate loss of this fin, and I tentatively refer the larva to *Muraenichthys* (although there are several ophichthids in the south-west Pacific which have neither pectoral nor caudal). If this identification is correct then the larva may possibly belong to *M. australis* which has about 152 vertebrae and would be the first record of the leptocephalus of this species.

## DISCUSSION

The composition of the *Tui* collection of adult eels, as may be expected, has clearly been determined by the nature of the gear used. Except for the three shallow water reef and coral sand species *Anarchias vermiformis*, *Gymnothorax griffini* and *Muraenichthys australis* the collection is made up of delicate eels which are so typical of the midwaters of the open ocean and which are not uncommon in bathypelagic hauls made in many parts of the world. Although there is only one new record for the south-west Pacific (*Anarchias vermiformis*) in the collection of adults, the *Tui* collection nevertheless makes a substantial addition to knowledge both of the eel fauna of this area and of the individual species in the collection.

The *Tui* leptocephali belong to a great diversity of species (nine genera and nine species in only 14 specimens) and include five new records of larvae in the south-west Pacific (*L. Nettastoma melanurum*, *L. Nemichthys scolopaceus*, *Leptocephalus attenuatus*, *L. Cyema atrum* and *L. ?Muraenichthys australis*). There are no very young larvae in the collection, but this may only indicate that the Isaacs-Kidd trawl was too coarse in the mesh or too deeply run to capture small specimens. However, present evidence suggests that the most likely breeding area for most of the species represented by the larvae is further to the north, in the area around New Caledonia.

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