A FIELD TEST OF SIX TYPES OF LIVE-TRAP FOR AFRICAN RODENTS

LLOYD R. WINGATE and JURGENS MEESTER
Department of Zoology, University of Natal, Pietermaritzburg.

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ABSTRACT

Six live-trap types were tested in a grassy vlei near Pretoria in an attempt to determine their success in trapping *Rhabdomys pumilio*, *Praomys* (*Mastomys*) *natalensis*, and *Otomys irroratus*. One trap of each type was set at each of fourteen trapping stations. The effect of trap position on captures was effectively ruled out by changing the arrangement of the traps each week. The frequency of capture of different age and sex classes of the three species is compared.

INTRODUCTION

An important consideration in any trapping study is the choice of the most effective available trap for the type and size of animals to be studied. Traps of different types vary in efficiency with respect to numbers of individuals and species caught (Cockrum 1947; Holdenreid 1954; Quast & Howard 1954; Sealander & James 1958; Wiener & Smith 1972). In addition trapability of rats may differ according to size and sex (Davis & Emlen 1956; Gliwicz 1970).

Data on trap efficiency under African conditions are scanty. Delany (1964) recognised the selectivity of different patterns of snap and live traps in Uganda. Neal & Cock (1969) gave a detailed statistical analysis of selectivity of two types of snap traps and concluded that the factors involved in trap selection were complex.

This study compares the efficiency of six different types of small mammal live-trap: two hardboard box traps, two metal traps and two wire-mesh traps. The wire-mesh traps do not provide cover against rain and wind, or protection from excessive temperatures. The box traps provide cover, the hardboard traps being better insulated than the metal traps.

Only three species of rodents were trapped regularly: the multimammate mouse, *Praomys natalensis;* the four-striped mouse, *Rhabdomys pumilio;* and the vlei rat, *Otomys irroratus*. In addition a single *Rattus rattus* was trapped twice.

The study area comprised approximately three acres of a small vlei 20 km south of Pretoria, outside the northern border of the Van Riebeeck Nature Reserve.

MATERIALS AND METHODS

The following trap types were used:

(*a*) *Large Hardboard* (LH): a home-made, tempered hardboard (Masonite) box, 27 × 9 × 8,5 cm, with a transparent perspex rear sliding door and a galvanized iron, gravity-operated trap-door, hinged at the top. The trap is treadle-operated and the door has no locking device. For details of its construction, see Meester (1970).

(*b*) *Small Hardboard* (SH): of the same design as the former, but smaller (21,5 × 6,5 × 6,2 cm), and with an opaque (hardboard) rear sliding door.

(*c*) *Large Wire* (LW): the 'Tomahawk' trap, made by the National Live Trap Corp., Tomahawk, Wisc., U.S.A. An all wire-mesh (mesh size 2,5 × 1,3 cm) trap, 31 × 13,5 × 14 cm, with a spring-loaded trap-door hinged from above, operated by a treadle. A locking device holds the trap-door in the closed position.

(*d*) *Small Wire* (SW): a home-made trap with the floor, trap-door and rear door of galvanized iron, with wire-mesh walls and top, dimensions 25,5 × 8,5 × 8 cm (mesh size 1 × 1 cm). The gravity-operated trap-door is released by a treadle, and locked in the closed position by a simple wire lock. For details of its construction, see Meester (1961).

(*e*) *Sherman Trap* (AL): a well-known, commercially made, 23 × 8 × 9 cm aluminium box trap, with a spring-loaded trap-door, hinging on the floor.

(*f*) *Galvanized Iron* (GI): basically the same design as SW (Meester 1961), consisting of a galvanized iron box, 26 × 8 × 8 cm, with galvanized iron rear door and gravity operated trap-door, which is released by a treadle and locked in the closed position by a simple wire lock, as in SW.

Fourteen trapping stations were selected on evidence of rodent activity, such as fresh runways and sign.

Six traps (one of each type) were set at each station, three on each side of a runway and at right angles to it, with their doorways on its edge, facing each other. A space of about 5 cm was left between traps. The two hardboard traps were always opposed, as were the two wire traps and the two metal traps. LW, LH and AL were always together on one side of a runway, with SW, SH and GI on the other side. This system reduced the number of possible trap arrangements to three.

All three trap arrangements were used at each trap station by rotating trap positions after each four-day trapping session.

The grass around the traps was bent over them to provide shade and cover where possible.

Bait was a dry mixture of rolled oats and currants, sprinkled inside the trap. Because this bait tended to fall through the wire mesh floor of LW, it was mixed into a paste with water and stuck to the treadle.

Captured animals were marked by toe-clipping the hind feet and released at the trap site.

Traps were set four days a week for three consecutive weeks in summer (Jan.–Feb. 1970) and were checked early each morning for the first four-day trapping period. Four animals died in the traps during this period. Subsequently the traps were checked twice a day, morning and evening.

Chi-square tests were applied to determine (*a*) whether or not there were differences in the trapping success of the six traps for particular species and for all species combined, and (*b*) whether or not relative trap position influenced capture. Differences in the trapability of the different sex and age classes of *R. pumilio* and *P. natalensis* were analysed.

RESULTS AND DISCUSSION

Each time a trap was examined, whether morning or afternoon, was regarded as a trap 'night'. During the study period 1 680 'trap nights' were recorded.

The effect of trap position on capture was effectively ruled out by the trapping procedure followed. Since there were two 'outer' and one 'inner' traps a ratio of 67:33 could be expected. There were only small deviations from this, both collectively and for each species (Table 1). These differences were not statistically significant.

TABLE 1

Effect of trap position on the success of six different trap designs in capturing three species of rodents on the Transvaal highveld.

	Trap position	*Number captured*			
		Observed	*Expected*	*Chi*^{2}	*P*
Praomys	outer	67	66,7	0,040	NS
natalensis	inner	33	33,3		
Rhabdomys	outer	89	90	0,03	NS
pumilio	inner	46	45		
Otomys	outer	24	22,7	0,24	NS
irroratus	inner	10	11,3		
Total	outer	180	179,33	0,0074	NS
	inner	89	89,66		

NS: no significant deviation at $P \leq 0,05$.

Trapping success is reflected in Table 2. The total numbers of individuals captured were: 46 *P. natalensis* (100 captures), 45 *R. pumilio* (135 captures), eight *O. irroratus* (34 captures), and one *Rattus* sp. (captured twice). The trapping data for the single *Rattus* were not analysed.

Significant differences in trapping success were exhibited by different traps in all three species, as shown in Table 3.

LH was the most effective, and GI the least effective of the traps, catching 34 per cent and 8 per cent of the rodents respectively. The other traps accounted for 14 per cent (SH), 14 per cent (LW), 15 per cent (SW) and 15 per cent (AL) of captures.

TABLE 2

Summary of captures of *P. natalensis*, *R. pumilio* and *O. irroratus*.

Trap Type	*Number of "trap nights"*	*Empty sprung*	*Total capture*	P. natalensis	R. pumilio	O. irroratus	*Other*
LH	280	12	92	27	59	6	0
SH	280	28	38	18	19	1	0
LW	280	10	39	1	15	20	2
SW	280	3	41	17	21	3	0
AL	280	0	40	23	13	4	0
GI	280	9	22	14	8	0	0
Total	1 680	62	272	100	135	34	2

TABLE 3

Comparison of trap preferences of *P. natalensis*, *R. pumilio* and *O. irroratus*. Chi^2 values are given for each comparison of the catch in one trap against that in another.

	LH	SH	LW	SW	AL
P. natalensis					
SH	1,9(NS)				
LW	175,2***	76,3***			
SW	2,4(NS)	0,02(NS)	67,8***		
AL	0,3(NS)	0,6(NS)	126,3***	0,9(NS)	
GI	4,6*	0,5(NS)	45,3***	0,3(NS)	2,3(NS)
R. pumilio					
SH	27,8***				
LW	40,5***	0,1(NS)			
SW	23,3***	0,1(NS)	1,0(NS)		
AL	49,7***	1,2(NS)	0,1(NS)	2,0(NS)	
GI	92,3***	5,4*	2,3(NS)	7,3***	1,3(NS)
O. irroratus					
SH	21,7***				
LW	10,6***	282,9***			
SW	3,3(NS)	4,0*	81,6***		
AL	1,2(NS)	8,5***	137,8***	0,4(NS)	

*** = highly significant difference (P < 0,01)
* = significant difference (0,02 < P < 0,05)
(NS) = No significant difference.

P. natalensis was caught with almost equal frequency in LH and AL; however, this trapping success did not differ significantly from the number of captures in SH or SW. The number of captures in AL did not differ significantly from that in GI. The single capture in LW was significantly lower than in any other trap.

R. pumilio showed a significantly higher frequency of capture in LH over each of the other types. The numbers caught in GI were significantly lower than in SW and SH. There were no significant differences between the numbers of captures in the other trap types.

O. irroratus was significantly more often caught in LW, with LH next. None were caught in GI, only one in SH, and three and four in SW and AL respectively.

The results of *O. irroratus* are based on captures of only eight individuals. Hershenson & Meester (unpublished data) in laboratory trials of the same traps, found considerable individual variation in the tendency of *O. irroratus* to enter traps. They also found, as did Davis (1973), that *O. irroratus* was caught more often in LH than in LW. A possible explanation of this difference is that all traps in the present study were covered with grass to provide cover, whereas in the two above-mentioned studies the traps were left uncovered.

Davis (1973) suspects that there is a seasonal difference in the trap preferences of *O. irroratus*. He used LH and LW traps together for seven monthly trapping periods (March–September). Davis gives figures showing almost equal numbers of captures of *O. irroratus* in LH and LW during March, and a significantly higher capture rate ($P < 0{,}01$) for LH above LW during April through September (when the use of LW was discontinued). Significantly, therefore, his results for March bear out our findings for January–February. Presumably the greater preference for LH during April–September is related to the fact that this trap offers shelter from the elements, which LW does not.

The trapability rate of a species is expressed as: the total number of captures/number of individuals, ignoring animals found dead in traps and those that escaped before identification could be checked. This ratio serves to demonstrate which species, sexes or age groups are relatively more frequently trapped in a given population, irrespective of numbers present. It is therefore a measure of trap response, and not of population density, and may in fact obscure differences in numbers. The trapability rate was higher for *O. irroratus* (3,86) than for *P. natalensis* (2,07) and *R. pumilio* (3,05). Offsetting the apparently high trapability of *O. irroratus*, only eight individuals were caught, and only one individual was responsible for 26 per cent of the trapping records for this species. This casts considerable doubt on the validity of the value obtained. Relatively higher numbers of *P. natalensis* and *R. pumilio* were caught (45 and 46 respectively), while their trapability ratios were lower, suggesting higher population densities of these two species compared with *O. irroratus*.

For comparison of the relative trapability rates of individuals of different sex and age classes of *P. natalensis*, see Table 4. Adult females have a high trapability rate (4,22) compared with that of immature females (1,63), adult males (1,55), immature males (1,36), and of sexes and age classes combined (2,07), despite the fact that both adult males and immature males outnumbered adult females in terms of number of individuals caught. There were no significant differences in trapability between adult males, immature males and immature females. The high trapability rate of adult females compared with the other sex and age classes held true for individuals as well as for the combined data for all individuals of each class (Figure 1).

No adult females were captured only once, two were captured twice, one three times, five four times, one six times, and one eight times. On the other hand, no males or immature females were caught more than three times.

TABLE 4

Trapability of various sex and age classes of *P. natalensis* in all trap types.

Class	*No. of individuals*	*Total captures*	*Trapability*
Adult ♀	9	38	4,22
Immature ♀	8	13	1,63
Adult ♂	11	17	1,55
Immature ♂	14	19	1,36
Combined	42	87	2,07
Died	4	11	
Unidentified	?	2	

A comparison of the relative trapability rates of different sex and age classes of *R. pumilio* appears in Table 5. Adult females have a high trapability rate (5,14) compared with that of immature females (2,22), adult males (3,00), immature males (2,45), and of sexes and age classes combined (3,05). There was considerable individual variation in trapability as can be seen in Figure 2, and this served to obscure the differences somewhat. Nevertheless, the rate for adult females was significantly higher than that for males or immature females.

TABLE 5

Trapability of various sex and age classes of *R. pumilio* in all trap types.

Class	*No. of individuals*	*Total captures*	*Trapability*
Adult♀	7	36	5,14
Immature ♀	9	20	2,22
Adult ♂	14	42	3,00
Immature ♂	11	27	2,45
Combined	41	125	3,05
Died	4	6	
Unidentified	?	5	

Adult females restrict their home ranges during the breeding season (P. M. Brooks pers. comm.). This may at least partly explain the high trapability rate of adult female *P. natalensis* and *R. pumilio*, as this study was conducted at the peak breeding period for these rodents.

Breeding females occupying home ranges in the vicinity of the traps would tend to get caught more often than males and immature females occupying larger home ranges. Another possible explanation is that the adult females were seeking nesting sites. C. N. V. Lloyd (pers. comm.) has found nesting material inside LH traps with *Myosorex varius* females, which are light enough to go into and out of these traps without setting them off. Heavier animals would of course set off the trap immediately on entering and could not bring in much nesting material.

There was considerable variation in the number of captures per individual of *O. irroratus* (from nine times to once). The numbers caught were too low to show sex or age differences in trapability.

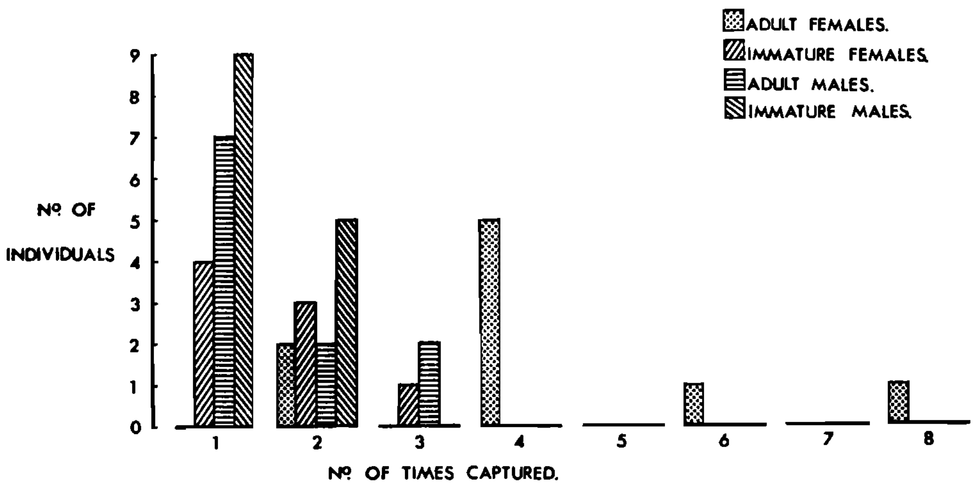

FIGURE 1

Frequency of capture of different sex and age classes of *P. natalensis* in all trap types.

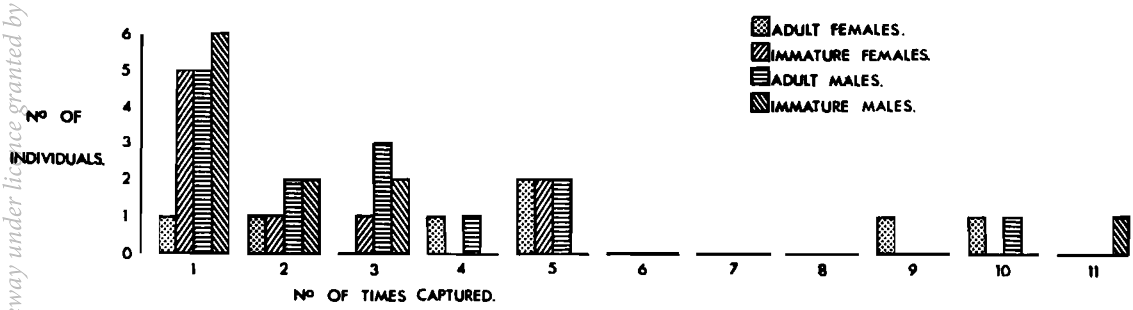

FIGURE 2

Frequency of capture of different sex and age classes of *R. pumilio* in all trap types.

Four *R. pumilio*, four *P. natalensis* and one *O. irroratus* were found dead in traps. From the available data, nothing can be deduced about the extent to which the different traps prevented death from exposure. It was assumed that the animals died either from an excess heat-load from being restricted in traps in the sun, or from the effect of cold and rain at night.

Apart from small mammals, rain and millipedes were the two most important factors in springing traps. Millipedes were abundant in the study area and were often found in both sprung and unsprung traps. In the latter case they were often found under the treadles, jamming them so that the traps would not spring. Hard rain sprung the LW on a few occasions. The SH was the most frequently sprung trap (Table 2).

The effectiveness of a live trap is determined by how successfully it attracts prey, its sensitivity and its ability to retain animals alive once caught. The traps used varied considerably in sensitivity, not only as a consequence of differences in design (*e.g.* springloaded as against gravity-operated treadles), but also as a consequence of variation in setting in traps of the same design. There was no objective means available of either preventing or compensating for differences in sensitivity.

Very sensitive trap settings must have been responsible for some traps being sprung without catching, aided perhaps by heavy rain or disturbance by other animals such as millipedes. However, additional factors would include the possibility of animals escaping after capture. In this connection neither LH nor SH were provided with locking devices on their trap-doors, so that animals once caught could escape by pulling the door open. SH traps moreover, being small, may not always have allowed large rodents such as *O. irroratus* to enter the trap fully before being sprung. In this case the trap-door would be prevented from closing altogether, thus readily allowing the prey to escape. Significantly, SH was sprung without catching far more frequently than any of the other traps used. LW, on the other hand, being constructed of fairly coarse wire mesh, may have allowed small animals, such as young *R. pumilio* and *P. natalensis*, to escape through the mesh.

Traps found sprung without catching (either having been sprung fortuitously or having lost the catch), traps with bait removed, either by ants or millipedes or by rodents which had succeeded in entering and leaving the trap without springing it, and the effects of variable trap sensitivity must clearly have been a source of inaccuracy in this experiment. However, as the effects of these factors could not be determined they are not taken into account, and the overall effectiveness of each type of trap is taken to be represented merely by the number of animals successfully caught.

The results suggest that LH is the most effective of the traps tested in small mammal trapping. In both *P. natalensis* and *R. pumilio* it was clearly more successful than any of the other traps tested, and the equivocal results obtained in the case of *O. irroratus* still present evidence that it is at least one of two traps equally successful in catching this species. The SH was one of four types (the others being LW, SW and AL) which were more or less equally effective. Significantly, it caught few *O. irroratus*, and was most frequently found sprung but empty, which reinforces the argument (above) that owing to its small size it may have allowed a proportion of its catch to escape, and that were it not for this it would have been more successful. Both types, being of hardboard construction, offer a surface which is perhaps less foreign to wild rodents than a metallic one. In addition they would be less likely to be affected by climatic extremes than metal traps, and therefore not only offer greater protection against extremes of heat and cold to an animal once caught, but perhaps also present a more attractive micro-environment to a potential prey animal than a solid metal trap would do.

A wire mesh trap would vary in attractiveness depending on climatic conditions and also the habitat requirements of the species concerned.

The effectiveness of the LH trap, and presumably also the SH, would be improved by providing it with a simple but efficient locking device for the trapdoor. Even without this, however, this experiment confirms, as does extended field use in a variety of circumstances, that it is an effective general purpose trap.

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