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Elephants for Africa: male Savannah elephant *Loxodonta africana* sociality, the Makgadikgadi and resource competition

K. E. EVANS[1,2]
[1]*Elephants for Africa, 5 Balfour Road, London N5 2HB, United Kingdom, and* [2]*Honorary Research Fellow, University of Exeter, Exeter, Devon EX4 4SB, United Kingdom*
E-mail: kate@elephantsforafrica.org

The resurgence of the Boteti River, at the western border of the Makgadikgadi Pans National Park (MPNP), has had a large influence on the importance of this area in the framework of ecosystem conservation in Botswana and, in particular, for the movement of elephants into historical rangelands. The River represents a hard border to the MPNP and community lands to the east. Cultural knowledge about how to deal with elephants is deficient because of the lack of recent exposure to this species, aggravating the issues in the region. Working towards human–elephant coexistence, Elephants for Africa's research focuses on the social and ecological requirements of male Savannah elephants *Loxodonta africana*, alongside those of the human population, and applies this in the context of human–wildlife resource competition in the region. Strong partnerships with the communities bordering the MPNP and engaging a local non-governmental organization board of experts to guide our work are the foundation of evolving working solutions to decrease the socio-economic impacts of living alongside elephants. The Boteti River and the MPNP constitute a key area for the long-term sustainability of populations of large mammalian species, including elephants.

Key-words: animal welfare; community outreach; elephant conservation; environmental education; male elephant ecology; management; social ecology; social networks.

INTRODUCTION

In Africa, the Savannah elephant *Loxodonta africana* is facing a very uncertain future as the demand for ivory fuels poaching throughout their remaining range states. However, the anthropogenic threats to their long-term survival do not end there; competition for resources with humans also poses a major threat, which will only increase as human populations continue to grow and climate change affects protected-area habitats making them unsuitable for the biodiversity they currently sustain (Chase & Griffin, 2009; Wittemyer *et al.*, 2014; Thouless *et al.*, 2016).

Contrary to other range states, Botswana's elephant population has increased in recent times (Thouless *et al.*, 2016). Ecological changes in the north of the country resulted in the Okavango Delta being much wetter for a period, particularly on the western side (Wolski & Murray-Hudson, 2008; Bennitt *et al.*, 2014; pers. obs). Furthermore, the flow of the Boteti River is highly variable and dependent on local rains as well as rains in Angola that flow into the Okavango Delta (Vanderpost & Hancock, 2018). The resurgence of the Boteti River in 2009, after a 19 year dry period, has had an impact on the region. Elephants have re-established themselves in historical areas and there has been a significant expansion of their range in Botswana (Thouless *et al.*, 2016). However, since the historical presence of elephants in these areas, the number of people residing there has increased, bringing people and elephants into ever-increasing contact, with detrimental impacts on both sides (Chiyo *et al.*, 2005; Thirgood *et al.*, 2005; Jackson *et al.*, 2008; Songhurst, 2010). Thus, Botswana faces different challenges for elephant

conservation compared with other range states, because of a large elephant population (Thouless *et al.*, 2010) and low (although increasing) poaching levels (Schlossberg *et al.*, 2019), and the primary peril for elephants is competition with humans for resources (Songhurst, 2010).

Throughout history male elephants have been the principal target of poachers and hunters, because of their bigger, heavier tusks; therefore, males have experienced relatively heavier anthropogenic pressure than females. The males are also the primary crop-raiders (Jackson *et al.*, 2008; Underwood *et al.*, 2013). However, least is known about male African elephants and, until recent times, it was thought that they were predominantly solitary and probably of little importance to elephant social systems once past their reproductive prime. However, this is far from the case, with males selecting who they spend time with and older bulls having important roles to play in bull society (Slotow *et al.*, 2000, 2001; Slotow & van Dyk, 2001; Evans, 2006; Chiyo *et al.*, 2011; Pitfield, 2017).

In the wild, males spend time in areas inhabited primarily by bulls that are located away from where the majority of the female population resides (Evans, 2006; Evans & Harris, 2008; Lee *et al.*, 2011). An extreme example of a bull area is the Makgadikgadi Pans National Park (MPNP), where Elephants for Africa (EfA) has been based since 2012 and where 98% of sightings are of male elephants.

EfA has always focused research efforts on male elephants to redress the balance of the bulk of the research on elephants to date. By collecting data on males, the aim is to contribute to our understanding of their social and ecological needs, identify the possible drivers of negative interactions with humans and facilitate the improvement of their welfare in captivity. The greater our understanding of the social and ecological requirements of both male and female elephants, the more likely it will be that viable elephant populations will be conserved into the future.

RESEARCH

The foundations of EfA's work started in 2002 in the western Okavango Delta focusing on male elephants, and their social and ecological needs in an area predominately inhabited by bulls. Supported by Elephant Back Safaris Ltd, an element of the work was to release captive-raised elephants to the wild (Evans, 2006; Evans *et al.*, 2013a,b). Additional support and funding for this research was secured from Columbus Zoo and Aquarium (Powell, OH, USA) and the Chicago Zoological Society (Brookfield, IL, USA). In 2008 this study area became much wetter as the Delta entered a wet phase transforming the environment and making it more accessible to female elephants. Whilst sightings of female herds were becoming more frequent in the area, observations of younger bulls were also increasing and those of the mature bulls decreasing (Elephants for Africa, unpubl. data). Concurrently there were reports of large aggregations of male elephants moving into and utilizing the MPNP (C. Brooks, pers. comm.; J. Bradley, pers. comm.). Therefore, in 2012 EfA relocated from the Okavango Delta to the MPNP to research the predominately male population of elephants in the Park and address the high levels of reported human–elephant interactions in the region.

Preliminary research conducted by our affiliated students, investigating the economic and personal costs of living alongside wildlife in the region in consultation with local stakeholders, drives and directs EfA's current and future research and outreach programmes in this area (Mayberry, 2015; Walker *et al.*, 2015, 2017; Chamberlain, 2016; Walker, 2016; Mayberry *et al.*, 2017; Stevens, 2018). Elephants have a significant effect on the economics of the region by negatively impacting both livestock and arable farmers (Walker *et al.*, 2015, 2017; Chamberlain, 2016; Walker, 2016; Stevens, 2018). As in other areas, it is not only the direct costs associated with the damage caused by elephants but also

indirect consequences (e.g. loss of educational hours) that affect the communities living alongside elephants and their future potential (Naughton-Treves, 1998; Kuriyan, 2002; Gadd, 2005; Mayberry, 2015; Mayberry *et al.*, 2017). Many of the communities on the western boundary of the MPNP have not had to deal with elephants for a generation or more because the Boteti River was dry following a lack of rainfall. This has resulted in a loss of the cultural knowledge of how to live alongside these animals, multiplying the challenges in this region. In a study to investigate the impacts of living near wild elephants, Mayberry (2015) found that:

- 71% (n = 24 of 34 respondents) of people interviewed reported that elephants threaten their safety;
- 56% (n = 34 of 61 respondents) stated that living alongside wildlife restricts their mobility in the community and immediate surroundings;
- 68% (n = 32 of 47 respondents) felt that the elephants inhibited their access to veld resources;
- 64% (n = 32 of 50 respondents) felt that elephants hindered their access to drinking water;
- 58% (n = 26 of 45 respondents) said that living near wild elephants disturbed their relations with neighbours.

These factors contribute to the additional psychological stress for those living alongside elephants as they anticipate raids (Sutton, 1998).

The EfA experience of researching elephants in two different ecosystems in the same country highlights the need for long-term studies, and the value of local data on behaviour showing the plasticity of male elephant social context, and the importance of applying this for the benefit of local stakeholders. In addition, these data will guide both national and international conservation and management policies for the Savannah elephant throughout its range in Africa. The EfA research methods involve identifying individual elephants within the population, which not only contributes to the long-term monitoring programme but also makes it possible to investigate the social network of male elephants. This research has revealed that males are far from solitary and that they actively choose whom they spend time with (Evans, 2006; Evans & Harris, 2012; Pitfield, 2017). Studies have shown that the MPNP elephant population harbours a non-resident, predominantly bull population, with males spending an average of 47 days in the study area and 238 days outside (Pitfield, 2017). This fact begs the question of where the males are going and how they spend their time outside of the Park, as well as the potential importance of the area for elephants moving to and from protected areas. With elephants being sighted further south in the Central Kalahari Game Reserve (Chase, 2009) it is likely that some leaving the MPNP are moving through human-inhabited areas to get there; likely aggravating the antagonistic interactions with humans. With 84% of African elephant habitat outside of protected areas (Blanc *et al.*, 2003), understanding when and how elephants utilize these areas will help us to address the issue of the growing competition for resources; for example, through the provisioning of wildlife corridors, communicating with elephants by indicating where not to go through the use of mitigation tools (e.g. chilli burning), and encouraging cooperative farming and conservation agriculture to increase yield. Changes to farming practices would offset any losses of crops to elephants and increase the time available for community members to diversify income, which would improve the economic robustness of the whole community. These sorts of solutions can be used to address the future needs of both humans and elephants in this dynamic and challenging landscape.

As well as identifying individual elephants their ages are also estimated (Hanks, 1972; Western *et al.*, 1983; Lark, 1984;

Lee & Moss, 1995). EfA has been working with many zoological institutions, but principally Maryland Zoo in Baltimore (MD, USA), to obtain tracks from known-aged individual elephants. The tracks gathered are given to WildTrack (http://wildtrack.org) to be added to their footprint-identification database. These tracks contribute to a program that is being developed to assist with how to age wild elephants and the possible identification of individuals.

EDUCATION

A large focus of the work of EfA is making sure that our findings positively impact and improve the daily circumstances for the people who live on the border of the MPNP. In order to achieve this, since 2012 EfA has worked hard to build trust with the communities neighbouring the Park. Developing relationships and trust building reflect the largest challenges faced in facilitating the needs and concerns of the people who live in close proximity to wild animals. However, this investment has paid dividends because the communities themselves are now requesting the assistance of EfA, and helping to shape the education and outreach programmes. The foundation of much of the education programme was initialized with the assistance of the Education Team at Chicago Zoological Society, sharing their expertise and personnel to build a long-term education programme focused on primary-school children and environmental educators. In 2014, an Education Advisory Board (EAB) was established to help build a culturally appropriate community-outreach programme, addressing the skills gaps to ensure that future school graduates will be more employable in the environmental sector. The EAB members are dedicated and skilled professionals from an array of backgrounds, including an officer of the Ministry of Education, teachers, lodge owners and guides. These individuals now form the Board of the EfA non-governmental organization, which was registered in Botswana in January 2016. In late 2015, the Community Coexistence Project (CCP) of EfA was launched, guided by previous research and the EAB. The CCP currently focuses on two main stakeholders – primary-school students and farmers, – with a growing programme for youth (18–35 years of age) launched in 2018. In 2017, a Community Outreach Officer was employed, with support from the GoodPlanet Foundation (Paris, France), Columbus Zoo & Aquarium, and Pittsburgh Zoo (PA, USA), to head up outreach work including the schools' education programme.

Partnering with the Environmental Clubs of three primary schools in the region, EfA delivers monthly activities, incorporating hands-on learning experiences, to bring science and the local environment to life. Taking children out into their surrounding habitat to observe wildlife provides an opportunity to learn key skills that will be useful for future employment within the environmental sector, such as tracking, observation and identification. The aim is to take committed club members into their National Park, an area that their communities border but few people have actually had the opportunity to visit. These trips are led by local safari guides, giving the children (and adults) the opportunity to meet with and learn from local role models. The time spent with the educational staff of Chicago Zoological Society and Zoo Atlanta (GA, USA) led to connections being made with schools in the United States and the development of a pen-pal scheme within the schools' education programme.

Alongside the pen-pal scheme, the education programme reaches beyond the borders of Botswana. The EfA team gives regular educational and public seminars in southern Africa, Europe and the USA as well as attending conferences and workshops to share their findings, experiences and passion for the work. A long-term affiliation with the Elephant Managers Association (EMA) (Houston, TX, USA) mirrors the bottom-up approach that EfA uses to achieve the behavioural change aimed for in community partners, opening up

communication about the welfare of captive elephants, particularly in the context of males. Keepers from zoos are encouraged to visit Botswana to see how wild elephants behave in their natural habitat, so they can share their experiences with senior zoo staff and the EMA. After observing elephants in the MPNP, the keepers should not only have a better understanding of the elephants at their own institutions but also may be able to improve routine management practices. To date four elephant keepers have been welcomed from the Memphis Zoo (TN, USA), sponsored through their Conservation Action Network grant award, to contribute to EfA's research and educational programmes, and more are expected in the future. This personal contact with active staff has led to the development of a long-term partnership, and the keepers have led and organized an annual fundraiser to support the work of EfA.

The lack of research and open dialogue about male elephants in the past may well have influenced how they are cared for in captivity, with the notion that they were solitary post-independence from their natal herd reflected in most *ex situ* management strategies. Of the male elephants recorded in the North American studbook for the African elephant, 63% had no male companion (Olson, 2011). The Association of Zoos & Aquariums standards state that males of 6 years or older can be housed alone, although not in complete isolation (Association of Zoos & Aquariums, 2011); however, in the wild, independence occurs between the ages of 10 and 19 years (Poole, 1982). Early removal from the herd may be a consequence of elephants in human care, where both males and females become reproductive at an earlier age than wild counterparts (Schaftenaar & Hildebrandt, 2009). While males as young as 5 years of age spend time away from their family unit (Lee *et al.*, 2011), male elephants of < 10 years of age are rarely sighted alone in the wild (Evans, 2006; Elephants for Africa, unpubl. data). Social interaction with male elephants is important throughout the life stages of all male elephants (Poole, 1982; Evans, 2006; Evans & Harris, 2008; Chiyo *et al.*, 2011; Lee *et al.*, 2011).

CONSERVATION

Elephants for Africa works in the MPNP and surrounding areas where the resurgence of the Boteti River in 2009 had a large influence on the importance of this area in the framework of ecosystem conservation in Botswana; in particular, for the movement of elephants into historical rangelands reflected by recent range expansion (Thouless *et al.*, 2016). The geographical position of the MPNP highlights the importance of understanding how elephants utilize and navigate through lands outside of protected areas. This is particularly relevant for males, who are less dependent on water and can thus move larger distances than females (Gibson *et al.*, 1998; Stokke & du Toit, 2000). Situated on the edge of the densely elephant-populated northern regions, the MPNP could provide an important stopover for elephants expanding their range. The Makgadikgadi complex forms part of the Northern Conservation Area that also comprises the Okavango Delta and Chobe area, and is one of the last remaining functioning ecosystems on the African continent (Brooks & Bradley, 2010; Bartlam-Brooks *et al.*, 2013). The MPNP likely provides a connection between the northern rangelands and protected areas to the south. To reach these protected areas, elephants must navigate through communal and commercial lands, where the dangers to both elephants and people are greatly increased. Gaining insight into factors that determine such movements will be valuable to all stakeholders, with communities and commercial farmers being able to tailor mitigation strategies accordingly. The vision of Botswana's National Spatial Plan – to have green corridors linking the Chobe Enclave in the north and the Kgalagadi Transfrontier Park in the south, thereby connecting all the major protected areas – will be

impacted by this work, allowing government decision makers to designate the corridor in the most appropriate location for both people and wildlife.

SUMMARY

Botswana has some clear advantages over other elephant range states when it comes to the long-term survival of their elephant population, with a low human population and over a third of the land designated for wildlife. These conditions have supported the largest remaining population of Savannah elephant, a population that is now highly mobile recolonizing historical rangelands. However, these rangelands also contain human populations that are concurrently undergoing changes, especially increasing urbanisation of younger cohorts leaving the older generations to farm (National Research Council, 2006; Heide-Ottosen, 2014; Reardon *et al.*, 2015). As the needs and requirements of both wildlife and humans change, the question is how can we best prepare to meet the requirements of both by enabling long-distance movement of large mammals inside and outside protected areas, while maintaining and improving the prosperity of rural livelihoods? The only way to achieve all this is by having a concerted effort with a multidisciplinary approach involving local, national and international stakeholders, working in partnership with experts, such as nutritionists, behavioural ecologists, anthropologists and social geographers.

In order to ensure that there will be stable, viable populations of elephants in the future, the social and ecological requirements of these species have to be taken into consideration, particularly the males, to provide appropriately for the long-term conservation and welfare of both *in situ* and *ex situ* populations. By studying the behaviour of male elephants in Botswana, and engaging in a wide-scale education programme, EfA is adding to the knowledge about the behaviour of elephants and the needs of local communities to move closer to achieving these goals.

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PRODUCT MENTIONED IN THE TEXT

WildTrack: footprint identification technology, developed by Sky Alibhai & Zoe Jewell, WildTrack, SAS Institute (JMP Division), Cary, NC 27513, USA.

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