Records of the Australian Museum (1999) Vol. 51: 113–122. ISSN 0067-1975

A New Genus and Two New Species of Myrophine Worm-eels, with Comments on *Muraenichthys* and *Scolecenchelys* (Anguilliformes: Ophichthidae)

P.H.J. CASTLE [1] AND JOHN E. MCCOSKER [2]

[1] School of Biological Sciences, Victoria University of Wellington,
PO Box 600, Wellington 6000, New Zealand
peter.castle@vuw.ac.nz

[2] California Academy of Sciences, Golden Gate Park,
San Francisco, CA 94118, United States of America
jmccosker@calacademy.org

ABSTRACT. *Skythrenchelys* n.gen. differs from other myrophine ophichthids in the condition of its gill openings (moderately elongate and below lateral midline), dentition (large, conical and uniserial), posterior nostril (entirely outside mouth), and other characters. *Skythrenchelys zabra* n.sp., the type species, is described from India, the Philippines, Indonesia and northern Australia; *S. lentiginosa* n.sp. is described from the Red Sea. *Scolecenchelys* Ogilby, previously a subgenus of *Muraenichthys* Bleeker, is generically distinct on the basis of differences in dentition (teeth conical and uniserial or biserial *vs* blunt and multiserial), cephalic pores (2 pores between anterior and posterior nostrils *vs* 1 pore), and its posterior nostril condition (within *vs* outside mouth). Valid species of *Muraenichthys* and *Scolecenchelys* and their synonyms are identified.

CASTLE, P.H.J., & JOHN E. MCCOSKER, 1999. A new genus and two new species of myrophine worm-eels, with comments on *Muraenichthys* and *Scolecenchelys* (Anguilliformes: Ophichthidae). *Records of the Australian Museum* 51(2): 113–122.

The most recent revision of the snake-eel and worm-eel family Ophichthidae (McCosker *et al*., 1989) recognised 55 genera, including 44 in the Subfamily Ophichthinae and 11 in the Myrophinae. The family is worldwide in distribution, principally but not exclusively in inshore waters of tropical seas. Its members mainly live burrowed tail first in soft sediments and readily avoid capture by most sampling methods, though they are variously vulnerable to ichthyocides. This may explain why some of the approximately 250 ophichthid species are known from few or even single specimens. Ophichthids have distinctive leptocephali, many of which were documented in the Atlantic by Leiby (1989), though most have not yet been identified.

The comprehensive treatment of the Ophichthidae by McCosker *et al*. (1989) brought together what is known of the western North Atlantic species in this family. In contrast, the ophichthid fauna of the Indo-west Pacific is much less well known. Localities where soft sediments of coral sand to mud predominate occur widely but are poorly sampled and warrant further attention. It is expected that new ophichthid taxa will be found from time to time in the Indo-west Pacific, as evidenced by recent records and by those reported here. This paper describes a new genus and two new species of myrophine worm-eels from such habitats, and reviews the related genera *Muraenichthys* Bleeker, 1853 and *Scolecenchelys* Ogilby, 1897.

The worm-eels of the subfamily Myrophinae comprise approximately 55 species distributed among 11 genera. The majority have been uncomfortably assigned to the genera *Myrophis* Lütken, 1851 (seven to eight species), *Pseudomyrophis* Wade, 1946 (eight species), and *Muraenichthys* (about 25 species) in that they lack characters so outstanding as to allow recognition of monophyletic lineages. In his treatment of the osteology and relationships of the Ophichthidae, McCosker (1977) identified subgeneric lineages within *Muraenichthys* but was hesitant to recognise them at the generic level pending a more thorough analysis of the species within that complex assemblage.

Several years ago we were provided with specimens of two remarkable new species, described herein, whose affinities were clearly with *Muraenichthys* (sensu lato). However, we were reluctant to describe them within that genus because of their unique physiognomy and associated characters. After the examination of specimens of most of the Tribe Myrophini, we are now confident in describing them as species of a new genus and at the same time separating two lineages within *Muraenichthys*. In particular, we herein elevate the subgenus *Scolecenchelys* to generic rank. This work is not meant to be a revisionary study of either genus in that numerous problems remain concerning the limits of species which we therefore conservatively retain.

Methods

Measurements are straight-line, made either with a 300 mm ruler with 0.5 mm gradations (for total length, body length, and tail length) and recorded to the nearest 0.5 mm, or with dial calipers (all other measurements) and recorded to the nearest 0.1 mm. Body length comprises head and trunk lengths. Head length is measured from the snout tip to the posterodorsal margin of the gill opening; trunk length is taken from the end of the head to mid-anus; maximum body depth does not include the median fins. Head pore terminology follows that of McCosker *et al*. (1989) such that the supraorbital pores (SO) are expressed as the ethmoid pore + pores in supraorbital canal, e.g., 1 + 3; infraorbital pores (IO) are expressed as pores along the upper jaw + those in vertical part of canal behind eye (the "postorbital pores"), e.g., 4 + 1, in that the last pore included along the upper jaw is part of the postorbital series; the preoperculomandibular pores (POM) include those along the lower jaw and those on the preopercular canal; the supratemporal pores (ST) include those on the dorsolateral side of the head in front of the lateral line pores. The median frontal and supratemporal pores are not included since they are present in all specimens examined. We are not fully satisfied that the numbers of POM pores and our interpretation of them that we have given is definitive. For example, the 6th mandibular pore may well be the first of the preopercular series, such is the extent of posterior displacement of the jaw angle; also, the stained paratype of *S. zabra* n.sp. (CAS 99802) shows just 2 pores in the preopercular series, confirmed in the unstained CAS specimen, while the NMNZ holotype and 2 paratypes apparently have 3 preopercular pores. Osteological examination involved clearing and counterstaining with alcian blue and alizarin red dyes (Dingerkus & Uhler, 1977). Vertebral counts (which include the hypural) were taken from radiographs. Radiographic techniques are described in Böhlke (1989). The mean vertebral formula (MVF) is expressed as the average of predorsal, preanal, and total vertebrae (Böhlke, 1982). Institutional abbreviations used in the text and figures are as listed in Leviton *et al*. (1985). All material is deposited in one or other of the above institutions, as indicated in the text.

AMS	Australian Museum, Sydney
BPBM	Bernice P. Bishop Museum, Honolulu
CAS	California Academy of Sciences, San Francisco
MNHN	Muséum national d'Histoire naturelle, Paris
NMNZ	National Museum of New Zealand, Wellington
NTM	Northern Territory Museum, Darwin
SIO	Scripps Institution of Oceanography, La Jolla, USA
USNM	United States National Museum, Washington D.C.

Skythrenchelys n.gen.

Type species. *Skythrenchelys zabra* n.sp.

Material examined. Holotypes and paratypes of *S. zabra* n.sp. and *S. lentiginosa* n.sp. Cleared and stained material: paratype of *S. zabra* n.sp., CAS 99802, TL 282 mm; *Muraenichthys gymnopterus* (Bleeker, 1853), CAS 61117, TL 184 mm; CAS 98928, TL 242 mm; SIO 69-276, TL 144 mm; *M. schultzei* Bleeker, 1857, CAS 35587, TL 176 mm; paratype of *Scolecenchelys chilensis* (McCosker, 1970), SIO 65-645, TL 248 mm; *S. gymnotus* (Bleeker, 1857), CAS 64946, TL 249 mm; SIO 69-266, TL 244 mm; *S. macropterus* (Bleeker, 1857), SIO 69-277, TL 181 mm.

Diagnosis. Elongate myrophines, Tribe Myrophini (*sensu* McCosker, 1977), with tail equal to or shorter than head and trunk, laterally compressed posteriorly. Snout conical, its underside not grooved and extending just beyond tip of lower jaw. Anterior nostril in a short tube that does not extend beyond lip; posterior nostril a hole with a small anterior flap, entirely above margin of upper lip, slightly below and in advance of orbit. Jaws elongate, centre of orbit in advance of middle of upper jaw. Lips smooth, without crenulae or barbels. Gill opening below lateral midline, unconstricted and elongate for a myrophine, nearly equal in length to isthmus. Median fins low but apparent; dorsal fin origin along trunk or above anus. Pectoral fins absent or a minute remnant. Cephalic and lateral line pores

developed; supraorbital, frontal, infraorbital, preoperculo-mandibular and supratemporal pore (including median supratemporal) series present; lateral line pores absent from posterior third of tail. Teeth conical and large, uniserial on jaws and vomer. Gill arches not well developed; upper pharyngeal tooth plates closely sutured but not fused. Neurocranium stout, sub-truncate posteriorly, supraoccipital crest barely developed. Jaws elongate, suspensorium posteriorly inclined, about 60° to horizontal; maxillae elongate and tapering posteriorly. Opercle and preopercle developed, other elements cartilaginous or absent. Branchiostegal rays typically myrophine (*sensu* McCosker, 1977), 6 attached to outer face of each epihyal with 32 unattached pairs well behind the basal arch. Pectoral girdle reduced to stout cleithrum and thin supracleithrum. Epipleural ribs on all precaudal vertebrae. Other characters those of the two species.

Distribution. Known from two species, ranging from the Red Sea and the Indian and western Pacific oceans, respectively.

Etymology. From Greek *skythros* (angry or sullen) and *enchelys* (an eel), in reference to the facial expression of the two included species. Treated as feminine according to Opinion 95 of the *Bulletin of Zoological Nomenclature*, 1970.

Affinities of the genus. The species of *Skythrenchelys* n.gen. are unique within the Myrophini in the conditions of their gill opening size and location, their dentition, and the inclination of the suspensorium and associated elongation of the jaws. They share with species of *Muraenichthys* the condition of their posterior nostril and the presence of but one supraorbital pore between the anterior and posterior nostrils. As well, *Skythrenchelys* n.gen. and *Muraenichthys* are more similar to each other in certain osteological characters (note: this analysis is based on the osteological preparation of *S. zabra* n.sp.; the single, small specimen of *S. lentiginosa* n.sp. only allowed radiographic examination) such as the slender supracleithrum, stout cleithrum, and the general shape of the neurocranium, than to those of other myrophines. The species of *Skythrenchelys* further differ from all other myrophines in the characters listed in the Key and in Table 1.

Upon cursory examination, the species of *Skythrenchelys* n.gen. are obviously myrophine in appearance, and could be mistaken for certain species of *Scolecenchelys*. The condition of the elongate jaw and the enlarged dentition are unique, and will differentiate them from any other myrophine.

Table 1. Characteristics of the genera *Skythrenchelys* n.gen., *Muraenichthys* and *Scolecenchelys*. IOP = infraorbital pore between anterior and posterior nostrils; POP^3 = third preopercular pore.

character	*Skythrenchelys* n.gen.	*Muraenichthys*	*Scolecenchelys*
gill opening	unconstricted	constricted	constricted
centre of orbit	before mid-jaw	» mid-jaw	behind mid-jaw
dentition	conical, mostly uniserial	blunt, multiserial	conical, uniserial or biserial
posterior nostril	in outer lip, with a small flap	in outer lip, with a prominent flap	inside of or along lip
POP^3	present or absent	present or absent	present
IOP	1	1	2

Key to the genera of Myrophinae lacking pectoral fins

1 Gill opening along lateral midline, a constricted opening; posterior nostril opening either along upper lip and preceded by a flap, within the mouth and covered by a flap, or entirely within the mouth; teeth varying from conical to blunt, uniserial to multiserial, all smaller than width of orbit 2

—— Gill opening more or less below lateral midline, unconstricted, its length about equal to interbranchial; posterior nostril opening entirely outside of mouth, a hole along upper lip preceded by a small flap; teeth conical and uniserial, the largest as long as the width of the orbit ..... *Skythrenchelys* n.gen.

2 Posterior nostril opens into mouth, covered partially or entirely by an exterior flap; 2 pores between nostrils; jaw teeth usually conical, uniserial or biserial, intermaxillary teeth not in a broad patch 3

—— Posterior nostril opening outside of mouth, a hole along upper lip preceded by a flap; 1 pore between anterior and posterior nostrils; teeth blunt, jaw teeth in bands; intermaxillary teeth in a patch ..... *Muraenichthys* Bleeker, 1853

3 Tongue not elongate, not extending outside of mouth, and lacking a fleshy appendage at its tip; inner edge of lips and palate smooth; teeth either conical or small and villiform, uniserial or multiserial 4

—— Tongue elongate, extending well beyond mouth and decorated with a fleshy appendage; inner edge of lips and palate decorated with fleshy lappets; teeth conical and uniserial ..... *Glenoglossa* McCosker, 1982

4 Ventral side of snout without a prominent median groove bordered by dermal folds; anterior nostrils less than eye in length 5

—— A prominent median toothed groove on ventral side of snout, bordered by dermal folds, extending anteriorly to anterior nostrils; anterior nostrils elongated tubes equal to eye in length ..... *Schismorhynchus* McCosker, 1970

5 Teeth absent on vomer, absent or embedded on intermaxillary, those on maxillary and dentary minute or villiform; dorsal-fin origin behind anus ..... *Schultzidia* Gosline, 1951

—— Teeth present on intermaxillary, maxillary, dentary and vomer; dorsal-fin origin either before or behind anus ..... *Scolecenchelys* Ogilby, 1897.

***Skythrenchelys zabra* n.sp.**

Figs. 1A–C, 2A; Table 2

Material examined. HOLOTYPE: female, TL 239 mm, Thevara, Ernakulam, southern India, 10°00'N 76°16'E, shallow, turbid water, K.H. Mohamed, 18 July 1956, NMNZ 35152. PARATYPES: TL 234–280 mm (2), same data as holotype, NMNZ 35153; TL 256–269 mm (2, the larger cleared and stained), same data as holotype, CAS 99802; TL 259 mm (1), same data as holotype, AMS 38844-001; TL 234 mm (1), same data as holotype, BPBM 38404; TL 185 mm (1), north of Smith Point, Cobourg Peninsula, Northern Territory, Australia, 12°58'S 132°10'E, prawn trawl by N.R. Anson, 18 October 1981, NTM S.10031-004; TL 296 mm (1), Manila Bay, MUSORSTOM-Philippines 1976, station 2, trawled in 180 m, 19 March 1976, MNHN 1998-681; TL 133 mm (1), Iloilo, Panay Island, Philippine Islands, H.C. Kellers, 20 March 1929, USNM 148574; TL 119 mm (1), Straits of Malacca, 08°10'N 92°00'E, W. Gladfelter, November–December 1961, USNM 193227.

Diagnosis. A moderately elongate species of *Skythrenchelys* n.gen. with the following characters: tail 43–46% of TL; dorsal fin arising in mid-trunk; head pores: SO 1 + 4, IO 4 + 1, POM 6 + 2 or 3, ST 2; teeth conical, prominent, uniserial in jaws and on vomer; colour uniform tan. Mean vertebral formula 33.4/56.7/118.6.

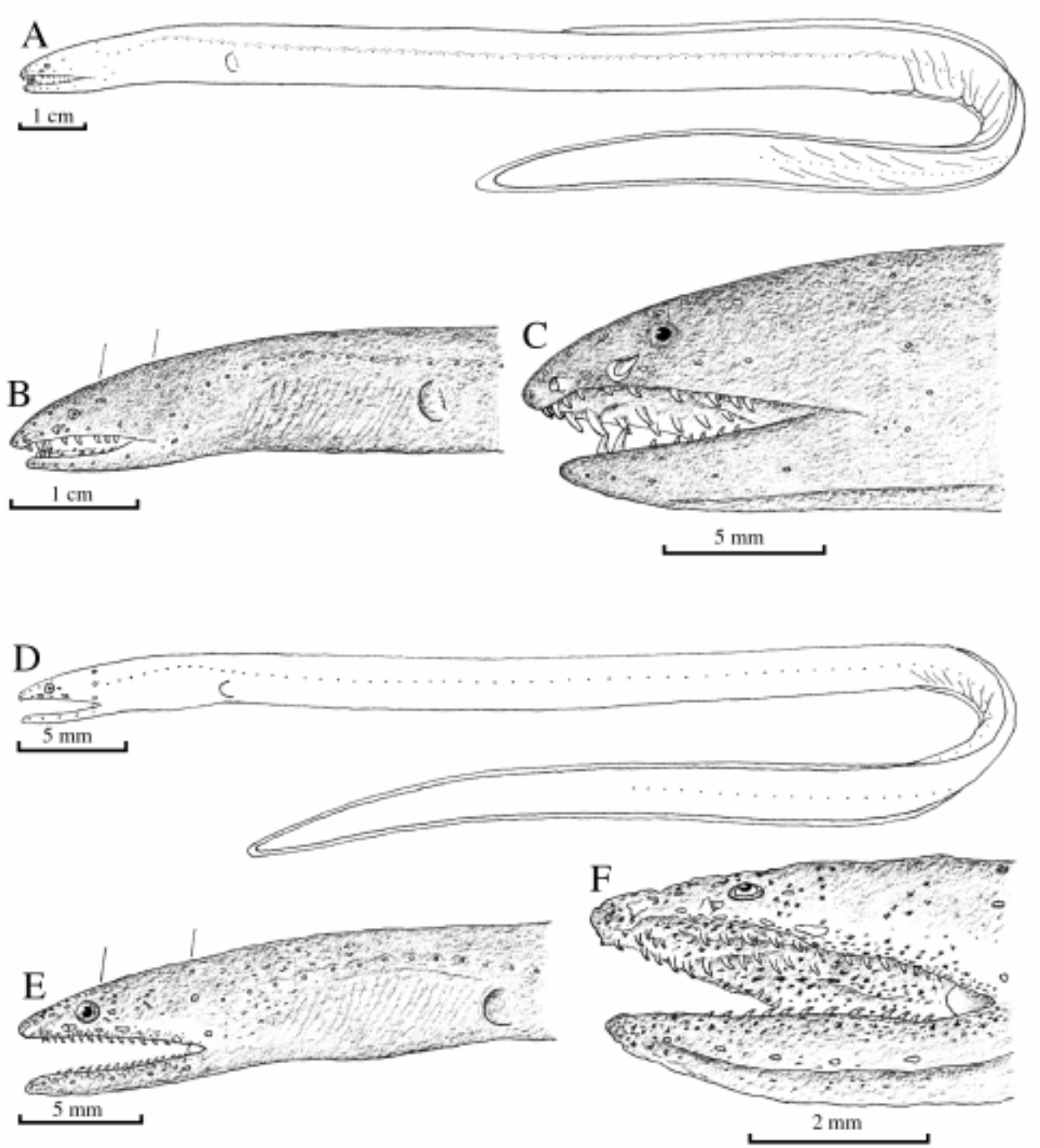

Figure 1. A–C, *Skythrenchelys zabra* n.sp., holotype, NMNZ 35152, TL 239 mm; A, body, lateral view; B, head, frontal and median supratemporal pores indicated; C, anterior part of head, ventrolateral to show intermaxillary, vomerine, maxillary and dentary teeth. D–F, *S. lentiginosa* n.sp., holotype, BPBM 29320, TL 165 mm; D, body, lateral view; E, head, median pores indicated; F, anterior part of head, ventrolateral to show intermaxillary, vomerine, maxillary and dentary teeth.

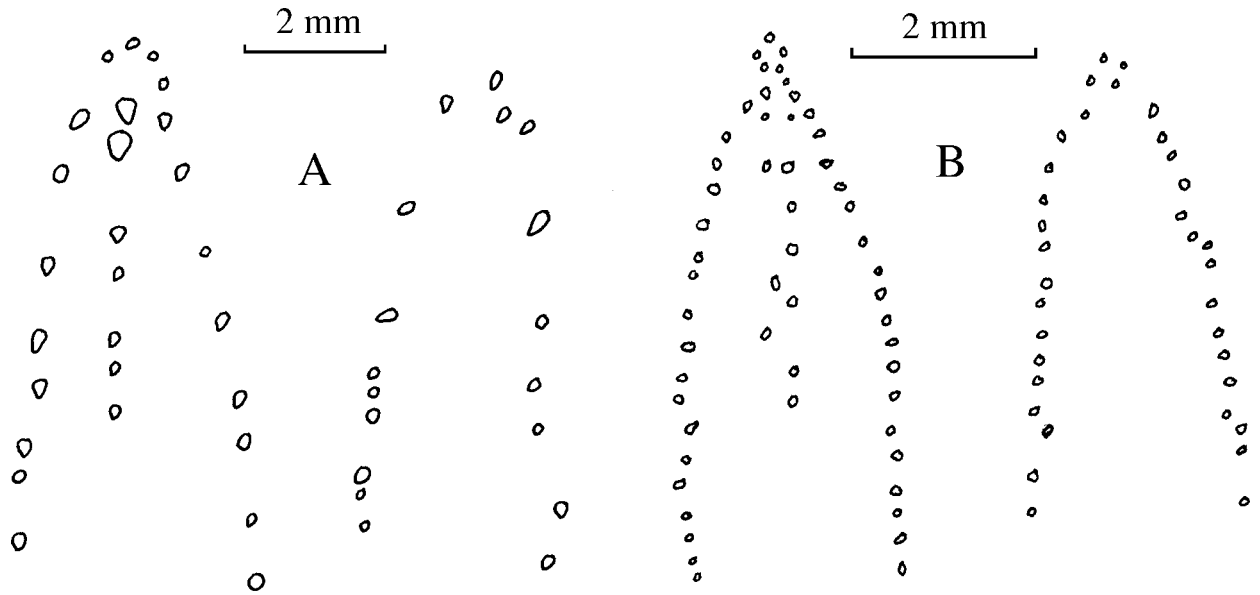

Figure 2. Patterns of upper (left) and lower (right) dentition of A—*Skythrenchelys zabra* n.sp., paratype, NTM S.10031-004, TL 185 mm; and B—*S. lentiginosa* n.sp., holotype, BPBM 29320, TL 165 mm. The sketches show arrangement, number and general size of the teeth, not their shape.

Further description. Measurements of holotype in mm. Total length 239; head length 31.9; trunk length 100.6; tail length 106.5; body depth at gill opening 8.9; body width at gill opening 4.5; body depth at anus 8.3; origin of dorsal fin 80.5; gill opening length 3.9; gill opening interspace 4.5; snout length 4.1; upper jaw length 9.0; eye diameter 1.0; interorbital space 3.1. Dorsal rays before anus 69; total dorsal rays 230; total anal rays 164. Lateral line pores before dorsal origin 35; total lateral line pores 105. Vertebral formula 34/57/116. Proportions and counts of holotype and 8 paratypes are presented in Table 2.

Body only moderately elongate (Fig. 1A), slender, rounded in section along most of its length, depth at gill opening 27 (25–36) in TL, head and trunk 1.8 (1.7–1.8) and head 7.5 (7.1–7.9) in TL. Snout pointed, depressed, its tip turned downwards over tip of lower jaw. Jaws elongate, curved, incapable of closing completely, lower jaw little shorter than snout. Mouth cleft reaching to well beyond eye; lower lip with irregular ridges on its inner surface alongside dentary teeth. Anterior nostril subterminal, a short tube, its rim simple; posterior nostril before and below eye, above free edge of upper jaw, a fully exposed, oblique slit with a free flap on its anterior and ventral rim, the anterior portion being much more prominent and the flap tending to form an anteroventral channel leading downwards to upper edge of mouth (Fig. 1C). Eye very small, diameter 31.9 (26.1–38.0) in head. Interorbital moderately broad. Gill opening crescentic, midlateral, relatively large. Pectoral fin a scarcely visible, extremely weak ridge behind gill opening, supported by several minute rays, the bases of which are visible in the base of the ridge and which project slightly from the free edge. Median fins low, anal fin height less than dorsal. Dorsal fin origin about halfway between gill opening and level of anus. Caudal fin short.

Head pores present and obvious (Fig. 1B), in holotype and 2 NMNZ paratypes on each side as follows: SO 1 + 4, IO 4 + 1, POM 6 + 3 (the 2 CAS paratypes have 2 preopercular pores), ST 2. Lateral line pores present, absent along posterior third of tail.

All teeth prominent (Figs. 1C, 2A), sharp, recurved, relatively few, uniserial and widely separated; in the holotype 2 large and 7 smaller on vomer; 8–9 on maxilla and dentary of which front 2–3 are larger than remainder; 2 or 3 on intermaxillary.

Body colour in isopropyl alcohol light greyish tan, lighter below, with very scattered minute freckles on dorsum of head and snout. Life colour unknown.

Gill arches not well developed; basibranchials absent, hypobranchials 1–2 ossified, hypobranchial 3 absent, ceratobranchials 1–4 ossified, ceratobranchial 5 absent; upper pharyngeal tooth plates closely sutured but not fused, with 17–18 conical teeth; lower pharyngeal tooth plate slender, smaller than upper plates, with 14–15 conical teeth.

Distribution and biology. India, Straits of Malacca, Philippines, Indonesia and northern Australia. Holotype—a female with 0.4 mm ova; all paratypes from Ernakulam (India) are females, except one possible male. The Ernakulam inlet is a large, shallow, turbid estuary; the other localities are apparently much the same, except that the Manila Bay specimen was collected in deeper water.

Etymology. From Greek *zabros* (gluttonous), in reference to the ability of this eel to ingest very large prey (as evident from radiographs of two paratypes [NMNZ 35153, 280 mm TL; MNHN 1998-681, 296 mm TL] that have enormous fish specimens filling out much of the gut cavity). The specimens were caught by fine-mesh

Table 2. Proportions (in thousandths) and counts of the holotype and eight paratypes of *Skythrenchelys zabra* n.sp. Abbreviations: TL = total length, HL = head length, DFO = dorsal fin origin, GO = gill opening, IO = interorbital space; number of specimens in parentheses.

	holotype	mean	range
total length, mm	239	—	119–296
head/TL	133	132.4	127–137
trunk/TL	421	423.6	406–468
tail/TL	446	444.0	405–457
depth at GO/TL	37	34.3	28–40
depth at anus/TL	35	26.7	24–30
DFO/TL	336	332.5	314–356
GO length/HL	122	99.4	81–134
GO interspace/HL	141	135.7	100–162
snout/HL	129	119.8	107–149
upper jaw/HL	282	298.1	252–379
eye/HL	31	30.5	26–38
IO/HL	97	86.8	74–110
dorsal-fin rays			
before anus	69	72.4	64–80
total rays (6)	230	233.3	217–250
anal-fin rays	164	150.1	127–165
lateral-line pores			
before DFO (7)	35	33.9	32–36
before anus (7)	58	56.4	55–57
total pores	105	92.8	90–99
vertebrae			
predorsal	34	33.4	31–36
preanal	57	56.7	55–58
potal	116	118.6	112–122

set net (NMNZ 35153) and by bottom trawl (MNHN 1998-681). That the prey might have been scavenged by the eels from the contents of the nets has to be considered, though the possibility is remote.

Skythrenchelys lentiginosa n.sp.

Figs. 1D–F, 2B

Material examined. HOLOTYPE: female, TL 165 mm, Red Sea, Port Sudan Harbour, 19°38'N 37°07'E, 25 m, rotenone, R. Lubbock and P. Etherington-Smith, 30 July 1972, BPBM 29320.

Diagnosis. A moderately elongate species of *Skythrenchelys* n.gen. with the following characters: tail 51% of TL; dorsal fin arising above anus; pores SO 1 + 4, IO 4 + 1, POM 6 + 1 or 2, ST 2; teeth conical, well-developed, uniserial in jaws and biserial in anterior vomer region; anterior head region and inside of mouth overlain with numerous brown freckles. Vertebral formula 51/50/120.

Further description. Measurements of holotype in mm. Total length 165; head length 20.3; trunk length 60.7; tail length 84; body depth at gill opening 4.6; body width at gill opening 4.2; body depth at anus 3.8; body width at anus 3.5; origin of dorsal fin 84; gill opening length »1.9; gill opening interspace »3.4; snout length 2.5; upper jaw length 7.4; eye diameter 0.8; interorbital space 1.65. Total dorsal rays 208; total anal rays 187. Lateral line pores before anus 50.

Body only moderately elongate (Fig. 1D), robust and nearly round in trunk and anterior tail region, tapering and laterally compressed posteriorly; depth at gill openings 36 in TL; head and trunk 2.0 and head 8.1 in TL. Snout acute, slightly bulbous at tip, without a median groove on its underside. Jaws elongate, curved, incapable of closing completely; centre of eye in anterior 1/3 of upper jaw; lower jaw included, its tip in advance of anterior nostrils. Anterior nostril subterminal, a short tube, its rim simple; posterior nostril entirely outside upper lip, beginning before anterior margin of eye, appearing externally as a large pore with a

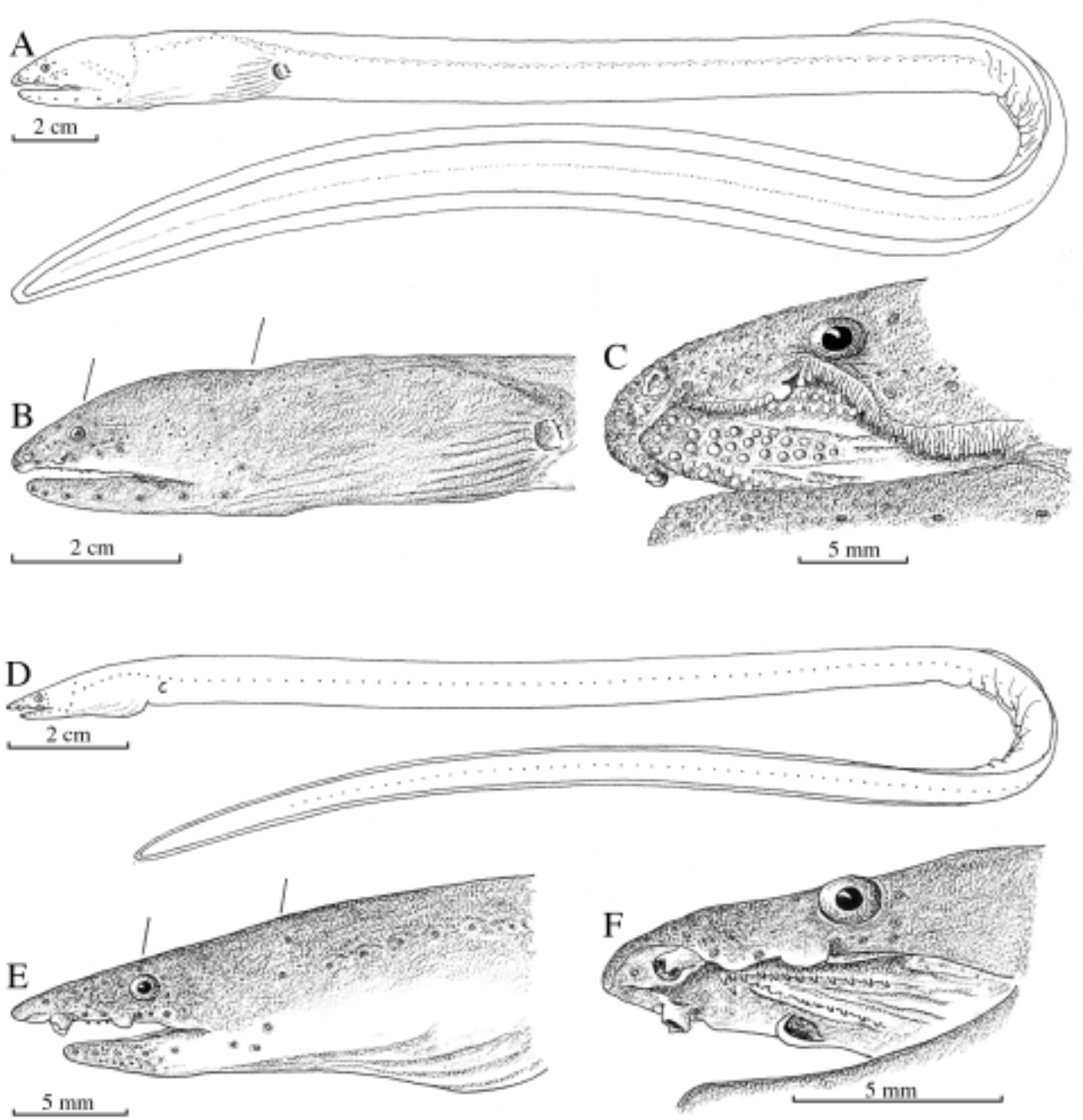

Figure 3. A–C, *Muraenichthys gymnopterus*, BPBM 32816, TL 497 mm; A, body, lateral view; B, head, median pores indicated; C, anterior part of hefad, ventrolateral to show vomerine and maxillary teeth (upper lip turned back). D–F, *Scolecenchelys australis*, NMNZ P.13230, TL 341 mm; D, body, lateral view; E, head, median pores indicated; F, anterior part of head, ventrolateral to show vomerine and maxillary teeth.

small, anterior flap. Eye small, diameter 25.3 in head and about twice in interorbital distance. Interorbital region dome-shaped. Pectoral fins absent. Median fins low, confluent with caudal. Dorsal fin origin above level of anus. Caudal fin very short.

Head pores mostly large and obvious (Fig. 1E), but those of preoperculomandibular series difficult to ascertain and subject to confirmation with the collection of larger specimens; SO 1 + 4, IO 4 + 1, POM 5 + 1 or 2, ST 2. A single pore between anterior and posterior nostrils. Four pores along mandible, 1 or 2 overlying preopercle. Lateral line pores not apparent along posterior third of tail region; approximately 10 pores above branchial basket.

Teeth conical, recurved, and large compared to most myrophines (Figs. 1F, 2B). An anterior intermaxillary block of 5 small teeth, followed by 3 large teeth and a smaller pair of teeth, followed by a uniserial but nonlinear row of 9 vomerine teeth decreasing in size. Maxillary teeth uniserial, 17–18 in a row, decreasing in size. Mandibular teeth uniserial, about 5 smaller teeth near symphysis, followed by 15–16 larger teeth decreasing in size.

Body colour in isopropyl alcohol uniform tan; snout, jaws chin, lips and inside of mouth with many brown to black freckles; numerous fine brown punctations occur above lateral midline; median fins pale; eyes dark blue. Life colour unknown.

Distribution and biology. Known only from the holotype, from the Red Sea. The holotype is a small female with developing ova of 0.3–0.4 mm in diameter; most ophichthids of this size are sexually immature.

Etymology. From Latin *lentiginosus* (freckled), in reference to the speckled head coloration.

Affinities of the two species. After discovering this remarkable specimen in the BPBM collection, McCosker was reluctant to describe it as a new genus and species until larger specimens were discovered. With the collection of many and larger specimens of its congener, *S. zabra* n.sp., we now feel confident in proceeding with its description. The two new species of *Skythrenchelys* n.gen. are easily separable externally on the basis of the origin of their dorsal fin, eye size and dentition (*S. zabra* n.sp. having the dorsal origin further forwards, a much smaller eye and relatively larger teeth), and minor differences in body/tail proportions and dentition. *Skythrenchelys zabra* n.sp. has distinctively large teeth and *S. lentiginosa* n.sp. would not be mistaken for any other ophichthid on the basis of its extraordinary jaw elongation, dentition, and facial coloration.

It is unknown if the coloration of *S. lentiginosa* n.sp. is maintained as it grows, though some facial spotting is likely to remain or even be enhanced with growth. Its facial coloration, eye position, jaw size and developed dentition would suggest a hole-dwelling habitus with only its snout and eyes exposed as is also likely for *S. zabra* n.sp. Such an appearance and lie-in-wait behaviour is typical of species of ophichthine genera such as *Brachysomophis* Kaup, 1856 and *Echiophis* Kaup, 1856 (McCosker *et al*., 1989).

On the status of *Muraenichthys* and *Scolecenchelys*

As stated in our introduction, several authors (Schultz & Woods, 1949; Gosline, 1951; McCosker, 1970, 1977) have recognised the polyphyletic nature of the many species assigned to *Muraenichthys* but were disinclined to identify the species groups as belonging to separate genera. We have seen most of the type specimens and are confident of the adequacy of most recent descriptions to thereby allow us to divide *Muraenichthys* into two separate phyletic groups. They are separable on the basis of characters described in the key and in Table 1. Specimens of the type species of *Muraenichthys* and *Scolecenchelys* are illustrated in Fig. 3. Aspects of the osteology of *Muraenichthys gymnopterus, Scolecenchelys chilensis, S. gymnotus* and *S. macropterus* are described and illustrated in McCosker (1977).

We provisionally list below the species that we consider to comprise the two genera; the species and their authors are listed in Eschmeyer (1998).

Muraenichthys (type species *Muraena gymnopterus* Bleeker, 1853) includes the following: *Muraena gymnopterus* (and its synonyms *Muraenichthys hattae* Jordan & Snyder, 1901 and *Muraenichthys microstomus* Bleeker, 1865); *Muraenichthys macrostomus* Bleeker, 1865; *Muraenichthys schultzei* Bleeker, 1857; *Muraenichthys sibogae* Weber & de Beaufort, 1916; and *Muraenichthys thompsoni* Jordan & Richardson, 1908 (and its probable synonyms *Muraenichthys malabonensis* Herre, 1923, the type apparently destroyed, and *Muraenichthys philippinensis* Schultz & Woods, 1949).

Scolecenchelys (type species *Muraenichthys australis* Macleay, 1881, by original designation), and its synonyms *Myropterura* Ogilby, 1897 (type species *M. laticaudata* Ogilby, 1897, by original designation) and *Aotea* Phillipps, 1926 (type species *A. acus* Phillipps, 1926, by monotypy) includes the following: *Muraenichthys acutirostris* Weber & de Beaufort, 1916; *Muraenichthys australis* Macleay, 1881 (and probable synonyms *Muraenichthys iredalei* Whitley, 1927, *Muraenichthys lengomena* Scott, 1980, *Muraenichthys lingowenah* Scott, 1975, and *Muraenichthys oliveri* Waite, 1910); *Muraenichthys borealis* Machida & Shiogaki, 1990; *Muraenichthys breviceps* Günther, 1876 (and synonyms *Aotea acus* Phillipps, 1926, *Muraenichthys devisi* Fowler, 1907, and *Muraenichthys ogilbyi* Fowler, 1907); *Muraenichthys chilensis* McCosker, 1970; *Muraenichthys cookei* Fowler, 1928; *Muraenichthys erythraeensis* Bauchot & Maugé, 1980; *Muraenichthys godeffroyi* Regan, 1909 (and probable synonym *Muraenichthys elerae* Fowler, 1934); *Muraenichthys gymnotus* Bleeker, 1857 (and synonyms *Muraenichthys aoki* Jordan & Snyder, 1901, *Muraenichthys fowleri* Schultz, 1943, and *Sphagebranchus huysmani* Weber, 1913); *Muraenichthys japonicus* Machida & Ohta, 1993; *Myropterura laticaudata* Ogilby, 1897; *Muraenichthys macropterus* Bleeker, 1857 (and synonyms *Muraenichthys owstoni* Jordan & Snyder, 1901 and *Echidna uniformis* Seale, 1901); *Muraenichthys nicholsae* Waite, 1904; *Muraenichthys okamurai* Machida & Ohta, 1996; *Muraenichthys profundorum* McCosker & Parin, 1995;

Muraenichthys puhioilo McCosker, 1979; *Muraenichthys tasmaniensis* McCulloch, 1911 (and synonym *M. tasmaniensis smithi* Whitley, 1944); *Chilorhinus (Muraenichthys) vermiformis* Peters, 1866; and *Muraenichthys xorae* Smith, 1958. *Incertae sedis*: *Muraenichthys moorii* Günther, 1870. Note that adjectival suffixes of species transferred from *Muraenichthys* to *Scolecenchelys* will change, in that *enchelys* is feminine.

ACKNOWLEDGMENTS. Many individuals have generously assisted with this study, and we thank the following: D. Catania, M. Huong and J. Fong (CAS); J. Llewellyn, Victoria University of Wellington, New Zealand, for the preparation of radiographs and other assistance; R. Drewes (CAS) for staining and clearing specimens; E. Böhlke, Academy of Natural Sciences of Philadelphia, for her advice and the use of her vertebral data. Many curators and collection managers have allowed us to examine specimens in their care, including: E. Böhlke (ANSP); J. Paxton, D. Hoese and M. McGrouther (AMS); A. Woolger and O. Crimmin, Natural History Museum, London; J. Randall and A. Suzumoto (BPBM); W. Eschmeyer and T. Iwamoto (CAS); A. Graham (CSIRO, Hobart); M. Bauchot, G. Duhamel and P. Bearez (MNHN); M. Gomon, Museum of Victoria, Melbourne; R. Rosenblatt (SIO); and the staff of the U.S. National Museum (USNM). We thank Carl Ferraris for reading a draft of this manuscript. Much of this project was accomplished during McCosker's tenure as a Visiting Fellow at the Australian Museum, Sydney; research assistance to Castle was funded by the Internal Grants Committee (VUW) and leave funds from the Leave Committee (VUW).

References

Böhlke, E.B., 1982. Vertebral formulae of type specimens of eels (Pisces: Anguilliformes). *Proceedings of the Academy of Natural Sciences of Philadelphia* 134: 31–49.

Böhlke, E.B., 1989. Methods and Terminology. In *Fishes of the western North Atlantic, Vol. I. Orders Anguilliformes and Saccopharyngiformes*, ed. E.B. Böhlke, pp. 1–7. *Memoirs of the Sears Foundation for Marine Research* 1(9): 1–655.

Dingerkus, G., & L.D. Uhler, 1977. Enzyme clearing of alcian blue stained whole small vertebrates for demonstration of cartilage. *Stain Technology* 52: 229–232.

Eschmeyer, W.N., ed., 1998. *Catalog of Fishes*. Special Publication No. 1 of the Center of Biodiversity Research and Information, California Academy of Sciences, 3 vols., pp. 2905.

Gosline, W.A., 1951. The osteology and classification of the ophichthid eels of the Hawaiian Islands. *Pacific Science* 5: 298–320.

Kaup, J.J., 1856. Uebersicht der Aale. *Archiv für Naturgeschichte* 22(1): 41–77.

Leiby, M.M., 1989. Family Ophichthidae: Leptocephali. In *Fishes of the western North Atlantic, Vol. II. Orders Anguilliformes, Saccopharyngiformes, Notacanthiformes, Elopiformes*, ed. E.B. Böhlke, pp. 764–897. *Memoirs of the Sears Foundation for Marine Research* 1(9): 657–1055.

Leviton, A.E., R.H. Gibbs Jr., E. Heal & C.E. Dawson, 1985. Standards in herpetology and ichthyology: part 1. Standard symbolic codes for institutional resource collections in herpetology and ichthyology. *Copeia* 1985: 802–832.

Lütken, C.F., 1851. Nogle bemaerkinger om naeseborenes stilling hos de i gruppe med *Ophisurus* staaende slaegter af aalefamilien. *Videnskabelige Meddelelser fra den Naturhistoriske Forening i Kjöbenhavn*, 1851 (1/2): 1–21.

McCosker, J.E., 1970. A review of the eel genera *Leptenchelys* and *Muraenichthys*, with the description of a new genus, *Schismorhynchus*, and a new species, *Muraenichthys chilensis*. *Pacific Science* 24: 506–516.

McCosker, J.E., 1977. The osteology, classification, and relationships of the eel family Ophichthidae. *Proceedings of the California Academy of Sciences* 41(1): 1–123.

McCosker, J.E., E.B. Böhlke & J.E. Böhlke, 1989. Family Ophichthidae. In *Fishes of the western North Atlantic, Vol. I. Orders Anguilliformes and Saccopharyngiformes*, ed. E.B. Böhlke, pp. 254–412. *Memoirs of the Sears Foundation for Marine Research* 1(9): 1–655.

Schultz, L.P., & L.P. Woods, 1949. Keys to the genera of echelid eels and the species of *Muraenichthys* of the Pacific, with two new species. *Journal of the Washington Academy of Sciences* 39: 169–174.

Wade, C.B., 1946. Two new genera and five new species of apodal fishes from the eastern Pacific. *Allan Hancock Pacific Expeditions* 9(7): 181–213.

Manuscript received 11 September 1998, revised 21 December 1998 and accepted 11 January 1999.

Associate Editor: J.M. Leis.