



VISITOR EFFECT ON ZOO ANIMALS

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Zoos and other centres that hold wild animals in captivity face different issues that can have a direct impact on the welfare of animals. Lack of space, social stress, presence of visitors, diseases and other health problems, and medical procedures are some of the main challenges facing zoos when they want to guarantee an optimal welfare status for the animals under their care.

VISITOR EFFECT

The presence of visitors nearby the enclosure or, in some occasions, inside the facility or in close contact with the animals is a situation that animals face daily during the zoo open hours. The presence of people that are unfamiliar to the animals as well as their movements, sounds and smells, all can elicit a stress response in the animals and may negatively affect their welfare.

The stress response is driven, along with other systems, by the activation of the hypothalamic-pituitary-adrenocortical (HPA) axis. The HPA axis releases glucocorticoids such as cortisol or corticosterone as part of the endocrine mechanism for self-protection of the body in the presence of a stressor. Cortisol or its metabolites can be quantified in different matrixes such as plasma, faeces, urine and saliva, and can be used as a physiological indicator for the assessment of stress. The concentrations of cortisol or its metabolites, as well as the expression of certain behaviours have been used as indicators to assess the effect of visitor presence on animal welfare.

On some occasions, it has been suggested that visitors do not have an evident negative impact on the welfare in animals of a variety of species such as meerkats (*Suricata suricatta*), Kangaroo Island kangaroos (*Macropus fuliginosus fuliginosus*), red kangaroos (*Macropus rufus*), chimpanzees (*Pan troglodytes*), ring-tailed lemurs (*Lemur catta*), and crowned lemurs (*Eulemur coronatus*).

However, other studies have concluded that the constant presence of unfamiliar people can produce stress and have a negative impact on welfare. Specifically, an increase of abnormal behaviours has been observed as a consequence of the presence of visitors in different species such as the lion-tailed macaque (*Macaca silenus*) and the jaguar (*Panthera onca*). Also, an increase in aggressive behaviours due to visitor presence has been described in jaguar and Indian gaur (*Bos gaurus gaurus*).

On other occasions, an increase in vigilance and visitor-avoidance behaviours was also considered negative for the welfare of different species such as siamangs (*Hylobates syndactylus*), white-cheeked gibbons (*Hylobates leucogenys*), and African penguins (*Spheniscus demersus*).

Finally, other studies, such as one done with spider monkeys (*Ateles geoffroyi rufiventris*) and another with Indian blackbuck (*Antelope cervicapra L.*), have found a positive correlation between the number of visitors and the concentration of cortisol or its metabolites in different biological matrixes.

The described vigilance or alertness behaviours in some species could be interpreted as responses due to fear, but also as a form of cu-

riosity towards visitors. In order to address this issue, some studies have complemented behavioural observations with physiological measures. For example, in a study on captive Mexican wolves (*Canis lupus baileyi*), the concentration of cortisol metabolites in faeces as well as some behaviours (related with posture, eating and locomotion) were assessed during days with different zoo visitor attendance. Results showed that higher visitor presence was related with changes in behaviour of the wolves and with higher levels of faecal metabolite cortisol.

However, different conclusions were reached in a study with Kangaroo Island kangaroos and red kangaroos in free-range exhibits, which determined that there was no evidence of adverse effects on the welfare of these animals due to visitors. The authors found an increase in visitor-directed vigilance behaviour when visitor numbers were higher, but there was no effect of visitor number on the distance kangaroos positioned themselves from the visitor pathway or on the faecal glucocorticoid metabolites concentration in either species. They concluded that the increase observed in visitor-directed vigilance behaviour could be due to a natural instinct to check for movements in the surrounding area, but that this behaviour may not be related to a stress response unless a real threat is detected.

The effects of visitors on behaviour and stress response of animals are variable and depend on different factors, such as the species. Also, individuals of the same species may show very different responses to the presence of visitors due to the temperament or personality and the previous experiences of each animal. Some scientists argue that the possibility that in some occasions animals might have been habituated to the presence of visitors needs to be considered.

HOW THE VISITOR EFFECT CAN BE MITIGATED

Several studies suggest that the negative visitor effect could be mitigated if some measures are taken to further enrich the environment of the animal. For example, existing enclosures can be modified and improved by the addition of barriers (such as camouflage nets) and hidden spots or refuges that allow the animals to avoid visual contact with visitors.

In some species it has been suggested that when visitors observe the animals from above, their presence can be more stressful than if they are at a lower level.

The movements and noise made by zoo visitors can have an effect on the stress response of animals. Therefore, education of the visitors and the use of signs to modify visitor behaviour can decrease the negative visitor effect.

Another way to reduce the potential negative effect of visitors could be the improvement of the animals' perceptions of unfamiliar humans by fostering positive relationships with them.

CONCLUSION

Zoo visitors are a factor that may be a stress source for captive animals, especially if the animals do not have any kind of control over their environment, enrichment opportunities, or if the enclosure does not have an adequate design that allows the animal to hide from the visitors' view if it chooses to.

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zoo animal welfare; animal behaviour; visitor effects; human-animal relationships; stress physiology. 1. Introduction. 1.1. Zoo Animal Welfare. However, the literature on the effects of visitor interactions on zoo animals is somewhat ambiguous, with studies providing evidence for a range of impacts interpreted as negative [12,13], neutral [14,15] and positive [16]. This variation in the responses of zoo animals to visitors may be due to species-specific differences, the nature and intensity of the visitor interactions, differences in the physical features of enclosures, and individual animal characteristics (e.g., past experiences and temperament). Research on this topic has expanded considerably in the past several years. Other studies suggest that naturalistic exhibit design may reduce the visitor effect and thereby increase animal welfare. Hiding places, camouflage netting, physical barriers, and even one-way viewing mirrors may reduce the impact that visitors have on zoo animals. And still other studies suggest that some animals, like golden-bellied mangabeys respond differently to different kinds of people. Their reactions varied by whether the person was a keeper or a visitor.