ROADKILL AND NEW RECORDS FOR GIANT ARMADILLO (Priodontes maximus) IN CENTRAL-WESTERN BRAZIL

Article *in* Mastozoologia Neotropical · May 2018

CITATIONS
0

READS
138

5 authors, including:

Wellington Hannibal
Universidade Estadual de Goiás, Quirinópolis, Brazil
32 PUBLICATIONS **274** CITATIONS
SEE PROFILE

Seixas Rezende Oliveira
State University of Mato Grosso
6 PUBLICATIONS **0** CITATIONS
SEE PROFILE

Mastozoología Neotropical, en prensa, Mendoza, 2018
Versión on-line ISSN 1666-0536

Nota

ROADKILL AND NEW RECORDS FOR GIANT ARMADILLO (*Priodontes maximus*) IN CENTRAL-WESTERN BRAZIL

Wellington Hannibal[1], Nicolay L. da Cunha[2], Guilherme Dalponti[2], Seixas R. Oliveira[3], and Katia R. F. Pereira[4]

[1] Laboratório de Ecologia e Biogeografia de Mamíferos, Universidade Estadual de Goiás, Quirinópolis, GO, Brazil. [Correspondence: <wellingtonhannibal@gmail.com>]
[2] Programa de Pós-Graduação em Ecologia e Conservação, Universidade Federal de Mato Grosso do Sul, Campo Grande, MS, Brazil
[3] Programa de Pós-Graduação em Biodiversidade e Conservação, Instituto Federal Goiano, Rio Verde, GO, Brazil
[4] Universidade Anhaguera, Campo Grande, MS, Brazil

ABSTRACT. Despite the widespread distribution of the giant armadillo *Priodontes maximus*, this species is found at low densities, often in disrupted populations. Here we report 12 new records, including five incidents of roadkill of *P. maximus* in different points of the Cerrado and one in an Atlantic Forest fragment in central-western Brazil. In addition to the relevant records, we discuss the negative effects of roadkills, which is a serious issue for the conservation and maintenance of local populations of giant armadillo.

RESUMO. Atropelamentos e novos registros para tatu-canastra (*Priodontes maximus*) no centro-oeste do Brasil. Apesar da ampla distribuição do tatu-canastra *Priodontes maximus*, esta espécie apresenta baixas densidades em populações não conectadas. Aqui, relatamos 12 novos registros, incluindo cinco atropelamentos rodoviários de *P. maximus* em diferentes pontos de Cerrado e um em fragmento de Floresta Atlântica no centro-oeste do Brasil. Além dos registros relevantes, discutimos o efeito negativo da perda de espécimes por atropelamentos em estradas, o qual é um problema sério para a conservação e manutenção de populações locais de tatu-canastra.

Key words: Atlantic Forest. Cerrado. Geographical range. Species conservation. Vulnerable species.

Palavras chaves: Área geográfica. Cerrado. Conservação de espécies. Espécies vulneráveis. Floresta Atlântica.

The Central region of Brazil is a key area for the conservation of the armadillo because it harbors eight of the 10 known species (Anacleto et al. 2006). Within the armadillo group, the original range of *Priodontes maximus* (Kerr, 1792) is quite large in Brazil; historically it has been found in the Cerrado (the Brazilian savannah), the Pantanal, and parts of the Atlantic Forest (Anacleto et al. 2006). Unfortunately, the Atlantic Forest and the Cerrado have been severely fragmented by human activities (Klink & Machado 2005; Ribeiro et al. 2009) and such disruptions have had severe effects on many of the giant armadillo populations, with some

Recibido 11 septiembre 2017. Aceptado 10 octubre 2017. Editor asociado: A Abba

becoming locally extinct and others nearing extinction in what is left of the Atlantic Forest (Anacleto et al. 2006; Srbek-Araujo et al. 2009; Carter et al. 2016). The giant armadillo has also been affected by poaching, in addition to the deforestation of its habitat, and is listed as "Vulnerable" by the International Union for Conservation of Nature and Natural Resources (Anacleto et al. 2014). Therefore, any available data concerning its natural status take on paramount importance for conservation initiatives.

Roads have tangible and evident negative effects on wildlife due to the reduction and disruption of natural environments (Forman 1998); they cause changes in natural ranges, movements, reproductive success, behavioral responses, and physiological state (Forman 2003; Van der Ree et al. 2011) of countless species. In addition to the their directly observable effects, roads also promote a plethora of indirect effects such as increased hunting, passive harassment of animals, increased susceptibility of ecological invasion, and the spread of diseases (Trombulak & Frissell 2001). *Priodontes maximus* has a widespread, but discontinuous distribution (see, **Fig. 1**) with individuals having a large home range, suggesting that large areas of suitable habitat are needed to sustain viable populations (~5.5 individuals/100 km^2) (Carter et al. 2016). Although in recent years new information has been obtained about the giant armadillo, its biology is still poorly understood (Silveira et al. 2009; Porfirio et al. 2012). Information on giant armadillo ecology includes indirect signs, sporadic sightings, camera trapping, and also the carcasses of dead animals (Silveira et al. 2009). Nevertheless, roadkill has been seldom considered to be a substantial threat to *P. maximus* populations (Chiarello et al. 2008), despite the research by Fischer et al. (2003) which documented at least one individual of *P. maximus* that frequently crossed the road close to Emas National Park.

This communication reports 13 new records, including five roadkills of *P. maximus* in different areas of central-western of Brazil. We used Global Biodiversity Information Facility-GBIF (GBIF 2017), Species Link (Species Link 2017), and published articles (Anacleto & Marinho-Filho 2001; Vaz 2003; Mamede & Alho 2006; Srbek-Araujo et al. 2009; Porfirio et al. 2012; Desbiez & Kluyber 2013; Martinelli et al. 2014; Hannibal & Godoi 2015) as database for showing site-records of giant armadillo in South America.

All live-records occurred in the last three years, and we observed the armadillos during searches for mammals of different academic interest and research projects, therefore, records were opportunistic with no systematic sampling. We observed the records in several different places, such as Pantano farm (Ribas do Rio Pardo municipality), Mato Grosso do Sul state and Refúgio da Vida Silvestre Serra da Fortaleza conservation unit-RVSSF (Quirinópolis municipality), and the state of Goiás (**Table 1**). The giant armadillo sightings in Pantano farm were recorded by ten camera traps, as well as by footprints and burrows in woodland savanna fragments (5700 ha) and in areas of eucalyptus and pine plantations (12 500 ha). The sighting in RVSSF was made by the documentation of footprints near the edge of a semi-deciduous forest fragment and by burrows inside this fragment. The RVSSF comprised an area of 489.72 ha covered by semi-deciduous forest, gallery forest and vereda—a savanna formation dominated by *Mauritia flexuosa* (Walter 2006), and surrounded by an agricultural plantation as well as an exotic grass matrix.

The south-western record of giant armadillo was a roadkill on BR-267, in the Jardim municipality, in the state of Mato Grosso do Sul and the eastern record was a burrow in the Cristianópolis municipality, in the state of Goiás (**Table 1**, **Figs. 1** and **2**). In addition, four of five roadkill records occurred in the last two years, 2016 and 2017, on different roads in central-western Brazil (**Table 1**, **Figs. 1** and **2**). Our records were in concordance with the distribution range of *P. maximus* (**Fig. 1**). Cerrado grassland (savannah) of central South America comprises about 25% of the distribution of *P. maximus*, but the species also occurs in forests with significant undergrowth, but appears to be absent in areas settled by humans or in which cattle are raised (Carter et al. 2016). In contrast, there are reports of *P. maximus* in disturbed vegetation surrounding forest fragments of Cerrado, possibly moving between

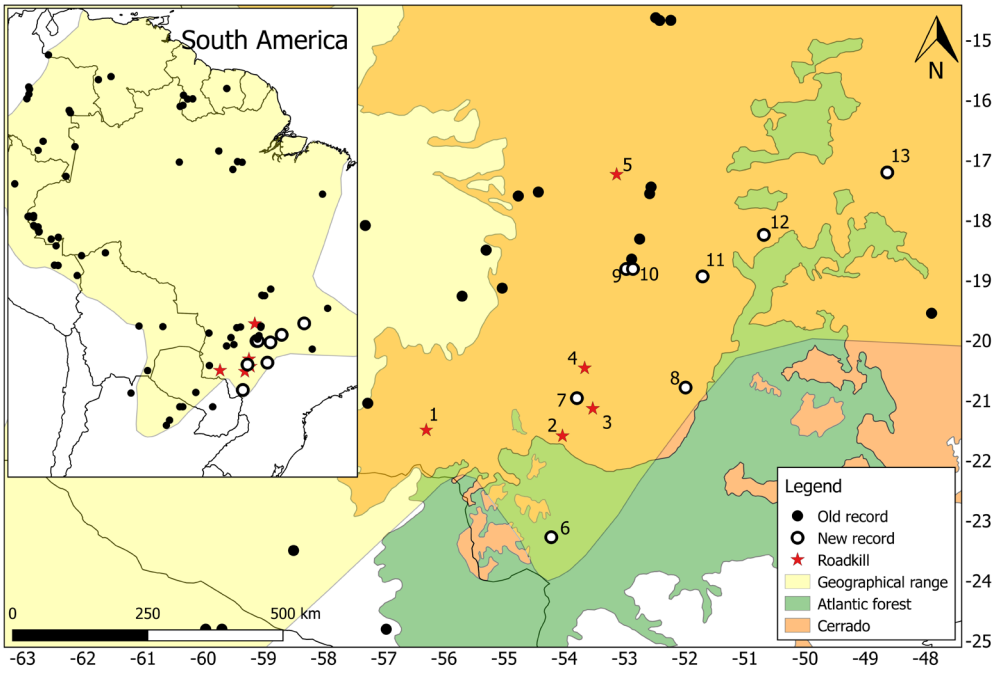

Fig. 1. New records and roadkills of *Priodontes maximus* in central-western Brazil. Geographical range according to IUCN (2017) and old records according to GBIF (2016), Species Link (2017), and published articles (Anacleto and Marinho-Filho 2001, Vaz 2003, Mamede and Alho 2006, Srbek-Araujo et al. 2009, Porfirio et al. 2012, Desbiez and Kluyber 2013, Martinelli et al. 2014, Hannibal and Godoi 2015) (see **Table 1** for information about the numbers).

Table 1

Information about giant armadillo (*Priodontes maximus*) new records and roadkills in central-western Brazil. Legend. Road: BR = interstates Brazilian roads, MS and GO = intrastate Brazilian roads; Record: B = burrow, C_T = camera trap, D_O = Direct observation, T = track; State: GO = Goiás state, MS = Mato Grosso do Sul state. For roadkills, we put the road name where the carcass was found.

Point	Register	Record type	Municipality-State	Latitude (S)	Longitude (W)	Year of record
1	Roadkill	BR-267	Jardim-MS	21°29'47"	56°17'44"	2007
2		BR-267	Nova Alvorada do Sul-MS	21°35'34"	54°01'55"	2017
3		MS-040	Campo Grande-MS	21°08'17"	53°31'43"	2017
4		BR-262	Ribas do Rio Pardo-MS	20°27'50"	53°39'48"	2016
5		GO-461	Santa Rita do Araguaia-GO	17°14'32"	53°07'41"	2016
6	New record	B	Itaquiraí-MS	23°16'41"	54°13'01"	2015
7		B, CT, T	Ribas do Rio Pardo-MS	20°57'48"	53°47'31"	2014
8		B	Três Lagoas	20°47'15"	51°59'12"	2015
9		T	Costa Rica-MS	18°48'54"	52°58'19"	2017
10		T	Costa Rica-MS	18°48'50"	52°51'41"	2017
11		DO	Itajá-GO	18°56'13"	51°42'13"	2016
12		B, T	Quirinópolis-GO	18°14'47"	50°41'09"	2015
13		B	Cristianópolis-GO	17°12'28"	48°38'10"	2017

Fig. 2. Roadkills of *Priodontes maximus* in central-western Brazil. A to D are respectively the road kill registers 2 to 5 in the **Table 1** and **Fig. 1**.

forest fragments (Anacleto et al. 2006), which show that political and management actions are urgently needed to effectively protect this giant xenarthran species of Cerrado hotspots.

The record in the Atlantic Forest fragment was a recent burrow (**Fig. 1**, **Table 1**) recorded in technical study regarding the viability of the implementation of a double track railroad in southern Mato Grosso do Sul. The last occurring fragments of the interior Atlantic Forest are under severe threat, being considered the most threatened phytophisiognomy in this domain (Ribeiro et al. 2009). The forest fragment surveyed in this study borders 3.2 kilometers of a paved road, and the implementation of tunnels and a fence alongside the road was recommended to the road managers.

Camera traps have been shown to be an efficient and non-invasive tool to study important ecological aspects of *P. maximus*, such as activity patterns, density estimates, habitat use, home range, and interaction with other species (Silveira et al. 2009; Srbek-Araujo et al. 2009; Porfirio et al. 2012). The occurrence of *P. maximus* during the rapid ecological assessment in the RVSSF motivated the creation of that conservation unit (Ministério Público de Goiás 2015). The majority studies involving new records and the ecology of giant armadillo in the Pantanal (Porfirio et al. 2012; Desbiez & Kluyber 2013), Cerrado (Silveira et al. 2009; Martinelli et al. 2014) and Atlantic Forest (Srbek-Araujo et al. 2009) has been done in conservation units and protected areas, and have demonstrated the value of these places for giant armadillo conservation. In Emas National Park, biometry, home range, density, activity patterns, and habitat of *P. maximus* were extensively studied throughout a period of three years, which greatly contributed to the

published observations of its biology (Silveira et al. 2009), which until then, had been poorly understood. Similarly, we expect that other studies involving the giant armadillo may also take place during the management plan of other conservation units in Cerrado.

Although Chiarello et al. (2008) and Fischer et al. (2003) have cited that roadkill might be a threat for giant armadillo conservation, no roadkill record was made during a seven-year period (2001 to 2008) on over 3900 kilometers of roads that cover the Atlantic Forest and Cerrado of south-western Brazil (Cáceres et al. 2010). Only one carcass of an adult individual was found close to the border of the Reserva Biológica de Sooretama (RBS) in the state of Espírito Santo in 2009 along the federal highway BR-101 that crosses 5 kilometers of the reserve. However, that carcass had no sign of injuries, lacerations, or perforations (Srbek-Araujo et al. 2009), indicating that its death was more likely due to natural causes. Therefore, our roadkill data seems to be both new and relevant to the scientific community.

Recently, new traffic signs alerting about the presence of wild animals have been posted along Brazilian highways (DNIT 2010). However, drivers routinely ignore these signs and commute at high speeds, well above the recommended limits, causing fatalities of many vertebrates, including threatened mammals (Srbek-Araujo et al. 2009, 2015; Cáceres et al. 2010). Deaths of giant armadillo in Brazil due to roadkill are likely to be more common than previously thought. However, these records are scarce and not available in scientific literature. Despite its wide home range, *Priodontes maximus* naturally occurs in low densities, and in East and Central Brazil the populations are often disrupted (Anacleto et al. 2014; Carter et al. 2016). Consequently, the negative effects of the loss of specimens due to vehicle collisions represent a serious challenge for giant armadillo conservation.

Acknowledgements. We thank W. Fischer for helpful comments and suggestions; we do also thank V. V. Figueiredo and R. F. Oliveira for assistance in mammal fieldwork in southern Goiás state, Brazil, and C. Aoki, M. Delatorre, M. N. Godoi, P. Landgref-Filho, T. M. Taveira and V. S.S. de Lima for assistance in mammal field work in Mato Grosso do Sul state, Brazil; and J. L. Holladay for English review.

LITERATURE CITED

Anacleto, T. C. S., J. A. F. Diniz-Filho, & M. V. C. Vital. 2006. Estimating potential geographic ranges of armadillos (Xenarthra, Dasypodidae) in Brazil under niche-based models. Mammalia 70:202-213.

Anacleto, T. C. S., & J. Marinho-Filho. 2001. Hábito alimentar do tatu-canastra (Xenarthra, Dasypodidae) em uma área de cerrado do Brasil Central. Revista Brasileira de Zoologia 18:681-688.

Anacleto, T. C. S., F. Miranda, I. Medri, E. Cuellar, A. M.Abba, & M. Superina. 2014. *Priodontes maximus*. The IUCN Red List of Threatened Species 2014: e.T18144A47442343. http://dx.doi.org/10.2305/IUCN.UK.2014-1.RLTS.T18144A47442343.en.

Cáceres, N. C., W. Hannibal, D. R. Freitas, E. L. Silva, C. Roman, & J. Casella. 2010. Mammal occurrence and roadkill in two adjacent ecoregions (Atlantic Forest and Cerrado) in South-Western Brazil. Zoologia 27:709-717.

Carter, T. S., M. Superina, & D. M. Leslie. 2016. *Priodontes maximus* (Cingulata: Chlamyphoridae). Mammalian Species 48:21-34.

Chiarello, A. G., L. M. Aguiar, R. Cerqueira, F. R. Melo, F. H. G. Rodrigues, & V. M. F. Silva. 2008. Mamíferos ameaçados de extinção no Brasil. Livro vermelho da fauna brasileira ameaçada de extinção (A. B. M. Machado, G. M. Drummond & A. P. Paglia, eds.). Ministério do Meio Ambiente, Brasília.

Desbiez, A. L. J., & D. Kluyber. 2013. The role of giant armadillos (*Priodontes maximus*) as physical ecosytem engineers. Biotropica 45: 537–540.

DNIT. 2010. Manual de projeto e práticas operacionais para segurança nas rodovias. Instituto de Pesquisas Rodoviárias. Rio de Janeiro.

Fischer, W. A., M. B. Ramos-Neto, L. Silveira, & A. T. A. Jacomo. 2003. Human transportation network as ecological barrier for wildelife on Brazilian Patananal-Cerrado corridors. Road Ecology Center 182-194.

Forman, R. T. T. 1998. Road ecology: a solution for the giant embracing us. Landscape Ecology 13:3-5.

Forman, R. T. T., et al. 2003. Road ecology: science and solutions. Island Press, Washington, D.C.

GBIF. 2017. GBIF Backbone Taxonomy. GBIF Secretariat. Checklist Dataset. Accessed online at https://doi.org/10.15468/39omei accessed via GBIF.org

Hannibal, W., & M. N. Godoi. 2015. Non-volant mammals of the Maracaju Mountains, southwestern Brazil: composition, richness and conservation. Revista Mexicana de Biodiversidad 86:217-225.

IUCN. 2017. The IUCN Red List of Threatened Species. 2017.1. <http://www.iucnredlist.org/amazing-species/>.

Klink, C. A., & R. B. Machado. 2005. Conservation of the Brazilian Cerrado. Conservation Biology 19:707-713.

Mamede, S. B., & C. J. R. Alho. 2006. Response of wild mammals to seasonal shrinking-and-expansion of habitats due to flooding regime of the Pantanal, Brazil. Brazilian Journal Biology 66:991-998.

Martinelli, A. G., W. R. Costa, R. S. Neto, P. H. M. Fonseca, G. Martins, & V. M. Silva. 2014. *Priodontes maximus* (Cingulata, Dasypodidae) in the Reserva Particular do Patrimônio Natural Vale Encantado, Triângulo Mineiro, Southeastern Brazil. Acta Zoológica Mexicana 30:716-722.

Ministério Público de Goiás. 2015. Unidades de Conservação em Goiás. <www.mp.go.gov.br/portalweb/hp/9/docs/unidades_de_conservacao_em_goias.pdf/>.

Porfirio, G. E. D. O. et al. 2012. New records of giant armadillo *Priodontes maximus* (Cingulata: Dasypodidae) at Serra do Amolar, Pantanal of Brazil. Edentata 13:72-75.

Ribeiro, M. C., J. P. Metzger, A. C. Martensen, F. J. Ponzoni, & M. M. Hirota. 2009. The Brazilian Atlantic Forest: how much is left, and how is the remaining forest distributed? Implications for conservation. Biological Conservation 142:1141-1153.

Silveira, L, A. T. A. Jácomo, M. M. Furtado, N. M. Torres, R. Sollmann, & C. Vynne. 2009. Ecology of the Giant Armadillo (*Priodontes maximus*) in the Grasslands of Central Brazil. Edentata 8:25-34.

Species Link. 2017. Coleção de Mamíferos da UNEMAT. <http://www.splink.org.br.>.

Srbek-Araujo, A. C., L. M. Scoss, A. Hirsch, & A. G. Chiarello. 2009. Records of the giant-armadillo *Priodontes maximus* (Cingulata: Dasypodidae) in the Atlantic Forest: are Minas Gerais and Espírito Santo the last strongholds of the species? Zoolgia 26:461-468.

Srbek-Araujo, A. C., S. L. Mendes, & A. G. Chiarello. 2015. Jaguar (*Panthera onca* Linnaeus, 1758) roadkill in Brazilian Atlantic Forest and implications for species conservation. Brazilian Journal Biology 75:581-586.

Trombulak. S. C., & C. Frissell. 2001. Review of ecological effects of roads on terrestrial and aquatic communities. Conservation Biology. 14:18-30.

Van der Ree, R., J. A. G. Jaeger, E. A. van der Grift, & A. P. Clevenger. 2011. Effects of roads and traffic on wildlife populations and landscape function: road ecology is moving towards larger scales. Ecology Society 16:48.

Vaz, S. M. 2003. Lista de localidades de captura de xernatros sob ameaça de extinção no Brasil. Edentata 5:4-5.

Walter, B. M. T. 2006. Fitofisionomias do bioma Cerrado: síntese terminológica e relações filogenéticas. Tesis de Doctorado. Universidade de Brasília, Brasília.