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TWO NEW SYNBRANCHID FISHES, *MONOPTERUS ROSENI* FROM PENINSULAR INDIA AND *M. DESILVAI* FROM SRI LANKA

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ABSTRACT.—*Bailey, R. M. and C. Gans. 1998. Two new synbranchid fishes,* Monopterus roseni *from peninsular India and* M. desilvai *from Sri Lanka. Occ. Pap. Mus. Zool. Univ. Michigan 726:1–18, 7 figs.* The swamp eels (Synbranchidae) of the Indian subcontinent are summarized and two are described as new species of *Monopterus. M. desilvai* from Sri Lanka, an epigean species, has scales on the tail like other members of the Amphipnous group. It is a small species with blotches on the body and is believed to be most closely related to *M. fossorius* from peninsular India. *M. roseni* from Kerala State, India, is a blind, depigmented cavernicole, probably related to *M. eapeni,* also from Kerala, but with notably different vertebral formula.

Key words: *cavernicole, India,* Monopterus, *Sri Lanka, swamp eels, Synbranchidae.*

INTRODUCTION

Current systematic understanding of the Synbranchidae depends largely on the revision by Rosen and Greenwood (1976). After removal of the Alabetidae (=Cheilobranchidae=Gobiesocidae, see Springer and Fraser, 1976) from the swamp eels, Rosen and Greenwood combined the remaining nominal families of synbranchoids (Amphipnoidae, Flutidae, Monopteridae) in the Synbranchidae. The group is widely

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distributed in lowland fresh and occasionally brackish waters in the tropics and subtropics with one species ranging to northern China, Japan, and probably the region of Vladivostok. Although some species live in clear flowing streams, most inhabit sluggish or standing waters, often with low oxygen content, commonly in dense vegetation or other cover, and are frequently burrowing or amphibious. Thus, they are admirably protoadapted for cave life and at least four species from three continents are cavernicolous; still another, from a fourth continent, is blind and lives in mud holes in swamps, not in caves. Many if not all species are capable of aerial respiration and can survive periodic drying of their environment (Liem, 1967, and included references).

In their analysis of the Synbranchidae, Rosen and Greenwood (1976) erected a provisional phylogeny of the two subfamilies, four genera, and 15 species of their classification. The monotypic genus *Macrotrema (caligans)* from Malaysia, the most primitive structurally, was ranked as a subfamily Macrotreminae (properly Macrotrematinae). Successive dichotomies in their phylogeny split off the pantropical genus *Ophisternon* (six species) and the Neotropical *Synbranchus* (two species), leaving an Old World genus *Monopterus* (six species). *Monopterus* is characterized by specializations of the dorsal gill arch skeleton; upper lip jowllike, without a separate or swollen fold; gills, if present, reduced to single rows of filaments on the first three arches; gill membrane attached internally to the isthmus; and other modifications of the branchial circulatory system and skeleton (Rosen and Greenwood, 1976: 64).

The genus *Monopterus* includes a subgroup of four species *(cuchia, indicus, fossorius,* and the new species *desilvai)* which share two notable characters, scales on the posterior part of the body (unique retention of a primitive character), and suprapharyngeal pouches, not verified in *M. desilvai* (a synapomorphy within the family). In their treatment of the Indian synbranchids, Talwar and Jhingran (1992: 774–780) employed these features as a basis for recognition of a subgenus *Amphipnous* Müller, 1841, in contrast to the remaining species, subgenus *Monopterus* Lacepède, 1800. Amphipnous is clearly a monophyletic group and for the Indian species this arrangement appears to be reasonable. However, the phylogenies proposed by Rosen and Greenwood (1976: 60–63), based on other characters, interpret the African species *M. boueti* as more closely allied to the "Amphipnous" group than to the other species *(albus, indicus, eapeni,* plus *roseni)* of *Monopterus.* Amphipnous would thus be paraphyletic. Until the phylogeny is further tested we accept it, and regard Amphipnous as a

group name of convenience rather than a subgenus (Table I).

Synbranchids presumably have a limited capacity for active dispersal. Nonetheless the family as a whole and the genus *Ophisternon* in particular (Rosen, 1976) have a broad pantropical distribution. Their occurrence suggests that temperate and cold water dispersal routes are inaccessible as are, one would judge, oceanic highways. Viewed together, and with an extensive distribution, it seems apparent that the Synbranchidae are an ancient group, dating perhaps to the late Mesozoic, with slow rates of differentiation. However, Tyler and Feller (1996) have recently reported the occurrence of *Ophisternon aenigmaticum* from a hypersaline marine situation in Belize. They suggest that the disjunct distribution of this species (Mexico and Guatemala, Cuba and northern South America) may be explained by relatively recent dispersal through the sea. Lundberg (1993:189–191) reasoned that because of estuarine occurrences, synbranchid history will not be convincingly explained by African-South American drift vicariance. In his view, intercontinental dispersal would appear to have been from the Old World to the New, possibly through Africa. Perhaps a crossing of the South Atlantic was effected during the early Cenozoic, after the disjunction of Gondwana, but when the intercontinental gap was much narrower than at present.

One of us (C.G.), while conducting herpetological field studies in Sri Lanka and India, obtained two synbranchids each of which proves on subsequent study to be undescribed. Efforts over several years to obtain additional specimens have been fruitless. It seems appropriate, therefore, to provide this preliminary notice in order to stimulate others who may be better situated to collect additional material. Many important morphological characters of synbranchids are internal and require destructive preparation of specimens which we are loath to perform on the unique holotypes. One, the fourth discovered partly-scaled species, Amphipnous group (genus *Monopterus*), was collected in a rice paddy near Marawila in west-central Sri Lanka. It appears to be structurally similar to *M. fossorius* (Nair, 1952) from near Trivandrum, Kerala State (formerly Travancore), southern India. The second is a small, blind, red cavernicole from Periyam village, northern Kerala, likely related to *Monopterus eapeni* Talwar, 1992, but with notably different vertebral count.

The Synbranchids of India and Sri Lanka

Including the two species described herein, the Synbranchidae number 17 forms. Of the 17, four species (two each in the genera *Synbranchus* and *Ophisternon*) occur in the Americas, two (*Ophisternon*

TABLE I.—Characters of genera and principal groups of Synbranchidae.

Character	*Macrotrema*	*Ophisternon*	*Synbranchus*	*Monopterus*	
				"Monopterus"	"Amphipnous"
Caudal fin	small; 9-14 rays	absent or reduced	absent or reduced	absent or reduced	absent or reduced
Gill cleft	extends up to midside; wide	ventral; transverse	ventral; narrow, porelike; deep folds	ventral; narrow *(boueti)* or wide	ventral; wide
Posterior nares	anterior to eyes	between eyes (if present)	between eyes	between eyes (if present)	between eyes except in *desilvai*
Soft tissue around upper jaw	normal; upper lip exposed	normal; upper lip exposed	normal; upper lip exposed	jowllike flap over upper jaw	jowllike flap over upper jaw
Branchiostegal membrane		free from isthmus	free from isthmus	attached to isthmus	attached to isthmus
Holobranchs	well developed on 4 arches	well developed on 4 arches	well developed on 4 arches	reduced or modified on first 3 arches; absent from 4th arch	reduced or modified on first 3 arches; absent from 4th arch
Suprapharyngeal pouches	absent	absent	absent	absent	present (uncertain in *desilvai)*
Afferent and efferent blood vessels of fourth (abranchiate) gill arch	separate	separate	separate	fused into single vessel that flows to dorsal aorta	fused into single vessel that flows to dorsal aorta

TABLE I. (cont.)

Character	*Macrotrema*	*Ophisternon*	*Synbranchus*	*Monopterus*	
				"Monopterus"	"Amphipnous"
Scales	none	none	none	none	present on tail
Habitat	epigean; enters brackish and marine water	epigean (4spp) or cavernicolous (2spp); may enter salt water	epigean; swamps or flowing water	epigean (2spp) or cavernicolous (2spp)	epigean
Range	Thailand; Malay Peninsula; Singapore	Tropical America; W. Africa; E. Asia; N. and W. Australia	Middle and South America	India to Japan; East Indies; West Africa	India; Sri Lanka; Pakistan; Nepal; Bangladesh; Burma

afrum and *Monopterus boueti)* are West African, two (now in the genus *Ophisternon*) live in northern and western Australia, and nine (in three genera) are Asian, including the East Indies.

Eight of the Asian species occur in India and Sri Lanka. Of these, one, *Ophisternon bengalense* M'Clelland, enters brackish waters; it occurs in both of these regions and ranges beyond, throughout southeastern Asia, reaching the Philippine Islands, Sulawesi, and New Guinea. A second species, *Monopterus albus* (Zuiew), is the best known Asiatic form, ranging widely from northern India and Burma to China, perhaps Asiatic Russia, Japan, and the Indo-Malayan Archipelago. The peripheral range is uncertain because of introductions, which include the Hawaiian Islands. A third widespread species is the cuchia *Monopterus cuchia* (Hamilton), ranging from Pakistan, through northern India and Nepal to Bangladesh and Burma. The only Asiatic species unknown from India is the distinctive *Macrotrema caligans* (Cantor), known from Thailand to Singapore; it is reported to enter brackish and marine waters.

Three species are endemic to Peninsular India, *Monopterus eapeni* Talwar (in Talwar and Jhingran, 1992), *M. indicus* (Silas and Dawson, 1961), and *M. fossorius* (Nair, 1952), and we here add a fourth, *M. roseni.* No species is now known to be endemic for Sri Lanka, making the new form *M. desilvai* significant.

Table I, derived chiefly from Rosen and Greenwood, 1976, lists the characteristics of the presently recognized genera.

Monopterus ***desilvai,*** new species
Figs. 1–4

Holotype.—UMMZ (University of Michigan Museum of Zoology) 199721, 251 mm in total length, collected in August 1976 by school children, in a rice paddy at coastal village of Marawila, west-central Sri Lanka, latitude 7° 24.5' N, longitude 79° 50.45' E, about 53 km north of Colombo and donated by Mr. Nimal Pereira; C.G. Field No. AL-336-C.

Diagnosis.—A relatively robust, epigean species of *Monopterus* with scales on the tail, minute beady black eyes, and a pattern of variable sized and irregular dark blotches on body and tail. Unlike all eyed synbranchids except *Macrotrema caligans,* the posterior nostril lies anterior to the level of the eyes. The upper jaw extends further than the lower; gill aperture wide, parabolic; tail 26.7 percent of total length; vertebrae 75 precaudal, 69 caudal, 144 total.

Description.—Measurements of the holotype and only known specimen

are given both in mm and as per mill (thousandths) of the total length (TL) in Table II; several morphometric ratios are given in Table III.

Like that of all synbranchids, the body is slender (Fig. 1), greatest depth contained 30 times in total length, but by comparison with the slim *Monopterus roseni* (depth 52 times in TL) it is rather robust. The tail is not whiplike, comprising 26.7 percent of TL and 36.4 percent of snout to vent (SV) length. The tail has narrow fin folds, dorsally and ventrally. Head length, from snout tip to lateral end of gill aperture, 8.2 percent of TL and 11.2 percent of SV length, distance from snout tip to occiput 5.7 percent of TL and 7.7 percent of SV length; head depth 39.3 percent of HL. The gill aperture (Fig. 2C) is wide, parabolic, its breadth 1.8 percent of TL or 22 percent of HL and 54 percent of head width. There are a few weak longitudinal furrows on the branchiostegal membrane anterior to the gill cleft. Distance from snout tip to gill cleft at midline 6.9 percent of TL. Snout tip to posterior nostril 1.6 percent of TL or 20 percent of HL. The eyes are tiny, beadlike, and lie behind the level of the posterior nostril, apparently a unique condition in *Monopterus*. The interorbital width is 0.2 percent of TL, or 2.9 percent of HL. Snout length 2.0 percent of TL and 23.8 percent of HL. Gape length 3.1 percent of TL or 37.4 percent of HL. The upper jaw projects well (6.8 percent of head length) beyond the lower jaw (Fig. 2B). The head bears several files of minute sensory papillae. A small inconclusive dissection failed to reveal suprapharyngeal pouches.

In preservation the body is pale brownish, little if any darker above than below. It is irregularly marked with about 20 rounded or irregular brown blotches (Fig. 1); these vary widely in size, shape, and arrangement and do not form an organized pattern. Most are dorsal or lateral but there is one just anterior to the vent that impinges on the midventral line. On the tail the blotches become ill defined and more or less confluent. Some of the smaller blotches are unicolored, but two on the top and right side of the head and most of the larger body blotches are freckled with darker brown.

Much of the tail is closely invested with small, embedded, non-imbricate cycloid scales (Fig. 3). These disappear gradually anteriorly at a distance of about 14 mm behind the vent and posteriorly near the tail tip. Unlike the other species of the Amphipnous group (Silas and Dawson, 1961) there are no scales at or anterior to the vent.

Comparisons.—Among the four species of the Amphipnous group of *Monopterus* (those with scales, at least posteriorly and at least usually paired suprapharyngeal pouches) two are of moderate size and so far as known two are small: *M. cuchia* attains a total length of 600 mm (Talwar and Jhingran, 1992: 776); *M. indicus* of 480 mm (Silas and

TABLE II.—Morphometric data on holotypes of two new species of *Monopterus*.

Character	*roseni*		*desilvai*	
	mm	per mill of TL	mm	per mill of TL
Total length (mm)	176	—	251	—
Snout tip to vent	109.0	619	184.0	733
Tail length	67.0	381	67.0	267
Snout tip to occiput	8.5	048	14.2	057
Snout tip to gill aperture at midline	7.3	041	17.2	069
Head length (snout tip to lateral end of gill aperture)	8.5	048	20.6	082
Snout length	NA		4.9	020
Snout tip to posterior nostril	1.9	011	4.1	016
Gape length (snout tip to angle of gape)	3.5	020	7.7	031
Lower jaw length	4.5	026	11.5	046
Snout tip to symphysis lower jaw	0		1.4	006
Eye diameter	0		0.6	002
Interorbital width	0		3.7	015
Width of gill aperture	1.9	011	4.5	018
Distance between anterior nostrils	0.9	005	1.6	006
Distance between posterior nostrils	1.0	006	2.1	008
Greatest width of upper lip (=eye to edge of "jowl")	NA		2.0	008
Head depth	4.3	024	8.1	032
Greatest body depth	3.4	019	8.4	033
Depth of body at vent	2.8	016	5.6	022
Head width	3.1	018	8.3	033
Greatest width of body	2.9	016	7.3	029
Width of body at vent	2.3	013	5.3	021

TABLE III.—Morphometric ratios (expressed as percentages) for holotypes of two new species of *Monopterus*.

Ratio	*roseni*	*desilvai*
Caudal length/snout-to-vent length	61.4	36.4
Head length/snout-to-vent length	7.8	11.2
Snout length/head length	—	23.8
Eye diameter/head length	—	2.9
Snout length/gape length	—	63.6
Gape length/head length	29.4	37.4

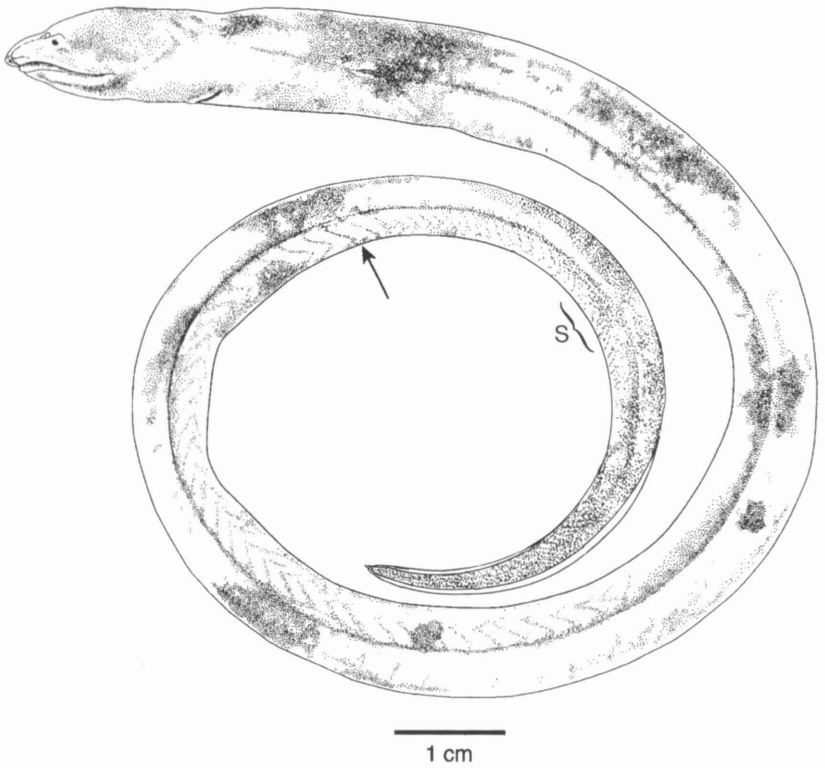

Fig. 1. *Monopterus desilvai*, new species, the holotype (UMMZ 199721), 251 mm in total length, in lateral view. The position of the vent is indicated by the arrow. The bracket-S shows the section of the tail for which the scales are indicated in Figure III.

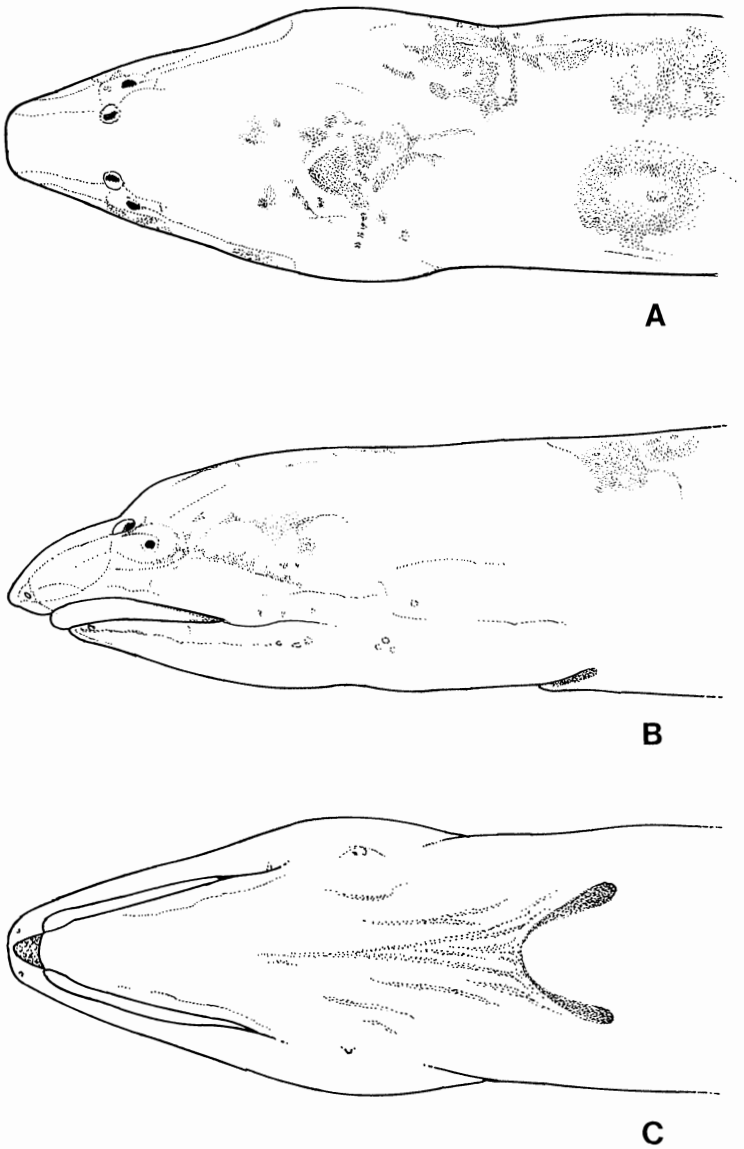

FIG. 2. *Monopterus desilvai,* holotype, the head in dorsal (A), lateral (B), and ventral (C) views.

Dawson, 1961: 373); *M. fossorius* of 230 mm (Talwar and Jhingran, 1992: 777); and our single specimen of *M. desilvai* is 251 mm long. Scales are recorded as present on the posterior half or more in the

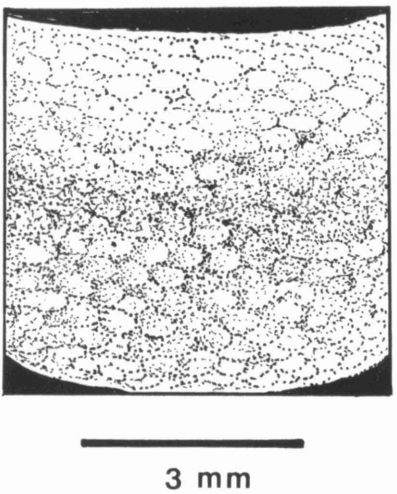

FIG. 3. *Monopterus desilvai,* holotype, lateral section near middle of tail (S in Figure 1) showing embedded scales.

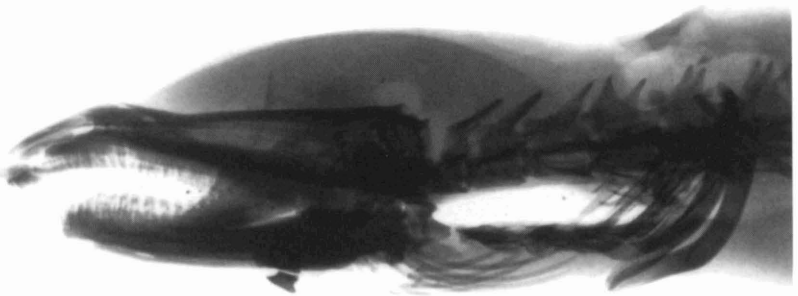

FIG. 4. *Monopterus desilvai,* holotype, radiograph of head in lateral view.

first three species, but are confined to the posterior fourth in *M. desilvai.*

Among the species of the Amphipnous group, *M. desilvai* is the only one described as having large conspicuous body blotches. *M. fossorius* and *M. indicus* are reddish to flesh colored but lack color markings; *M. cuchia* has numerous black spots on the body (Talwar and Jhingran, 1992:776–779).

Vertebral counts of the above four species differ substantially (Table IV). The two larger species have more precaudal vertebrae (93–112) than the smaller species (73–75). *M. cuchia* has more caudal vertebrae than the other species except *M. desilvai* and thus has the highest total counts in the group. The caudal and total counts in *desilvai* are decidedly higher than in *M. fossorius,* presumably its sister species.

TABLE IV.—Vertebral counts in species of the "Amphipnous" group of *Monopterus*.

Species and Source	Precaudal (Abdominal)	Caudal	Total
cuchia			
Günther (N=1)	106	65	171
Rosen and Greenwood (N=4)	99-112	55-70	166-178
indicus			
Silas and Dawson (N=34)	93-99	42-45	137-144
fossorius			
Silas and Dawson (from Nair, 1952) (N=?)	73	53-56	126-129
desilvai			
This paper (N=1)	75	69	144

Sources: Günther, 1870:12, Silas and Dawson, 1961, table 2; Rosen and Greenwood, 1976, table 2; and original data.

Branchiostegal rays are described as six in *Monopterus cuchia* and *M. fossorius* and five in *M. indicus* (Talwar and Jhingran, 1992: 776–778), and we count six in *M. desilvai*. The skin of the ventral side of the branchial region is drawn into deep longitudinal folds in *M. cuchia* and *M. fossorius*, but into shallow folds in *M. indicus* (Rosen and Greenwood, 1976: 65–66); in *M. desilvai* the folds are shallow.

As described above, the advanced position of the posterior nares (instead of between the eyes) is distinctive in *Monopterus*.

Ecology: The paddy area in which this species was apparently taken extends to within a kilometer of the coast. There are extensive zones of sandy soils and wide stretches of coconut palm cultivation.

Etymology.—We take pleasure in naming this species for Dr. P. H. S. H. de Silva, former director of the National Museums of Ceylon, herpetologist and zoologist. This acknowledges his personal hospitality and support to C.G. during field work on the island as well as much professional advice on local conditions and natural history.

Monopterus ***roseni,*** new species
(Figs. 5–7)

Holotype.—UMMZ 228131, 176 mm in total length, given to a field party comprising Carl Gans, S. K. Saraswat and C. Rajasunderam. It had been taken from a well at Periyam village (elevation 50 meters), latitude 10° 38' N, longitude 76° 22' E, northern Kerala state, India,

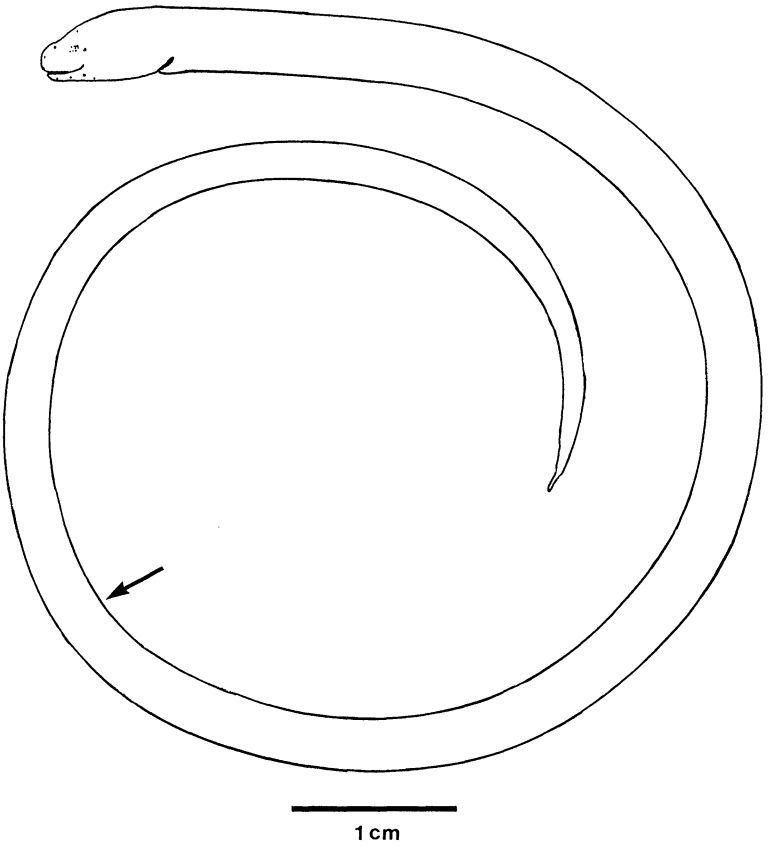

FIG. 5. *Monopterus roseni,* the holotype (UMMZ 228131), 176 mm in total length, in lateral view. This blind synbranchid is devoid of melanophores. The darkened structure near the normal position of the eye is the posterior naris. The position of the vent is indicated by the arrow.

during July, 1986 (Field No. 4109). The type locality is approximately 102 km slightly W of N from Kottayam, the type locality of *M. eapeni.*

Diagnosis.—A presumably small species of *Monopterus,* the holotype 176 mm in total length. A cavernicole, it is blind and depigmented; the body is slender, whiplike, and scaleless; jaws equal in forward extent; gill aperture wide, crescentic; tail length 38.1 percent of total length; vertebrae 76 precaudal, 71 caudal, 147 total.

Description.—Measurements of the holotype and only known specimen are given both in mm and as per mill (thousandths) of the total length (TL) in Table II; several morphometric ratios are presented in Table III.

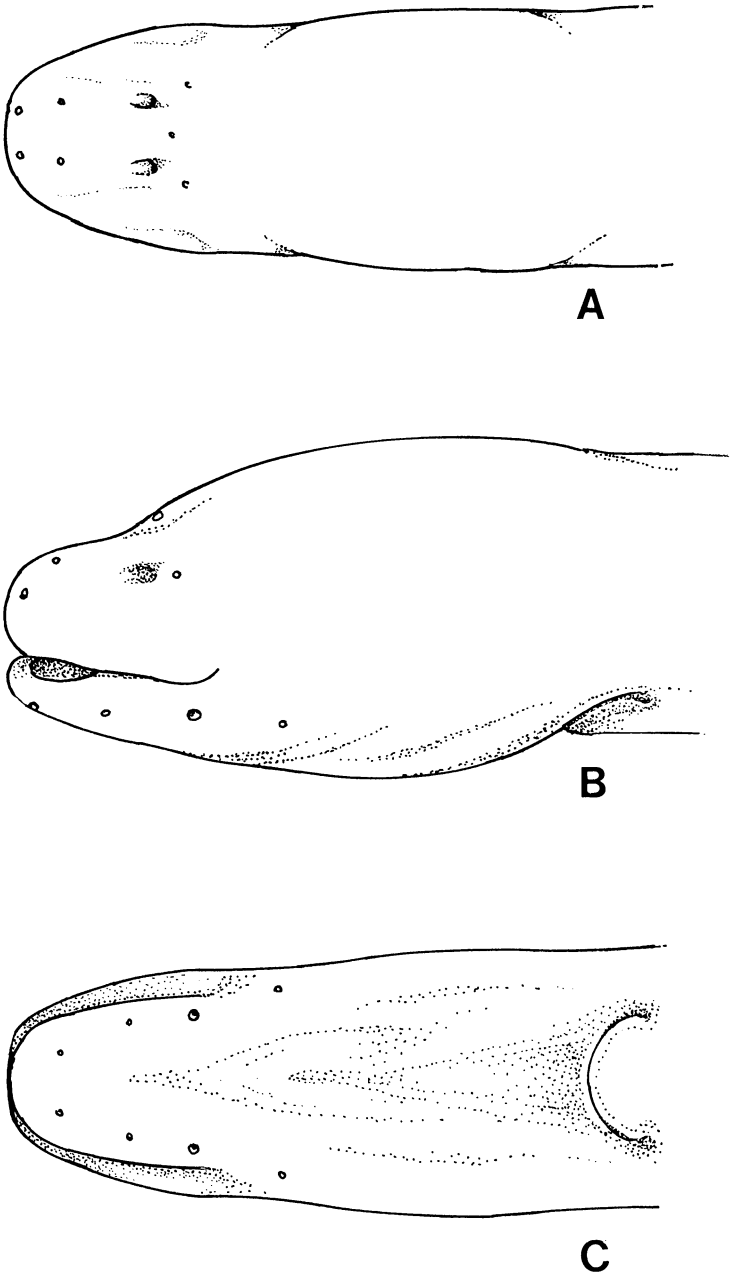

Fig. 6. *Monopterus roseni,* holotype, the head in dorsal (A), lateral (B), and ventral (C) views. Structures shown are cephalic pores (A, B, C), anterior naris (A, B), posterior naris (A, B), and ventral gill cleft (B, C).

Fig. 7. *Monopterus roseni,* holotype, radiograph of head in lateral view.

In life the body was bright (blood) red but this faded rapidly under anesthesia. In preservation the body is tawny, somewhat lighter below, but apparently wholly amelanic. There is no external visible indication of eyes or eye pigmentation. Body slender (Fig. 5), its greatest depth 1.9 percent of TL, or 40.0 percent of head length (HL) (as measured from snout tip to lateral end of gill cleft). The tail is long and whiplike, 38.1 percent of TL and 61.4 percent of snout to vent (SV) length. Head short, equal to distance from snout tip to occiput, 4.8 percent of TL and 7.8 percent of SV length; its depth 50.6 percent of its length. The gill aperture is broad and crescentic (Fig. 6C), without lateral folds, its width 1.1 percent of TL or 22 percent of HL and 61 percent of head width. Distance from snout tip to gill cleft at midline 4.1 percent of TL. Snout tip to posterior nostril 1.1 percent of TL or 22.4 percent of HL. Gape length 2.0 percent of TL or 41.2 percent of HL. The jaws are equal in forward extension (Fig. 6B).

The head bears a number of pores of the lateralis system (Fig. 6); a pair of internasal pores between anterior and posterior nares, a pair of postnasal pores, a median coronal pore slightly behind the posterior nares; four pores lie on each side of the mandible, the third of these is the largest, the fourth lies behind the angle of the gape.

Comparisons.—M. roseni is the second known true cavernicole in *Monopterus.* The first cavernicole is *M. eapeni* Talwar, in Talwar and Jhingran, 1992 [this is a replacement name for *Monopterus indicus* Eapen, 1963, preoccupied in *Monopterus* by *Amphipnous indicus* Silas and Dawson, 1961, as pointed out by Rosen and Greenwood, 1976: 58, 65]. We have seen no specimens of *M. eapeni.* It was collected at a depth of 30 feet (9 m) in a well at Kottayam (latitude 9° 30' N, longitude 76° 33' E), Kerala, India, about 102 km almost due south of the type locality of *M. roseni.* Like *M. roseni, M. eapeni* is a small, slender, blind species of which the five specimens described by Eapen (1963) ranged from 130 to 162 mm in total length. The two species differ in several body

proportions, here given in percentages of TL as computed from Eapen's measurements (Eapen, 1963: 131) and our own for the holotype of *M. roseni:* length from snout to vent, *M. eapeni* 61.5–67.9, mean 65.1, *M. roseni* 61.9; depth of head, *M. eapeni* 2.5–2.9, mean 2.7, *M. roseni* 2.4; length of tail, *M. eapeni* 32.0–34.6, mean 32.7, *M. roseni* 38.1; length of gape, *M. eapeni* 2.5–2.9, mean 2.7, *M. roseni* 2.0. The few fish available show no overlap in depth of head, length of tail, and length of gape.

In lateral and ventral views of the head of *M. eapeni* (Eapen, 1963: Figs. 1–3) the upper jaw is seen to project forward well beyond the lower (as it does also in *M. desilvai,* Fig. 2 B); in *M. roseni* the jaws project forward equally (Fig. 6 B).

As described by Eapen (1963: 129), *M. eapeni* shows "highly degenerated subcutaneous visual elements," in contrast to the sympatric clariid catfish, *Horaglanis krishnai* Menon (1951), which is "totally blind." *M. roseni* also appears to be totally blind.

The most notable apparent difference between these two blind synbranchids is in vertebral count. For *"indicus"* Eapen (1963: 130, 132) gave 135 precaudal and 24 caudal, total 159; in the holotype of *M. roseni* we count 76 plus 71, total 147. The posteriormost vertebrae are tiny and the caudal count may be in error by one or two, but the interspecific difference is striking and raises a question of possible error. In no other synbranchid except *Macrotrema caligans* and the minimum count in *Ophisternon aenigmaticum* (25) are the caudal vertebrae as few as the 24 reported in *M. eapeni* (Rosen and Greenwood, 1976: Table 2); in *Monopterus* the next lowest count is 39 in the African *M. boueti.* The difference of 12 in total count of precaudal plus caudal vertebrae is a reasonable expectation between two apparently related species. In contrast, the disparate ratios of 135 precaudal to 24 caudal (5.6:1) for *eapeni* and 76 to 71 (1.1:1) for *roseni* are surprising. These ratios are not concordant with the measured ratio for snout to vent and tail lengths, 1.99:1 (mean of five specimens, range 1.78:1 to 2.12:1) for *M. eapeni* and 1.63:1 for *M. roseni.* We suspect an error in distinction between precaudal and caudal vertebrae in the single recorded count for *M. eapeni.* For our counts we mark the level of the vent prior to radiography by inserting a slender steel insect pin.

The West African species *Monopterus boueti* differs from *M. roseni* in the minute gill aperture (Rosen and Greenwood, 1976, Fig. 21), the reduced, sunken eyes, vertebral count (more precaudal and total but fewer caudal vertebrae), and other characters.

The widespread Asiatic species *Monopterus albus* differs notably from *M. roseni* in the presence of eyes and pigmentation, large size (to at least 875 mm), shorter tail, larger gape, greater body depth, and

vertebral count, precaudal 88–102, caudal 45–74 (Rosen and Greenwood, 1976, Table 2). The wide gill cleft is triangular (Rosen and Greenwood, Fig. 19) rather then crescentic.

Ecology.—The holotype of *M. roseni* was collected in the village water supply and was initially assumed to be a toxic animal. The bright red individual was circling in a 6 cm diameter glass jar and was moving around rapidly and continuously so that it was difficult to determine any surface detail. There seemed to be no eye spots.

The research party then visited the water supply tank at the edge of Periyam village. The village was in a flat area and surrounded by a wide zone of paddy fields, being slightly raised above these. The circular tank was several meters in diameter and the water level five meters below the edge. Probing suggested that the tank was eight meters deep. Nearly two hours of continuous pumping by two gasoline driven pumps, each forming an approximately 15 cm jet of water, lowered the surface only 1.5 m. No additional animals were noted.

Etymology.—This species is named for the late Dr. Donn E. Rosen, accomplished ichthyologist, discerning student of the Synbranchidae, and personal friend and associate of both of us. He was a field companion with one of us (RMB) on five expeditions to Guatemala where the many memorable months of ichthyological research included field investigation of two species of synbranchids.

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