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Subspecies-specific rutting calls and male vocal activity in an Asian subspecies of red deer, *Cervus elaphus xanthopygus*

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Red deer *Cervus elaphus* subspecies substantially differ in the acoustic structure of their rutting calls and vocal activity pattern during the rut. For some subspecies, the acoustics of rutting calls are well-studied and are used as indicators of subspecies together with genetic and morphological markers. Deer censuses by voice are often used as abundance indices, however to obtain reliable results knowledge about the vocal activity patterns in the given locality is required. This study provides the first data on the acoustic structure of stag rutting calls in *C. e. xanthopygus* and the relationship of vocal activity and ambient temperature, obtained using automated recording systems. Data were collected in the eastern part of the Komarov Ussuriiskii State Nature Reserve, the Russian Federation from September 18 to October 16, 2014. The maximum number of calls per hour was recorded during nighttime (3 a.m. to 6 a.m.), whereas from 2 p.m. to 5 p.m. no rutting calls were recorded. The number of calls per hour decreased with increasing ambient temperature. Most rutting calls were single calls with a mean \pm SD duration (3.41 ± 0.65 s) that was similar to that of bugles of the Siberian and Northern American subspecies, but exceeded the duration of rutting roars of the European red deer. The mean maximum fundamental frequency (0.66 ± 0.15 kHz) was considerably lower than in Siberian *C. e. sibiricus* (1.23 ± 0.21 kHz) and a few Northern-American subspecies of *Cervus elaphus* (1.5 - 2 kHz), although the frequency of the highest calls of *C. e. xanthopygus* (1.01 kHz) exceeded that of the lowest calls of the Siberian red deer *C. e. sibiricus* (0.79 kHz). The lower range of the maximum fundamental frequency of *C. e. xanthopygus* calls (0.32 kHz) was similar to the upper range of the maximum fundamental frequency of calls of *C. e. hispanicus* (0.34 kHz), whose rutting calls are the highest among all European subspecies of *Cervus elaphus*. We conclude that rutting calls of *C. e. xanthopygus* are considerably lower than those of the studied Asian and American subspecies of *Cervus elaphus* and higher than those of all European subspecies. Acoustic differences may therefore be used for subspecies diagnostic in combination with morphological and genetic indices.

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