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ASSESSING POPULATION SIZE OF MARTINO'S VOLE (*DINAROMYS BOGDANOVI*) IN CENTRAL BOSNIA

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ABSTRACT - We carried out a Capture-Mark-Recapture study on Martino's vole *Dinaromys bogdanovi* on Mt. Bjelašnica, central Bosnia. During two trapping sessions (June and September 2008) we recorded 21 individuals which were captured 33 times. Voles were trapped significantly more frequently during the night (85% of all captures). In June all the animals were adult females while three age classes (juvenile, subadult and adult) were distinguished in September. No reproductive activity was recorded in mid-June and not a single adult female was evidently pregnant in September. Also, subadults (N = 6) did not show reproductive activity. Martino's voles proved sedentary and only two individuals moved between trap stations. Ten adults were captured in two sessions on an area of 5.67 ha, resulting in a population density of about 2.5 voles per hectare.

Key words: *Dinaromys bogdanovi*, rarity, population density, CMR, Balkan biodiversity

RIASSUNTO - ***Valutazione della consistenza della popolazione di arvicola Balkan della neve* (Dinaromys bogdanovi) *in Bosnia centrale***. Lo studio con il metodo di cattura-marcamento-ricattura è stato effettuato sull'arvicola di Balkan della neve *Dinaromys bogdanovi* sul M.te Bjelašnica, Bosnia centrale. Nel corso di due sessioni di trappolaggio (giugno e settembre 2008) sono stati catturati 21 esemplari per un totale di 33 volte. Le arvicole erano catturate più frequentemente di notte (85% delle catture totali). In giugno tutti gli animali trappolati erano femmine adulte, mentre tre classi di età (giovani, sub-adulti e adulti) erano distinte in settembre. Nessuna attività riproduttiva è stata registrata a metà giugno e nessuna femmina adulta era trovata gravida in settembre. Anche gli esemplari subadulti (N = 6) non mostravano attività riproduttiva. Le arvicole erano sedentarie; solo due individui hanno compiuto spostamenti (220 m per una femmina adulta) tra le stazioni di trappolaggio. Dieci individui adulti sono stati catturati in due sessioni su una superficie di 5,67 ha, pari ad una densità di popolazione di circa 2,5 arvicole/ha.

Parole chiave: *Dinaromys bogdanovi*, rarità, densità di popolazione, CMR, Bosnia

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INTRODUCTION

Martino's vole *Dinaromys bogdanovi* (Martino and Martino, 1922) is a rare and little known paleoendemic rodent from the mountainous landscape of the western Balkans. The species shows all three attributes of rarity in accordance with Rabinowitz's 'seven forms of rarity' model (Kryštufek and Bužan, 2008) and is classified as Vulnerable in the IUCN red list (Kryštufek, 2008). While the distribution of this vole is well documented and its habitat requirements are mainly understood (Kryštufek and Bužan, 2008), there is a general shortage of information on its life history, which has been mainly obtained by the analysis of museum specimens (e.g. Kryštufek *et al*., 2000). It is generally agreed that Martino's vole is either rare (Tvrtković, 1994) or uncommon (Petrov, 1992), its relative abundance only occasionally exceeding five specimens per 100 trap-nights (Kryštufek and Bužan, 2008). However, the actual population density of Martino's vole has never been assessed.

In this paper we report the results of a Capture-Mark-Recapture (CMR) trapping of Martino's voles in Central Bosnia, hence providing first data on population numbers of this rare and elusive rodent.

STUDY AREA AND METHODS

Trapping was carried out in Turski Do on Mt. Bjelašnica, central Bosnia and Herzegovina (43°42.144' - 43°42.305', 018°14.898' - 018°15.252'), at an elevation of 1930-1953 m a.s.l. Mt. Bjelašnica is a typical Dinaric mountain with a karstified limestone bedrock and modest altitude (several peaks between 2057 and 2067 m a.s.l.). Mean yearly temperature is 0.7 °C, winter is long with snow cover >10 cm deep lasting on average 175 days. Precipitation is abundant (about 1235 mm annually) with, on average, 99 rainy days and 91 snowy days per year (climate data for the period 1998-2007; provided by the Institute for Hydrometeorology in Sarajevo). The mountain ridge above the timber line, which is at about 1900 m a.s.l., is covered by short-grass alpine meadows, dominated by *Carex kitaibeliana*, *Sesleria* sp., *Poa minor*, and *Festuca bosniaca*. Both the bottom and northern slopes of funnel-shaped karstic valleys (*dolines* = sink-hole; Fig. 1) are dominated by *Saxifraga prenja* and *Salix retusa*, respectively (Ritter-Studnička, 1955).

1. Trapping

We set 100 Sherman live traps inside 14 *dolines*, which spread over an area of about 5.67 ha and were the only habitat suitable for the target species in the study site (Kryštufek and Bužan, 2008). Traps were provided with bedding material (cotton wool) and baited with a mixture of rolled oats and sunflower oil and a piece of apple. Due to habitat heterogeneity, trap layout did not follow a fixed pattern and traps were set in those sites where the probability of capture was thought to be the highest. Trapping lasted for four consecutive nights, on 12–16 June and on 5–9 September 2008. Traps were checked twice a day, in the morning and afternoon. Captured Martino's voles were anesthetized using diethyl ether, sexed, weighted, individually marked by ear-tattooing (7 mm high characters produced by Hauptner – Herberholz GmbH & Co. KG, Solingen, Germany) and then released at the site of capture.

2. Data analysis

Age - adults, subadults and juveniles - was assessed on the basis of reproductive condition and body mass using the collection in the

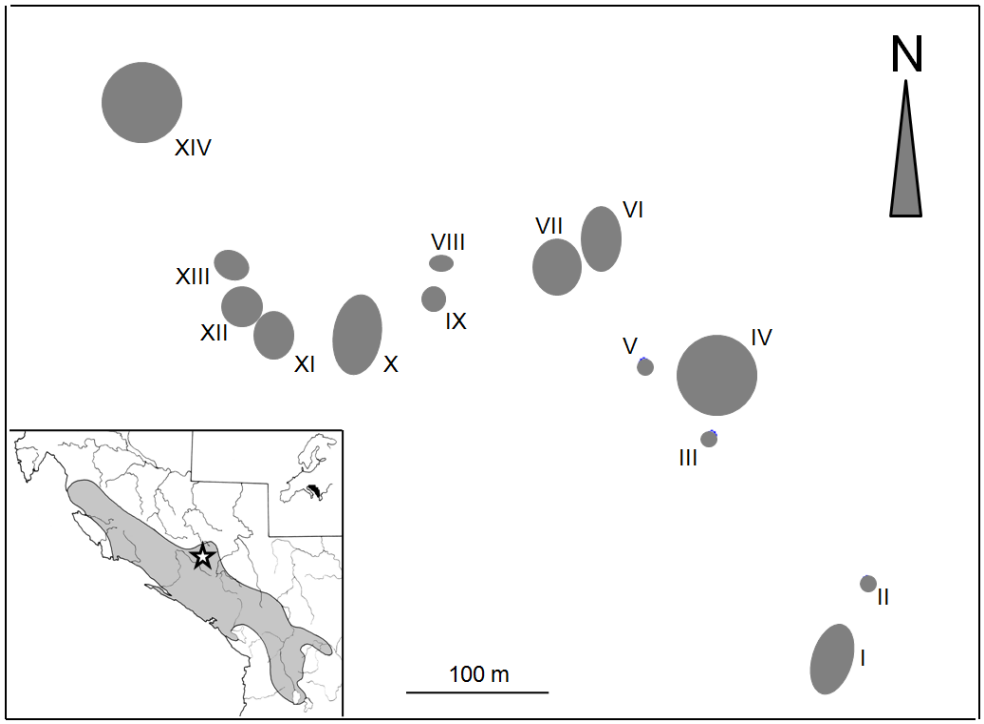

Figure 1 - Study area: distribution and approximate extent of karstic *dolines* (I to XIV) in Turski do on Mt. Bjelašnica, where trapping was carried out. The insert shows the approximate range of Martino's vole (shaded) in the western Balkans with the location of the study site (star).

Slovenian Museum of Natural History, Ljubljana, as a reference. The absolute age of museum specimens had been estimated in an earlier study by Kryštufek *et al.* (2000). Standard univariate statistics (mean ± Standard Deviation) were calculated for body parameters. Population density was estimated applying Petersen's index $N = M\,Y^{-1}$ (Aplin *et al.*, 2003), where N is population size, M is the number of animals marked during the first trapping session (June) and $Y = m\,n^{-1}$, where m is the number of marked individuals re-captured and n the total number of animals captured during the 2nd session (September). Variation between day- and night-captures was tested by a distribution-free Chi-square (χ^2) test in Statistica 5.5 (StatSoft, Tulsa, Oklahoma).

RESULTS AND DISCUSSION

In total we recorded 21 Martino's vole individuals which were trapped 33 times. Seven individuals were trapped in June and 17 individuals in September, including three recaptures from June. Only six individuals (ca. 30%) were recaptured from two to five times (mean ± SD = 3.0 ± 1.10). We had no losses due to mortality in traps, except for an adult female which was killed by a weasel (*Mustela nivalis*) during the June session. Out of 33 captures, only five (15.2%) happened during the day. Voles were therefore significantly nocturnal in their surface activity ($\chi^2 = 16.03$,

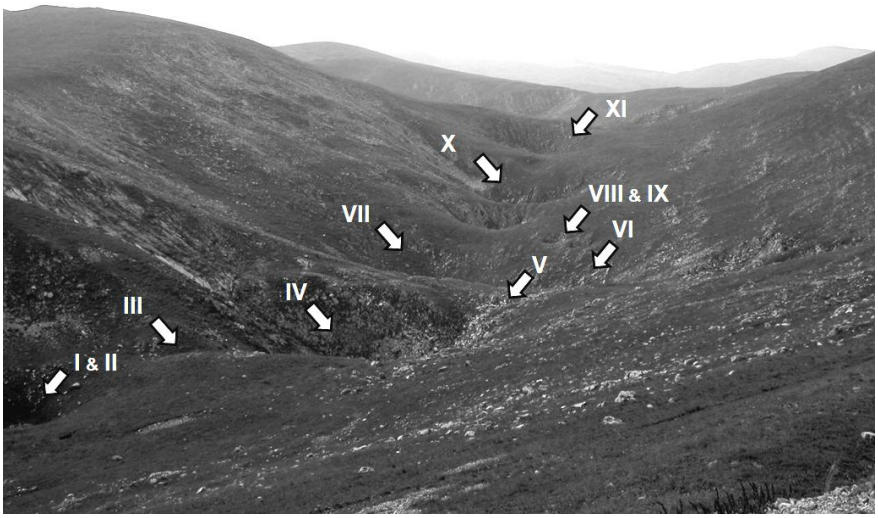

Figure 2 - Habitat of Martino's vole in Turski do, Mt. Bjelašnica. Arrows indicate the *dolines*.

df =1, P < 0.0001).

All voles captured in June were adult females (body mass 58–73 g; mean ± SD = 67.3 ± 6.07; n = 7), while three age-groups were distinguished among voles captured in September: adults (58–68 g, 64.5 ± 3.21; n = 7), subadults (43.5–48 g; 45.6 ± 2.05; n = 6) and juveniles (30.5–41.5 g; 37.3 ± 4.56; n = 4). No reproductive activity was recorded in mid-June and not a single adult female was evidently pregnant in September, although two were still lactating. Moreover, subadults did not show reproductive activity, in concordance with published evidence of sexual maturity being delayed to the second calendar year (Kryštufek and Bužan, 2008). On this basis, we suggest that at most two litters were delivered during July and August 2008. Such a reproductive output may be the maximum which females can afford during the short summer occurring close to 2000 m a.s.l.

Only two individuals moved between trap stations, suggesting that Martino's voles are sedentary, although the low recapture rate may have caused misperception. An adult female moved over a short distance between *dolines* IV and V during the daytime on June 15. Another adult female moved between June and September from *doline* VII to *doline* XII over a distance of 220 m (Fig. 1).

Ten adult Martino's voles (seven females and three males) were captured in two sessions on an area of 5.67 ha and three females were recaptured in September. Applying the Petersen estimate on adults (M = 7, m = 3, n = 6), population size was 14.0 individuals, corresponding to a density of 2.47 voles per hectare. Generally most arvicolines show substantially higher densities, but are also prone to wide oscillations (Taitt and Krebs, 1985). Therefore, a single snapshot survey of vole density can be misleading, even for a

K-selected species as Martino's vole (Kryštufek *et al*., 2000). Clearly, more field work is necessary to ensure better insight into population dynamics of this rare rodent.

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