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NOTES ON GEOGRAPHIC DISTRIBUTION

First confirmed country record of the globally threatened *Uperodon assamensis* (Das, Sengupta, Ahmed & Dutta, 2004), Assamese Balloon Frog (Amphibia, Anura, Microhylidae), from Bangladesh, with an updated global range map and taxonomic analysis

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Abstract. We report a new country record of *Uperodon assamensis* (Das, Sengupta, Ahmed & Dutta, 2004) from Bangladesh. The specimen was identified by its distinctive yellowish dorsal vertebral stripe, absence of tympanum and vomerine teeth, rounded choanae, oval tongue, and supratympanic fold. Among the type specimens, snout–vent length, head width, head depth, tibia length, and axillary-groin distance reveal substantial variability. In contrast, eye diameter, internarial distance, eye nostril distance, and eye-to-snout distance show less variability. We also mapped the current global distribution in India, Nepal, and Bangladesh.

Key words. Amphibia, geographical distribution, Microhylidae, morphology, narrow-mouthed frog

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INTRODUCTION

Uperodon assamensis (Das, Sengupta, Ahmed & Dutta, 2004), Assamese Balloon Frog, is a Vulnerable species belonging to the family Microhylidae (Amphibia, Anura) (IUCN SSC Amphibian Specialist Group 2023). It was thought to be a morphological variant of *Kaloula pulchra* (Gray, 1831) or *Uperodon taprobanica* (Parker, 1934) until 2004 (Frost 2024; Portik et al. 2023), when it was described as a new species based on a holotype from Assam state in Eastern India (Das et al. 2004). Previously, *U. assamensis* was reported from multiple localities in India (Deuti et al. 2012; Mandal et al. 2024; Nath et al. 2011; Paul et al. 2007; Sengupta et al. 2009; Talukdar et al. 2007) and was considered endemic to the country (Frost 2024); however, recent records from Nepal extend its range across the Indo-Himalayan plateau (Mandal et al. 2024; iNaturalist 2024). This plateau lies at the convergence of the Indian subcontinent and Southeast Asia and comprises northeastern India, Bangladesh, Bhutan, and Nepal. This subregion is considered a vital migration corridor for regional flora and fauna, including anuran species (Khan 2018). Thus, *U. assamensis* was expected to be present in Bangladesh (Reza 2014) and Bhutan, or to have the potential to cross the Indo-Bhutan border (Mandal et al. 2024). Incorporating the known occurrence points, a distributional map will clarify the range of this threatened species.

Globally, 24 species of narrow-mouth frogs are known in the genera *Kaloula* and *Uperodon* (Frost 2024; Portik et al. 2023). Among them, only three species, *Kaloula pulchra*, *Uperodon taprobanica*, and *Uperodon globulosus* (Günther, 1864) have been reported from Bangladesh (Hasan et al. 2014; IUCN Bangladesh 2015; Khan 2018). There are no scientific reports on the presence of *U. assamensis* from Bangladesh, and it has not been included in the country's existing checklist of the amphibian fauna (Hasan et al. 2014; IUCN Bangladesh 2015; Khan 2018).

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We report a specimen of *U. assamensis* from the Madaripur District of southern Bangladesh based on morphological and morphometric characteristics of the holotype. We also compile the known occurrences and map these to show the global distribution of this threatened frog species.

METHODS

Specimen collection from a new locality. A live specimen was spotted during a random night survey in July 2024 near the bank of the Kumar River in the playground of A.R. Howlader Jute Mills, Madaripur District, Bangladesh. The geographic coordinates were recorded with a GPS-enabled smartphone, and the natural habitat features were documented to capture the ecological context of the site. Even after careful observation of the locality, we were unable to find more than one specimen due to the dense vegetation cover at the site, and rarity and mimicry of the species. The collected specimen was carefully transported alive to the University of Chittagong for analysis. Upon arrival, we humanely euthanized the specimen and initially preserved it in 95% isopropanol for 5 h and stored it in 70% isopropanol by following standard procedure (Deichmann et al. 2009; Gamble 2014). The preserved specimen was subsequently deposited and stored in the Museum of Department of Zoology, University of Chittagong (specimen voucher no. BD/CU/Zool/Amp. 37).

Morphometric analysis of the studied specimens. Morphological and meristic features of the type specimens were obtained from Das et al. (2004) to compare with the studied specimen. For taxonomic analysis of the newly recorded specimen, a lamp with a simple microscope (5×) and a digital weighing balance (to the nearest 0.01 g) were used to obtain morphological data.

We measured the key morphometric features of the studied specimen according to the published literature by Das et al (2004). Those features include: snout–vent length (SVL): tip of the snout to the posterior tip of the urostyle; head length (HL): snout tip to the posterior edge of the jaw or to the base of the head where it meets the neck region; head depth (HD): vertical measurement of the head; tibia length (TBL): length of the tibia; Eye diameter (ED): horizontal width of the eye; upper eyelid width (UE): maximum horizontal width of the upper eyelid; interorbital distance (IO): distance between the eyes; internarial distance (IN): distance between the nostrils; eye-to-snout distance (E-S): straight-line distance from the anterior edge of the eye (usually the center of the eye or anterior canthus) to the tip of the snout; eye-to-nostril distance (E-N): linear distance from the anterior edge of the eye to the center of the nostril; and axilla-to-groin distance (A-G): distance from armpit to the groin.

Mapping the global distribution. A total of 16 occurrence records of *Uperodon assamensis* were used in this study (Table 1). Among them, 10 occurrence data were collected from different published literature sources (Das et al. 2004; Deuti et al. 2012; Mandal et al. 2024; Nath et al. 2011; Paul et al. 2007; Sengupta et al. 2009; Talukdar et al. 2007), and the remaining verifiable, research-grade data were retrieved from GBIF (GBIF Secretariat 2024) and iNaturalist (iNaturalist 2024). We mapped the known distribution of *U. assamensis* in R v. 4.3.2. The country and state boundary datasets were retrieved from 'rnaturalearth' and 'rnaturalearthhires' (Natural Earth 2023). We divided the species occurrence data into old (before 2020), recent (2020–2023), and

Table 1. Known occurrence records of *Uperodon assamensis*.

No.	Locality	Country	Geographic coordinates	Year	Sources
1	Majbat, Sonitpur, Assam	India	26°45′N, 092°20′E	1998	(Das et al. 2004)
2	Darrang, Assam	India	26°30′N, 092°15′E	1998	
3	Sonitpur, Assam	India	26°42′N, 092°12′E	2001	
4	Sonitpur, Assam	India	26°56′N, 092°52′E	2003	
5	Kameng, Arunachal Pradesh	India	26°55′N, 092°51′E	2004	
6	Bongaigaon, Assam	India	26°28′N, 090°31′E	2007	(Talukdar et al. 2007)
7	West Bengal	India	26°32′N, 089°25′E	2007	(Paul et al. 2007)
8	West Champaran, Bihar	India	27°28′N, 084°12′E	1996	(Deuti et al. 2012)
9	Bongaigaon, Assam	India	26°24′N, 090°31′E	2009	(Nath et al. 2011)
10	Jalpaiguri, West Bengal	India	26°31′N, 088°43′E	2012	(GBIF Secretariat 2024)
11	Jalpaiguri, West Bengal	India	26°32′N, 088°43′E	2015	(GBIF Secretariat 2024)
12	Jalpaiguri, West Bengal	India	26°31′N, 088°43′E	2017	(GBIF Secretariat 2024)
13	Sauraha, Ratnanagar	Nepal	27°35′N, 084°30′E	2020	(iNaturalist 2024)
14	Bachhauli, Ratnanagar	Nepal	27°34′N, 084°28′E	2022	(iNaturalist 2024)
15	Manas National Park, Assam	India	26°45′29″N, 091°12′42″E	2022	(Mandal et al. 2024)
16	Madaripur	Bangladesh	23°10′09″N, 090°11′39″E	2024	New record, herein

new (2024) records, and these data were compiled and standardized to the WGS84 coordinate system using the 'sf' package (Pebesma 2018).

RESULTS

***Uperodon assamensis* (Das, Sengupta, Ahmed & Dutta, 2004)**
Figure 1

New record. BANGLADESH — Madaripur • playground of A.R. Howlader Jute Mills; 23°10′9.05″N, 090° 11′38.69″E; 6 m elev.; 15.VII.2024; Najmul Hasan, Erich Köck & Christoph Andrijczuk leg.; dense, bushy vegetation near the bank of Kumar River; 1♀, BD/CU/Zool/Amp. 37.

This specimen of *U. assamensis* was collected from a field beside a jute mill in Madaripur of south-central Bangladesh. The habitat is characterized by dense, bushy vegetation situated nearer to a narrow river. There is a mass of better stones from broken buildings that are covered with dense vegetation. The specimen was observed approximately one foot above the ground within the dense vegetation.

Identification. Our studied specimen exhibits several key characteristics that align with the holotype of *Uperodon assamensis*. It is a medium-sized frog with a snout–vent length (SVL) of 50 mm; rounded body; notable features include a distinct yellowish dorsal vertebral stripe (Figure 1A); absent or non-visible tympanum; rounded, moderately large choanae; absence of vomerine teeth; mouth extending to the midorbital level and an oval tongue with rounded tips and papillae; a distinct supratympanic fold extends from the eyes' posterior corner to the supra-axillary region. The head is moderately small and broader than its length,

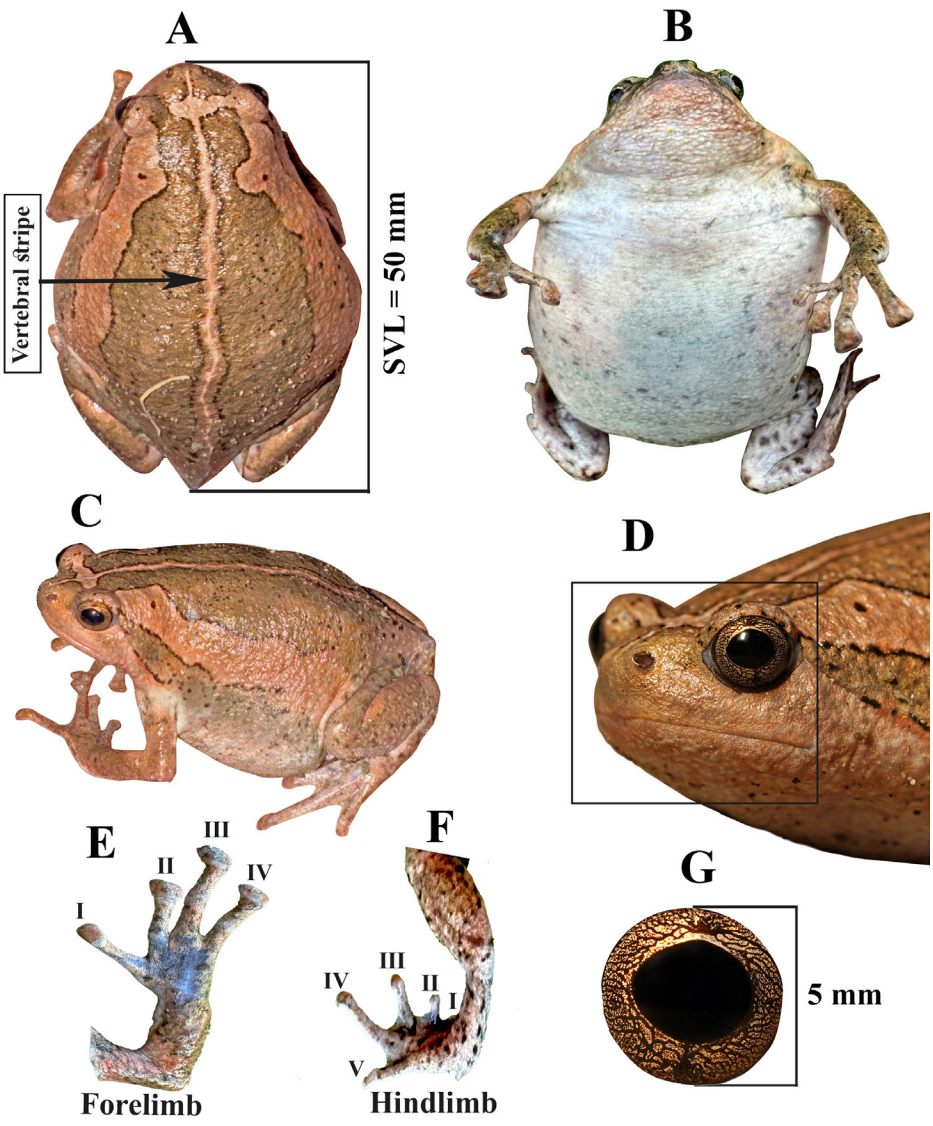

Figure 1. Morphological features of *Uperodon assamensis* from the new distributional locality in Madaripur, Bangladesh. **A.** Dorsal view. **B.** Ventral view. **C.** Lateral view. **D.** Head profile. **E.** Forelimb. **F.** Hind limb. **G.** Close-up view of the eye. (Photographs: Najmul Hasan & Christoph Andrijczuk.)

with a head length and head width ratio (HW/HL) of 1.4. Nostrils are dorsolaterally positioned, closer to the snout tip than the eye (E-N/E-S ratio of 0.60), and the postnarial ridges do not curve backwards towards the choanae. Internarial distance greater than the distance from the anterior margin of the eye to the nostril (IN/E-N ratio of 0.89). Large eyes (ED/HL ratio of 0.50) with an eye-to-nostril distance ratio (ED/E-N) of 1.79. A flat interorbital region with a width-to-upper eyelid width ratio (IO/UE) of 2.58 (for details, see Tables 2, 3).

Forelimb. The fingers lack webbing, the nuptial pad is absent, and the tips are swollen with a relative length order of III (9.3 mm) > II (7.2 mm) > IV (6.7 mm) > I (6.1 mm) (Figure 1E).

Hindlimb. The toes are about half-webbed, with webbing extending beyond the basal subarticular tubercle, following a relative length order of IV (12.3 mm) > III (7.9 mm) > V (6.7 mm) > II (5.1 mm) > I (4 mm) (Figure 1F). Notable features on the toes include prominent subarticular tubercles and distinct metatarsal tubercles, along with smooth tarsi and the absence of a lateral glandular flank ridge.

Body colouration. Dorsally dark brown with a dark-edged yellow vertebral stripe (Figure 1A), commencing from the snout tip and ending near the vent; a dark-bordered, broad, orange-brown stripe on either lateral side (Figure 1C), extending from the post ocular region to the inguinal region. A light pericloacal ring is present. The ventral side is silvery to grey, with scattered black spots (Figure 1B).

Eyes. Eyes are located in the dorsolateral position. A bright golden ring encircles the rounded black pupil. The ring is intertwined with a network of narrow, root-like structures. Eye diameter is 5 mm (Figure 1G).

Coloration in life (Figure 1A–G).

Morphometric diversity among the type specimens. Among the morphometric variables, snout–vent length (SVL) ranges from 37.9 to 50.0 mm in adult, head width (HW) from 9.0 to 14.7 mm, and head depth (HD) from 4.8 to 13.1 mm, tibia length (TBL) from 9.4 to 17 mm, axillary-groin distance (A-G) from 11.0 to 20.9 mm displaying the greatest variability (Table 2). Meanwhile, the eye diameter (ED) ranges from 2.7 to 5.0 mm upper eyelid width (UE) from 2.3 to 3.3 mm, internarial distance (IN) from 2.5 to 3.4 mm, eye nostril distance (E-N) 2 to 3.2 mm, Eye to snout distance (E-S) from 3.4 to 5.4 mm, show less variability (Table 2). This significant variability among the type specimens (n = 7) is shown on the boxplot of morphometric measurements (Figure 2).

Table 2. Morphometric measurement (in mm) of *Uperodon assamensis* specimens (n =7) from throughout its geographic range, including the newly reported specimen from Bangladesh. *Source of data: Das et al. (2004).

ID	Locality	SVL	HL	HW	HD	TBL	ED	UE	IO	IN	E-S	E-N	A-G
New specimen (BD/CU/Zool/Amp. 37) (adult ♀)	Bangladesh	50.0	10.0	14.0	10.5	17.0	5.0	3.1	8.0	2.5	4.7	2.4	20.9
ZSI A.10069 (holotype)* (adult ♀)	Assam, India	38.0	7.3	11.3	7.4	13.7	4.8	3.1	6.8	3.0	3.7	2.9	14.4
ZSI/ERS 37314* (adult ♂)	Assam, India	43.1	9.8	14.7	13.1	12.9	4.2	3.2	4.4	2.9	5.4	3.1	20.4
ZSI/ERS* (adult ♂)	Assam, India	37.9	8.7	12.1	12.2	10.9	3.6	2.5	5.5	2.7	3.9	3.1	15.5
ZSI A.9790* (juvenile ♀)	Assam, India	30.0	7.6	9.7	6.4	11.0	3.1	2.3	3.3	3.4	3.4	2.0	13.0
ZSI A.9791* (juvenile ♂)	Assam, India	29.4	7.0	9.0	4.8	9.4	2.7	2.4	3.0	2.6	3.4	2.0	11.0
ZSI/ERS 37315* (adult ♀)	Arunachal Pradesh, India	42.0	9.5	14.7	5.0	14.7	4.8	3.3	4.0	3.0	5.4	3.2	18.3

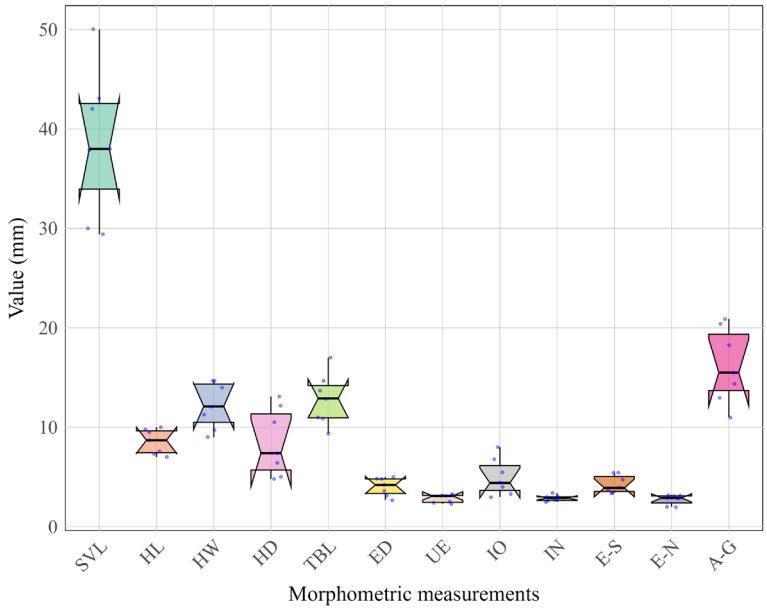

Figure 2. The morphometric data distribution of the type specimens of *U. assamensis* (n = 7) from distant localities, including Bangladesh, illustrates the variation in key morphometric measurements of this species from diverse geographic locations.

Table 3. Ratio of morphometric measurements in *Uperodon assamensis* ($n = 7$). Abbreviations: see Methods. *Source of data: Das et al. (2004).

Ratio	Locality	HW/HL	E-N/E-S	IN/E-N	ED/HL	ED/E-N	IO/UE
New specimen (BD/CU/Zool/Amp. 37) (adult ♀)	Bangladesh	1.40	0.60	0.89	0.50	1.79	2.58
ZSI A.10069 (holotype)* (adult ♀)	Assam, India	1.55	0.78	1.03	0.66	1.66	2.19
ZSI/ERS 37314* (adult ♂)	Assam, India	1.50	0.57	0.94	0.43	1.35	1.38
ZSI/ERS * (adult ♂)	Assam, India	1.39	0.79	0.87	0.41	1.16	2.20
ZSI A.9790 * (juvenile ♀)	Assam, India	1.28	0.59	1.70	0.41	1.55	1.43
ZSI A.9791* (juvenile ♂)	Assam, India	1.29	0.59	1.30	0.39	1.35	1.25
ZSI/ERS 37315* (adult ♀)	India	1.55	0.59	0.94	0.51	1.50	1.21

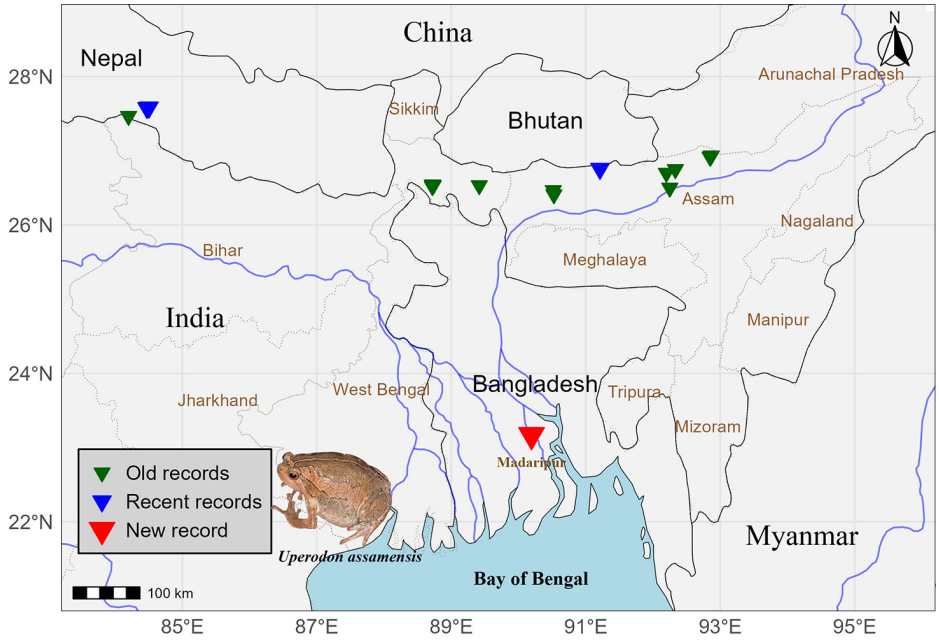

Figure 3. Globally known distribution of *Uperodon assamensis* in India, Bangladesh, and Nepal, highlighting its old (before 2020), recent (2020–2023), and new (2024) occurrence records. Its historic distribution was in Assam, West Bengal, Arunachal Pradesh, and Bihar states of India. We report a new distributional record from Madaripur, Bangladesh.

Geographic distribution. The updated distribution of *U. assamensis* ranges from Nepal in the west to Arunachal Pradesh of India in the east, the northern part of West Bengal in the north to Bangladesh in the south (Figure 3).

The specimen reported in this study was from a new locality of Madaripur District in the southern part of Bangladesh. This location is approximately 400 km from the closest record locality, Jalpaiguri District, India, and marks the southernmost distributional range of this species.

DISCUSSION

We report a new country record of *Uperodon assamensis* in southern Bangladesh, extending the species' known range by about 400 km to the south of its previously known distribution, and provide the first morphometric-based description of the species from this country. The discovery of this species in the Madaripur District, Bangladesh, confirms its presence in three South Asian countries—India, Bangladesh, and Nepal. Bhutan and Myanmar have no confirmed records of this species.

Before 2020, *U. assamensis* was only known in four states of India: Assam, West Bengal, Arunachal Pradesh, and Bihar. Later, this species was also recorded from other localities in these states. Until 2020, *U. assamensis* was thought to be endemic to India (Frost 2024). Recent studies have discovered occurrences in additional localities and have extended the species' geographic distribution (Mandal et al. 2024). The discovery of new geographic records and range extensions of *U. assamensis* in Bangladesh is not surprising (Reza 2014), as the country is surrounded by several states of India, as well as northern Myanmar, and shares common wildlife diversity with its neighboring countries (Ahmed et al. 2009; Grewal et al. 2002; Khan 2018; Whitakar and Captain 2004). In recent years, many species have been recorded from Bangladesh; these belong to the herpetofauna of neighboring South Asian countries (Chowdhury et al. 2021; Haidar et al. 2025; Romon et al. 2021). This underscores the need for extensive field surveys to uncover the unknown biodiversity in Bangladesh. The lack of clarity on the geographic distributions of amphibians of Bangladesh and neighboring countries

is likely due to paucity of field surveys in a region that is mostly unexplored (Hasan et al. 2014; Khan 2018).

Our specimen and type specimens ($n = 7$) show diverse body sizes and considerable differences in head dimensions due to the different ages and sexes. Nevertheless, for some morphometric variables—for example eye diameter, upper eyelid width, internarial distance, eye nostril distance, and eye to snout distance—values show less variability in all ages and sexes of this species.

Until 2004, *U. assamensis* used to be considered a variant of *Kaloula pulchra* and a close relative and sister taxon of *Uperodon taprobanica* (Frost 2024; Portik et al. 2023) due to their greatly similar body patterns and colorations. *Uperodon assamensis* was described as a new species, based on the holotype specimen with a distinctive yellowish vertebral stripe from Assam, India (Das et al. 2004). The morphological features, and particularly the yellowish vertebral stripe, support our identification of our specimen as *U. assamensis*.

The global distribution of *U. assamensis* is restricted in the Indo-Himalayan plateau; hence, there is concern among herpetologists about the need for proper conservation measures (Frost 2024). The species has been considered globally threatened due to its fragmented distribution within a limited geographic range and declines in habitat quality (IUCN SSC Amphibian Specialist Group 2023). Most of the records of this species are in and around riverside areas, suggesting a potential niche of this species around lotic water bodies, and water can be a good dispersal pathway for this species (Hasan et al. 2025). River pollution is a major problem in the Indian subcontinent, specifically in Bangladesh (Uddin and Jeong 2021), and vegetation in riverbank areas has also declined in the last few decades (Hasan et al. 2019). We should consider these possible threats to survival of *U. assamensis*. Effective conservation strategies will be needed for conservation of this species.

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ADDITIONAL INFORMATION

Conflict of interest

The authors declare that no competing interests exist.

Ethical statement

No ethical statement is reported.

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Author contributions

Conceptualization: NH, IKAH, MAWC. Data curation: NH, HU, MRI, MAU, MHU, KR, EK, CA. Formal analysis: NH, HU. Investigation: NH, HU, MRI, MAU, MHU, KR. Methodology: NH, MAWC, IKAH. Resources: NH, HU. Supervision: MAWC, IKAH. Visualization: NH. Project administration: MAWC, IKAH. Software: NH. Validation: MAWC, IKAH. Writing – original draft: NH. Writing – review and editing: HU, EK, CA, MAWC, IKAH.

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Data availability

All data that support the findings of this study are available in the main text.

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