

Response of *Microtus pennsylvanicus* to multiple-capture traps¹

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Received March 22, 1982

MIHOK, S., R. BOONSTRA, F. H. RODD, and B. SCHWARTZ. 1982. Response of *Microtus pennsylvanicus* to multiple-capture traps. *Can. J. Zool.* 60: 2965-2967.

Microtus pennsylvanicus was livetrapped on demographic grids in Ontario and Manitoba to determine the efficiency of Longworth and one-way door multiple-capture traps. In paired-choice field trials, multiple-capture traps caught far fewer voles

¹Issued as AECL-7462.

than did Longworth traps. Sand-tracking and a flagging system indicated that voles rarely lifted the one-way door of the multiple-capture trap, although they often approached the traps and began to enter the one-way door.

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Le piégeage de *Microtus pennsylvanicus* vivants, dans des treillis démographiques de l'Ontario et du Manitoba, a permis de déterminer l'efficacité des pièges Longworth et de pièges à captures multiples dont les portes n'ouvrent que dans un sens. Au cours d'essais où les animaux avaient le choix, les pièges à captures multiples ont attrapé beaucoup moins de campagnols que les pièges Longworth. L'utilisation de pistes de sable et d'un système de signalisation indiquent que les campagnols soulèvent rarement la porte à un sens des pièges à captures multiples, même s'ils approchent souvent de ces pièges et cherchent à y entrer.

[Traduit par le journal]

Multiple-capture traps with continuously operating one-way doors (Burt 1940) have occasionally been used in small mammal population studies as an alternative to the conventional Longworth (Chitty and Kempson 1949) or Sherman trap. The one-way door is attractive in that it is gravity dependent, resets automatically, requires no maintenance or adjustment, and can capture several individuals in a single trap. Variable trap sensitivity and learned escape behavior (Pietsch and Ickert 1979; Boonstra and Rodd 1982) are probably minimized with this trap design (Mihok 1979). To date, multiple-capture traps have provided unique data on the social structure of small rodents as well as general data on demography.

Except for some limited comparisons in Timchenko (1979), little is known about the effectiveness of multiple-capture traps. Mihok (1979) reported only modest trappabilities of 52 to 77% for *Clethrionomys gapperi*, and 77 to 83% for *Peromyscus maniculatus*. Similarly, Mihok (1979) found that a long, and hence impractical, trapping period was necessary to compensate for delayed entry of animals into traps. The object of the present study was to investigate the efficiency of the one-way door design for another common North American rodent, *Microtus*.

In a preliminary experiment, we incorporated the door and tunnel of Mihok (1979) into a metal box trap that was also equipped with a separate exit hole covered by a Plexiglas flap. This exit flap was unlatched between trapping periods to permit entrance through the tunnel and exit through the flap. Traps were set on four consecutive occasions near Toronto, Ontario, in the spring of 1980 on a grid used for biweekly trapping of a high-density population of *Microtus pennsylvanicus*. Twenty locations under wooden shelters (Iverson and Turner 1969) were equipped with a multiple-capture trap and prebaited for 2 weeks, after which a Longworth trap was added, and both traps were set. Thereafter both traps remained on the grid, prebaited, all the time. In the first sampling period, multiple-capture traps caught as many voles as Longworth traps (1:0.78, $\chi^2 = 0.74$, $N = 66$, $P > 0.5$). In the other three periods, multiple-capture traps caught significantly fewer voles than Longworth traps (1:2.8, $\chi^2 = 19.4$, $N = 91$, $P < 0.001$).

The reason for this change in trap response was not obvious.

In the next set of experiments, at Pinawa, Manitoba, new multiple-capture traps were made by replacing Longworth trap tunnels with similar tunnels equipped with a one-way door. The weight of the door was reduced to 4.3 g by making it from wire mesh rather than Plexiglas. We also incorporated an extension to the top of the door that supported a light, pivoted wire "flag" that fell down at the least movement of the door. The flag extension also acted as a counterweight for the one-way door. These new multiple-capture traps were therefore identical to Longworth traps except for the nature of the capture mechanism.

The modified Longworth traps were tested against normal Longworth traps in the summer of 1981 during biweekly trapping of grids that were being trapped for other purposes near Pinawa, Manitoba (Turner and Iverson 1976). Three 1-ha isolated meadows with 64 trap shelters at 11-m spacings were set with both trap types on 15 occasions from April to August. Grid 1 was trapped seven times, grid 2 six times, and grid 6 twice. Each trap type was placed along opposite walls of a trap shelter (Iverson and Turner 1969) so that the entrances to the tunnels were about 35 cm apart. Traps were removed before each 2-day sampling period. Vole densities averaged 20/ha. New voles with no previous trap experience were entering the population continuously throughout the study.

At Pinawa, multiple-capture versions of the Longworth trap caught far fewer voles than did Longworth traps (1:5.3, $\chi^2 = 119.6$, $N = 259$, $P \ll 0.001$). In contrast to the Toronto results, the capture frequencies were similar during the first and subsequent uses of the traps (16.2% multiple vs. 15.7% multiple). Captures in multiple-capture traps never exceeded 30% of total captures in any one sampling period. This poor capture rate remained the same throughout. Voles captured in multiple-capture traps were of similar weight to voles captured in Longworths (26.3 g vs. 25.7 g), and were in a similar state of reproductive activity (75.2% active vs. 75.6% active). Males and females were similarly captured in equal proportions in Longworth and multiple-capture traps (39.4% vs. 29.3%, $\chi^2 = 1.52$, $P > 0.10$).

TABLE 1. Results of sand-tracking of *Microtus pennsylvanicus* on 64 trap stations near Pinawa, Manitoba in July and August, 1981

Trap	Total approaches	Investigate only	Trip door or flag only	Captured
Longworth	147	105	4	38
Multiple-capture	137	110	20	7

NOTE: Thirty stations had *Microtus* tracks but neither trap was approached.

Tripped flags showed that voles were attempting to enter multiple-capture traps but were not being caught. We therefore added tracking sand (Bider 1968) to the trap shelters on grid 1 towards the end of our experiments. Activity was assessed during fair weather on a total of six occasions. Tracking revealed that both trap types were "inefficient" in that voles often visited trap stations without being captured (Table 1). Generally, we saw only one set of tracks at each trap station. Repeat visits accounted for less than 10% of our observations. Of the 314 sets of tracks, 9.6% showed that neither trap was approached, 8.6% showed that only one trap was approached, and 81.8% showed that both traps were approached. The multiple-capture traps were investigated as often as the Longworth traps were, despite the low number of captures (Table 1). Since investigation was scored only if a vole approached within 5 cm of the front of the trap, many of these voles could have been captured. Twenty (14%) of these voles did, in fact, start to enter the tunnel (flag tripped) but did not persist to the point of capture. These tripped flags cannot be explained by escape from the traps as we noted no disturbance of food and bedding materials in traps with tripped flags. Apparently, the feel of the one-way door on the vole's back or nose was usually sufficient to deter complete entry. These results support those of Boonstra and Rodd (1982), who found that voles sometimes back out of Longworth tunnels when they feel the door drop on their back. In the laboratory, some voles (but not all) are similarly reluctant to enter multiple-capture traps. These different behavioral quirks require further investigation by those researchers designing new traps.

In conclusion, we can surmise that the one-way door or any similar obstruction is a significant barrier to *Microtus pennsylvanicus*. Studies based on the sole use of multiple-capture traps could, therefore, fail to enumerate many voles that are reluctant to enter traps. Whether this is a real problem for all species of *Microtus*, or only a potential problem, is not clear at this point. Getz et al. (1979) have used multiple-capture traps with prebaiting with apparent success, but have not

compared trap response to a standard trap type such as the Longworth. Perhaps this behavioral avoidance of the one-way door is not applicable to all species in all situations.

Acknowledgements

Funding was provided by Atomic Energy of Canada Limited Research Corporation and the Natural Sciences and Engineering Research Council of Canada. We thank T. Lawton, E. Wuschke, P. Backer, P. Fetterolf, and J. Ross for their help in trapping voles.

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