

**Toponyms predict recolonization and extinction patterns for large carnivores in Italy**

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**Introduction** The name given to places usually reflects the usage, the most striking natural features or particular historical events. In wilderness area we expect that names could be linked to the occurrence of animals and plants that people were used to see in their everyday life: for example name places such as “Cervara” are linked places used for hunting deers (*Cervo* in Italian), while “Rovereto”, “Roverè” are instead places linked to the presence of an oak species (*Rovere* in Italian). Charismatic animals, such as large predators, are likely to have been chosen to name places and they also occur in many flags and town emblems across Italy (Rome is one). In this paper we argue that it is thus more likely that a place was named after wolf or bear if the species was actually present in historical times.

**Methods** A list of dialectal names for bear and wolf were retrieved from an online vocabulary of Italian dialects.

Open Street Map (OSM) and the toponym map of Italy downloaded from the national cartographic portal (PCN) were queried with the selected words or pattern of letters from the previously identified list.

The queries were then refined by semi-automatic selection of the relevant name places, removing obvious artifacts of the queries. The remaining points were processed in order to obtain a Gaussian kernel distribution of the occurrence of the toponyms

for each species. This results was then overlapped with the past distribution (1950-present) of the two species obtained from published literature and assessed with K-statistics in GRASS GIS.

**Results** The query of the PCN map returned about of 2700 records, of which 709 were considered meaningful for the name linked to brown bear. The query on OSM instead yielded 523 records (valid 330) including name of places of bar, restaurants and toy shops. The query of PCN map using the words related to wolf returned 1636 records of which 1546 were valid. OSM results overlapped with those from PCN, thus only the results from PCN map were further processed. Name places carrying obvious reference to those carnivores are located all across Italy, with highest densities in the Alps and central southern Appennines and the lowest occur in the Po valley and the Islands. The pattern of the name places map overlaps with the pattern of contraction and expansion of the species over time. The minimum historical distributions of wolf and brown bears occurs at the highest densities of toponyms related to them.

**Discussion** Such an exercise can raise awareness in people about the past presence of the species in the Italian territory. The maps can be presented in discussions with stakeholders or during dissemination events to highlight the historical heritage of the territories and the cultural value of large carnivores.

**Analysis of philopatry by biometric measures in Red Deer (*Cervus elaphus*) as a tool to identify different management areas**C. VANNINI<sup>1</sup>, F. PECCHIOLI<sup>2</sup>, P. SEMENZATO<sup>3</sup>, P. LUPI<sup>4</sup>, S. NICOLOSO<sup>3</sup><sup>1</sup>“La Sapienza” Università di Roma, Dipartimento di Scienze della Terra. e-mail: chiara.vans88@gmail.com<sup>2</sup>Università degli Studi di Firenze, Dipartimento di Biologia<sup>3</sup>D.R.E.Am Italia via Enrico Bindi, 14 51100 Pistoia<sup>4</sup>Università degli Studi di Firenze, già Dipartimento di Scienze delle Produzioni Agroalimentari e dell’Ambiente (DISPAA)

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Deer damage management should be based on knowledge of their spatial behavior to implement actions aimed to reduce the local density of animals. Previous study showed that the female’s philopatric behavior in deer entails that localized removal of individuals may create persistent areas of low density. Therefore the knowledge of areas used by animals allows identifying different management areas, driving the remove actions. The aim of the present work was to verify the suitability of the use of biometric data to identify separate sub-populations in the study area, defining in turn of different management areas. We hypothesized that philopatry behavior of female red deer (*Cervus elaphus*) entailed a biometric characterization of different localized group. In particular, we hypothesized the presence of two different sub-population (mountain area and plain/hill area) with a low exchange of individuals in the study area.

To test this hypothesis, we performed the discriminant analysis comparing a few biometric parameters (such as weight of freshly killed, weight eviscerated, and length of hind foot) of individuals belonging to both sexes. The biometric data and their geo-locations were collected on 561 male and 581 female red deer (age $\geq$ 2) killed during the hunting seasons from 2000 to 2015 in Province of Pistoia (District Central ACATER – Area of the deer

of the Central Tuscan-Emilia-Romagna Apennine).

A significant difference of the mean of each biometric measurement ( $p\leq 0.05$ ) between individuals killed in the mountain and in the plain/hill area was found only in females. On the contrary, males of different areas did not differed significantly ( $p\leq 0.05$ ). However, the discriminant analysis did not highlight a strong discriminating power of the biometric parameters used. Our results showed that, unlike the males, female deer exhibit some degree of philopatry, consistently with the presence of the two sub-populations identified a priori.

Despite, these findings suggest that a greater number of biometric parameters have to be considered to increase their discriminating power. Nevertheless, it emerged that use of biometric data collected from killed animals may be used to distinguish different management areas. The applicability of this approach is higher with the increase of geographic area considered, and it is not efficient for small areas comparable to home range size used by social groups. Future studies that consider biometric data on a wider geographical scale are strongly recommended to improve potentiality of this method to drive the deer harvest in management actions.