Stressors of captive giant pandas (*Ailuropoda melanoleuca)*, their effects and how they may be alleviated

By Stephanie Hing

Introduction

Giant pandas (*Ailuropoda melanoleuca*) are an endangered species (IUCN, 2006). *Ex situ* conservation of captive populations plays a crucial role in their continued survival. However, captivity presents a variety of possible stressors, including inadequate control over the environment and lack of opportunity to express natural behaviours, such as exploration of varied terrain in search of food and shelter (Swaisgood *et al*., 2001). In addition, alien disturbances are introduced in captive contexts, such as persistent and inescapable visual and auditory stimuli from visitors (Shyne, 2006). This paper will explore recent studies that examine specific stressors in captivity, their effects on giant pandas and how they may be alleviated through the implementation of enrichment programs.

Discussion

Anxiety and stress-related behaviour in giant pandas include frequent scent-marking, excessive self-grooming and sterotypies such as pacing, pirouetting and paw-sucking. They have been attributed to stressors in captivity (Swaisgood *et al*., 2003). Powell *et al.* (2006) specifically investigated increased ambient noise as a potential stressor. They hypothesised that the pandas' activity budget and cortisol concentration would vary on days with and without construction work going on nearby. An adult male and adult female were observed over 100 days of demolition work. Using sound loggers, the study established that noises were louder and of a higher frequency on demolition days than on non-work days. This correlated with differences in some panda behaviours. On demolition days, the male spent less time resting and more time engaged in stereotyped behaviour. The female was reported to run, look into the keeper's work area and move toward the male for reassurance when startled by certain noises, such as drilling. However, the degree of behavioural change in response to ambient noise was said to be small and idiosyncratic.

The study also included urine cortisol analysis by enzyme immunoassay. There has been an increasing tendency to use cortisol concentration in combination with behavioural observations to comprehensively assess the wellbeing of wildlife in captivity (Owen, 2005). Powell *et al.* (2006) did not observe any significant difference between mean cortisol concentrations during work compared with non-work periods.

The pandas in this study were deemed not to have suffered any decline in welfare due to ambient noise. However, the interpretation of results is compromised by the small sample size. In contrast, Peng *et al.* (2006) studied a larger sample population (n=14) over a period of four years and are better able to identify solid trends. This study investigated another potential stressor, spatial limitation. Captive pandas are generally housed in enclosures that are only a fraction of their natural home range of up to 15km^2 (Linburg & Baragona, 2004). Peng *et al.* (2006) examined the effect of reduced space on activity status and reproductive behaviour in 11 adult females and 3 adult males. The duration and frequency of various behaviours were recorded when the pandas were housed in pens less than 12m^2 compared with yards greater than 200m^2. The results showed that the size of activity space significantly influences the behaviour of giant pandas. Oestrous behaviour, such as tail-raising in the female and bleating vocalisations in the male, were significantly more frequent when the pandas were housed in large yards compared to small pens. Peng *et al.* (2006) suggested that pandas prioritise available resources, including space, for basic survival and the area provided may be insufficient to prompt complex activities, including oestrous behaviour.

The results of this study support the widely held belief that adverse behavioural and physiological responses to captivity not only signify compromised welfare but also lead to diminished reproductive success (Yang *et al*., 2006; Swaisgood *et al*., 2003). This adds a degree of urgency to the need to address stressors, as they may contribute to further decline of the species.

It has been proposed that enrichment can prevent and counter the effects of stressors in captivity (Swaisgood *et al.,* 2001). Enrichment effectively is any husbandry principle that provides the stimuli necessary for the psychological and physiological wellbeing of captive animals (Shepherdson, 1998). Liu *et al.* (2006) examined the effect of environmental enrichment on stereotypic behaviour and cortisol concentration of four adult pandas. The pandas were observed over a 42-day period during which two enrichment items were introduced: bamboo segments stapled to a log and bunches of bamboo in a metal tube fastened to the ground. The study found that enrichment did not produce significant changes in the frequency of episodes of stereotypic behaviour or faecal cortisol concentration. However, a significant decrease was calculated in the total duration of stereotyped behaviour post-enrichment.

As in the study by Powell *et al.* (2006), Liu *et al.* (2006) employ a small sample size, which decreased the confidence intervals of the results. Nevertheless, the finding that enrichment decreased the duration of stereotyped behaviour is consistent with previous research. Several studies have concluded that enrichment, such as novel presentation of food items, spacious and naturalistic enclosure design, provision of conspecifics and species-appropriate furnishings, can benefit captive giant pandas (Carlstead *et al*., 1991; Shyne, 2006; Swaisgood *et al*., 2003; Yang *et al*., 2006). Many advantages have been reported, including reduced emotional reactivity, reduced frequency and duration of stereotypic behaviour and a greater ability to cope with stressors (Swaisgood *et al*., 2001). As it happens, Powell *et al.* (2006), in their study on the effects of ambient noise, mentioned that keepers increased enrichment during demolition work and this may have contributed to the lack of a significant stress response to increased ambient noise.

Conclusion

These studies provide an insight into how the captive environment can be designed and managed to discourage adverse responses of giant pandas to captivity. Ample space and enrichment are prerequisites for optimal welfare of captive individuals. Further research into stressors of captive giant pandas, using large sample sizes, is required to increase the success of *ex situ* conservation efforts.

References

Carlstead, K., Seidensticker, J. & Baldwin, R. (1991) Environmental enrichment for zoo bears. Zoo Biology 10, 3-16.

IUCN Red List of Threatened Species 2006. Bear Specialist Group (2006) *Ailuropoda melanoleuca*.

Linburg, D.G. & Baragona, K. (2004) Giant Pandas: Biology and Conservation. University of California Press, 57.

Liu, K., Chen, Y., Guo, L., Gu, B., Liu, H., Hou, A., Liu, X., Sun, L. & Dingzhen L. (2006) Stereotypic Behavior and Fecal Cortisol Level in Captive Giant Pandas in Relation to Environmental Enrichment. Zoo Biology 25, 445-459.

Owen M.A., Swaisgood, R.R., Czekala, N.M. & Lindburg, D.G. (2005) Enclosure choice and wellbeing in giant pandas: is it all about control? Zoo Biology 24, 475–81.

Peng, J., Jiang, Z., Huang, Q., Qin, G., Li, Y., Jiao, Z., Zhang, F., Li, Z., Li, J., Fang, H., Zhang, J., Lu, Y. & Liu X. (2006) The Influence of Activity Space on the Behaviour of Giant Pandas (*Ailuropoda melanoleuca*) in Captivity. Turkish Journal of Zoology 30, 423-431.

Powell D.M., Carlstead K., Tarou L.R., Brown J.L. & Monfort S.L. (2006) Effects of Construction Noise on Behavior and Cortisol Levels in a Pair of Captive Giant Pandas (*Ailuropoda melanoleuca*). Zoo Biology 25, 391-408.

Shepherdson, D.J. (1998) Tracing the path of environmental enrichment in zoos. In Mace, E.G., Olhey, P.J.S. and Feismer, A.(eds) Second Nature: Environmental Enrichment for Captive Animals. Chapman & Hall, 167-177.

Shyne, A. (2006) Meta-Analytic Review of the Effects of Enrichment on Stereotypic Behavior in Zoo Mammals. Zoo Biology 25, 317-337.

Swaisgood, R.R., Ellis, S., Forthman, D.L. & Shepherdson, D.J. (2003) Commentary: Improving Well-Being for Captive Giant Pandas: Theoretical and Practical Issues. Zoo Biol 22, 347-354.

Swaisgood, R.R., White, A.M., Zhou, X., Zhang, H., Zhang, G., Wei, R., Hare, V.J., Tepper, E.M. & Lindburg, D.G. (2001) A quantitative assessment of the efficacy of an environmental enrichment programme for giant pandas. Animal Behaviour 61, 447-457.

Yang, C. & Wang, X. (2006) Stereotypic behavior of giant pandas and its correcting strategy – environmental enrichment. Sichuan Journal of Zoology 25, 529-532.