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A multi-enclosure study investigating the behavioural response of meerkats to zoo visitors

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ABSTRACT

The scientific literature indicates that visitors may affect both the behaviour and welfare of zoo animals. Captive born slender-tailed meerkats, *Suricata suricatta*, at three exhibits were studied under two treatments (1) unregulated visitor behaviour and (2) regulated visitor behaviour, where signage was positioned requesting visitors to be quiet and not to interact with the animals. At each exhibit, treatments were imposed using a four-replicate paired comparison design, with each pair consisting of 2 consecutive days of different treatments. Meerkat behaviour and location were recorded using instantaneous sampling every 2 min over a total of 72 h across exhibits. The efficacy of the regulated treatment in moderating visitor behaviour was evaluated by recording visitor noise using a decibel logger and by assessing the intensity of visitor behaviour (scale of 0–2 from passively observing to actively attempting to gain the animals' attention) every 2 min during each observation period. The regulated treatment was successful in reducing visitor noise at each exhibit by around 32% (from 55 to 51 dBA, $P = 0.0001$). Furthermore, while there was a significant interaction of exhibit with treatment ($P = 0.013$), the regulated treatment reduced the score of intensity of visitor behaviour at each exhibit. However, despite good experimental precision, the regulated treatment did not change the distance meerkats positioned themselves from visitors (regulated 2.9 m and unregulated 3.1 m, $P = 0.2$) or the proportion of time they engaged in vigilant behaviour (regulated 0.34 and unregulated 0.32, $P = 0.6$) or the proportion of time spent looking towards visitors (regulated 0.42 and unregulated 0.46, $P = 0.4$), indicating that the meerkats at the three study exhibits were behaviourally unresponsive to variation in the intensity of visitor behaviour.

1. Introduction

Most zoos aim to provide visitors with close contact with zoo animals on the basis that this may enhance visitor experience and ultimately contribute to conservation goals, a key mission of contemporary zoos (Clayton et al., 2008). However, the impact of visitor behaviour on zoo animals remains poorly understood in a range of species (Hosey, 2005).

Visitor number, behaviour and even demographic varies extensively within zoos and this variability may potentially benefit animal welfare for some species. Indeed, a

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handful of studies have suggested visitors are a source of stimulation for animals, especially if visitors are associated with food (Cook and Hosey, 1995; Margulis et al., 2003; Nimon and Dalziel, 1992). However, studies have also suggested that high visitor numbers have negative impacts on zoo animal behaviour (Smith and Kuhar, 2010; Stevens et al., 2013; Wells, 2005) and stress (Menargues et al., 2013; Pifarré et al., 2012; Rajagopal et al., 2011). Common animal behaviour responses to aversive visitor conditions include spending less time visible to the public (Birke, 2002; Sellinger and Ha, 2005), decreasing affiliative behaviours (Chamove et al., 1988; Glatston et al., 1984; Todd et al., 2007), and increasing aggression (Chamove et al., 1988; Rajagopal et al., 2011; Sekar et al., 2008) and abnormal behaviour (Mallapur et al., 2005; Sellinger and Ha, 2005; Skyner et al., 2004). These changes in behaviour not only highlight potential ethical concerns but also have implications for visitor experience.

The majority of studies investigating visitor effects on zoo animals have focussed on non-human primate species (Davey, 2007; Fernandez et al., 2009; Hosey, 2000). Zoo records show that even close taxonomic relatives can vary in response to the zoo environment (Mason, 2010). An animals' life history, previous experience and how they perceive humans will influence their response to visitors (Hosey, 2013). For example, the response of a prey species to humans is likely to differ from the response of a large predatory species. Some researchers have suggested small species could be particularly prone to negative effects from visitors as they may perceive humans as predators (Chamove et al., 1988; Mitchell et al., 1991). However, other factors such as previous experience with humans (Ellenberg et al., 2009) and extent of social learning (Stankowich and Blumstein, 2005) can also influence how an animal responds to humans. This variation in perception of humans highlights the importance of understanding the effect of visitors in a range of zoo species (Hosey, 2013).

Furthermore, previous studies have tended to focus on the effects of visitor number or presence or absence without taking into account other visitor variables such as visitor behaviour (Choo et al., 2011). Visitors vary in their behaviour directed at zoo animals, often in attempts to interact with individuals (Morgan and Tromborg, 2007). For example certain visitor behaviours such as shouting, waving, banging on glass and throwing objects could potentially be a source of stress for some species. This has been proposed in research into human–animal relationships in agricultural settings that demonstrated negative human interactions, such as loud noises and sudden movements can elicit fear and stress in livestock (Hemsworth and Coleman, 2011).

In this experiment, we studied small groups of meerkats, *Suricata suricatta*, as a model to investigate the effect of the intensity of visitor behaviour. Meerkats are a common zoo species and preliminary observations by the authors indicated that meerkat exhibits attract large crowds of visitors that often display behaviours such as waving, creating noise and throwing objects into the exhibits.

We used signage requesting visitors be quiet and not interact with animals as well as the presence of researchers in zoo uniform at three meerkat exhibits in two Australian Zoos to determine if (1) intensity of visitor behaviour at zoo exhibits can be effectively reduced, and (2) meerkat behaviour changes with reduced intensity of visitor behaviour.

Table 1
Characteristics of each meerkat group and exhibit studied.

Meerkat group	Number of males studied (total in group)	Number of females studied (total in group)	Enclosure area (m^2)
Melbourne Zoo[1]	2 (2)	2 (2)	45.4
Melbourne Zoo[2]	1 (1)	2 (5)	35.4
Werribee Zoo	1 (1)	2 (2)	77.6

These numbers are used to label the two Melbourne Zoo enclosures.

2. Materials and methods

2.1. Subjects

This research received ethics approval from the Zoos Victoria Animal Ethics Committee. The study was conducted at three meerkat, *S. suricatta* exhibits; two at Melbourne Zoo, Australia (hereafter referred to as Melbourne Zoo[1] and Melbourne Zoo[2]) and one at Werribee Zoo, Australia (referred to as Werribee Zoo). All meerkats were captive born. Data were collected on individuals, using physical characteristics to distinguish between animals. All individuals in two groups were observed, however in the other group only three of five individuals could be distinguished easily from physical characteristics and thus data for this group were only collected from these three individuals. Details of the meerkat group composition, visitor barriers and size of the exhibits are presented in Table 1. Exhibits varied in overall size and were open air, enriched with similar digging substrates, climbing structures and naturalistic furniture such as trees, logs and artificial mounds (Table 1 and Fig. 1). At each exhibit, meerkats had 24 h access to off-display dens. Husbandry routines for each exhibit were constant across the study period. For each exhibit, there was one central viewing area for visitors (ranging from 6 m to 7.6 m across, Fig. 1). At the two Melbourne Zoo exhibits, the two barriers (one at each exhibit) were 1.2 m-high glass panels and at the Werribee Zoo exhibit, the barrier was a dry moat with a 1.2 m wooden fence, separating visitors from meerkats by at least 2.7 m.

2.2. Procedure

2.2.1. Two treatments were studied

(1) *Unregulated visitor behaviour (Control treatment)*: no visitor regulation was imposed and observers were inconspicuous by wearing casual clothes and using a voice recorder for behavioural observations

(2) *Regulated visitor behaviour (Experimental treatment)*: the objective of this treatment was to reduce visitor noise and attempted interaction with the meerkats through the presence of signage positioned at the viewing area stating:

> "Research in progress. Please be as quiet as possible and do not attempt to interact with the animals"