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First confirmed record of caecilians (Amphibia: Gymnophiona) from the Himalayan Kingdom of Bhutan

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Abstract

The world currently recognizes 214 species of Caecilians (Amphibia: Gymnophiona) most of which occur in the wet tropics and some adjacent subtropical regions. Of the ten-family classification known, three occur in Asia, viz. Chikilidae (endemic to northeast India, Indotyphlidae (India's Western and Eastern Ghats) and Ichthyophiidae. However, until this report, there were no confirmed reports of any caecilian species from Bhutan, although their presence has been assumed likely given their occurrence in adjacent countries. This report provides the first confirmed report of caecilians in Bhutan with work to identify the species to be carried on later with further research.

Key words: Apoda, annular grooves, Ichthyophis, species, Tsirang district

The 214 currently recognized species of caecilians (Amphibia: Gymnophiona) occur in the wet tropics West of Wallace's Line, and in some adjacent subtropical regions (Frost, 2021). Under the current ten-family classification (Wilkinson et al., 2011; Kamei et al., 2012), three families of caecilians occur in Asia. Chikilidae (one genus, four species) are endemic to northeast India (Kamei et al., 2012). Indotyphlidae (24 genera, seven species) occur in the Western and Eastern Ghats of peninsular India (two genera, 14 species) as well as the Seychelles and sub-Saharan Africa (Wilkinson et al., 2011; Frost, 2021). The exclusively Asian Ichthyophiidae (two genera, 57 species) is the most speciose and widely distributed family in this region (Frost, 2021).

Although chikilids have been reported from northeast India, and ichthyophiids from Nepal, northeast India, Myanmar and southwestern China, there are no confirmed reports of caecilians from Bhutan. The presence of caecilians in Bhutan has been assumed likely given their occurrence in adjacent countries. *Ichthyophis sikkimensis* Taylor, (Ichthyophiidae) has been listed in summaries of the Bhutanese herpetofauna based on this assumption and/or unconfirmed anecdotal reports (Wangyal and Das, 2014; Wangyal and Gurung, 2017). *Ichthyophis sikkimensis* was originally described from the northeast Indian state of Sikkim (Taylor, 1960) and has subsequently been reported from adjacent Nepal (Anders et al., 2002; Nepali, 2012; Thapa and Shah, 2020). Gower et al. (2017) refuted a report of the species from the Western Ghats of peninsular India.

Here we provide the first confirmed report of caecilians in Bhutan. A single animal (Fig. 1A, B) was observed opportunistically on the morning of September 10, 2020, on the surface at the roadside at Mendrelgang (Fig. 2) in Tsirang district. The locality (26°56'57.174"N, 90°6'5.2452"E) is at an elevation of 1099 m a.s.l. (Fig. 3). The main habitat here is degraded forest, with nearby low-intensity agriculture and villages. Adjacent to the road the habitat was generally marshy, but at other times of the year a stream flows here. Preliminary information collected from this area suggested that local people do not pay any particular attention to this caecilian considered to be an earthworm with a different head.

Figure 1: Dorsal view (A) and frontal view (B) of *Ichthyophis* sp. (of this report) from Medrelgang, Tsirang, Bhutan. (Photo: Second Author).

Figure 2: Habitat of the species (this report) at Medrelgang, Tsirang, Bhutan. (Photo: Second Author).

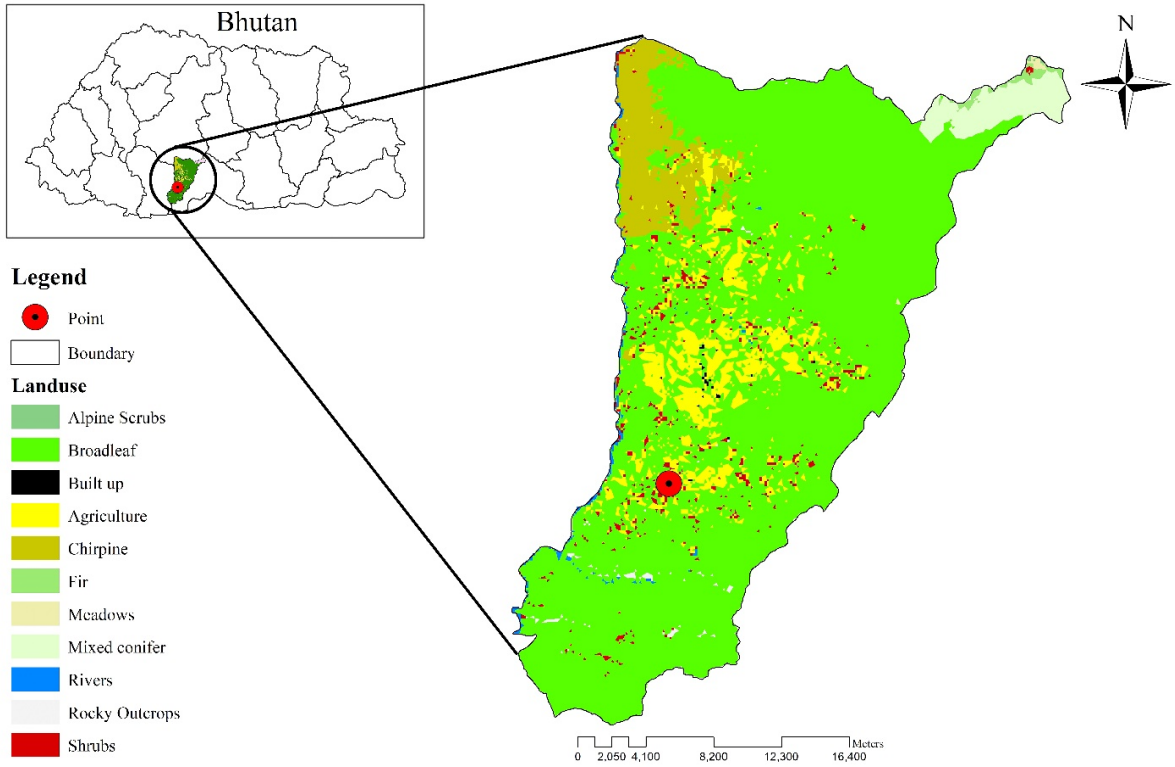

Figure 3: Mendrelgang, Tsirang District, the exact location of the species produced using ARC GIS 15.

The specimen was not observed by a professional herpetologist and was photographed but not collected. The available photographs (Figs. 1A, B) indicate that this individual is an *Ichthyophis* sp., because it has many, closely-spaced annular grooves, a visible eye, and a tentacular aperture

close to the upper lip between eye and naris. The animal lacks the yellowish lateral stripe present in most species of the genus. From a photograph of the dorsal view of the whole animal (Fig. 1A), we counted ca. 397 annuli. From close-up photographs (Fig. 1B), the animal incontrovertibly has the typical pattern for *Ichthyophis* of narrowly and regularly spaced annuli. We magnified the image in Fig. 1A on computer screens and counted total annuli multiple times. Figure 1b shows that there are very few (one or two) transverse grooves first groove that clearly extends beyond the lateral apex of the animal (e.g., Wilkinson et al., 2007). The anterior most groove that we counted also coincides with the posterior end of the slightly expanded girth of the collar region as is typical in *Ichthyophis*. Determining the position of the posterior most annular groove is not easy from the available photographs, but the terminal annulus (sometimes termed a 'cap': e.g., Wilkinson et al., 2007) in *Ichthyophis* is typically no longer than the combined length of two or three of the preceding annuli (Kamei et al., 2009; Wilkinson et al., 2014).

We also asked an expert colleague (R. G. Kamei) to make an independent estimate of total annuli, resulting in a count of approximately, and perhaps slightly more than, 400. The animal was not measured, but was approximately 250 mm in total length.

Of the 57 currently recognized species of *Ichthyophis*, 20 lack a lateral yellow stripe (Geissler et al., 2015). Data for the number of annuli and for TN/TE for these 20 species is summarized in Table 1.

Only two of the currently recognized species has more than 360 annuli, *I. bombayensis* Taylor, from peninsular India, with a reported range of 352–402 (Taylor, 1968; Gower et al., 2007) and *I. lakimi* Nishikawa, Matsui, and Yambun, from Malaysian Borneo with 349–374 (Nishikawa et al., 2012). Unfortunately, our TN/TE measure for the Bhutan animal is an estimate and this approximate value helps little in further comparisons. We lack data for other important features for *Ichthyophis* species identifications, such as numbers of vertebrae and teeth, and length of the tail. Generally, caecilians have cylindrical bodies with annular rings and reach length of between 90 to 1600 mm (Clayton and Mylniczenko, 2015). *Ichthyophis sikkimensis* has < 300 annuli (Table 1), far fewer than the ca. 400 we counted.

We are therefore confident that the Bhutan animal is not *I. sikkimensis* (Fig. 4). We consider it highly unlikely that the Bhutan animal is *I. bombayensis* (Fig. 5), because that species is known only from peninsular India, with the nearest verified locality > 1,500 km away. Thus, we suspect that the Bhutan animal represents an undescribed species of unstriped *Ichthyophis*.

Table 1: Comparative data on numbers of annuli, ratio of distance between tentacle-naris (TN) to distance between tentacle-eye (TE), and countries of distribution for currently recognized unstriped species of *Ichthyophis*. From photographs, the new Bhutan record has ca. 397 annuli and TN/TE of >2.0.

Species	Annuli	TN/TE	Distribution	References
Ichthyophis acuminatus Taylor	296–327	2.4–3.1	Thailand	Geissler et al. (2014)
Ichthyophis bilitonensis Taylor	251–254	2.0	Indonesia	Taylor (1968)
Ichthyophis bombayensis Taylor	352–402	1.7–2.4	India	Gower et al. (2007); Taylor (1968)
Ichthyophis Cardamonensis Geissler, Poyarkov, Grismer, Nguyen, An, Neang, Kupfer, Ziegler, Böhme and Müller	320–359	2.8–3.2	Cambodia	Geissler et al. (2014)
Ichthyophis catlocensis Geissler, Poyarkov, Grismer, Nguyen, An, Neang, Kupfer, Ziegler, Böhme, and Müller	340	4.5	Vietnam	Geissler et al. (2014)
Ichthyophis chaloensis Geissler, Poyarkov, Grismer, Nguyen, An, Neang, Kupfer, Ziegler, Böhme and Müller	342	2.2	Vietnam	Geissler et al. (2014)
Ichthyophis dulitensis Taylor	304–313	< 2.0	Malaysia	Taylor (1968)
Ichthyophis glandulosus Taylor	273	2.7	Philippines	Taylor (1968)
Ichthyophis javanicus Taylor	348–351	2.3	Indonesia	Taylor (1968)
Ichthyophis lakimi Nishikawa, Matsui and Yambun	349–374	1.9	Malaysia	Nishikawa et al. (2012)
Ichthyophis laosensis Taylor	346	2.7	Laos	Geissler et al. (2014)
Ichthyophis larutensis Taylor	298–310	1.8	Malaysia	Taylor (1968)
Ichthyophis mindanaoensis Taylor	288–348	2.1–2.4	Philippines	Taylor (1968)
Ichthyophis monochrous (Bleeker)	247	2.5	Malaysia	Taylor (1968)
Ichthyophis orthoplicatus Taylor	282–335	2.3–3.6	Sri Lanka	Nussbam and Gans (1980)
Ichthyophis sikkimensis Taylor	276–292	1.7	India, Nepal	Taylor (1968)
Ichthyophis singaporensis Taylor	267	2.3	Singapore	Taylor (1968)
Ichthyophis sumatranus Taylor	295–329	1.6	Indonesia	Taylor (1968)
Ichthyophis weberi Taylor	299–340	1.7–2.4	Philippines	Taylor (1968)
Ichthyophis youngorum Taylor	317–328	2.5	Thailand	Geissler et al. (2014)

Figure 4: *Ichthyophis sikkimensis* Taylor (Photo: Krushnamegh Kunte from India).

Figure 5: *Ichthyophis bombayensis* Taylor (Photo: Zeeshan Mirza from India).

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Conflict of interest

The authors declare that there are no conflicting issues related to this short communication.

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