Distances between individuals in an artificial herd of African elephants (*Loxodonta africana africana*) during resource utilisation in a semi-captive environment

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A R T I C L E   I N F O

A B S T R A C T

Space allowance and resource dispersion is recognised as an important factor affecting the welfare of elephants in captivity. In the present pilot study, we investigated distances kept among individuals in an artificially created semi-captive mixed-sex group of African elephants, when individuals were free to disperse. The study involved a herd of six elephants, three females (aged 11 to 16 years), and three males (aged 15 to 23 years). They were observed through instantaneous scan sampling in order to assess distances between individuals and body orientation in space and through continuous focal animal sampling to assess inter-specific social behaviour and general activity. A total of 312 suitable scans were collected for evaluation of distances between individuals. While foraging in absence of discernible space constraints, elephants maintained a distance equalling five or more body lengths in 63.9% of the scans, with wide differences between dyads. Little social behaviour, mainly affiliative, was recorded.

The results of this pilot study suggest further scientific investigation could help to understand whether placing resources at five body lengths distance or over in a controlled environment could increase their simultaneous utilisation by all members of a group and contribute to decrease aggression. However, caution is warranted when applying results to different groups, environments and management regimes.

1. Introduction

Space allowance is recognised as an important factor affecting the welfare of elephants in captivity (Meehan et al., 2016). An elephant in the wild can use between 34 km^2 and 6400 km^2 over his lifetime: the home range changes depending on the availability of resources (Schulte et al., 2006). The space required is also highly influenced by social relationships (American Zoo and Aquarium Association, 2011; Elefanten Schutz Europa e.V. European Elephant Group, 2014). EAZA (European Associations of Zoo & Aquaria, 1997, as cited in Clubb and Mason, 2002) and AZA (American Zoo and Aquarium Association, 2011) prescribed minimum sizes of elephant enclosures in captivity (Clubb and Mason, 2002; American Zoo and Aquarium Association, 2011), even though, in the same document, they state that suitable space is the most difficult requirement to standardise and quantify. This lack of scientific reference is due to several reasons. Many variables, such as individual history and temperament, health, level of social

adaptation, and management settings influence the use of space and are therefore of paramount importance in assessing enclosure space suitability (American Zoo and Aquarium Association, 2011; Olson, 2004). Moreover, differing management of the elephants hinder standardisation in the studies (Meehan et al., 2016). Also, different welfare indicators often do not co-vary with available space in different studies (Miller et al., 2016; Lewis et al., 2010; Holdgate et al., 2016). Last but not least, specific welfare requirements and indicators for wild animals in captivity, including space allowance, have not been as extensively researched as those of farm and laboratory species (Mason and Veasey, 2010). Therefore, it is not unusual to find official or internal documents recommending that "sufficient space and environmental complexity" has to be provided to the elephants, without specifying how much space is sufficient or even how to assess whether space is sufficient (American Zoo and Aquarium Association, 2011). However, one of the requirements on which there appears to be agreement in the welfare literature is that there should be enough space to enable subordinate animals to

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withdraw from threats and aggressive attacks from conspecifics (e.g., Wiedenmayer, 1995, as cited in Clubb and Mason, 2002; American Zoo and Aquarium Association, 2011; Flauger and Krueger, 2013; Li et al., 2007) and that resources should be provided to the animals in a number of ways and in such a manner that they can be used by all animals simultaneously and are not monopolised by one or a few individuals (Stoinski et al., 2000; Paquette and Prescott, 1988). The use of exhibit and resources in a captive environment has been studied in a herd of five adult African elephants through GPS, finding that hierarchy impacts the percentage of occupied space and may influence resource accessibility (Leighty et al., 2010). The need to spatially dispersing resources in captive environments has been recognised, but to our knowledge there are not enough studies investigating the distance kept by elephants in an artificial group (such as those in semi-captive circumstances) during foraging, when they are able to choose their individual distances without the space limitation of a zoo's enclosure. In many countries, there are no standards for minimum inter-individual distances (American Zoo & Aquarium Association, 2011). Germany's updated guidelines for zoo enclosures adopted the distance described by Kurt in the wild. He found that related adult Asian female elephants maintained a median of 18 m between them. Furthermore, the author found that the distance increased with age (Kurt, 2011). If another individual invades this "Comfort" distance, there might be withdrawal or aggression (Elefanten Schutz Europa e.V. European Elephant Group, 2017). However, different distances are observed in different circumstances: in the wild, Dornbusch observed an average distance of 8.21 m (min 1 m–max 55 m) between related female elephants in Tsavo East National Park (Dornbusch, 2017). Garaï (1997), observing different groups of translocated young orphaned African elephants, which grouped and dispersed in different ways, recorded distances of between 30 m and 100 m. Holdgate et al. (2016) showed that during the days in which food items were distributed more thoroughly in space, elephants walked longer distances to acquire them, but the scientists did not measure the distance between feeding sites.

Hence, the aim of the present pilot study was to investigate the distances elephants choose to maintain between one another in a mixed-sex herd when foraging in a semi-captive environment. While in captive environments elephants are fenced in enclosures for the whole day, a semi-captive environment provides a dynamic setting in which the elephants spend part of their daytime free to move in vast areas of bush without being fenced in or controlled, except in case of emergency. Hence a semi-captive environment was deemed valid to assess which distances the elephants choose to maintain between themselves in the absence of discernible external constrains.

2. Material and methods

2.1. Subjects

The study involved a herd of six elephants, three females, Amari (A, aged 16 years), Shanti (S, aged 14) and Madiwa (Ma, aged 11), and three males Mooketsi (M, 23 years), Bakari (B, 15 years) and Tebogo (T, 15 years). Mooketsi, the older bull, was the only animal in the herd treated with GnRH vaccine. None of the females exhibited oestrus signs during the observation period.

Five of the elephants were taken from the wild in 2008 (Amari and Shanti from Hoedspruit area, Limpopo province; Bakari, Tebogo and Madiwe from Sandhurst area, North West Province) and were housed in at least another facility before arriving at their present residence (Indalu Game Reserve). Mooketsi's origin is not specified in his Studbook. He was transferred at least twice and arrived in the same facility where the other elephants were hosted before being moved to Indalu. All elephants arrived at Indalu Game Reserve in 2012, and have been kept together ever since.
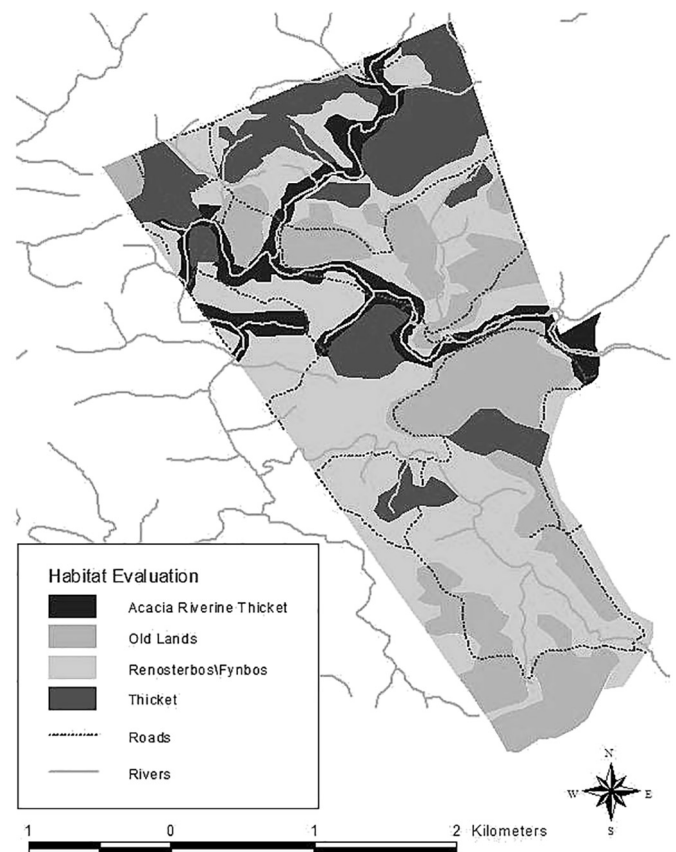

Fig. 1. Map of Indalu.

2.2. Area, housing and management

The study was undertaken at Indalu Game Reserve, a private reserve where the six elephants were housed. The reserve is about 750 ha in size and is situated in the Western Cape, South Africa, 30 km from the coast (− 34.179605, 21.805016). The territory comprises hills and valleys and is crossed by a seasonal river from East to West (Fig. 1). At the bottom of the valleys, when precipitations are abundant, there are several humid areas.

The reserve hosts different indigenous types of vegetation (Mossel Bay Shale Renosterveld, North Langeberg Sandstone Fynbos, Southern Cape Valley Thicket and Swellendam Silcrete Fynbos).

The vegetation of the reserve is characterised by thick bush, providing all elephants with equal access to edible resources at any given distance among individuals.

In December 2014 the reserve started offering "interactions with elephants" to tourists to whose presence, even if occasional, the elephants had become accustomed to since 2012. The interactions consist of "feeding" and "walking with" the elephants. "Walking with" is a 15 min' walk alongside the elephant. A handler walks in between, and explains the elephants' characteristics. The tourists can touch the elephants and take pictures. The number of daily interaction sessions depends on the number of tourists, going from zero to three. Only three elephants are involved in the interactions at any given time, and they are chosen randomly from the herd, except for Mooketsi, who is always part of the interaction.

During night-time, the elephants are kept in a 5 ha boma (i.e., pen) for security reasons. They are released around 7.30 am and brought back to the boma at 5 pm. In the boma, branches are provided in addition to the natural vegetation of the enclosure. During day-time, the elephants are herded around the reserve for the so-called "*Free Choice* activity", i.e. they are herded in an area of the bush where they are free