

ARTICLE

WHAT DOES A DISCOVERY TELL US? CAMERA-TRAPPING INSIGHT INTO THE ASIAN SMALL- CLAWED OTTER IN NORTH-EASTERN BANGLADESH

Muntasir AKASH^{1*}, Sultan AHMED², Joyanto BISWAS¹, Mohammad Samiul ALAM¹, Tania ZAKIR³, S M SHAFI¹, Azizul Islam BARKAT¹, Md Tazul ISLAM⁴, Haris DEBBARMA⁵, Khurshed ALOM⁶, Chonchol GUALA⁷

¹Department of Zoology, Faculty of Biological Sciences, University of Dhaka, Dhaka 1000, Bangladesh

²Nature Conservation Management, Gulshan 1, Dhaka 1212, Bangladesh

³International Union for Conservation of Nature, Bangladesh Country Office, Mohakhali DOHS, Dhaka 1206, Bangladesh

⁴Kalenga village, Rema-Kalenga Wildlife Sanctuary, Habiganj 3320, Bangladesh

⁵Satchari village, Satchari National Park, Chunarughat, Habiganj, Sylhet, 3320, Bangladesh

⁶Department of Zoology, Madanmohan College, Sylhet 3100, Bangladesh

⁷Creative Conservation Alliance, Rajendrapur Turtle Conservation Centre, Gazipur 1741, Bangladesh

*Corresponding Author: akashmuntasir10@gmail.com

(Received 10th January 2022, accepted 27th April 2022)

Abstract: For three of the four Oriental otters that live in Bangladesh, as of early 2022, four pertinent peer-reviewed studies were conducted in the country. The distribution of the country's otters, because of the dearth of empirical evidence, is made of guesswork and yet to be scientifically understood. Subsequently, eastern forests although a part of the globally recognized range of the small-clawed otter (*Aonyx cinereus*) are not accredited in Bangladesh for the species and are not receiving any conservation investment. This study, for the first time, provided evidence of the relict populations of small-clawed otters in eastern Bangladesh. A survey on terrestrial carnivore mammals was carried out between January and October 2021 in four north-eastern forest reserves that found the species in three reserves, with 132 notionally independent events from a sampling effort of 3629 camera-trap nights. The activity rhythm of nocturnal–crepuscular otters leaned more towards dawn. The work highlights (i) the potential of the small-clawed otter as an umbrella species for the traditionally ignored, trans-border riparian mixed-evergreen forests of north-eastern Bangladesh; (ii) a great inconsistency between sources concerning its distribution in the country; (iii) the necessities to investigate the lack of this survey's records of smooth-coated otter (*Lutrogale perspicillata*) and Eurasian otter (*Lutra lutra*, no evidence in Bangladesh for 30 years) although the surveyed forest reserves are widely noted for both species; and (iv) the stark absence of any recent information on otter status in the adjacent Indian states (Meghalaya, Tripura, Mizoram, and southern Assam) that, together with eastern Bangladesh, belong to an ecologically uncharted territory and form the western limit of the Indo-Burma Biodiversity Hotspot.

Citation: Akash, M., Ahmed, S., Biswas, J., Alam, M.S., Zakir, T., S M Shafi, Barkat, A.I., Islam, M.T., Debbarma, H., Alom, K., and Guala, C. (2022). What does a Discovery tell Us? Camera-Trapping Insight into the Asian Small-Clawed Otter in North-Eastern Bangladesh. *IUCN Otter Spec. Group Bull.* 39 (3): 158 - 170

Keywords: *Aonyx cinereus*, circadian rhythm, Lathitila forest, Lawachara national park, Rema-Kalenga wildlife sanctuary, riparian reserves

INTRODUCTION

Bangladesh, one of the smallest Asian countries, is reportedly home to nearly half of the Indian Subcontinent's species of the mammalian order Carnivora, i.e., 27 species,

including three of the four Oriental otter species (Menon, 2014; Khan, 2015a, 2018). Not adhering to the remarkable assemblage, carnivore conservation efforts are strongly skewed in the country, tilted toward the tiger (*Panthera tigris*) (Akash and Zakir, 2020). Studies on almost every other carnivore that followed a systematic framework are non-existent (Akash and Zakir, 2020). Otters are no different. To date, only four peer-reviewed works are available specifically on the otters of Bangladesh (Feeroz et al., 2011 a,b; Aziz, 2018; Shashoto and Yoxon, 2020).

The absence of studies has long been considered a hurdle to the conservation mainstreaming of Asian otters (Foster-Turley and Santiapillai, 1990; Basnet et al., 2020). The challenge becomes glaring while considering the Asian small-clawed otter (*Aonyx cinereus*). The appraisal by Basnet et al., (2020) showed that, out of 244 research works on Asian otters, only 16 exclusively studied the species. Also, simply known as the small-clawed otter or short-clawed otter, it is the smallest of 13 known otter species and is present in multiple range countries in South and Southeast Asia (Fig. 1A). According to The International Union for Conservation of Nature (IUCN) Red List of Threatened Species (Wright et al., 2021), this species is globally Vulnerable, facing threats such as poaching for pelt, and extraction for the pet trade. The IUCN Bangladesh Red List of Threatened Species (Begum, 2015) evaluated the small-clawed otter as endangered.

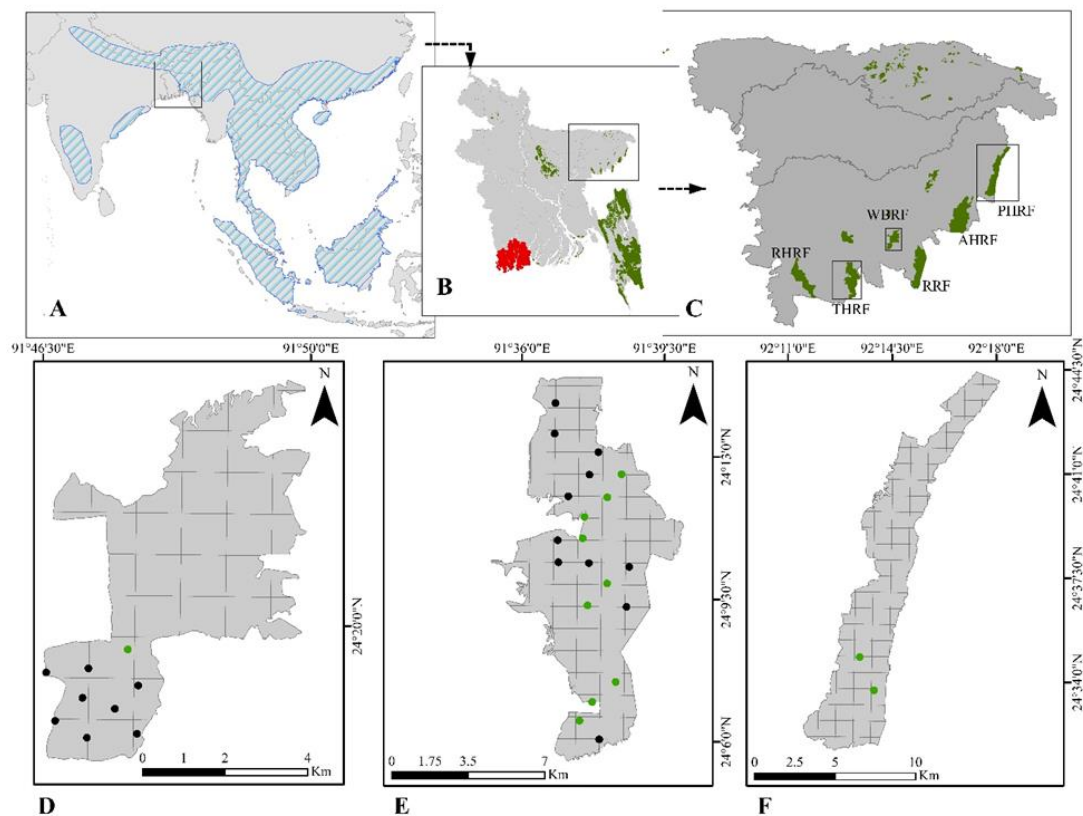


Figure 1. Proposed global range (blue cross-hatched area) of the Asian small-clawed otter (*Aonyx cinereus*) (after Wright et al. 2021) (A); Forest cover (green patches) of Bangladesh with the species' known extent of occurrence [red patch; adapted from Begum (2015)] (B); North-eastern Bangladesh and its six trans-border, riparian, mixed-evergreen forest reserves (C); Raghunandan Hill Reserve Forest (D); Tarap Hill Reserve Forest (E); Patharia Hill Reserve Forest (F). Each square grid is 1000×1000 m. Green dots denote the areas where evidence (camera-trap image or track) was obtained. Black dots denote the remaining trap stations. RHRF, Raghunandan Hill Reserve Forest; THRF, Tarap Hill Reserve Forest; WBRF, West Bhanugach Reserve Forest; RRF, Rajkandi Reserve Forest; AHRF, Atora Hill Reserve Forest; PHRF, Patharia Hill Reserve Forest.

Accounts of the distribution of this species in Bangladesh reflect the paucity of accurate and precise information. There are great inconsistencies between sources concerning the perceived distribution of the species in the country (Table 1). Local assessments and works recognised only the Sundarbans as a species range in the country but not the forests of eastern Bangladesh. In contrast, global assessment and most of the recent studies did the opposite.

Table 1. A brief review of major forests of Bangladesh that are regarded as the Asian small-clawed otter (*Aonyx cinereus*) habitat in different literature. Tick-mark (✓) refers to that the region is stated as the species range while cross-mark (×) indicates that the region is not presented as the species range in the concerned study.

	North-eastern Bangladesh	South-eastern Bangladesh	Sundarbans
Global assessment and books			
Hussain et al. (2011)	✓	✓	✓
Menon (2014)	✓	✓	✓
Duplaix and Savage (2018)	✓	✓	×
Hunter and Barrett (2018)	✓	✓	×
Wright et al. (2021)	✓	✓	×
Assessments and studies carried out in Bangladesh			
Begum (2015)	×	×	✓
Khan (2015a)	×	✓	✓
Aziz (2018)	×	×	✓
Khan (2018)	×	✓	✓

Wright et al., (2021) considered the riparian, mixed-evergreen, rugged forests of eastern Bangladesh as within the extant range of this species (Fig. 1A,B), as did Akash and Zakir (2020) (Fig. 1C). These forests belong to ecologically uncharted territory and form the western limit of the Indo-Burma Biodiversity Hotspot (Myers et al., 2000).

On the other hand, only the Sundarbans, the largest continuous mangrove network in the world straddling the south-western border of Bangladesh and the state of West Bengal, India, was shown as the range of the species in the national Red List assessment (Begum, 2015; Fig. 1B). All the existing inventories on mammals in Bangladesh followed a similar approach, e.g., Khan (2015a) and Khan (2018). The recently published sole research on small-clawed otters in Bangladesh also made a similar remark. Aziz (2018) studied the population size and feeding behaviour of the species in the Sundarbans and regarded the mangrove as its only extant range in Bangladesh. However, in Hunter and Barrett (2018), Duplaix and Savage (2018), Wright et al., (2021), there is no mention of the Sundarbans as a small-clawed otter habitat (Fig. 1A).

Only Hussain et al., (2011) and Menon (2014) considered both the Sundarbans and the forests of eastern Bangladesh as habitats of the Asian small-clawed otter.

Although eastern forests are widely ruled out for small-clawed otter, they have been regarded to hold the country's other two (and similarly little-studied) otter species: the smooth-coated otter (*Lutrogale perspicillata*) and Eurasian otter (*Lutra lutra*) [IUCN Bangladesh Red List of Threatened Species: Khan (2015b), Feeroz (2015)]. The basis for this perspective has not been detailed anywhere. Here, we provide camera-trapped evidence of the small-clawed otter in eastern Bangladesh and discuss its activity rhythm there. These findings are the outcome of an ongoing camera-trapping programme to understand terrestrial mammalian carnivore assemblage in the region.

We also discuss the potential of small-clawed otters to be an umbrella species for the mixed-evergreen, stream-fed, trans-border forests of north-eastern (NE) Bangladesh.

METHODOLOGY

Study area

The trans-border forests of NE Bangladesh are the northernmost fringes of the anticlinal Baramura-Atharamura-Longtharai-Jampui Hills situated in the states of Tripura and Assam, India (Saigal, 2005). These hill ranges, then, re-enter Bangladesh, gain elevation, and form the Chattogram (previously spelt as Chittagong) Hill Tracts (CHT), south-eastern Bangladesh. Southward, CHT forests are continuous with the Rakhine Yoma mountain range, Myanmar; on the east, these are also trans-border, continuous with the Dampa Tiger Reserve, the state of Mizoram, India (Akash et al., 2021).

In total, eastern Bangladesh possesses around 5000 km² of forested landscape, of which about 500 km² are located in the NE region. These landscapes are largely defined as reserve forests, which are oriented towards the sustainable use of forestry resources (Chakma, 2016). North-eastern Bangladesh has six reserves that are low in elevation [highest above sea level (a.s.l.) altitude 335 m], composed of mosaics of plantation forests and secondary natural mixed-evergreen growths, crisscrossed by seasonal and perennial streams, and surrounded by tea gardens (Zakir et al., 2020). The SE reserves are heavily rugged (highest a.s.l. altitude 1055 m), fed by stream systems, and still retain some old-growth dipterocarp-dominated patches (Chakma, 2016; Akash et al., 2021).

Three of the six NE reserves were selected for camera-trapping survey comprising about 114 km² of protected forests viz., Raghunandan Hill Reserve Forest (RHRF; 26.3 km²; Fig. 1C), West Bhanugach Reserve Forest (WBRF; 26 km²; Fig. 1D), and Tarap Hill Reserve Forest (THRF, 62 km², Fig. 1E). These are mostly flat, with an average a.s.l. altitude of 50–150 m. The scarcity of water is a prominent feature of RHRF; all streams there have turned into dried-out sand-beds with small pools available only throughout the monsoon. WBRF has streams but most of them are not perennial. Only THRF holds the ideal riparian characteristics. At least five major stream networks are spread throughout the forests with numerous interconnecting branches. The other three NE reserves are Rajkandi Reserve Forest (RRF; 60 km²; Fig. 1C), Aтора Hill Reserve Forest (AHRF, 100 km²; Fig. 1C), and Patharia Hill Reserve Forest (PHRF, 60 km²; Fig. 1C, F). The riparian characteristics of RRF, AHRF, and PHRF are similar to that of THRF. However, compared with the other three NE reserves, RRF, AHRF and PHRF are more hilly (average a.s.l. altitude is 90–220 m) and streams are strewn with boulders forming small but steep cascading slopes (Talukdar and Choudhury, 2017; Haque et al., 2018).

To protect wildlife, around 5.2 % of these reserves have been notified as IUCN-designated protected areas (one IUCN category II national park each in RHRF and WBRF; one IUCN category IV wildlife sanctuary in THRF) (Khan, 2018).

Camera-trapping and sign survey

A 1×1 km grid system was followed in each of the three reserves. A total of 43 trap stations were deployed (22 in THRF, 12 in RHRF, and 9 in WBRF). We aimed to assess the diversity of ground-level carnivore mammals in the study area. Camera-traps were kept operational 24 hours a day, with a single camera-trap (used models: *Bushnell Trophy Cam*, *Bushnell Core Low Glow*, and *Browning Dark Ops*) at each station. We put one station in each of the selected grid cells. Cells were chosen randomly and sprawled across forest peripheries to cores, but precise positions of trap stations were

optimized based on the findings of mammalian signs from reconnaissance visits. Camera-traps were installed on forest streams, and trails; on average, these were 25–100cm above the ground. In case of an elevated position, the angle of view of the camera-trap was always tilted down to the ground for about 20 to 40 degrees relevant to its vertical axis. No attractant, lure or bait was used. The average camera-trapping night across the stations was 84.

Between August 2021 and September 2021, two reconnaissance trail- and stream-mapping attempts were made at PHRF (Fig. 1C, F). We looked for animal signs e.g., tracks, scats, feeding stations, kills, etc. In total, we trekked 18 km of forest trails and 8.5 km of streams.

Data analysis

Camera-trapping data were organized following Niedballa et al., (2016). A capture event was considered notionally independent if at least 30 minutes had elapsed after the previous photograph of the same species at the same station (O'Brien et al., 2003). The identification of the animal was made visually based on size and distinctive coat pattern following Menon (2014), and Hunter and Barrett (2018). In addition, the camera-trap images and tracks were shared with the members of the IUCN Otter Specialist Group as well as the Facebook-based group *Otters of Himalayas*. We did not make any attempt to identify individuals or bevvies i.e., separate groups.

Data obtained from THRF were incorporated into activity pattern analysis; here, 11 out of 22 trap stations were considered, as they had been installed on streams. Average camera-trap days at these 11 stations were 90. Thus, for analyzing diel activity, we considered data from a trapping effort of 1000 camera-trap days. The diel cycle was classified into four periods: night, dawn, day, and dusk. Considering regional sunrise and sunset time, the dawn and dusk time bands were set as 1.0–1.5 hours at sunrise and 1.5–1.5 hours at sunset respectively (Gerber et al., 2012; Noor et al., 2017; Zakir et al., 2020).

We observed diel activity patterns of the small-clawed otter in kernel density analysis (Sollmann et al., 2013). Electivity indices were calculated to understand the relative preference for different periods of a diel cycle. Following Lechowicz (1982) and Garrote et al., (2020), we considered four different indices viz., Ivlev's electivity index, E; Jacob's modified electivity index, D; Strauss' electivity index, and Vanderploeg and Scavia's relativized electivity index, E*. We tested the indices on the bootstrapped samples. We resampled the notionally independent events 1000 times using the original sample.

All analyses were carried out in R statistical software version 4.1.0 using packages *camtrapR* (Niedballa et al., 2016), *astroFns* (Harris, 2012), and *electivity* (Quintans, 2019). Distribution maps were prepared using ArcMap 10.5 using the geodatum WGS 1984.

RESULTS

The small-clawed otter was found at two of three camera-trapped reserves (Fig. 2). At WBRF (885 camera-trap nights, of which 800 were in streambeds), three individuals appeared at 01h01 on 21 June 2021 (Figs. 1D, 2A).

In THRF (1472 camera-trap nights, of which 1000 were in streambeds), nine camera-trap stations provided 131 notionally independent events (total 930 images and 54 5-second-long video clips) (Fig. 1E). Each event had an average of 3–6 otter individuals. Pups were identified (Fig. 2). A total of 20 other mammals, 15 birds, and three reptile species also visited the otter-positive stations, including several other

carnivore mammals: The leopard cat (*Prionailurus bengalensis*), common palm civet (*Paradoxurus hermaphroditus*), masked palm civet (*Paguma larvata*), large Indian civet (*Viverra zibetha*), yellow-throated marten (*Martes flavigula*), and crab-eating mongoose (*Urva urva*); all frequently visited the otter-positive stations. In WBRF, we found the Asiatic golden cat (*Catopuma temminckii*) at the same station that the otters had visited. We found no evidence of otters in RHRF (active camera-trap night 1272, of which 1100 were in streambeds). We observed multiple otter footprints and a feeding station in PHRF from two locations (Figs. 3B, C).

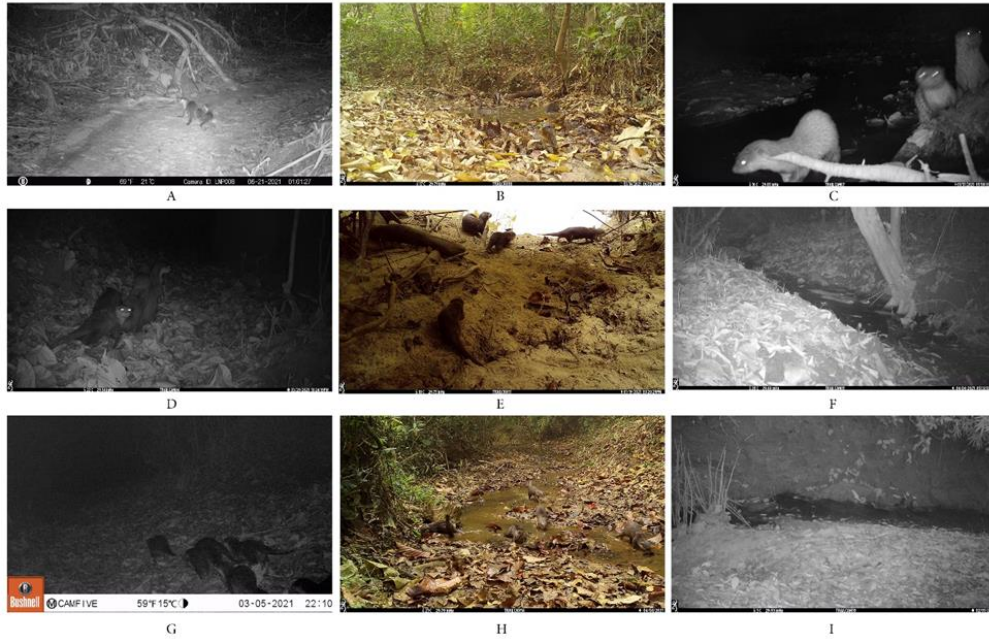


Figure 2. Camera-trapped photographs of the Asian small-clawed otter (*Aonyx cinereus*) in West Bhanugach Reserve Forest (A) and Tarap Hill Reserve Forest (B–I) of north-eastern Bangladesh.



Figure 3. Tracks and feeding stations at Tarap Hill Reserve Forest (A) and Patharia Hill Reserve Forest (B–C), and the stream where the feeding station was observed (D). Photograph by Azizul Islam Barkat and Muntasir Akash/Northeast Bangladesh Carnivore Conservation Initiative.

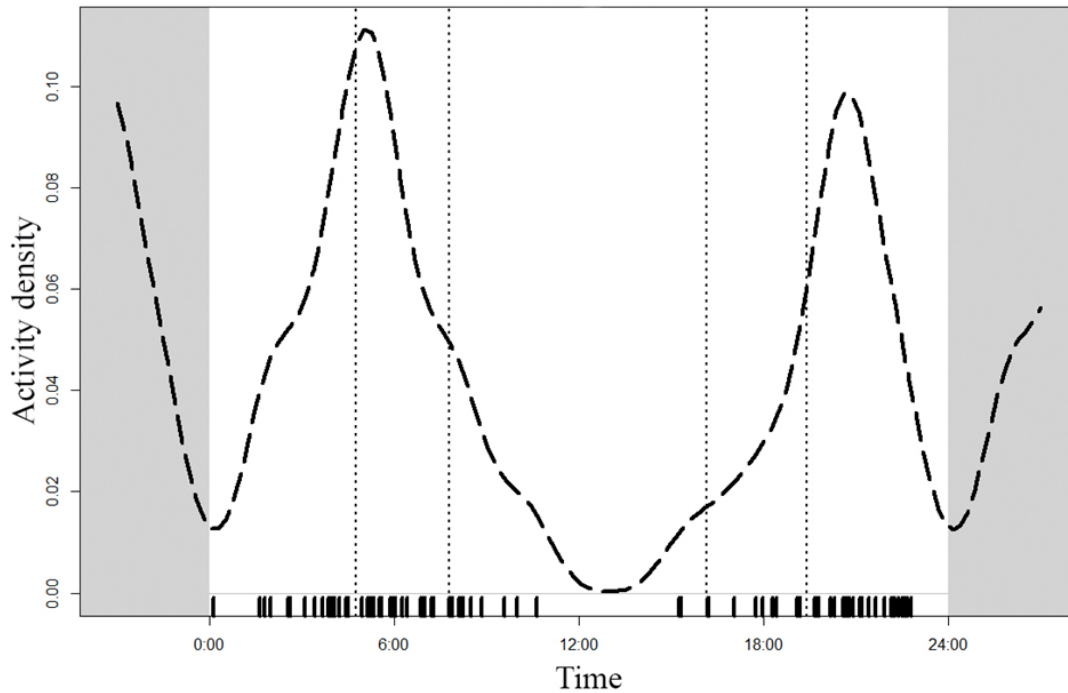


Figure 4. Activity pattern of the Asian small-clawed otter (*Aonyx cinereus*) observed in 2020–2021 survey in Tarap Hill Reserve Forest. The vertical dashed (---) lines indicate the time band separating ranges of three activity periods: twilight, day, and night. Independent detection events for each species are indicated by the short vertical lines appended below the x-axis.

Otters of THRF were primarily active during dawn (04h45–07h48) and night (19h25–04h45) (Fig. 4). However, dawn-time activity reached its highest peak (Fig. 4). During the night, activity peaked around 2000 hours following a short peak around nautical dusk (1900 hours). Although we found 12 day-time events, the indices (obtained separately from original and bootstrapped samples) showed that otters of THRF had an avoiding tendency toward dusk and day periods of the diel cycle (Table 2).

Table 2. Electivity indices of the Asian small-clawed otter (*Aonyx cinereus*) in north-eastern Bangladesh (based on the survey result in Tarap Hill Reserve Forest).

Period	Electivity Indices			
	Ivlev's (E)	Strauss' (L)	Vanderploeg and Scavia's (E*)	Jacbo's modified (D)
based on original sample (n = 131)				
dawn	0.3293	0.1248	0.2882	0.3963
day	-0.5055	-0.234	-0.5386	-0.6108
dusk	-0.1929	-0.0438	-0.2364	-0.2167
night	0.1645	0.1531	0.1199	0.3006
based on bootstrapped sample				
dawn	0.3434	0.1329	0.2952	0.4141
day	-0.5860	-0.2576	-0.6201	-0.6848
dusk	-0.1554	-0.0364	-0.2071	-0.1754
night	0.1716	0.1611	0.1191	0.3152

DISCUSSION

What does the discovery tell us?

Comparing the topography and habitat of the NE reserves, and the identified habitat requirement of the small-clawed otters (Hussain et al., 2011), it seems extremely likely that all of the six reserves (three camera-trapped and three not camera-trapped) hold otter populations. These reserves are surrounded by tea gardens or paddy-field mosaics and have 2–5m wide meandering streams with moderate to dense bank vegetation (Haque et al., 2018). Except for RHRF and WBRF, streams of THRF, RRF, PHRF, and AHRF become torrential in monsoons. Large or small, these streams are also rich in riparian fish and invertebrates (Fig. 5). According to Hussain et al., (2011), small-clawed otters are known to exist in these habitats and feed on similar prey species.



Figure 5. Streambeds observed in the surveyed forest reserves: Tarap Hill Reserve Forest (A), West Bhanugach Reserve Forest (B); Raghunandan Hill Reserve Forest (C); and Patharia Hill Reserve Forest (D). Photograph by Muntasir Akash/Northeast Bangladesh Carnivore Conservation Initiative.

The absence of otter records from RHRF may not indicate that it does not hold the species. Based on the presence of tea gardens on the periphery of RHRF, its trans-border connectivity and the finding from WBRF, we suggest not to discard RHRF as an otter range. Although otters might cease to exist inside RHRF (as its streams are largely dried up; Fig. 5C), they can survive in the peripheral and the bordering areas. The conjecture subjects for further research, however, is strengthened by the findings from WBRF. It is the most disconnected (from the Tripura Hills) of the six NE reserves (Fig. 1C), and its streams are not perennial anymore but hold large natural water reservoirs within the forest boundary (Hakim et al., 2020) which might be supporting a few surviving families, and the plausible reason behind the obtained event.

The species is considered the least aquatic otter (Hussain et al., 2011). Our observation corroborated this trait. In THRF, we found otters on camera-traps (in January–February) placed near pools that were about 1 m in depth formed at the otherwise dried-up streambeds (Fig. 1B). However, otter records from camera-trap

stations became significantly reduced in the dry season (April-May) and subsequently resumed with the commencement of the monsoon (June-July).

The existence of the small-clawed otter highlights the NE forests' conservation significance. Regardless of their connectivity with the forests of Tripura Hills, Bangladesh's NE reserves are viewed largely as 'empty forests' in literature (Akash and Zakir, 2020; Akash et al., 2021). Nonetheless, recent camera-trapping indicated a higher value (e.g., Zakir et al., 2020 found 17 terrestrial mammals including 10 carnivores). These riparian reserves still receive insufficient conservation attention and investments (Pianzin et al., 2021). Given the home-range size, threatened status, and global appeal for otters, promoting research and conservation of this species can create an umbrella effect for these reserves.

In a regional context, the adjacent Indian states, i.e., Tripura, Meghalaya, Mizoram, and the southern part of Assam, are assessed as otter habitats (Duplaix and Savage, 2018), but concerted studies are lacking. Peer-reviewed carnivore studies are absent in Tripura. There seems to be no published literature on otters in Meghalaya and Mizoram. Although Talukdar and Choudhury (2017) mentioned the presence of the small-clawed otter in the forests of southern Assam (bordering PHRF; Fig. 1C), we found no ecological study conducted on the otters of this region. Thus, this work stands as a head start necessitating otter research in the north-eastern Indian subcontinent.

Activity rhythm

The nocturnal-crepuscular behaviour of the small-clawed otter in THRF corroborated the description provided by Hussain et al., (2011) and Duplaix and Savage (2018) but little primary information seems to be available from anywhere in its range. However, we looked for similar work that dealt with the diel rhythm of the species with camera-trapping techniques but did not find any. Thus, the species' preference over dawn to dusk that we obtained from this study adds new information to its ecology.

Bimodal activity peak (during dawn and night) is known in African *Aonyx* species although the number of pertinent published literature on *Aonyx* genus is few. Njoroge et al., (2014) studied the African clawless otter (*Aonyx capensis*) in Kenya although did not differentiate between the dawn and the dusk band. We looked into similar studies made on other otters. A similar activity rhythm was found for the neotropical river otter (*Lontra longicaudis*) in the Orinoco River, Colombia (Garrote et al., 2020). The pattern we found, however, differs from that of the smooth-coated otter (the same would potentially be found for other tropical otter species if there were more studies): Palei et al., (2020) and Wai et al., (2020) found smooth-coated otters to be diurnally active. Hussain (2013), in the National Chambal Sanctuary, India, observed the overall nocturnality of smooth-coated otters with substantial daytime activity during winter.

Otter research in Bangladesh

To our knowledge, Bangladesh is among the tropical Asian countries that barely have any scientific data on its otters. The paucity of empirical evidence on the otters of Bangladesh is highlighted in multiple works in regular intervals, for example, Conroy et al., (1998), de Silva (2011), Yoxon and Yoxon (2019), Duplaix and Savage (2018), and Basnet et al., (2020).

Bangladesh is considered a range country for the Eurasian otter (Roos et al., 2015; Khan, 2018) but a valid and documented record is lacking since 1995, if not since the post-independence period (Yoxon and Yoxon 2019; Basnet et al., 2020). Three of the four existing studies on the otters of Bangladesh featured the smooth-coated otter. Feeroz et al., (2011a,b) studied its breeding activities and the traditional fishing

practices in the wetlands of west-central Bangladesh. Recently, Shashoto and Yoxon (2020) documented smooth-coated otters from riverine grassland-sandbar mosaics of the Ganges, a previously undescribed locality and provided insight into the size of the population residing there. In comparison with the known ecology of the smooth-coated and Eurasian otters (Roos, et al., 2015; Khoo, et al., 2021), although Khan (2015b) and Feeroz (2015) considered the possibility, plausibility might be slim for NE reserves to harbour these two species.

CONCLUSION

Our study not only proves the existence of otters in NE Bangladesh but also points out the exact species residing in these forests. The study poses several critical research questions. For example, understanding the population size of otters residing in the six NE reserves, and the driving ecological and anthropogenic factors that help or hamper these populations are of immense significance. Although we observed that the local people of THRF are generally reluctant toward otters, we noticed the usage of irrigation engines in fishing (to pump out water from certain blocks of stream) and heard of instances of poison fishing. The secretive and less-demanding small-clawed otters might not be in conflict with the local people but a silent victim of these practices; threat measures that need to be assessed.

Lastly, the absence of two larger otter species from our camera-trapping effort also demands urgent attention. We suggest systematic studies involving camera-trapping and other contemporary techniques to overcome the information deficiency and initiate conservation mainstreaming of these long-neglected small carnivores in Bangladesh.

ACKNOWLEDGMENTS - The authors would like to thank the Bangladesh Forest Department for their support and permission to conduct this study. We owe our thanks to the Conservation Leadership Programme for funding the research. Thanks also to F-T-Z Khaleque Mila, Tahsina Saniat, Rakibul Islam Robin, Siam Emon, Sohel Shyam, and Khukon Thounajam for assisting with the surveys, and to Aadrean, Nicole Duplaix, Melissa Savage, Will Duckworth, and the Facebook group *Otters of Himalayas* for helping with the identification.

REFERENCES

- Akash, M., Trageser, T., Zakir, T., Rahman, S.C., Mila, F.T.Z.K., Ghose, A. (2021).** Detecting the spots: a review on leopard occurrences in Bangladesh. *Cat News* **73**:21-27.
- Akash, M., Zakir, T. (2020).** Appraising carnivore (Mammalia: Carnivora) studies in Bangladesh from 1971 to 2019 bibliographic retrieves: trends, biases, and opportunities. *J. Threat. Taxa* **12**(15):17105–17120. <https://doi.org/10.11609/jott.6486.12.15.17105-17120>
- Aziz, M.A. (2018).** Notes on population status and feeding behaviour of Asian small-clawed Otter (*Aonyx cinereus*) in the Sundarbans Mangrove Forest of Bangladesh. *IUCN Otter Spec. Group Bull.* **35**(1): 3-10. https://www.iucnosgbull.org/Volume35/Aziz_2018.html
- Basnet, A., Ghimire, P., Timilsina, Y.P., Bist, B.S. (2020).** Otter research in Asia: Trends, biases and future directions. *Glob. Ecol. Conserv.* **24**: e01391. <https://doi.org/10.1016/j.gecco.2020.e01391>
- Begum, S. (2015).** *Aonyx cinereus*. In: IUCN Bangladesh. *Red List of Bangladesh Volume 2: Mammals*. Dhaka: IUCN, International Union for Conservation of Nature, Bangladesh Country Office. p. 94.
- Chakma, S. (2016).** Assessment of large mammals of the Chittagong Hill Tracts of Bangladesh with emphasis on tiger *Panthera tigris*. PhD Thesis, Department of Zoology, University of Dhaka, Dhaka, Bangladesh. 209 pp.
- Conroy, J., Melisch, R., Chanin, P. (1998).** The distribution and status of the Eurasian Otter (*Lutra lutra*) in Asia - a preliminary review. *IUCN Otter Spec. Group Bull.* **15**(1): 15-30. https://www.iucnosgbull.org/Volume15/Conroy_et_al_1998.html
- de Silva, P.K. (2011).** Status of Otter Species in the Asian Region Status for 2007. *IUCN Otter Spec. Group Bull.* **28**(A): 97-107. https://www.iucnosgbull.org/Volume28A/de_Silva_2011.html

- Duplaix, N., Savage, M. (2018).** The Global Otter Conservation Strategy. Oregon: IUCN/SSC Otter Specialist Group. https://www.otterspecialistgroup.org/osg-newsite/wp-content/uploads/2018/12/IUCN-Otter-Report-DEC%2012%20final_small.pdf
- Feeroz, M.M. (2015).** *Lutrogale perspicillata*. In IUCN Bangladesh. *Red List of Bangladesh Volume 2: Mammals*. Dhaka: IUCN, International Union for Conservation of Nature, Bangladesh Country Office. p. 76.
- Feeroz, M.M., Aziz, M.A., Thanchanga, P.K. (2011b).** Breeding activities of *Lutra perspicillata* in Bangladesh. *IUCN Otter Spec Group Bull.* **28(A)**: 38-44. https://www.iucnosgbull.org/Volume28A/Feeroz_et_al_2011a.html
- Feeroz, M.M., Begum, S., Hasan, M.K. (2011a).** Fishing with otters: a traditional conservation practice in Bangladesh. *IUCN Otter Spec Group Bull.* **28(A)**: 14-21. https://www.iucnosgbull.org/Volume28A/Feeroz_et_al_2011.html
- Foster-Turley, P., Santiapillai, C. (1990).** Action plan for Asian otters. In P. Foster-Turley, Macdonald, M.S., Mason, C.F. (Eds.), *Otters: An Action Plan for their Conservation* (pp. 52-63). Gland: IUCN, International Union for Conservation of Nature.
- Garrote, G., Alvarez, A., Asensio, V., Castañeda, B., Marín, B., Bonilla, P., Trujillo, F. (2020).** Activity Patterns of the Neotropical Otter (*Lontra longicaudis*) in the River Orinoco (Colombia). *IUCN Otter Spec. Group Bull.* **37(3)**: 158-162. https://www.iucnosgbull.org/Volume37/Garrote_et_al_2020.html
- Gerber, B.D., Karpanty, S.M., Randrianantenaina, J. (2012).** Activity patterns of carnivores in the rain forests of Madagascar: implications for species coexistence. *J. Mammal.* **93**: 667-676.
- Hakim, J., Trageser, S.J., Ghose, A., Das, K., Rashid, S.M.A. and Rahman, S.C. (2020).** Amphibians and reptiles from Lawachara National Park in Bangladesh. *Check List* **16** (5): 1239–1268.
- Haque, A.K., Khan, S.A., Uddin, S.N., Shetu, S.S. (2018).** An Annotated checklist of the angiospermic flora of Rajkandi Reserve Forest of Moulvibazar, Bangladesh. *Bangladesh Journal of Plant Taxonomy* **25** (2): 187–207.
- Harris, A. (2012).** astroFns: Astronomy: time and position functions, misc. utilities. R package version 4.1-0. <https://CRAN.R-project.org/package=astroFns> / <https://doi.org/10.1515/mammalia-2019-0050>
- Hunter, L., Barrett, P. (2018).** *Carnivores of the World*. Bloomsbury: Bloomsbury Wildlife.
- Hussain, S.A. (2013).** Activity Pattern, Behavioural Activity and Interspecific Interaction of Smooth-Coated Otter (*Lutrogale perspicillata*) in National Chambal Sanctuary, India. *IUCN Otter Spec Group Bull.* **30(1)**: 5-17. https://www.iucnosgbull.org/Volume30/Hussain_2013.html
- Hussain, S.A., Gupta, S.K., de Silva, P.K. (2011).** Biology and Ecology of Asian Small-Clawed Otter *Aonyx cinereus* (Illiger, 1815): A Review. *IUCN Otter Spec. Group Bull.* **28(2)**: 63-75. https://www.iucnosgbull.org/Volume28/Hussain_et_al_2011.html
- Khan, M.A.R. (2015a).** *Wildlife of Bangladesh - Checklist and Guide*. Dhaka: Chayabithi Publisher.
- Khan, M.M.H. (2015b).** *Lutra lutra*. In: IUCN Bangladesh. *Red List of Bangladesh Volume 2: Mammals*. Dhaka: IUCN, International Union for Conservation of Nature, Bangladesh Country Office. p. 75.
- Khan, M.M.H. (2018).** *Photographic Guide to the Wildlife of Bangladesh*. Dhaka: Arannayk Foundation.
- Khoo, M., Basak, S., Sivasothi, N., de Silva, P.K., Lubis, I.R. (2021).** *Lutrogale perspicillata*. The IUCN Red List of Threatened Species 2021:e.T12427A164579961. <https://dx.doi.org/10.2305/IUCN.UK.2021-3.RLTS.T12427A164579961.en> Accessed on 25 December 2021.
- Lechowicz, M.J. (1982).** The sampling characteristics of electivity indices. *Oecologia* **52(1)**: 22-30.
- Menon, V.K. (2014).** *Indian Mammals A Field Guide*. Delhi: Hachette India.
- Myers, N., Mittermeier, R.A., Mittermeier, C.G., Da Fonseca, G.A., Kent, J. (2000).** Biodiversity hotspots for conservation priorities. *Nature* **403(6772)**: 853-858.
- Niedballa, J., Sollmann, R., Courtiol, A., Wilting, A. (2016).** camtrapR: an R package for efficient camera trap data management. *Methods Ecol. Evol.* **7(12)**: 1457-1462. <https://doi.org/10.1111/2041-210X.12600>
- Njoroge, C.H., Ogada, M.O., Gichuki, N.N. (2014).** Temporal Detection Patterns of the African Clawless Otter *Aonyx capensis* (Schinz, 1821) in the Laikipia Plateau of Central Kenya. *IUCN Otter Spec Group Bull* **31(1)**: 44-48. https://www.iucnosgbull.org/Volume31/Njoroge_et_al_2014.html
- Noor, A., Mir, Z.R., Veeraswami, G.G., Habib, B. (2017).** Activity patterns and spatial co-occurrence of sympatric mammals in the moist temperate forest of the Kashmir Himalaya, India. *Folia Zoologica* **66**: 231-242.

- O'Brien, T.G., Kinnaird, M.F., Wibisono, H.T. (2003).** Crouching tigers, hidden prey: Sumatran tiger and prey populations in a tropical forest landscape. *Anim. Conserv.* **6**(2): 131-139. <https://doi.org/10.1017/S1367943003003172>
- Palei, N.C., Rath, B.P., Palei, H.S., Acharya, B.P. (2020).** Population Status and Activity Pattern of Smooth-Coated Otter (*Lutrogale perspicillata*) in Bhitarkanika National Park, Odisha, Eastern India. *IUCN Otter Spec. Group Bull.* **37**(4): 205-211.
- Pianzin, A., Wong, A., Bernard, H. (2021).** Riparian Reserves serve as a Critical Refuge for Asian Otters (*Aonyx cinereus* and *Lutrogale perspicillata*) in Oil Palm Dominated Landscapes of Sabah, Malaysian Borneo. *IUCN Otter Spec. Group Bull.* **38**(3): 133-154. https://www.iucnosgbull.org/Volume37/Palei_et_al_2020.html
- Quintans, D. (2019).** electivity: Algorithms for Electivity Indices. R package version 1.0.2. <https://CRAN.R-project.org/package=electivity>
- Roos, A., Loy, A., de Silva, P., Hajkova, P., Zemanová, B. (2015).** *Lutra lutra*. The IUCN Red List of Threatened Species 2015:e.T12419A21935287. <https://doi.org/10.2305/IUCN.UK.2015-2.RLTS.T12419A21935287.en>. Accessed on 25 December 2021.
- Saigal, O. (2005).** Tripura-the land. *Ishani* 1: 33-36. Available at <http://www.indianfolklore.org/> (Accessed 27 February 2019).
- Shashoto, Z.A., Yoxon, G.A. (2020).** Existence of smooth-coated otters (*Lutrogale perspicillata*) in the Ganges-Padma River basin area of Rajshahi, Bangladesh. *Otter, Journal of the International Otter Survival Fund* **6**: 94-107.
- Sollmann, R., Mohamed, A., Samejima, H., Wilting, A. (2013).** Risky business or simple solution—Relative abundance indices from camera-trapping. *Biol. Conserv.* **159**: 405-412.
- Talukdar, N.R., Choudhury, P. (2017).** Conserving wildlife wealth of Patharia Hills reserve forest, Assam, India: A critical analysis. *Glob. Ecol. Conserv* **10**: 126-138.
- Wai, L., Evans, M.N., Bernard, H., Goossens, B. (2020).** Holt-Based Activity Patterns of Smooth-Coated Otter (*Lutrogale perspicillata*) in the Lower Kinabatangan Wildlife Sanctuary, Sabah, Malaysia. *IUCN Otter Spec Group Bull* **37**(1): 20-28. https://www.iucnosgbull.org/Volume37/Wai_et_al_2020.html
- Wright, L., de Silva, P., Chan, B., Lubis, I.R., Basak, R. (2021).** *Aonyx cinereus*. The IUCN Red List of Threatened Species 2015: e.T44166A21939068. <https://doi.org/10.2305/IUCN.UK.20152.RLTS.T44166A21939068.en>. Accessed on 25 February 2022.
- Yoxon, P.A., Yoxon, B. (2019).** Eurasian otter (*Lutra lutra*): A review of the current world status. *Otter, Journal of the International Otter Survival Fund* **5**: 53-73.
- Zakir, T., Debbarma, H., Akash, M. (2020).** Dhole *Cuon alpinus* in Satchari National Park: on the first verifiable evidence from northeast Bangladesh. *Mammalia* **84**(6): 587-593.

RESUME

QUE NOUS APPREND UNE DÉCOUVERTE ?

APERÇU DU PIÉGEAGE PAR CAMÉRA DE LA LOUTRE CENDRÉE DANS LE NORD-EST DU BANGLADESH

Au début de l'année 2022, quatre études pertinentes évaluées par des pairs ont été menées sur trois des quatre espèces de loutres orientales qui vivent au Bangladesh. La répartition des loutres dans le pays, en raison du manque de preuves empiriques, est faite de conjectures et n'a pas encore été scientifiquement prouvée. Par la suite, les forêts de l'Est - bien qu'elles fassent partie de l'aire de répartition mondialement reconnue de la loutre cendrée (*Aonyx cinereus*) - ne sont pas accréditées au Bangladesh pour l'espèce et ne reçoivent aucun investissement de conservation. Cette étude a fourni, pour la première fois, des preuves de la présence de populations reliques de loutres cendrées dans l'est du Bangladesh. Une enquête sur les mammifères carnivores terrestres a été réalisée entre janvier et octobre 2021 dans quatre réserves forestières du nord-est, ce qui a permis de trouver l'espèce dans trois réserves, avec 132 événements théoriquement indépendants à partir d'un effort d'échantillonnage de 3.629 nuits de pièges photographiques. Le rythme d'activité des loutres nocturnes-crêpusculaires s'orientait davantage vers l'aube. Le travail met en évidence (i) le potentiel de la loutre cendrée en tant qu'espèce parapluie pour les forêts mixtes ripicoles transfrontalières

traditionnellement ignorées du nord-est du Bangladesh ; (ii) une grande incohérence entre les sources concernant sa répartition dans le pays ; (iii) la nécessité d'investiguer sur l'absence d'enregistrements de loutre à pelage lisse (*Lutrogale perspicillata*) et de la loutre eurasienne (*Lutra lutra*, aucune preuve de sa présence au Bangladesh depuis 30 ans) durant cette enquête bien que les réserves forestières étudiées soient largement répertoriées pour ces deux espèces ; et (iv) l'absence flagrante de toute information récente sur le statut de la loutre dans les États Indiens adjacents (Meghalaya, Tripura, Mizoram et sud de l'Assam) qui, avec l'est du Bangladesh, appartiennent à un territoire écologiquement inexploré et forment la limite ouest d'un point chaud de la biodiversité indo-birmane.

RESUMEN

¿QUÉ NOS PUEDE DECIR UN DESCUBRIMIENTO? INDAGACIÓN CON CÁMARAS-TRAMPA SOBRE LA NUTRIA ASIÁTICA DE UÑAS PEQUEÑAS EN EL NORESTE DE BANGLADESH

Para tres de las cuatro nutrias Orientales que viven en Bangladesh, hasta principios de 2022 se habían conducido en el país cuatro estudios pertinentes revisados por pares. La distribución de las nutrias del país, a causa de la carencia de evidencias empíricas, se construyó a partir de conjeturas y está pendiente conocerla científicamente. En consecuencia, los bosques orientales, aunque son una parte del rango de distribución globalmente reconocido de la nutria de uñas pequeñas (*Aonyx cinereus*) aún no están acreditados en Bangladesh para la especie, y no están recibiendo inversiones de conservación. Este estudio, por primera vez, proveyó evidencias de poblaciones relictuales de nutrias de uñas pequeñas en Bangladesh oriental. Llevamos a cabo un relevamiento de mamíferos terrestres entre Enero y Octubre de 2021 en cuatro reservas forestales del noreste, encontrando a la especie en tres reservas, con 132 eventos nocionalmente independientes a partir de un esfuerzo de muestreo de 3629 noches-cámara trampa. El ritmo de actividad de las nutrias nocturnas-crepusculares se inclinó más hacia el amanecer. Este trabajo destaca (i) el potencial de la nutria de uñas pequeñas como especie paraguas para los bosques trans-fronterizos ribereños mixtos-siempreverdes de Bangladesh nor-oriental; (ii) una gran inconsistencia entre las fuentes, en lo relacionado con su distribución en el país; (iii) las necesidades de investigar la ausencia de registros, durante éste relevamiento, de nutria lisa (*Lutrogale perspicillata*) y nutria Eurasiática (*Lutra lutra*, sin evidencias en Bangladesh por 30 años) aunque las reservas forestales prospectadas son ampliamente reconocidas por contener a ambas especies; y (iv) la impactante ausencia de cualquier información reciente acerca del status de las nutrias en los estados Indios adyacentes (Meghalaya, Tripura, Mizoram, y el sur de Assam) que, junto con Bangladesh oriental, pertenecen a un territorio ecológicamente inexplorado, y forman el límite occidental del Hotspot de Biodiversidad Indo-Burma.