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THE CONGRID EELS

of the

Western Indian Ocean and the Red Sea

by

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The subject of this paper was suggested by the late Professor J. L. B. Smith of this Department, who provided much encouragement throughout. The work is submitted as my personal tribute to his memory and as an acknowledgment of his interest in my studies.

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(With 4 plates and 1 text-figure)

ABSTRACT

The eel family Congridae is now known to be represented in the western Indian Ocean (here regarded to be west of 60° E. from and including the Red Sea, to Cape Point) by 11 genera and 19 species as well as at least five distinct larval forms which have not yet been identified. More than half of these species inhabit the shallow and offshore waters of the tropical western Indian Ocean. The remainder are known only from cool-temperate waters off the Cape, with one deep-water Atlantic species and one Mediterranean species also present in this area. Considerable additions to this fauna can be expected as the deep waters off the east coast are more fully sampled. **Congrina wallacei** sp. nov., described here from 260-270 fathoms off southern Mozambique and Durban, has rather large teeth on the jaws, a long snout and about 168 vertebrae. At least one species spawns off the Cape, but the majority probably do so over the western edge of the oceanic basins north and south of Madagascar. The shallow-water species show strong affinities with the tropical and cool-temperate Indo-Pacific.

INTRODUCTION

In recent years there has been a slow but firm advance in knowledge of the systematics of the larger and more complex eel families (e.g. the Congridae, Ophichthidae and Muraenidae) concurrent with more intensive complete studies on the smaller eel groups. The limits and relationships of many genera in the Congridae, in particular, have now been greatly clarified and the broad constitution of this family has been confidently established.

The elucidation of many of the systematic problems which have occasioned difficulty in the Congridae has largely come about through greater attention being paid to critical skeletal features. A number of congrid genera which may be confused externally are clearly distinguishable on osteological characters. For example, in his useful study of the congrids of the Japanese region, Asano (1962) devised a workable scheme to show the generic relationships and distinctions of the 10 genera inhabiting these waters. The scheme, which for practical purposes involves many external differences, is firmly supported by detailed osteological studies in which the external differences outlined have their basis.

Despite these advances in classification of the Congridae the family is still incompletely known in many parts of the world. The 10 Japanese genera recognised by Asano probably represent only about one-third of the valid congrid genera. Including larval forms about 50 genera have been referred to the family but some 20 of these enter the synonymy of other congrid genera. There are upwards of 60-70 valid congrid species, aside from those which have been described only from otoliths. A comprehensive study of the family would seem difficult to undertake because of the wide dispersal of the various pertinent forms in type collections. There is also the relative difficulty of obtaining rarer offshore forms from the deeper waters. A review by way of the literature would undoubtedly be of little practical value because the original descriptions of many species are inadequate for present needs. Nevertheless, studies similar to that of Asano in other parts of the world would surely further clarify the systematics of this important and fundamental eel family.

Of particular interest from a world-wide point of view are the relationships of congeneric species throughout the Indo-Pacific and Atlantic. Presumably, detailed studies on the precise distinctions and similarities of such species might contribute valuable zoogeographic information on the many interesting questions relating to the distribution and dispersal of eels. It has become quite clear in the author's examinations of large collections of congrid larvae from various parts of the central and southern Pacific and the Indian Ocean that tropical species in particular tend to be rather more widespread than formerly supposed, at least as larvae. This is no doubt because of the singular ability of eel-larvae to move over considerable oceanic distances. However, so little is known about adult congrids throughout the tropical Indo-Pacific that just how normal it is for a particular species to be very widespread has yet to be determined by detailed morphological comparisons of these species from the various areas. The fact that a number of species have long been misidentified adds to the difficulties of evaluating

geographic relationships. For example, **Anago anago** (Temm. & Schleg.) has often been ascribed a wide distribution throughout the Indo-Pacific, but this has been the result of a history of misidentification of similar, but distinct, species of **Ariosoma** Swainson.

Clearly, a good deal more collecting in certain parts of the Indo-Pacific is required in order to construct a more accurate picture of the congrid fauna of this region. A recent study (Castle, in press) of the eel-larvae of the eastern Indian Ocean has shown that although at least nine genera and 13 species of congrid larvae are present throughout this area, available records account for only three genera and three adult species. Undoubtedly the deeper waters need to be sampled more effectively in order to fill such gaps in the adult record.

The revision which is attempted here is designed with the need in mind for comparing congrid eels of the Indo-Pacific more closely. It sets out in detail the structure of the congrid fauna in the western Indian Ocean and the essential characters of the various species occurring in this area. Incidentally, the literature is reviewed and the particular systematic problems relating to each group of species are discussed for further examination. No attempt is made to set out the relationships of congrid genera as a whole, since this will only be possible with a more complete selection of the Congridae to hand.

Asano's study on the congrid eels of Japan is an exception in systematic work on Indo-Pacific Congridae. No other comparable survey has been undertaken and the literature on the subject consists of rather isolated accounts incidental to comprehensive studies on other fishes. In a series of papers Alcock (1889-1899) described a number of congrid genera and species from material collected by the "Investigator" in the deep waters of the Bay of Bengal and adjacent areas. Alcock's valuable material, comprising seven species in what may now be recognised as about six genera, is fundamental in congrid systematics and nomenclature but to date it has not been re-examined.

In 1939 the northwest sector of the Indian Ocean was explored by the "John Murray" Expedition and the fishes reported on by Norman (1939). Amongst these were seven congrid species. Some of Norman's original material has been available for study in the preparation of this paper. Barnard (1925) and Smith (1949-65) have described the congrids of the waters bordering southern Africa. Their material has also been re-examined here.

This revision is based also on material forming a part of the collection of the Department of Ichthyology, Rhodes University and collected along the east African coast from Kenya southwards, as well as from the Aldabras, Amirantes and Seychelles. Other material has kindly been made available from the collections of the South African Museum (adults and larvae) and the Division of Sea Fisheries (larvae). Local collections also produced some specimens.

For the purposes of brevity in this report the "western Indian Ocean" is considered to be that part of the Indian Ocean west of 60°E. This area includes the Red Sea (and Suez Canal), Gulf of Aden, Persian Gulf and Gulf of Oman in the north, and the whole east coast of Africa as far south and west as Cape Point in the south. The island groups of the Seychelles, Amirantes, Aldabra, Comores, Madagascar, Réunion, Mauritius, and Rodriguez are also included. Plate 105 shows the "western Indian Ocean" as defined here, with the various localities mentioned in the text detailed. One species from the Maldive Islands is also described here as this seems the most appropriate place in which to discuss its generic position within the family in the light of new data. The area so defined, although mainly tropical, also ranges to cool-temperate waters bordering on the Southern Ocean.

This account reports on some 11 genera and 19 species of congrid eels, including one new species. Five distinct larval types are also included in this revision. The extensive areas along the east coast of Africa will no doubt in time produce a number of forms which are not covered here. The present study will nevertheless serve as a basis on which any future material might be recognised as such and inserted into the scheme. If the rich variety of congrid larvae which occur along these coasts is any indication, it seems very likely that the known congrid fauna will indeed be greatly enlarged from that recognised here. The ability by which eel-larvae can move from one oceanic area to another would support the suggestion that congrid species of other parts of the Indian Ocean, especially those of deep water, could be expected to occur off the east African coast. For example, some or all of the deep water congrid species described by Alcock from Indian waters (i.e. **Congermuraena musteliceps, C. squaliceps, C. nasica** and **Promyllantor purpureus**), but not so far known from the western Indian Ocean, probably have a much wider distribution.

SYSTEMATIC ACCOUNT

Family **CONGRIDAE**

Body rather robust, sometimes slender and worm-like, but only in a few forms reaching a large size (3 ft. or more). No scales. Seldom brightly coloured or conspicuously marked (except in the subfamily Heterocongrinae), more usually cream, brown, grey or black with varying amounts of silver or gold. Pectoral usually well developed (small to absent in the Heterocongrinae). Dorsal, caudal and anal with clearly visible rays (in fresh specimens) but in large species these fins are covered with a thick integument. Dorsal origin always over gill or pectoral

region, caudal absent only in some Heterocongrinae, but sometimes abbreviated in burrowing species. Anal origin immediately behind vent which is usually before middle of length. Snout not produced, anterior nostril subtubular, posterior nostril simple, close to anterior margin of eye. Jaws robust, seldom with rapacious teeth, the latter more often relatively small, sharp, recurved and cardiform but sometimes placed in one or two rows along the jaws. Teeth usually present on the premaxillary-ethmoid and vomer but often in small numbers on these bones. Tongue conspicuous and free from floor of mouth. Branchial aperture lateral, before and below pectoral fin. Lateral line present, usually as a series of simple pores but these pores occasionally on the ends of short tubes.

Frontal bones ankylosed, hyomandibula directed obliquely forwards, maxilla-"premaxilla" articulation near tip of snout, branchiostegals few, not overlapping in the ventral midline, neurocranium truncate posteriorly, ethmovomerine complex sometimes with lateral processes, parapophyses vertically divided.

Larvae with pigment along the intestine, in some species on the lateral body surface, intestine straight without swellings or "festoons", vent subterminal at full larval development.

Congrid eels are virtually cosmopolitan and are very well represented in temperate regions. They seldom enter freshwater but are sometimes abundant in shallow water (to 100 fathoms) and are not uncommon in the depths (to about 1000 fathoms). They are normally bottom-dwelling. There are some 30 genera and possibly 70 or more species throughout the world. Spawning of the adults is almost certainly offshore (over the continental slope, or even oceanic) and larval life is about one year before metamorphosis. Except for a single genus **(Conger)** they are nowhere valued as food and are nowhere particularly abundant as individuals. In the western Indian Ocean congrid eels are seldom seen but this apparent scarcity may be partly because, like all eels, they readily escape from wide-meshed commercial trawls in the offshore habitat. Along certain areas of the east African coast the juveniles of one or two species occur in numbers in inter-tidal coral pools and amongst coral rubble, but the adults probably live beyond the tidemarks.

KEY TO SUBFAMILIES *

(Note: The keys set out in this paper are simple to use. If the characters listed in each section agree with those of the specimen in hand, proceed to the following number; if they do not agree, proceed to the alternative in brackets. Should there be no agreement then, the material in hand is new to the western Indian Ocean.)

1 (4)	Pectoral fin present, well developed; body rather robust or slender, but not worm-like; mouth reaching at least to below anterior margin of eye;		
2 (3)	Fin-rays unsegmented; caudal fin present, but short; vent usually near middle of length; larvae with oblique lines of minute melanophores on each myoseptum below the lateral line	**Bathymyrinae**	(p. 687)
3 (2)	Fin-rays segmented; caudal fin relatively long; vent usually well before middle of length; larvae without pigment on the myosepta but in a paired series of melanophores along the ventral body wall	**Congrinae**	(p. 694)
4 (1)	Pectoral fin much reduced or absent; body very slender and worm-like; mouth very short, at the most reaching only to below anterior margin of eye	**Heterocongrinae**	(p. 715)

Subfamily **Bathymyrinae** Böhlke, 1949

Fin-rays unsegmented; caudal fin present, but short; pectoral present; tail not much longer than head and trunk combined; preorbital bone above upper lip without bony projections from its ventral edge into lip; lateral line ossicles simple and well ossified, staining well in alizarin; dorsal wall of gas bladder attached firmly to parapophyses; precaudal and caudal vertebrae about equal in number; lateral ethmoid process present on each side of ethmovomer; supraoccipital bone absent. Larvae very large at full growth (200mm or more) and with an oblique row of minute melanophores on each myoseptum below the lateral line, as well as ventral pigment. About six genera and about 17 species throughout the world, mostly small eels in shallow water of tropical and warm-temperate seas, but also found in deepish water. Most species are probably burrowing forms rather like ophichthids. Two genera and four species recorded here from the western Indian Ocean.

*Four other congrid subfamilies have been named. The Leptocephalinae Whitley, 1935 is clearly equivalent to the Congrinae (although Leptocephalini Bonaparte, 1837 for the larval forms would seem to be prior even to the latter). The Scalanagoinae Whitley, 1935 with **Scalanago** Whitley, 1935 as type, was established to contain a peculiar congrid having dorsal and ventral extensions of the lateral line canal. I have examined a paratype of **S. lateralis** Whitley and, although it possesses some characters of the Congrinae, I am satsified that the Scalanagoinae should remain distinct at least until the osteology of this unusual form is known. After a detailed osteological study of **Bathymyrus smithi** Castle, 1968 I have concluded that **Bathymyrus** Alcock, 1889 must be grouped with the congrids which have come to be known as the Anagoinae Asano, 1962, in which case the Bathymyrinae Böhlke, 1949 has precedence. **Uroconger** Kaup, 1860 does not seem sufficiently distinct from the Congrinae for it to be set aside as the Urocongrinae Fowler, 1958.

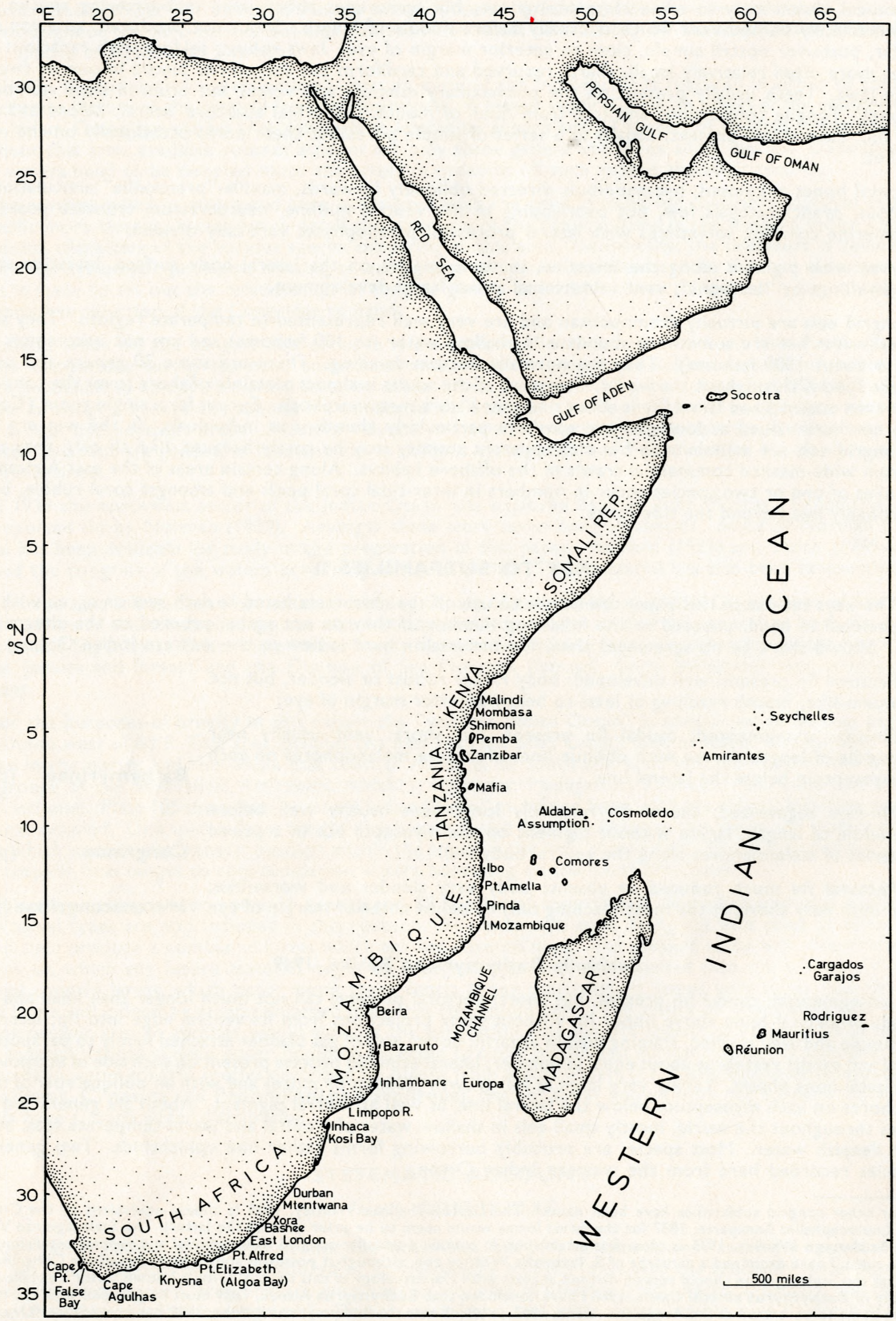


PLATE 105

The western Indian Ocean, showing localities mentioned in the text.

KEY TO GENERA

1 (2) "Premaxillary" teeth in an elongate patch wholly outside mouth and curving up on front face of snout; posterior nostril a slit placed below anteroventral corner of eye ..... **Bathymyrus**

2 (1) "Premaxillary" teeth in an oval patch partly outside mouth but not curving up on front face of snout; posterior nostril a simple aperture immediately in front of eye ..... **Ariosoma**

Bathymyrus Alcock, 1889

Type **B. echinorhynchus** Alcock, 1889 (Bay of Bengal). Body robust with the caudal region not attenuate and the vent only a little in advance of the mid-length. Snout short, barely overlapping lower jaw when mouth closed; eye moderate; upper lip weak, without ventral extensions from the preorbital bone, lower fleshy. Mouth rather large, reaching to below posterior margin of eye. Teeth essentially uniserial in jaws except that there is usually a cluster of teeth on each jaw anteriorly; teeth on the "premaxillary" acute and recurved in a distinct patch outside the mouth and sometimes also on anterior face of snout; vomerine teeth few, in a group on anterior part of bone. Anterior nostril tubular, on anterior face of snout; posterior nostril slit-like, below anteroventral corner of eye. Dorsal origin over anterior part of pectoral. Branchial aperture large with a narrow interspace. For further definitive features and osteology see Castle (1968a:5,7). Indian Ocean, South China Sea; deepish water; three species, here reported from one species off Mozambique.

BATHYMYRUS SMITHI Castle, 1968 **Plate 106 A**

Bathymyrus smithi Castle, 1968a:2, figs. 1–2.

MATERIAL EXAMINED. 35 specimens: holotype, 512mm total length (female), 10 paratypes (475mm–532mm total lengths, 9 females, 1 male), 24 others (440mm–580mm total lengths, including 4 males), collected by commercial trawl off the mouth of the Limpopo River, Mozambique in 470–490 metres, 17/1/68, Department of Ichthyology Collection, Rhodes University.

DESCRIPTION. Proportional measurements in per cent of total length (type material only): standard 97.1–98.2, head 13.7–15.1, snout 1.8–2.5, eye 2.1–2.6, interorbital 2.0–2.5, cleft of mouth 4.7–5.5, branchial aperture 1.9–3.1, branchial interspace 2.9–3.8, pectoral 5.2–6.3, predorsal 15.8–19.5, snout-vent 38.5–43.5, depth at pectoral base 6.1–7.4, depth at vent 5.0–6.1. Branchiostegal rays 8–9, pectoral rays 12–14, dorsal rays before level of vent 50–65, total dorsal rays 198–235, anal rays 141–168, caudal rays 4+4. Lateral line pores before level of vent 43–47, total lateral line pores 141–149. Vertebrae (7 specimens): precaudal 70–74, caudal 80–81, total 150–155. Teeth (in holotype): maxilla 56, dentary 65, "premaxillary" 17, vomer 3. Cephalic pores (in holotype): one pore near midline on extreme tip of snout, one anterodorsal to base of anterior nostril, one posteroventral to base of anterior nostril, one in front of eye on its horizontal diameter, one pore behind rictus, three minute pores on tip of lower jaw, one slit-like pore halfway along lower jaw. Colour: greyish-brown tinged with violet-pink, lighter below, base of caudal cream, remainder black, tips of dorsal and anal black. For a general description see Castle (1968a:2, figs. 1–2).

REMARKS. Previous to the latter account the genus **Bathymyrus** was known from **B. echinorhynchus** Alcock, 1889 in the northern Indian Ocean and **B. simus** Smith, 1965 from Vietnam. The latter species has also been found off Formosa (Chen & Weng, 1967: 43). All three species are characterised by the development forwards and upwards of the "premaxillary" portion of the ethmovomer and the posterior nostril placed low down on the snout. The extra-oral teeth carried on the "premaxilla" are most spectacularly developed in **B. simus,** they are less obvious in the type species, while in **B. smithi** they are relatively insignificant, but nevertheless characteristic. **B. smithi** possibly spawns off the Mozambique coast.

Ariosoma Swainson, 1838

Type **Ophisoma acuta** Swainson, 1839 (= **Muraena balearica** De La Roche, 1809). Synonyms: **Ophisoma** Swainson, 1839;**Congermuraena** Kaup, 1856 (in part); **Diaphanichthys** Peters, 1864; **Congromuraena** Kaup emend. Günther, 1870 (in part); **Congrellus** Ogilby, 1898; **Nesocongrus** Whitley, 1935; **Thyreoconger** Wade, 1946. Body slender, with caudal region not greatly attenuated and vent placed at about middle of length or slightly before. Snout short, acute, just overlapping tip of lower jaw when mouth closed; eye large and prominent; lips relatively well developed, fleshy, the upper supported by a triangular preorbital bone without ventral projections into the lip. Teeth minute, increasing in number with age; those of the jaws cardiform (i.e. in many rows) anteriorly but fewer rows posteriorly; premaxillary-ethmoid patch small, confluent with a short vomerine patch. Dorsal origin over branchial aperture. Larvae reach at least 200mm at full growth, they have a round eye without pigment on the iris, the vent is subterminal until the beginning of metamorphosis, the pigmentation is in the form of melanophores along the ventral body wall, on the dorsal body wall before the dorsal origin and in a very characteristic oblique series on each myoseptum below the lateral line. Atlantic, Indo-Pacific, most species in shallow water of warm-temperate or warm seas, two or three in the Atlantic, probably about six in the Indo-Pacific. Here recognised as three species from the western Indian Ocean.

The history of systematic work on the Congridae has been marked by great difficulties in delimiting the genera centred on **Ariosoma** Swainson, 1838. Like the genera **Congermuraena** Kaup, 1856 (which is part synonym of **Ariosoma**) and **Bathycongrus** Ogilby, 1898 it has commonly been used as a convenient dumping ground for a plethora of species which are now known to belong to widely diverse genera of congrids. In seeming desperation Parr (1932: 30–31) placed all these related forms in the genus **Ariosoma sensu lato** but as later authors have shown (Reid, 1934: 3; Wade, 1946: 183) the genus can readily be restricted to something which closely approaches the present conception of **Ariosoma**, having the general characters outlined above. Its closest relatives are **Anago** Jordan & Hubbs, 1925, **Alloconger** Jordan & Hubbs, 1925, and the recently-described **Paraconger** Kanazawa, 1961, as well as **Bathymyrus** Alcock, 1889. These, together possibly with **Chiloconger** Myers & Wade, 1941, form a relatively compact subfamilial unit, the Bathymyrinae, which is readily distinguished from other congrid subfamilies (Congrinae, ?Scalanagoinae and Heterocongrinae) both in adult and larval morphology.

KEY TO SPECIES

1 (2) Lateral line pores before level of vent less than 45 ..... **A. scheelei**

2 (1) Lateral line pores before level of vent more than 50;

3 (4) Head and predorsal each about 15% of total length; vertebrae 142–150; pectoral plain in colour ..... **A. mauritianum**

4 (3) Head and predorsal each about 20% of total length; vertebrae about 154; pectoral black ..... **A. nigrimanum**

ARIOSOMA SCHEELEI (Strömman, 1896) **Plates 106 B; 108 A, B, D.**

Leptocephalus scheelei Strömman, 1896 (in part): 21, pl.1, figs. 6–7 (Indonesian specimen and figure only; original reference).

Synonymy (adults):

?Conger neoguinaicus Bleeker, 1859a: 22; 1878: 56; Günther, 1870: 43.

?Ophisoma neoguinaicum (Bleeker). Bleeker, 1864: 28.

?Congermuraena neoguinaica (Bleeker). Ogilby, 1898: 286.

?Congrellus neoguinaicus (Bleeker). Weber & de Beaufort, 1916: 263; Munro, 1958: 131.

?Congromuraena anago (**non** Temminck & Schlegel, 1842). Day, 1878: 660, pl.169, fig.2 (Madras); 1889: 88 fig. 36 (Indo–Malaya).

Congrellus anago (**non** Temm. & Schleg.). Weber & de Beaufort, 1916: 262, figs.109 & 111 (Indonesia).

Ophisoma anago (**non** Temm. & Schleg.). D'Ancona, 1928a: 13, pl.1. fig.1 (Red Sea); 1928b: 429 (Red Sea).

Ariosoma anago (**non** Temm. & Schleg.). Smith, 1949–65: 393, fig.1112 (southern Africa, Natal specimens are **A. mauritianum** (Pappenheim, 1914), figure (from Day) is probably of **A. scheelei**); 1958a: 58; 1958b: 135 (Inhaca, southern Mozambique); Munro, 1955: 64, pl.12, fig.180 (Ceylon); Fowler, 1956; 114 (Red Sea); 1959: 51 (Indo-Pacific, Fiji specimens); Scott, 1959: 137 (Malaya); Woodland & Slack-Smith, 1963: 23 (Gt. Barrier Reef).

Ariosoma scheelei (Strömman). Castle, 1966a: 22 (southwest Pacific).

?Ariosoma sp. Norman, 1939: 40 (S. Arabian coast, Zanzibar).

?Congrellus fijiensis Ogilby, 1898: 290 (Fiji).

?Congromuraena fidjiensis (Ogilby). Günther, 1910: 394.

?Conger fijiensis (Ogilby). Whitley, 1927: 4.

?Conger fidjiensis (Ogilby). Fowler, 1928: 38.

?Ariosoma fijiensis (Ogilby). Fowler, 1959: 50.

Synonymy (larvae):

?Leptocephalus taenia Lesson, 1830: 126 (New Guinea); Bleeker, 1864b: 122, pl.192, fig.2; 1878: 56; Günther, 1870: 143; Grassi, 1913: 10, 71; Weber, 1913: 64, figs.12,13,15 (Indonesia); Weber & de

Beaufort, 1916: 404, figs.204–207; Thompson, 1916: 80; Sherborn, 1922: 6368; 1932: 621; Fish, 1927: 308; D'Ancona, 1928a: 104; 1928b: 429; Fowler, 1928: 37; 1931: 316; 1934: 387; Duncker & Mohr, 1929: 82 (West Pacific); Nair, 1947: 1; Gopinath, 1950: 87; Munro, 1958: 131. The identity of **L. taenia** is in doubt as the number of myomeres in the type specimen is unknown. However, it is almost certain that some or all of the above records apply to **Ariosoma scheelei.**

?Leptocephalus taenia Bleeker, 1855 (**non** Lesson, **non** Agassiz): 428 (Indonesia); 1860: 56 (Cape of Good Hope).

?Leptocephalus taenia Kaup, 1856 (**non** Lesson, **non** Agassiz, **non** Bleeker): 151, pl.19, figs.18–18a (Indo-Pacific); Cunningham, 1895: 280; Eigenmann, 1902: 39; Fish, 1927: 307; D'Ancona, 1928a: 103–104; Bertin, 1935: 3; Nair, 1947: 2; 1960: 233; Gopinath, 1950: 88.

?Leptocephalus marginatus Kaup, 1856 (in part): 152, pl.19, fig.19 (India); Playfair & Günther, 1866: 128 (Zanzibar); Sauvage, 1891: 527 (Madagascar); Cunningham, 1895: 280; D'Ancona, 1928a: 103; 1928b: 429; Bertin, 1935: 102, fig.M; Nair, 1947: 1; 1960: 233; Gopinath, 1950: 87.

?Leptocephalichthys taenioides Bleeker, 1859b: 180 (**nomen novum** for **Leptocephalus taenia** Bleeker preocc.).

?Leptocephalus taenioides (Bleeker). Bleeker, 1864b: 123, pl.192, fig.4 (Indonesia); 1865: 297; Günther 1870: 142 (Zanzibar); Grassi, 1913: 11 (as **L. taeniodes**); Weber, 1913: 66; Weber & de Beaufort 1916: 408; D'Ancona, 1928a: 104; 1928b: 429; Gopinath, 1950: 88 (as **L. taenoides**).

?Leptocephalus (Diaphanichthys) brevicaudus Peters, 1864: 399 (Philippines); Bleeker, 1864b: 123; Günther, 1870: 142; Weber, 1913: 65; Jordan, 1919: 334; Herre, 1923: 143; 1953: 91; D'Ancona, 1928a: 104; 1928b: 429; Jordan, Evermann & Clark, 1930: 79.

Leptocephalus scheelei Strömman, 1896 (in part): 21, pl. 1, figs.1-7 (Indonesia); Weber, 1913: 66; D'Ancona, 1928a: 103; 1928b: 429; Bertin, 1936: 3, fig. 4; Gopinath, 1950: 88; Castle, 1964: 6.

Leptocephalus indicus Weber, 1913: 74, fig.22 (Indonesia); Weber & de Beaufort, 1916: 399, fig.195; Fish, 1927: 308; D'Ancona, 1928a: 104; 1928b: 429; Gopinath, 1950: 88; Castle, 1964: 3.

Leptocephalus Ophisomatis anagoi (**non** Temm. & Schleg.). D'Ancona, 1928a: 17, pl.2, figs.1–4a (Red Sea and Gulf of Aden); Klausewitz, 1964: xxvi.

Larva I Deraniyagala, 1934: 91, fig.1 (Ceylon).

Leptocephalus sp. Tortonese, 1939: 73, pl.3, figs.1–3 (New Guinea).

Congrellus anago (**non** Temm. & Schleg.). Gopinath, 1946: 10 (India); Nair, 1948: 87, fig.1 (India); 1960: 234; Jones & Pantalu, 1955: 62; Nair & Mohamed, 1960: 147.

L. Ariosoma scheelei (Strömman). Castle, 1964: 3, fig.1 A–I (southwest Pacific Ocean, southeast Indian Ocean); 1966b: 58.

?Leptocephalus sanzoi D'Ancona, 1928a: 27, pl.2, figs.5–9a; 1928b: 430; 1928c: 517; 1930: 263, fig.2; Fowler, 1956: 110, fig.48; Klausewitz, 1964: xxvi.

MATERIAL EXAMINED. 87 specimens (82 juveniles and adults, total lengths 69mm–195mm, including mature males and females; 5 larvae, total lengths 80mm–125mm) from the following localities: Aldabra (1 speciman 78mm); Porto Amelia, Mozambique (2 specimens 80mm (larva) and 98mm); Pinda, Mozambique (80 specimens 69mm–195mm); off Durban (4 larvae 105mm–125mm, South African Museum IKMT Station 37, 30°30′S., 31°45′E., 23/8/62, 1805–0330 hrs, 200 metres).

DESCRIPTION. Proportional measurements in per cent of total length (38 specimens 84mm–195mm): head 15.5–18.1, snout 3.0–3.8, eye 3.5–4.4, interorbital 0.6–1.8, upper jaw 3.9–5.0, branchial aperture 1.9–3.0, branchial interspace 2.6–3.8, pectoral 3.1–5.9, predorsal 15.6–19.0, snout-vent 39.9–45.5, depth at vent 4.6–6.8. Branchiostegal rays 8–9, pectoral rays 11–12, dorsal rays before level of vent 40–55, total dorsal rays 146–178, anal rays 119–135, caudal rays 5+4. Lateral line pores before level of vent 38–42. Vertebrae (10 specimens): precaudal 56–59, total 114–117. Teeth increasing with age, in a 168mm mature female as follows: maxilla-35 in inner row, dentary-32 in inner row, premaxillary-ethmoid patch of teeth confluent with anterior tips of maxillary series, vomer-21 teeth on anterior portion, 9 in a uniserial row along shaft. Cephalic sensory pores: 8 circumorbital (including 1 posterior to rictus), 3 along upper lip, those around anterior nostril difficult to determine in the present material, 8–9 along lower jaw continuing on to suboperculum, 4 in an almost vertical line from suboperculum to occipital region including one median occipital pore: a vertical series of minute pores behind the postorbital pores.

The four larvae collected off Durban show the characteristic features of **Ariosoma** larvae including most conspicuously the oblique line of minute melanophores on each myoseptum below the lateral line. The Porto Amelia specimen (80mm) is metamorphic. For a detailed description of the larva of this species, its growth and metamorphosis see Castle (1964: 3–9, fig.1 A–I). A brief diagnosis of the present larvae is as follows: myomeres

114–118, anterior margin of gall bladder at myomere 22–23, last vertical blood vessel at myomere 56–58, in one specimen teeth $\frac{I + VIII + 6}{I + VII + 6}$, anal rays 54, caudal rays 5+4, a – d (i.e. myomeres between levels of dorsal origin and vent) = –2 (Plate 108 A,B,D).

REMARKS. In the synonymy set out above I have attempted to bring together all references to this species, including those papers referring to the larvae as well as the adults. The species suffers from a long history of misidentification, the adult with which it has been most frequently confused being **Anago anago** (Temminck & Schlegel, 1842). The latter, however, appears to be a Japanese species not occurring elsewhere in the Indo-Pacific. Without critical information on specimens from India, Indo-Malaya and the Central Pacific it is doubtful whether an entirely conclusive synonymy of the species can be achieved. Nevertheless, it is quite clear from the vertebral count given from an X-rayed Red Sea specimen of "**Ophisoma anago**" by D'Ancona (1928a: 13), that his specimen was actually **A. scheelei.** Similarly, the larval species described by D'Ancona (**L. Ophisomatis anagoi**), Weber **(L. indicus)**, Gopinath and others **(Congrellus anago)**, Tortonese **(Leptocephalus** sp.) and Deraniyagala **(Larva I)** from various parts of the Indo-Pacific, having about 115 myomeres must also belong to **A. scheelei.** From this it seems most likely that records of adults from these areas as the Japanese species **(Anago anago)** must be thrown into doubt.

Conger neoguinaicus Bleeker, 1859 is based on a poorly preserved specimen the true specific identity of which must remain in doubt until more information on it becomes available, if this is possible. With regard to **Congrellus fijiensis** Ogilby, 1898, Dr. W. H. Dawbin, University of Sydney, has kindly checked through the collection in the Zoology Department Museum there but was unable to locate the type of this species. Neither is it in the Australian Museum and the specimen can be presumed lost. The characters given in the original description suggest that **C. fijiensis** is identifiable with **A. scheelei**, although no vertebral count is available.

A number of larval species which are clearly referable to **Ariosoma** have been described from the Indo-Pacific and these are set out in the above synonymy. At least three species of the genus are known from this large area, each with a different range in number of myomeres. The first-described species for which the number of myomeres is known and which corresponds with that of the present species is **Leptocephalus scheelei** Strömman, 1896. The type series of this species is a mixture of Atlantic and Indonesian specimens although the figures given by Strömman (1896: pl.1, figs.6–7) were made from the Indonesian specimen, whose myomere count is 114 (Bertin, 1936: 3). I therefore propose that this name be used for the eels described above and for those indicated in the synonymy. **L. sanzoi** D'Ancona, 1928, also from the Red Sea, has myomeres 122–123 but otherwise shows few distinctions from **L. scheelei** and it is therefore tentatively included as a synonym of this species.

A. scheelei has a relatively low number of vertebrae for a congrid eel and the species is indeed a small eel which reaches maturity at less than 200mm. The specimens recorded here from the western Indian Ocean agree very well in meristic characters with larvae from the Australasian region (Castle, 1964: 5). Although larvae of **A. scheelei** are not uncommon in the Australasian region, and especially in the north, as such the adult has not been recorded from that area.

The abundant material collected in the western Indian Ocean suggests that **A. scheelei** must be fairly common there, especially in northern Mozambique and areas to the north. Almost all of the specimens studied were collected at Pinda on the northern Mozambique coast; many of them were postmetamorphic suggesting that the area is in the direct path of the currents carrying larvae of the species. Presumably also the particular ecological situation which obtains in the Pinda area is eminently suitable for survival of both young and adults of **A. scheelei** since mature adults were collected with the postmetamorphic specimens.

A few larvae are known from much further south but the species is evidently a tropical one and it has not been found on southern shores. D'Ancona (1928a: 17) records a 15.5mm larva from the southern entrance to the Red Sea and other larvae of 48mm–143mm as well as metamorphics of 120mm total length from the same area (Bab-el-Mandeb), but not in the Red Sea itself. The identity of the smallest larva is in some doubt because the full complement of myomeres could not be counted. It would thus seem likely that spawning of **A. scheelei** does not occur in the Red Sea or south of Madagascar but rather in the northwest part of the Indian Ocean. Most larvae thus appear to reach the coast of east Africa and adjacent island groups where metamorphosis takes place, but some must be turned northwards and southwards, with a few reaching as far south as Durban. Abundant metamorphic material has been described from the waters of Ceylon (Gopinath, 1946: 10) and it is possible that this area is within the range of distribution of larvae derived from this particular spawning area in the northwest.

Off Western Australia **A. scheelei** is relatively abundant as larvae and spawning of adults is known to occur south of Java (8°S.–10°S.) during May–July when temperatures of about 18°C. and salinities of about $34^{\circ}/_{\circ\circ}$ occur in about 200 metres in this area. Larger larvae are found later in the year progressively further south as the influence of the tropical low salinity water extends to the south. Very young larvae near the spawning area are thus in a position to be transported not only to the south but to the west into the central Indian Ocean under the influence of the west-moving South Equatorial Current which has its origin south of Java. As no collections of eel-larvae have been reported on from the central Indian Ocean it remains to be seen just to what extent larvae

of **A. scheelei**, derived from this easterly spawning area, are transported westwards. The species also spawns in the southwest Pacific (Castle, 1964: 9) although much less detailed information is available from this area than from the eastern Indian Ocean.

ARIOSOMA MAURITIANUM (Pappenheim, 1914) **Plate 106 C**

Leptocephalus mauritianus Pappenheim, 1914: 189, fig.8, pl.10, fig.2 (east of Madagascar, original reference).

Synonymy (adults and juveniles):

Congermuraena anago (**non** Temm. & Schleg.). Barnard, 1925: 190 (southern Africa).

Ariosoma anago (**non** Temm. & Schleg.). Smith, 1949–65: 393 (Natal specimen only).

Ariosoma mauritianum (Pappenheim). Castle, 1966a: 22.

Synonymy (larvae):

?Helmichthys oculus Peters, 1865a: 48 (Indonesia); 1866: 525, fig.4; Günther, 1870: 140; Bleeker & Pollen, 1874: 73 (Madagascar); Sauvage, 1891: 527 (Madagascar); Jatzow & Lenz, 1898: 528, pl.36, fig.18; Weber, 1913: 65; Weber & de Beaufort, 1916: 408; Fish, 1927: 308; D'Ancona, 1928a: 104.

Leptocephalus mauritianus Pappenheim, 1914: 189, fig.8, pl.10, fig.2 (east of Madagascar); D'Ancona, 1928a: 36, pl.2, figs.12–12a (Red Sea and Gulf of Aden); 1928b: 430; 1928c: 517; 1930: 270, fig.4; Fowler, 1956: 110, fig.49; Castle, 1964: 12.

?Leptocephalus macrenteron D'Ancona, 1928a: 32, pl.2, figs.10–11a (Red Sea and Gulf of Aden); 1928b: 430; 1928c: 517; 1930: 267, fig.3; Fowler, 1956: 110; Klausewitz, 1964: xxvi; Castle, 1964: 17.

L. Ariosoma mauritianum (Pappenheim). Castle, 1964: 10, fig.3 A (southwest Pacific Ocean, southeast Indian Ocean); 1966b: 68; Della Croce & Castle, 1966: 150 (southwest Indian Ocean).

MATERIAL EXAMINED. 12 specimens as follows: 262mm total length, 8 miles off Durban in 22 fathoms, S.S. "Pieter Faure", South African Museum No. 12790 (this specimen described as **Congermuraena anago** by Barnard, 1925: 190); larvae: 32.3mm, Division of Sea 116mm, Fisheries Station A 65, 31°50′S., 29°51′E., 8/6/59, 0953–1006 hrs, N100B, 150–0 metres; 116mm, D.S.F. Station A 3090, 36°13′S. 19°41′E. 14/7/64, 0229–0239 hrs. N100H, 0–5 metres, ca. 96mm, S.A.M. IKMT station 35, 25°55′S., 39°30′E., 19/8/62, 1825–0745 hrs. 500 metres; 215mm, S.A.M. IKMT Station 36, 26°30′S., 33°40′E., 21/8/62, 1800–0725 hrs, 500 metres; 187mm, 217mm, S.A.M. IKMT Station 47, 28°12′S., 33°24′E., 24/2/63, 2030–2325 hrs, 500 metres; 142mm, S.A.M. IKMT Station 48, 29°52′S., 33°24′E., 25–26/2/63, 2130–0400 hrs. 500 metres; 130mm (metamorphic), at Bluff, Durban, no other data: 150mm (metamorphic), no other data; 166mm (metamorphic), 214mm, 30°05′S., 31°05′E., 28/6/64, ca. 350 metres, S.A.M. No. 24386.

DESCRIPTION. Adult—proportional measurements in percent of total length: head 17.1, snout 3.1, eye 3.3, interorbital 1.9, upper jaw 4.2, branchial aperture 2.6, branchial interspace 2.3, pectoral 6.1, predorsal 15.2, snout-vent 47.5, depth at vent 5.7. Branchiostegal rays 9, pectoral rays 11, dorsal rays before level of vent 66, total dorsal rays 167, anal rays 110, caudal rays 4+5, lateral line pores before level of vent 56, lateral line pores 143. Teeth: maxilla 43, triserial; dentary 44 biserial; premaxillary-ethmoid patch of teeth elongate-oval, placed transversely; vomer 12 in each of two longitudinal rows. Cephalic pores as in **A. scheelei.** Colour: "brownish, fins yellowish, the vertical ones (usually) with dark edging, tip of tail white" (Barnard, 1925: 191).

Larvae are essentially similar in general body form and pigmentation to those I have described in detail elsewhere (Castle, 1964: 10, fig.3A) for **A. scheelei.** They have the following meristic characters: myomeres 142–150, anterior margin of gall bladder at myomere 23–25, last vertical blood vessel at myomere 72–74, in a 142mm specimen teeth $\frac{I + I + V + 4}{I + V + 5}$, dorsal rays 60–87, anal rays 45–82, caudal rays 3+2, a – d = –2.

REMARKS. **A. mauritianum,** like the previous species, has at times been misidentified as **Anago anago.** The specimen described from Amboina, Indonesia by Peters as **Helmichthys oculus** was metamorphic and although it shows similarities in general body form to metamorphic larvae of **Ariosoma** its generic identity must be a matter of conjecture. The original figure shows about 144 myomeres but this alone is insufficient to relate **H. oculus** to **A. mauritianum.**

A. mauritianum is a rather more slender species than **A. scheelei**, the caudal region being more attenuated although the vent is placed very close to the middle of the length. The single adult specimen of **A. mauritianum** available is insufficient to make detailed comparisons of this species with **A. scheelei** but clearly there are more pores before level of vent and a higher total number of vertebrae in **A. mauritianum.** The teeth on the vomer are set in an essentially elongate patch rather than in a fairly short triangular patch as in **A. scheelei.** In the larvae the myomeres are greater in number and the last vertical blood vessel is placed further back at about myomere 73, rather than at about myomere 58. Precaudal vertebrae are accordingly more numerous in **A. mauritianum.**

Larvae of **A. mauritianum** are common off Western Australia although the adult has yet to be collected in this area (Castle, 1964: 10, fig.4; and in press). The earlier study of this species (1964) showed that spawning of

west Australian **A. mauritianum** occurs off Perth during March–April, with growth to about 200mm by February–March of the following year, when metamorphosis takes place. The more recent and detailed study of the species off west Australia (Castle, in press) confirms these observations and adds substantial information on the seasonal distribution and environmental conditions associated with larval development of the species. In this area during 1962–63 **A. mauritianum** spawned and the larvae underwent early development in waters of moderate temperature (18°C.) but relatively high salinity (35°/$_{oo}$) (i.e. subtropical waters). During growth the larvae moved northwards from the spawning area off Perth in company with this water mass. Spawning of **A. mauritianum** is also known to occur off Sydney over the continental slope in rather similar hydrological conditions.

These Australasian records show that **A. mauritianum**, at least in its larval form, is associated with "subtropical" water of moderate temperature and relatively high salinity. Water of similar characteristics (15°C.–20°C., 35.5°/$_{oo}$) i.e. "salinity maximum water" apparently occurs east of southern Africa and south of Madagascar in about 200 metres (Orren, 1963: fig.11, 1966: figs.15,20). The latter studies show also that this "salinity maximum" water of subtropical origin reaches as far south of the Agulhas Bank (Orren, 1966: figs.16,21), its western edge essentially following the line of the continental slope in this region.

If the spawning requirements of **A. mauritianum** in the South African region are similar to those of the species in the southeast Indian Ocean (and there would seem to be little reason for doubting this) it would be reasonable to suggest that its spawning and early development takes place somewhere in the area occupied by these water conditions, that is, to the east of southern Africa. Very small leptocephali taken in this area would confirm this suggestion but to date only a single relatively young larva is known from there (i.e. the 32.5mm specimen taken at D.S.F. Station A 65 where the temperature was at least 23.81°C. and salinity 35.28°/$_{oo}$—see D.S.F. 31st. Ann. Rep., 1963: 228). The larger larva (116mm) from the Division of Sea Fisheries collection was taken south of Cape Point in surface water of 17.89°C. and 35.42°/$_{oo}$. Collections made throughout this area in 200 metres with suitable gear (e.g. Isaacs-Kidd midwater trawls) in late autumn might serve to locate the spawning area of South African **A. mauritianum** more precisely.

ARIOSOMA NIGRIMANUM Norman, 1939

Ariosoma nigrimanus Norman, 1939: 39, fig.12 (Gulf of Aden): Marshall and Bourne, 1964: 243; Castle, 1964: 7.

MATERIAL EXAMINED. Holotype, 298mm total length, "John Murray" Station 194 (Gulf of Aden), 220 metres, Agassiz trawl, mature male, BMNH No. 1939.5.24: 621–623.

DESCRIPTION. Proportional measurements in per cent of total length: head 20.6, snout 3.9, eye 4.1, interorbital 3.2, upper jaw 6.4, branchial aperture 3.5, branchial interspace 2.3, pectoral 7.1, predorsal 19.6, snout-vent 48.0, depth at vent 6.1. Branchiostegal rays 11, pectoral rays 14, dorsal rays before level of vent 63, total dorsal rays 184, anal rays 136, caudal rays 4+4, lateral line pores before level of vent 57 (vertebrae 59). Vertebrae: precaudal 76, caudal 78, total 154. Teeth: maxilla 24 in lateral row, biserial; dentary 38 in lateral row, biserial; premaxillary-ethmoid 22 in a transversely oval patch; vomer 10, more or less biserial. Cephalic pores: 1 pore in front of anterior nostril, 1 behind anterior nostril with prominent anterior and posterior flaps, 3 along upper lip including 1 just above rictus, 1 behind rictus, 2 behind eye, 1 above posterodorsal corner of eye with a small one medial to this, 1 above anterodorsal corner of eye, 1 above posterior nostril, 10 along lower jaw continuing on to suboperculum, 4 in a transverse commissural line on temporal region, including a median occipital pore. Colour: "yellowish brown, paler below; traces of faint dusky cross-bars on head; dorsal, anal and caudal with a narrow black margin; pectorals wholly dusky or blackish" (Norman).

REMARKS: In external characters **A. nigrimanum** differs little from **A. mauritianum**, except that the former has a slightly longer head and predorsal and possibly more rays in the fins. Further specimens of both species are required in order to confirm these distinctions. There are possibly more precaudal and total vertebrae in **A. nigrimanum**. In addition, the pectoral fin of **A. mauritianum** is plain in coloration.

Subfamily **Congrinae** Kaup, 1860

Fin-rays segmented; caudal fin well developed; pectoral present; tail appreciably longer than head and trunk combined; preorbital bone above upper lip with bony projections from its ventral edge into lip (except in **Conger** and **Congriscus**); lateral line ossicles rather complex and poorly ossified; dorsal wall of gas bladder free from parapophyses; precaudal vertebrae fewer than caudal vertebrae; lateral ethmoid process of ethmovomer absent; supraoccipital bone present (except in **Congriscus**). Larvae moderate in size at full growth (about 100mm, more or less) and with a paired series of melanophores along the ventral body wall but melanophores on the myosepta absent. Many genera and species throughout the world, mostly small eels in shallow to moderately deep water of tropical and warm-temperate seas although some species extend to cool-temperate areas. Seven genera and 10 species recorded here from the western Indian Ocean, but larvae of other species also present in the area.

KEY TO GENERA

1 (12)	Vent placed before middle of length;		
2 (5)	Teeth essentially in a single series on each jaw;		
3 (4)	Dorsal origin over branchial aperture; snout shorter than eye; visceral peritoneum wholly black	**Congriscus**	(p. 695)
4 (3)	Dorsal origin over middle or posterior half of pectoral; snout longer than eye; visceral peritoneum light-coloured	**Conger**	(p. 696)
5 (2)	Teeth in several series on each jaw;		
6 (9)	Teeth rather small, cardiform on jaws and in several rows on the vomer;		
7 (8)	Anterior nostril tube with an incised rim; vomerine teeth granular; lateral line barely raised above body surface, its pores simple; body surface without hair-like epidermal papillae	**Gnathophis**	(p. 700)
8 (7)	Anterior nostril tube with an entire rim; vomerine teeth acute; lateral line raised above body surface, its pores on the ends of tiny tubes; body surface with hair-like epidermal papillae, especially in large specimens	**Pseudoxenomystax**	(p. 704)
9 (6)	Teeth rather large, acute, essentially in two rows on jaws and in a single row or scattered on front of vomer;		
10 (11)	Sensory pores on head large and slit-like; snout long, twice length of eye; visceral peritoneum wholly black	**Congrina**	(p. 705)
11 (10)	Sensory pores on head rather small and round; snout moderate, about 1.5 times eye; visceral peritoneum light-coloured	**Uroconger**	(p. 711)
12 (1)	Vent placed behind middle of length	**Coloconger**	(p. 714)

Congriscus Jordan & Hubbs, 1925

Type **Congromuraena megastoma** Günther, 1880 (Japan). Body robust, with caudal region not greatly attenuated and vent placed well before middle of length. Snout short, barely overlapping tip of lower jaw when mouth closed; eye large; upper lip developed but narrow and containing no ventral projections of preorbital bone. Mouth relatively short, just reaching vertical from middle of eye. Teeth small, none enlarged, essentially uniserial in jaws, a few in premaxillary-ethmoid patch, the latter continuous with a short triangular patch on vomer. For further definitive features see Asano (1962: 71, 82). Indo-Pacific; previously known only from the type species from Japanese waters, now recorded as a second species from the northern Indian Ocean in deepish water.

CONGRISCUS MALDIVENSIS (Norman, 1939) **Plate 106 D**

Conger maldivensis Norman, 1939: 37, fig.11 (near Maldive Islands).

MATERIAL EXAMINED. One specimen: paratype, 340mm total length, "John Murray" Station 145 (Maldive area), 494 metres, Agassiz trawl, BMNH No. 1939.5.24: 610–612.

DESCRIPTION. Proportional measurements in per cent of total length: head 18.1, snout 3.5, eye 4.1, interorbita 3.4, cleft of mouth 6.1, branchial aperture 2.8, branchial interspace 5.3, pectoral 7.5, predorsal 17.2, snout-vent 39.8, maximum depth (at pectoral base) 9.0. Branchiostegal rays 7, pectoral rays 19, dorsal rays before level of vent 71, total dorsal rays 283, anal rays 231, lateral line pores before level of vent ca. 40. Vertebrae: precaudal 47, caudal 101, total 148. Teeth: maxilla 39, dentary 35, premaxillary-ethmoid 13, vomer 8. Cephalic sensory pores as follows: 4 around anterior nostril, 1 above posterior nostril, 1 above anterodorsal margin of eye, 3 postorbital, 1 posterior to rictus, 3 maxillary, 8 mandibular, 1 in centre of opercular region, 1 supratemporal (minute), 1 between this and anterodorsal pore of eye. Colour: "yellowish-brown, paler below, without evident markings; all the fins yellowish" (Norman).

REMARKS. The above specimen differs in no essential features from Norman's description of the species, except that the dorsal origin of the paratype lies slightly behind level of pectoral base while that of the holotype (as illustrated by Norman in fig.11) is a little further forwards.

Norman (1939: 38) placed this species provisionally in the genus **Conger** Oken, 1817 no doubt in consideration of the essentially uniserial teeth in the jaws forming more or less of a cutting edge, and the configuration of the premaxillary-vomerine patch of teeth. However, although the teeth of the present species are indeed similar to those of some species of **Conger** it has other characters which clearly refer it to **Congriscus**, as described in detail

by Asano (1962: 71, 82). In **C. maldivensis** the lips are rather narrow, the snout is very short and not depressed, the eye is relatively large and the dorsal originates over the branchial aperture. In **Conger** the snout is not foreshortened but depressed, the eye is relatively small, especially in large individuals, and the dorsal origin is usually over the posterior half of the pectoral. A radiograph of the specimen described above shows the presence of a large otic bulla, while in **Conger** this structure is only weakly developed. **C. maldivensis** is clearly a species which inhabits deepish water, while all species of **Conger** live on the shallower portions of the continental shelf.

Only the type species, **C. megastomus** (Günther, 1880) has so far been recognised for the genus. This has head 5.9–7.2 in total, that of **C. maldivensis** is 5.5–6.0. The eye of **C. maldivensis** is subequal to snout, that is, a little smaller than in the Japanese species. Perhaps more significantly the paratype of **C. maldivensis** has fewer pores before level of vent (ca.40, compared with 46–52 in **C. megastomus**), fewer precaudal vertebrae (47, compared with 54–59) and fewer total vertebrae (148, compared with 150–159).

Conger Oken, 1817

Type **Muraena conger** Linnaeus, 1758 (Europe). Body rather robust, although relatively more slender in small specimens, with caudal region moderately attenuated and vent placed well before middle of length. Snout short, hardly overlapping tip of lower jaw when mouth closed; eye relatively small, particularly in large specimens; lips very well developed, fleshy, the upper supported by a triangular preorbital bone without ventral projections into the lip. Mouth moderately large, reaching a vertical from middle of eye or perhaps slightly further back. Teeth never very large but numerous, increasing in number with age; those of the jaws essentially uniserial or perhaps biserial, triangular, compressed, with the bases arranged across the jaw so that the teeth form a distinct cutting edge, sometimes with a subsidiary row of much smaller teeth on either side of the main row, especially anteriorly and in very large specimens; teeth on the premaxillary-ethmoid in an elongate-oval transverse patch confluent with a short, triangular patch on the anterior part of the vomer. Dorsal origin usually near level of pectoral tip, sometimes further forwards or back but never directly over or in front of the level of the branchial aperture as in many other congrid genera. For further definitive features see the revision of the genus (Kanazawa, 1958) and also Asano (1962) for osteology. Atlantic, Indo-Pacific; most species in shallow water of warm-temperate seas, six in the Atlantic and about nine in the Indo-Pacific. Two species in the western Indian Ocean are here recognised.

KEY TO SPECIES *

1 (2) Dorsal origin over pectoral tip or further back; a sensory pore behind and in line with angle of mouth ..... **C. wilsoni**

2 (1) Dorsal origin over anterior half of pectoral fin; a sensory pore behind and above angle of mouth ..... **C. cinereus**

CONGER WILSONI (Bloch & Schneider, 1801) **Plate 106 E**

Gymnothorax wilsoni Bloch & Schneider, 1801: 529 (Australia, original reference).

Conger conger (**non** Linnaeus). Smith, 1949–65: 392, fig.1110 (Cape to Delagoa Bay); Baissac, 1957: 21 (Mauritius).

Conger vulgaris (**non** Cuvier). Barnard, 1925: 188 (Cape).

Conger jordani Kanazawa, 1958: 250; Smith & Smith, 1966: 138 (adult and larva).

L. Conger wilsoni (Bl. & Schn.). Della Croce & Castle, 1966: 153 (larva, Mozambique Channel).

MATERIAL EXAMINED. 24 specimens (21 young and adults, 3 metamorphic larvae), as follows: 14 specimens 317mm-482mm total lengths, Knysna, 15/3/57.

446mm, no data; 524mm, Port Alfred, January 1967; 584mm, Summerstrand, near Port Elizabeth, 17/3/67; 701mm, no data; 723mm, off Bird Island, Algoa Bay, 2/8/60; 1149mm, Port Alfred, 2/2/59; 1472mm, Algoa Bay, March 1967; metamorphic larvae: 81.2mm, Knysna, February 1958; 76.8mm, 83.8mm, no data. All specimens in the Department of Ichthyology Collection, Rhodes University.

DESCRIPTION. **Immatures and adults**, proportional measurements in per cent of total length: standard 97.6–99.1, head 12.1–14.3, snout 2.8–3.6, eye 1.8–2.2, interorbital 1.9–2.4, cleft of mouth 4.0–5.4, branchial aperture 1.4–2.3, branchial interspace 3.6–4.6, pectoral 3.7–4.6, predorsal 17.2–21.3, snout-vent 34.5–39.4, depth at pectoral

*The larvae recorded as **Leptocephalus morrisii** Gmelin, 1789 by Bleeker (1860:56), Gilchrist (1902: 155) and Thompson (1916: 80) from the Cape are of doubtful identity. It is most unlikely that they belong to **Conger conger** (Linnaeus, 1758), the adult of **L. morrisii.** Those recorded by Barnard (1925: 219) from the South African Museum under the names **L. morrisii** and **L. Congri vulgaris** have myomere counts agreeing with **Conger conger** but their origin is unknown and I would suggest that they are specimens accessioned from European sources. It is extremely doubtful that even as larvae **Conger conger** reaches as far south as the Cape.

base 4.8–6.3, depth at vent 5.0–6.6. Branchiostegal rays 8–9, pectoral rays 14–17, dorsal rays before level of vent 44–62, total dorsal rays 238–276, anal rays 193–235, caudal rays 5+4, lateral line pores before level of vent 37–40 (mean 38.0). Vertebrae (10 specimens): precaudal 49–50, caudal 90–92, total 140–142. Teeth increasing with age, in the 524mm specimen as follows: maxilla 49, dentary 38 (with 4 extra teeth on each side anteriorly and a medial row of 7 minute teeth), premaxillary-ethmoid 20 in an oval patch, vomer 15 in a triangular patch; the largest specimen (1472mm) has three rows of teeth on upper and lower jaws. Cephalic pores: a minute pore on ventral face of snout; one pore behind base of anterior nostril tube; two pores on anterodorsal tip of snout; three pores along upper jaw, the first two covered by upper lip; one pore behind and level with rictus; one pore on midline of occiput; 10 pores along the mandible and opercular bones. Colour: brownish grey to a point halfway between lateral line and the ventral midline, creamish white below; lower half of head creamish white; dorsal and anal fins margined with a relatively wide band of black.

Metamorphic larvae: myomeres 52–59 preanal, 79–93 post-anal, 138–145 total, last vertical blood vessel at about myomere 51–52, dorsal rays 262–269, anal rays 198–236, 11–20 myomeres between dorsal and anal origins. There is a paired longitudinal series of melanophores along the ventral body wall from throat to vent but no pigment spots on the lateral body wall; pigment also occurs on the bases of the anal rays and on the body wall above the anal base as an extension of the anterior ventral series. Larvae, as exemplified by the single specimen described previously (Della Croce & Castle, 1966: 153) from the Mozambique Channel, have closely similar characters to those of **C. wilsoni** from New Zealand (Castle, 1964: 21, fig.9 A–C). The body is deeper, more leaf-like and transparent than metamorphic specimens, with the dorsal origin further back and larval teeth on the jaws.

REMARKS. **Conger** Oken, 1817 is the largest of all congrid genera. Fortunately it is systematically well known, mainly through the recent detailed study by Kanazawa (1958) who revised the genus on a worldwide basis. Asano (1962) has provided similar valuable information on the Japanese species of the genus. These studies contain the essential data by which the various species of **Conger** can now be firmly identified and compared.

Kanazawa's key to the species (1958: 230–231), together with his descriptions, clearly demonstrate that the distinguishing characters of the species are complex. Unlike some other genera of congrids (e.g. **Ariosoma**) in which marked disparities between the ranges of vertebral numbers from species to species facilitate their identification, the genus **Conger** does not seem to have so differentiated. Indeed, of the 14 species of **Conger** recognised by Kanazawa nine have vertebral numbers within the relatively narrow range 136–152. A number of other characters therefore need consideration in distinguishing the species. These include the number and disposition of cephalic sensory pores, the number of pectoral rays and lateral line pores before level of vent, the disposition of teeth, the size of eye and the position of dorsal origin.

On the basis of such characters Kanazawa's key is quite satisfactory although it is so constructed that it does not show the actual relationships of the species particularly well. For example, **C. jordani** Kanazawa, 1958 and **C. wilsoni** (Bloch & Schneider, 1801) are rather distantly separated in the key but their essential characters show that these two species are so similar that in practice they are only distinguished with some difficulty. The particular feature by which they have been separated is the pattern of distribution of the teeth on the jaws. **C. jordani** has these teeth generally in one row in each jaw with a subsidiary medial row while **C. wilsoni** and a whole group of other species have teeth on each jaw in two rows (at least in large specimens). As noted elsewhere (Castle, 1964: 20, fig. 6 E; Della Croce & Castle, 1966: 154) the teeth of **C. wilsoni** are essentially in a single row with a few teeth anteriorly in a medial row. Teeth increase with age in **Conger**, as has been amply demonstrated (Kanazawa, 1958: fig. 2; Castle, 1964: fig. 7) so that this feature should be used with considerable caution in distinguishing the species. Many species of **Conger** have not been examined in detail over their whole growth range and the extent to which body proportions alter with age is not well known, with possible resultant confusion in identification.

The conger eels of the type described above from shallow waters of southern Africa were earlier referred to **C. conger** (L.) a species which is known to extend only as far south as the Canary Islands in the eastern Atlantic. **C. conger**, amongst other distinguishing characters, has 44–47 lateral line pores before level of vent, 17–20 pectoral rays and 148–153 vertebrae (Kanazawa, 1958: 248, tab. 3) while South African specimens have 37–40 pores before level of vent, 13–17 pectoral rays and 140–144 vertebrae. They are thus quite distinct from the Atlantic species. The South African conger has been referred more reasonably to **C. jordani** by Kanazawa (1958: 251) although the latter pointed out that the two specimens he examined from Port Alfred, South Africa had the dorsal origin somewhat further forwards than in Japanese **C. jordani.**

In order that the present species be more readily evaluated in relation to its precise systematic position, various characters are set out in Table 1 and a comparison made with these characters in Japanese **C. jordani** and New Zealand **C. wilsoni**, its closest relatives.

The figures given clearly show that there are no essential differences in major body proportions or counts in material from the three areas. Indeed, the only difference appears to be in the number of dorsal and anal fin-rays, South African specimens having appreciably fewer, particularly in the dorsal, even though the average position

of the dorsal origin is slightly further forwards than in New Zealand **C. wilsoni** or Japanese **C. jordani.** Such a difference is small compared with the differences shown between other species of the genus.

TABLE I

Comparison of **Conger jordani** (Japan; data from Kanazawa, 1958: 250), **C. wilsoni** (New Zealand: data from Castle, 1964: 19) and **C. wilsoni** (South Africa).

Items	**C. jordani** (Japan)	**C. wilsoni** (N.Z.)	**C. wilsoni** (S.A.)
Total length (mm)	409–635	70–628	317–723
Head	12.6–14.8	12.5–16.3	12.1–14.3
Snout	3.0–3.7	3.2–4.5	2.8–3.6
Eye	1.8–2.6	1.9–3.9	1.8–2.2
Interorbital		2.1–3.6	1.9–2.4
Upper jaw	3.6–5.1	4.5–6.4	4.0–5.4
Branchial aperture		1.1–2.3	1.4–2.3
Branchial interspace		2.1–4.2	3.6–4.6
Pectoral	4.0–5.6	3.4–5.5	3.7–4.6
Predorsal	18.0–21.7	19.1–21.9	17.2–21.3
Snout-vent	35.2–38.8	34.2–39.1	34.5–39.4
Depth at vent		4.0–6.0	5.0–6.6
Pectoral rays	15–18	16–18	14–17
Dorsal rays	301–307 (2)	294–330	238–276 (10)
Anal rays	225–240 (2)	229–261	193–235 (10)
Lateral line pores before vent	36–40	36–41	37–40
Precaudal vertebrae	48–50		49–50 (6)
Total vertebrae	141–143	141–149	140–142 (10)

In consequence, there would seem no reason to regard the eels of the three areas as distinct species. Rather, they might more accurately be considered as subspecies or variants of **C. wilsoni** differing only in fin-ray numbers and possibly in modal number of vertebrae. These differences may result from variations in the environmental conditions of the spawning areas during development of the embryo. They nevertheless suggest almost complete geographical separation of the three forms and possible ultimate speciation, with only limited present contact through movements of larvae.

Having seen abundant material from New Zealand and southern Africa I have no hesitation in referring the latter to **C. wilsoni** but hesitate to disrupt the current nomenclature of the Japanese form, especially as I have not had material to hand. More importantly, there appears to be some disagreement as to what species of the genus **Conger** actually occur in Japanese waters. Kanazawa recognises four species in that area; **C. cinereus** Rüppell, 1828, **C. myriaster** (Brevoort, 1856), **C. erebennus** (Jordan & Snyder, 1901) and **C. jordani**; **C. japonicus** Bleeker, 1879 is regarded by him as a synonym of **C. myriaster**. However, Asano (1962) recognises only three: **C. cinereus, C. myriaster** and **C. japonicus** (with synonyms **C. jordani** and possibly **C. erebennus**). The original description of **C. japonicus** (Bleeker, 1879a: 32, pl. 2, fig. 2) shows an eel with a large pectoral fin, the tip of which extends to slightly beyond the level of the dorsal origin, there are 260 dorsal rays and 170 anal rays and there are two rows of teeth in the jaws—characters entirely inconsistent with **C. jordani** as described by Kanazawa and which Asano included under **C. japonicus.** I am inclined therefore to agree with Kanazawa in his synonymy but the question would best be solved by reference to the type specimen of **C. japonicus**, if it is still in existence. * Until the matter is settled the Japanese species is best considered distinct from its southern counterparts.

Although the African and Australasian populations of adult **C. wilsoni** are apparently not in contact there is a possibility that movement of their larvae may occur so as to cause a very limited mixing of these populations. Larval **C. wilsoni** are now known from the eastern Indian Ocean in the general area where the northward-moving current off the west coast of Australia is turned strongly to the west as the South Equatorial Current. This current ultimately enters the western Indian Ocean and may possibly carry with it larvae derived from west Australian stocks of **C. wilsoni**. Unfortunately, no collections of leptocephali in the central Indian Ocean have yet been reported on to state how effective such exchange of larvae may be. Larval **Conger** are not abundant in the large collections of eel-larvae which have been examined by the present author from the Australasian region, even though leptocephali of other congrids (notably **Ariosoma** and **Gnathophis**) are exceedingly numerous.

*__C. japonicus__ was originally reported by Bleeker (1879a:32, pl.2, fig. 2) from material in the Hamburg Museum. The type cannot be located there (Dr. W. Ladiges, pers. comm.) and was possibly destroyed during the 1939–45 war. Neither is it at the Rijksmuseum van Natuurlijke Historie, Leiden, where much of Bleeker's collection is lodged (Dr. M. Boeseman, pers. comm.).

Only a single larva of **Conger** has been identified in the collections of eel-larvae examined from the waters of southern Africa (Della Croce & Castle, 1966: 153). Undoubtedly, spawning of **C. wilsoni** takes place in the western Indian Ocean but the location of this spawning area is unknown. A few metamorphic specimens have been identified but as the larval life of **Conger** is probably about a year these metamorphics may have travelled some considerable distance from the area of early development.

CONGER CINEREUS CINEREUS Rüppell, 1828 **Plate 106 F**

Synonymy (western Indian Ocean only):

Conger cinereus Rüppell, 1828: 115, pl. 29, fig.1 (Red Sea); 1852: 32; Peters, 1855: 248, 270 (Mozambique); Klunzinger, 1871: 607 (Red Sea); Pfeffer, 1901: 40 (East Africa); Barnard, 1925: 188 (Natal); Tortonese, 1937: 15 (Red Sea); Smith, 1949–65: 393, pl. 99, fig. 1111 (western Indian Ocean as far south as the Bashee, Pondoland); 1958a: 58 (Aldabra); 1958b: 135 (Inhaca, southern Mozambique); Ben-Tuvia & Steinitz, 1952: 4 (Red Sea); Morrow, 1954: 805 (Comores, Madagascar, Europa); Fowler, 1956: 49 (Red Sea); Baissac, 1957: 21 (Mauritius); 1958: III (append.B) (Rodriguez); Fourmanoir & Guézé, 1961: 5 (Réunion); Smith & Smith, 1963: 56, pl. 47 G (Seychelles).

Conger cinereus cinereus Rüppell. Kanazawa, 1958: 234, figs. 4–6, pl. 2 (western Indian Ocean).

Leptocephalus congricinerei (Rüppell). D'Ancona, 1928a: 38, pl. 3, figs. 1–2c (Red Sea, Gulf of Aden); 1928b: 429; 1930: 271, fig. 5; Fowler, 1956: 109; Klausewitz, 1964: xxvi.

Conger marginatus (**non** Valenciennes). Günther, 1870: 38 (Indian Ocean, Zanzibar); 1910: 393 (east coast of Africa); Bleeker, 1875: 72 (Mauritius); 1879b: 22 (Mauritius); Peters, 1876: 445 (Mauritius); Möbius & Peters, 1883: 57 (Mauritius); Sauvage, 1891: 500, 527, pl. 49a, fig. 2 (Mauritius); Norman, 1922: 320 (Natal); Gudger, 1929: 516 (Mauritius).

Conger altipinnis Kaup, 1856a: 72 (Réunion); 1856b: 114 (Réunion); Guichenot, 1863: 29 (Réunion); Playfair & Günther, 1866: 125 (Red Sea, Zanzibar, Mozambique); Günther, 1870: 38 (Indian Ocean, Zanzibar); Gudger, 1929: 516 (Mauritius).

MATERIAL EXAMINED. 56 specimens 54mm–1030mm total lengths, as follows: Seychelles (Mahé, Denis: 5 specimens 54mm–246mm); Amirantes (D'Arros: 2 specimens 104mm–166mm); Aldabra and Cosmoledo (3 specimens 73mm–303mm); Kenya (Malindi; Mombasa; Shimoni: 20 specimens 62mm–710mm); Zanzibar (1 specimen 281mm); Mozambique (Ibo; Pinda; I. Mozambique; Quirimba; Inhaca: 9 specimens 73mm–482mm); South Africa (Kosi Bay, Zululand; Durban; Mtentwana Pt. and Xora, Transkei; Knysna: 12 specimens 69mm–1030mm); no data (4 specimens: 120mm–228mm).

DESCRIPTION. Proportional measurements in per cent of total length (10 specimens, 196mm–351mm total lengths): head 12.2–12.8, snout 2.7–3.3, eye 1.7–2.2, interorbital 1.6–1.9, upper jaw 4.2–4.8, branchial aperture 1.5–1.9, branchial interspace 3.4–4.2, pectoral 2.6–3.1, predorsal 12.7–14.1, snout-vent 31.6–36.2, depth at vent 4.4–5.8. Branchiostegal rays 8–9, pectoral rays 15–19, dorsal rays before level of vent 65–79, total dorsal rays 273–333, anal rays 229–287, caudal rays 4–5+4–5, lateral line pores before level of vent 37–41. Vertebrae: precaudal 52–55, total 141–148. Teeth increasing with age, essentially as in **C. wilsoni**, except that the medial row on each jaw is often more well developed in large specimens. Cephalic sensory pores as follows: 4 around anterior nostril, 6 along upper lip of which the last lies above angle of mouth, 2 supraorbital, 3 postorbital, 10 along lower jaw and opercular region, 1 on midline of occipital region. Colour in life: brown to grey above, yellowish below and on the fins, the median fins with a narrow black edging for their whole length, pectoral fin (especially in specimens of over 300mm) with a conspicuous black patch on its rear edge or on the posterodorsal corner, in addition a dark bar under the eye. Younger specimens are yellowish and often show dark vertical bars along the whole of the body. Very small specimens (100mm) retain some of the larval pigmentation i.e. a paired series of minute melanophores from the throat to the vent, continuing along the body wall above the anal base. Kanazawa (1961a: 115) described this pigmentation in young **C. cinereus** and in **Paramyrus kellersi** Fowler, 1932 (which is a synonym of the former). There are also minute melanophores on the bases of the anal fin-rays but the midlateral row of melanophores occurring in the larva are lost at metamorphosis. The spots above the anal base make it possible to identify very young **Conger** without reference to other characters.

REMARKS: **C. cinereus** is readily recognised amongst the species of **Conger** in having the origin of the dorsal placed level with the middle of the pectoral or before this point, a sensory pore immediately above angle of mouth, as well as by having black markings on the pectoral, beneath the eye and along the borders of the dorsal and anal fins. A number of other characters may be used in distinguishing **C. cinereus**, including the shape of the lateral line ossicles, which is unique in the genus (see Asano, 1962: fig. 7 C). **C. cinereus** might perhaps be set aside as a separate subgenus of **Conger**, for which the name **Forskalichthys** Whitley, 1935 (or possibly **Microconger** Fowler, 1912) is available. Larvae of **C. cinereus** are readily distinguished from those of **C. wilsoni** and **C. verreauxi** Kaup in having midlateral pigment but so are those of **C. conger** which in adult characters is otherwise unlike **C. cinereus**. Larval characters are therefore of little value in indicating possible subdivision of the genus **Conger**.

C. cinereus is the most characteristic congrid eel of the Indo-Pacific and it has been reported from almost every locality from the Red Sea to the southern coast of Africa, the whole of the Indian Ocean, Indo-Malaya, and all of the Central Pacific excluding Pacific Central America. It favours the warm waters of coral reefs but in southern Africa it has been found as a straggler as far south as the Knysna estuary where temperatures range from 15°C. to 20°C. (Day, 1967: 398). **C. cinereus** is particularly abundant along the warmer shores of the western Indian Ocean and around adjacent island groups. Individuals of all sizes occur together although the smaller ones are more frequently collected in tidal areas. The adults probably move out at night to forage.

Postmetamorphic specimens have been taken during August-November in the western Indian Ocean so that metamorphosis probably takes place during June-July some distance offshore. D'Ancona (1928a: 38–40, pl.3, figs.1–2c) describes four larvae from the Red Sea, the smallest of which was 28mm indicating that spawning of **C. cinereus** occurs in this area if not elsewhere in the western Indian Ocean. The 28mm specimen was taken in May suggesting a spawning in March-April in the Red Sea. As postmetamorphic specimens have been taken as far south as the Transkei coast (South Africa) it is reasonable to suggest that spawning and larval growth of **C. cinereus** must also take place in the south, unless the larval life is rather long allowing the leptocephali from a possible northern spawning area to be carried southwards.

The present specimens conform closely with the description of **Conger cinereus cinereus** by Kanazawa (1958: 234, figs. 4–6, pl. 2). **C. c. marginatus** from Hawaii has, on the other hand, rather more vertebrae (148–152), more numerous pectoral rays and the dorsal origin placed slightly further back. These differences, when compared with the differences which distinguish other species of **Conger**, are minor and there seems little justification for regarding Hawaiian specimens as representative of a distinct species **C. marginatus**.

Gnathophis Kaup, 1860

Type **Myrophis heterognathus** Bleeker, 1859 (Japan). Body rather slender, with caudal region moderately attenuated and vent placed well before middle of length. Snout moderate, overlapping tip of lower jaw when mouth closed; eye large; upper lip weak, supported by two small preorbital bones which send three ventral processes into the lip; lower lip well developed, fleshy. Mouth rather short, barely reaching a vertical from middle of eye. Teeth very small, cardiform on jaws and "premaxillary", bluntly conical and in an elongate-oval patch on the vomer. Dorsal origin over middle of pectoral. For further definitive features see Asano (1962) under **Rhynchocymba** Jordan & Hubbs, 1925, which is a synonym. Atlantic, Indo-Pacific; shallow water of temperate seas, one species in the Atlantic, at least four in the Indo-Pacific, one in the eastern Pacific; here recognised as two species in the waters around the southern coast of Africa and a third species (Atlantic) once recorded from the Suez Canal and unlikely to occur in the main part of the western Indian Ocean.

KEY TO SPECIES

1 (4) Vertebrae more than 127, head more than 6.0 in total length, dorsal rays more than 200;

2 (3) Eye 4.5 in head, lateral line pores about 38 before level of vent, vertebrae 128–135 ..... **G. capensis**

3 (2) Eye 5.5 in head, lateral line pores about 35 before level of vent, vertebrae 134–141 ..... **G. mystax**

4 (1) Vertebrae less than 128, head less than 5.5 in total length, dorsal rays less than 200 ..... **G. habenatus**

GNATHOPHIS CAPENSIS (Kaup, 1856) **Plates 106 G, 108 C.D.F**

Leptocephalus capensis Kaup, 1856: 153 (Cape of Good Hope; a larval specimen); Playfair & Günther, 1866: 129; Günther, 1870: 143; Sauvage, 1891: 527; Cunningham, 1895: 280; Gilchrist, 1902: 155; Thompson, 1916: 80; Barnard, 1923: 443; 1925: 219, fig. 13; D'Ancona, 1928a: 121 (**incertae sedis**); Bertin, 1935: 100 (type re-examined); Castle, 1968b (in press).

Leptocephalus yarellii (**non** Kaup). Strömman, 1896: 5–6.

Leptocephalus sicanus (**non** Facciola). Strömman, 1896: 5–6.

Congermuraena australis Barnard, 1923: 442; 1925: 190.

Ariosoma balearica (**non** De La Roche). Smith, 1949–65: 393.

Ariosoma australis (Barnard). Penrith, 1967: 538, fig.1a, tab. 6.

Leptocephalus Gnathophis incognitus (**non** Castle). Della Croce & Castle, 1966: 152 (Mozambique Channel, probable mis-identification).

MATERIAL EXAMINED. 11 young and adult specimens as follows: 160mm total length, off Cape Peninsula in 120 metres, "Pieter Faure", South African Museum No. 12779; 245mm total length, Kalk Bay (False Bay), 1/8/1904, "Pieter Faure", S.A.M. No. 12780; 210mm, 229mm, 281mm, total lengths, Kalk Bay (False Bay), 1910 "Pieter Faure", S.A.M. No. 12781; 190mm total length, Tristan da Cunha, 1909, S.A.M. No. 12782; 225mm total length, ?coast of Southwest Africa, 1919, S.A.M. No. 15481; 199mm total length, Kalk Bay (False Bay), S.A.M. No. 17611; 286mm total length, False Bay, February 1931, S.A.M. No. 18097; 374mm total length, Tristan da Cunha, 1949, S.A.M. No. 24551; 326mm total length, Plettenberg Bay, 24/4/61, Rhodes Univ. Collection

The first seven specimens are syntypes of **Congermuraena australis** Barnard. In addition 165 larvae and metamorphic specimens as described elsewhere (Castle, 1968b in press) from off the coast of southern Africa. The Division of Sea Fisheries Collection was not completely checked through for larvae of this species, and since the latter report some 62 additional specimens have come to hand from this collection.

DESCRIPTION. **Adult** (proportional measurements in per cent of total length): standard 98.1–99.5, head 15.2–16.8, snout 4.0–4.8, eye 3.0–3.8, interorbital 1.1–2.5, cleft of mouth 5.3–6.1, branchial aperture 1.1–2.4, branchial interspace 3.0–4.8, pectoral 4.0–6.2, predorsal 16.3–18.7, snout-vent 36.8–41.4, depth at pectoral 4.8–6.3, depth at vent 4.0–5.0. Branchiostegal rays 8–9, pectoral rays 12–14, dorsal rays before level of vent 42–52, total dorsal rays 200–225, anal rays 125–150, caudal rays 5+4. Lateral line pores before level of vent 32–40, total lateral line pores ca.130. Vertebrae (7 specimens): precaudal 44–45, caudal 84–90, total 128–135. Teeth in the 281mm specimen: maxilla ca.38 along outside row, dentary ca.34 along outside row, premaxillary-ethmoid ca.18, vomer triserial with ca.12 teeth in each row. Cephalic pores: two minute pores on the under surface of the snout immediately in front of the "premaxillary" patch of teeth; a large slit-like pore on the anterodorsal surface of the snout; one pore above the base of the anterior nostril; three slit-like pores along the upper lip and one slit-like pore behind the rictus; one pore each above the anterodorsal and posterodorsal corner of the eye; three post-orbital pores; one pore on the midline of the occiput; two commissural pores on each side between this and the first pore of the lateral line; mandibulo-preopercular pores about 10. Colour: "Brown, the vertical fins with dark edging" (Barnard 1923: 443).

Body slender, not greatly elongate or compressed, with the vent placed well in front of the mid-length, Head about 6.3 in total; snout acute, about 3.5 in head, projecting conspicuously in advance of lower jaw; eye rather large; mouth noticeably subterminal, extending almost to below middle of eye; lips rather weak, especially the upper. Teeth cardiform on jaws, in a subcircular patch on the "premaxillary" and in 3–4 rows on the vomer; teeth generally acute, but those on the vomer blunter, conical. Anterior nostril subterminal, subtubular with the medial edge of its rim incised to form a free flap, and the tube directed anteroventrally. Dorsal origin above middle of pectoral, caudal rather short. Lateral line with obvious, simple pores which are barely raised above the surface of the body; minute surface sensory organs, in the form of minute papillae, cover the surface of the head and snout.

Larvae: length of body reaching about 150mm at full growth, myomeres 132–140, first major vertical blood vessel to intestine at myomere 12–14, last at myomere 47–50, anterior margin of gall bladder at myomere 36–39, teeth increasing with age ($\frac{I + VIII + 15}{I + VIII + 7}$ in a 135mm specimen), dorsal rays 164–222, anal rays 137–163, caudal rays 5+4, dorsal origin and anal origin separated by about 13–29 myomeres. The body is elongate, but not excessively so; a pectoral is present at all stadia of growth; the intestine is straight and unmodified; the vent is subterminal except during metamorphosis when it moves forwards along the body to its final position. Black pigment is present as a crescentic patch on the posteroventral margin of the iris, on the throat as three or four melanophores, as a double series of melanophores longitudinally placed on the ventral body wall from throat to vent and spaced at about one pair of spots every 2–3 segments; minute melanophores also occur on the bases of the anal rays and the terminal dorsal rays as well as deep on the spinal cord. These characters are described and illustrated elsewhere in detail (Castle, 1968b in press).

Although no elvers of this species have yet been collected it is likely that they will possess remnants of the larval pigmentation in the form of a scattering of pigment ventrally on the abdomen and on the bases of the anal rays. **Conger** larvae, on the other hand, have in addition the ventral series of melanophores continuing along the body wall above the anal base; larvae of **C. conger** and **C. cinereus** also have a midlateral series of melanophores. REMARKS. The generic and specific identity of **Gnathophis capensis** has been briefly discussed elsewhere (Castle, 1968b in press) for the purposes of assigning a correct name to the multitude of larvae of this species present in South African collections. However, it is considered appropriate here to discuss the structure of the genus **Gnathophis**, as it is now known, and particularly the relationships of **G. capensis** to Atlantic and Australasian species with which it may be confused.

Barnard originally described the species as a member of the genus **Congermuraena** Kaup, 1856. The latter has a long and unfortunate history of being used as a convenient dumping ground for various congrid eels of several genera which are now known to be distinct. Some of this generic confusion has recently been resolved. Nevertheless, many of the deep-water forms to which **Congermuraena** has been applied are still imperfectly known for them to be assigned precise places in the Congridae, on the literature alone. In establishing **Congermuraena**, Kaup (1856a: 105) unknowingly included species of two different genera. Bleeker (1864a: 116) later selected **Muraena balearica** De La Roche, 1809 as the type of **Congermuraena**, Kaup not having specified one. **M.**

balearica, however, is the same as **Ophisoma acuta** Swainson, 1839, the type of **Ariosoma** Swainson, 1838. **Congermuraena** is therefore a synonym of **Ariosoma**.

Kaup also included **Muraena mystax** De La Roche, 1809 and **Congrus habenatus** Richardson, 1848 in his **Congermuraena**. As has been previously shown (Castle, 1963: 17), the latter species must be referred to **Gnathophis** Kaup, 1860, type species **Myrophis heterognathus** Bleeker, 1859 from Japan. Other Indo-Pacific species and De La Roche's **Muraena mystax** itself must also be referred to **Gnathophis**. The salient features of **Gnathophis** as compared with other congrid genera are the presence of three ventrally or anteroventrally directed, prong-like projections of the preorbital bone into the upper lip, anterior nostrils rather ventrally directed and with the nasal tube having a scroll-like or incised margin, the dorsal origin over the middle of the pectoral, granular vomerine teeth, an inconspicuous lateral line with the pores not raised above the surface, and larvae with a double longitudinal row of melanophores from throat to vent but not continued above anal base.

In an earlier study (Castle, 1960: 464) the identity of the eels described by Smith (1949–65: 393) under the name **Ariosoma balearica** Swainson (including **Congermuraena albescens** and **C. australis** Barnard, 1923) was discussed. The information obtained at that time led me to refer these eels to **Pseudoxenomystax** Breder, 1927 and to distinguish them clearly from **Ariosoma.** However, I have since determined that this information was taken from a specimen of Barnard's **Congermuraena albescens** and not from his **C. australis**. The former must therefore be known as **Pseudoxenomystax albescens** (as discussed elsewhere in this report). The major distinguishing features of **Pseudoxenomystax** are: upper lip containing prong-like extensions to the ventral edge of the preorbital bone (although these are dorsally fused, not separate as in **Gnathophis**); tubular, anteriorly directed nostrils with an entire rim; vomerine teeth not granular; a raised lateral line with the pores on the ends of conspicuous tubes; hair-like epidermal processes present. Larvae are unknown although they are probably like those of **Gnathophis** or **Conger** and not like those of **Ariosoma**.

Penrith (1967: 538) has recently reviewed the systematic position of Barnard's two South African species, referring both to **Ariosoma** but retaining them as distinct species. An examination of the original type material of Barnard's **C. albescens** and **C. australis**, as well as other material collected since his account, confirms the opinion that the two species are distinct but also shows that neither belongs in **Ariosoma**. Species of the latter do indeed occur on the African coast (e.g. **A. scheelei** and **A. mauritianum**) but are readily distinguished from Barnard's eels.

Congermuraena australis has all the characters consistent with its identification with **Gnathophis**. Most notable are the anterior nostrils with an incised rim, as illustrated for **G. incognitus** Castle, 1963 (fig. 7 C), labial prongs, a rather inconspicuous lateral line, and the dorsal origin over the middle of the pectoral fin. Furthermore, larvae described and illustrated by Barnard (1925: 219, fig. 13) and quite reasonably referred to this species, are clearly those of **Gnathophis** (see Castle, 1963: fig. 2).

In his original description of **Congermuraena australis**, Barnard (1923: 443) noted " . . . As evident from a series of Leptocephali in the South African Museum, this is the adult of the form described by Kaup as **Leptocephalus capensis**" but did not apply the prior name. Kaup's description (1856b: 153) is poor but contains some important observations. It states " . . . A row of points exists on the short anal . . . and the lateral line exhibits neither longitudinal nor transverse rows of points . . . " In other words, larvae of **Conger cinereus** Rüppell, 1828 (with a midlateral row of melanophores), of **Uroconger** (with a closely set midlateral row), of **Congrina** (with three lateral rows), and of the **Ariosoma**-group (with oblique rows of minute melanophores on the myosepta below the lateral line), must be eliminated from consideration as the same as **L. capensis**. Larvae of **Conger wilsoni**, which might be confused with those of **Gnathophis**, are very rare in the waters of southern Africa, while those of **Gnathophis australis** are extremely abundant. The evidence for **L. capensis** being a **Gnathophis** and that in addition it is the young of **G. australis** is therefore convincing. In my opinion the prior specific name should stand and Barnard's **Congermuraena australis** must therefore be known as **Gnathophis capensis** (Kaup, 1856).

Larvae having similar characters as those of **G. capensis** were also described from off the Cape as **L. sicanus** Facciolà, 1883 and **L. yarellii** Kaup, 1856 by Strömman (1896: 5–6). Both of these species were originally described from the Mediterranean but the South African material must be referred to **Gnathophis capensis**.

There remains the question of the relationship of **G. capensis** to other species of the genus. As indicated above, there are a number of Indo-Pacific species of **Gnathophis** and at least one in the Atlantic. These have not been closely compared because it is only recently that their true generic identity has been recognised. The following species are referable to **Gnathophis**: **G. mystax** (De La Roche, 1809) * from the Atlantic and Mediterranean; **G. capensis** (Kaup, 1856) from southern Africa and the South Atlantic; **G. habenatus** (Richardson, 1848) and **G. incognitus** Castle, 1963 from Australasia including Western Australia; **G. catalinensis** (Wade, 1946) from

* Through the kindness of Dr. E. Tortonese, Genova, I have received a 247mm specimen of **Gnathophis mystax** from the Bay of Genova. The characters it possesses confirms my earlier suggestion (1963: 18; 1966a: 25) as to its true generic identity. Dr. Tortonese himself came to the same conclusion (1967: 1).

the East Pacific, and **G. heterognathus** (Bleeker, 1859) (?syn. **G. nystromi** (Jordan & Snyder, 1901)) and **G. xenicus** (Matsubara & Ochiai, 1951) from Japan. These are distinguished on external characters as well as vertebral counts, although as Table II shows, the latter is not in itself a clear character.

TABLE II

Vertebral or myomere counts from various species of **Gnathophis**.

Species:	Area:	Myomeres in larvae:	Vertebrae in adults:
G. mystax	East Atlantic	132–147	134–141
G. capensis	South Africa	132–140	128–135
G. habenatus	Australasia	116–131	120–127
G. incognitus	Australasia	134–150	139–147
G. catalinensis	East Pacific		132
G. heterognathus	Japan		117–134
G. xenicus	Japan		151–157

The species which show closest similarities are **G. mystax** and **G. capensis**, although **G. incognitus** may also be included here. Vertebrae in the single specimen of **G. mystax** examined from the Bay of Genova numbered 134, with dorsal fin-rays 208 and anal rays 164. On these characters **G. capensis** cannot be separated from **G. mystax**. However, the former has a larger eye (4.5 in head) than **G. mystax** (5.5 in head). For the moment, until a more complete series of specimens of both species can be compared in detail it would be unwise to combine the two, especially in view of the almost complete geographical separation of the Atlantic and South African populations and certain separation of their spawning areas. The true relationship of **G. mystax** and **G. capensis** might be better expressed by regarding them as subspecies of **G. mystax** with the possibility of some mixing by way of pelagic larvae through the southern Atlantic.

As I have shown elsewhere (Castle, 1968b in press) the adults of **G. capensis** probably spawn in mid- to late-summer over the continental slope south of Cape Point under the influence of warm Agulhas water which intrudes into the area at this time of the year. The larvae develop in water of 18°C.–19°C. and salinity of greater than $35^{\circ}/_{\circ\circ}$ and are later to be found elsewhere off the South African coast. Metamorphosis of the larvae takes place in early summer of the spawning year so that larval life is about 10 months to a year in duration. The Australasian species (**G. habenatus** and **G. incognitus**), the larvae of which are relatively abundant in water of similar hydrological conditions off the west and east coasts of Australia, apparently have much the same early life-history.

GNATHOPHIS HABENATUS (Richardson, 1848)

Congrus habenatus Richardson, 1848: 109, pl. 50, figs. 1–5 (New Zealand, original description).

Gnathophis habenatus (Richardson). Castle, 1963: 20 (synonymy and literature, description of adults and larvae from Australasian waters).

Western Indian Ocean only:

Species A Barnard, 1925: 222 (juveniles and larvae).

L. Gnathophis habenatus (Richardson). Della Croce & Castle, 1966: 151 (Mozambique Channel).

MATERIAL EXAMINED: Two juveniles: 60mm total length, off Struys Point (south coast), 17/7/02, 90 metres, S.A.M. No. 16233; 82mm, off Nahoon River (East London), 10/7/01, 82 metres, S.A.M. No. 15664; three larvae: 96mm, off Cape Morgan (near East London), 8/7/06, 450 metres, S.A.M. No. 12816; 77mm, off Great Fish Point (near Port Alfred), 5/9/01, 70 metres, S.A.M. No. 12819; 65mm., Algoa Bay, 27/9/01, 70 metres, S.A.M. No. 12821. These specimens were described by Barnard (1925: 222) as **Species A.**

DESCRIPTION. Juveniles (proportional measurements in per cent of total length): head 18.6–18.8, snout 5.0–5.4, eye 3.7, interorbital 1.7, cleft of mouth 7.5–9.2, branchial aperture 1.7–1.8, branchial interspace 3.0–3.8, pectoral 6.3–6.8, predorsal 19.4–20.7, snout-vent 38.4–39.2, depth at pectoral base 5.5–5.7, depth at vent 3.7–4.5. Branchiostegal rays 8–9, pectoral rays 13, dorsal rays before level of vent 32–39, total dorsal rays 173–178, anal rays 129–132, caudal rays 5+4. Lateral line pores before level of vent 32–33. Vertebrae 119–126. Larvae: myomeres 123–127. REMARKS. In an earlier paper (Della Croce & Castle, 1966) dealing with leptocephali collected in the Mozambique Channel, two larvae (one of 71mm total length with 123 myomeres, the other of 62mm total length with 111 preanal myomeres) were described and referred to **Gnathophis habenatus** and **G. incognitus** respectively. In myomere number and position of the last vertical blood vessel (myomere 39), the first-mentioned larva agrees with larvae of **G. habenatus** previously described from Australasian waters (Castle, 1963: 25, figs. 2 A–F, 5 A–C). rather than with those of **G. capensis**. This suggested that **G. habenatus** may possibly occur as an adult in South African waters, in addition to **G. capensis**. This possibility appears to be confirmed by the identification of Barnard's juveniles (**Species A**) as **G. habenatus**, together with further leptocephali of this species, although it would be useful to have specimens of later growth stages, including adults, from South African waters.

G. habenatus has been tentatively recorded from St. Paul island, southern Indian Ocean (Kner, 1865: 374; Sauvage, 1879: 43). Its presence there is here confirmed by the record of a juvenile gnathophid eel (133mm total length) collected there in 1959 (Paris Museum) and kindly sent to the author for examination by Mr. M. J. Penrith, Cape Town. The specimen has a slightly longer head and predorsal than **G. capensis**, less than 200 dorsal rays and about 124 vertebrae, characters which refer the specimen to **G. habenatus**.

Although the above specimens are too few for confidence on this matter, their locality of capture suggests that South African **G. habenatus**, at least as a larva and juvenile, is more typical of the southeast coast, where **G. capensis** of all growth stadia is rather rare. This may be related to the locality of the spawning area of **G. habenatus**, which is possibly off the southeast coast. More specimens of larvae and adults of this species are required before the significance of **G. habenatus**, compared with that of **G. capensis**, in the waters around southern Africa is clearly understood.

Finally, as the larva from the Mozambique Channel (referred to **G. incognitus** by Della Croce & Castle, 1966: 152) was damaged a complete myomere count was not originally possible. At the time of this earlier account the generic identity of Barnard's **Congermuraena australis** was unknown, but I am now in a position to identify this single specimen with **G. capensis**, rather than with the very closely related Australasian species.

GNATHOPHIS MYSTAX (De La Roche, 1809)

Muraena mystax De La Roche, 1809: 328, pl. 23, fig. 10 (original reference, Mediterranean).

Congermuraena mystax (De La Roche). Gruvel & Chabanaud, 1937: 4 (Lake Menzaleh, Suez Canal).

Bathycongrus mystax (De La Roche). Fowler, 1956: 114.

MATERIAL EXAMINED. None from the present area although comparative material has been examined from the Mediterranean.

DESCRIPTION AND REMARKS. The essential characters and relationships of **Gnathophis mystax** have been discussed above under **G. capensis**. The specimen recorded by Gruvel & Chabanaud (1937) from the Suez Canal was obviously a straggler from the Mediterranean and the species cannot be regarded as an established member of the fauna of the Red Sea. **Gnathophis** appears to be restricted to temperate regions.

Pseudoxenomystax Breder, 1927

Type **P. dubius** Breder, 1927 (Caribbean). Body robust, with caudal region rather attenuated and vent placed well before middle of length. Snout moderate, overlapping tip of lower jaw when mouth closed; eye moderately large; upper lip weak, supported by three projections from the ventral margin of the preorbital bone. Mouth relatively large, reaching a vertical from middle of eye. Teeth moderate in size, cardiform on jaws and "premaxillary", multiserial on vomer. Dorsal origin over the base or anterior half of pectoral. Body surface covered with minute epidermal papillae which are scattered and difficult to locate in small specimens but which are profuse in large specimens, giving a "hairy" look to the body. For further definitive features see Castle (1960: 464). Atlantic, southern Indo-Pacific; deep water; about four species, here reported from a single species off the Cape.

PSEUDOXENOMYSTAX ALBESCENS (Barnard, 1923) Plate 106 H

Congermuraena albescens Barnard, 1923: 442 (off Cape Point): 1925: 189.

Ariosoma balearica (**non** De La Roche). Smith, 1949–65: 393, fig. 1113.

Ariosoma albescens (Barnard). Penrith, 1967: 538, fig. 1b, tab. 6.

MATERIAL EXAMINED. 10 specimens: **holotype,** ca. 730mm total length (caudal tip missing), off Cape Peninsula in 500 metres, "Pieter Faure", South African Museum No. 12775; 740mm, 845mm (mature male) total lengths, off Cape Peninsula, January 1962, S.A.M. No. 23198; 641mm total length, Hout Bay beach, 12/12/63, S.A.M. No. 23966; 500mm (maturing female), 802mm (gravid female) total lengths, off Cape Peninsula, 1/6/66, Department of Ichthyology Collection, Rhodes University. Also one head and two damaged specimens, same data as the latter.

DESCRIPTION. Five specimens, 641mm–852mm total lengths, excluding the holotype because of its damaged tail (proportional measurements in per cent of total length): standard 99.0–99.5, head 14.0–15.5, snout 3.5–4.3, eye 2.0–2.4, interorbital 2.4–2.6, cleft of mouth 4.9–5.7, branchial aperture 1.9–2.1, branchial interspace 3.7–4.8, pectoral 3.7–4.6, predorsal 15.2–16.3, snout-vent 39.1–43.1, depth at pectoral origin 5.9–8.3, depth at vent 6.9–8.4. Branchiostegal rays 8–9, pectoral rays 13–14, dorsal rays before level of vent 60–71, total dorsal rays 316–323, anal rays 195–260, caudal rays 4+4. Lateral line pores before level of vent 40–44. Vertebrae (one specimen): precaudal 54, caudal 116, total 170. Teeth (in the holotype): 38 in outside row of maxilla, 34 in outside row of dentary, about 24 in "premaxillary", and in a cigar-shaped patch on the vomer with 12 teeth in the medial row. Cephalic pores: two pores on each side of the midline of the undersurface of the snout, a large slit-like pore on the anterodorsal aspect of the snout, one pore above base of anterior nostril, three pores along upper lip, one pore

behind the rictus, nine pores along the lower jaw and on to the operculum, and a conspicuous pore on the midline of the occiput. Colour: "yellowish white, vertical fins without any traces of dark edging" (Barnard, 1923: 442). Pinkish-brown after preservation, lighter below.

Body robust with a moderately attenuated tail and the vent placed well before mid-length. Head about 6.6 in total; snout rather swollen, about four in head, projecting noticeably in front of lower jaw when mouth closed; eye large, about seven in head; mouth subterminal, extending to below middle of eye; lips very weak, especially the upper. Teeth cardiform in jaws and in about four rows (anteriorly); those on the "premaxillary" in an oval patch which is almost completely exposed when the mouth is closed; vomerine teeth rather blunt, multiserial. Anterior nostril a simple tube almost on tip of snout, directed anteriorly; posterior nostril a wide, oval aperture just in front of eye. Dorsal origin over the middle of pectoral or a little further forwards. Lateral line well developed with the pores on the ends of short tubes, but the pores becoming difficult to distinguish along the posterior part of the caudal region. Minute sensory papillae clustered on snout and in lines on head; body in large specimens covered with well developed, pigmented epidermal papillae.

REMARKS. The identity of the eels described as **Congermuraena albescens** by Barnard (1923: 442) has been briefly discussed above in relation to their inclusion in **Ariosoma** by both Smith (1949–65) and Penrith (1967). As indicated above **C. albescens** can now be definitely referred to **Pseudoxenomystax** Breder, 1927, confirming an earlier suggestion (Castle, 1960: 465). Reference may be made to the latter account for the detailed argument in favour of this conclusion.

Pseudoxenomystax was originally established as a muraenesocid for the type species **P. dubius** but Breder's original description (1927: 6, fig. 2) clearly indicates that this genus belongs in the Congridae. Following the re-description of **Rhynchoconger** Jordan & Hubbs, 1925 by Asano (1962: 100) it seems likely that **Pseudoxenomystax** is closely similar to the Japanese genus (in swollen snout, pattern of teeth, and shape of preorbital bone) but a closer comparison than was possible here is required before the two genera are combined. Although no epidermal processes were noted in the type species by Breder these are not always obvious and they are often in fact, absent from small specimens.

There are two species of **Pseudoxenomystax** in Australasian waters: **P. bulbiceps** (Whitley, 1948) and **P. hirsutus** Castle, 1960 separated on fin-ray counts, shape of pectoral, distribution of epidermal papillae and on pattern of distribution of teeth, although both species have vertebrae numbering about 150–170 with 43–48 pores before level of vent in **P. bulbiceps** and 39–44 in **P. hirsutus**. **P. dubius** is not so well known for such characters but, as is evident from the original description, there are about 28 pores before level of vent, a relatively short snout-vent distance, and a dorsal origin above the rear part of the pectoral. The vertebral number is probably rather low and the Caribbean species is therefore readily distinguished from the Australasian forms.

P. albescens, on the other hand, shows remarkably close similarities to **P. hirsutus**. The only significant difference that I can detect between the two is that the dorsal origin is more posteriorly placed in the South African species. Expressed in per cent of total length the predorsal is 14.2–15.1% of total in **P. hirsutus** with 65–82 dorsal rays before level of vent, while in **P. albescens** the predorsal is 15.2–16.3% of total with 60–71 dorsal rays before level of vent. These differences are small and the relationship of the two species might be better expressed by regarding them as subspecies of **P. albescens**. However, the probably complete geographical separation of the Australasian and South African forms, when taken together with the difference in the position of the dorsal origin, would seem adequate reasons for retaining the two as distinct species, a course which I follow here.

P. albescens is unknown in its larval form, and even juvenile specimens have yet to be collected. However, it is likely that **Pseudoxenomystax** would have larval characters similar to those of the **Gnathophis – Conger – Uroconger** group. Full maturity appears to be reached in **P. hirsutus** only after individuals attain approximately 700mm.

Congrina Jordan & Hubbs, 1925

Type **Congermuraena aequorea** Gilbert & Cramer, 1897 (Hawaii). Body rather slender, with caudal region conspicuously attenuated and vent placed well before middle of length. Snout long, markedly overlapping tip of lower jaw when mouth closed; eye moderately large; lips poorly developed, especially the upper, which contains two or three ventral projections of the preorbital bone. Mouth relatively long but not reaching much beyond a vertical from middle of eye. Teeth large, particularly those on the front of the jaws and on the premaxillary-ethmoid patch which is distinct from the small patch on the vomer. For further definitive features see Asano (1962: 71, 110). Atlantic, Indo-Pacific; about six species recognised and probably more have been described but inadequate descriptions of some congrids prevent their firm identification with this genus; previously recorded from Hawaii and Japan, here recognised as a third and fourth species, one of them new, from the western Indian Ocean, in deepish water.

As has already been pointed out, the generic structure of the Congridae is demonstrably complex and many of the species which have been described under the catch-all genera **Ariosoma** Swainson, 1838, **Congermuraena**

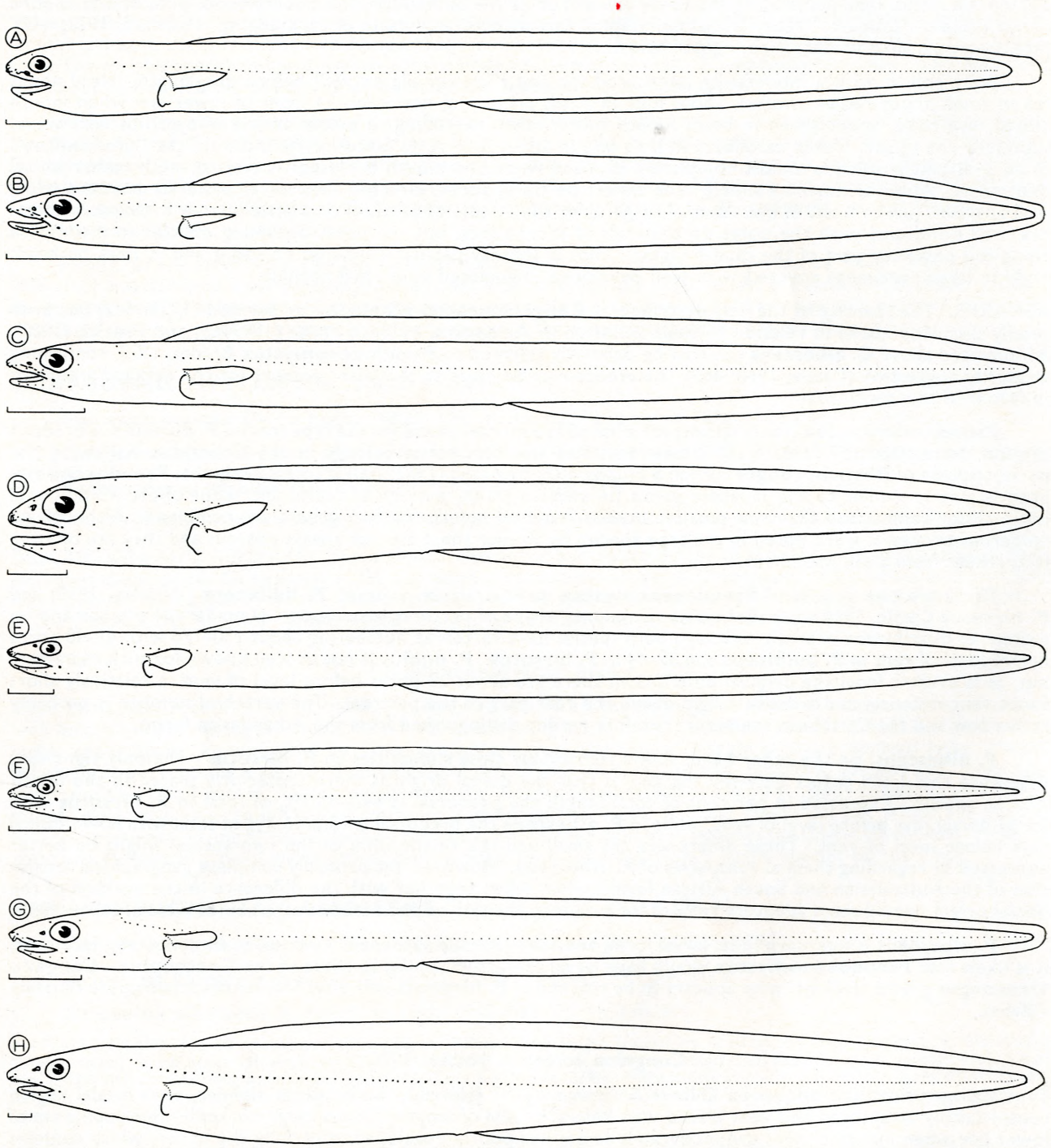


PLATE 106

Fig. A: **Bathymyrus smithi** Castle – holotype, 512mm total length, female. Fig. B: **Ariosoma scheelei** (Strömman) 168mm total length, female. Fig. C: **Ariosoma mauritianum** (Pappenheim) – 262mm total length. Fig. D: **Congriscus maldivensis** (Norman) – paratype, 340mm total length. Fig. E: **Conger wilsoni** (Bl. & Schn.) – 457mm total length. Fig. F: **Conger cinereus cinereus** Rüppell – 328mm total length. Fig. G: **Gnathophis capensis** (Kaup) 281mm total length (syntype of **Congermuraena australis** Barnard). Fig. H: **Pseudoxenomystax albescens** (Barnard) – 852mm total length, female. Scales indicate 2cm.

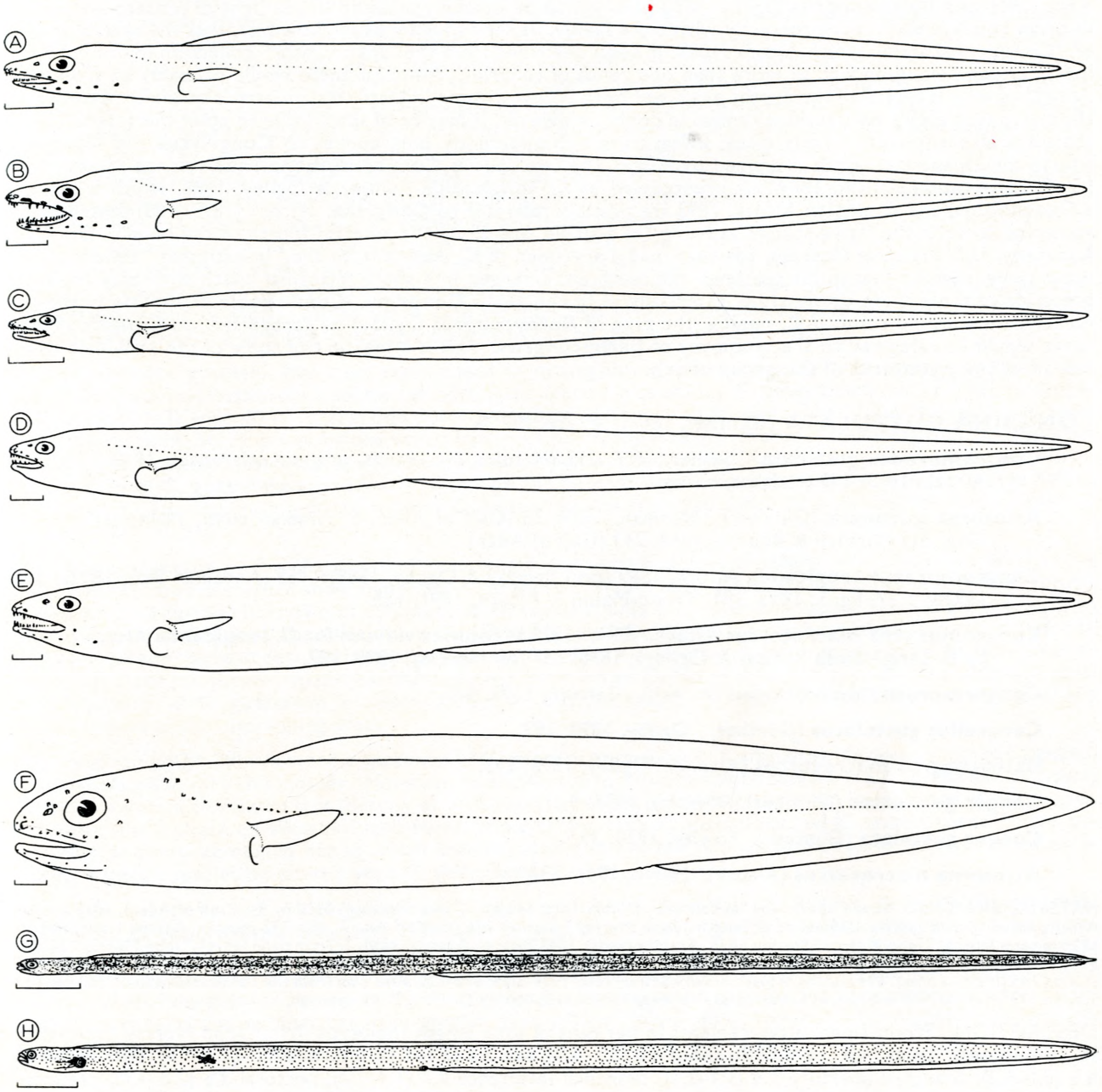


PLATE 107

Fig. A: **Congrina guttulata** (Günther) – 430mm total length, female. Fig. B: **Congrina wallacei** sp. nov. – holotype, 523mm total length, female. Fig. C: **Uroconger lepturus** (Richardson) – 385mm total length, ?male. Fig. D: **Uroconger vicinus** Vaillant – 653mm total length. Fig. E: **Uroconger braueri** Weber & de Beaufort – reconstructed from Brauer (1906). Fig. F: **Coloconger raniceps** Alcock – reconstructed from Alcock (1892b) and Kanazawa (1957, 1961b). Fig. G: **Gorgasia sillneri** Klausewitz – 313mm total length, reconstructed from Klausewitz (1962). Fig. H: **Taenioconger hassi** (Klausewitz & Eibl-Eibesfeldt) – 357mm total length, reconstructed from authors (1959). Scales indicate 2cm.

Kaup, 1856 and **Bathycongrus** Ogilby, 1898 have yet to be carefully assessed in the light of present knowledge in order to place them more correctly within the family. It seems highly likely, however, that the several species of "**Congermuraena**" which Alcock (1889 **et seq.**) described from the "Investigator" collection in the northern Indian Ocean belong, in fact, in more than one genus of congrids. Amongst these would probably be **Congrina** since the genus is typical of the depths examined by the "Investigator". Until this material is carefully re-evaluated the status of Alcock's species must remain in doubt. However, it may be of some value to point out that in having the visceral peritoneum wholly black, a feature which apparently only applies to **Congriscus** and **Congrina** among the Japanese congrids examined by Asano, the two species **Congermuraena macrocerca** Alcock, 1894 (= **C. longicauda** Alcock, 1889 but preoccupied by **C. longicauda** Ramsay & Ogilby, 1888, which is actually a **Gnathophis**) and **C. nasica** Alcock, 1893 are possibly referable to **Congrina**. Alcock (1893: 183) describes the vomerine teeth in the latter species as being "in a single row along the anterior fourth of the bone". Dr. R. H. Kanazawa, U.S. National Museum, has examined a specimen of **C. nasica** from the "Investigator" collection and notes (pers. comm.) that in his specimen the teeth are arranged in a short triangular patch with only the most posterior of these teeth uniserial i.e. essentially as in the genus **Congrina**. Considerable disruption in congrid nomenclature would result if **C. nasica** (the type of **Bathycongrus** Ogilby) be recognised as a **Congrina** as the latter would be relegated to the synonymy of **Bathycongrus**. This is a measure of some of the problems which still afflict the systematics of this group of eels.

CONGRINA GUTTULATA (Günther, 1887) Plate 107 A

Congromuraena guttulata Günther, 1887: 252 (Matuku, Fiji Islands, original reference); 1910: 394 (Fiji); Alcock, 1899: 199 (Malabar, India).

Ariosoma guttulata (Günther). Norman, 1939: 38 (Gulf of Aden, S. Arabian coast, Maldives); Fowler, 1956: 51; Marshall & Bourne, 1964: 243 (Gulf of Aden).

Congromuraena longicauda Alcock, 1889 (**non** Ramsay & Ogilby, 1888): 455 (Andaman Sea); 1892a: 362; 1892b: pl. 7, fig. 5; 1893: 183; Wood-Mason & Alcock, 1891: 135.

Congromuraena macrocercus Alcock, 1894: 133, 134 (**nomen novum** for **C. longicauda** Alcock preocc. by **C. longicauda** Ramsay & Ogilby); 1896: 337 (off Madras); 1899: 197.

Congermuraena macrocercus (Alcock). Garman, 1899: 405.

Congrellus guttulatus (Günther). Ogilby, 1898: 292.

Bathycongrus macrocercus (Alcock). Ogilby, 1898: 293.

Conger guttulatus (Günther). Whitley, 1927: 4.

Conger guttulata (Günther). Fowler, 1928: 39.

Ariosoma macrocercus (Alcock). Herre, 1941: 337.

MATERIAL EXAMINED. Seven specimens, as follows: 430mm total length, "John Murray" Station 34 (Gulf of Aden), 1022 metres, Agassiz trawl, gravid female; 325mm total length "John Murray" Station 176 (Gulf of Aden), 655–732 metres, Agassiz trawl, female; 290mm total length, "John Murray" Station 54 (S. Arabian coast), 1046 metres, Agassiz trawl; 273mm total length "John Murray" Station 35 (Gulf of Aden), 457–549 metres, otter trawl - all BMNH Nos. 1939-5-24: 613–616. 124mm, 121mm, 110mm total lengths, "John Murray" Station 145 (Maldive area), 494 metres, Agassiz trawl - BMNH Nos. 1939-5-24: 618–620. Also data from the 184mm holotype, "Challenger" Station 173 (Matuku, Fiji Islands), 575 metres, which were kindly supplied by Dr. P. J. P. Whitehead, British Museum (NH).

DESCRIPTION. Proportional measurements in per cent of total length (holotype first, "John Murray" specimens in parentheses): head 14.0 (14.4–17.8), snout 4.0 (3.5–4.3), eye 2.3 (2.1–3.1), interorbital –(1.1–1.5), cleft of mouth 4.6 (5.0–6.2), branchial aperture 1.4 (1.1–2.1), branchial interspace 2.7 (1.4–2.2), pectoral 3.6 (2.8–4.7), predorsal 16.4 (14.5–17.4), snout-vent 36.2 (33.9–38.8), depth at pectoral base 4.5 (3.8–5.1), depth at vent –(3.2–5.1). Branchiostegal rays –(9), pectoral rays 11 (14), dorsal rays before level of vent in "John Murray" specimens 59–72, total dorsal rays (JM) ca.280–297, anal rays (JM) ca.195, lateral line pores before level of vent 36 (36–39). Vertebrae (JM): precaudal 46–48, caudal 111–115, total 158–161. Teeth: maxilla 4–5 irregular rows, dentary 4–5 irregular rows, premaxillary-ethmoid 16 in a transversely oval exposed patch, vomer 9–12 in a short triangular patch, the two central teeth the largest; teeth generally fewer in the smaller specimens. Cephalic sensory pores large, in the 325mm "John Murray" specimen as follows: 4 around anterior nostril, 3 elongate slits along upper lip, 1 posterior to rictus, no circumorbital pores, 1 supratemporal, 8 along lower jaw of which the first three are rather differently disposed to the remainder, 2 on lower edge of preoperculum, first lateral line pore very large. Colour: "brownish, smaller specimens sometimes paler below; young yellowish, with series of small black dots above and below lateral line; fins pale in young becoming greyish or blackish with age" (Norman). The smaller specimens examined now show a silver ground coloration on the lower surface of head and body. Visceral peritoneum wholly black. Juveniles have a series of black pigment spots along the body slightly below midlateral line, with a similar series above and below this; there is also a paired series from throat to vent on the ventral body wall and pigment spots on the anal base. The pigmentation described probably remains from the larvae.

REMARKS. Three Indo-Pacific species can be definitely referred to **Congrina: C. aequorea** (Gilbert & Cramer, 1897) from Hawaiian waters, **C. retrotincta** (Jordan & Snyder, 1901) from Japan, and **C. guttulata** (Günther, 1887) from Fiji. They are externally closely similar and clear distinctions between them have not yet been demonstrated. Norman (1939: 38–39) placed **C. aequorea** as a synonym of **C. guttulata** but gave no reasons. He was clearly unaware that Jordan & Hubbs (1925: 196) had earlier named the Hawaiian species as the type of **Congrina** and that the latter was very similar to **C. retrotincta** from Japan. As Jordan & Hubbs note (1925: 197) **C. retrotincta**, with head length contained about 7.2–7.9 in the total appears to be distinct from **C. aequorea** with head 6.5–6.8 in total. The type of **C. guttulata** (an immature eel) has head 7.1 while in the "John Murray" specimens from the northern Indian Ocean it is 5.6–6.9 being relatively shorter in the smaller specimens. ,Although Jordan & Hubbs suggest to the contrary there appear to be no essential differences in the number and disposition of the vomerine teeth in **C. retrotincta** and **C. aequorea** and in the present material, including the type of **C. guttulata**. In all, the vomerine teeth form a short triangular patch on the forward extremity of the bone and two or three (one in small specimens) of the central teeth of the patch are enlarged. The difficulty in separating the known "species" of **Congrina** on most external characters, at least as far as they are known, parallels that of the **C. jordani – C. wilsoni** group of species in the genus **Conger**, and that of the **Ariosoma** group of species. In these also external differences are so slight that single specimens can be placed only with difficulty.

The present problem, like that experienced in distinguishing the species of **Ariosoma**, may be a little simplified by a consideration of vertebral numbers in the species in question. **C. retrotincta** has 173–181 vertebrae (Asano, 1962: 113) with 40–43 lateral line pores (vertebrae) before level of vent. The "John Murray" specimens have 158–161 with 36–39 pores before vent. Indian Ocean **Congrina** are therefore distinct from the Japanese form on this character. Unfortunately, as with many other species of eels, vertebral numbers in **C. aequorea** and the type of **C. guttulata** are unknown although the latter is now known to have about 36 vertebrae before level of vent. The illustration of the type of **C. aequorea** shows an estimated 40 pores before vent (Gilbert & Cramer, 1897: pl. 37).

In consideration of the characters of head length and vertebral/pore numbers, which seem to be the only ones presently available which show significant differences, it would seem a wise course to retain the three species as distinct until further is known of comparative vertebral counts and other characters. The single character in which the type of **C. guttulata** differs from the "John Murray" specimens is that of head length but as the type is an immature eel and the head demonstrably shortens relative to total with growth, there appear to be no firm grounds for setting aside the present specimens from the northern Indian Ocean as a distinct species. The distribution of known material of **C. guttulata** is indeed disruptive, but this may be a result of insufficient knowledge of the deeper waters of the intervening areas.

Norman (1939: 39) examined a specimen of **C. macrocerca** Alcock in preparing his description of **C. guttulata** and placed it with this species. However, as shown above, all Indo-Pacific species of **Congrina** are so closely similar in external characters that identity of such characters does not necessarily mean the identity of the species. It is clear that a check on vertebral numbers is required for both **C. guttulata** and **C. macrocerca** before the two may be firmly combined but to avoid needless disruption of the nomenclature I have followed Norman in placing Alcock's species tentatively with **C. guttulata**.

Four Atlantic species of **Congrina** have been recognised: **C. flava** (Goode & Bean, 1895), **C. thysanochila** Reid, 1934, **C. macrosoma** Ginsburg, 1951, and **C. gracilior** Ginsburg, 1951. Atlantic congrids are, however, insufficiently well known on a comparative basis to say whether other species may fall here. **C. thysanochila** has 31 pores before level of vent indicating that the number of vertebrae is probably quite low compared with other species of the genus. It seems likely that at least **Bathycongrus megalops** and **Uranoconger odontostomus** of the congrid species described from deepish water off the Philippines by Fowler (1933) might also be referable to **Congrina**.

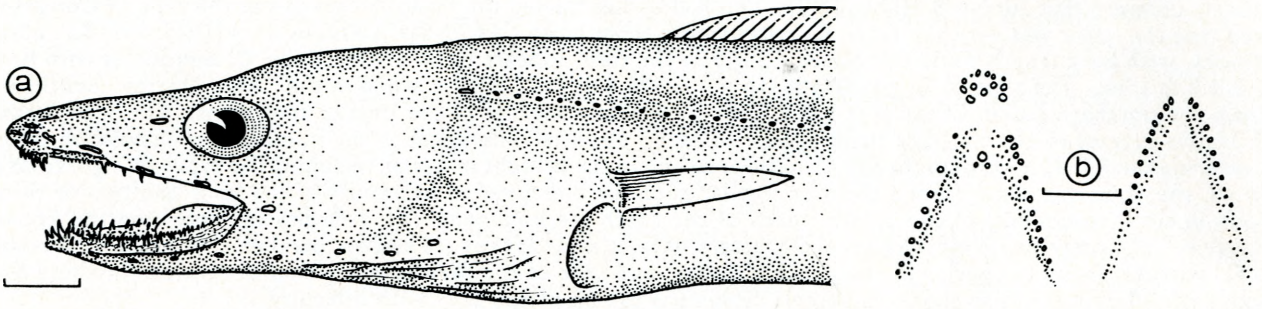
CONGRINA WALLACEI sp. nov.

(Plate 107 B, text-figure 1 a–b)

MATERIAL EXAMINED. Five specimens, as follows: **Holotype** – 523mm total length, mature female, collected by commercial trawl off the mouth of the Limpopo River, Mozambique in 480-500 metres on January 17, 1968; 2 **paratypes** - 452mm total length, mature male, collected with the holotype; 540mm total length (caudal damaged), mature female, collected 15 miles off Durban in 500 metres on December 20, 1967 by the Oceanographic Research Institute vessel "David Davies"; also one specimen 422mm total length, mature female, locality and other data unknown, probably off Natal Coast, and one specimen 547mm total length (caudal damaged), collected with the holotype. All specimens deposited in the Department of Ichthyology Collection, Rhodes University.

DESCRIPTION. Holotype first, paratype and last-named specimen in brackets (in per cent of total length): standard 98.1 (98.2–98.3), head 15.1 (15.1–15.4), snout 4.5 (4.4–4.5), eye 2.1 (1.9–2.6), interorbital 1.9 (2.3–2.4), cleft of mouth 6.4 (6.3–6.4), branchial aperture 2.2 (1.8–1.9), branchial interspace 2.6 (3.0–3.4), pectoral 4.4 (4.3–4.4), predorsal 16.3 (15.5–15.7), snout-vent 37.8 (37.7–37.8), depth at pectoral base 6.5 (6.1–6.7), depth at vent 6.0 (5.2–6.7). Branchiostegal rays 8 (8), pectoral rays 15 (12–16), dorsal rays before level of vent 59 (52–60), total dorsal rays

275 (249–253), anal rays 220 (193–201), lateral line pores before level of vent 39 (38). Vertebrae: 50 precaudal, 118 caudal, 168 total (48, 105, 153 in the smaller paratype but the tip of the caudal region shows signs of previous damage and regrowth). Teeth in the holotype: 41 moderately sized teeth along the maxilla, with 7 large ones



Text–Fig.1

Congrina wallacei sp. nov. – holotype, 532mm total length, mature female. Fig.a: lateral view of head; Fig. b: upper (left) and lower (right) dentition. Scale indicates 1cm.

laterally; 39 teeth on the main row of the dentary, with 15 large teeth laterally and an extra two teeth lateral to these; 14 large teeth in a transversely oval patch on the premaxillary-ethmoid, the rear ones larger; 3 sharp teeth on the head of the vomer. Cephalic pores: one small pore in front of "premaxillary" patch of teeth; one large, elongate-oval pore on tip of snout; a very large slit immediately behind this on anterodorsal surface of snout; one large slit behind base of anterior nostril; three slits along upper lip; one behind rictus; three minute pores in a line on anterior tip of mandible, followed by seven pores in a line on to the operculum; one pore on the midline of the occiput. Colour: grey on upper half of body, much lighter below; posterior tips of dorsal and anal fins, and caudal, edged with black.

Named for Mr. J. H. Wallace, Oceanographic Research Institute, Durban, whose efforts were primarily responsible in forwarding valuable specimens of this species for study.

REMARKS. The systematic problems relating to **Congrina** have been discussed above. They indicate that knowledge of the species structure of the genus is at present greatly confused and addition of further new forms at this stage, without a wide-ranging revision, would be undesirable. The identity and relationships of **C. macrocerca**, **C. guttulata** and **C. aequorea** should become more firmly known, and the Atlantic species further investigated. However, the specimens described above from deepish water off the southeast coast of Africa show sufficient distinctions from the recognised species that it has been necessary to allocate them a novel place in the genus.

The most striking feature of these specimens is the large size of the teeth on the jaws, "premaxilla" and vomer. Even in a specimen of comparable size they are much larger than the teeth of the specimens of **C. guttulata** examined. As far as I can judge from the illustration of **C. aequorea** given in Gilbert & Cramer (1897: pl. 37) they are also larger than in this species, but are somewhat of the same size as in **C. thysanochila** (see Reid, 1934: fig. 2). Furthermore, there appear to be fewer teeth on the jaws and vomer than in **C. guttulata**, at least, of the known species.

In general body proportions **C. wallacei** is closely similar to **C. guttulata** except that it has a longer snout (about 3.4 in head, compared with about 4.0 in head) and mouth, a broader interorbital and branchial interspace, and is deeper in the body than is **C. guttulata**. It is possible that the latter three proportions are relatively larger in **C. wallacei** because the specimens examined were rather larger than those of **C. guttulata**. The new species possibly has slightly more numerous pectoral rays but fewer dorsal rays than does **C. guttulata** and the vertebral count of **C. wallacei** is slightly higher (168, 48–50 precaudal) compared with 158–161 (46–48 precaudal) in **C. guttulata**.

Notes on the larvae of **Congrina**:

The early life histories of eels of the genus **Congrina** are totally unknown. However, the pigmentation described for the types of **C. guttulata** and **C. aequorea** and also shown in all but the largest "John Murray" specimen appears to be so persistent from the postelver 110mm to more than 200mm total length that it seemed likely to be a characteristic remnant of larval coloration. A similar persistence of the lateral and ventral melanophores of larval **Conger cinereus** through into the juvenile has already been noted above.

The essentials of this pigmentation in **Congrina** are the three longitudinally placed rows of spaced melanophores on the lateral body surface. Two larval species possessing precisely this coloration are known: **Leptocephalus trilineatus** Castle, 1964 with 199 myomeres and **L. geminus** Castle, 1964 with 160–174 myomeres, both

from the central and southwest Pacific. In **L. geminus** the last vertical blood vessel is placed at about myomere 52 (Castle, 1964: 33) indicating that the adult would probably have about 52 precaudal vertebrae. (In eel-larvae, the segmental position of this vessel, which supplies the developing mesonephric kidney, approximately indicates the end of the body cavity and hence the division between precaudal and caudal vertebrae). This would suggest that **L. geminus** is referable to **Congrina retrotincta** which has 54–56 precaudal vertebrae (Asano, 1962: 113). The present author has recorded, but not named, a larval species of similar pigmentation from the eastern Indian Ocean having 144–147 myomeres (Castle, in press). These observations on larval characters strongly suggest that at least two further species of **Congrina**, having about 199 and 144–147 vertebrae, are present in the Indo-Pacific. They may of course be identifiable with **C. aequorea** and **C. guttulata** but vertebral information is required for these species before the true identity or novelty of these larval species is established.

Uroconger Kaup, 1856

Type **Congrus lepturus** Richardson, 1845 (China). Body slender or rather robust, the caudal region markedly attenuated and the vent placed relatively far forwards. Snout rather short, slightly overlapping the lower jaw when mouth closed; eye moderate in size; lips very weak, including the lower, with the upper lip supported by two or three backwardly-directed ventral projections of the preorbital bone; mouth large, extending to below posterior margin of eye. Teeth acute, conspicuous, biserial on jaws and in two transverse rows on "premaxillary", either in a small group on head of vomer or uniserial along this bone. Dorsal origin over base or posterior portion of pectoral. For further definitive features see Asano (1962: 113). Atlantic, Indo-Pacific, East Pacific; about five species in shallow tropical and deep waters; here described from three species from the western Indian Ocean, one in shallow tropical water along the east coast of Africa, another in deep water off the Cape, and the third in deep water in the northwest Indian Ocean.

KEY TO SPECIES

1 (2) Vomerine teeth numerous, in a uniserial row of 10–20 teeth with a few larger teeth anteriorly ..... **U. lepturus**

2 (1) Vomerine teeth sparse, in a group of two or three large teeth anteriorly with perhaps a few smaller teeth on each side and behind;

3 (4) Dorsal origin over pectoral tip ..... **U. vicinus**

4 (3) Dorsal origin over pectoral base ..... **U. braueri**

UROCONGER LEPTURUS (Richardson, 1845) **Plate 107 C**

Congrus lepturus Richardson, 1845: 106, pl. 56, figs. 1–6 (original reference, Canton, China).

Western Indian Ocean only:

Uroconger lepturus (Richardson). Boulenger, 1901: 261 (Sea of Oman); Barnard, 1925: 191 (Zululand coast); Norman, 1939: 41 (Sea of Oman); Smith, 1949–65: 394, fig. 1115 (Natal and Zululand coast); Fourmanoir, 1961: 10 (Mozambique Channel).

MATERIAL EXAMINED. Five specimens: 426mm total length, off Durban in 47 metres, "Pieter Faure", South African Museum No. 12777; 380mm total length (female) off Malindi, Kenya in 18-37 metres, 15/10/52, Department of Ichthyology Collection, Rhodes University; 348mm (female), 353mm (?male), 385 mm(?male) total lengths, off Malindi, Kenya in 18 metres, 21/10/52, Department of Ichthyology Collection, Rhodes University. Also a larval specimen, tentatively referred to this species: 18.8mm total length, S.A.S. "Natal" Station No. NGY 20, 30°34′S., 32°02′E. (Natal Coast), 16/5/58 (1725–1735 hrs), N100H (100cm. net, horizontal tow), 0.5m, surface temp. 24.78°C., salinity 35.33‰, Department of Oceanography Collection, University of Cape Town.

DESCRIPTION. **Adult** (proportional measurements in per cent of total length): standard 97.5–98.1, head 12.0–13.5, snout 3.0–3.4, eye 1.1–1.6, interorbital 1.9–2.2, cleft of mouth 4.2–4.9, branchial aperture 1.9–2.5, branchial interspace 1.3–1.5, pectoral 2.8–3.2, predorsal 11.7–13.2, snout-vent 29.0–31.8, depth at pectoral base 3.9–4.9, depth at vent 4.2–4.7. Branchiostegal rays 9–10, pectoral rays 12–13, dorsal rays before level of vent 46-62, total dorsal rays ca.294–340, anal rays 238–260, caudal rays 5+4. Lateral line pores before level of vent 42–44. Vertebrae (one specimen): precaudal 87, caudal 123, total 210; the caudal region of this species is readily subject to damage and low vertebral numbers and pore counts are not unusual. Teeth: biserial on maxilla with about 30 teeth in lateral row and 20 larger teeth in medial row; biserial also on dentary with 25–30 teeth in lateral row, 23 in medial row, sometimes a few teeth medial to this; about 8 teeth on "premaxilla", of which the anterior form a transverse row outside closed mouth; 10–23 in a uniserial row on the vomer with one or two extra teeth on each side at the beginning of this row. Cephalic pores: two pores on the underside of the snout, medial to the anterior nostril, one pore above base of anterior nostril, one behind base of anterior nostril, three slit-like pores along upper lip and one behind rictus, about eight along lower jaw and on to interoperculum, one pore on midline of occipital region. Colour: "brownish, the vertical fins with black margins" (Barnard, 1925: 192).

Body slender, very elongate, with the vent placed one-third of the way along the body. Head about 7.5–8.0 in total; snout short, about 4.0 in head, just projecting in advance of lower jaw when mouth closed; eye moderate, rather small; mouth essentially terminal, extending almost to a vertical from the posterior margin of the eye; lips very weak. Teeth more or less biserial in jaws, acicular, those of the inner rows larger, "premaxillary" teeth large, in two transverse rows, those of the anterior row the larger, vomerine teeth generally small, but one or two large teeth anteriorly. Anterior nostril on the anterior face of the snout and with a short tube, posterior nostril a wide oval aperture placed slightly above horizontal diameter of eye immediately before eye. Dorsal origin placed over pectoral base. Branchial interspace less than the length of the branchial aperture. Lateral line with obvious simple pores.

Larva: 18.8mm total length, myomeres ca.190, with 111 before level of vent, pigmentation in the form of a double longitudinal series of melanophores along the ventral body wall as far as the vent and in addition a scattered series of melanophores along the lateral line. The specimen is too small for further details to be obtained regarding the positions of the blood vessels and gall bladder and the number of fin-rays. When fully grown, larvae of **Uroconger** have a compact series of melanophores along the lateral line and in this way they can be readily distinguished from other congrid leptocephali.

REMARKS. The conspicuously attenuated body, the presence of backwardly-directed preorbital prongs and the general nature and distribution of the teeth on the jaws, amongst other features, characterise the eels of the genus **Uroconger**. They have consequently seldom been confused with other congrid genera. **U. lepturus** itself has frequently been described from various localities in the Indo-West-Pacific, particularly from Indo-Malaya, Indonesia, China and Japan, and is well documented.

Richardson's original description of **U. lepturus** (1845: 106) was partly in error but Bleeker (1864: 29, pl. 5, fig. 1) later provided a detailed and accurate account of the species upon which later identifications were largely based. There are two well-known species of **Uroconger**: **U. lepturus** (Richardson) from Indo-Pacific shallow waters and **U. vicinus** Vaillant, 1888 from deep water of the Atlantic. Apart from their normal depth range the two are readily distinguished by the pattern of teeth, the size of the interbranchial space, the origin of the dorsal, the number of vertebrae, and the average maximum size. **U. lepturus** has a single row of teeth on the vomer, a narrow interbranchial, the dorsal origin over the pectoral base, about 200–210 vertebrae and reaches about 450mm; **U. vicinus** has only a few enlarged teeth on the head of the vomer, a wide interbranchial, the dorsal origin near the level of the pectoral tip, about 181–184 vertebrae (personal communication from Dr. J. Blache, IFAN, Sénégal), and reaches 650mm.

Four other species have been referred to **Uroconger**: **U. vicinalis** Garman, 1899 from the West Atlantic, **U. varidens** Garman, 1899 from the East Pacific, **U. braueri** Weber & de Beaufort, 1916 from Indonesia and East Africa, and **U. syringinus** Ginsburg, 1954 from the West Atlantic. **U. vicinalis**, as described by Garman (1899: 304) and as illustrated previously by Goode & Bean (1895: pl. 42, fig. 160) under the name **U. vicinus** has a uniserial row of teeth on the vomer and an anterior dorsal origin. **U. syringinus**, established for West Atlantic **Uroconger** with similar characters (Ginsburg, 1954: 256, figs.1–2), is almost certainly a synonym of **U. vicinalis**, which must be regarded as the Atlantic shallow water equivalent of **U. lepturus**. Until detailed counts become available from **U. vicinalis** the latter should be regarded as valid. **U. varidens** is a much less elongate **Uroconger** than others, probably with a relatively low number of vertebrae (Garman gives a lateral line pore count of ca.147). **Atopichthys falcidens** Garman, 1899, a larval species from the East Pacific, has 153 myomeres and a midlateral row of melanophores and is possibly the young of **U. varidens**. **U. braueri** has only three vomerine teeth and in this respect is similar to **U. vicinus**, but the former also has an anterior dorsal origin and 19 pectoral rays (compared with about 12 in the other species, except **U. varidens**). For the latter reason **U. braueri** has been made the type species of the subgenus **Bathyuroconger** by Fowler (1933: 273). However, I do not consider this difference to be sufficient to merit such distinction and **U. braueri** should be retained in **Uroconger**.

The original description of **U. lepturus** (Richardson, 1845: 106, pl. 56, figs. 1–6) states " . . . two or three teeth in a line on the vomer, though being partly broken in the specimen before the artist, only one is represented." A later statement by the same author (1848: 109) omits mention of the damage to the vomerine teeth. In view of the fact that there are at least two other species in which vomerine teeth are few in number and that there has been some confusion caused by Richardson's statements (Ginsburg, 1954: 257) it was thought desirable to check the characters of the Richardson type.

Dr. P. J. P. Whitehead has kindly examined the specimen recorded as the type of **U. lepturus** in the British Museum (NH). This specimen is 260mm standard length, as recorded by Günther (1870: 44, "10½"). However, Richardson's original specimen from Canton was "9 inches" (229mm) and there is thus some immediate doubt as to the validity of the present type in the British Museum, assuming the original measurement to have been accurate.

In the "type" the vomerine teeth number 22 consisting of two large canines anteriorly with a small tooth on each side, followed by an essentially uniserial row of 18 smaller teeth. In these respects, therefore, the recorded "type" of **U. lepturus** is more or less identical with that described in detail by Bleeker and later authors. Consider-

ing that the form described by the latter is relatively common in shallow water in the China Sea, it seems likely that whatever the exact status of the present "type", the two are conspecific.

As pointed out elsewhere (Della Croce & Castle, 1966: 155) the larval characters of **Uroconger** are now fairly well known. **Leptocephalus acuticaudatus** Kaup, 1856 from India and **L. magnaghii** D'Ancona, 1928 from the Red Sea are very probably larvae of **U. lepturus**. **L. mediopunctatus** Castle, 1964 from the southwest Pacific and eastern Indian Oceans, having a very high myomere number (225–242) has been referred tentatively to **U. braueri**, although the vertebral number in adults of this species is at present unknown. Five leptocephali, presumed to be those of **U. braueri,** were recently recorded from the Mozambique Channel (Della Croce & Castle, 1966: 154).

UROCONGER VICINUS Vaillant, 1888 **Plate 107 D**

Uroconger vicinus Vaillant, 1888: 86, pl.6, figs.1–1b (original reference, East Atlantic).

Western Indian Ocean only:

Uroconger vicinus Vaillant. Barnard, 1925: 192 (off Cape Point); Smith, 1949–65: 393.

MATERIAL EXAMINED. Two specimens: 447mm and 653mm total lengths (both females), off Cape Point in 630 metres, "Pieter Faure", South African Museum No. 12772.

DESCRIPTION. Proportional measurements in per cent of total length: standard 98.2–99.0, head 12.4–12.7, snout 2.4–3.2, eye 1.7–2.0, interorbital 1.6–1.9, cleft of mouth 4.5–4.7, branchial aperture 2.4–2.1, branchial interspace 3.3–3.4, pectoral 3.0–3.3, predorsal 14.2–15.8, snout-vent 35.4–38.6, depth at pectoral base 6.3–6.4, depth at vent 4.6. Branchiostegal rays 8, pectoral rays 12, dorsal rays before level of vent 65–77, total dorsal rays 315–335, anal rays 230–238, caudal rays 5+3–4. Lateral line pores before level of vent 43–48. Vertebrae: precaudal 58–59, caudal 123, total 181–182. Teeth (in the smaller specimen): biserial on jaws with about 20 teeth in the medial row, a few larger teeth in the lateral row; about 6 teeth on the "premaxillary" patch, 2 large vomerine teeth, with a smaller one on each side. Cephalic pores: as in **U. lepturus** although generally larger. Colour: "Brownish, vertical fins black posteriorly" (Barnard, 1925: 192).

Body rather slender in the smaller specimen, although massive and flabby in the larger, with the caudal region much attenuated and the vent placed well forward of the mid-length. Head about 8.0 in total, snout very short, about 5.0 in head, more or less level with lower jaw; eye rather small; mouth terminal, extending to below posterior margin of eye; lips very weak. Teeth on jaws acicular, larger and more scattered than in **U. lepturus**, the canines on the vomer conspicuous. Nostrils as in **U. lepturus**. Dorsal origin over pectoral tip. Branchial interspace considerably larger than the length of the branchial aperture.

REMARKS. The distinguishing characters of **U. vicinus**, as compared with other species of **Uroconger**, have been discussed under **U. lepturus**. **U. vicinus** is apparently characteristic of the deep water of the eastern tropical Atlantic and has been recorded as far south as Angola on the west coast of Africa. It is therefore not remarkable that the species should also be found off the Cape, but its occurrence adds an interesting Atlantic element to the eel fauna of southern Africa. Few Atlantic species of eels occur in the latter area.

UROCONGER BRAUERI Weber & de Beaufort, 1916 **Plate 107 E**

Uroconger vicinus (**non** Vaillant). Alcock, 1892a: 363 (Bay of Bengal); 1896: 338 (off Madras, Laccadive Sea); 1899: 200; Garman, 1899: 405.

Uroconger lepturus (**non** Richardson). Brauer, 1906: 124 (west coast of Sumatra; east coast of Africa); Sewell, 1912: 12.

Uroconger braueri Weber & de Beaufort, 1916: 266 (west coast of Sumatra; east coast of Africa); Della Croce & Castle, 1966: 154 (as **L. Uroconger braueri**—larval specimens from the Mozambique Channel tentatively referred to this species).

Bathyuroconger braueri (Weber & de Beaufort). Fowler, 1934: 273; Reid, 1934: 3; Norman, 1939: 40 (Maldives).

MATERIAL EXAMINED. None, description adapted from Weber & de Beaufort (1916: 266). The latter was essentially a combination of the descriptions of both Alcock (1892: 363) and Brauer (1906: 124) for material from both sides of the northern Indian Ocean and the Bay of Bengal. The east African material ("Valdivia") was collected on the continental slope off the southern coast of the Somali Republic.

DESCRIPTION. Proportional measurements in per cent of total length (from a 700mm specimen): head 14.0, snout 3.9, eye 2.0, pectoral 5.6, snout-vent 38.0, depth 8.7. All specimens: cleft of mouth extending to below middle of eye. Branchial interspace greater than the length of each aperture. Dorsal origin over the base of the pectoral. Pectoral rays 17. Colour brown, head and lower surface bluish-black.

REMARKS. There has been considerable confusion regarding the status of **U. braueri**. In their original description of **U. braueri**, Weber & de Beaufort clearly referred the Alcock specimens of "**U. vicinus**" and Brauer's specimens of "**U. lepturus**" to this species. While **U. braueri** has a similar dental pattern and massive body to **U. vicinus** Vaillant from the Atlantic, and is also a deep-water species, it shares an anterior dorsal origin with the shallow-water Indo-Pacific **U. lepturus** Richardson. Barnard (1925: 193) compounded the difficulties by giving a pectoral ray count of 9 in his **U. vicinus**. This should be 12, more or less the same as in **U. lepturus**. The pectoral rays may indeed be more numerous in **U. braueri**, but in the absence of other more firm distinctions, it scarcely seems sufficient for regarding **U. braueri** as separate from the other urocongrids at the subgeneric level (i.e. as **Bathyuroconger** Fowler).

Coloconger Alcock, 1889

Type **C. raniceps** Alcock, 1889 (Andaman Sea). Body robust and even massive, deep, the caudal region not attenuate and the vent placed in the posterior half of the body. Snout short, rounded, just overlapping tip of lower jaw when mouth closed; eye moderate to relatively large; lips weak, the upper without bony supports from the preorbital bone. Mouth relatively large, extending to below posterior half of eye. Teeth minute, uniserial in jaws (with additional rows sometimes present, but hidden in tissue), "premaxillary" teeth in two rows, teeth absent from vomer. Dorsal origin over pectoral. Sensory pores on head (with the exception of those on lower jaw) and in lateral line on the ends of short tubes, other sensory organs on head and body marked by minute papillae. For further definitive features and osteology see Chan (1967: 97, figs.1–14). Atlantic, Indo-Pacific; deep water; known from four species, here reported from one species in the northwest Indian Ocean, not at present known off southern Africa as adults.

COLOCONGER RANICEPS Alcock, 1889 **Plate 107 F**

Coloconger raniceps Alcock, 1889: 456 (Andaman Sea): 1892a: 364 (Bay of Bengal); 1892b: pl.7,fig.4: 1896: 337; 1899: 196; Garman, 1899: 405; Brauer, 1906: 123, pl.8, fig.1, text-fig.67; Lloyd, 1909: 152; Sewell, 1912: 12; Norman, 1939: 42, fig.14: Herre, 1941: 337; Kanazawa, 1957: 235, fig.1; 1961b: 110, tables 1–2.

MATERIAL EXAMINED. None, description adapted from that of Alcock (1889: 456) for the type, which agrees with the figure (Alcock, 1892b: pl. 7, fig. 4), and Kanazawa (1961b: tabs. 1–2). Norman's description of 4 specimens ("John Murray") from the northwest Indian Ocean closely agrees with the type description.

DESCRIPTION. Proportional measurements in per cent of total length: standard 97.0, head 21.9, snout 4.2, eye 5.3, cleft of mouth 8.3, pectoral 8.7, predorsal 23.4, snout-vent 58.6, depth at pectoral base 11.4, depth at vent 9.6. Pectoral rays 22, dorsal rays 210–214, anal rays 115–119, lateral line pores before vent 69. Vertebrae 145. Teeth apparently uniserial in jaws, about 35 on maxilla and 39 on dentary in the specimen illustrated by Norman (1939), about 6 on "premaxillary" patch, none on vomer. Cephalic pores, as in Norman (1939) and Kanazawa (1957): three pores medial to anterior nostril, one behind base of anterior nostril, six pores along upper jaw, two tube-like pores above posterior nostril; one tube-like pore above anterodorsal corner of eye and one above posterodorsal corner; three behind eye; two on temporal region and two on occiput in the midline.

Body robust, massive, the tail not attenuated and the vent placed well behind the mid-length. Head about 5.0 or a little less in total; snout very short, about 5.2 in head; eye large, 4.2 in head; mouth terminal, large, reaching to below posterior margin of pupil; lips very weak. Teeth apparently uniserial in jaws; a second row medial to main row is present, but this is obscured by tissue. A few teeth on "premaxilla". Anterior nostril subtubular, almost on anterior face of snout; posterior nostril with a slightly raised rim, above horizontal diameter of eye. Dorsal origin over base of pectoral or slightly further back. Pectoral relatively long, about equal to length of mouth. Branchial aperture relatively small. Lateral line well developed with the pores on the ends of short tubes. Some of the cephalic sensory pores on the ends of tubes, other pores simple; supratemporal pores in three pairs. Other minute papillae also present on head and body.

REMARKS. Eels of the genus **Coloconger** are restricted to the deep waters of more than 500 metres. Although Alcock's papers indicate that **C. raniceps** was by no means uncommon in the northern Indian Ocean, these eels are generally rather rare.

In addition to **C. raniceps**, three other species have been described: **C. meadi** Kanazawa, 1957 from the western Atlantic, **C. cadenati** Kanazawa, 1961 from the eastern Atlantic, and **C. scholesi** Chan, 1967 from the South China Sea. Kanazawa (1961b: tables 1–2) sets out the various counts recorded in the three first-named species (i.e. numbers of dorsal rays, anal rays, pectoral rays, lateral line pores before level of vent, vertebrae, and position of dorsal origin). In all of these characters **C. raniceps** appears to be more like **C. meadi** than **C. cadenati**, but is distinguished from both by having three pairs of supratemporal pores (instead of three only) and a relatively low number of vertebrae (145). **C. scholesi** has a smaller eye (2.8–3.2% of total length), dorsal origin almost over the tip of the pectoral and 154 vertebrae, and is thus distinct from **C. raniceps**.

Coloconger has yet to be taken in the deep waters off southern Africa although it occurs further to the north. Available records show that the genus tends to be found in deep waters of moderate latitudes rather than elsewhere.

Subfamily **Heterocongrinae** Böhlke, 1957

Fin-rays unsegmented; caudal fin much reduced or absent; pectoral fin reduced or absent; body worm-like; tail much longer than head and trunk combined; preorbital bone much reduced; lateral line ossicles simple tubes or troughs and well ossified; dorsal wall of gas bladder free from parapophyses; precaudal vertebrae much fewer than caudal vertebrae; lateral ethmoid process of ethmovomer absent (except in **Gorgasia**); supraoccipital bone present. Larvae poorly known but probably having pigment as a series of melanophores along the ventral body wall as well as along the lateral line. Four genera and about a dozen species throughout shallow tropical seas. Almost certainly all burrowing forms, living in tubes in coral sand in places of moderately strong current, usually on areas sloping away from coral reefs. Heterocongrine eels have been termed "garden eels" for the characteristic way in which groups of them live in coral sand with the front portions of their bodies projecting upwards to give the impression of spindly plants. Their small mouths and well developed eyes suggest that they live on planktonic animals or perhaps on other burrowing creatures. Two genera and two species recorded here from the western Indian Ocean.

KEY TO GENERA

1 (2) Tip of caudal region without fins, free; teeth essentially uniserial on jaws and vomer; anterior nostril tube free from upper lip ..... **Gorgasia**

2 (1) Tip of caudal region with a very short caudal; teeth in several rows on jaws and vomer; anterior nostril tube enclosed by upper lip ..... **Taenioconger**

Gorgasia Meek & Hildebrand, 1923

Type **G. punctata** Meek & Hildebrand, 1923 (East Pacific). Body very slender, vermiform, with the vent placed well in advance of mid-length. Snout very short, rounded, lower jaw projecting slightly in advance of snout tip; eye large and prominent; lips well developed. Mouth short, oblique, terminal, reaching to below middle of eye. Anterior nostril with a very short tube above upper lip; posterior nostril a simple aperture in front of eye. Teeth in the jaws essentially uniserial but in several series anteriorly; vomerine teeth uniserial. Pectoral fin present, very small. Dorsal origin over the pectoral fin. Tip of caudal region without fins, free (as in ophichthid eels). For details of osteology and relationships see Rosenblatt (1967: 92). Indo-Pacific, East Pacific; shallow water of coral reefs; four species (one each in the East Pacific, Philippines, north Indian Ocean and Red Sea) reported here from the latter.

GORGASIA SILLNERI Klausewitz, 1962 **Plate 107 G**

Gorgasia sillneri Klausewitz, 1962a: 97, fig.3 (un-named); 1962b: 433, fig.1 (Red Sea).

MATERIAL EXAMINED. None, description adapted from Klausuewitz (1962b: 433, fig 1) for the unique 313mm holotype.

DESCRIPTION. Proportional measurements in per cent of total length: head 5.5, snout 0.8, eye 1.5, predorsal 6.6, snout-vent 38.6, depth 1.4. Number of fin-rays, lateral line pores and vertebrae unknown. Colour: generally light brown closely flecked with dark brown.

Body very slender, not compressed, with the vent placed well before the mid-length. Head short, about 17 in total; snout very short, 8.0 in head, rounded; eye relatively large, 3.9 in head. Mouth terminal, reaching to below posterior margin of pupil. Dorsal origin over the pectoral base. Branchial aperture small.

REMARKS. The increasing use of chemicals in fish collecting has resulted in the discovery of a number of new forms of Heterocongrinae in widespread localities throughout shallow tropical waters. Smith (1962: 447) suggested that as underwater collections were made in the western Indian Ocean these eels would probably be found there. The work of Klausewitz (1959, 1962) has indeed revealed a rich fauna of so-called "garden eels" or "Röhrenaale" in the northern Indian Ocean and the Red Sea. Rosenblatt (1967) recently recorded the family in the Amirantes Islands, western Indian Ocean. Undoubtedly they occur elsewhere, where suitable conditions obtain, but as they normally inhabit water of five metres or more and they are fossorial, they are unlikely to be seen or collected except by the specialist.

The presence of a pectoral fin, a finless tail, generalised dentition, well developed cephalic sensory system and anterior nostrils free from the upper lip characterise the genus **Gorgasia** and indicate also that it is rather more primitive than the three other genera of heterocongrines: **Heteroconger** Bleeker, 1868, **Taenioconger** Herre, 1923, and **Nystatichthys** Böhlke, 1958.

Taenioconger Herre, 1923

Type **T. chapmani** Herre, 1923 (Philippines). Body very slender, vermiform, with the vent placed well before the mid-length. Snout very short, rounded, lower jaw slightly projecting in advance of tip of snout; eye rather

large and prominent; upper lip well developed and enclosing anterior nostril tube. Mouth terminal, very short, just reaching level of anterior margin of eye. Teeth in the jaws in several series, those on the vomer in a broad multiserial patch. Pectoral fin present but minute. Dorsal origin from slightly forward of level of branchial aperture to beyond level of pectoral tip. Dorsal and anal continuous around caudal but the caudal fin very short. Colour usually plain but some species with spectacular black markings. For further definitive features see Klausewitz & Eibl-Eibesfeldt (1959: 137, under the name **Xarifania** which is a synonym). Atlantic, Indo-Pacific, East Pacific; shallow water of coral reef areas; six species, of which one has been divided into three subspecies, here reported from one species in the Amirantes Islands and the Seychelles, western Indian Ocean.

TAENIOCONGER HASSI (Klausewitz & Eibl-Eibesfeldt, 1959) **Plate 107 H**

Xarifania hassi Klausewitz & Eibl-Eibesfeldt, 1959: 138, figs.6, 8–10, 15, 16 (original reference, northern Indian Ocean); Klausewitz, 1967: 335 (Seychelles).

Taenioconger hassi (K. & E.). Rosenblatt, 1967: 91 (D'Arros Island, Amirantes Islands); Castle, 1967: 6.

MATERIAL EXAMINED. None from the Indian Ocean, nine specimens from the southwest pacific (described as **T. hassi neocaledoniensis** by Castle, 1967: 7) As there appears to be appreciable divergence in minor characters in material from the Maldives, the Nicobar Islands and New Caledonia, on which three subspecies have been based, the description given is that for **T. hassi hassi** (Maldive Islands) as adapted from Klausewitz & Eibl-Eibesfeldt (1959: 140).

DESCRIPTION. Type (357.0mm) and two paratypes (336.5mm, 353.8mm), proportional measurements in per cent of total length: head 5.5–5.9, snout 0.8–0.9, predorsal 5.1–6.0, snout-vent 37.0–38.1, depth at vent 1.5–1.9. Lateral line pores 157–166. Number of fin-rays unknown but in **T. hassi neocaledoniensis** these are: dorsal rays before level of vent 159–161, total dorsal rays 420–442, anal rays 266, with 62–71 lateral line pores before level of vent and 165–171 vertebrae.

Body very slender, depth about 52 in total, not compressed, with the vent placed well before the mid-length. Head short, about 17 in total; snout very short, 6.4 in head; eye rather large, 5.3 in head. Dorsal origin over the branchial aperture or further forwards. The head and body are covered with regularly spaced, brownish-black, round spots; three large, oval to irregular black patches, one each on the branchial region over the aperture and pectoral fin, on the lateral line between the pectoral and the vent, and midventrally around the vent itself. REMARKS. Although the other species of **Taenioconger** are dull in coloration **T. hassi** exhibits perhaps the most remarkable colour pattern of all heterocongrine eels. **Heteroconger polyzona** Bleeker, 1868 from the Philippines also displays a unique coloration, except that it is in the form of vertical bars along the body. In **T. hassi** there is some suggestion that the position of the mid-lateral black patch along the body is placed relatively further forwards in males, but this possibility requires more detailed examination.

LARVAL FORMS

The western Indian Ocean and the waters around southern Africa are rich in larval eels of various families. Many of these larval species have yet to be correlated with their adults but not enough is known of them for firm identifications to be made at present. More information on them as well as on the possible adults, is required before their identities are established.

Larvae of the Congridae, and of one or two species in particular (e.g. **Gnathophis capensis**), are very abundant in certain areas at certain times of the year. More than 20 distinct forms of congrid larvae are known from the western Indian Ocean and southern Africa. These are listed below in order to complete the documentation of the Congridae in this area. Where the adult is known, or tentatively known, the larval species is discussed further under that adult species in the main account, together with a summary of the relevant literature. Larval forms of unknown identity are listed below under the generic name **Leptocephalus** Gronovius, 1763. The latter (together with **Leptocephalus** Scopoli, 1777) have been rejected by the International Commission on Zoological Nomenclature and now have no standing. However, the use of **Leptocephalus** in many ways seems to be the most satisfactory procedure for referring to such eel larvae.

Leptocephalus Conger wilsoni (Bloch & Schneider, 1801) .. .. see **CONGER WILSONI**
L. Conger cinereus (Rüppell, 1828) .. .. see **CONGER CINEREUS**
L. Ophisoma anago (**non** Temm. & Schleg., 1842) .. .. .. see **ARIOSOMA SCHEELEI**
L. Gnathophis habenatus (Richardson, 1848) .. .. see **GNATHOPHIS CAPENSIS**
L. Uroconger braueri Weber & de Beaufort, 1916 .. .. .. see **UROCONGER BRAUERI**
L. Gnathophis incognitus Castle, 1963 .. .. see **GNATHOPHIS CAPENSIS**
L. Gnathophis australis (Barnard, 1923) .. .. see **GNATHOPHIS CAPENSIS**
Leptocephalus morrisii Gmelin, 1789 .. .. see footnote p. 696
L. taenia Lesson, 1830 .. .. see **ARIOSOMA SCHEELEI**
L. marginatus Kaup, 1856 (in part) .. .. see **ARIOSOMA SCHEELEI**
L. capensis Kaup, 1856 .. .. see **GNATHOPHIS CAPENSIS**

L. yareilii non Kaup, 1856 .. .. see **GNATHOPHIS CAPENSIS**
L. oculus (Peters, 1865) .. .. see **ARIOSOMA MAURITIANUM**
L. sicanus non Facciolà, 1883 .. .. see **GNATHOPHIS CAPENSIS**
L. scheelei Strömman, 1896 (in part) .. .. see **ARIOSOMA SCHEELEI**
L. mauritianus Pappenheim, 1914 .. .. see **ARIOSOMA MAURITIANUM**
L. sanzoi D'Ancona, 1928 .. .. see **ARIOSOMA SCHEELEI**
L. macrenteron D'Ancona, 1928 .. .. see **ARIOSOMA MAURITIANUM**
L. magnaghii D'Ancona, 1928 .. .. see **UROCONGER LEPTURUS**

LEPTOCEPHALUS DENTEX Cantor, 1849

Leptocephalus dentex Cantor, 1849: 1315 (original description, Malaya); 1850: 333; Playfair & Günther, 1866: 129 (east coast of Africa); Günther, 1870: 142 (Zanzibar); Sauvage, 1891: 527 (Madagascar); D'Ancona, 1928a: 104; 1928b: 429.

REMARKS. Cantor's description was very brief and the exact identity of **L. dentex** cannot now be established. It seems likely that several species have been confused under this name.

LEPTOCEPHALUS CONGROIDES D'Ancona, 1928

Leptocephalus congroides D'Ancona, 1928a: 43, pl. 3, figs. 3–3a; 1928b: 430; 1928c: 518; 1930: 274, fig. 6; Fowler, 1956: 110, fig. 51; Castle, 1964: 29; Klausewitz, 1964: xxvi.

REMARKS. **L. congroides** has a relatively high number of myomeres (169 in the unique holotype) and a pigmentation similar to that of larval **Conger cinereus**, that is, with a row of mid-lateral melanophores in addition to the melanophores along the ventral margin.

LEPTOCEPHALUS COTRONEII D'Ancona, 1928

Leptocephalus cotroneii D'Ancona, 1928a: 47, pl. 3, figs. 6–8b; 1928b: 430; Fowler, 1956: 110, fig. 50; Klausewitz, 1964: xxvi.

REMARKS. **L. cotroneii** has 147–150 myomeres and pigmentation in the form of a mid-lateral series of melanophores, 1–2 on each myoseptum. In the latter respect **L. cotroneii** shows similarities to larvae of **Ariosoma**. The myomere count accords with **Congriscus maldivensis** which itself shows some similarities to the **Ariosoma** group. However, it would be pure guesswork to identify **L. cotroneii** with **C. maldivensis** without further specimens, in particular those which are metamorphic.

LEPTOCEPHALUS SCALARIS Castle, 1964 **Plate 108 G–J**

Leptocephalus scalaris Castle, 1964: 16, fig. 5 E–I: 1966b: 58 (southwest Pacific).

MATERIAL EXAMINED. Two specimens: 224mm total length, South African Museum IKMT Station No. 47, 28°12′S., 33°24′E., (off coast of northern Natal), 24/2/63, 2030–2335 hrs, 500 metres; 61.5mm total length, Division of Sea Fisheries Station A 3055, 35°06′S., 17°45′E. (off Cape Point), 13/6/64, N 100 B (100cm. net, oblique haul), 0–5 metres.

DESCRIPTION. Myomeres 134–136+20–21 = 154–158, anterior margin of gall bladder at myomere 21, first vertical blood vessel to viscera at myomere 20, last at myomere 99–100, in the larger specimen teeth $\frac{I + VII + 25}{I + X + 6}$ dorsal rays 70, anal rays 113, caudal rays 5+3+1. Pigmentation in the larger specimen as follows: an oblique line of minute, compact, somatic melanophores on each myoseptum below the lateral line, reaching 37 in number on each myoseptum in the middle of the body; this row on each segment is briefly separated from a shorter row further out on the myoseptum towards the ventral angle of the myomere, with a similar row above the lateral line; irregularly scattered melanophores on the ventral body wall before the level of the gall bladder; a row of minute, compact melanophores along each kidney duct from the level of the gall bladder to the vent; scattered pigment spots on the bases of the dorsal and anal rays; on the body wall of the lateral line from segments 51–54 a roundish patch of minute melanophores forming a large brownish spot. The smaller specimen has only a few dorsal and ventral spots on the myosepta, and there is no mid-lateral patch of pigment.

REMARKS. The remarkable pattern of pigmentation of the large larva described above from off the coast of Natal readily identifies it (and the small specimen) with leptocephali of the type described as **L. scalaris** from the southwest Pacific (Castle, 1964: 16, fig. 5 E–I) with 147–151 myomeres and from the Gulf of Guinea by Blache (1963: 12, pls. 15–16), with 142 myomeres. Since my earlier account I have been able to examine abundant identical material from the eastern Indian Ocean. The latter (25 specimens 32mm–223mm total lengths), collected along the 110°E. meridian from 9°S. (south of Java) to 25°S. (west of Dirk Hartog Is., West Australia), has 142–155 myomeres (mean about 148). I have also examined a specimen from off the coast of Brazil, with 146 myomeres.

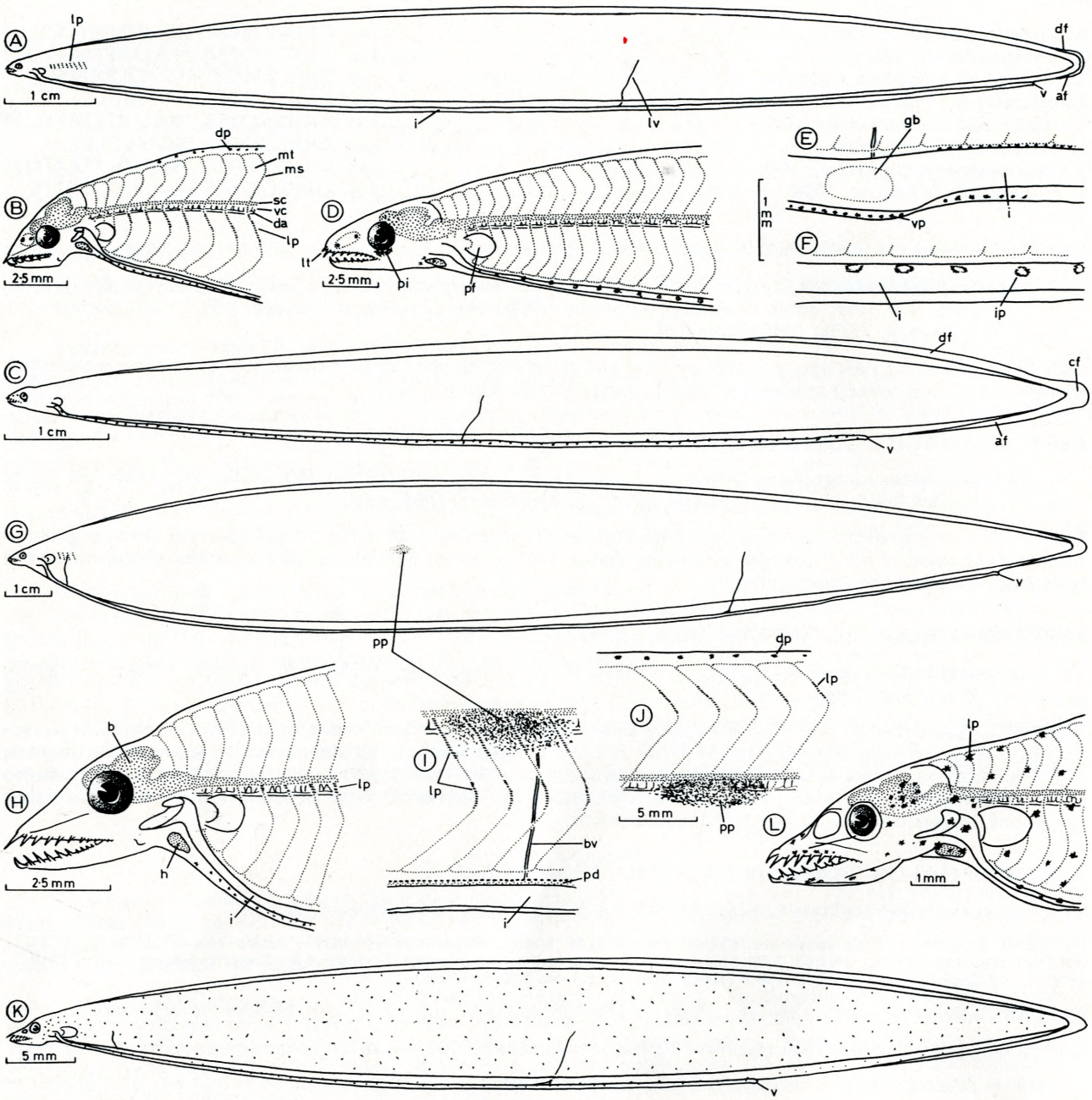


PLATE 108

Figs. A, B, E: Larva of **Ariosoma scheelei** (Strömman) – Fig. A: lateral view, pigment on myosepta below lateral line only partly shown: Fig. B: head region; Fig. E: view at level of gall bladder to show pigment on ventral body wall and on pronephric duct above intestine.

Figs. C, D, F: Larva of **Gnathophis capensis** (Kaup) – Fig. C: lateral view, showing pigment along intestine; Fig. D: head region; Fig. F: view of intestine to show nature of pigmentation.

Figs. G–J: **Leptocephalus scalaris** Castle (larva of **Coloconger?**) – Fig. G: lateral view, lateral pigment only partly shown; Fig. H: head region; Fig. I: view at level of black lateral spot to show pigmentation on myosepta below lateral line; Fig. J: view at same level to show pigmentation on myosepta above lateral line.

Figs. K, L: **Leptocephalus maculatus** – Della Croce & Castle – Fig. K: lateral view to show body pigmentation; Fig. L: head region.

Abbreviations: af – anal fin, b – brain, bv – blood vessel, cf – caudal fin, da – dorsal aorta, df – dorsal fin, dp – dorsal pigment, gb – gall bladder, h – heart, i – intestine, ip – intestinal pigment, lp – lateral pigment, lt – larval teeth, lv – last vertical blood vessel to viscera, ms – myoseptum, mt – myotome, pd – pronephric duct, pf – pectoral fin, pi – pigment on the iris, pp - midlateral pigment patch, sc – spinal cord, v – vent, vc – vertebral column, vp – ventral pigment.

From these observations it is clear that **L. scalaris** represents a species or a species complex which is very widespread throughout the Indo-Pacific and which also occurs in the tropical Atlantic. The range of myomere number for all **L. scalaris**-type larvae is thus 142–157. Collections in the eastern Indian Ocean suggest that the adult (whatever this may ultimately prove to be) of the species in this part of the Indo-Pacific probably spawns in the area south of Java during August–September. The developing larvae are carried with the spread of tropical waters along 110°E. into more southerly latitudes.

In pigmentation and body form **L. scalaris** shows similarities to larvae of the **Ariosoma** group of congrid eels, although the latter do not possess the additional series of melanophores on the myosepta. A remarkable feature of the present species is the posterior position of the last vertical blood vessel to the viscera. Its position at the 100th segment indicates that the kidney and posterior limit of the body cavity in the adult would be placed well back so that precaudal vertebrae would number about 90–100 and caudal vertebrae about 50–60.

As far as I can determine, only **Coloconger** amongst the known congrid eels would have such a character. Unfortunately, precaudal vertebral numbers are unknown in the four species of the genus. Chan (1967: 100) gives a count of 77 (trunk) and 77 (caudal) vertebrae for **C. scholesi** but I do not know if the "trunk" vertebrae are those before the level of the vent or that they are actually precaudal. However, Kanazawa (1961b: table 1) records lateral line pores before vent to be 69 in **C. raniceps**, 67–74 in **C. meadi** and 65–71 in **C. cadenati**. It thus seems likely that precaudal vertebral number in **Coloconger** is high, possibly as many as 90–100.

In consideration of the similarities in caudal structure of **L. scalaris**-type larvae and **Coloconger** (as illustrated by Chan, 1967: fig.10—caudal rays 4+3+1—for **C. scholesi**), the general coincidence of vertebral and myomere numbers, and the posterior position of the end of the body cavity, I would suggest that larvae of this type are identifiable as young **Coloconger**.

LEPTOCEPHALUS MACULATUS Della Croce & Castle, 1966 **Plate 108 K,L**

Leptocephalus maculatus Della Croce & Castle, 1966: 156, fig.1 A–C (Mozambique Channel).

MATERIAL EXAMINED. Holotype, 47.9mm total length, **Anton Bruun** Station 404 A, 19°34′S., 40°19′E., 10/10/64, 0415 hrs., surface.

DESCRIPTION. Myomeres 105+66 = 171, first vertical blood vessel to viscera at myomere 22, last at myomere 70, anterior margin of gall bladder at myomere 22, teeth $\frac{I + VI}{I + V} \frac{+ 4.}{+ 4}$ Pigmentation as follows: a series of melanophores along the ventral body wall from throat to vent; melanophores over the whole of the lateral body surface and on the head, snout and lower jaw; pigment spots on the bases of the dorsal and anal rays.

REMARKS. This larval species is remarkable amongst congrid larvae in having melanophores scattered over the lateral body surface. It also has a relatively high number of myomeres. The identity of **L. maculatus** must remain unknown until metamorphic specimens showing both larval and juvenile characters are collected.

SUMMARY

(1) Eleven genera and 19 species of eels of the family Congridae are now known from the western Indian Ocean and the Red Sea. At least five additional species, known only from larvae, also occur in the area.

(2) The majority of these inhabit shallow to deepish waters off the tropical east coast; the others are more characteristic of waters around the Cape. There are almost complete Indo-Pacific affinities although in the south the species show similarities to Australasian forms and there is a slight Atlantic faunal influence.

(3) **Bathymyrus smithi** Castle is known only from deepish water off southern Mozambique. In its dentition it is a more conservative species than other members of the genus and is thus a possible link with **Anago-Ariosoma** congrids to which it is osteologically closely similar. The Bathymyrinae is used here for this group of congrids, in preference to the Anagoinae.

(4) **Ariosoma scheelei** (Strömman), with about 115 vertebrae, is present in all post-metamorphic growth stadia along the north coast of Mozambique but it is also known from various other parts of the tropical Indo-Pacific. Adults probably spawn on the continental slope of the oceanic basin north of Madagascar and larvae are to be found to the north and south. **A. nigrimanum** (Norman) is a poorly-known species from the Gulf of Aden. **A. mauritianum** (Pappenheim), with about 145 vertebrae, occurs in offshore waters of the southern coast, but it is also known from subtropical waters of Australia. Adults probably spawn on the continental slope of the oceanic basin south of Madagascar and larvae are to be found in Natal waters and further south.

(5) **Congriscus maldivensis** (Norman), from deepish water near the Maldives, is now recognised as the second species of this genus. It is distinguished from **C. megastomus** (Günther) from Japan in having a shorter head and snout and fewer vertebrae (148).

(6) There are two species of **Conger** in the area. The species of cooler southern waters and previously referred to **C. conger** (L.) (Atlantic) and **C. jordani** (Japan) is now recognised to be **C. wilsoni** (Bl. & Schn.), an Australasian species. South African specimens have fewer dorsal and anal rays than **C. wilsoni** from New Zealand, but the species needs further investigation before local material is set aside as distinct. **C. cinereus** Rüppell is relatively abundant at all growth stadia along the tropical east coast, but may range as far south as Knysna on the south coast.

(7) **Gnathophis capensis** (Kaup), previously known as **Congermuraena australis** Barnard, is closely similar to **G. mystax** (De La Roche) from the Atlantic and **G. incognitus** Castle from Australasian waters. It spawns over the continental slope south of Cape Point under the influence of warmer waters which intrude into this area in late summer. Larval life of **G. capensis** is about a year. Larvae and juveniles of **G. habenatus** (Richardson), a species previously known only from Australasia, occur off the southeast coast but adults of this species have not yet been collected in this area. **G. mystax** itself, otherwise known from the North and Central Atlantic and Mediterranean has been recorded from the Suez Canal in the north, but cannot be regarded as a normal inhabitant of the western Indian Ocean.

(8) **Pseudoxenomystax albescens** (Barnard), previously recorded as **Congermuraena albescens**, is found in deepish water off the Cape and is closely similar to **P. hirsutus** Castle from New Zealand waters.

(9) **Congrina guttulata** (Günther) is known from the northern Indian Ocean but its exact relationships to other similar species of the genus have yet to be determined by more critical study of these species. **C. wallacei** sp. nov. from off southern Mozambique and Natal has conspicuously large teeth on the jaws, a long snout and 168 vertebrae.

(10) **Uroconger lepturus** (Richardson) is not uncommon offshore in tropical areas of the east coast and occurs widely throughout the Indo-Pacific. **U. braueri** (Weber & de Beaufort), in contrast, inhabits much deeper waters apparently across the whole of the northern Indian Ocean. **U. vicinus** Vaillant, essentially an eastern Atlantic species, reaches as far south as the Cape.

(11) **Coloconger raniceps** Alcock in the Indian Ocean is known only from the north. However, the presence of larvae of the type **Leptocephalus scalaris** Castle, which appear to be identifiable with **Coloconger**, suggests also the presence of eels of this genus in southern deep waters.

(12) **Gorgasia sillneri** Klausewitz (from the Red Sea) and **Taenioconger hassi** (Klausewitz & Eibl-Eibesfeldt) (from the Amirantes) are the only eels of the subfamily Heterocongrinae in the western Indian Ocean although others possibly also occur.

(13) Larval species which have not yet been identified with their adults suggest that further congrids to those listed above will become known from this area, particularly when the deeper offshore waters are examined more closely.

LITERATURE CITED

ALCOCK, A. W., 1889. On the bathybial fishes of the Bay of Bengal and neighbouring waters, obtained during the seasons 1885–89. **Ann. Mag. nat. Hist.,** 6 ser., **4:** 450–461.

ALCOCK, A. W., 1892a. On the bathybial fishes collected during the season of 1891–92. **Ann Mag. nat .Hist.,** 6 ser., **10:** 345–364, 1 pl.

ALCOCK, A. W., 1892b. **Illustrations of the zoology of H.M. Indian marine surveying steamer "Investigator", under the command of Comm. A. Carpenter and Comm. R. F. Hoskyn.** Fishes, Part 1, Plates I-VII, Calcutta.

ALCOCK, A. W., 1893. An account of the deep sea collection made during the season of 1892–93. **J. Asiat. Soc. Beng., 62** (2): 169–184, 2 pls.

ALCOCK, A. W., 1894. An account of a recent collection of bathybial fishes from the Bay of Bengal and from the Laccadive Sea. **J. Asiat. Soc. Beng., 63** (2): 115–137, 2 pls.

ALCOCK, A. W., 1896. A supplementary list of the marine fishes of India, with descriptions of 2 new genera and 8 new species. **J. Asiat. Soc. Beng., 65** (2): 301–338.

ALCOCK, A. W., 1899. **A descriptive catalogue of Indian deep-sea fishes in the Indian Museum, collected by the royal Indian marine survey ship "Investigator".** Calcutta, iii + 220 pp., 1 map.

ASANO, H., 1962. Studies on the congrid eels of Japan. **Bull. Misaki mar. biol. Inst. Kyoto Univ.,** (1): 1–143, 62 figs., 10 tabs.

BAISSAC, J. de B., 1957. Contribution à l'étude des poissons de l'île Maurice. VII. **Proc. R. Soc. Arts Sci. Maurit., 2** (1): 1–37.

BAISSAC, J. de B., 1958. Annual report of the Fisheries Branch for 1956. **Ann. Rep. Fish. Off. Maurit., 14:** 1–13, App. A-D.

BARNARD, K. H., 1923. Diagnosis of new species of marine fishes from South African waters. **Ann. S. Afr. Mus., 13** (8): 439–445.

BARNARD, K. H., 1925. A monograph of the marine fishes of South Africa. **Ann. S. Afr. Mus., 21** (1): 1–418, 18 figs., 17 pls.

BEN-TUVIA, A. & STEINITZ, H., 1952. Report on a collection of fishes from Eylath (Gulf of Aqaba), Red Sea. **Bull. Israel Dept. Fish. Res. St., 2:** 1–12.

BERTIN, L., 1935. Les types de Kaup dans la collection des leptocéphales du Museum. **Bull. Mus. natn. Hist. nat., Paris,** 2 sér., **7** (2): 99–106, 1 fig.

BERTIN, L., 1936. Contribution à l'étude des larves de poissons Apodes. (Les types de Strömman à l'Institut zoologique de l'Université d'Uppsal). **Bull. Inst. océanogr. Monaco,** (694): 1–16, 13 figs.

BLACHE, J., 1963. Note préliminaire sur les larves leptocéphales d'apodes du Golfe de Guinée (Zone Sud.) **Cah. océanogr.,** (5) (sér. Pointe-Noire III): 5–23, 22 pls.

BLEEKER, P., 1855. Zesde bijdrage tot de kennis der ichthyologische fauna van Amboina. **Natuurk. Tijdschr. Ned.-Indië, 8:** 391–434.

BLEEKER, P., 1859a. Bijdrage tot de kennis der fischfauna van Nieuw-Guinea. **Act. Soc. scient. Indo-Néêrl., 6:** 1–24.

BLEEKER, P., 1859b. Enumeratio specierum piscium hucusque in Archipelago Indico observatorum . . . . . **Act. Soc. scient. Indo-Néêrl., 6:** xxxvi + 276 pp.

BLEEKER, P., 1860. Over eenige vischoorten van die Kaap de Goede Hoop. **Natuurk. Tijdschr. Ned.-Indië, 21:** 49–80.

BLEEKER, P., 1864a. Systema muraenorum revisum. **Ned. Tijdschr. Dierk., 2:** 113–122.

BLEEKER, P., 1864b. **Atlas ichthyologique des Indes Orientales Néêrlandaises, publié sous les auspices du Gouvernement colonial. Tome IV. Murènes, Synbranches, Leptocéphales.** Leiden, 132 pp., 49 pls.

BLEEKER, P., 1865. Enumération des espèces de poissons actuellement connues de l'île d'Amboine. **Ned. Tijdschr. Dierk., 2:** 270–293.

BLEEKER, P., 1878. Quatrième mémoire sur la faune ichthyologique de la Nouvelle-Guinée. **Archs néerl. Sci., 13:** 35–66, 2 pls.

BLEEKER, P., 1879a. Enumération des espèces de poissons actuellement connues du Japon et description de trois espèces inédites. **Natuurk. Verh. K. Akad., 18:** 1–33, 3 pls.

BLEEKER, P., 1879b. Contribution à la faune ichthyologique de l'île Maurice. **Natuurk. Verh. K.Akad., 18:** 1–23, 3 figs.

BLEEKER, P. & POLLEN, F. P. L., 1874. **Poissons de Madagascar et de l'île de la Réunion.** Leiden: E. J. Brill, 104 pp. 24 pls.

BLOCH, M. E. & SCHNEIDER, J. G., 1801. **M.C. Blochii . . . Systema Ichthyologiae iconibus cx illustratum. Post obitum auctoris . . . interpolavit Jo. Gottlob Schneider.** Berlin, Ix + 584 pp., 110 col. pls.

BOULENGER, G. A., 1901. On some deep-sea fishes collected by Mr. F. W. Townsend in the Sea of Oman. **Ann. Mag. nat. Hist.,** 7 ser., **7:** 261–263, 1 pl.

BRAUER, A., 1906. Die Tiefsee-Fische, I, Systematischer Teil. **Wiss. Ergebn. dt. Tiefsee-Exped.,** Zoologie, 432 pp., 176 figs., 16 pls., 2 charts.

BREDER, C. M., 1927. Scientific results of the First Oceanographic Expedition of the "Pawnee" 1925. Fishes. **Bull. Bingham oceanogr. Coll., I** (1): 1–90, 36 figs.

CANTOR, T. E., 1849. Catalogue of Malayan fishes. **J. Asiat. Soc. Beng., 18:** xii + pp. 983–1443.

CANTOR, T. E., 1850. **Catalogue of Malayan fishes.** Calcutta: Baptist Mission Press, xii + 461 pp.

CASTLE, P. H. J., 1960. Two eels of the genus **Pseudoxenomystax** from New Zealand waters. **Trans. R. Soc. N.Z., 88** (3): 463–472, 2 figs.

CASTLE, P. H. J., 1963. The systematics, development and distribution of two eels of the genus **Gnathophis** (Congridae) in Australasian waters. **Zoology Publs Vict. Univ. Wellington,** (34): 15–47, 10 figs.

CASTLE, P. H. J., 1964. Congrid leptocephali in Australasian waters with descriptions of **Conger wilsoni** (Bl. & Schn.) and **C. verreauxi** Kaup. **Zoology Publs Vict. Univ. Wellington,** (37): 1–45, 11 figs.

CASTLE, P. H. J., 1966a. Die ichthyologische Ausbeute der ersten WestafrikaFahrt des fischeritechnischen Forschungsschiffes "Walter Herwig". 3. The eel larvae (leptocephali). **Arch. FischWiss., 17** (1): 19–35, 3 figs.

CASTLE, P. H. J., 1966b. Les leptocéphales dans le Pacifique Sud-ouest. **Cah. océanogr., 4** (4): 51–71, 5 figs.

CASTLE, P. H. J., 1967. Heterocongrine eels in the southwest Pacific. **Rec. Dom. Mus., Wellington, 6** (2): 5–12, 1 fig.

CASTLE, P. H. J., 1968a. Description and osteology of a new eel of the genus **Bathymyrus** Alcock from off Mozambique. **Spec. Publn Dept. Ichthyol. Rhodes Univ.,** (4): 1–12, 2 figs.

CASTLE, P. H. J., 1968b. Larval development of the congrid eel, **Gnathophis capensis** (Kaup), off southern Africa, with notes on the identity of **Congermuraena australis** Barnard. **Zoologica Africana, 3** (2) (in press).

CASTLE, P. H. J., (in press). Species structure and seasonal distribution of eel-larvae in the eastern Indian ocean during 1962–63. **Cah. océanogr.**

CHAN, W. L., 1967. A new species of congrid eel from the South China Sea. **J. nat. Hist., 1** (1): 97–112, 13 figs.

CHEN, J. T. F. & WENG, H. T. C., 1967. A review of the apodal fishes of Taiwan. **Biol. Bull. Dept. Biol. Tunghai Univ., 32,** ichthyol. ser., (6): 1–86, 64 figs.

CUNNINGHAM, J. T., 1895. The larva of the eel. **J. mar. biol. Ass.,** (1893–95), n.s., **3**: 278–287, fig.

D'ANCONA, U., 1928a. Murenoidi (Apodes) del Mar Rosso e del Golfo di Aden. Materiali raccolti dal Prof. Luigi Sanzo nella campagna della R.N. "Ammiraglio Magnaghii" 1923–24. **Memorie R. Com. talassogr. ital., 146:** 1–146, 5 pls.

D'ANCONA, U., 1928b. Notizie preliminaire sugli stadi larvali di Murenoidi raccolti dal prof. Luigi Sanzo nel Mar Rosso e nel Golfo di Aden durante la crociera della R.N. "Ammiraglio Magnaghii" 1923–24. **Atti Accad. naz. Lincei Rc., 7:** 427–431.

D'ANCONA, U., 1928c. Sulla possibilità di ordinaire sistematicamente le specie larvali dei Murenoidi. **Atti Accad. naz. Lincei Rc. 7:** 516–520.

D'ANCONA, U., 1930. Ricerche di biologia marina sui materiali raccolti dalla R.N. "Ammiraglio Magnaghii" anno 1923–24. Memoria VI.-Murenoidi (Apodes) del Mar Rosso. **Annali idrogr. Genova, 11:** 243–259, 1 pl.; **11** (bis.): 241–354, 1 pl.

DAY, F., 1878. **The fishes of India: being a natural history of the fishes known to inhabit the seas and fresh waters of India, Burma, and Ceylon.** London: William Dawson & Sons (reprint, 1958), xx + 778 pp., 198 pls.

DAY, F., 1889. **The fauna of British India, including Ceylon and Burma. Fishes.-Vol. I.** London: Taylor & Francis, xvii + 548 pp., 164 figs.

DAY, J. H., 1967. The biology of the Knysna Estuary, South Africa. In: **Estuaries:** Am. Ass. Advt Sci., pp. 397–407, 6 figs., 4 tabs.

DE LA ROCHE, F. E., 1809. Observations sur des poissons recueillis dans un voyage aux îles Baléares et Pythiuses. **Ann. Mus. natn. Hist. Nat., Paris, 13:** 313–361, fig.

DELLA CROCE, N. & CASTLE, P. H. J., 1966. Leptocephali from the Mozambique Channel. **Boll. Musei. Ist. biol. Univ. Genova, 34** (211): 149–164, 1 fig.

DEPT. COMMERCE & IND., SOUTH AFRICA, 1963. Thirty-first annual report for the period 1st. April, 1959, to 31st. March, 1960. **Commerce & Industry,** pp. 1–242, figs. (January, 1963).

DERANIYAGALA, P.E.P., 1934. Some apodal larvae from Ceylon waters. **Ceylon J. Sci.,** B **19** (1): 89–96, 11 figs.

DUNCKER, G. & MOHR, E., 1929. Die Fische der Südsee - Expedition der Hamburgischen wissenschaftlichen Stiftung 1908-1909. **Mitt. zool. StInst. Hamb.,** (44): 57-84, 9 figs.

EIGENMANN, C. H., 1902. The egg and development of the conger eel. **Bull. U.S. Fish Commn,** (1901), **21:** 37–44, 12 figs.

FISH, M.P., 1927. Contributions to the embryology of tha American eel (**Anguilla rostrata** Lesueur). **Zoologica, N.Y., 8** (5): 289–324, 14 figs.

FOURMANOIR, P., 1957. Poissons teleostéens des eaux malgaches du Canal de Mozambique. **Mém. Inst. scient. Madagascar,** sér. océanogr., F **1:** 1–316, 195 figs.

FOURMANOIR, P., 1961. Liste complémentaire des poissons du Canal de Mozambique. **Mém. Inst. scient. Madagascar,** sér. océanogr., F **4:** 83–107, 19 figs.

FOURMANOIR, P. & GUEZE, P., 1961. Poissons de la Réunion. III. Ordre des Apodes et famille des Siganides. **Publs Inst. Réch. scient. Tananarive-Tsimbazaza,** pp. 5–14, 7 figs.

FOWLER, H. W., 1928. The fishes of Oceania. **Mem. Bernice P. Bishop Mus., 10:** iii + 486 pp., 82 figs., 49 pls.

FOWLER, H. W., 1931. The fishes of Oceania. Suppl. 1. **Mem. Bernice P. Bishop Mus., 11** (5): 311–381.

FOWLER, H. W., 1933. Descriptions of new fishes obtained 1907 to 1910, chiefly in the Philippine Islands and adjacent seas. **Proc. Acad. nat. Sci. Philad., 85:** 233–367, 117 figs.

FOWLER, H. W., 1934. The fishes of Oceania. Suppl. 2. **Mem. Bernice P. Bishop Mus., 11** (6): 383–466.

FOWLER, H. W., 1956. **Fishes of the Red Sea and Southern Arabia. Volume 1. Branchiostomida to Polynemida.** Jerusalem: Weismann Science Press of Israel, 240 pp., 115 figs.

FOWLER, H. W., 1959. **Fishes of Fiji.** Suva: Government of Fiji, 670 pp., incl. suppl., 243 figs.

GARMAN, S., 1899. Reports on an exploration . . . "Albatross" during 1891, Lieut.-Commander Z. L. Tanner, U.S.N., commanding. XXVI. The fishes. **Mem. Mus. comp. Zool. Harv., 24:** 1–431, 97 pls., 1 chart.

GILBERT, C. H. & CRAMER, F., 1897. Report on the fishes dredged in deep water near the Hawaiian islands, with description and figures of twenty three new species. **Proc. U.S. natn. Mus., 19:** 403–435, 12 pls.

GILCHRIST, J. D. F., 1902. **Catalogue of fishes from South Africa. Marine Invest. Sth. Africa.** Cape Town: Cape of Good Hope Dept. Agric., vi + 238 pp., 183 pls.

GINSBURG, I., 1954. Four new fishes and one little-known species from the east coast of the United States including the Gulf of Mexico. **J. Wash. Acad. Sci., 44** (8): 256–264 6 figs.

GOODE, G. B. & BEAN, T. H., 1895. Oceanic ichthyology. A treatise on the deep-sea and pelagic fishes of the world, based chiefly upon the collections made by the steamers Blake, Albatross, and Fish Hawk in the northwestern Atlantic. **Smithson. Contrib. to Knowledge,** (981): xxxv + 553 pp., 123 pls (with 417 figs.).

GOPINATH, K., 1946. Notes on the larval and post-larval stages of fishes found along the Trivandrum coast. **Proc. natn. Inst. Sci. India, 12:** 7–21, 7 figs.

GOPINATH, K., 1950. On a few leptocephali from the Trivandrum coast. **Rec. Indian Mus., 47** (1): 87–98, 1 fig., 1 pl.

GRASSI, G. B., 1913. **Metamorfosi dei murenoidi. Ricerche sistematiche ed ecologiche.** Jena: Fischer, x + 211 pp. 15 pls.

GRUVEL, A. & CHABANAUD, P., 1937. Missions A. Gruvel dans le Canal de Suez. II Poissons. **Mem. Inst. Egypt, 35:** 1–30, 29 figs.

GUDGER, E. W., 1929. Nicolas Pike and his unpublished paintings of the fishes of Mauritius, western Indian Ocean, with an index to the fishes. **Bull. Amer. Mus. nat. Hist., 58** (9): 489–530, 8 figs.

GUICHENOT, A., 1863. **Fauna ichthyologique.** In: Maillard, L., **Notes sur l'île de la Réunion (Bourbon) avec l'histoire naturelle etc., vol. 2.** Paris, 32 pp.

GUNTHER, A. C. L. G., 1870. **Catalogue of the fishes in the British Museum, 8.** London: British Museum, xxv + 549 pp., figs.

GUNTHER, A. C. L. G., 1887. Report on the deep-sea fishes collected by H.M.S. "Challenger" during the years 1873–76. **Rep. scient. Res. Challenger, 22** (57): 1–268, 66 pls.

GUNTHER, A. C. L. G., 1910. Fische der Sudsee. Vol. 3, pt. 9. **J. Mus. Godeffroy, 6** (17): 389–515, 19 pls.

HERRE, A. W. C. T., 1923. A review of the eels of the Philippine Archipelago. **Philipp. J. Sci., 23** (2): 123–236, 14 figs., 11 pls.

HERRE, A. W. C. T., 1941. A list of the fishes known from the Andaman Islands **Mem. Indian Mus., 13** (3): 331–403.

HERRE, A. W. C. T., 1953. Check list of Philippine fishes. **Res. Rep. U.S. Fish Wildl. Serv., 20:** 1–977.

JATZOW, R. & LENZ, H., 1898. Fische von Ost-Afrika, Madagascar und Aldabra. **Abh. senckenb. naturforsch. Ges., 21:** 497-531, 3 pls.

JONES, S. & PANTALU, V. R., 1955. On some ophichthyid larvae from Indian coastal waters. **Indian J. Fish., 2** (1): 57–66, 4 figs.

JORDAN, D. S., 1919. The genera of fishes, part III, from Guenther to Gill, 1859–1880, twenty-two years, with the accepted type of each. A contribution to the stability of scientific nomenclature. **Leland Stanf. jr Univ. Publs Univ. Ser.,** pp. 285–410 + i-xv.

JORDAN, D. S., EVERMANN, B. W. & CLARK, H. W., 1930. A check list of the fishes and fishlike vertebrates of North and Middle America north of Venezuela and Colombia. **Rep. U.S. Commnr Fish.,** (1928), (2): 1–670.

JORDAN, D. S. & HUBBS, C. L., 1925. Record of fishes obtained by David Starr Jordan in Japan, 1922. **Mem. Carneg. Mus., 10** (2): 93–346, 1 fig., 8 pls.

KANAZAWA, R. H., 1957. A new species of eel, **Coloconger meadi,** and new records for the ateleopid fish, **Ijimaia antillarum** Howell Rivero, both from the Gulf of Mexico. **Copeia,** (3): 234–235, 1 fig.

KANAZAWA, R. H., 1958. A revision of the eels of the genus **Conger** with descriptions of four new species. **Proc. U.S. natn. Mus., 108:** 219–267, 7 figs., 7 tabs., 4 pls.

KANAZAWA, R. H., 1961a. **Paramyrus kellersi** Fowler, a synonym of the eel **Conger cinereus cinereus** Rüppell. **Copeia,** (1): 115.

KANAZAWA, R. H., 1961b. A new eel, **Coloconger cadenati** and a redescription of the heterocongrid eel, **Taenioconger longissimus** (Günther) both from the coast of Senegal. **Bull. Inst. fr. Afr. noire, 23,** sér. A, (1): 108–115, 2 pls.

KAUP, J. J., 1856a. **Catalogue of apodal fish, in the collection of the British Museum.** London:British Museum, vii + 163 pp., 19 pls.

KAUP, J. J., 1856b. Uebersicht der Aale. **Arch. Naturgesch., 22** (1): 41–77.

KLAUSEWITZ, W., 1962a. Röhrenaale im Roten Meer. **Natur Mus., 92** (3): 95–98, 4 figs.

KLAUSEWITZ, W., 1962b. **Gorgasia sillneri,** ein neuer Röhrenaal aus dem Roten Meer (Pisces, Apodes, Heterocongridae). **Senckenb. biol., 43** (6): 433–435, 2 figs.

KLAUSEWITZ, W., 1965. **Die Erforschung der Ichthyofauna des Roten Meeres.** Weinheim: J. Cramer, pp. v-xxxvi, 3 figs.

KLAUSEWITZ, W., 1967. **Xarifania hassi,** ein Neunachweis für die Seychellen. (Pisces, Osteichthyes, Apodes, Heterocongridae). **Senckenb. biol., 48** (5–6): 335–336.

KLAUSEWITZ, W. & EIBL-EIBESFELDT, I., 1959. Neue Röhrenaale von den Maldiven und Nikobaren (Pisces, Apodes, Heterocongridae). **Senckenb. biol., 40** (3–4): 135–153, 17 figs.

KLUNZINGER, C. B., 1871. Synopsis der Fische des Rothen Meeres. II. Theil. **Verh. zool.-Bot. Ges. Wien, 21:** 441–668.

KNER, R., 1865. **Reise der österreischischen Fregatte "Novara" um die Erde in den Jahren 1857-1859, unter den Befehlen des Commodore B. von Wüllerstorf Urbain.** Fische, 433 pp., 16 pls.

LESSON, R. P., 1830. **Poissons.** In: Duperry, L. I., **Voyage autour du monde exécuté sur la corvette "La Coquille", pendant les annees 1822-25: publié sous les auspices de S.E.M. le comte de Charrol.** Vol. 2, pt. 1, pp. 86–238, 58 pls in atlas (separate).

LLOYD, R. B., 1909. A description of the deep-sea fish caught by the R.I.M.S. ship 'Investigator'. since the year 1900, with supposed evidence of mutation in **Malthopsis. Mem. Indian Mus., 2:** 139–180, 8 figs., 7 pls.

MARSHALL, N. B. & BOURNE, D. W., 1964. A photographic survey of benthic fishes in the Red Sea and Gulf of Aden, with observations on their population density, diversity, and habits. **Bull. Mus. comp. Zool. Harv., 132** (2): 225–244, 4 figs., 2 tabs., 4 pls.

MOBIUS, K. A. & PETERS, W. C. H., 1883. Liste des poissons collectionés à Maurice et aux Seychelles. **Trans. R. Soc. Arts Sci. Maurit., 11:** 49–58.

MORROW, J. E., 1954. Fishes from east Africa with new records and description of two new species. **Ann. Mag. nat. Hist.,** 12 ser., **7:** 797–820, 2 pls.

MUNRO, I. S. R., 1955. **The marine and fresh water fishes of Ceylon.** Canberra: Dept. of External Affairs, xiii + 351 pp., 56 pls.

MUNRO, I. S. R., 1958. The fishes of the New Guinea region. A check list of the fishes of New Guinea incorporating records of species collected by the Fisheries Survey vessel "Fairwind" during the years 1948 to 1950. **Papua New Guin. agric. J., 10** (4): 97–369, 1 fig., 3 maps.

NAIR, R. V., 1947. On the metamorphosis of two leptocephali from the Madras plankton. **Proc. Indian Acad. Sci.,** B **25** (1): 1–14, 11 figs., 2 pls.

NAIR, R. V., 1948. Leptocephali of the Gulf of Manaar. **Proc. Indian Acad. Sci.,** B **27:** 87–91, 2 figs.

NAIR, R. V., 1960. General remarks on Indian leptocephali. **Proc. Indian Acad. Sci.,** B **52:** 228–252, 4 tabs.

NAIR, R. V. & MOHAMED, K. H., 1960. Studies on the leptocephali of Bombay waters. I. The metamorphosing stages of **Muraenesox talabonoides** (Bleeker). **Proc. Indian Acad. Sci.,** B **52:** 147–168, 8 figs., 3 tabs., 1 pl.

NORMAN, J. R., 1922. Three new fishes from Zululand and Natal, collected by Mr. H. W. Bell Marley; with additions to the fish fauna of Natal. **Ann. Mag. nat. Hist.,** 9 ser., **9:** 318–322.

NORMAN, J. R., 1939. Fishes. **Sci. Res. John Murray Exped., 7** (1): 1–116, 41 figs.

ORREN, M. J., 1963. Hydrological observations in the south west Indian Ocean. **Investl Rep. Dept. Comm. Indust. S. Afr.,** (45): 1–61, 37 figs., 6 tabs.

ORREN, M. J., 1966. Hydrology of the south west Indian Ocean. **Inv. Rep. Div. Sea Fish. S. Afr.,** (55): 1–36, 45 figs., 4 tabs.

OGILBY, J. D., 1898. New genera and species of fishes. **Proc. Linn. Soc. N.S.W., 23** (3): 280–299.

PAPPENHEIM, P., 1914. Die Fische der deutschen Südpolar-Expedition 1901-1903. II. Die Tiefseefische. **Dt. Sudpol.-Exped., 15 (Zool. Abh. 7),** pp. 161–200, 10 figs.

PARR, A. E., 1932. Deep sea eels, exclusive of larval forms. **Bull. Bingham oceangr. Coll., 3** (5): 1–41, 15 figs.

PENRITH, M. J., 1967. The fishes of Tristan da Cunha, Gough Island and the Vema Seamount. **Ann. S. Afr. Mus., 48** (22): 523–548, 2 figs., 1 pl., 1 tab.

PETERS, W. C. H., 1855a. Uebersicht der in Mossambique beobachteten Seefische. **Mber. dt. Akad. Wiss. Berl.,** pp. 428–466.

PETERS, W. C. H., 1855b. Uebersicht der in Mossambiqua beobachteten Seefische. **Arch. Naturgesch.,** 21 Jahrg., **1:** 234–282.

PETERS, W. C. H., 1859. Eine neue vom Herrn Jagor im atlantischen Meere gafangene Art der Gattung Leptocephalus, und über einige andere neue Fische des Zoologischen Museums. **Mber. dt. Akad. Wiss. Berl.,** pp. 411–414.

PETERS, W. C. H., 1865a. Ueber einige neue Säugethiere, Amphibien und Fische. **Mber. dt. Akad. Wiss. Berl.,** pp. 381–399.

PETERS, W. C. H., 1865b. Description of a new species of Leptocephalus. **Ann. Mag. nat Hist.,** 3 ser., **15.** 48-49.

PETERS, W. C. H., 1866. Mittheilung über Fische (Protopterus, Auliscops, Labrax, Labracoglossa, Nematocentris, Serranus etc.). **Mber. dt. Akad. Wiss. Berl.,** pp. 509–526, 1 pl.

PETERS, W. C. H., 1876. Uebersicht der von Dr. K. Möbius in Mauritius und bei den Seychellean gesammeten Fische. **Mber. dt. Akad. Wiss. Berl.,** pp. 435–447.

PFEFFER, G. J., 1901. **Fische.** In: Stuhlmann, F. L., **Zoologische Ergebnisse einer in der Jahren 1888-90 . . . von . . . F. Stuhlmann in die Küstengebiete von Ost-Afrika unternommenen Reise.** Berlin, 49 pp., figs.

PLAYFAIR, R. L. & GUNTHER, A. C. L. G., 1866. **The fishes of Zanzibar, with a list of the fishes of the whole east coast of Africa.** London: John van Voorst, xiv + 153 pp. 21 pls.

REID, E. D., 1934. Two new congrid eels and a new flatfish. **Smithson. misc. Coll., 91** (15): 1–11, 2 figs., 1 pl.

RICHARDSON, J., 1845. **Ichthyology.** In: Hinds, R. B. (ed.), **The zoology of the voyage of H.M.S. "Sulphur", under the command of Captain Sir Edward Belcher, during the years 1836-42.** London, pp. 51–150, 30 pls.

RICHARDSON, J., 1848. **Ichthyology of the voyage of H.M.S. Erebus & Terror, under the command of Captain Sir James Clark Ross., F.R.S.** London: Edward Newman, viii + 139 pp., 60 pls.

ROSENBLATT, R. H., 1967. The osteology of the congrid eel **Gorgasia punctata** and the relationships of the Heterocongrinae. **Pacific Sci., 21** (1): 91–97, 4 figs.

RUPPELL, W. P. E. S., 1828. **Atlas zu der Reise im nördlichen Afrika. Fische des Roten Meeres.** Frankfurt: Ludwig Brönner, 141 pp., 119 pls.

RUPPELL, W. P. E. S., 1858. **Verzeichniss der in dem Museum der Senckenbergischen naturforschenden Gesellschaft aufgestellten Sammlungen. Vierte Abtheilung: Fische und deren Skelette.** Frankfurt: Sauerländer, iv + 40 pp.

SAUVAGE, M. H. E., 1879. La faune ichthyologique de l'île Saint-Paul. **Arch. Zool. exp. gén., 8:** 1–46.

SAUVAGE, M. H. E., 1891. **Histoire naturelle des poissons.** In: Grandidier, A., **Histoire physique, naturelle et politique de Madagascar. Vol. 16.** Paris, 543 pp., 50 pls.

SCOTT, J. S., 1959. **An introduction to the sea fishes of Malaya.** Kuala Lumpur: Ministry of Agric., Fed. of Malaya, xii + 180 pp., figs.

SEWELL, R. B., 1912. Notes on the deep-sea fish obtained by the R.I.M.S.S. 'Investigator', during the survey season 1910–11. **Rec. Indian Mus., 7** (1): 1–14.

SHERBORN, C. D., 1922. **Index animalium . . . Section 2, A-Z.** London: British Museum, cxxxii + 7056 pp.

SHERBORN, C. D., 1932. **Index animalium. Section 2, epilogue and index.** London: British Museum, vii + cxxxiii-cxlvii + 1098 pp.

SMITH, J. L. B., 1949–65. **The sea fishes of southern Africa.** South Africa: Central News Agency, xvi + 564 pp., 1232 figs., 107 pls.

SMITH, J. L. B., 1958a. The fishes of Aldabra. Part X. **Ann. Mag. nat. Hist.,** 13 ser., **1**: 57–63, 1 pl.

SMITH, J. L. B., 1958b. **Fishes of Inhaca.** In: Macnae, W. & Kalk, M. (eds.), **A natural history of Inhaca Island, Mocambique.** Johannesburg: Witwatersrand University Press, v + 163 pp., 30 figs., 11 pls.

SMITH, J. L. B., 1962. Sand-dwelling eels of the western Indian Ocean and the Red Sea. **Ichthyol. Bull. Rhodes Univ.,** (24): 447–466, 12 figs., 6 pls.

SMITH, J. L. B. & SMITH, M. M., 1963. **The fishes of Seychelles.** Grahamstown: Dept. of Ichthyology, Rhodes Univ., 215 pp. 98 pls.

SMITH, J. L. B. & SMITH, M. M., 1966. **Fishes of Tsitsikama Coastal National Park.** Johannesburg: Swan Press, 161 pp., figs.

STROMMAN, P. H., 1896. **Leptocephalids in the University Zoological Museum at Upsala.** Upsala: Almqvist & Wiksell, vi + 53 pp., 5 pls.

SWAINSON, W., 1838. **The natural history of fishes, amphibians, & reptiles or monocardian animals. Vol. 1.** London: Longmans etc., vi + 368 pp., 100 figs.

SWAINSON, W., 1839. **The natural history of fishes, amphibians, & reptiles or monocardian animals. Vol. 2.** London: Longmans etc., vi + 452 pp., 135 figs.

THOMPSON, W. W., 1916. Catalogue of fishes of the Cape Province. **Rep. Fish. mar. biol. Surv. Un. S. Afr., 3** (7): 69–133.

TORTONESE, E., 1937. Pesci del Mar Rosso. **Boll. Musei Zool. Anat. comp. R. Univ. Torino, 45,**3 ser., (63): 3–68.

TORTONESE, E., 1939. Resultati ictiologici del viaggio di circumnavigazione del globo dell R.N. "Magenta" (1865–68). **Boll. Musei Zool. Anat. comp. R. Univ. Torino, 47,** 3 ser., (100): 1–245, 47 figs., 9 pls.

TORTONESE, E., 1967. Su alcuni pesci del Golfo di Genova. **Doriana, 4** (177): 1–5, 2 figs.

VAILLANT, L. L., 1888. **Expéditions scientifiques du "Travailleur" et du "Talisman" pendant les années 1880, 1881, 1882, 1883. Poissons.** Paris: Masson, 406 pp., 28 pls.

WADE, C. B., 1946. Two new genera and five new species of apodal fishes from the eastern Pacific. **Allan Hancock Pacif. Exped., 9** (7): 181–238, 4 pls.

WEBER, M., 1913. **Die Fische der Siboga Expedition. 57.** Leiden: E. J. Brill, vii + 710 pp., 123 figs,. 12 pls.

WEBER, M. & BEAUFORT, L. F. de, 1916. **The fishes of the Indo-Australian archipelago. 3. Ostariophysi: II. Cyprinoidea, Apodes, Synbranchi.** Leiden: E. J. Brill, xv + 455 pp., 214 figs.

WHITLEY, G. P., 1927. A check-list of fishes recorded from Fijian waters. **Jour. pan-Pacific Res. Instn, 2** (1): 3–8.

WOODLAND, D. J. & SLACK-SMITH, R. J., 1963. Fishes of Heron Island, Capricorn Group, Great Barrier Reef. **Pap. Dep. Zool. Univ. Queensland., 2** (2): 15–69, 2 pls.

WOOD-MASON, J. & ALCOCK, A., 1891. On the results of deep-sea dredging during the season of 1890–91. **Ann. Mag. nat. Hist.,** 6 ser., **8:** 119–138.

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Names in capitals are those accepted as valid

SUBFAMILIES, GENERA AND SUBGENERA

SPECIES AND SUBSPECIES

LARVAL NAMES

Names in the literature prefixed by **Leptocephalus, L.,** or **Atopichthys**