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Original article

Re-discovery of *Cynisca bifrontalis* in Gabon, with additional notes on *Monopeltis galeata* (Reptilia: Amphisbaenia)

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Abstract.—A small series of amphisbaenians from the Toucan/Rabi region, Ogooué-Maritime Province, south-western Gabon, is reported. It includes five specimens of *Cynisca bifrontalis* (Boulenger 1906), previously known only from the holotype, and five specimens of *Monopeltis galeata* (Hallowell 1852). The Toucan/Rabi material represents a range extension of 90 km south-east for both species. Morphological variation in the new material is discussed. Body annuli counts in both species differ from documented ranges, but the possible taxonomic significance of this cannot be assessed until larger series become available. Like congeners with extensively fused head shields, *C. bifrontalis* displays variability in cephalic scutellation. Pre-cloacal pores in females are represented by small scale depressions, but these lack secretion cores. The species reaches a snout-vent length of only 131 mm and is thus one of the smallest known fossorial reptiles. *Cynisca haughi* (Mocquard 1904) is poorly diagnosed and its taxonomic status requires further study.

Key words.—Amphisbaenia, *Cynisca bifrontalis*, *Cynisca haughi*, *Monopeltis galeata*, taxonomy, distribution, Gabon.

There are few recent records of amphisbaenians from Gabon. Gans (1987) revised the small, round-headed amphisbaenians from West Africa. However, only two specimens from Gabon were available: the unique types of *Amphisbaena bifrontalis* Boulenger 1906 and *Amphisbaena Haughi* Mocquard 1904. Gans (1987) recognized both species and followed Laurent (1947) and Vanzolini (1951) in transferring them to *Cynisca* Gray 1844. Gans & Lehman (1973) reviewed the genus *Monopeltis* A. Smith 1848 north of the Congo River and recorded only a single species, *Monopeltis galeata* (Hallowell 1852), from Gabon. All known localities are in lowland habitat in the north-west of the country. The type of *Lepidosternon koppenfelsi* Strauch 1881 was recorded from "West Africa (Gabon)", but was referred to the synonymy of *Monopeltis jugularis* Peters 1880 by both Loveridge (1941) and Gans & Lehman (1973). The latter species is currently known only from Cameroon and Rio Muni, and there are no recent records confirming its presence in Gabon.

An extended survey of the herpetofauna of the Gamba region, Ogooué-Maritime Province, south-western Gabon, forms part of the Smithsonian Institution - Monitoring and Assessment of Biodiversity (SI/MAB)

Table 1. Morphometric and meristic data for *Cynisca bifrontalis* from Gabon, and for the types of *C. haughi* and *C. schaeferi*. * data from Gans (1987).

Number	Sex	SVL	Tail L	SVL/TL	Body annuli	No. dorsals/ ventrals in body annulus	Tail annuli	Autotomy Site	Precloacal pores (with cores)
Holotype *C. schaeferi**	♀?	196	23	8.52	241	12/10	26	13	0
Holotype *C. haughi**	♀?	124	16	7.75	251	8/8	27	7	0
Holotype *C. bifrontalis**	♀	131	-		240	8/8	-	11	10 (0)
R178 (SI)	♂	68.5	10.5	6.52	231	8/8	27	11	8 (4)
R178(2) (GAM 043)	?	79+	-		206+	8/8	-	-	-
PEM R5515	♀	90	-		229	8/8	11+	11	8 (0)
PEM R5514	♀	105	13.5	7.78	230	8/8	25	11	8 (0)

Program. As part of this program we have undertaken surveys in Gamba, the Toucan and Rabi oilfields, and the Loango and Moukalaba-Doudou national parks. The main results of these surveys will be presented elsewhere (Branch *et al*. in prep.; Burger *et al*. in prep.; Pauwels *et al*. in prep.a). Material collected is divided between the herpetological collections of the following institutions: Port Elizabeth Museum, Humewood, South Africa (PEM), Biodiversity Research and Conservation Center, Gamba, Gabon (GAM), Smithsonian Institution, Washington D.C., U.S.A. (SI), and Institut Royal des Sciences naturelles de Belgique, Brussels, Belgium (IRSNB).

During fieldwork in lowland forest habitats in the Toucan/Rabi oilfields we collected a series of five *C. bifrontalis* and five *M. galeata*. Most specimens (nine of 10) were unearthed during forest clearance for road construction and the preparation of a drilling platform. Morphological variation in this material and its biological and taxonomic significance is discussed below. Terminology and the methodology of scale counts follows Broadley *et al*. (1976), Gans & Lehman (1973) and Gans (1987). The autotomy site in amphisbaenians falls between caudal annuli, but its position in the tail is referred to that of the preceding annulus (Gans 1987).

SYSTEMATIC ACCOUNT

CYNISCA BIFRONTALIS (BOULENGER, 1906)

Type locality.—"Fernand Vaz, French Congo".

Material examined.— (Ogooué-Maritime Province, Gabon): five specimens: R178 (SI), along newly excavated Toucan-Calao road, Rabi oilfield (01° 47' 40" S, 09° 53' 34" E), 29 May 2002, W.R. Branch & M. Burger; R178(2) (GAM 043), near the Toucan-Calao road (01° 47' 37" S, 09° 53' 30" E), 5 June 2002, M. Lee, W.R. Branch & M. Burger; PEM R5514, PEM R5515, "chantier Perenco", Rabi oilfield (01° 58' 16" S, 09° 51' 18' 'E; alt. 15 m a.s.l.), 27 July 2002, O.S.G. Pauwels. Another specimen was collected along the Toucan-Calao road, Rabi oilfield (01° 47' 31" S, 09° 53' 28" E, 31 May 2002, W.R. Branch & M. Burger) and photographed (Fig. 1), but subsequently lost.

Only three *Cynisca* species are known from the Bight of Africa. In addition to *C. bifrontalis* and *C. haughi* from Gabon, *C. schaeferi* (Sternfeld 1912) is known from the holotype (Yapoma, coastal Cameroon) and two specimens without locality data (Gans 1987). The four preserved specimens from Toucan/Rabi share the following diagnostic features with the holotype of *C. bifrontalis*: a discreet ocular (absent in *C. haughi*; see discussion); no postmental (present in *C. schaeferi*); eight dorsals and eight ventrals per midbody annulus (12 and 10 respec-

Table 2. Morphometric and meristic data for *Monopeltis galeata* from Gabon. * data from Gans & Lehman (1973).

Number	Sex	SVL	Tail L	SVL/TL	Body annuli	No. dorsals/ ventrals in body annulus	Tail annuli	Autotomy site	Precloacal pores
Lectotype *M. galeata**	♂	360	32	11.25	224	9-10/8	18	5	3
Paralectotype *M. galeata**	♂	400	34	11.76	219	10-11/8	17	5	2
PEM R5367	♂	396	37	10.70	232	10/8	19	5	2
P858 (SI)	♂	373	37	10.08	229	10/8	18	5	2
P868 (IRSNB)	♂	388	37	10.49	226	10/8	19	5	2
P857 (GAM 044)	♂	231	26	8.88	227	10/8	19	5	2
PEM R5513	♀	397	30	13.23	233	10/8	16	5	0

tively in *C. schaeferi*); autotomy site at 11th caudal (at 7th in *C. haughi* and 13th in *C. schaeferi*); no intercalated dorsal half-annulus in the nuchal region (present in *C. schaeferi*); precloacal pores present but lacking secretion cores in females (absent in *C. schaeferi* and *C. haughi*). Morphometric and meristic details for the four Toucan/Rabi specimens and the holotypes of *C. bifrontalis*, *C. haughi* and *C. schaeferi* (after Gans 1987) are given in Table 1.

Cephalic scutellation in *Cynisca* is variable (Gans 1987), with considerable intra-populational variation (e.g., *C. rouxae*, Rödel & Grabow 1996; *C. feae*, Pauwels & Meirte 1996). The present small series reveals similar

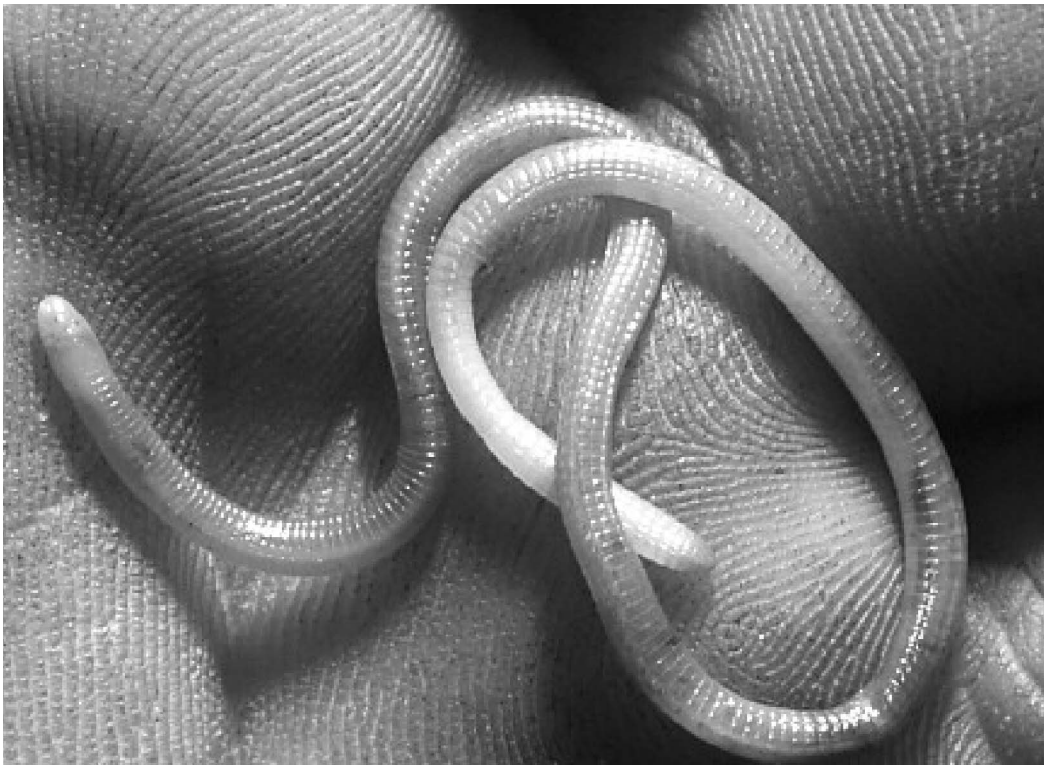

Figure 1. Live adult *Cynisca bifrontalis* from Toucan/Rabi, Ogooué-Maritime Province, Gabon. Note the small size, rounded snout, and uniform, unpigmented colouration (photograph: Marius Burger).

variability in *C. bifrontalis* as all specimens show a number of minor differences from the type illustrated by Gans (1987). All specimens conform to the type in having a swollen snout covered by large paired shields formed by the fusion of the preocular, supraocular, supralabials, nasals and prefrontals. A blind suture extends anteriorly into this compound shield from the front of the ocular. The eye is visible in three specimens at the suture of the enlarged postocular-supralabial and the ocular (lying behind this suture in R178 (SI), and just in front of it in both PEM R5514 and 5515). Variation occurs with regard to fusion of the asymmetrical parietals and the tiny occipitals of the dorsal half-annulus of the second body annulus. In the holotype of *C. bifrontalis* the occipital is fused to the parietal on the left side only (Gans 1987); in R178 (SI), both occipitals remain discreet; in R178(2) (GAM 043) the left occipital is discreet from the parietal but fused along its posterior margin with the scute of the adjacent body annulus; and in both PEM R5514 and 5515 the occipitals are fused with the parietals on both sides. All the Toucan/Rabi *Cynisca* have lower body annuli counts (229-231, *N* = 3) than the holotype (240), but too few specimens are known to determine whether this has any taxonomic significance.

In his original description and figure of the cloacal region, Boulenger (1906) recorded 10 precloacal pores in the female holotype, an observation that was reiterated by Loveridge (1941). In contrast, Gans (1987) noted only "eight precloacal pore scars lacking secretion cores" in his species description, but then confusingly listed 10 pores in his table. The generic synopsis notes that pre-cloacal pores are well developed in males, but are lacking or without secretion cores in females. The gender of the holotype (female) is confirmed by the presence of eggs (Gans 1987). Both intact females (PEM R5514-5515) lack distinct pre-cloacal pores with secretion cores, although in both, slight depressions are evident in eight pre-cloacal scutes. The small male (R178 [SI]; SVL 68.5 mm, juvenile?) possesses eight pre-cloacal pores, of which the central four have small secretion cores.

As with the holotype the autotomy plane is found between the 11th and 12th caudal annulus in the three intact specimens.

Gans (1987) noted that the holotype had faded to a uniform pale brown. In life all three Toucan/Rabi specimens were uniform light pink above with a paler ventrum and lacked any visible pigmentation (Fig. 1).

This is a very small species, the largest of the two intact specimens measuring only 118.5 (105 + 13.5) mm in total length (Table 1). Loveridge (1941) gives the total length of the sexually mature female holotype as 140 (130 + 10) mm, whilst Gans (1987) records a SVL of 131 mm, but notes that the tail is autotomised between the 11th and 12th caudal annulus. Snout-vent/tail length ratio was 7.78 in the adult female and only 6.52 in the male.

Distribution and habitat.—Four specimens were unearthed during road and oil site construction in dense, mature lowland forest. Another specimen was collected approximately 300 mm beneath the surface whilst digging a hole for a pitfall trap in drier, sandy soil in open forest. At "chantier Perenco" the species occurred in strict syntopy with *M. galeata*.

MONOPELTIS GALEATA (HALLOWELL, 1852)

Type locality.—"Liberia, West Coast of Africa"; corrected by Hallowell (1857, p. 50) to "Gaboon Country, West Africa".

Material examined.—(Ogooué-Maritime Province, Gabon): five specimens: PEM R5367, start of newly-excavated Toucan-Calao road, Rabi oilfield (01° 47' 41" S, 09° 53' 44" E), 30 May 2002, M. Boddicker, W.R. Branch & M. Burger; PEM R5513, P858 (SI), P868

(IRSNB), "chantier Perenco", Rabi oilfield (01° 58' 16" S, 09° 51' 18" E; alt. 15 m asl), 27 July 2002, O.S.G. Pauwels; P857 (GAM 044), "camp CBG", NW of Rabi oilfield (01° 50' 36" S, 09° 47' 34" E), 20 July 2002, A. Brenon.

Morphometric and meristic data for the five specimens are given in Table 2. Variation in scutellation generally falls within the range noted by Gans & Lehman (1973). The two main head shields were unfused in all specimens, with extensive keratinization (Fig. 2). All males had a single precloacal pore on either side of the vent, but these were absent in females. Although some pigmentation may be present on the posterior body and beneath the tail (Loveridge 1941; Gans & Lehman 1973), this appeared to be absent in the Toucan/Rabi specimens, with the exception of slight darkening of the autonomy plane in two specimens.

It is possible that regional differences in body annuli counts occur within the species. Gans & Lehman (1973) listed two specimens of *M. galeata* with very low body annuli counts (i.e., 201, Lambaréné; 208, Corisco Island; 214-233 in all other specimens, $N = 30$). *Monopeltis jugularis* from Cameroon has similarly low annuli counts (200-211, $N = 15$, Gans & Lehman 1973). However, in other diagnostic characters, e.g., preanal pores, caudal annuli, and number of dorsals and ventrals in midbody annuli, the Lambaréné and Corisco Island specimens conform to *M. galeata*. Excluding these specimens, body annuli counts in the remaining specimens of *M. galeata* still show regional differences in body annuli counts between southern and northern populations. The southern population (here taken to include the new Toucan/Rabi series and specimens from adjacent Omboué; Gans & Lehmann 1973) have higher body annuli counts (range 220-233, mean 227.6, S.D. 4.3, $N = 14$) than those of the northern population centered around Libreville and Cape Esterias (range 214-230, mean 223.2, S.D. 3.6, $N = 21$; after Gans & Lehman 1973). However, larger series are required to test whether these populations are discreet and whether variation in body annuli counts is simply clinal.

The hemipenes of few amphisbaenians have been described (Rosenberg 1967). Gans (1978) noted that hemipenes of amphisbaenians were short and generally bilobed (simple in *Bipes*, *Rhineura* and *Blanus*) with centrifugal sulci and flounced ornamentation. However, in an earlier revision of southern African *Monopeltis* and *Dalophia*, Broadley *et al*. (1976) noted that the sulcus of the everted hemipenis of *Dalophia pistillum* ran to the crotch between the arms, the sulcal forks then running to the tips (i.e., centripetal condition, Branch 1986). Moreover, they described the terminal ornamentation as spinose. The latter probably represents papillate flounces, rather than true spines, which are unknown in amphisbaenians (Gans 1978; Rosenberg 1967). A similar bilobed hemipenis, with centripetal sulcus and flounced ornamentation, was illustrated for *Monopeltis sphenorhynchus* (Broadley *et al*. 1976).

Cope (1896) noted that the retracted hemipenis of *M. galeata* was "bifurcate, each branch … marked with fine, close, transverse folds, while the region proximad to these has coarser folds directed transversely and obliquely." The everted hemipenial morphology of four male *M. galeata* in the present series generally conforms to this description. The organ flexes sideways from the cloaca and upwards along the curvature of the body. The sulcus spermaticus travels proximad around the nude basal section (which is almost half the total length of the organ) and then along its length to the crotch between the large arms (i.e., centripetal condition). The sulcal folds are raised but unadorned, each sulcal fork running semi-revolute around the flexed arm to the tip. A small, raised fold occurs at the sulcal furcation. The arms bear fine, papillate flounces. The Toucan/Rabi series

thus confirms the presence of a centripetal sulcus and papillate flounced ornamentation in the hemipenis of *M. galeata*, as found in other *Monopeltis* and related genera (Broadley *et al*. 1976). The sulcal orientation in the New World genera *Amphisbaena*, *Leptosternon*, *Anops* and African *Chirindia* is also centripetal, whilst the latter genus, although having unusually complex terminal lobes, still retains papillate ornamentation (Rosenberg 1967). Hemipenial morphology for *Cynisca* is undescribed.

Biological notes.—The single adult female (PEM R5513, snout-vent length 397 mm) contained six well-developed eggs, four in the left oviduct and two in the right. The smallest egg measured 6 x 15 mm and the largest 8 x 25 mm. There was no sign of embryonic development.

Distribution and habitat.—All specimens were unearthed in dense, mature lowland forest with clayey soil. At the "chantier Perenco" site three specimens were collected in four hours in an area of 1200 m^2 of cleared forest. They were found in strict syntopy with two *C. bifrontalis* and the fossorial skink *Feylinia grandisquamis*. The latter species and the blind snake *Typhlops angolensis* were found in syntopy with *M. galeata* at "camp CBG". Apart from a single record for Corisco Island (Equatorial Guinea), *M. galeata* is known only from the western regions of Gabon.

DISCUSSION

Cynisca bifrontalis and *C. haughi* are both endemic to Gabon. For nearly 100 years they have been known only from holotypes (Gans 1987). Differentiation between the two species is relatively minor (Gans 1987). It involves the lack of a discreet ocular in *C. haughi* (present in *C. bifrontalis*), and a caudal autotomy site at the level of the 7th caudal annulus (at the 11th in *C. bifrontalis*).

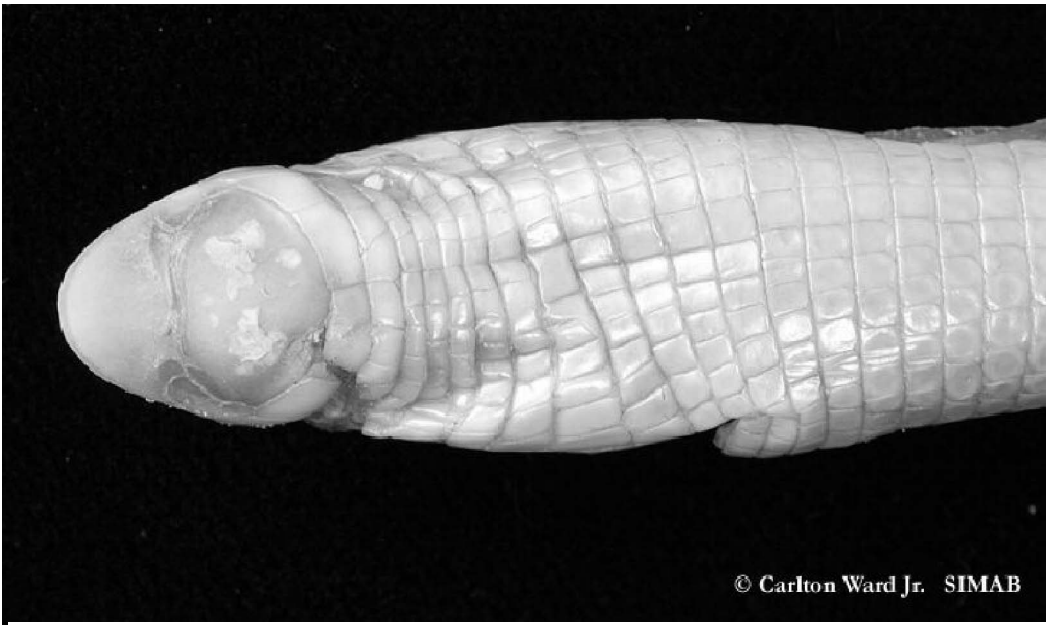

Figure 2. Dorsal cephalic scutellation of *Monopeltis galeata*. PEM R5367, Toucan/Rabi, Ogooué-Maritime Province, Gabon. Note the two large, unfused head shields and their extensive keratinization (photograph: Carlon Ward Jr.).

Although all specimens in the present series of *Cynisca* retained a discreet ocular, cephalic scutellation in the genus is variable (Dunger 1968, Gans 1987; Pauwels & Meirte 1996; Rödel & Grabow 1996) and fusion of the ocular to the compound shield may be expected to occur occasionlly. The female holotype of *C. haughi* is in relatively poor condition with an abraded anterior region, but "there once may have been a discreet squarish ocular" (Gans 1987: 40). Despite this observation and its taxonomic implications, Gans (1987) continued to recognize the absence of an ocular as a diagnostic feature for the species.

The other remaining "diagnostic" features, i.e., position of the autotomy plane and presence of preanal pores in females, are also subject to some confusion. Dunger (1968) indicated that the autotomy site occurred at the 9th caudal annulus in the type of *C. haughi*, but Gans (1987) corrected this to the 7th caudal annulus. Finally, although Gans (1987) indicated that there were no precloacal pores in the female type of *C. haughi*, the specimen is in poor condition. Precloacal pores in *C. bifrontalis* females are represented only by shallow depressions that are difficult to see and which may be expected to become indistinguishable in poorly preserved specimens. The only feature, therefore, that seems to distinguish *C. haughi* from *C. bifrontalis* is the more distal position of the autotomy site (7th annulus, Gans 1987; 11th in *C. bifrontalis*).

Cynisca haughi may also have higher body annuli counts (251 in the holotype), although more material is required for confirmation. The holotype of *C. bifrontalis* has 240 body annuli, whilst in the Toucan-Rabi series they range from only 229 to 231. Omboué ("Fernand Vaz"), the type locality of *C. bifrontalis*, lies on the coast of Gabon some 90 km north-west of Toucan/Rabi. The type locality for *C. haughi* ("Gabon, à environ 50 kilométres sud-ouest de Lambaréné") is south of the Ogooué River, which is therefore not currently a barrier between the two species. Whilst the present observations do not invalidate the specific status of *C. haughi*, we do caution that this species remains poorly diagnosed.

Most previous records of *M. galeata* are from around Libreville, with the southern-most records being Omboué and Lambaréné (Gans & Lehman 1973). The Lambarene specimen has an exceptionally low body annuli count (201) and further material from the region is required to confirm whether this is natural variation or reflects a taxonomic novelty.

The new collections reported here represent important range extensions (90 km to the south-east) for both *C. bifrontalis* and *M. galeata* into the poorly surveyed southern parts of Gabon. They confirm the rich, yet largely unknown, herpetofauna of the region (Branch *et al*. in prep. ; Burger *et al*. in prep. ; Pauwels *et al*. in prep. b).

Both amphisbaenian species appear to be restricted to lowland forest habitats. Their protection is therefore dependent upon the preservation of intact forest. Neither species was discovered during a survey of the reptiles of Loango National Park (Pauwels *et al*. in prep. a) that lies between the Toucan/Rabi oilfields and Omboué. However, forest amphisbaenians are difficult to collect and both species may still occur within the newly-proclaimed national park.

Members of the genus *Cynisca* are minute amphisbaenians. Only two species are known to exceed 170 mm SVL. *Cynisca bifrontalis* appears to be one of the smallest species (maximum SVL 131 mm, holotype). Of the 17 recognized species (Gans 1987) only *C. degrysi* (Loveridge 1941) (known from Sierra Leone and from a single type of 107 mm SVL, 13 mm tail length) may be smaller. These bizarre creatures are probably the smallest fossorial reptiles

in the world, and the diverse physical and physiological attributes of such extreme miniaturization have not been adequately addressed.

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