

## Vocal Communication in the Black Rhino (*Diceros bicornis* ssp.) and Possibilities of Individual Identification

Christa Budde, Georg Klump

Technical University of Munich, Zoological Institute, Lichtenbergstr. 4,  
85748 Garching, Germany ([christa.budde@djh-freeweb.de](mailto:christa.budde@djh-freeweb.de))

### Introduction

Although rhinos have been the focus of many studies not much is known about their vocal communication. A more detailed study has been done on the vocalisations of the Indian Rhino (Laurie 1997) and on the White rhino (Owen-Smith 1973). Laurie mentions 14 calls in the Indian rhino and Owen-Smith describes 10 sounds in the White Rhino. Muggenthaler et al. (1991) report that all rhino species use infrasound signals.

This study analyses the audible vocal communication of the Black rhino *Diceros bicornis* ssp., and if there is evidence for the use of infrasound signals. A thorough knowledge of the communication and behaviour of the rhinos could help to improve their management and breeding in zoos. Furthermore, vocalisations could be used for the monitoring of free-living rhinos provided that individual identification should prove possible. This project also examines if individual identification by acoustic means is possible to allow vocal tagging.

### Material and Methods

The following zoos were visited for the investigations: Zoo Frankfurt with 1,1 *Diceros bicornis* minor, Dvur Kralove with 4,8 *Diceros bicornis* michaeli of which 1,1 were juveniles, Zoo Berlin with 2,7 *Diceros bicornis* michaeli. Recordings were performed with a Sony DAT recorder TCD D100 and a Sennheiser microphone KE4-211-2 (modified by Sennheiser), both also sensitive to infrasound signals. Acoustic data were evaluated with the help of the Software Avisoft. Following parameters were measured: duration, minimum frequency, frequency with the highest energy. Behavioural data were recorded on a dictaphone at the same time when recording vocalisations. To test if individual identification of Black rhinos by vocal means is possible a discriminant analysis was run. As no sonagrams of calls of any of the rhino species were available from previous studies for comparison new names for the calls are introduced.

### Results

See Figure 1: Sonogram of the AM call.

### Individual identification

To test if individuals can be identified by their calls a discriminant analysis was run. The first two discriminant functions explained already 96% of the overall variance. A stepwise

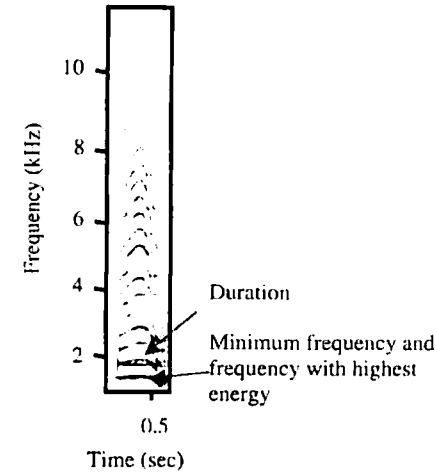


Fig. 1: Sonogram of the AM call.

discriminant analysis revealed that the main discriminating parameters were the frequencies with the highest energy and the minimum frequencies. Some individuals had a very high identification rate, e.g. individual 2 with 83,67%, the overall discrimination rate was 56,43%. Although the discrimination rate of 56,43% is statistically higher than expected by chance it is not considered high enough for the practicable use of this method for vocal tagging. For reliable vocal tagging the discrimination rate should reach about 75%.

### Conclusions

Only six calls could be identified during the period of observation (total 308 hours). Behaviours like mating, courtship, fighting could not be observed and thus calls associated with these behaviours could not be recorded. Although the recordings were scanned for infrasound components, only the growl that was recorded once had energy at 23 Hz. None of the other calls showed energy in the infrasound range. However, it cannot be excluded

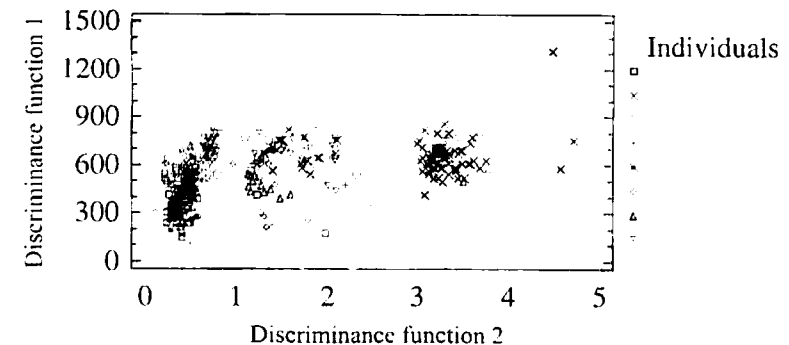


Fig. 2: Discriminant analysis of AM call of 8 adult individuals.

Table 1. Behavioural context and physical description of all recorded calls. N corresponds to the number of different individuals recorded and n to the number of calls recorded.

Call	Amplitude modulated call (AM) „Begging call“	Hollow snort	Snort	AM call, Juvenile, 10 days old	AM call, Juvenile, 1 year old	Aggressive snort	Growl
Behavioral context	Before feeding especially when hearing keepers, trying to get food from adjacent enclosure. „asking“ to be petted, time approached to be let out into the outdoor enclosures.	Standing still, ears erect, no action would follow.	No obvious behaviour accompanied this vocalisation. It was given when feeding, walking, or standing still. No reaction of other rhinos could be observed following this vocalisation.	Before nursing „asking“ to be petted, the juvenile could follow the mother when calling or not.	Before nursing. „asking“ to be petted, the juvenile could follow the mother when calling or not.	Before attacking head held down.	Head held down, no attack followed.
Acoustic parameters	Mean duration: 0.36 s, n = 637 Mean minimum frequency: 497.3 Hz, n = 603 Mean frequency with highest energy: 1054.11 Hz, n = 600, N = 8	Mean duration: 0.76 s, n = 28 Mean minimum frequency of first bout: 657.34 Hz, n = 23 Mean frequency end of first bout: 1108.2 Hz, n = 25, N = 5	Mean duration: 0.73 s, n = 100 Mean minimum frequency of first bout: 198.34 Hz, n = 97 Mean frequency end of first bout: 733.53 Hz, n = 95, N = 13	Mean duration: 0.31 s, n = 11 Mean minimum frequency: 137 Hz, n = 12 Mean frequency with highest energy: 1270.9 Hz, n = 10, N = 1	Mean duration: 0.37 s, n = 66 Mean minimum frequency: 1012.28 Hz, n = 61, N = 1 Mean frequency with highest energy: no single frequency determinable	Mean duration: 0.33 s, n = 12 Mean frequency end of first bout: 1537.53 Hz, n = 15, N = 1	Mean duration: 0.73 s, n = 1 Mean minimum frequency: 23 Hz.

that dispersed rhinos in their natural habitat may use infrasound for finding mates or other purposes. Recording of wild rhinos is also necessary to round up the analysis of the vocal communication of the Black rhino in the audible range.

### Acknowledgements

This study was supported by a grant from the Technical University Munich, by Sennheiser, the working group of G. Klump and by Tom Frazier. I thank all zoos for free accommodation, their interest and further help.

### References

- LAURIE, A., 1997. Das Indische Panzernashorn. In: Die Nashörner. Filander Verlag, Fürth.
- VON MUGGENTHALER, E., STOUGHTON, J.W., DANIEL, J. C., 1991. Infrasound from the Rhinocerotidae. Proceedings from the International Conference on Rhinoceros Biology and Behavior.
- OWEN-SMITH, R.N., 1973. The Behavioural Ecology of the White Rhinoceros. Ph.D. thesis. Univ. of Wisconsin.

250 JAHRE  
1752-2002  
TIERGARTEN  
SCHÖNBRUNN



Scientific  
Progress Reports

Harald M. Schwammer  
Thomas J. Foose  
Michael Fouraker  
Deborah Olson



## **A Research Update on Elephants and Rhinos**

Proceedings of the  
International Elephant  
and Rhino Research Symposium,  
Vienna, June 7-11, 2001