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The Effects of Prebaiting Live Traps on Catching Woodland Rodents

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Gurnell J., 1980: The effects of prebaiting live traps on catching woodland rodents. Acta theriol., 25, 20: 255—264 [With 2 Tables & 3 Figs.].

The effects on catches of woodland rodents of prebaiting Longworth live traps for varying lengths of time were investigated in fifteen different studies over a three year period. Differences in trap response between *Apodemus sylvaticus*, *A. flavicollis* and *Clethrionomys glareolus* were observed. The effect of prebaiting was most pronounced in *A. flavicollis* although the data were few and least pronounced in *A. sylvaticus*. In the main, the effect of prebaiting for one night was equally as effective as prebaiting for two. The results have been discussed with respect to sampling effort and efficiency in estimating population numbers.

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1. INTRODUCTION

It has clearly been shown that the presence of an appropriate bait at a Longworth trap greatly enhances the probability of capture of woodland rodents and further, that the presence of bait is necessary if estimations of population size are required (Gurnell, 1976). An additional technique frequently employed in small mammal field studies is that of prebaiting; here bait is placed at the trap (or trapping station) from one to several days before the traps are set (*eg.* Smith, Gardner *et al.*, 1975). Chitty & Kempson (1949) pointed out that prebaiting traps allows more, if not all, of the population to locate and become familiar with the traps before trapping commences. This, in turn, should minimise bias in the initial samples which may result from intra and interspecific variations in activity patterns and trap reaction. There have been several studies on the effects of prebaiting kill traps on the catches obtained (*e.g.* Babińska & Bock, 1969; Gentry *et al.*, 1968; Grodziński *et al.*, 1966; Tanaka & Kanamori, 1969; Zejda & Holišova, 1971) but only a few investigators have studied the effects of prebaiting live traps (*e.g.* Tanaka, 1970; Trojan & Wojciechowska, 1967). This paper reports on

a series of studies on the effects of prebaiting Longworth traps on the capture of woodland rodents.

2. METHODS

The trapping studies were carried out in a mature oak woodland in Alice Holt Forest, Surrey (see Gurnell, 1978b). Longworth traps were used and contained hay bedding and whole oats as food. Prebaited traps had their doors fixed in the open position and whole oat bait scattered in and around the trap entrances (see Chitty & Kempson, 1949; Gurnell, 1976).

The trapping programme was organised so that one third of the traps used in any one study were placed in position and prebaited for two nights (called traps of type P_2) one third for one night (P_1) and the remaining third were not prebaited at all (P_0). All the traps were checked for efficient operation and were set at the same time, and trapping was then carried out for four nights. The traps

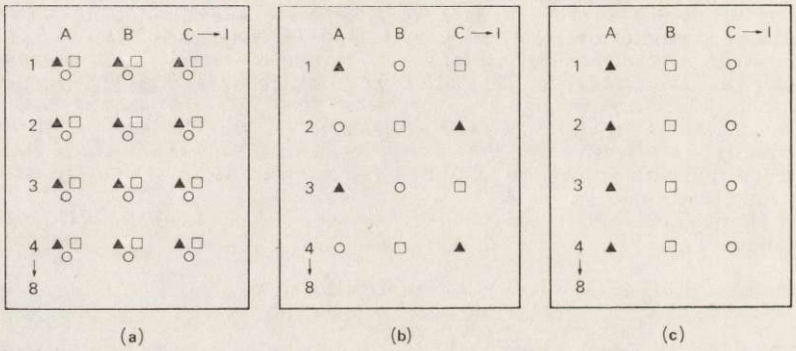

Fig. 1. Trapping patterns; different symbols represent different trap types; (a) pattern *W*, (b) pattern *X*, and (c) pattern *Y*.
Only the corners of the grids have been presented — not to scale.

were checked each morning during the prebait and trap periods and the bait replenished if necessary. The animals captured were weighed, sexed, individually toe-clipped and released.

In order to minimise the influence of small variations in the nature of the habitat, such as changing ground cover, on the catches obtained, and to eliminate the influence of trap pattern, four different patterns of traps were used. In addition, two different study areas were used (areas *A* and *B*) which were some 200 m apart. The trap patterns, which differed in the closeness of the different trap types, are outlined below, and three of the patterns are illustrated in Fig. 1.

Pattern *W*, area *A* — three traps per point, about 1.5 m apart and each of a different type, on a grid consisting of 8 lines by 9 rows with 10 m spacing. The total number of traps was 216 (Fig. 1a).

Pattern *X*, area *A* — one trap per point on the same grid as above. Adjacent traps were of a different type (see Fig. 1b). The total number of traps was 72.

Pattern *Y*, area *B* — one trap per point on a grid consisting of 8 lines, 10 m apart, by 9 rows, 15 m apart; different types of trap were used in each row. The total number of traps was 72 (Fig. 1c).

Pattern *Z*, area *B* — three different grids 30 m apart, consisting of 6 lines by 5 rows with 6 m spacing. Traps of a different type were used on each grid, the total number of traps used was 90.

Fifteen trapping studies were carried out between September 1975 and January 1979, some of them concurrently on areas *A* and *B* (Table 1). The position of the different trap types was varied in subsequent studies using the same pattern of traps. Owing to cold wet conditions trapping was terminated early in studies 9, 10 and 14. Further, not all the unmarked animals captured on nights two and three of study 12 were toe-clipped.

3. RESULTS

3.1. Densities of Wood Mice and Bank Voles

Table 1 shows the dates of the trapping studies, the trap patterns used and crude densities of wood mice, *Apodemus sylvaticus* (Linnaeus, 1758) and bank voles, *Clethrionomys glareolus*

Table 1

Trapping studies.

Study No.	Date traps set	Trap pattern	No. nights trapping	Density wood mice (no/ha)	Density bank voles (no/ha)
1	14.09.75	W	4	50	38
2	30.09.75	W	4	42	32
3	31.10.75	X	4	31	22
4	21.01.76	X	4	15	21
5	3.05.76	X	4	6	7
6	5.08.76	W	4	14	28
7	22.10.76	X	4	46	25
8	22.10.76	Y	4	29	17
9	17.12.76	W	2	118	35
10	17.12.76	Y	3	60	18
11	3.03.77	X	4	76	64
12	3.03.77	Y	4	42	39
13	28.11.78	Z	4	25 *	8 *
14	17.12.78	Z	3	33 *	9 *
15	18.01.79	Z	4	48 *	25 *

* Average densities for three grids (see text).

(Schreber, 1780) calculated from the number of individuals captured highest in autumn or winter and lowest in summer; the reasons for values for the three grids used in trap pattern *Z* in each study period (see above). The results show a considerable range in densities of the rodent species over the study period. In general the numbers were highest in autumn or winter and lowest in summer; the reasons for this will be discussed elsewhere.

3.2. Numbers of Captures of Wood Mice and Bank Voles

The numbers and percentage numbers of nightly totals of wood mice and bank voles captured each night are presented in Table 2. The results of studies 3 to 8 have been pooled because of the small numbers of animals captured in each trap type in the individual studies. Studies 1 and 2 have been combined because they were carried out within two weeks of each other, and studies 9 and 10, and 11 and 12 have been combined because they were carried out concurrently. These combined results have been analysed by the chi-square test to see whether more or less animals than expected were captured in each trap type; significant findings ($p < 0.05$) have been marked with an asterisk in Table 2.

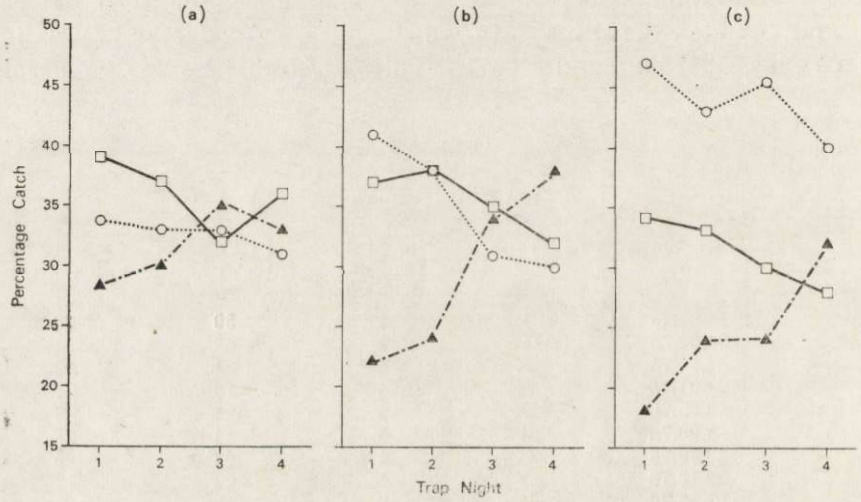

Fig. 2. The percentage numbers of nightly totals of wood mice (a), bank voles (b), and yellow-necked mice (c) captured in different trap types.
○ — P_2 traps, □ — P_1 traps, ▲ — P_0 traps (see text).

Intuitively prebaiting should have its greatest effect on catches on the first night of trapping; thereafter its influence should decline the longer the trapping period. There was considerable variation in numbers captured in each trap type on the first night of each combination of studies, particularly in voles. Overall more voles were captured in prebaited traps on night one, although the difference between P_2 and P_1 traps was slight. A significant value of chi-square was only found for the pooled data. In catching wood mice on night one, P_1 traps were slightly more effective than P_2. Here differences were only significant for studies 9 and 10; the reason for this is unclear, although the weather

Table 2

Number of captures (percentages in brackets) according to trap night and trap type.
P_2=traps prebaited for 2 nights, P_1=traps prebaited for 1 night, P_0=traps not prebaited.

Study nos	Night 1			Night 2			Night 3			Night 4		
	P_2	P_1	P_0	P_2	P_1	P_0	P_2	P_1	P_0	P_2	P_1	P_0
						Apodemus sylvaticus						
1—2	11(31)	14(39)	11(31)	8(18)	17(39)	19(43)	14(35)	14(35)	12(30)	9(24)	15(41)	13(35)
3—8	15(32)	17(36)	15(32)	21(38)	16(29)	19(34)	14(26)	21(40)	18(34)	14(37)	10(26)	14(37)
9—10	36(36)	44(44)	21(21) *	24(31)	35(46)	18(23)	8(36)	5(23)	9(41)	—	—	—
11—12	15(32)	19(40)	13(27)	13(41)	11(34)	8(25)	11(30)	12(32)	14(38)	6(25)	11(46)	7(29)
13—15	10(35)	8(28)	11(38)	10(45)	7(32)	5(23)	12(44)	6(22)	9(33)	9(41)	7(32)	6(27)
1—15	87(34)	102(39)	71(27)	76(33)	86(37)	69(30)	59(33)	58(32)	62(35)	38(31)	43(36)	40(33)
						Clethrionomys glareolus						
1—2	8(33)	9(38)	7(29)	8(36)	8(36)	6(27)	5(23)	7(32)	10(46)	6(22)	10(37)	11(41)
3—8	19(40)	19(40)	9(19)	13(30)	22(50)	9(21) *	13(33)	14(36)	12(31)	7(24)	9(31)	13(45)
9—10	10(44)	9(39)	4(17)	10(59)	5(29)	2(12)	3(50)	2(33)	1(17)	—	—	—
11—12	12(41)	9(31)	8(28)	4(21)	6(32)	9(47)	5(28)	7(39)	6(33)	8(47)	5(29)	4(24)
13—15	6(55)	3(27)	2(18)	7(88)	1(13)	0 (0) *	1(33)	1(33)	1(33)	1(100)	0 (0)	0 (0)
1—15	55(41)	49(37)	30(22) *	42(38)	42(38)	26(24)	27(31)	31(35)	30(34)	22(30)	24(32)	28(38)

* Chi-square, $p < 0.05$

was very wet and cold, and this may have effected trap reaction at this time.

Significant differences in the number of captures in each trap type on nights two to four were only found in two of the study combinations, both for voles on night two (Table 2). Fig. 2 shows the percentage number of nightly totals of mice and voles captured in each trap on each night for all the studies combined, less the results from studies 9, 10 and 14 which were not completed.

In wood mice the effects of prebaiting were never large and certainly after night two there was little difference in numbers captured between any of the trap types. The results for bank voles again show differences from wood mice; P_2 traps declined in their capture efficiency throughout the four nights of trapping whilst the reverse was seen in P_0 traps. The effects of prebaiting on catching voels do not appear to have been lost until night 3.

The results have been analysed by chi-square tests for homogeneity according to trap type and trap night. No significant differences were obtained for either the trapping patterns analysed separately or for all the studies combined.

3.3. Individual Wood Mice and Bank Voles Captured

The results above have been examined for variations in capture efficiency according to if and for how long the traps have been prebaited. Differences in the night of initial capture of individual animals could also reflect variations in trap reaction, and traps which have not been prebaited could act in a similar manner to prebaited traps on the second and third nights of trapping. Fig. 3 presents the percentage number of the total number of individuals according to their night of initial capture in all the studies combined, excluding the incomplete data from studies 9, 10, 12 and 14. The findings from other trapping studies in area *A* of Alice Holt, where prebaiting was not used, have also been presented for comparison. These figures are from 12 trapping periods carried out over the same time period and involving similar numbers of individuals (see Fig. 3).

The prebait results show no clear differences in the efficiency of different types of trap in catching new wood mice or bank voles on trapping nights two to four. Overall, between 7 and 15% of animals were first captured on the fourth night of trapping, this indicates, particularly with bank voles, that some individuals exhibited long delays in initial capture, or possibly movement onto the study areas. Interestingly, and again especially in bank voles, more individuals were first captured on the first night of trapping in the prebait studies than

in the non-prebait studies, and in the voles there was a bias towards prebaited traps. In bank voles, therefore, there is a suggestion, although inconclusive, that prebaiting just some traps influenced the activity and trap reaction of animals on the study areas as a whole.

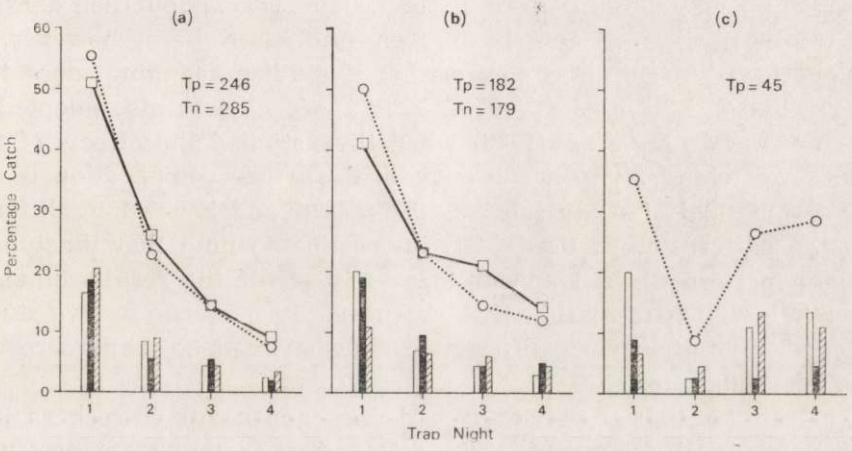

Fig. 3. The percentage number of the total number of individuals of (a) wood mice, (b) bank voles, and (c) yellow-necked mice captured on each night of trapping.
○ — prebait studies, □ — non-prebait studies. Bar graphs are percentages of individuals captured in each trap type on each night; unshaded — P_2 traps, shaded — P_1 traps, cross-hatched — P_0 traps, T_p= total number of individuals from the prebait studies on which the figure is based. T_n=total number of individuals from the non-prebait studies.

3.4. Numbers of Yellow-necked Mice Captured

Some yellow-necked mice, *A. flavicollis* (Melchior, 1834), were captured during the study period, especially on area *B*. These results have been analysed in the same way as above for all studies combined, and the results are presented in Fig. 2 (based on a total of 138 captures) and Fig. 3 (based on 45 individuals). The data are scanty but they indicate that the behaviour of yellow-necked mice towards live traps differs from that of wood mice and bank voles. Traps prebaited for two nights were most successful in catching *A. flavicollis* throughout the four nights of trapping (Fig. 2) whilst P_0 traps were least successful. In addition, a considerable number of new individuals were captured on the third and fourth nights of trapping, although after the first night, there is no clear bias towards prebaited traps (Fig. 3).

4. DISCUSSION AND CONCLUSIONS

There are many factors which affect the trappability of small mammals (*e.g.* Kikkawa, 1964; Gurnell, 1972) and it is difficult

to study the effects of any one factor in isolation. Laboratory, confined populations and specifically designed field studies have all been used to study different aspects of the trappability of woodland rodents (*e.g.*, Gurnell, 1976, 1978a, 1978b). The results from field studies in particular may be influenced by the time of year, population densities and weather; these effects have been minimised here, however, by pooling the results from a long series of studies spanning more than three years (cf. Tanaka, 1970). This approach was also adopted by Boonstra & Krebs (1976) when they studied the effects of trap odour on catching *Microtus townsendii*. A further complication is that the very method of study can bias the results and hence four different trapping patterns were used. It is interesting to note that the type of trapping pattern did not appear to greatly affect the results obtained. Nevertheless, it is clear that if the results from just one or two studies are considered then very different conclusions can be made according to which studies are chosen.

The trap reaction of yellow-necked mice appears to have been most improved by prebaiting traps and indicates that further trapping studies on these animals, in Britain in particular, would be useful. Bank voles were more influenced by prebaiting traps than wood mice and in the latter case prebaiting for one night appears to have been equally if not more effective than prebaiting for two. The »prebaiting effect« was mainly lost by night two in wood mice, but by night three in bank voles. Gurnell (1976) has shown that wood mice quickly locate and utilise new traps placed on the ground, and the differences in trappability between the two species may result from differences in their exploration and penetration of the habitat, or from the fact that *Apodemus* spp. are known to dominate bank voles when they encounter each other (*e.g.*, Andrzejewski & Olszewski, 1963; Perrin, 1971).

The results show that prebaiting for one or two nights is only going to be beneficial if the trapping period is short, of the order of one or two nights. However, it should be pointed out that factors such as adverse weather can seriously affect the results from short trapping studies (Tanton, 1965). It has also been argued that prebaiting is necessary for estimating population size from short trapping periods (*e.g.* Tanton, 1969, see Smith *et al.*, 1975) but again in the case of wood mice it has been shown that capture-mark-recapture estimates of population numbers are of little value (Gurnell, 1972, 1976). Lastly, whether traps are prebaited or not, it has been shown that a substantial number of new animals are captured on the fourth night of trapping. It seems sensible, therefore to divert sampling effort away from

prebaiting into trapping for several nights in order to obtain as much information as possible about the individual members of the population.

Many kill trap studies of woodland rodents have suggested prebait periods of five days or more (Gentry *et al.*, 1968; Grodziński *et al.*, 1966). In addition to the above points there are two further possible consequences of extended prebait periods in live trapping studies. Firstly, bait could attract animals from outside the area (*e.g.*, Pelikan *et al.*, 1972) and secondly unless fresh food and dry bedding are placed in the traps regularly, prebaiting could exacerbate trap deaths by animals eating all the food in the traps and making the bedding damp before trapping begins (see Perrin, 1975). Quite a few animals died in the traps during the studies reported here and the combined results for all species are 62 deaths in P_2 traps, 40 in P_1 traps and 29 in P_0 traps ($\chi^2=12.9313$, $p < 0.01$); food was replenished but bedding was not replaced. One further point is that the trapping technique of the field worker must depend on the particular species being studied, and that as much as possible should be learnt about the trappability of that species; extended prebait periods may be necessary with some animals such as Common rats, *Rattus norvegicus*, or Grey squirrels, *Sciurus carolinensis*.

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WPŁYW ZANĘCANIA NA ŁOWIENIE SIĘ GRYZONI LEŚNYCH W ŻYWOŁÓWKI

Przez trzy lata, w 15 różnych próbach badano wpływ zanęcania na łowienie się gryzoni w pułapki żywołowne typu Longworth (Tabela 1). Modyfikowano też sposób rozstawienia pułapek (Ryc. 1). Stwierdzono różnice w reakcji na pułapkę pomiędzy *Apodemus sylvaticus, A. flavicollis* i *Clethrionomys glareolus*. Choć łowienie się tych gatunków w przynęcane i nieprzynęcane pułapki różni się znacznie, to różnice są w większości nieistotne (Tabela 2). Wpływ przynęcania jest najlepiej widoczny u *A. flavicollis,* mimo niewielkiej ilości danych, a słabo wyrażony u *A. sylvaticus* (Ryc. 2 i 3). W zasadzie przynęcanie przez jedną noc jest tak samo efektywne jak przynęcanie przez dwie noce. Wyniki przedyskutowano w nawiązaniu do efektywności oznaczenia liczebności populacji.