

## Brief Communication:

# Domestic Dogs Present a Human-Induced Threat to Thick-tailed Bushbabies (*Otolemur crassicaudatus*) in Northern South Africa

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## INTRODUCTION

The world's nonhuman primates are increasingly under stress from numerous human-induced causes (e.g., Schwitzer *et al.* 2019). Habitat loss, the wild animal trade, various forms of hunting, and human infrastructure including roads, electric sources such as power lines and fences, all pose threats to many of Africa's remaining nonhuman primates (e.g., Schwitzer *et al.* 2019). In South Africa, ever expanding urban areas, extensive road networks, farms surrounded by electric fences, overhead power lines and traditional hunting practices have resulted in many of the nation's endemic nonhuman primates being under increasing pressure, even among those species often viewed as common such as *Otolemur crassicaudatus* (the greater or thick-tailed bushbaby), and receiving a current IUCN rating of "Least Concern" (Masters & Genin 2016; Cuzzo *et al.* 2020, 2021; Svensson *et al.* 2021; Linden *et al.* 2022).

The impact of domestic dog kills on nonhuman primates in Africa is often alluded to, but largely based on limited data and small samples (Astley-Maberly 1967; Anderson 1986; Waters *et al.* 2017; Pihlström *et al.* 2021). Waters *et al.* (2017) note four examples of macaques being preyed upon in Morocco across a 12-month period and Linden

*et al.* (2016) list domestic dogs as a threat for samango monkeys (*Cercopithecus mitis*) in South Africa. Among Madagascar's lemurs, the data on dog kills are rare, and reports are quite limited, often reporting single events (e.g., Gould & Sauter 2007; Moresco *et al.* 2012). Given the importance of domestic dogs as sentinels of unwanted activity (guarding people, livestock, and property) it should not be a surprise that domestic dogs and nonhuman primates are in conflict. As seen in Gould and Sauter (2007), evidence of domestic dog kills (in this case a ring-tailed lemur in Madagascar) can also be very scant, with only limited remains being found. Therefore, as with other examples of human-induced kills of nonhuman primates (e.g., Cuzzo *et al.* 2020, 2021; Linden *et al.* 2022), the record likely far underestimates the actual number of events.

Much of the published work on *O. crassicaudatus* focuses on biology, behavior, and ecology, with older data based on fundamental behavior and ecology (e.g., Bearder 1974; Harcourt 1980). More recent research expands into the area of human-animal conflict and predation (Cuzzo *et al.* 2020, 2021; Linden *et al.* 2022). This new focus includes a much broader assessment of *O. crassicaudatus* biology and physiology (Kotze *et al.* 2016; Phukuntsi *et al.*

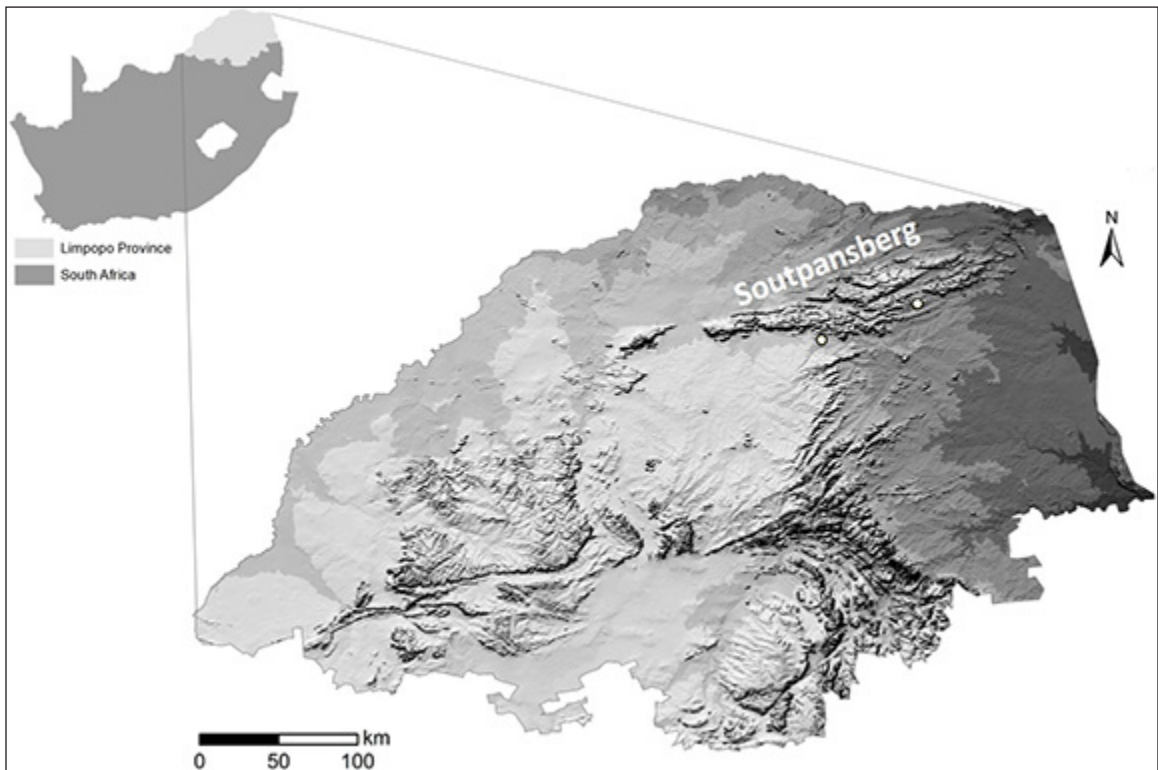
2019; Long *et al.* 2021), based on data collected at the Lajuma Research Centre, northern Limpopo Province, South Africa (Figure 1).

Here we report 13 known incidents of domestic dog kills of *O. crassicaudatus*, since 2014 (Figure 1). Among these 13 events, there is a variety of contexts to contemplate, to establish effective mitigation plans. To date, there is only a single published report of a domestic dog kill of *Otolemur* sp. in Africa (*Otolemur garnetti*), from Kenya (Pihlström *et al.* 2021).

## METHODS

As part of our collaborative, comprehensive ecology, biology, and conservation work on northern South Africa's greater bushbabies, we have opportunistically recorded the deaths of *O. crassicaudatus*, regardless of the cause – whether by domestic dogs, road kills, electrocutions, and natural predation. In part, these records have been obtained through the broad network of citizen-scientists (through local newspaper and social media

calls), other researchers and ourselves, in northern Limpopo Province, South Africa. The data presented herein are from all these sources. In addition, we include one case reported in local print media responded to by one of us (Linden 2015) in the same medium, that speaks to the endemic cultural component of dog kills of greater bushbabies in Limpopo Province. All domestic dog kills reported here come from the greater Soutpansberg area, South Africa's northernmost, isolated east-west orientated, mountain range (Figure 1). The specific area from which these data emanate runs from the town of Thohoyandou (in the eastern end of the range) west to the town of Louis Trichardt (Machado) in the centre of the range and several privately owned farms near the western end of the mountains. In South African vernacular, “farm” typically describes a large portion of privately owned land in rural areas which is used variously for agriculture, tourism, conservation, or simply as private residence. Note that reports do not have an exact date, only a year of occurrence and for most accounts life-history and age/sex data were not available.



**Figure 1.** Study area showing the Limpopo Province in far northern South Africa and the Soutpansberg mountain range. White circles indicate the towns of Thohoyandou (in the east) and Louis Trichardt (further west).

## RESULTS AND DISCUSSION

Our collaborative work has resulted in 13 documented domestic dog kills of *O. crassicaudatus* since 2014 in northern Limpopo Province, South Africa. Twelve of these were caused by owned dogs enclosed in gardens or yards and one by free roaming hunting dogs in a rural village. Recorded events span both agricultural and natural rural areas, and urban/semi-urban areas within this region (see Table 1). The predation of nocturnal strepsirrhine primates is rarely documented and is often hypothesized to include birds of prey, snakes, and various carnivores (Nash 1983; Crompton 1984; Bearder 2007). *O. crassicaudatus* and *Galago moholi* (the southern lesser bushbaby) are known to be preyed upon by chimpanzees (*Pan troglodytes* [e.g., Nishida *et al.* 1979, Uehara 1997; Pruetz & Bertolani 2007; O'Mally 2010]) in other areas of Africa. One of our recent publications documents the first example of *O. crassicaudatus* being preyed upon by a caracal (*Caracal caracal*, Cuzzo *et al.* 2021).

It is important to note that dog kills do not fall into the traditional category of predation, such as that by endemic carnivores (e.g., Cuzzo *et al.* 2021), as these dog kills are rarely for consumption (see Figure 2). The bushbaby seen in this figure was killed in a suburban area, in a garden in Louis Trichardt, and was brought to the patio of the homeowner by the dog.

To illustrate the varied threats of domestic dogs to *O. crassicaudatus*, we highlight here two of the 13 known kills listed in Table 1. One example comes from the Lajuma Research Centre, located approximately 45 km west of Louis Trichardt in the Soutpansberg Mountains. Lajuma has been the center of collaborative bushbaby research since 2013. This example is similar to eight of the other dog kills noted in Table 1, although the latter are without the life history data on the individual from Lajuma described below. This known individual, listed in Table 1 (from 2018) had been captured and examined four times from June 2015 to January 2018, shortly before his demise, as part of our longitudinal study. He was an older male with several physical challenges including having lost one eye, numerous soft tissue injuries, and severe dental pathologies including broken teeth, dental decay, apical maxillary canine abscesses, and a tooth comb worn nearly to the gum line. Yet, this male survived for nearly four years after the first examination in 2015. However, given his physical challenges it is likely that he was coming to the ground more frequently than expected, in search of food. His attack by the guard dogs at Lajuma occurred on the open lawn of the garden, which he was likely crossing to obtain food from a known fruiting *Ficus ingens* tree adjacent to the farmhouse. This is one example, again likely similar to the majority of documented dog kills listed in Table 1, of a greater bushbaby crossing a

**Table 1. Years and locations/type of documented domestic dog kills of *Otolemur crassicaudatus* (since 2014) in residential gardens or yards in northern Limpopo Province, South Africa. The “Levuvhu area” is located between the towns of Louis Trichardt and Thohoyandou.**

Year	Location	Type
2014(a)	Levuvhu area	agricultural farm
2014(b)	N of Louis Trichardt	residential farm
2015	Thohoyandou	residential/semi-urban
2017(a)	Levuvhu area	agricultural farm
2017(b)	Levuvhu area	agricultural farm
2018(a)	Lajuma Research Centre	Nature Reserve
2018(b)	N of Louis Trichardt	residential farm
2019(a)	Sigurwana Lodge	residential farm
2019(b)	Sigurwana Lodge	residential farm
2019(c)	Levuvhu area	agricultural farm
2020	Sigurwana Lodge	residential farm
2022(a)	Louis Trichardt	residential/semi-urban
2022(b)	NE of Louis Trichardt	farm



**Figure 2.** *Oryzomys crassicaudatus* killed by a domestic dog (March, 2022) in a garden of a residential area of Louis Trichardt, South Africa. Photograph by R. Bornman.

large open area, to obtain food, and therefore being susceptible to domestic dog attack.

A second example noted in Table 1, from 2015, provides a very different human-induced dog kill of a greater bushbaby. In this example, a group of dogs was used to kill a greater bushbaby in a village outside Thohoyandou, a larger town approximately 85 km east of Louis Trichardt. These dogs were used to intentionally attack the bushbaby, thought by a local individual to be a tokoloshe (Linden 2015; Tshikudo 2015), a malevolent creature common to belief systems among numerous cultural groups in South Africa (e.g., Brown 2008). Although very different than the majority of the domestic dog kills noted in Table 1, this does provide an example of the range of human-induced domestic dog kills of *O. crassicaudatus* in northern South Africa, likely being enhanced by habitat degradation and more frequent terrestrial movement by this bushbaby species.

As we document herein, dog kills (as well as documented road kills [e.g., Cuzzo *et al.* 2020; Linden *et al.* 2022]) indicate that the nocturnal thick-tailed bushbaby may be spending more time on the ground than previously known. Earlier work on forests within agricultural farms (Bearder 1974; Harcourt 1980) did note that *O. crassicaudatus* consumes terrestrial insects such as termites, but due to the challenges of behavioral observation of nocturnal primates, their actual time spent on the ground remains unknown. At our research site

of Lajuma, which is a primarily intact habitat, we have seen some terrestrial movement and foraging, including *Oryzomys* moving several dozens of meters on the ground between food patches. However, based on our recent year-long study documenting 244 *Oryzomys* encounters, none of these were on the ground (Sauter & Cuzzo unpublished data). This suggests that while *Oryzomys* can come to the ground to forage, this is not a common occurrence in mostly intact habitat and may be related to feeding on terrestrial invertebrates such as termites. Near human affected areas we have observed road kills of *Oryzomys* on primary and secondary roads in and around the Louis Trichardt area, often with no forest cover for 50 meters. Thus, as habitat is being reduced and individuals of this species need to cover longer distances between forest areas/patches, they may be more susceptible to predation by natural predators such as the caracal (e.g., Cuzzo *et al.* 2021) and also domestic and feral dogs as seen in other nonhuman primate species (e.g., Goldberg *et al.* 2008; Georgiev *et al.* 2019). Mitigation efforts are difficult to design, let alone implement, as dogs play a vital safety and protection role in South Africa and typically sleep outside the house at night. One possible form of mitigation would be for homeowners, farmers, etc. to ensure that food resources (i.e., open bowls of dog or cat food, garden bird feeders where fruits are provided) not be left accessible during evening hours, when bushbabies are active and may be attracted to

such food sources. Purposeful feeding of bushbabies, recorded at two properties in this study (one of which recorded two dog kills of *O. crassicaudatus*) should also be discouraged. Finally, awareness of the threat of domestic dogs to *O. crassicaudatus*, one of the largest extant nocturnal primates, and often viewed as being of “Least Concern” (e.g., Masters & Génin 2016), is the first step needed to develop a conservation plan for this species.

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