Hystrix It. J. Mamm. (n.s.) 21(2) 2010: 189-193

EFFECTIVENESS OF TWO TRAPPING PROTOCOLS FOR STUDYING THE DEMOGRAPHY OF COMMON VOLES

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Received 25 August 2010; accepted 8 December 2010

RIASSUNTO - ***Efficacia di due metodi di trappolaggio per lo studio della demografia dell'arvicola campestre.*** Per valutare l'efficacia di due tipi di trappole, trappole "killer" e trappole "a vivo" tipo Rödl, sono stati confrontati i risultati della rimozione completa di una popolazione di arvicola campestre *Microtus arvalis* in merito a età, sesso, status riproduttivo e peso degli individui trappolati tramite ciascun metodo. Le trappole Rödl hanno catturato, in media, animali di età maggiore e più femmine riproduttive, mentre non sono state rilevate differenze significative in termini sia di rapporto sessi sia di peso medio. I risultati ottenuti suggeriscono di utilizzare almeno due metodi di cattura e che il confronto dei parametri demografici di popolazioni differenti può essere considerato valido solo quando siano stati utilizzati gli stessi metodi di trappolaggio.

Key words: M*icrotus arvalis*, trappole "a vivo" Rödl., trappole killer

DOI: 10.4404/Hystrix-21.2-4466

Population studies on small rodent pest species are crucial for understanding their demography and reducing pest-caused damages. In the last decades, animal welfare has required a shift to the predominant use of live traps rather than killer snap traps in population studies.

"Rödl" live traps (Rödl, 1975; Fig. 1) are considered to be very suitable for studies on rodent dynamics and have been widely used throughout Central Europe (Bryja *et al*., 2001; Bryja *et al*., 2005; Rico *et al*., 2007 a,b; Rico *et al*., 2009). However, even more studies have been carried out using snap traps, some of them in the same regions and for the same populations (e.g. Zejda and Nesvadbova, 2000; Janova *et al*., 2003; Heroldova *et al*., 2005; Janova *et al*., 2008).

It is well known that sampling methods affect significantly the output of the study (*e.g*.: Kratochvil and Geisler, 1964; Somsook and Steiner, 1991; Giraudoux *et al*., 1998; Giraudoux *et al*., 2008), as a consequence of interspecific differences in capture rates for different types of traps (Hansson, 1973; Rose *et al*., 1977; Slade *et al*., 1993; Anthony *et al*., 2005).

According to Pelikan *et al*. (1977) and Galindo-Leal (1990), the trapping success of Microtinae is the same for snap traps and Longworth live traps, whilst higher capture rates have been recorded by the use of snap traps rather than Sherman live traps (Weiner and Smith, 1972; Woodman *et al*., 1996). In contrast, Cocrum (1947), comparing live and snap traps, reported the opposite relationship.

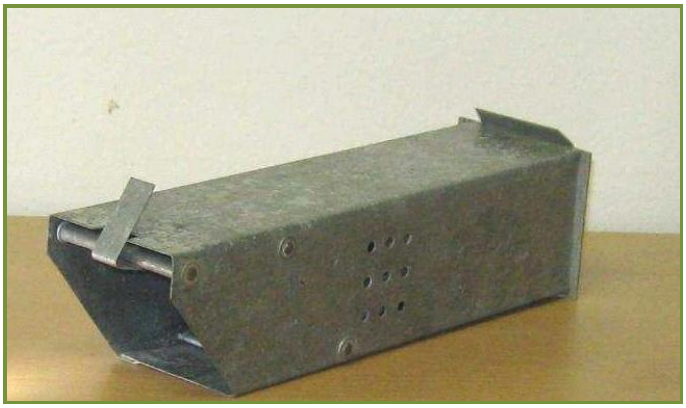

Figure 1 - Rödl live trap (245x60x60 mm).

Biases can occur in assessing either sex or age structure of Microtinae: Nicolas and Colyn (2006) found no difference in sex structures when comparing Sherman live traps and snap traps, while Galindo-Leal (1990) implied them comparing Longworth live traps to snap traps.

The conclusions of any demographic study carried out by a single method may be inaccurate if both the amount and direction of bias are unknown. The aim of our study was to compare age, sex, breeding status and weight of common voles *Microtus arvalis* (Pallas 1778) captured simultaneously by two widely used trapping methods, *i.e.* snap traps and Rödl traps.

In 1996-2003, a long-term study on common vole demography was carried out in a alfalfa field near Drnholec, south Moravia (48°53'N, 16°27'E; Janova *et al*., 2003; Bryja *et al*., 2005; Heroldova *et al*., 2005; Janova *et al*., 2008; Heroldova, 2007). At the end of this study, on 20-24th October 2003, the whole population of a 28 x 60 m area was removed by using simultaneously the two traps. Snap traps were baited with fried wicks, live traps by oat flakes, as done throughout the study period. Total number of traps was 465 and 128, respectively.

Snap traps were set at the junctions of a 2 m wide square mesh, while that used for live traps was 4 m wide. Traps were brought in operation for four consecutive nights. All trapped individuals were weighted, sexed, measured and dissected. Breeding females were identified by the presence of recent placental scars on the wall of the uterus. Age was estimated by the eye-lens method according to Janova *et al*. (2007). Data being not normally distributed, average age and body mass of individuals caught by different types of traps were compared by Mann Whitney's test. Males and females were analysed separately. Variation in both the sex ratio (actual numbers of males and females) and proportion of breeding and non-breeding females between traps was tested by the chi-squared test (χ^2) for contingency tables.

All experiments complied with Council directive 86/609/EEC and had been previously approved by the Institute of Vertebrate Biology AV ČR.

A total of 143 individuals from snap traps and 50 individuals from live traps were analysed. Sex ratio did not significantly differ between traps (respectively, 77 ♂ / 66 ♀ and 20 ♂ / 30 ♀; $\chi^2 = 2.84$, P = 0.092). Live traps captured slightly less males than females ($\chi^2 = 4.0$, P = 0.045), although males have higher spatial activity and then should be more trap-prone (Kikka-

Table 1 - Variation in age (days) and body weight (g) of male and female common voles caught in live traps (LT) and snap traps (ST) (Mann-Whitney's test).

	N LT/ST	Median LT	Median ST	Z	P
Male age	20/68	53	44	-2.196	0.028
Female age	27/62	60	49	-2.075	0.038
Male body weight	20/72	15.75	16	-0.393	0.694
Female body weight	30/66	16	15.5	-1.088	0.278

wa, 1964; Gliwicz, 1970; Grunwald, 1975; Bryja *et al*., 2005). The balanced sex ratio observed while using both types of the traps is in accordance with previous studies (Pelikan *et al*., 1977, Nicolas and Colyn, 2006).

On average, live traps captured older individuals than snap traps, but there was no difference in body weight between individuals from different traps (Tab. 1). Older individuals may enter live traps more often because they previously experienced the presence of food (Andrzejewski *et al*., 1967; Gliwicz, 1970; Grunwald, 1975; Galindo-Leal, 1990). Accordingly, 22 out of 50 live-trapped individuals had already been marked during previous trapping actions and their median age was higher than that of inexperienced individuals (63.2 *vs*. 47.4 days). The use of different baits may be another important factor causing the observed differences, as young voles or post-breeding females could prefer baits rich in fat.

Although there is a strong correlation between age and body weight for young individuals (*e.g*.: Bujalska and Gliwicz, 1968; Ford, 1981; Fuller, 1988) at the end of October even the youngest individuals have grown up to the size of adult individuals. Moreover, older and bigger animals tend to lose some weight while in the trap (Weiner and Smith, 1972; Bietz *et al*., 1977; Kaufman and Kaufman, 1994) and we are aware that some weight loss may have occurred before the euthanasia of live-trapped individuals.

Females which have already given birth, were significantly more frequent in live traps (12 breeding ♀ *vs.* 18 non-breeding ♀) than in snap traps (9 breeding ♀ *vs.* 56 non-breeding♀; $\chi^2 = 8.15$, $P < 0.05$). It has been observed that females, especially breeding ones (Grunwald, 1975), are more interested in entering live traps perhaps because these traps remind the burrow and offer food.

Our results suggest that the outcomes of live and snap trapping can be qualitatively different and, as a consequence, the comparison of the results gained by different single methods questionable. We suggest to use more than one method for studying the structure of small mammal populations and that, to avoid biases, the same trapping methods should be used when different populations are studied and compared.

ACKNOWLEDGEMENTS

The study was supported by grant GACR 521/08/P529 and by Long-term Research Plan MSM 0021622416 of the Masaryk University.

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