The more the merrier or happy when alone? Hypothesis on stress susceptibility in captive individuals of solitary species

Clauss, M; Müller, D W H; Steinmetz, H W; Hatt, J M
THE MORE THE MERRIER OR HAPPY WHEN ALONE? HYPOTHESIS ON STRESS SUSCEPTIBILITY IN CAPTIVE INDIVIDUALS OF SOLITARY SPECIES

CLAUSS M, MÜLLER DWH, STEINMETZ HW, HATT JM

Clinic for Zoo Animals, Exotic Pets and Wildlife, Vetsuisse Faculty, University of Zurich, Winterthurerstr. 260, CH-8057 Zurich, SWITZERLAND; mclauss@vetclinics.uzh.ch

In research on the well-being of captive wild animals the quantification of ‘stress’ has been a focus of increasing attention in the zoo community. In humans, the concept that ‘stress’ favours disease susceptibility is well-established (e.g. COHEN et al., 1993; SERGERSTROM and MILLER, 2004; COHEN et al., 2007; CHIDA et al., 2008). However, most studies on long-term stress assess it by either noting circumstances usually considered stressful (such as care for a spouse with dementia), or by recording the perception of stress by the probands, thus introducing the additional factor of awareness and affect. As affect (the ‘attitude’) can also effect human health to some degree (PRESSMAN and COHEN, 2005), a speculative aspect remains when transferring concepts from humans to animals. Additionally, the effect of stress perception from the animals’ point of view remains largely unknown. Nevertheless, the effect of chronic stress on various health aspects of laboratory animals has been demonstrated. In zoo animals, links between stress measured by corticosteroids and mortality have only been rarely documented (CARLSTEAD and BROWN, 2005), but a variety of additional measurements have been used – including the incidence of disease or pathological behaviour, breeding success, or life expectancy (BROOM, 1991; HILL and BROOM, 2009).

The effect of a variety of factors related to captive conditions has been investigated. Amongst others, such factors comprise enclosure size, enclosure design, exposure to visitors and visitor behaviour, external stressors such as building sites, keeper behaviour and routine, diet and diet presentation, other means of behavioural enrichment, climatic conditions, certain events such as transport, or the effect of medication. On the part of the individual animal, its origin (wild born vs. captive born) and rearing history (mother-reared vs. hand-reared), individual character, loss of a close relative, and clinical measurements such as body weight have been included in such investigations. Finally, group size and group composition is recognized as a major factor influencing the stress experienced by different group members (e.g. SCHMIDT and SACHSER, 1996; BOINSKI et al., 1999; CARLSTEAD et al., 1999a; CARLSTEAD et al., 1999b; DEHNHARD et al., 2001; WIELEBNOWSKI et al., 2002a; CARLSTEAD and BROWN, 2005; WELLS, 2005; ENGH et al., 2006; GRABOWSKI and CLAUSS, 2006; COCKS, 2007; ANGE-VAN HEUTGEN et al., 2009; GILBERT-NORTON et al., 2009; DURANTE CHIRSTOFOLETTI et al., 2010).

One historical, but not conceptually obligatory characteristic of most research on stress in captive wild animals is a species-specific approach. In contrast, studies with a comparative approach that aim at detecting differences between species or groups of species sharing certain biological characteristics are rare. One of the few existing examples is the study by CLUDD and MASON (2003; 2007) which showed that both neonate mortality and stereotypy frequency in captive carnivores are positively linked to their natural home range size, suggesting for the 1st time that a particular biological characteristic has implications for the welfare of captive animals across species. Similarly, MÜLLER et al. (2010) demonstrated that the relative life expectancy in captive cervid species is correlated with their natural feeding behaviour, with browsers having lower life expectancy values than grazers. This study also hinted at a positive effect of international studbooks on the life expectancy of species.

Such comparative studies yield insights that could translate into general husbandry guidelines that transcend species borders. One factor that could potentially have an important impact on the well-being of captive wild animals is the nature of their sociality. Animals that live in groups are usually kept...
in groups; and the interactions within groups, as well as the ‘stress level’ of individuals in different positions within the group hierarchy, have been explored in the past. In this respect, it is reasonable to suggest that social animals (living naturally in groups) are adapted to the level of stress they experience in a group. In contrast, animals that live truly solitary in nature are often not kept solitarily in captivity, but either in breeding pairs, or – even though physically separated – in close vicinity to a conspecific (usually the intended breeding partner). In other words, individuals of solitary species very likely experience an unusually high degree of intraspecific contact in captivity. We hypothesize that this may represent a particular source of stress for such animals, and propose that this hypothesis should be further investigated.

Several examples exist in ungulates, primates and carnivores that contact with conspecifics represent a stressful event for solitary species. In brown brocket deer (*Mazama gouazoubira*), a South American cervid with a solitary nature, lower faecal corticoid levels were measured in an experimental setting when animals were either kept in individual stalls or only shared an enclosure for a limited period of the day with a conspecific, compared to when kept in pairs all the time (Durante Christofoletti et al., 2010). In black rhinoceros (*Diceros bicornis*), also a solitary species in the wild, Carlstead and Brown (2005) found less variability in faecal corticoid levels and less fighting during oestrus in animals that were kept separately compared to animals kept constantly as a pair; furthermore, mortality was higher in zoos that kept black rhinos as pairs. Van Schaik et al. (2009) cite unpublished data by Weingrill indicating that individuals of the Bornean orangutan species (*Pongo pygmaeus*), which are less sociable than the Sumatran subspecies (*P. abelii*), are more susceptible to stress in captivity when kept in groups.

Among the carnivores, the cheetah (*Acinonyx jubatus*) is the classical example of an originally solitary species that is often kept with several individuals in close vicinity. Captive cheetahs display higher levels of faecal corticosteroids than free-ranging individuals (Terio et al., 2004). A correlation between faecal corticoid levels and reproductive success was demonstrated in this species. Close proximity to conspecifics was suggested as the ultimate cause of reproductive failure (Jurke et al., 1997) – a suspicion later confirmed experimentally (Wielebnowski et al., 2002b). Interestingly, the anoestric episodes triggered in the female cheetah by keeping them in pairs (rather than individually) were not accompanied by systematic variations in faecal corticoid levels, indicating that faecal corticoid levels, though useful indicators of stress in many studies (Keay et al., 2006), may not always yield conclusive insights. It is now common practice to keep cheetahs separated, and only introduce them for mating, in order to achieve breeding success. Additionally, one of the authors (Steinmetz) experienced a clinical case of lick dermatitis in a cheetah kept in an enclosure that was separated from that of a conspecific by a mesh wire only. Lick dermatitis is among the dermatological conditions often associated with emotional stress in animals (Virga, 2003). After creating a visual barrier between the 2 conspecifics by adding wood boards to the wire, the lick dermatitis receded. For small felids, Mellen (1991) had already recommended that no more than 2 individuals should be housed together, based on epidemiological evaluation of breeding success and husbandry practices.

We suggest that the principles demonstrated in the mentioned studies might be transferred to more, particular solitary species. Our hypothesis is that individuals of solitary species that are kept in close vicinity of conspecifics in captivity are subject to particular social stress to which they are not naturally adapted. This hypothesis could be investigated using an epidemiologic approach (comparing measures of stress between facilities where individuals are kept in pairs, in close vicinity of conspecifics, or truly isolated), or an experimental approach where stress measurements are taken in the same animals when exposed to different conditions. Example species could include flagship species such as the okapi, the tiger or the giant panda, but also other species might benefit from truly solitary husbandry, with prevention of not only visual but also olfactory and acoustic contact. Given the usual display concept in zoological gardens, and an anthropocentric high esteem of ‘company’, this might
represent psychological as well as logistical challenges (including the effort required to bring animals together for mating that are not kept in close vicinity, or alternatively increasing options for assisted reproduction). For captive cheetah, many institutions have adopted corresponding measures. Whether more solitary species would benefit from such measures, and the actual degree of physical separation necessary, should be further investigated.

References


