

# Influence of Zoo Visitors on Behaviour and Salivary Stress-Hormone Concentrations in White Rhinos (*Ceratotherium simum simum*)

Andreas Kalthoff, Carsten Schmidt, Norbert Sachser  
 University of Muenster, Dept. of Behavioural Biology, Badestr. 9, D-48149 Muenster  
 e-mail: kalthoa@uni-muenster.de



## Introduction

For zoo animals visitors are a variable environmental factor. In the last years, several studies focussed on the influence of zoo visitors on captive animals. Especially for non-human primates changes were demonstrated in many behavioural patterns (e.g. activity, social behaviour, aggression and spatial dispersion). However, only very few studies investigated other mammals.

The aim of this study was to evaluate the influence of zoo visitors on behaviour and salivary corticosterone concentrations of white rhinos (*Ceratotherium simum simum*) in the Allwetterzoo Münster.



## Methods

The investigated group consisted of three female and one male white rhinos. In the summer of 1999 the animals' behaviour was observed at 39 days from 9.00 a.m. to 3.00 p.m. (with a total observation time of 148 h). At the end of each observation-session saliva was collected from all individuals and corticosterone levels were measured by radioimmunoassay.

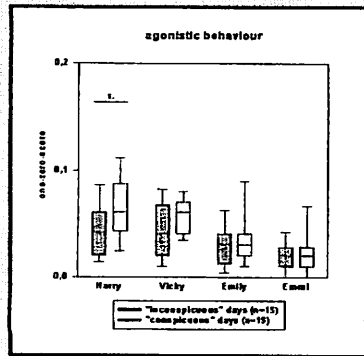
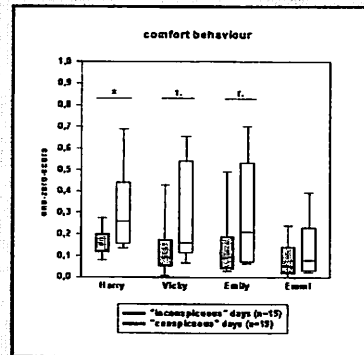
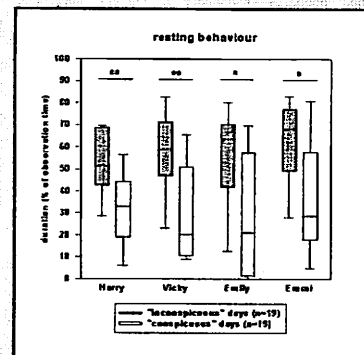
Visitors were observed with regard to three parameters: (1) number of visitors, (2) noise level and (3) optical stimuli from the visitors in front of the enclosure. According to these parameters observation-days were classified into two categories for each parameter ("low" and "high", "quiet" and "loud", "inconspicuous" and "conspicuous"). Behavioural data and salivary corticosterone levels were compared between these categories of visitors' performance.

## Conclusion

Zoo visitors had a distinct influence on the rhinos' behaviour.

Salivary stress-hormone concentrations, however, were not affected by the visitors' performance.

## Optical Stimuli



## Results

### Behaviour:

- On "conspicuous" days all rhinos performed less resting behaviour, whereas the frequencies of comfort behaviour were increased in three rhinos. One animal showed more agonistic behaviour (Fig. 1 a-c);
- On "loud" days three rhinos showed less resting behaviour, two more comfort behaviour and three individuals performed more agonistic behaviour (Fig. 2 a-c);
- In addition, the spatial distribution of the animals was strongly affected: On days with high numbers of visitors the rhinos were found in closer proximity to the spectators.

### Stress-hormone concentrations:

- No significant changes in salivary corticosterone concentrations were found concerning the different categories of visitors' performance.

## Noise level

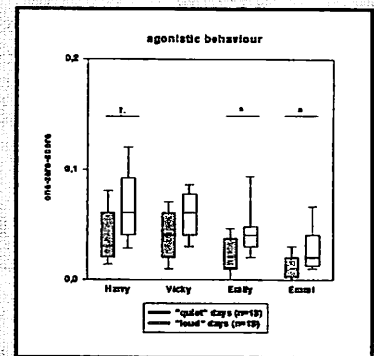
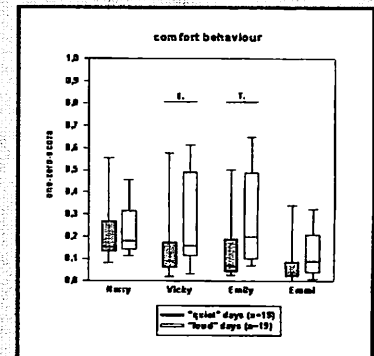
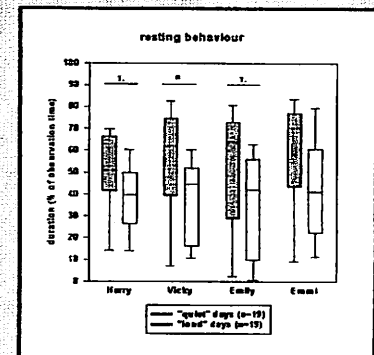


Fig 1 a-c: Comparison of the animals' behaviour between days with "inconspicuous" and "conspicuous" visitors' performance. Means, Interquartiles and Percentiles are given.  $T = 0.05 < p < 0.1$ , \* =  $p < 0.05$ , \*\* =  $p < 0.01$ . Statistical test: Mann-Whitney-U-Test, two-tailed.

Fig 2 a-c: Comparison of the animals' behaviour between days with "quiet" and "loud" visitors' performance. Means, Interquartiles and Percentiles are given.  $T = 0.05 < p < 0.1$ , \* =  $p < 0.05$ . Statistical test: Mann-Whitney-U-Test, two-tailed.



**Influence of zoo visitors on behaviour and salivary stress-hormone concentrations in white rhinos (*Ceratotherium simum simum*)**  
Einfluß von Zoobesuchern auf Verhalten und Streßhormonkonzentrationen im Speichel von Breitmaulnashörnern (*Ceratotherium simum simum*)

A. KALTHOFF, C. SCHMIDT & N. SACHSER  
University of Muenster, Department of Behavioural Biology,  
Badestr. 9, D-48149 Muenster, Germany  
e-mail: kalthoa@uni-muenster.de

**Key words:** Rhinoceros, *Ceratotherium simum*, zoo visitors, Corticosterone, Saliva

In the last years several studies focussed on the influence of zoo visitors on captive animals. Especially for non-human primates changes were demonstrated in many behavioural patterns (e.g. activity, social behaviour, aggression and spatial dispersion). However, only few studies investigated other mammals.

The aim of this study was to evaluate the influence of zoo visitors on behaviour and salivary corticosterone concentrations of white rhinos in the Allwetterzoo Münster. The investigated group consisted of three females and one male. In summer 1999 the animals' behaviour was observed on 39 days from 9.00 a.m. to 3.00 p.m. (with a total of 148 h). At the end of each observation-session saliva was collected from all individuals and corticosterone levels were measured by radioimmunoassay.

Observation-days were classified with regard to three parameters: (1) number of visitors, (2) noise level and (3) intensity of optical stimuli from the visitors in front of the enclosure. According to these parameters observation-days were divided into two categories for each parameter ("low" and "high", "quiet" and "loud", "inconspicuous" and "conspicuous"). Behavioural data and saliva-corticosterone levels were compared between these categories of visitor performance.

The visitor performance had a distinct influence on the animals' behaviour. On "conspicuous" and "loud" days, for example, the rhinos performed less resting behaviour, whereas the frequencies of comfort and agonistic behaviour were increased. In addition, the spatial distribution of the animals was strongly affected. On days with high numbers of visitors the rhinos were found in higher proximity to the spectators. Obviously, salivary stress-hormone concentrations were not affected significantly by the visitor performance.

It is discussed to what extend the behavioural changes due to the visitor performance can be regarded as an indicator of enhancement of the animals' welfare.



**14-18 August 2000, Utrecht**

**17.**  
***Ethologentreffen***

**Organized by: Ethologie & Socio-Ecologie,  
Faculteit Biologie, Universiteit Utrecht, The Netherlands**