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Analysis of the microtheriofauna of the Alta Murgia National Park (Apulia)

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Abstract

The study presents the first data on the community of micromammals present in the Alta Murgia National Park (Puglia, Italy) by analyzing pellets from several species of raptors. A total of 300 pellets were considered: 131 of Barn Owl, *Tyto alba*, 5 of Long Eared Owl, *Asio otus*, 94 of Kestrel, *Falco tinnunculus* and 70 of Little Owl, *Athene noctua*. The analysis of the pellets allowed to determine 1039 individuals of micromammals belonging to 8 species. Savi's pine vole, *Microtus savii* resulted as the most frequent species. Of particular interest is the discovery of a specimen of Italian water vole, *Arvicola italicus*. A correlation between the frequency of presence of *M. savii* and *Suncus etruscus* and the landscape diversity index (Hill number) was found.

Keywords: micromammals, raptors, pellets, Alta Murgia

Riassunto

Questo studio presenta i primi dati sulla comunità di micromammiferi presenti nel Parco Nazionale dell'Alta Murgia (Puglia, Italia) analizzando borre di diverse specie di rapaci. Sono state analizzate in totale 300 borre: 131 di Barbagianni, *Tyto alba*, 5 di Gufo comune, *Asio otus*, 94 di Gheppio, *Falco*

tinnunculus e 70 di Civetta, *Athene noctua*. L'analisi delle borre ha consentito di determinare 1039 individui di micromammiferi appartenenti a 8 specie. L'arvicola di Savi, *Microtus savii* è risultata la specie più frequente. Di particolare interesse è stato il ritrovamento di un esemplare di arvicola d'acqua italiana, *Arvicola italicus*. È stata riscontrata una correlazione tra la frequenza di presenza di *M. savii* e *Suncus etruscus* e l'indice di diversità del paesaggio (numero di Hill).

Parole chiave: micromammiferi, rapaci, borre, Alta Murgia

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Introduction

Distribution data about micromammals in Italy is abundant (e.g. Amori et al. 2008, Piccari and Szpunar 2012, Amori et al. 2014, Gaggi et al. 2014), anyway its geographic coverage is discontinuous, and many areas are still poorly investigated. This is the case of Apulia, despite its remarkable position that makes it a natural bridge between Europe and the East Mediterranean. An exhaustive distributional analysis of Apulian microtheriofauna is still lacking and some areas, such as the Alta Murgia district, are almost unknown.

Micromammals occupy an intermediate level of the trophic pyramid and are a key element to support the diversity and abundance of predators at higher levels (Amori et al. 2014). Their burrowing activities contribute to the bioturbation of the soil and increase water retention (Golley et al., 1975). Besides, their tunnels can host complex communities of arthropods (Carpaneto et al., 2011). Therefore, an optimal management of micromammal populations is a core element in the conservation of the target species and of the communities that co-evolved with

them (Carpaneto et al. 2011). It is well known that pellet analysis is a valid tool in gathering data on micromammals (Contoli 1981, Nappi 2001) and is one of the most used methods for the study of microteriocenosis (Cheylan 1976, Morton and Martin 1979, Contoli 1980, 1981, Campbell et al. 1987, Contoli et al. 1991).

In the present contribution we present the first data on the community of micromammals present in the Alta Murgia National Park by comparing pellets from several species of raptors.

The Park was established in 2004 (DPR March 10 2004) and extends for about 68.077 ha in the western Province of Bari, including the highest elevations of the Murge Plateau. It falls within Natura 2000 SIC/ZPS IT9120007 "Murgia Alta" which covers about 128.880 ha.

Most of the Alta Murgia territory is characterized by mosaic areas in which semi-natural grasslands are found (Fig. 1). Semi-natural grasslands of the Western Palaearctic region are considered among the most species-rich habitats in the world (Dengler et al. 2012) and their biodiversity increased during millennia of extensive land-use and

management practices, including grazing and deliberate burning regimes (Willems 1990, Turbé et al. 2010, Dengler et al. 2014). Due to the presence of habitats of Community interest and species of high conservation value, the Park is included in the Habitats Directive 92/43 CEE and the Birds Directive 79/409 CEE.

Materials and Methods

The study was carried out in 17 sites located in different sectors of the Alta Murgia National Park from October 2018 to October 2019 (Fig. 2). A total of 300 pellets were analyzed: 131 of Barn Owl, *Tyto alba*, 5 of Long Eared Owl, *Asio otus*, 94 of Kestrel, *Falco tinnunculus* and 70 of Little Owl, *Athene noctua*. Species were determined by referring to the identification keys available

in literature, by an analysis of cranial parts and postcranial bones (Toschi and Lanza 1959, Toschi 1965, Nappi 2001, Amori et al. 2008). The determination of the sex of each single specimen was performed on the pelvis following Nappi (2001). Sex ratio was computed when possible. A correlation analysis was performed by computing Pearson coefficients between the frequency of presence of each species for each sampling site and the landscape diversity index (Hill number) calculated on a circular buffer with a radius of 2.5 km radius, i.e. considering the mean radius of predation of the different raptors of study (Wijnandts 1984, Gilli 1998, Salvati et al. 2002, Kross et al. 2016). The Hill number (Hill, 1973) expresses the effective number of land uses that contribute to the diversity of a given landscape. As the number of Hill increases,



Figure 1: A semi-natural grassland with an abandoned farm hosting raptor roosts sampled in the present work (Minervino Murge).

there is an increase in the dominance of some landscape patches over the others, with a consequent decrease in the complexity of the mosaic analyzed and its simplification, as the landscape is dominated by a lower number of types of land uses.

Results and Discussion

The analysis of the pellets allowed to determine 1039 individuals of micromammals belonging to 8 species: *Microtus savii* 871 (83,83% of total), *Apodemus sylvaticus* 91 (8,76%), *Apodemus* sp. 18 (1,73%), *Rattus rattus* 3 (0,29 %), *Arvicola italicus* 1 (0,1 %) *Crocidura suaveolens* 12 (1,15 %), *Crocidura leucodon* 25 (2,4%), *Crocidura* sp. 6 (0,58 %), *Suncus etruscus* 7 (0,68 %) and *Talpa* sp. 5 (0,48%). Out of the 1039 individuals analyzed, Savi's pine vole, *M. savii* resulted as the most

frequent species with a value higher than 83%. This finding agrees with the studies conducted in central Italy by Pennesi and Battisti (2003), in Salento by Battisti et al. (1997) and in several areas of Apulia by Bux et al. (2000, 2009). *M. savii* is a very plastic species, typical of areas with herbaceous cover or cultivated, where the tree cover has been greatly reduced.

Of particular interest is the discovery of a specimen of Italian water vole, *A. italicus* in the site of "Masserie Nuove", in the Corato area. Costa (1871) indicates that this species is "rare" in Apulia and is recorded only in Brindisi (BR) and Capo di Leuca (LE). Records from other areas Apulia date to 1916 (seven finds from Cerignola, FG at the Museum of Genoa "G. Doria") and to 1951 (a tooth found at Lake Lesina by Pasa) (Amori et al. 1986). Recent investigations on the microteriofauna of Apulia carried out

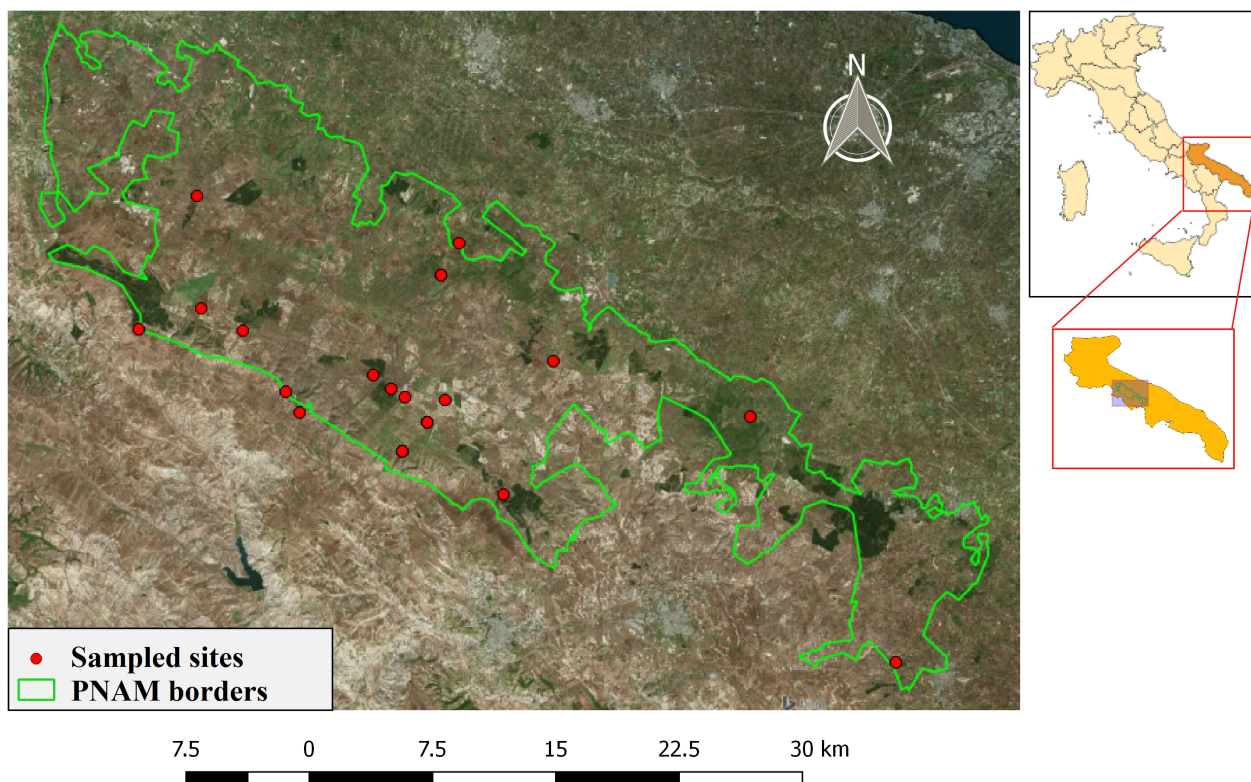


Figure 2: Geographical location of the sampled sites in the Alta Murgia National Park (PNAM).

through the analysis of a large number of raptors pellets (Battisti et al. 1997, Bux et al. 1999, 2000, 2001, 2009) have not confirmed the presence of this species. In a recent survey of micromammals from barn owl pellets in one out of five sites in the Maremma of Latium, Ferri et al. (2021) found some remnants of *A. italicus*. This site has the highest coverage of wet habitats among those sampled, confirming the semiaquatic habits of this declining species in peninsular Italy and thus the possible reason for the scarceness of findings in Apulia. Regarding murids, the presence of the wood mouse, *Apodemus sylvaticus* is recorded with a frequency of 8.76%. For the *Apodemus* genus, many findings were bone fragments so it was impossible to identify them at the species level by applying the morphological-morphometric index of Filippucci et al. (1984), so they were ascribed to *Apodemus* sp. Anyway, they probably belong to the widespread *A. sylvaticus*, since its congener *Apodemus flavicollis* in Apulia is found only in the area of the Gargano promontory (Umbra Forest; Amori et al. 1986) in which wooden coenoses with an elevated tree cover are found (Lovari et al. 1976).

As far as the synanthropic species, only a few specimens of black rat, *R. rattus* have been found. The absence of *Rattus norvegicus* could be due to the lack of waterways or in any case wetland and sewerage areas near the sites studied (Amori et al. 2008). The absence of *Mus domesticus* could be explained by the lack of urban centers near the analyzed sites (Amori et al. 2008).

Eulipotyphla have a low percentage (5.5%) compared to rodents, with *C. leucodon* as the most widespread species. *C. suaveolens* and *S. etruscus* individuals are rare. Their presence confirms the high naturalistic value

of these areas that host suitable sites despite the intense agricultural exploitation. Crocidurini, in particular the two last cited species are considered excellent bioclimatic indicators (Contoli 1980, Bonvicino et al. 2002), since they are typical and exclusive species of thermo-xerophilous environments of macro- and mesoclimate (Spagnesi and De Marinis 2002): in fact, they select mostly arid and dry environments, similar to those sampled in this study.

Shrews of Genra *Sorex* and *Neomys* are completely absent; this could depend on the fact that they are more shade tolerant than the Crocidurini since they prefer colder, more humid environments with a minimum vegetation cover (Ricci and De Ascentiis 2002).

Sex determination was possible only for some *M. savii* and *A. sylvaticus* specimens, since the pelvic bones were often absent or broken. In *M. savii* sexes are almost equally distributed, with a slight prevalence in favor of males. In fact, the value of sex ratio, calculated on a sample of 224 individuals, was 1.33, in line with the values calculated for the species in other geographical areas (Caroli et al. 2000, Ettorre et al. 2013, Zaccaroni et al. 2015). On the opposite, a slight deviation towards females is observed in *A. sylvaticus* ($n = 43$; sex ratio = 0.87). This result is similar to capture-marking-recapture data from Sicily (Sarà and Casamento 1992). A positive correlation ($r = 0.044$, $n=11$, $p < 0.05$) was found for *S. etruscus* suggesting preference of this species for diversified and heterogeneous areas from a structural point of view. The negative correlation ($r = -0.041$, $n=11$, $p < 0.05$) found for *M. savii* confirms the plasticity and generalist attitudes of this species to frequent the unselected and homogeneous habitat from the structural

point of view. This result is in accordance with previous data (Amori et al 2008), in fact, this species is regarded as euryecious, being able to adapt to diversified environmental conditions, and is more or less ubiquitous, versatile, and sometimes even invasive.

Author contributions

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