

New records and a taxonomic review prompts reassessment of *Lonchophylla bokermanni*, a rare bat endemic to the Brazilian Cerrado

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Abstract *Lonchophylla bokermanni* is a nectar-feeding bat endemic to south-east Brazil that is currently categorized as Vulnerable in Brazil but as Data Deficient on the IUCN Red List. Originally described in the Cerrado savannah of Minas Gerais state in 1978, the species is known to occur in only two other nearby localities. In the last 2 decades individuals identified as *L. bokermanni* were recorded in the Brazilian Atlantic Forest, increasing the known range of the species. A recent taxonomic review, however, has shown that Atlantic Forest individuals belong to a separate, new species, *Lonchophylla peracchii*. *L. bokermanni*, therefore, is known from only three localities, with an Extent of Occurrence of 1,506 km². Because this EOO is < 5,000 km², the species is known from < 5 localities, and there is a presumed continued decline in its habitat extent and quality, it should be categorized as Endangered on the IUCN Red List. We recommend that the state of the three known populations of *L. bokermanni* be evaluated, and that surveys for further populations are required, particularly in Serra do Cipó National Park.

Keywords Brazil, Cerrado, Chiroptera, conservation status, IUCN, Neotropics

Lonchophylla bokermanni Sazima, Vizotto & Tadei 1978 is a medium-sized nectar-feeding bat endemic to south-east Brazil (Sazima et al., 1978; Nogueira et al., 2007; Chiarello et al., 2008). It is categorized as Vulnerable on Brazilian Red Lists because of its restricted distribution and small populations, and the reduction of its habitat

(Brazil, 2003; Machado et al., 2005; Bergallo et al., 2009), but as Data Deficient on the IUCN Red List because 'not enough information is available to assess the species distribution, which may be widespread or restricted' (Sampaio et al., 2008).

The species' type locality, Jaboticatubas, in the Serra do Cipó mountains in the state of Minas Gerais (Sazima et al., 1978), is in the Cerrado (Fig. 1), and a few additional specimens were taken near the type locality 9 years after the species was discovered (Sazima et al., 1989). For 10 years these were the only records of *L. bokermanni*, prompting concern regarding its status. Individuals identified as *L. bokermanni* were later recorded on the coast of Brazil in a few well-preserved localities in the Atlantic Forest of Rio de Janeiro, Espírito Santo and São Paulo states, expanding the species' known range (Taddei et al., 1988; Dias et al., 2002; Brito et al., 2004; Esbérard et al., 2006, 2010; Moratelli & Peracchi, 2007; Dias & Peracchi, 2008; Esbérard, 2009; Bolzan et al., 2010; Novaes et al., 2010; Pimenta et al., 2010; Teixeira et al., 2013). There were a number of misclassifications of *L. bokermanni* specimens as *Lonchophylla mordax* Thomas 1903 in Rio de Janeiro (Dias et al., 2002; Esbérard, 2003; Esbérard et al., 2006) because of the lack of a taxonomic review of the known Brazilian forms of the genus, and the overlap of the forearm length of *L. mordax* and *L. bokermanni* specimens from the Atlantic Forest (Taddei et al., 1988; Dias et al., 2002; Dias & Peracchi, 2008; Pimenta et al., 2010). A recent review of *L. bokermanni* specimens (Dias et al., 2013), however, found sufficient differences between Cerrado and Atlantic Forest populations to warrant the treatment of the latter as a separate and new species, *Lonchophylla peracchii* Dias, Esbérard & Moratelli, 2013. At the same time, *L. bokermanni* was rediscovered in Minas Gerais, near its type locality, in Itambé do Mato Dentro (Nascimento et al., 2013) and the Diamantina region (Dias et al., 2013; Fig. 1).

Lonchophylla bokermanni, therefore, is known from only three localities in Minas Gerais state. These localities can be used to determine the species' Extent of Occurrence (EOO), which can be calculated as the minimum convex polygon defined by the species' occurrence records (IUCN, 2001; Gaston, 2003). The EOO of *L. bokermanni* is 1,506 km², less than the 5,000-km² threshold for categorization as Endangered (Fig. 1), the species is known from < 5

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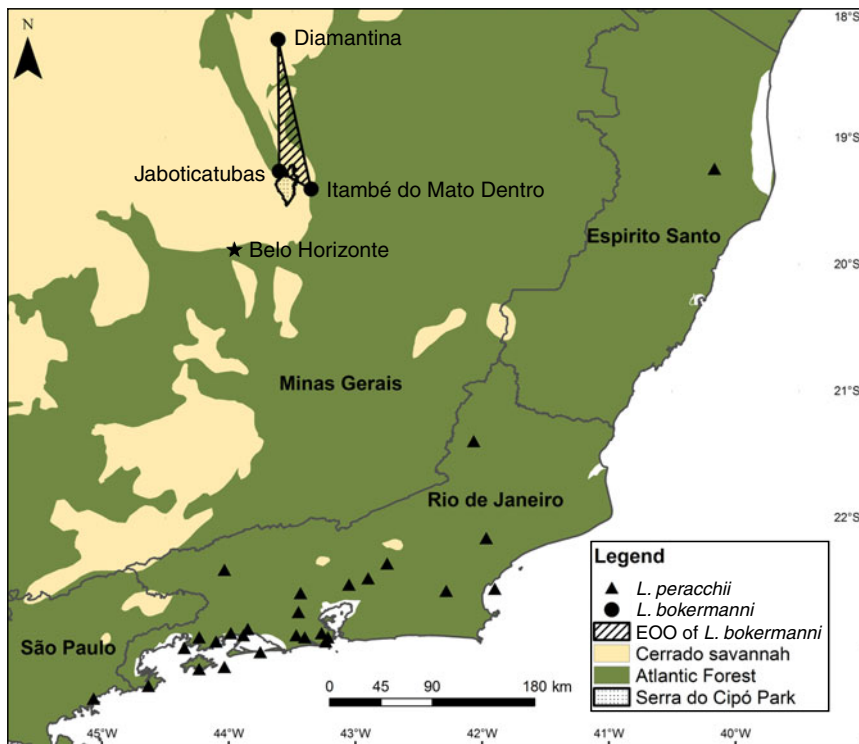


FIG. 1 Distribution of *Lonchophylla bokermanni* and *Lonchophylla peracchii* in south-east Brazil, with the original extent of Cerrado and Atlantic Forest (from Olson et al., 2001). The dashed triangle shows the Extent of Occurrence (EOO) of *L. bokermanni* (see text for details), with an area of 1,506 km², encompassing the three known records, at Jaboticatubas, Itambé do Mato Dentro and Diamantina.

locations, and there is a presumed decline in the extent and quality of its habitat. The Cerrado is a biodiversity hotspot but it has lost > 80% of its original vegetation cover, mostly to the continuing expansion of Brazil's agriculture frontier (Myers et al., 1999; Klink & Machado, 2005). Thus, the species should be categorized as Endangered based on criteria Brabii (IUCN, 2001), rather than Data Deficient, on the IUCN Red List. The categorization of the species as Vulnerable on the Brazilian Red Lists (Machado et al., 2005) should also be reconsidered.

Information on the ecology of *L. bokermanni* is limited to notes on its feeding (Sazima et al., 1978, 1989). There have been no studies of why the species seems to be so rare, or of the threats it faces. There is, therefore, an urgent need to study this species, identifying the factors that are responsible for its current status. The records of *L. bokermanni* are within 50 km of Belo Horizonte (Fig. 1), the capital city of Minas Gerais, with a population of 2.5 million people, but are also close to Serra do Cipó National Park (Fig. 1), which protects 33,800 ha of relatively well-preserved Cerrado vegetation. We recommend that the state of the three known populations of *L. bokermanni* be evaluated, and that targeted surveys are carried out for further populations, particularly in Serra do Cipó National Park.

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References

- BERGALLO, H.G., ESBÉRARD, C.E.L., GEISE, L., GRELE, C.E.V., VIEIRA, M.V., GONÇALVES, P.R. et al. (2009) Mamíferos endêmicos e ameaçados do Estado do Rio de Janeiro: diagnóstico e estratégias para a conservação. In *Estratégia e ações para a conservação da biodiversidade no Estado do Rio de Janeiro* (eds H.G. Bergallo, E.C. Fidalgo, C.F.D. Rocha, M.C. Uzêda, M.C. Costa, M.A.S. Alves et al.), pp. 209–219. Instituto Biomas, Rio de Janeiro, Brazil.
- BOLZAN, D.P., LOURENÇO, E.C., COSTA, L.M., LUZ, J.L., JORDÃO-NOGUEIRA, T., DIAS, D. et al. (2010) Morcegos da região da Costa Verde e adjacências, litoral sul do Estado do Rio de Janeiro. *Chiroptera Neotropical*, 16, 586–595.
- BRAZIL (2003) Lista Nacional das Espécies da Fauna Brasileira Ameaçadas de Extinção. Instrução Normativa No. 3 de 27 de Maio de 2003. *Diário Oficial da União* (1), 101, 88–97.
- BRITO, D., OLIVEIRA, L.C. & MELLO, M.A.R. (2004) An overview of mammalian conservation at Poço das Antas biological reserve, southern Brazil. *Journal for Nature Conservation*, 12, 219–228.
- CHIARELLO, A.G., AGUIAR, L.M.S., CERQUEIRA, R., MELO, F.R., RODRIGUES, F.H.G. & SILVA, V.M. (2008) Mamíferos ameaçados de extinção no Brasil. In *Livro Vermelho da Fauna Brasileira Ameaçada de Extinção* (eds A.B.M. Machado, G.M. Drummond & A.P. Paglia), pp. 681–702. Ministério do Meio Ambiente, Brasília, Brazil.
- DIAS, D., ESBÉRARD, C.E. & MORATELLI, R. (2013) A new species of *Lonchophylla* (Chiroptera, Phyllostomidae) from the Atlantic Forest of southeastern Brazil, with comments on *L. bokermanni*. *Zootaxa*, 3722, 347–360.

- DIAS, D. & PERACCHI, A.L. (2008) Quirópteros da Reserva Biológica do Tinguá, estado do Rio de Janeiro, sudeste do Brasil (Mammalia, Chiroptera). *Revista Brasileira de Zoologia*, 25, 333–369.
- DIAS, D., PERACCHI, A.L. & SILVA, S.S.P. (2002) Quirópteros do Parque Estadual da Pedra Branca, Rio de Janeiro, Brasil (Mammalia, Chiroptera). *Revista Brasileira de Zoologia* 19, 113–140.
- ESBÉRARD, C.E.L. (2003) Diversidade de morcegos em área de Mata Atlântica regenerada no sudeste do Brasil. *Revista Brasileira de Zoociências*, 5, 189–204.
- ESBÉRARD, C.E.L. (2009) Capture sequence and relative abundance of bats during surveys. *Zoologia*, 26, 103–108.
- ESBÉRARD, C.E.L., BAPTISTA, M., COSTA, L.M., LUZ, J.L. & LOURENÇO, E.C. (2010) Morcegos de Paraíso do Tobias, Miracema, Rio de Janeiro. *Biota Neotropica*, 10, 249–255.
- ESBÉRARD, C.E.L., JORDÃO-NOGUEIRA, T., LUZ, J.L., MELO, G.G.S., MANGOLIN, R., JUÇA, N. et al. (2006) Morcegos da Ilha Grande, Angra dos Reis, RJ, Sudeste do Brasil. *Revista Brasileira de Zoociências*, 8, 147–153.
- GASTON, K.J. (2003) *The Structure and Dynamics of Geographic Ranges*. Oxford University Press, Oxford, UK.
- IUCN (2001) *IUCN Red List Categories and Criteria*. Version 3.1. IUCN, Gland, Switzerland, and Cambridge, UK.
- KLINK, C.A. & MACHADO, R.B. (2005) Conservation of the Brazilian Cerrado. *Conservation Biology*, 19, 707–713.
- MACHADO, A.B.M., MARTINS, C.S. & DRUMMOND, G. M. (2005) *Lista da fauna brasileira ameaçada de extinção: incluindo as listas das espécies quase ameaçadas e deficientes em dados*. Fundação Biodiversitas, Belo Horizonte, Brazil.
- MORATELLI, R. & PERACCHI, A.L. (2007) Morcegos (Mammalia, Chiroptera) do Parque Nacional da Serra dos Órgãos. In *Ciência e Conservação na Serra dos Órgãos* (eds C. Cronemberger & E.B. Viveiros de Castro), pp. 193–210. IBAMA, Brasília, Brazil.
- MYERS, N., MITTERMEIER, R. A., MITTERMEIER, C. G., DA FONSECA, G.A.B. & KENT, J. (1999) Biodiversity hotspots for conservation priorities. *Nature*, 403, 853–858.
- NASCIMENTO, M. C., DIAS, L. H., GREGORIN, R. & LESSA, G. (2013) Rediscovery of *Lonchophylla bokermanni* Sazima, Vizotto and Taddei, 1978 (Chiroptera: Phyllostomidae: Lonchophyllinae) in Minas Gerais, and new records for Espírito Santo, southeastern Brazil. *Check List*, 9, 1046–1049.
- NOGUEIRA, M.R., DIAS, D. & PERACCHI, A.L. (2007) Subfamília Glossophaginae. In *Morcegos do Brasil* (eds N.R. Reis, A.L. Peracchi & W.A. Pedro.), pp. 45–59. Editora Universidade Estadual de Londrina, Londrina, Brazil.
- NOVAES, R.L.M., MELLO, F.A.P., FELIX, S., SILVARES, R., SANT'ANNA, C., FAÇANHA, A.C. et al. (2010) *Lonchophylla bokermanni* na Floresta Atlântica: distribuição, conservação e nova localidade de ocorrência para uma espécie ameaçada de extinção. *Chiroptera Neotropical*, 16, 710–714.
- OLSON, D.M., DINERSTEIN, E., WIKRAMANAYAKE, E.D., BURGESS, N.D., POWELL, G.V.N., UNDERWOOD, E.C. et al. (2001) Terrestrial ecoregions of the world: a new map of life on earth. *BioScience*, 51, 933–938.
- PIMENTA, V.T., MACHEL, C.T., FONSECA, B.S. & DITCHFIELD, A.D. (2010) First occurrence of *L. bokermanni* Sazima, Vizotto & Taddei, 1978 (Phyllostomidae) in Espírito Santo State, Southeastern Brazil. *Chiroptera Neotropical*, 16, 740–742.
- SAMPAIO, E., LIM, B. & PETERS, S. (2008) *Lonchophylla bokermanni*. In *IUCN Red List of Threatened Species v. 2013.1*. <http://www.iucnredlist.org> [accessed 23 October 2013].
- SAZIMA, I., VIZOTTO, L.D. & TADDEI, V.A. (1978) Uma nova espécie de *Lonchophylla* da Serra do Cipó, Minas Gerais, Brasil (Mammalia, Chiroptera, Phyllostomidae). *Revista Brasileira de Biologia*, 38, 81–89.
- SAZIMA, I., VOGEL, S. & SAZIMA, M. (1989) Bat pollination of *Encholirium glaziovii*, a terrestrial bromeliad. *Plant Systematics and Evolution*, 168, 167–179.
- TADDEI, V.A., DE SOUZA, A.S. & MANUZZI, J.L. (1988) Notas sobre uma coleção de *Lonchophylla bokermanni* de Ilha Grande, sudeste do Brasil (Mammalia: Chiroptera). *Revista Brasileira de Biologia*, 48, 851–855.
- TEIXEIRA, T. S. M., ROSA, D. T. C., DIAS, D., CERQUEIRA, R. & VALE, M. M. (2013) First record of *Lonchophylla peracchii* Dias, Esbérard and Moratelli, 2013 (Chiroptera, Phyllostomidae) in São Paulo State, Southeastern Brazil. *Oecologia Australis*, 17, 424–428.

Biographical sketches

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