



Number of nearby visitors and noise level affect vigilance in captive koalas



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ABSTRACT

Understanding human-animal interactions is particularly important for institutions that display animals to the public due to the frequent, and sometimes intense, interactions with unfamiliar humans. Past research has shown that visitors can have a negative impact on the welfare of a wide range of captive zoo species through an activation of the stress response, which influences energy metabolism. The koala (*Phascolarctos cinereus*) evolved on a specific diet of extremely low energy content and is therefore likely to be particularly susceptible to any effects from stress. However, the knowledge of visitor effects on captive koala behaviour and welfare is almost non-existent. The effects of visitor number (Study 1) and visitor noise (Study 2) were investigated in a population of captive koalas. In Study 1, behavioural observations were conducted on koalas across a total of eight days: four days of high visitor attendance and four days of low visitor attendance. Scan sampling was used every 2 min to record individual koala behaviour, position in enclosure and proximity to the boardwalk. The number of visitors within a 5 m radius on the boardwalk, hereafter referred to as 'nearby visitors', was also recorded for each scan. In Study 2, the effect of visitor noise was investigated using audio recordings of visitor noise taken from the study site in three levels of treatment (No visitors, Quiet visitors and Loud visitors). Each koala was randomly allocated each noise treatment once daily over eight days and the presence or absence of vigilance behaviour was recorded. Study 1 demonstrated that an increase in the number of nearby visitors, but not total daily visitor number, resulted in increased time spent vigilant in the koalas. Study 2 showed that an increase in visitor noise treatment resulted in increased time spent vigilant in the koalas. These results show that koalas do respond behaviourally to visitors, supporting the value of behavioural observations as a monitoring tool to assess visitor-related disturbance in koalas. The welfare implications of these behavioural changes remain to be determined, as well as adequate management strategies to minimise negative visitor effects.

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1. Introduction

Visitors to zoological parks and wildlife sanctuaries often seek close-encounter animal experiences and prefer to watch and engage with animals that are active and easily viewed (Fredline and Faulkner, 2001; Woods, 2002). This can attract more visitors which in turn increase resources to fund efforts toward conservation and welfare goals. Visitors are thus an integral feature of the zoo environment.

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It has been suggested that humans can be a source of stimulation, possibly providing environmental enrichment (Claxton, 2011). However, in most cases, the forced proximity to humans in zoos could be a source of fear and stress for species that rarely come into contact with humans in their natural environment (Morgan and Tromborg, 2007).

Negative effects from visitors on the welfare of captive animals have been shown in various species (Schetini de Azevedo et al., 2012; Trone et al., 2005), with a stress response commonly suggested as the underlying mechanism for changes in behaviour (Chamove et al., 1988; Mallapur et al., 2005; Sellinger and Ha, 2005). For example, Mallapur et al. (2005) studied Lion-tailed Macaques housed in eight Indian zoos and found that the frequencies of abnormal behaviour (self-biting, begging and bouncing) were significantly higher on days when visitors were present than on days when visitors were absent. High visitor density has also been associated with increased aggression, repetitive teeth clenching and body rocking in gorillas (Wells, 2005). It is clear that any negative changes in behaviour attributed to visitors is of concern for zoos and wildlife parks as it can be deleterious for animal welfare and visitor experience. Despite a number of studies investigating relationships between visitors and changes in animal behaviour, the visitor effect remains poorly understood across a range of taxa (Davey, 2007; Hosey, 2005). This may be a result of methodological challenges associated with conducting experiments in zoos and the difficulty to control confounding variables. However, another significant gap in the literature is the lack of studies on non-primate species.

The koala (*Phascolarctos cinereus*), an arboreal folivorous marsupial, is an iconic symbol of Australia and a major ecotourism attraction for international and domestic visitors (Higginbottom et al., 2004). There is great demand for tourists to view koalas and numerous zoos and wildlife parks in Australia and around the world keep koalas in captivity, usually restricted to hands-off experiences that focus on close viewing only. Nonetheless, hands-on encounters are also available in a number of zoos and parks which allow visitors to pat, feed, and even hold koalas.

The koala evolved on a specific diet of *Eucalyptus* leaves which have extremely low energy content and are difficult to digest and process (Logan and Sanson, 2002). Koalas have thus adapted their physiology and behaviour to minimise energy expenditure, such as sleeping up to 20 h per day (Benesch et al., 2010). Since energy is required for basic living and koalas have limited resources of it, any unnecessary use of energy is likely to be of importance to their welfare. The stress response is a very costly biological response in terms of energy metabolism (Selye, 1973). It is possible that the triggering of stress responses may have a greater impact on koalas than other captive species due to their reliance on a low-energy regimen.

However, there is little knowledge of visitor effects on the koala's behaviour and welfare. There has been only one previous study which looked at the effect of visitor presence on the heart-rate of captive koalas (Ropert-Coudert et al., 2009). These researchers found a correlation between visitor presence and increased heart-rate, concluding that visitors elicited a physiological response in

koalas displayed to the public. However, this study was based on only three individuals, with two housed on display and another off-display in a holding pen, and relied on just one measure of stress, heart rate, without taking into account other animal responses to visitors, the most obvious one being the behavioural response.

Therefore, our study aimed to determine the effects of visitor number and visitor noise on koala vigilance behaviour, as an indication of disturbance. We predicted that vigilance behaviours would increase with both an increase in visitor number and an increase in visitor noise.

2. Materials and methods

2.1. Site and subjects

The research was conducted at the Koala Conservation Centre on Phillip Island, Victoria, Australia. Ethics approval was gained from the Phillip Island Nature Parks Animal Ethics Committee. This park includes two separate boardwalk enclosures, each covering a third of a hectare dominated by *Eucalyptus* trees ranging from 10 m to 15 m high. The boardwalks themselves are large wooden walkways raised up to a maximum height of 4 m. This gives visitors a closer viewing of the koalas at a mid-tree level. Boardwalks are approximately 400 m in total length and designed in a circular shape (Boardwalk 1) and a U-shape (Boardwalk 2). The park is open to visitors seven days per week between 10:00 h and 17:30 h.

Boardwalk 1 contained seven koalas (one adult male, two young males and four adult females) and Boardwalk 2 contained six koalas (one adult male, two young males and three adult females). The koalas were all captive born, with an age range of 1–12 years and an average age of 5.3 years including 3.1 ± 0.7 years (mean \pm S.E.) spent in the boardwalk enclosures and the rest in other parts of the park. Koalas were able to move and forage freely within the large enclosures which were identical to their natural habitat. Extra browse was placed in feed stations on the boardwalk once per day in the afternoon by the park rangers. All adult koalas were individually identified by their plastic ear tags along with their physical appearance. All 13 koalas were used for Study 1 and 10 koalas were used for Study 2 due to the removal of one adult male from Boardwalk 1 and two young males from Boardwalk 2 after Study 1 for breeding purposes.

2.2. Study 1: Effects of visitor number on koala vigilance

Behavioural observations were conducted using an ethogram (Table 1) specifically designed for this study from preliminary *ad libitum* observations and human approach tests conducted a month prior to the study. Resting included sleep, resting and relaxing periods. Visitor-vigilance was only vigilant behaviour directed at visitors whereas Alert non-visitors was directed at environmental disturbances when there were few or no visitors present. Each koala in the two boardwalks was observed on eight days which included two repetitions of 2 predicted busy days (Saturday and Sunday) and 2 predicted quiet days (Monday and Tuesday), according to

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