

Contributions to the

**11th International Conference on Behaviour,
Physiology and Genetics of Wildlife**

October 4th – 7th, 2017, Berlin, Germany

Edited by

Josepha Prügel, Stefanie Lenz

Organised by

Leibniz Institute for Zoo and Wildlife Research (IZW)
Alfred-Kowalke-Straße 17
10315 Berlin
Germany

www.leibniz-izw.de

European Association of Zoos and Aquaria (EAZA)
Executive Office
PO Box 20164
1000 HD Amsterdam
The Netherlands

www.eaza.net



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ISSN 1865-4436

Analysis of vocal rutting activity across populations of red deer (*Cervus elaphus*): effects of rut phase, time of day and ambient temperature

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In polygynous red deer *Cervus elaphus*, a prolonged rutting vocal activity represents a prominent part of male reproductive behaviour. Duration of the rut as well as the overall vocal activity differ between populations and between years. This study compares stag vocal rutting activity across populations of red deer. Data were collected in September-October 2015 using 5 SongMeter 2+ automated recording devices, scheduled for 5 min/hour, 24 hours/day, 60 - 70 days per each device in 3 populations of red deer: Ussuri (*C.e. xanthopygus*, 2 devices), Lipetsk, (*C.e. hippelaphus*, 1 device), Kostroma (*C.e. sibiricus*, 2 devices). For each device, call dynamics had a humped shape with one maximum. We calculated daily mean call number/hour for each 24-hour period. We selected days when call number/hour reached 1 % of maximum as days of rut onset and completions. We calculated the mean call number/hour for the entire rut period and subdivided rut period into beginning phase (between onset day and day with mean call number/hour), active phase (between two days with mean call number/hour) and end phase (from day with mean call number/hour to the end day). Vocal activity was highest in Kostroma (maximum 331 and 351 calls/hour), intermediate in Lipetsk (271 calls/hour) and weakest in Ussuri (46 and 19 calls/hour). Rut duration was longest in Lipetsk (58 days), intermediate in Kostroma (52 days) and shortest in Ussuri (45 days). However, the active phase was longest in Kostroma (25 days), intermediate in Lipetsk (20 days), and shortest in Ussuri (12 days), probably in relation to differences in animal density, highest in Kostroma and lowest in Ussuri. Separately for each rut phase, we estimated effects of time of day and ambient temperature on call number/hour with GLMM. Time of day significantly affected call number/hour for the beginning phase in two cases (Lipetsk and Kostroma1), for the active phase in five cases (all devices) and for the end phase in two cases of the five (Kostroma1,2). Temperature significantly affected call number/hour for the beginning phase in one case (Ussuri1), for the active phase in three of the five cases (Ussuri, Kostroma1,2), and never for the end phase. Thus, temperature had lower effect on call number/hour compared to time of day. Data on more populations and examining effects of other weather factors are necessary for the conclusive data on effects of environment factors on vocal rutting activity across populations of red deer. Support: RFBR grant 15-04-06241.