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## A new species of *Chthonerpeton* (Amphibia: Gymnophiona: Typhlonectidae) from Bahia, Brazil

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### Abstract

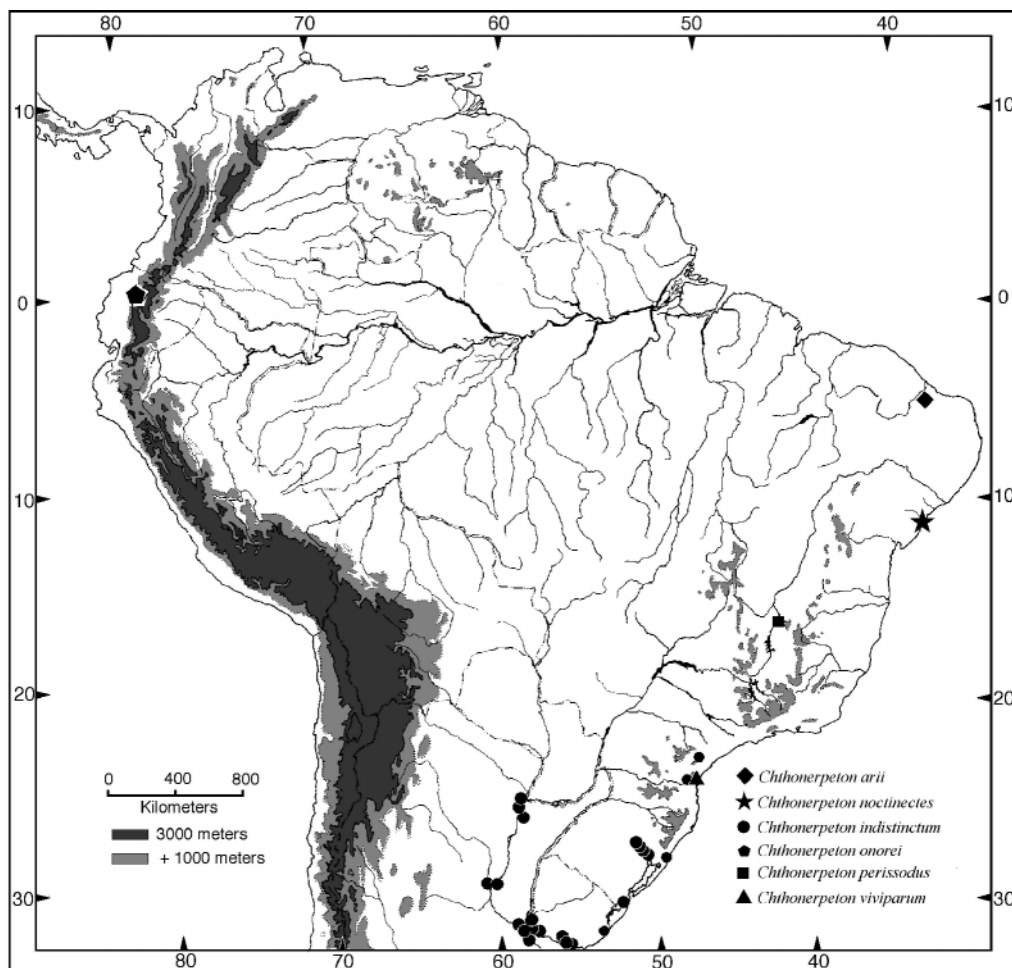
A new species of the *Chthonerpeton indistinctum* group is described from Brazil based on fourteen specimens collected in the Municipality of Conde, State of Bahia. The new species is characterized by 94–103 primary annuli, 100–108 vertebrae, tentacular aperture closer to nares than to eyes, unpigmented cloacal disk and narial plug areas, and by the number of vomeropalatine and dentary teeth that is smaller than that of the other species in the group. The new species is aquatic and fossorial, and can be found swimming actively at night or borrowed in mud in places near the river.

**Key words:** *Chthonerpeton noctinectes* sp. nov., natural history

### Introduction

The Neotropical typhlonectid genus *Chthonerpeton* Peters, 1880 includes seven species (Nussbaum and Wilkinson, 1989, Cascon and Lima-Verde, 1994); all confined to South America. Six species occur in Brazil, one of which, *Chthonerpeton indistinctum* (Reinhardt and Lütken, 1862), also occurs in Paraguay, Uruguay, and Argentina, and a single species, *Chthonerpeton onorei* Nussbaum, 1986 occurs in northeastern Ecuador, well outside of the range for the majority of the species (Fig. 1). The genus is currently subdivided

in two species-groups that may represent monophyletic sister groups (Nussbaum, 1986). The *C. indistinctum* group, which is composed of *C. braestrupi* Taylor, 1968, *C. exile* Nussbaum and Wilkinson, 1987, *C. indistinctum*, and *C. perissodus* Nussbaum and Wilkinson, 1987, is characterized by a smaller number of vertebrae and primary annuli, stocky body form, wide head, and choanal valves relatively more superficial. The *C. viviparum* group, which includes *C. viviparum* Parker and Wettstein, 1929 and *C. onorei*, is characterized by a larger number of vertebrae and primary annuli, slender body, narrower head, and deeply recessed choanal valves. Cascon and Lima-Verde (1994) described *C. arii* from the Brazilian northeastern State of Ceará, which they were unable to assign to either group because the number of vertebrae in the species is intermediate between that for *C. indistinctum* and *C. viviparum* groups.



**FIGURE 1.**—Map of South America showing the known distribution of species of the genus *Chthonerpeton*. Locality data for *C. indistinctum* from Gudynas, Williams, and Azpelicueta (1998), the remaining species from the original description papers.

Little is known about the natural history of the species of *Chthonerpeton*. For some species in the genus, locality data is incomplete, and most of them are known only from the type locality and type series, often composed of a single specimen. Notwithstanding, based on data gathered for *C. indistinctum* (Azpelicueta et al., 1987; Barrios, 1969; Barrio, Saes, and Chieri, 1971; de Carlo, 1980; de Sá and Berois, 1986; Gudynas, Measey and Di-Bernardo, 2003. Williams and Azpelicueta, 1988; Taylor, 1968) and *C. arii* (Cascon and Lima-Verde, 1994), species in the genus are considered semi-aquatic and viviparous (see also Taylor, 1968; Nussbaum and Wilkinson, 1987; 1989; and Cascon and Lima-Verde, 1994).

Herein we describe a new species of *Chthonerpeton* collected at the margin of the Itapicurú River, a medium sized river in the north of the State of Bahia, northeastern Brazil. As this river runs directly into the Atlantic Ocean without any major tributaries, and all described species of *Chthonerpeton* have been found associated with larger rivers or river systems, we believe that this population represents a new species isolated from other known *Chthonerpeton*. The new species is most similar to *C. perissodus*, which were collected from the Pandeiro River, a tributary of the Rio São Francisco in the State of Minas Gerais, about 1500 Km southwest of the mouth of the Itapicurú River. Based on the number of vertebrae (100-108), primary annuli counts (94-103), and general body shape (stocky not slender) of the new species, all of which fall within the range of variation for the *Chthonerpeton indistinctum* species group (Nussbaum, 1986), we restricted our detailed comparisons to species in this group only.

## Methods

All measurements were obtained with dial calipers to the nearest 0.01 mm and followed Nussbaum (1986) and Nussbaum and Wilkinson (1987). Abbreviations used for measurements and meristic data are as follows: TL (total length), HL (head length), HW (head width), IOD (interorbital distance), IND (internarial distance), END (eye-narial distance), ETD (eye-tentacle distance), CD (number of cloacal denticles), PW (posterior width, measured on the posterior portion of the body in the cloacal region), TL/BW (ratio of total length to body width), P (primary annuli), V (number of vertebrae), PM (number of pre-maxillary-maxillary teeth), VP (number of vomeropalatine teeth), D (number of dentary teeth), S (number of splenial teeth).

In order to preserve part of the type series intact for future studies, only a few specimens of the series were used for some of the anatomical examinations. Three specimens (two adults and one neonate) were cleared and doubly stained for bone and cartilage observations using the method described in Taylor and Van Dyke (1985). Herein, these specimens were used mainly for confirming tooth and vertebral counts. A full description of the skeletal morphology will be presented elsewhere. For tooth counts only six specimens, including the holotype, were examined. Some of the specimens were X-rayed for verte-

bral counts. The acronyms of the museum collections housing the specimens examined are as follows: MNRJ (Museu Nacional do Rio de Janeiro, Universidade Federal do Rio de Janeiro, Brazil), MUZUSP (Museu de Zoologia, Universidade de São Paulo, Brazil), UFC (Coleção Herpetologia da Universidade Federal do Ceará), and ZUFRJ (Departamento de Zoologia, Universidade Federal do Rio de Janeiro).

***Chthonerpeton noctinectes* spn. nov.**

*Holotype*:—MNRJ 10581, an adult male collected at Sítio (11° 50' S, 37° 35' W, at sea level), Municipality of Conde, State of Bahia, Brazil, by Hélio Ricardo da Silva, Mônica Cox de Britto Pereira, and Hussam Zaher in February, 1989.

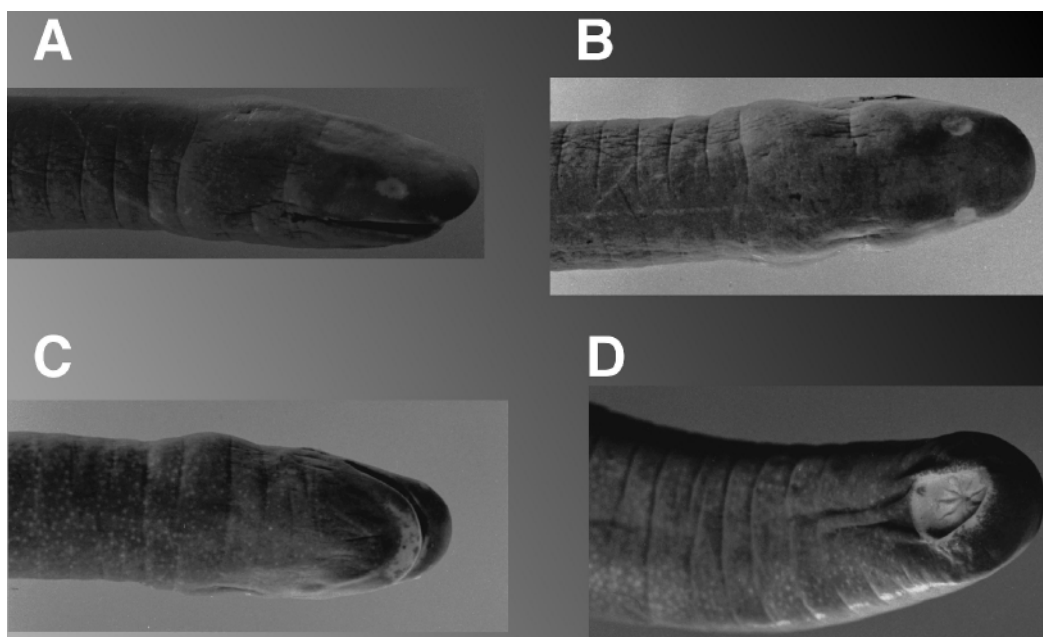
*Paratypes*:—Ten adult females (MNRJ 10583-590, 10592-193) and two adult males (MNRJ 10582, 10591) collected with the Holotype.

*Diagnosis*:—A species of the *Chthonerpeton indistinctum* group characterized by (1) 94–103 primary annuli, (2) 100–108 vertebrae, (3) 26–36 premaxillary-maxillary teeth, (4) 20–33 vomeropalatine teeth, (5) 23–28 dentary teeth, and (6) marked sexual dimorphism in the width of the vent area (males being larger).

The number of primary annuli and vertebrae distinguishes *Chthonerpeton noctinectes* from *C. indistinctum* (72–79 annuli and 82–86 vertebrae). *C. noctinectes* is distinct from *C. braestrupi* and *C. exile* in having the tentacle closer to the naris than to the eye (Table 1). *C. noctinectes* may be promptly distinguished from *C. arii* on the basis of color; *C. arii* has a dark gray dorsum, light gray flanks, and a distinctive longitudinal yellow stripe mid-ventrally. The smaller number of premaxillary-maxillary, vomeropalatine, and dentary teeth distinguishes *C. noctinectes* from *C. perissodus*.

*Description of holotype*:—Morphometric and meristic data are presented in Table 1. The specimen is an adult male with slits in both sides of the jaw, which were made in order to facilitate the observation of characters inside the mouth. Also, as a result of the fixation process, the body shape, which was cylindrical in life, became somewhat ventrally flattened.

Head oval in dorsal view, larger in the nuchal region, blunt anteriorly. Eyes dorsolaterally oriented, covered by a white and opaque epidermis (Fig. 2A, B); lens minute but easily discernible. Tentacular apertures minute, visible in anterior, lateral, and ventral views; encircled by an oval, white epidermis (Fig. 2A), closer to nares than to eyes and below eye-naris line. Naris minute, oval, and anterolaterally oriented. Mouth recessed, snout projecting 2.7 mm in front of it. Teeth small, moncuspid, pointed, and recurved. Choanae close to each other, circular (1 mm in diameter), with choanal valves relatively shallow and easily observable. Tongue with two unpigmented narial plugs, its posteriormost portion with a sagittal groove.



**FIGURE 2.**—Holotype (MNRJ 10581) *Chthonerpeton noctinectes*: (A) Lateral view of the head and neck showing left side, (B) head dorsal, (C) head ventral, and (D) ventral view of body terminus showing detail of vent.

**TABLE 1.**—Measurements and meristic data for the type series of *Chthonerpeton noctinectes*.

	Males		Females
	Holotype	Paratypes (2)	Paratypes (10)
TL	334	286–318	254–345
BW	14.00	12.00–14.90	7.00–13.70
HL	10.60	8.60–10.60	3.62–9.80
HW	10.40	8.20–10.00	7.00–10.00
IOD	6.00	5.30–6.10	4.30–6.00
IND	4.00	3.60–3.70	2.70–4.10
END	4.80	3.80–5.50	3.00–5.00
ETD	3.50	3.00–3.40	2.10–3.90
TND	2.00	1.90–2.00	1.30–2.00
CD	12	10–11	9–12
EMD	2.20	1.75–1.80	1.50–2.30
TMD	1.30	1.00–1.15	0.70–1.45
NV	106	101–105	99–108
PA	99	95–101	94–103
PW	7.10	6.30–8.70	4.20–7.10

Two nuchal collars are clearly visible ventrally and laterally; first thicker than the second (Fig. 2C), bearing two incomplete grooves ventrally and three incomplete ones dorsally. Ninety-nine primary annuli; body robust, ratio of total length to width at the mid-body 24.6:1 mm. Scales absent. Body terminus rounded, forming an unsegmented shield 7.5 mm long. Cloacal disk circular; situated in a depression surrounded by a skin fold (Fig. 2D), and divided into twelve cloacal denticulations, the two lateral ones each bearing a small anal papilla. One hundred and six vertebrae.

Coloration: Dorsally the body is a uniform dark bluish-gray, covered by minute white spots. The cloacal disk is white. The anterior margin of the lower jaw bears an irregular crescent white area. The coloration pattern has not changed after fixation.

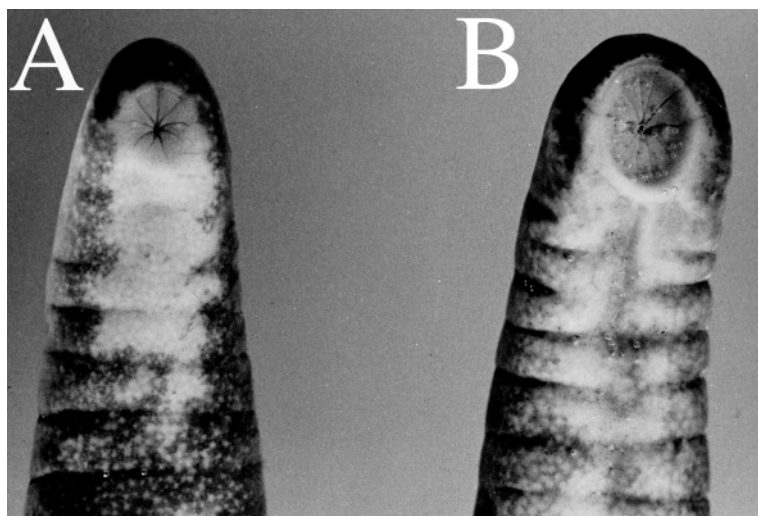
Variation: Measurement data for the holotype and paratypes are presented in Table 1. Tooth counts are presented in Table 2. The general color pattern of the series of paratypes agrees with the description presented for the holotype. Paratypes differ from the holotype in having a larger and more irregular white ventral area at the mid-body, and a larger white area around the vent. A whitish eye eye-tentacle stripe also varies among the paratypes. Three states occur: a) stripe is absent, as in the holotype; b) stripe is incomplete, beginning around the tentacle aperture and not reaching the eye; and c) stripe is complete going from the eye to the tentacle (in this case it is narrow and tenuous).

**TABLE 2.** —Tooth counts for the Holotype and selected Paratypes of *Chthonerpeton noctinectes*.

	MNRJ 10581	MNRJ 10584	MNRJ 10587	MNRJ 10591	MNRJ 10592
Tooth Series	Holotype	Paratype	Paratype	Paratype	Paratype
PM	30	39	26	26	31
VP	30	25	23	29	27
D	25	27	25	23	22
S	5	8	4	4	4

The cloacal disk also shows variation in the number and in size of denticulations (Table 1). Some individuals present all denticulations about the same size, and in others the size varies, with some of the denticulations being half the size of the larger ones. Some denticulations also show incomplete subdivision.

Disk papillae (= anal glands of Taylor, 1968) are not exclusive to males. They can also be found in some females (Fig. 3A), although they are smaller than those of males. There is an obvious sexual dimorphism in the shape and width of the body terminus, with males being larger than females (Fig. 3A, B). The body width around the vent area proved to be an adequate measurement in distinguishing males from females. A Student's t-test showed that this area in males are significantly larger than that of females ( $t = 4.9$ ,  $P > 0.95$ ). This expression of sexual dimorphism in the vent area is different from that presented in *C. indistinctum* in which only the cloacal disk is smaller in females (Barrio, 1969 and Gudyas and Williams, 1986).



**FIGURE 3.**—Body terminus of a female (A) and male (B) showing detail of vent. Notice sexual size dimorphism relating to the terminus width, and the presence of disc papillae in both females and males.

One male specimen, MNRJ 10692, collected with the type series, has measurements, vertebrae and primary annuli counts within the range for the type series, but is otherwise unusual. Although not smaller (270 mm) than the type specimens it is markedly thinner, with the smallest body width measurement for the entire sample (BW = 7.0 mm), differing by 2.8 mm from the next smallest specimen (MN 10589, BW = 9.8 mm). It also has a higher tooth count for all teeth series (ranges for paratypes in parentheses): PM= 50 (26–36); VP = 40 (23–33) D = 33 (23–28); S = 10 (4–8). This specimen also differs from the rest of the type series in the shape of its head, which is clearly blunter and not oval, having its largest width at the middle of the head, not at the nuchal region. Because of these differences we chose not to include this specimen in the type series. Although it falls within the range of variation reported for *C. perissodus* (Nussbaum and Wilkinson, 1987), we prefer to regard the specimen as an aberrant *C. noctinectes* rather than a *C. perrissodus* because they just appeared in one specimen and the type locality for *C. perissodus* is about 1.500 km away, and we have only a single such specimen

*Etymology*:—The specific name is an adjective derived from nocti (Latin [nox, noctis] nocturnal) and nectes (Greek [nekton, nektos] swimmer), as an allusion to the nocturnal swimming activity of the species.

*Habitat*:—The specimens were collected in a large marsh, fed by the Itapicurú River, almost 10 km from the river mouth. The marsh resembles a big lake, and is basically composed of two distinct environments. One is a flooded terrain (used for cattle grazing during the dry season), and the other is an area submerged almost all year round. Aquatic plants were found covering almost all the surface of the marsh.



Several individuals were seen at night by the shore of the marsh actively swimming or coming up the surface to breathe. During the day no individuals were observed. Although at night many of them were seen, only a few could be collected due to their agility as swimmers and the slipperiness of their bodies. Other specimens were collected buried about one meter deep into a mud bank about a kilometer from the river canal.

**Biology:**—Four individuals, two females (MNRJ 10592-93) and two males (MNRJ 10590-91), all collected with the type series, were kept in captivity for some months. They were all kept together in a large aquarium and also showed nocturnal habits, swimming actively at night. During the day they remained coiled among the plants (Fig. 3) or among themselves. They showed sub-aquatic fossorial habits, burying themselves into the gravel without coming up to breath for hours.



**FIGURE 4.**—Living specimen of *Chthonerpeton noctinectes* showing common resting posture during the day in the aquarium.

The captive individuals received a diet of chicken meat and living tadpoles of *Phasmahyla guttata* (Hylidae). As soon as the chicken meat was offered, they actively searched for the food, but it always took them almost a minute to find and take it. They appeared clumsy when confronted with this food. Somehow it was not easy for them to locate static food at the bottom of the aquarium. Sometimes they bit the gravel or another individual nearby, or even moved away from the food. When tadpoles were offered, their behavior was quite different. They also became more active as the tadpoles were placed in the aquarium, but they were able to find them much more easily. Almost invariably they attacked and ate the tadpoles with one precise strike. These observations suggest that this species of *Chthonerpeton* is able to perceive prey chemically and by movement. It may be possible that they are able to sense vibrations in the water and use them to locate food; the sense of smell also seems to be of importance.

One of the captive females (MNRJ 10593) was probably pregnant when collected in February of 1989, and at the beginning of April of the same year gave birth to eight young. At first, three young were born, then two, and three more within an interval of two days for each group. The newborns all resembled the adults, and have no external gills or any observable external larval characters. They also ate chicken meat, and were observed eating the sloughed skin. Sloughing was often observed in both the young and the adults.

After some time in the aquarium, many individuals were observed with red nematodes coming out of their mouth and cloaca. Within a few days after we had detected the presence of the nematodes, the behavior of the infected individuals began to change. They moved slowly and remained near the surface until death. We believed that the infestation of nematodes, identified as being of the Genus *Camallanus*, was the cause of their death.

Remarks:—Nussbaum (1986) used the position of the choanal valves, together with other characters, in justifying the division of the genus *Chthonerpeton* into two subgroups. According to him, the valves in the genus could be either recessed (the *C. viviparum* group) or superficial (the *C. indistinctum* group). Our examinations of the material of *Chthonerpeton* available to us did not reveal any differences in the relative position of the valves in *C. indistinctum*, *C. viviparum*, or *C. noctinectes*. The valves in the specimens we examined were all near the surface and easy to observe.

## Acknowledgments

During the field work that resulted in the collection of the specimens used in this description, we had the help of several individuals. We thank Dr. Hussam Zaher for indispensable help in collecting the specimens; Anita Lima, Januário Batista, and Diva Santos guided us through Conde, lodge us, and were extremely generous to us during the field activities. João Alves de Oliveira took the photos. MD João F. Pitombo helped us with the X-rays. C. P. Santos identified the nematodes. The various versions of the manuscript were kindly revised by Mary S. Linn, Michael Morrison, Joe Mendelson, Linda Trueb, and Hussam Zaher. Mark Wilkinson and David Gower helped improve the final revision of the paper. David Kizirian helped with the assembling of the epithet for the specific name.

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## APPENDIX

### *Additional Specimens Examined*

ZOOTAXA

381

*Chthonerpeton arii*.— Brasil: Ceará, Limoeiro do Norte, UFC A 3508-3512

*Chthonerpeton indistinctum*.—Argentina: Barranqueras, Chaco, MZUSP 36725; Buenos Aires, MNHN 3592. Uruguay: Colonia, MUZUSP 57071-72, ZUFRJ 2661-2677.

*Chthonerpeton noctinectes*.—Brazil: Bahia, Conde, MNRJ 10962, MNRJ 13572-80 (born in captivity), MNRJ 13581-13584.

*Chthonerpeton viviparum*.—Brazil: Santa Catarina, Joenville, MNRJ 857-66; Guará-Mirin, MNRJ 874-77, MNRJ 881.