ACTA THERIOLOGICA
Vol. 34, 43; 643—647, 1989

Fragmenta Theriologica

Differential Capture of Deer Mice with Pitfalls and Live Traps

ZRÓŻNICOWANIE ZŁOWIEŃ *PEROMYSCUS MANICULATUS* PRZY UŻYCIU STOŻKÓW I ŻYWOŁÓWEK

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Walters B.B., 1989: Differential capture of deer mice with pitfalls and live traps. Acta theriol., 34, 43: 643—647 [With 2 Tables]

A new pitfall trap for small mammals is described. This multiple-capture pitfall trap sampled an unmanipulated (control) population of deer mice (*Peromyscus maniculatus*) more effectively than did single-capture live traps. The main advantage of the pitfall was its greater effectiveness for the capture of young mice. However, young deer mice were captured equally as well in live traps as in pitfalls in a population with adults removed, thus suggesting that adults influence the trappability of young.

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1. INTRODUCTION

Single-capture live traps are commonly used for mark-recapture sampling of deer mouse populations. However, in many field studies of small mammals, younger animals apparently are under-represented by single-capture live traps (Andrzejewski & Rajska, 1972; Boonstra & Krebs, 1978; Beacham & Krebs, 1980). Multiple-capture pitfall traps have not been used to sample live deer mice (*Peromyscus maniculatus*), in part, because of the difficulty in preventing their escape.

The purposes of this study are to describe a method for sampling deer mice and to test the hypothesis that pitfall traps more effectively trap juvenile deer mice than do single-capture live traps in populations with or without adults removed. To test this, deer mouse populations were sampled concurrently with both pitfall and live traps on a control grid and a grid from which all adult deer mice were removed.

2. STUDY AREA, METHODS, AND MATERIAL

This study was conducted in a second-growth forest, dominated by Douglas-fir (*Pseudotsuga menziesii*), on the grounds of the University of British Columbia Animal Care Centre, Vancouver, British Columbia. The study area is within the coastal Douglas-fir

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biogeoclimatic zone, characterized by a cool maritime climate with high rainfall typically in all months except July and August (Krajina, 1970).

I established an intact (0.33 ha) and a total adult-removal grid (0.25 ha) approximately 20 m apart, on opposite sides of a paved road with gravel shoulders. The grids were not symmetrical because boundaries of the grids were defined by forest edges and wire fences. On each grid, parallel trap lines were 15 m apart with stations (consisting of one or two Longworth live traps) located at 10 m intervals. Single pitfall traps were spaced 15—25 m apart on the trap lines. The control grid had seven pitfalls and fifteen live trap stations, while the adult-removal grid had six pitfalls and twelve live trap stations.

I made escape-proof pitfalls from 25-l recycled metal drums 44 cm deep and 28 cm diameter. Lids were made by cutting the tops off the drums and boring a 3.5 cm diameter hole near the centre of each drum top. A 36 cm long piece of wood was bolted across the upper side of the metal lid to support the lid in place above the trap. The objective was to recreate the original sealed drum with the exception that the top of the drum be made into a removable lid with a hole punctured in the centre. Mice enter the pitfall by falling through this hole in the drum lid. Trial-and-error revealed that the depth and smoothness of the pitfall drum, the tightness of the pitfall lid seal, and the centering of the 3.5 cm hole on the pitfall lid were important in preventing escape.

Hay for bedding was placed within each drum to a depth of approximately 5 cm, and a 46 cm by 3 cm wire mesh ladder was placed through the lid hole to the floor of the drum. I sank the drums deep into the soil so that the tops were nearly flush with the surrounding ground. Drums were located in high terrain to minimize the chance of flooding or floating (there were no holes punctured in the drums). A plywood board was propped over each pitfall to protect it from direct sun and rainfall.

To bait pitfall traps, I removed the ladder, placed a handful of oats in the drum, replaced the lid, and sprinkled oats on and around the lid. Longworth live traps were baited with oats and supplied with cotton batting for bedding. Between trapping periods, pitfall ladders were replaced and longworths were locked open so that animals could enter and leave all traps freely.

1 trapped 2 consecutive nights per week from June 1, 1986 to September 1, 1986. During each trapping period, I set live traps one evening and pitfalls the next. The order was reversed each trapping period.

Deer mice were considered as either adults (>13 g) or juveniles (≤13 g). The adult-removal grid was kept free of adults by removing them whenever they were first captured on the removal grid. All animals on the intact grid and juveniles on the adult removal grid were ear-tagged with fingerling fish tags and released upon first capture. I recorded tag number, sex, weight in grams, reproductive condition, and trap location for every capture of each animal. Population size was estimated by using the minimum number alive (M.N.A.) (Hilborn *et. al.*, 1976) separately for each trapping technique and by combining trapping information from both techniques.

3. RESULTS

Pitfall construction is labour intensive. However, once in place the pitfalls required little maintenance, and because as many as seven adult deer mice were caught in one trap, fewer pitfalls than live traps were required to sample the population. With so few pitfall traps to work with, approximately 35% less time was spent in the field baiting and checking pitfalls than live traps.

The mean number of adults on the control grid during each month were seven males and four females in June, nine males and five females in July, and twelve males and six females in August. All but one of the adult females were lactating at some time during the study. However, all evidence of breeding (lactating or pregnant females) on the intact grid ceased after mid-August. Juvenile numbers on the control grid ranged from a low of two in early June to a high of six in late July.

The total population size on the control grid varied considerably depending on which trapping information was used (Table 1). In general, pitfall traps were equally or more successful than live traps for sampling the population. Discrepancies between the pitfall trapping estimate and combined estimate are largely due to the failure of pitfalls to capture two adult mice throughout the study. Alernatively, discrepancies between live trap and combined estimates are primarily due to the failure of live traps to capture young mice. Juveniles on the adult removal grid were just as likely to be caught at first capture in pitfall as live-traps ($\chi^2=0.067$, $p>0.9$, d.f.=1; Table 2); but they were far more likely to be caught in pitfall than live traps on the control grid ($\chi^2=9.783$, $p<0.005$, d.f.=1). Cumulative captures of juveniles showed similar trends to first-captures (Table 2), although they were not tested statistically since cumulative captures are not independent of each other.

Juveniles trapped first in pitfalls on the control grid took a mean of

Table 1
Deer mouse population size (M. N. A.) for the control grid as determined from live-trapping only, pitfall trapping only, and combined live and pitfall trapping.

	Week No.													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Live traps	7	8	10	11	14	14	11	10	11	15	16	19	19	21
Pitfalls	11	13	11	13	13	15	14	13	10	15	16	19	19	15
Combined	12	17	16	17	16	19	16	17	13	18	20	21	22	21

Table 2
First and cumulative captures of juvenile deer mice in live and pitfall traps on a control and adult-free grid.

	First capture		Cumulative capture	
	Live trap	Pitfall	Live trap	Pitfall
Control grid	4	19*	10	39
Adult-free grid	7	8	23	22

* $p<0.005$, $\chi^2=9.783$; comparison between pitfall and live trap first-captures on the control grid.

25 days following first pitfall-capture to be caught in a live trap (range 7—43 days, N=11). When these animals eventually were captured in live traps, their mean weight was 15 g (range 14—16 g). Also, 8 of 19 juveniles first trapped in pitfalls disappeared from the control grid without ever being caught in live traps.

4. DISCUSSION

A major drawback with using pitfalls for live trapping small mammals has been the difficulty containing species that are good climbers and jumpers such as *Peromyscus maniculatus* (Williams & Braun, 1983; Bury & Corn, 1987) and *Apodemus* sp. (Andrzejewski & Wrocławek, 1963; Pelikán *et al.*, 1977). The pitfall used in this study appears to have overcome this difficulty. In addition, since many studies of population dynamics focus attention on the analysis of juvenile recruitment and survival (Galindo & Krebs, 1987), the finding that pitfalls more effectively sample young deer mice is important. Failure to detect mice at an early age deprives the researcher of useful data, and may result in misleading interpretations (Boonstra & Krebs, 1978).

The high incidence of captures of juveniles in live traps on the adult removal grid suggests that under normal conditions the presence of adults inhibits juveniles from entering live traps. Conspecific aggression by social dominants may deter subordinates from entering live traps (Kikkawa, 1964; Summerlin & Wolfe, 1973). Watts (1970) removed adult male *Clethrionomys gapperi* and found that juveniles entered the live trap population three weeks earlier than in intact populations. Also, comparative studies have found that subordinate voles enter pitfalls more readily than live traps in control populations (Andrzejewski & Rajska, 1972; Boonstra & Krebs, 1978; Beacham & Krebs, 1980). The similarity of results between this and other studies suggests that live-trap inhibition by subordinate small mammals is probably widespread.

Acknowledgements: I thank D. Cichowski, C. Galindo, T. Herman, and K. Lertzman for their helpful comments on earlier drafts. I am most grateful to D. Chitty for his support, criticism, and inspiration during this study. Financial support was provided by a Natural Sciences and Engineering Research Council of Canada (NSERC) operating grant awarded to D. Chitty.

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Received 16 April 1989, Accepted 13 August 1989.