

## NATURAL HISTORY NOTE

# First Records of the Wrinkle-lipped Free-tailed Bat (Molossidae: *Mops plicatus* (Buchanan 1800)) from the Maldives

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## ABSTRACT

We report two records of Wrinkle-lipped Free-tailed Bat, *Mops plicatus* (Buchanan 1800), from the Maldives. The first came on board a live-aboard diving vessel during the night of 24-25 March 2024 while it was anchored near Rasdhoo Island, Alifu Alifu Atoll. The second was rescued from the sea alongside another live-aboard vessel anchored off Mulhafushi Island, Haa Alifu Atoll, during the evening of 15 April 2024. Both were released alive and were subsequently identified from photographs and external body measurements. Wind trajectory analysis suggests that both may have been wind-blown from Sri Lanka or southwest India. These are the first records of this species and, indeed, only the second and third confirmed records of any insectivorous bat from the Maldives.

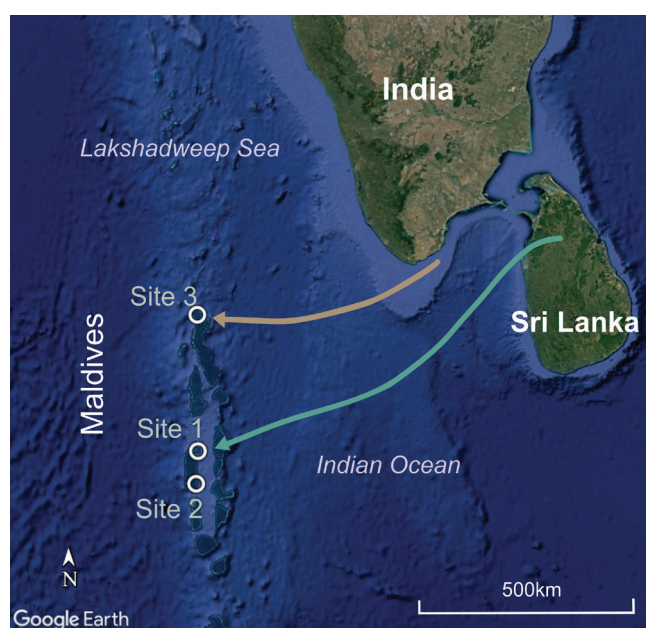
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The Republic of Maldives, off the southwest coast of India, is a country made up entirely of small coral cays with limited land area and terrestrial diversity. There is just one resident bat, an endemic subspecies of the Indian Flying Fox, *Pteropus medius ariel* Allen 1908 (Hill 1958, Anderson et al. 2022). And there is only one record of an insectivorous bat from the entire country, a single vagrant Long-winged Tomb Bat, *Taphozous longimanus* Hardwicke 1825 (Anderson et al. 2022). Here we report two opportunistic sightings of a second species of small insectivorous bat from the Maldives.

The first bat was found on board a live-aboard dive vessel, M.V. *Emperor Voyager*, clinging to the leg of a table on deck on the morning of 25 March 2024. It was presumed to have flown on board the previous night. The boat was anchored off Rasdhoo Island, Alifu Alifu Atoll, at about 4°16'N 73°00'E (Fig. 1). The bat was photographed by KS using an Olympus TG5 camera (Fig. 2) and some external body measurements were taken by ruler: body length to posterior edge of interfemoral membrane about 9 cm, tail from posterior edge of interfemoral membrane about 2 cm, wing length about 10 cm. The bat appeared exhausted; it was kept in a box and fed termites, until being released on Dhangethi Island, Alifu Dhaalu Atoll (3°36.5'N 72°57.5'E) on the evening of 27 March 2024.



**Fig. 1** - Map showing the locations of *Mops plicatus* from Maldives. Site 1: Rasdhoo Island, Alifu Alifu Atoll. Site 2: Dhangethi Island, Alifu Dhaalu Atoll (the release point of the bat spotted at Site 1). Site 3: Mulhafushi Island, Haa Alifu Atoll. The green and brown arrowed lines represent the wind trajectories recorded at 1000 m on 25 March 2024 and 15 April 2024 respectively (source: NOAA HYSPLIT model, see text for details).

The second bat was seen in the sea alongside another live-aboard vessel, M.V. *Keana*, during the evening of 15 April 2024. The bat was lifted out of the water using a mop and placed on a bunch of bananas tied up on the stern, where it was left to rest and dry out. The boat was anchored off Mulhafushi Island, Haa Alifu Atoll, at 7°01.5'N 72°58.9'E. The bat was photographed by RCA with a Panasonic Lumix DMC-FZ330 camera (Fig. 3) and some measurements were taken with a ruler: body length to posterior end of interfemoral membrane about 9.5 cm, tail from posterior edge of interfemoral membrane 23 mm, forearm (FA) 48 mm. The bat had disappeared by the next morning, presumably flying off during the night.

During the days preceding both bats' arrivals, the wind had been blowing from the ENE/NE, suggesting they may have originated from southwest India or Sri Lanka. To provide more objective estimates of the possible sources of the bats, we carried out wind trajectory analyses using the HYSPLIT (Hybrid Single Particle Lagrangian Integrated Trajectory) model developed by the U.S. National Oceanic and Atmospheric Administration (NOAA) Air Resources Laboratory (Stein et al. 2015), with the GDAS1 dataset. These generated backwards trajectories from our boats' locations to possible areas of origin ([www.ready.noaa.gov/hypub-bin/trajsrc.pl](http://www.ready.noaa.gov/hypub-bin/trajsrc.pl)). Representative trajectories are illustrated in Fig. 1 (25 March 2024 48h backward trajectory ending 0000h Greenwich Mean Time at 1000m, and 15 April 2024 30h backward trajectory ending 1900h GMT at 1000m)

Wind trajectory analysis suggests that the first bat, discovered in Alifu Alifu Atoll on 25 March 2024, could have flown from Sri Lanka. Results for the second bat, recorded in Haa Alifu Atoll on 15 April 2024, suggest that it could have come from the very south of India or Sri Lanka. Of course, either bat may have arrived in the Maldives at any time before its first discovery. However, as both bats were recorded towards the end of the northeast monsoon season, when the wind had been blowing from the ENE/NE for many weeks, it is likely that both arrived from Sri Lanka or southern India.

From photographs, both bats were identified as Molossids (Free-tailed Bats): they were both small to medium-sized bats without complex noseleaf or other fleshy facial appendages; nostrils on a small fleshy pad, and directed forward; small or rudimentary tragus, with a relatively larger antitragus present; muzzle without a dermal ridge, but wrinkle-lipped; and tail emerging from the outer edge of the interfemoral membrane (Allison 1988, Bates & Harrison 1997, Srinivasulu et al. 2010). Within the family Molossidae, four species are known from south India and Sri Lanka (Phillips 1980, Bates & Harrison 1997, Srinivasulu et al. 2010, Deshpande & Kelkar 2015, Kusuminda & Yapa 2017, Yapa 2017):

- *Tadarida teniotis* (Rafinesque, 1814), European Free-tailed Bat,
- *Tadarida aegyptiaca* (E. Geoffroy, 1818), Egyptian Free-tailed Bat,
- *Mops plicatus* (Buchanan, 1800), Wrinkle-lipped Free-tailed Bat, and
- *Otomops wroughtoni* Thomas, 1913, Wroughton's Free-tailed Bat.

Two of these species (*T. teniotis* and *O. wroughtoni*) are particularly rare in the southern subcontinent and are absent from Sri Lanka (Ruedi et al. 2014, Deshpande & Kelkar 2015, Yapa 2017). Furthermore, both species are larger than the Maldivian individuals: body plus tail length >117mm and forearm length >58mm (Bates & Harrison 1997, Srinivasulu et al. 2010).

Our two individuals both had their ears joined by a membrane over the forehead (most clearly visible in Fig. 3). This characteristic eliminates *Tadarida*, and confirms both Maldivian individuals as *Mops plicatus* (Bates & Harrison 1997, Srinivasulu et al. 2010). Furthermore, both bats possessed prominent lip wrinkles, while the muzzles themselves were blunt and broad, with very thick fluted upper lips overhanging the lower lips (which were



**Fig. 2** - Wrinkle-lipped Free-tailed Bat, *Mops plicatus*, Rasdhoo Island, Alifu Alifu Atoll, 25 March 2024. Note wrinkled lips and dark shoulder fur. Photo: Katrin Schweigler.



**Fig. 3** - Wrinkle-lipped Free-tailed Bat, *Mops plicatus*, Mulhafushi Island, Haa Alifu Atoll, 15 April 2024. This individual had just been rescued from the sea, so was wet. This obscured the natural fur colour, but accentuated the membrane joining the ears above the forehead. Photo: R.C. Anderson.

essentially naked apart from a few long upright bristles and several short ones). Also, the base of the thumb had a well-defined pad. In addition, the first individual had fur colouration characteristic for this species, with darker hairs on the shoulder, just after the posterior base of the ears (Thong 2014), the pelage being short, very dense, soft and velvety (Fig. 2). The second individual was wet when photographed, so its natural fur colour was unclear. *Mops plicatus* was commonly known as *Chaerephon plicatus* until recently (Gregorin & Cirranello 2016, Amador et al. 2018). This species has been considered to be of Least Concern in IUCN Red List assessments (Molur et al. 2002, Csorba et al. 2020).

As noted above, wind trajectory analysis suggests that the first bat, discovered in Alifu Alifu Atoll on 25 March 2024, could have flown from Sri Lanka. Photos of that individual showing its lower teeth are not especially sharp, but do suggest that it might have had just a single incisor on each side of the lower jaw. *Mops plicatus* typically has two lower incisors each side, but one specimen with a single lower incisor has been recorded from Sri Lanka (Bates & Harrison 1997, Borissenko & Kruskop 2003). Whether or not this is indicative of regional variation within *M. plicatus* is unknown. A distinct subspecies, *Chaerephon plicata insularis* Phillips (1932), has been described from Sri Lanka, however, that taxon has not been widely accepted, and further study is required to determine its validity (Molur et al. 2002, Kusuminda & Yapa 2017, Csorba et al. 2020).

The two Maldivian records occurred within just three weeks of each other and only 180 km apart. This is a striking coincidence given that there has only been one previous record of any insectivorous bat from the Maldives (Anderson et al. 2022). Apart from coincidence, we have no explanation for this co-occurrence, although there are some speculative possibilities:

1. The two sightings may have been of one individual. However, after being transported south, it would have had to have flown over 250 km north, across and against the wind.
2. A roost in Sri Lanka or south India may have been recently disturbed or destroyed, with two of the displaced bats subsequently being wind-blown to the Maldives. Roost destruction is a known threat to *M. plicata* (Csorba et al. 2020). It is possible that other high-flying Molossids or Emballonurids could also be displaced by similar events.
3. There may be a resident population somewhere in the Maldives, perhaps on one or more of the larger northern islands. This seems unlikely, given the dearth of previous reports of insectivorous bats from the Maldives, despite some relevant searching (e.g. Hill 1958, Dolbeer et al. 1988, Holmes et al. 1994). However, a recent acoustic survey in the Lakshadweep islands (adjacent to and ecologically similar to the Maldives) detected four species of insectivorous bat (SR pers. obs.) even though only one single specimen of one species had ever been previously reported from the archipelago

(Deshpande et al. 2016). This possibility suggests that an acoustic survey of some of the larger northern islands of the Maldives might produce some positive results. It also suggests that due care should be taken to identify potential insectivorous bat populations on Maldivian islands selected for development (for example as tourist resorts) and in the vicinity of any planned wind turbine developments.

In conclusion, we present the first documented records of the Free-tailed Wrinkle-lipped Bat, *Mops plicatus*, from the Maldives. This is only the second species of insectivorous bat recorded from the Maldives. An acoustic survey in the northern atolls is recommended.

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