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Journal of Threatened Taxa

10.11609/jott.2022.14.8.21487-21750
www.threatenedtaxa.org

26 August 2022 (Online & Print)
14(8): 21487-21750
ISSN 0974-7907 (Online)
ISSN 0974-7893 (Print)

Open Access

ISSN 0974-7907 (Online); ISSN 0974-7893 (Print)

Publisher
Wildlife Information Liaison Development Society
www.wild.zooreach.org

Host
Zoo Outreach Organization
www.zooreach.org

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Cover: Fish species recorded in the Gowthami-Godavari Estuary, Andhra Pradesh: *Lutjanus johnii* (top left), *Triacanthus biaculeatus* (top right), *Acentrogobius cyanomos*, *Elops machnata*, *Trypauchen vagina*, *Oxyurichthys microlepis*. © Paromita Ray.

Journal of Threatened Taxa | www.threatenedtaxa.org | 26 August 2022 | 14(8): 21501–21507

ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

https://doi.org/10.11609/jott.7995.14.8.21501-21507

#7995 | Received 29 April 2022 | Final received 02 August 2022 | Finally accepted 11 August 2022

OPEN ACCESS

REVIEW

Natural history notes on three bat species

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Abstract: Three bat species have long been considered to occur within the state of Rajasthan—the Lesser Mouse-Eared bat *Myotis blythii* Tomes, 1857, the Large Barbastelle *Barbastella darjelingensis* Hodgson, in Horsfield, 1855 and the Serotine Bat *Eptesicus serotinus pachyomus* Tomes, 1857. Rajasthan is considered the type locality for two of these species—*Myotis blythii* and *Eptesicus serotinus pachyomus*. Despite targeted surveys, these bats have not been observed in Rajasthan for more than a century and a half. A chronological review of published literature reveals that the bats were never originally claimed to occur in Rajasthan and their inclusion among bats occurring in Rajasthan was a consequence of assumptions perpetuated as facts.

Keywords: Chiroptera, Large Barbastelle, Serotine Bat, Lesser Mouse-eared Bat, Rajasthan, India, British Museum, Captain Boys, Himalaya.

Editor: Paul Racey, University of Exeter, Cornwall, UK.

Date of publication: 26 August 2022 (online & print)

Citation: Khandal, D., I. Dhar, D.L. Bohra & S.S. Talmale (2022). Natural history notes on three bat species. *Journal of Threatened Taxa* 14(8): 21501–21507. https://doi.org/10.11609/jott.7995.14.8.21501-21507

Funding: None.

Competing interests: The authors declare no competing interests.

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Author contributions: All authors have contributed equally to this chronological literature review.

Acknowledgements: The authors are grateful to Mr. Dieter Gutmann & Mrs. Liz Gutmann, and Tiger Watch for their unstinting support.

INTRODUCTION

Bats (Chiroptera) are among the most widely distributed and diverse mammals in the world, second only to rodents in both regards (Sinha 1996). India is home to 127 species of bats (Talmale & Saikia 2018) and the state of Rajasthan has a long history of chiropteran study. There have been contributions by Blanford (1888–91), Ryley (1914), Wroughton (1918), Ellerman & Morrison-Scott (1951), Prakash (1963a,b, 1973), Agrawal (1967), Biswas & Ghosh (1968), and Sinha (1973, 1975, 1976, 1977) to chiropteran study in Rajasthan. Prakash's (1963a) study in Rajasthan was limited to nine bat species in the Thar Desert. Sinha (1980) carried out the first systematic study of bats covering all of Rajasthan, discussing in great detail, both the taxonomy and zoogeography of 21 species based on a field survey and published literature. Some of these 21 species were recorded for the first time in the state of Rajasthan (Sinha 1980). Sinha (1981), Sharma (1986), Bhupathy (1987) and Senacha & Dookia (2013) recorded a new species each for the state of Rajasthan. Srinivasulu et al. (2013) provided an 'intensive account' of 25 bat species recorded in Rajasthan.

However, despite targeted surveys and the consistent addition of new species to the list of bats occurring in Rajasthan, it is believed that three bat species have not been observed in the state for more than a century and a half: the Lesser Mouse-eared Bat *Myotis blythii* (Tomes, 1857), the Large Barbastelle *Barbastella darjelingensis* (Hodgson, in Horsfield, 1855) and the Serotine Bat *Eptesicus serotinus pachyomus* (Tomes, 1857). Rajasthan is in fact considered the type locality for two of these species—*Myotis blythii* and *Eptesicus serotinus pachyomus* (Thomas 1915; Wroughton 1918; Sinha 1980; Bates & Harrison 1997; Srinivasulu & Srinivasulu 2012; Srinivasulu et al. 2013). Information on these bats is fragmented, and the presence of these bats has only been questioned sporadically before in Rajasthan (Blanford 1888–91; Topal 1971). In addition to not being observed for more than a century, targeted field surveys such as by Sinha (1980) did not yield any results. The authors thus propose a thorough chronological review of published literature on these species to ascertain just why there has been absolutely no evidence of occurrence for such a long period of time.

OBSERVATIONS

Lesser Mouse-eared Bat *Myotis blythii* (Tomes, 1857)

The description for this species of bat (then *Vespertilio blythii)* was provided by R.F. Tomes (1857). Robert Fisher Tomes (1823–1904) was an English farmer and zoologist with an avid interest in Chiroptera. His description was based on a specimen preserved in the British Museum and thus he did not collect the specimen himself. Tomes (1857) wrote that the type specimen in the British Museum was labelled, "Hab. India, Nassenabad, from Mr. Warwick, 1848" and he added, "I believe collected by Captain Boys".

Tomes (1857) provides two pieces of information, a location in India, the fact that the specimen was sent to the British Museum by a Mr. Warwick in 1848. Now considering there already was a name attached to the specimen, why did Tomes (1857) speculate that the collector was Captain Boys? Where precisely "Nassenabad" is in India is also unknown, but Tomes (1857) created confusion by speculating that the collector might be Captain Boys. There is absolutely no mention of Rajasthan or as it was then known, Rajputana.

So what could be the reason behind this speculation? The "Mr. Warwick" referred to here was John Edington Warwick, a 'naturalist' employed by the Royal Surrey Zoological Gardens in Walworth, London at the time (not to be confused with the Zoological Gardens managed by the Zoological Society of London in Regent's Park) (Grigson 2016). The gardens sourced animals for their displays from at least three continents during Warwick's time (Editor 1835; Jardine 1858; Sclater 1870; Grigson 2016). Warwick appears to have occasionally sourced and procured animals back from overseas personally, such as giraffes from Egypt in 1836 (also brought back were five ostriches, 18 Numidian cranes, one camel and five jerboas) which became the subject of a book authored by him (Warwick 1836; Grigson 2016). The animals displayed at the gardens often became specimens for museums upon expiry. The gardens were clearly the final destination of many kinds of fauna from overseas, and it appears that Warwick's specimens were even sold to museums, such as the Cuban nightjar to the Derby Museum in 1849 (Sclater 1866), a year after the British Museum received the type specimen for *Myotis blythii*. It is therefore clear that although Warwick was certainly the source of the specimen, he was not necessarily the collector, prompting Tomes (1857) to speculate that perhaps it was Captain Boys who collected it from the field in India.

Which brings us to why Tomes (1857) speculated that

the collector might be Captain Boys. It is possible that Tomes (1857) connected Captain Boys to the locality "Nasirabad", and assumed that was what was meant by "Nassenabad" on the specimen label. However, there were multiple towns named "Nasirabad" in British India. A background on Capt. Boys might shed some light on such an assumption. Captain W.J.E Boys was an officer in the 6th Regt. Light Cavalry of the British East India Company and a known collector of specimens. Nasirabad in the district of Ajmer in Rajasthan has a very long history as a cantonment town. It is also quite possible that the label "Nassenabad" was a typological error since error by curators was not unheard of in the British Museum during that period (Benda & Mlíkovský 2008).

It should also be noted that Boys died three years before Tomes (1857) authored his description and thus could not be consulted to confirm nor refute the contents of the description or any work by subsequent authors. Nevertheless, the purported association of Captain Boys with Nasirabad, Rajasthan led to the perpetuation of certain assumptions regarding the type locality of this species, even though Tomes (1857) clearly never made any such claims.

It was Jerdon (1867) who first made the claim that the type specimen was procured from Rajasthan, and wrote that "The bat was found by Captain Boys in Nusserabad, Rajputana". Jerdon (1867) made three assumptions in this claim. The first is that the "Nassenabad" mentioned by Tomes (1857) is "Nusserabad". The second is that "Nusserabad" is in Rajputana (Rajasthan), thereby becoming the first author to connect an otherwise ambiguous locality to the state of Rajasthan. This is despite the fact there were multiple towns with the same name, which still exist to this day in independent India and Pakistan, including in the Indian states of Uttar Pradesh and Uttarakhand, where Boys was also known to be active. The third is that the collector of the specimen was Captain Boys. Therefore, Jerdon (1876) stated what was clearly a speculation by Tomes (1857) as fact.

Dobson (1878) in his 'Catalogue of the Chiroptera in the Collection of the British Museum', wrote that the type specimen was from "India" and from the "Warwick Coll." (Coll. =Collection). Dobson (1878) was thus most appropriate in his treatment of the specimen, for he did not include any speculative information in his account and mentioned the undisputed facts alone, which were that the type specimen was from India and that the origin was the collection of J.E. Warwick. Blanford (1888–91) was the first to question whether the locality of this report was correct, and wrote "This type of *V. blythii* was said to be from Nusserabad, in Rajputana, but this locality I think requires confirmation". However, Blanford (1888–91) did not stress this point any further and did not elaborate why he thought so.

Following Jerdon (1867), the aforementioned assumptions regarding the locality and collector are further perpetuated as facts by Thomas (1915) in the Bombay Natural History Society's Indian Mammal Survey, "Of this group of large grey species, the Indian representative in *M. blythii*, Tomes of which the Museum contains the type (skin and skull) from Nusserabad (Boys)". Which was in turn, further perpetuated by Ellerman & Morrison-Scott (1951), who claimed that the type locality of "1857, *Vespertilio blythii* Tomes" was "Nasirabad, Rajputana" and on distribution, commented, "Ranges to Simla, northern India". It should be noted that the text by Ellerman & Morrison-Scott (1951) did not exclusively focus on *Chiroptera*, but their text was a checklist on 'Palearctic and Indian Mammals- 1758 to 1946', and brought 'Rajputana' back into the discourse concerning this bat.

Nearly a century after Blanford (1888–91) questioned the locality of the report, Topal (1971) commented on the improbability of Nasirabad, Rajasthan being the origin of the type specimen discussed by Tomes (1857) on ecological grounds, and also suggested that the locality "Nassenabad" was in all likelihood, somewhere in the Himalayas. Topal (1971) wrote, "this site lies, on the one hand, at least 600 km. to the SW of the nearest locality of occurrence of *M. blythi,* and, on the other, in a climatically and zoogeographically utterly different region, separated by an extensive plain of hot and mostly dry climate from the Himalayas. It is therefore improbable that Nasirabad, Rajputana, could be the type-locality of *M. blythi.* Since Mussoorie, Chamba, Simla (Dodsworth 1914), Kashmir, and probably the locality Nassenabad all belong to the climatically and zoogeographically essentially uniform area of the western Himalaya, it is in all likelihood inhabited by a single form, the nominate one, of *Myotis blythi."*

Nevertheless, Sinha (1980) also gave "Nasirabad, Rajasthan" as the type locality for "*Vespertilio blythii* Tomes, 1857, *Proc. zool. Soc. Lond.*, 1857. p. 53" and citing Ellerman & Morrison-Scott (1951), described the distribution of the species in India to range from "Nasirabad (Rajasthan) to Simla, northern India". Sinha (1980) thus ignored Dobson (1878), Blanford (1888-91) and Topal (1971). Sinha (1980) only examined a female specimen sourced from Chamba (Himachal Pradesh) during this survey and not the type specimen in the British Museum.

Bates & Harrison (1997) in their book on *Bats of the Indian Subcontinent*, acknowledged Blanford (1888–91) and Topal (1971), by marking the locality in Rajasthan with a "?", on their distributional map for *Myotis blythii*. In the section on distribution, Bates & Harrison (1997), state the following, "Rajasthan: Nasirabad (type loc. of *blythii*, but Topal, 1971 suggests the correct locality is Nassenabad, possibly in the Himalayas)".

Srinivasulu & Srinivasulu (2012) in their book on: "Checklist of South Asian mammals" mentioned the type locality Nasirabad, Rajasthan without any further comment. Even more recently, Srinivasulu et al. (2013) (includes Y.P. Sinha as co-author) wrote that, "*Myotis blythi blythi* (Tomes, 1857) has been reported from Nasirabad (Ajmer District) which is also its type locality, but Topal suggests that the correct locality is Naseerabad, possibly in the Himalayas". While acknowledging the arguments made by Topal (1971), Srinivasulu et al. (2013) nevertheless perpetuated assumptions first made by Jerdon (1867) by including this species in their account of bats recorded in Rajasthan.

The Serotine Bat *Eptesicus serotinus pachyomus* (Tomes, 1857)

In the same publication, Tomes (1857) also provided a description for the Serotine Bat (then *Scotophilus pachyomus*), which was based on a specimen preserved in the British Museum. According to Tomes (1857), the collector was "Capt. Boys" and the specimen was from "Hab. India". There is no mention of Rajasthan (then known as Rajputana), but a non-specific type locality in the form of "India".

Dobson (1878) wrote in his catalogue that the type specimen for "*Scotophilus pachyomus*, Tomes" was from "India" and collected by "Capt. Boys [C]". This is completely consistent with Tomes (1857). As far as distribution in India is concerned, Dobson (1878) did not name *Rajputana* nor any contiguous region in the distribution of the species, but "India, where it inhabits the valleys of the Himalayas".

The first account of this species purportedly occurring in *Rajputana* or Rajasthan is by Wroughton (1918) in a manner similar to the last species by Jerdon (1867). In the Bombay Natural History Society's Indian Mammal Survey, in which Wroughton (1918) wrote, "Type Locality: Rajputana: Boys". It appears that this is an assumption presented as fact, quite possibly made on account of the collector of the type specimen being Captain Boys. Ellerman & Morrison-Scott (1951) further perpetuated this assumption, when they included "Rajputana" in the distribution area of this species. Therefore, once again, the purported association between Captain Boys and Rajputana or Nasirabad, caused the perpetuation of assumptions as facts regarding the type locality of the specimen.

Sinha (1980) also wrote that *E. serotinus pachyomus* "is found in Rajasthan" and that the type locality for "*Scotophilus pachyomus* Tomes, 1857, *Proc. zool. Soc. Lond.*, 1857. p. 50" as "*Rajputana*". Sinha (1980) then further added, "As informed by J.E. Hill (Brit. Mus.): It seems that Boy's collected the specimen in Rajputana, probably near Nasirabad, but labelled "India"; I failed to collect it in Nasirabad". J.E. Hill (now deceased) is consistent with Tomes (1857) and Dobson (1878) on the facts that Captain Boys collected the type specimen and that it was indeed labelled "India", however it is evident that the origin of the specimen being Nasirabad or anywhere else in *Rajputana* is guess work at best. Boys being the collector of the type specimen might well have informed Hill's speculation regarding the locality. Despite a clear lack of confirmation, Sinha (1980) included this species in his survey for Rajasthan. The three Indian specimens Sinha (1980) examined for this survey originated in "Kashmir".

Bates & Harrison (1997) included Rajasthan in the distributional area of the species but with the following caveat, "Rajasthan: no fixed locality (type loc. of *pachyomus*)". Rather pertinently, Bates & Harrison (1997) also did not mark any locality in Rajasthan on their distributional map for the subspecies. Srinivasulu & Srinivasulu (2012) in their book on: "Checklist of South Asian mammals" included Rajasthan in the distribution area for the subspecies *pachyomus* without providing any further details.

Srinivasulu et al. (2013) wrote that "The type locality of *Eptesicus serotinus pachyomus* (Tomes 1857) is "Rajputana" (present-day Rajasthan), India". Then, citing Sinha (1980), Srinivasulu et al. (2013) added "The type probably has been collected from Nasirabad (Ajmer District)". Despite a lack of confirmation regarding the origin of the type specimen and the absence of any other evidence of this bat's occurrence in Rajasthan, Srinivasulu et al. (2013) included this species in their account of bats recorded in Rajasthan.

In addition, Srinivasulu et al. (2013) also categorically stated, "The first account of bats from *Rajputana* (British name for Rajasthan and its surrounding states) dates back to 1857 in the work of R.F. Tomes who provided descriptions of *Scotophilus pachyomus* (presently *Eptesicus serotinus pachyomus*) and *Vespertilio blythi* (presently *Myotis blythi blythi*) collected from Nasirabad, 130 km south of Jaipur in the present-day Ajmer district".

However, it should be abundantly clear that Tomes (1857) never mentioned "Nasirabad" nor *Rajputana* in his accounts of the two species.

Large Barbastelle *Barbastella darjelingensis* (Hodgson, in Horsfield, 1855)

The first account of this species of bat purportedly occurring in Rajasthan is provided by Wroughton (1918). Wroughton (1918) includes "Rajputana" in the distribution of this species on account of a specimen in the British Museum, but does not mention a collector nor a specific locality within *Rajputana* for this specimen in the survey.

A close examination of the catalogue by Dobson (1878), reveals that in addition to the type specimen collected by B.H. Hodgson from the district of Darjeeling ("Darjiling" in the text) in northern West Bengal, there was one more specimen labelled from "India" with "Capt. Boys" named as the collector. There is no mention of *Rajputana* nor any specific locality in India for this specimen. Dobson (1878) also did not mention *Rajputana* in the distribution of this species in the accompanying account, "India (Darjiling, Khasia hills, Sikhim, Masuri, Simla); Yarkand".

This raises the obvious question, how then did Wroughton (1918) include *Rajputana* in the distribution of this species? Here too, it appears that the purported association between Captain Boys and Nasirabad or *Rajputana* (Rajasthan) led to the perpetuation of certain assumptions, similar to what transpired with the two species described by Tomes (1857).

Ellerman & Morrison-Scott (1951) also included *Rajputana* in the distribution area of this species. Sinha (1980) however, while pointing out that Wroughton (1918) and Ellerman & Morrison-Scott (1951) included "Rajputana" to the range of distribution of this species, mentions that he was unable to find any specimens in Rajasthan for his survey. However, here too, Sinha (1980) consulted J.E. Hill from the British Museum and wrote the following: "as informed by J.E. Hill (B.M.) the specimen from the British Museum is probably from Nasirabad but labelled as "India". J.E. Hill is consistent with Dobson (1878) on the fact that the specimen is labelled from just "India". However, it is quite clear that the origin of the specimen being "Nasirabad" is guess work. This is also the first instance of the specimen being alleged to have originated in Nasirabad, and not just *Rajputana*. It is quite possible that in addition to following Wroughton (1918) and Ellerman & Morrison-Scott (1951) as far as *Rajputana* is concerned, Hill speculated that the type locality is Nasirabad on account of the collector being Captain Boys (as Wroughton (1918) might have done for this species earlier for *Rajputana*), although Sinha (1980) does not mention Boys in this particular account.

In addition, the specimens that Sinha (1980) examined for this survey originated from locations in the Himalayas. Despite a clear lack of confirmation of the origin of the relevant specimen, Sinha (1980) included this species in his survey for Rajasthan. Bates & Harrison (1997) did not mention Rajasthan in the distributional area of this species in their text, nor did they mark any locality in Rajasthan on their distributional map for this species.

Srinivasulu & Srinivasulu (2012) in their book on: "Checklist of South Asian mammals" did not include Rajasthan in the distributional area for this species. Citing Wroughton (1918), Ellerman & Morrison-Scott (1951) and Sinha (1980), Srinivasulu et al. (2013) asserted, "*Barbastella darjelingensis* (Hodgson, 1855 in Horsfield 1855) has been reported from Nasirabad (Ajmer District)". Thus Srinivasulu et al. (2013) further perpetuated their assumptions by including this species to their account of bats recorded in Rajasthan.

DISCUSSION AND CONCLUSION

Our chronological review of literature reveals that many authors believed Captain Boys to be the collector of the relevant specimens for all three species. However, the original descriptions and account reveal that Boys was the collector of just two specimens (Tomes, 1857; Dobson, 1878). Tomes (1857) only traced the type specimen for *Myotis blythii* with certainty to J.E. Warwick of the Surrey Zoological Gardens in Walworth, London and merely speculated that Boys was the collector in India. Among the three species, only one specific locality was ever provided and this was the ambiguous "India, Nassenabad" for *Myotis blythii* (Tomes 1857). The relevant specimens for *Eptesicus serotinus pachyomus* and *Barbastella darjelingensis* were only described to have originated in "India" (Tomes 1857; Dobson 1878).

The erroneous belief regarding Boys evidently gained currency because authors either associated Captain Boys with *Rajputana* first and then Nasirabad (for *Eptesicus serotinus pachyomus* & *Barbastella darjilengensis),* or in the reverse order (for *Myotis blythii*) (Jerdon 1867; Thomas 1915; Wroughton 1918; Sinha 1980). The connection between Captain Boys and *Rajputana* or Nasirabad is unclear. It could possibly be on account of Boys having been a cavalry officer and that Nasirabad was a cantonment town.

On examination of Boys's life, it is evident that he was rather mobile through northern India. In 1843, he served as assistant to the Commissioner of Kumaon (Uttarakhand) (Piddington 1843) and was also a combatant in the second Anglo-Sikh war (Grant 1849). Boys eventually expired in Almora (Uttarakhand) on 21 March 1854 (Editor 1854).

Authors such as Wroughton (1918) categorically associated Captain Boys with the collection of mammal specimens in "Rajputana" during the early period of Indian Mammalogy (second quarter of the 19th century), however an examination of his work reveals that Boys was by no means limited to just *Rajputana* nor mammals.

Such was Boys's prowess in collecting specimens, that he was unanimously elected a member of the Asiatic Society of Bengal in 1842 (Prinsep 1842). Specimen contributions by Boys range from a snail from Agra (Uttar Pradesh) (Benson 1864), a wasp from Almora (Uttarakhand) (Turner 1912), a bird from a location in between Sindh (now Pakistan) and Ferozepur (Indian Punjab) (Blyth 1846), to even a caracal from Jaipur in Rajasthan (Blyth, 1845). Strickland & Strickland, in Jardine (1852), wrote of the auction of Boys's ornithological collection in London which included, "the result of many years residence in the upper Gangetic provinces of India, ….an extensive series of birds, amounting to between 500 and 600 species. Some of them very rare". Piddington (1843) even wrote of the Asiatic Society of Bengal providing Boys with financial assistance for geological expeditions to the "Thibet passes" (India-Tibet border areas).

Thus it is evident that Boys was not limited to just *Rajputana* in his endeavours and spent a considerable amount of time in the Himalayas (Piddington 1843; Strickland & Strickland, in Jardine 1852; Turner 1912). Incidentally, the Himalayas are where Topal (1971) believed the type specimen of *Myotis blythii* to originate from based on its ecology, and where there are at least two localities by the name Nasirabad (one in Haridwar district in the state of Uttarakhand, and the other in the Hunza district of Pakistan Occupied Ladakh).

It should also be noted that errors in the provenance of specimens were not only common, but often translated to taxonomic errors of great magnitudes. In a notable example, the eminent curator and zoologist John Edward Gray made just such an error with a small cat specimen in the British Museum. Gray (1867) declared a new species based on the aforementioned specimen, *Pardalina warwickii* or Warwick's Cat, which was apparently from the Himalayas. The specimen, when alive was exhibited as a "Himalayan Cat" in the Surrey Zoological Gardens (hence named after J.E. Warwick). It was not until 1870, that zoologist Philip Sclater proved that the cat was a Geoffroy's Cat (*L. geoffroyi*) from South America, a species which had been described much earlier in 1844 (Sclater 1870). Thus not only was the specimen not from the Himalayas, it was not even Asian. Gray (1874), in his recantation, commented that, "there was an inclination of the dealers to give Himalaya as the habitat of animals of which they did not know whence they came, as animals of that country were interesting and fetched a good price".

Thus the authors propose that until there is tangible evidence of occurrence of these three species in Rajasthan—*Myotis blythii* Tomes, 1857, *Eptesicus serotinus pachyomus* Tomes, 1857, and *Barbastella darjeligensis*, Hodgson, in Horsfield, 1855—they should be omitted from lists and accounts of *Chiroptera* occurring in Rajasthan. The bats were never originally claimed to occur in Rajasthan (Tomes 1857; Dobson 1878) and their inclusion among bats occurring in Rajasthan was a consequence of assumptions perpetuated as facts.

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NAAS rating (India) 5.64

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Journal of Threatened Taxa

www.threatenedtaxa.org

ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

August 2022 | Vol. 14 | No. 8 | Pages: 21487–21750
Date of Publication: 26 August 2022 (Online & Print)
DOI: 10.11609/jott.2022.14.8.21487-21750

Publisher & Host

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