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Note and record

Life-history patterns of the Sitatunga (*Tragelaphus spekii*) at Mbeli Bai, northern Congo

Marie L. Manguette[1,2], Kelly W. Greenway[1], Vidrige H. Kandza[1], Mireille Breuer-Ndoundou Hockemba[1], Franck B. Mavinga[1], Richard J. Parnell[3], Emma J. Stokes[3] and Thomas Breuer[1,3]*

[1]*Mbeli Bai Study, Nouabalé-Ndoki National Park, Wildlife Conservation Society, B.P. 14537, Brazzaville, Congo,* [2]*Department of Primatology, Max Planck Institute for Evolutionary Anthropology, Deutscher Platz 6, 04103, Leipzig, Germany and* [3]*Global Conservation Program, Wildlife Conservation Society, 2300 Southern Boulevard, Bronx, NY, 10460, U.S.A.*

Introduction

Due to their elusive behaviour, there is a paucity of life-history data on free-ranging rain forest ungulates (but see Korte, 2008; Mockrin, 2010). This includes the Sitatunga (*Tragelaphus spekii*), a large sexually dimorphic antelope restricted to inundated habitats throughout Africa (May & Lindholm, 2013). Previous reports on Sitatungas were mostly based on opportunistic observations (Games, 1983; Williamson, 1986; Starin, 2000), captive populations (Densmore, 1980) or short-term studies (Owen, 1970; Magliocca, Quérouil & Gautier-Hion, 2002). Sitatungas regularly visit forest clearings known as 'bais' (Vanleeuwe, Cajani & Gautier-Hion, 1998; Parnell, 2002) permitting direct observations of known individuals and the documentation of their natural history and demography (Magliocca, Quérouil & Gautier-Hion, 2002). Here, we provide the first long-term data set on life-history traits of a Sitatunga population at Mbeli Bai in northern Congo.

Materials and methods

This study utilizes a 20-year data set (February 1995–March 2015) on the Sitatungas visiting Mbeli Bai (2°15.5′N 16°24.7′E) a 12.7 hectare natural forest clearing in the south-west of the Nouabalé-Ndoki National Park, Republic of Congo. The vegetation is semideciduous with a dry season of less than 100 mm rainfall between December and February. Both the Sitatunga population and the surrounding forest are undisturbed, with illegal hunting levels maintained at zero and no previous history of logging. All observations were made from a 9-m-high viewing platform providing almost 100% visibility (Parnell, 2002; Breuer *et al.*, 2009). Data were collected by various researchers on an almost daily basis with the exception of a 3-month period between 1997 and 1998 due to civil war. Sitatungas were identified with the help of identification cards and digital photos using features such as size, pelage coloration, horn shape and striping patterns specific to each individual. All new individuals (either born in or coming from outside the population) were sexed, aged and considered immigrant if they had not been previously identified. Both males and females show natal dispersal with only a small portion of individuals born into the population showing philopatry (Mbeli Bai Study, long-term data), explaining small sample size of some parameters, such as age of first birth. Our analyses were limited to births for which the dates were known within ±30 days. We excluded data from two resident females because of the rarity of their visits. We also removed cases where the length of the interbirth interval was at least double the length for that female with an otherwise consistent interbirth interval (larger than 15 months) as this indicated that we had likely missed a birth. We carried out nonparametric statistical tests using the package 'coin' (Hothorn *et al.*, 2008) and the package 'circular' (Agostinelli & Lund, 2013) for seasonal analysis in R (R Development Core Team, 2014). We recognize the limitation of this analysis due to the large proportion of dispersing and unsexed individuals dying early.

Results and discussion

A total of 124 Sitatungas (42 females, 54 males and 28 unsexed infants) were monitored over 247.15 Sitatunga years. Twelve individuals were present at the beginning of

**Correspondence:* E-mail: Thomas Breuer tbreuer@wcs.org

the study, 79 were born into the population and the remaining 33 individuals immigrated into the population. We rarely observed copulations, but in two cases, females known from birth were mounted for the first time at the age of 1.28 and 1.39 years. Females had their first offspring at 2.30 ± 0.32 years (range: 2.00–2.79; n = 5) (Table 1) always giving birth to a single young. The overall birth sex ratio was not significantly different from unity (Binomial test: $n_{fem} = 28$, $n_{male} = 24$, $P = 0.339$; 27 unsexed infants). We could not find any evidence for birth seasonality (Rayleigh test of uniformity: $r = 0.095$; $P = 0.563$). Interbirth interval averaged 8.88 ± 0.72 months (range: 7.50–11.10; n = 40 intervals of seven females) (Table 1). The sex of the offspring at birth did not influence interbirth interval (Mann–Whitney *U*-test: U = 134, $n_f = 13$ (9.24 months), $n_m = 17$ (8.70 months), $P = 0.336$). Infants born into the wet season were not born with a different interbirth interval that those in the dry season (U = 122, $n_{wet} = 33$, $n_{dry} = 7$, $P = 0.831$). Infants were last seen suckling at 2.92 ± 0.50 months (range: 1.97–2.92; n = 13) with no significant difference between males and females (U = 22, $n_{fem} = 7$, $n_{male} = 6$, $P = 0.918$). Most offspring were observed moving separately from the mother at 4.78 ± 1.23 months (range: 2.99–7.13; n = 19) with no significant difference between males and females (U = 47.5, $n_{fem} = 8$, $n_{male} = 11$, $P = 0.794$). The emergence of horns was first evident at 9.74 ± 0.67 months (range: 8.71–10.48; n = 5) and coincided with the darkening of the pelage, starting first on the neck, followed by the fading of the stripes. Horn and body size of males were fully developed at approximately 4 years.

Based on our preliminary data on adult life expectancy, females reached up to 16 years of age in our population while males reached approximately 10 years of age. We witnessed the death of two females, one to a python (*Python sebae*) and another to a suspected snake bite. One adult male died from exhaustion following an aggressive interaction with a dominant male (Breuer & Ndoundou-Hockemba, 2008). Four males died during a *Stomoxys* sp. fly outbreak in 1997 (Elkan, Parnell & Smith, 2009). Effects of senescence, such as longer interbirth intervals, weaker body condition or reduced activity have not been witnessed at Mbeli Bai.

Reproduction in Sitatungas in this population seems to be almost continuous but not synchronized. Courtship and copulation have been observed as early as 4–15 days after giving birth, suggesting that postpartum ovulation occurs. Taking into account interbirth intervals, we estimated that gestation length in our population to be approximately between 228 and 338 days, which is longer than the previously reported 165 day period (Magliocca, Quérouil & Gautier-Hion, 2002), but similar to the 247 days (range 225–258) found in captive Sitatungas (Densmore, 1980). Based on the above findings, we propose the following age categories for Sitatungas: infant: 0–3 months; juvenile: 3–9 months; subadult female: 9–16 months; subadult male: 9–16 months; adult female: >16 months; young adult male; 16 months to 4 years; adult male: >4 years. Further studies are needed to understand the reproductive

Table 1 Summary of adult females and their life-history patterns[a]

Name of adult female	Status	First observed	Last observed	Interbirth interval in months (average, range, sample size)	Age at first copulation (years)	Age at first birth (years)
Alice	Immigrated	10 September 2011	31 March 2015	8.51, 8.18–8.84, n = 2	–	–
Jane	Born in	22 January 1999	10 July 2004	8.67, 8.40–8.90, n = 3		2.79
Meg (daughter of Miranda)	Born in	28 February 2006	31 March 2015	8.84, 8.41–10.63, n = 9	1.39	2.36
Michou (daughter of Meg)	Born in	02 July 2008	16 July 2012	9.48, 8.80–10.17, n = 2	1.28	2.00
Miranda	Was in population	01 February 1995	26 September 2006	9.24, 8.07–11.10, n = 11	–	–
Sake (daughter of Suzy)	Born in	08 October 2011	31 March 2015	8.43, 8.12–8.74, n = 2	–	2.05
Suzy	Immigrated	27 June 2001	21 October 2012	8.66, 7.50–9.63, n = 11	–	–
Naomie	Born in	20 March 2012	27 March 2015	–	–	2.34

[a]See Materials and methods for explanation on excluded cases.

biology, migration patterns and population dynamics of the elusive Sitatunga, and studies at bais can help to provide such knowledge.

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