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To cite this article: Maria Paola Ponzetta, Francesco Sacconi, Chiara Crocetti, Francesco Cervasio & Isabelle Minder (2009) GPS/GSM collars monitoring of red deer in the Tosco-Emiliano Apennine Mountains, Italian Journal of Animal Science, 8:sup2, 646-648, DOI: [10.4081/ijas.2009.s2.646](https://doi.org/10.4081/ijas.2009.s2.646)

To link to this article: <http://dx.doi.org/10.4081/ijas.2009.s2.646>



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Published online: 07 Mar 2016.



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GPS/GSM collars monitoring of red deer in the Tosco-Emiliano Apennine Mountains

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ABSTRACT - Nine red deer hinds were captured in the Nature Reserve of Acquerino-Cantagallo in the Apennine mountains and fitted with GPS/GSM collars to monitor spatial movement and habitat use. Preliminary results of interfix distances in the first 48 hours after capture showed highly variable distances immediately after release and a decreasing during the following day. Possible effects of capture were evaluated.

Key words: GPS/GSM collars, Red deer, Apennine mountains.

Introduction – Red deer *Cervus elaphus* (L., 1758) are present all over Europe in a great variety of habitats, living from forest areas to pastures and meadows from 0-2500m.s.l. (Boitani *et al.* 2003). Extirpated in Italy at the end of the 19th century, red deer were re-introduced in the Northern Apennines about 50 years ago and their population size has increased to approximately 3000 individuals (Technical Commission ACATE, 07-08). Negative impact (e.g. damage to crops, car collision) has augmented in recent years (Ponzetta *et al.*, 2007), thus requiring an appropriate management plan. However, information about spatial movements and habitat use of this local population of red deer is scarce. The aim of this study was to assess the phenology of spatial behaviour and local habitat use of red deer captured within the Nature Reserve of Acquerino-Cantagallo (Prato and Pistoia provinces), where relatively high densities (2500 individuals/800 km²) of these ungulates occur (Nicoloso *et al.* 2007). GPS radio-tracking was used to collect reliable position data at regular and frequent intervals (Aragno *et al.*, 2007). Here we present the preliminary data about spatial movements of red deer hinds during the first two days after narcosis and release.

Material and methods – The study area is situated in the Nature Reserve of Acquerino-Cantagallo, in the Tosco-Emiliano Apennines, Italy. In winter 2008/2009, nine red deer hinds were captured between 7 p.m. and 2 a.m. in free-ranging. Each animal was measured, examined for parasites and blood samples were taken for genetic analyses. A GPS collar (Vectronic Aerospace®, Germany, mod. GPS-Plus) with GPS and VHF transmitters and sensors for activity, environmental temperature and mortality measurements was fitted (Girard *et al.*, 2002). The collars were programmed to take locations every hour and to transmit data by GSM system. For data analysis, only validated fixes, based on the reception of five or more satellites were used. For all hinds, distances between consecutive fixes (interfix distances; 1fix/hour) within the first 48 hours after release were calculated. Medians of inter-fix distances for each hind within the first 12 hours were calculated and compared by Wilcoxon paired-sample test (Zar, 1998) with median values of distances within 13-24 hrs, 25-36 hrs and 37-48 hrs, respectively.

Home ranges were calculated for eight hinds (fixes of the last captured hind were excluded from analysis as enough data were not available) through the 95% Minimum Convex Polygon (MCP) method considering fixes collected in the first week after capture for each hind separately.

Figure 1. Distances covered by hinds (n=9) between consecutive fixes (m) within time periods after release.

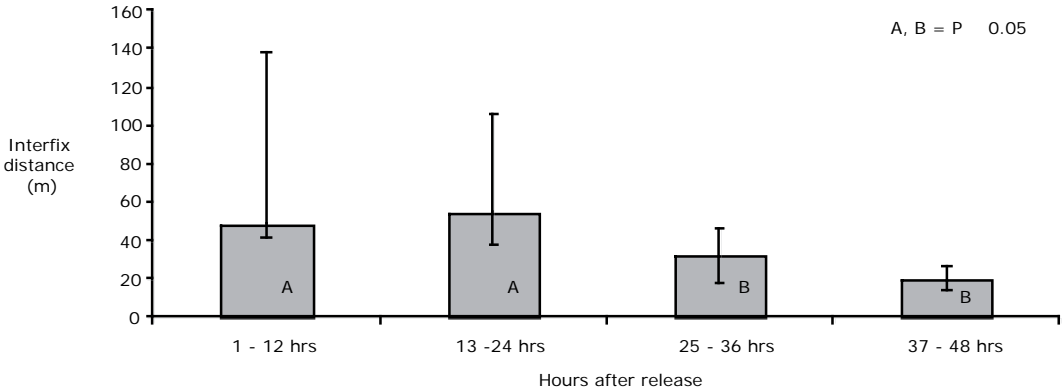
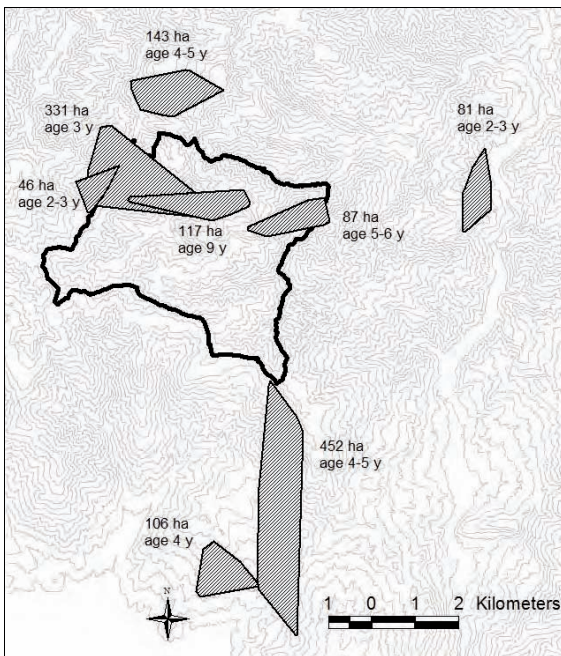


Figure 2. Home ranges size, estimated age of hinds and borderline of the Nature Reserve of Acquerino-Cantagallo



Results and conclusions – Distances covered by the nine red deer hinds between consecutive fixes (1 fix/hour) were highly variable (Figure 1), with a median value of 48.6 m ($Q_1=41.6$ m, $Q_3=138.3$ m) within the first 12 hours after release of hinds, decreasing significantly to 32 m ($Q_1=17.4$ m, $Q_3=46.6$ m) 24 hours later (Wilcoxon paired-sample test; $Z=-2.547$, $P=0.011$, $n=9$) and to 19 m ($Q_1=14.5$ m, $Q_3=26.6$ m) in the time period of 37-48 hours after release (Wilcoxon paired-sample test; $Z=-2.073$, $P=0.038$, $n=9$).

This decrease in median distances was accompanied by a reduced variability of values and a stabilization of ranging movements.

Figure 2 shows the home ranges of red deer hinds calculated on fixes collected in the first week after capture. Home range sizes (MCP 95%) within the first week after capture varied from 46 hectares (ha) to 452 ha and apparently they did not differ between age classes.

In conclusion, in the first hours after release the animals appeared to show a

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wider mobility, followed by a progressive stabilization of ranging movements, suggesting indirectly that hinds had perceived effects of capture and narcosis. Even though data about home range sizes provided some interesting preliminary data, the analysis of hinds spatial movements needs a longer period of observation to obtain significant information. Therefore, this study will continue during the presumed life of the GPS collars batteries, which are supposed to endure about two years.

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