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Revised distribution for *Otomops martiensseni* (Chiroptera: Molossidae) in southern Africa

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ABSTRACT

We provide new data on the distributional range and abundance of the giant mastiff bat, *Otomops martiensseni* for which information on distribution and ecology are sorely needed. Because this species can forage at high altitudes, it is difficult to capture and most observations have been from caves and buildings. With the advent of new sonar gathering devices and analysis software, recording of echolocation calls can give unprecedented information on evasive bat species. Previous records from South Africa were restricted to the Durban area where several colonies in buildings were documented. No published records were available for Botswana. Our data expand the range of *O. martiensseni*in South Africa about 870km northward. However, this species' relative occurrence continues to be rare, composing <0.74% of all our recorded call sequences across the region. We provide the first evidence of *O. martiensseni* in Kruger National Park (KNP) and Mapungubwe National Park (MNP) in South Africa and from Molema Bush Camp in the Tuli Block of Botswana. Of the 13,449 call sequences analyzed in our study, 91 were determined to be from *O. martiensseni* and of these, 84 occurred in KNP. Our data show that *O. martiensseni* is more widely distributed in eastern South Africa than previously thought; however, this species is rare throughout the region and thus faces an uncertain future.

1. Introduction

The giant mastiff bat (*Otomops martiensseni*) is an IUCN listed species for which ecological and distributional data are deficient. This species has been reported throughout sub-Saharan Africa with a noncontiguous distribution from Burkina Faso, eastward through Nigeria, Chad, Central African Republic, South Sudan, Ethiopia, Uganda, Kenya, Tanzania, Zambia, Angola, Zimbabwe and north-western Mozambique. In addition, a small population exists in buildings in the Durban area of South Africa (Fenton et al., 2004; Monadjem et al., 2010). Because of its patchy occurrence and the fact that major colonies have declined severely (Hutson et al., 2001), the giant mastiff bat is listed as near-threatened (Mickleburge et al., 2004; Monadjem et al., 2010). Most data suggest that *O. martiensseni* is relatively rare within its distribution, but is found locally abundant in the KwaZulu Natal Province of South Africa (Fenton et al., 2002).

In the early 20th century, Chubb (1917) described colonies of bats roosting in buildings in Durban, South Africa as the species *O. icarus*. Although, this taxonomic designation is not widely recognized (Meester et al., 1986; Koopman, 1993; Bronner et al., 2003; Simmons, 2005), genetic comparisons among populations of *O. martiensseni* lacks parsimony because

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east Africa populations show cytochrome b and D-loop mitochondrial sequences distinct from those in Durban, whereas nuclear markers showed high genetic similarities between populations in Kenya and South Africa (Lamb et al., 2006, 2008). Other than the Durban records, the southernmost record of *O. martiensseni* was in southwestern Zimbabwe where a single individual was captured in 1978 (Fenton and Bell, 1981).

Throughout most of its range, *O. martiensseni* roosts in hollow trees (Decher et al., 1997) and caves (Mutere, 1973; Kock et al., 2005) where they occured in colonies of hundreds to tens of thousands of individuals (Kock et al., 2005). However, the colonies using buildings in Durban consisted of 30 or fewer individuals (Fenton et al., 2002).

The diet of *O. martiensseni* in Ethiopia consisted of 56% Lepidoptera (moths), 14% Isoptera, 10% Coleoptera, 8% Orthoptera with a remaining composition of Hemiptera, Neuroptera, Hymenoptera, and Diptera (Rydell and Yalden, 1997). Foraging has been noted to occur at altitudes exceeding 600 m above ground level (Fenton and Griffin, 1997), making this species very difficult to catch in nets, but individuals do fly within the range of ground-based sonar detectors. In addition, *O. martiensseni* performs unique flight maneuvers involving sequences of slide-slips that alternate to the left and right when making steep descents into caves (Norberg and Rayner, 1987).

With the improvement of sonar gathering devices and analysis software, the ability to document the distributional ranges of bat species has greatly advanced, especially for difficult to capture species (Fenton et al., 2002). We hypothesized that *O. martiensseni* is more widely distributed throughout sub-Saharan Africa than is currently known from the limited observations at roost sites. In addition, we predict that through the use of sonar capture, we will find *O. martiensseni* to be more locally abundant than previously thought.

2. Methods and materials

We deployed one or two Pettersson D240x bat detectors (Pettersson Elektronik, Uppsala, Sweden) positioned on tripods or hand-held, 1 m above the ground and angled 45° to the horizontal for two hours past the time of published sunset. On some occasions, when recording within the safety of research or tourists camps, we were able to deploy detectors unattended throughout the night (sunset to dawn). Also, on certain nights we sampled from 1 to 3 h after sunset while driving and pausing along road transects in order to briefly sample larger numbers of localities. Real-time sonar call sequences were recorded onto a PC laptop or onto a Samson H2 Zoom digital recorder (Samson Technologies, Hauppauge, New York, USA) from the D240x detectors and analyzed for call parameters using Sonobat 3.1 (SonoBat Inc., Arcata, Oregon, USA). SonoBat 3.1 uses FFT with 2048 frequency bins, Hanning window, and a 0.025 msec time interval (high precision) to calculate frequency data. To identify call sequences of *O. martiensseni*, we compared call duration, high frequency, and low frequency with published data from Fenton et al. (2004). We also calculated band-width and Fc (characteristic call frequency determined by finding the point in the final 40% of the call having the lowest slope or exhibiting the end of the main trend of the body of the call).

3. Results

3.1. Survey sites

We surveyed for *O. martiensseni* across 32 sites in KNP in both the dry (May and June, 2008 and 2009) and wet seasons (December, January or February 2010 and 2011). We also surveyed along the Limpopo River at two sites in MNP, South Africa and at the MBC in Botswana during the wet season in December 2011.

3.2. Vocalizations

The sonar calls of *O. martiensseni* consist of a frequency modulated sweep beginning and ending at relatively low frequencies audible to the human ear, with a narrow band width and long duration (Fig. 1), unique among African echolocating bats (Fenton et al., 2004). Some sonar calls gathered from KNP, MNP and MBC matched the call structure published for *O. martiensseni* (Fenton et al., 2004).

A total of 13,449 analyzable call sequences were recorded throughout our study. Of these, 91 were distinguished to be those of *O. martiensseni*. Means and standard deviations as well as maximum and minimum values for five call structure variables are provided in Table 1 and call data for all 91 call sequences are presented in Appendix.

3.3. Relative abundance and new localities

In KNP we surveyed 32 sites (Table 2) and recorded 11,655 sequences of which 86 (0.74%) were confirmed as *O. martiensseni* from 11 of the 32 sites. In MNP, we recorded 1284 sequences of which two (0.16%) were from *O. martiensseni* and for MBC, 510 sequences led to three calls (0.59%) distinguished as *O. martiensseni*. Thus, calls recorded of this species foraging in any of our survey areas were rare. In MNP, we were restricted to collecting data from the private tourist camp where we censused at two sites. At our camp, we were able to keep the detector running all night and we captured two sonar passes by *O. martiensseni*. We also sampled for sonar calls near a swimming pool about 0.5 km from our camp. Although bat activity was high, no sonar sequences were recorded from *O. martiensseni* (Table 2).