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THE USE OF TIP TRAPS TO CONTROL RABBIT DAMAGE IN SCOTLAND

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ABSTRACT: The factors affecting efficient use of tip traps to control rabbit populations were investigated in a series of field experiments. It was found that continual trapping at the same location was much less effective than periodic trapping. Night-time trapping operations produced larger catches of rabbits than day-time trapping. Traps were equally effective whether sited on existing runs through rabbit proof fences or on previously unbreached sections of fence. The sex ratio of rabbits caught was examined at four different locations and, in each instance, more females were caught than males. The installation of a network of tip traps and associated rabbit proof fencing on a study farm in southern Scotland provided a small positive income per rabbit when carcasses were sold to a local game dealer. Traditional trapping methods employing a professional trapper on the same study farm resulted in a large reduction in rabbit numbers, but despite the sale of carcasses to a local dealer, there was still a net cost to the farmer per rabbit caught. The catch time per rabbit using tip traps was considerably less than the catch time per rabbit using a professional trapper.

KEY WORDS: animal damage control, trapping, live traps, rabbit control

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INTRODUCTION

The cost of rabbits (*Oryctolagus cuniculus* L.) to agriculture in Great Britain has been the subject of a number of studies. Damage caused by grazing has variously been evaluated as between £120 million and £150 million per annum (ADAS 1985; ADAS 1988). Before the arrival of the myxomatosis virus into Britain in October 1953, rabbit numbers were estimated to be in the region of 100,000,000. The disease reduced the rabbit population by over 95% in some areas (Sheail 1991). Gradually, populations have recovered until they are now believed to be at pre-myxomatosis levels again in some parts of the country (Anon. 1992; Haly 1992; Lovelidge 1994). However, Boag (1987) suggests that because of factors such as the urbanization of suitable breeding areas, numbers will never return to the levels of the early 1950s (Boag 1987). The presence of myxomatosis in wild rabbit populations was still a restraint on population build-up in the 1980s (Trout et al. 1992). Even so, rabbits still represent one of the major pest problems of British agriculture including Scotland, where Kolb (1994) surveyed farms in 1990-1991 and concluded that rabbits were causing damage worth £11,790,000 at that time.

Control of rabbit populations and their damage has been dependent upon either killing the pest or excluding it from crops by fencing. An important factor in the selection of methods of killing rabbits in Britain is the need for a humane approach. Methods of control are restricted by legislation such as the Wildlife and Countryside Act 1981 and the Pests Act 1954, which led to the ban of the leg-hold "gin trap" and the prohibition of the deliberate spread of myxomatosis (Parkes and Thornley 1989; Sheail 1991).

The most commonly used methods of killing are daytime and night-time shooting, the use of ferrets, fumigation with poisonous gases and the use of free-running snares (Trout 1994). These methods are all reliant upon high levels of skill and are time consuming. With the exception of fumigation, these activities are often carried out primarily for recreational and sporting reasons and although they can also have a significant effect on numbers, they are very often not cost-effective (Henly 1992).

The technique of catching rabbits in tip-trap boxes, which is a re-introduction of an eighteenth century technique, has been the subject of much interest in the farming press in recent years. These multiple-capture traps comprise a treadle board covering a buried box. When a rabbit walks over the board, the board tips and the rabbit drops into the box from which it cannot escape. Thomson and Worden (1956) recorded that these "box-traps" were not effective in their experiments. However, it was reported that a farmer in eastern Scotland had caught 76,000 rabbits using 100 such traps over a five year period, with a maximum number of 62 rabbits being caught in a box on one occasion (Powell 1996).

This paper reports the following investigations which were carried out from 1993 to 1995:

1. The effect of continual trapping at the same location.
2. A comparison of day-time and night-time trapping.
3. Siting of traps on existing rabbit runs or unbreached sections of fence.
4. Determination of the numbers of females, males and juveniles caught.
5. The costs of installing and running the traps compared with more traditional methods of control.

MATERIALS AND METHODS

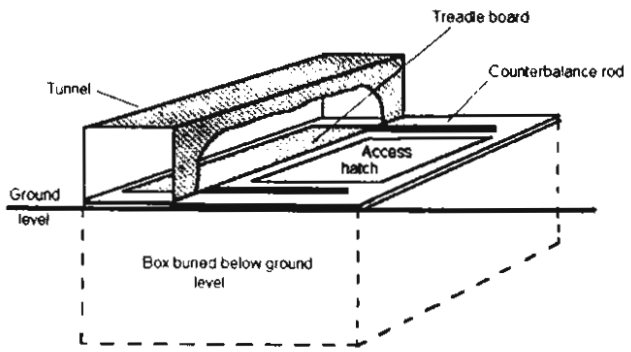
Trapping

Galvanized steel tip traps are available commercially (Lauderdale Engineering) in Great Britain and were used in these experiments. Each comprises a tunnel, tip board with counterbalance rods and access hatch. The entire mechanism is placed on top of a box of dimensions 530 x 530 x 530 mm deep buried at ground level (see diagram). The sides of the underground boxes were made of either concrete paving slabs or galvanized steel. The earth floor of each was covered with wire mesh to

prevent rabbits from digging out and to permit drainage. The traps were sited under existing rabbit proof fences.

DIAGRAM TO SHOW CONSTRUCTION OF TIP TRAP

Cut away to show position of treadle board



The tunnel provides access for the animals to move freely from the warren areas to the field. Rabbits are allowed access to their normal feeding areas, so some degree of grazing loss will occur using this technique. When the rabbit moves through the tunnel, it steps on the board which tips and the animal drops into the box. Counterbalance weights cause the board to swing back into place preventing escape by trapped animals and resets the board ready to trap the next animal to pass over. A few days are allowed from installation of the traps, when the treadle board is rendered inactive, until rabbits are using the tunnels regularly. Traps are rendered inactive by placing heavy weights on the counterbalance rods. Tip traps are normally activated only for one 12-hour period every 5 to 14 days, or longer when population levels are not high.

In 1994 and 1995, eight traps were sited under existing rabbit proof fence lines which separated warren areas from valuable grazing. Traps were installed in pairs, about 100 meters distance apart. The traps were operated as pairs to allow for comparative tests to be carried out. Once the traps were installed, existing breaches in the fence where rabbit runs had previously been established, were blocked to encourage rabbits to use the tunnels as the means of access to the grazing areas. Regular inspections were made of the fence line and any subsequent breaches were repaired to maintain an intact barrier.

Except where stated differently below, traps were operated on four or five day cycles. The treadle boards were activated at approximately 1800 hours in the evening and trapped animals were removed and humanely destroyed at approximately 0730 the following morning. The traps were then deactivated until the next trapping occasion though the tunnels were left open to allow free passage. Any non-target animals caught in the traps could be released unharmed.

The following field investigations were carried out in 1994 and 1995:

1. The effect of continual trapping at the same location—four traps were operated continuously over a 72-hour period, with animals being removed every 12 hours.
2. The success of day-time and night-time trapping was compared. Traps used to assess the effectiveness of day-time trapping were activated at approximately 0730 and animals removed at approximately 1830.
3. Two traps sited on existing runs were compared with two traps placed at previously unbreached sections of fence. All four traps were installed on the same day.
4. The sex ratio of caught rabbits was determined. All trapped rabbits were weighed and examined to determine whether they were male or female. It was difficult to determine the sex of young rabbits weighing less than 500 g without dissection and these were classed separately as "juveniles" (Thomson and Worden 1956).

Comparative Costs of Installing and Running Tip Traps

A detailed financial study was carried out on a predominantly livestock farm in the Scottish Borders region, 30 miles south of Edinburgh. The farm, extending to 577 hectares, carried 1,000 breeding ewes and 120 suckler cows. Grass for hay, silage and grazing was provided from 260 hectares of enclosed, in-bye land and 260 hectares of rough grazing. The farm had a long history of rabbit damage, which was considered by the owner to be costing in excess of £15,000 per annum. In an attempt to reduce the problem, a professional trapper was employed full-time for a period of 14 weeks in 1993 and provided with accommodation on the farm. Full costings were made available of all items relating to labor and trapping equipment purchased, including a rifle. A complete record was kept of rabbits caught and carcass sales.

When it became apparent to the farmer that the traditional methods of shooting and snaring were too costly, an initial network of 12 tip traps and associated rabbit proof fencing was installed on the farm later in 1993. Further traps were added up to June 1994, to give a final total of 46 traps. The costs of materials and establishment were available and records were kept of the number of rabbits caught, the number of traps used and the sale value of the carcasses. The total costs of both traditional trapping and the tip trap system were calculated and compared.

RESULTS

Results of Trapping Experiments

1. Effect of continual trapping at the same location.

   When the traps were first activated, the number of rabbits trapped was high, with 20 being caught in the four traps in the first 12-hour period after activation of the traps (see Table 1). A further six animals were caught in the second 12-hour period. Later catches were much reduced, with only three animals caught over the next 48-hour period.
2. Comparison of day-time and night-time trapping.

   Periodic, night-time trapping at four day intervals produced a more consistent number of rabbits caught per trapping occasion than had been recorded for the continual trapping experiment (see Table 1). The

results in Table 2 show that a significantly greater number of rabbits were caught by night-time trapping compared to day-time trapping ($p < 0.01$). On four out of six trapping occasions, an average of two to three rabbits was caught in each of the traps that was activated over a night-time period. Only a small number of animals were caught by the traps that were activated during the day-time. On four of the six trapping occasions, no rabbits were caught in any of the traps activated during the day-time period.

Table 1. Total number of rabbits caught at 12-hour intervals of continual trapping using four tip traps (July 1994).

Hours From First Activation of Trap	Number of Rabbits Caught After Each 12-hour Period
12	20
24	6
36	0
48	0
60	1
72	2

Table 2. Total number of rabbits caught per trapping occasion in day-time (mean of four traps) and night-time (mean of four traps) (July 1994).

Days From Start of Experiment	Day-time Trapping	Night-time Trapping
4	0.25	3.75
8	0	2.75
12	0	2.50
16	0	0.67*
20	0	2.33*
24	0.25	0*

*Mean of three traps.

3. Siting of traps in relation to runs.

There was no statistical difference in numbers caught in the two traps sited on existing rabbit runs compared with the two traps installed in areas of the fence where runs were not previously established ($p > 0.05$). Rabbits were caught regularly in both pairs of traps (see Table 3). A large total of 16 rabbits were caught in the two traps on the unbreached sections of fence on the final trapping occasion of this experiment. There did not appear to be any consistent pattern of catching which favored either pair of traps.

Table 3. Total number of rabbits caught using two tip traps installed on existing runs and two traps installed across sections of fence not previously breached by rabbits (July 1994).

Days From Start of Trapping	Sited on Runs	Installed on Previously Unbreached Areas of Fence
6	5	2
10	4	3
13	5	2
17	0	4
21	6	16
Totals	20	27

4. Sex ratio of rabbits trapped.

At every location, more females than males or juveniles were caught over a period of time (see Table 4). At Locations 1, 2 and 4, the sex ratio was similar. At Location 3, the ratio of females caught to males was much higher than at the other two locations. At this location, the trapping experiment coincided with an extremely warm, dry period of weather; an outbreak of myxomatosis killed many rabbits in the colony. No juvenile rabbits were caught at Location 2, where the traps were at least 50 meters distance from the warren area. The traps at Locations 1, 3 and 4 were adjacent to or very close to, warren areas. Trapping at Location 4 started in February. No juvenile rabbits were caught until April 20.

Results of Comparative Costs

It can be seen from the results in Table 5 that traditional methods resulted in a net cost to the farm of £0.39 per rabbit caught. The cost of accommodation for the trapper was not included in this initial calculation, but when included, raised the cost per rabbit caught to £0.58. The initial investment to establish the permanent network of tip traps was expensive, costing £6115.00. The traps were expected to last for at least ten years without requiring any substantial maintenance and were, therefore, costed at 10% per annum for this exercise. Provided that there was a market for carcasses at the local game dealer, rabbit sales could be expected to offset the cost of installation and running by providing a small potential profit of £0.13 per rabbit.

It was estimated that the average time taken to activate the tip trap network was 15 minutes per trap. This gave an average time of 1.81 minutes per rabbit to trap a single rabbit. Trapping was carried out by unskilled labor already available on the farm. The average time taken to trap or kill a rabbit by the skilled traditional trapper was 7.14 minutes.

DISCUSSION

Three aspects of the use of tip traps were investigated: the continual use of traps on the same location, the time of day when traps are set and emptied and the siting of traps in relation to rabbit runs. The sex ratio of rabbits caught was recorded.

Continual trapping at the same location with traps emptied at 12-hour intervals resulted in rabbits not using the trap, which concurs with anecdotal evidence from farmers (Sutherland pers. comm.) and confirms the general advice that periodic trapping is more effective. The reasons for aversion to the traps are not understood.

Few rabbits were trapped by day-time operation (Table 2). This would result from the known feeding habits of rabbits which graze most actively during dusk and early morning (Southern 1940; Thomson 1953). Day-time operation is likely to be most intense in the summer months when farmers are particularly concerned to reduce numbers to protect vulnerable crops during the growing season. Trapping during daylight hours would not be regarded as being as humane since any animals caught would be confined within the box during the hottest part of the day. Any trapping occasions should include dawn and dusk within the activation period.

The exact location of a trap along a fence line do not appear to be important, contrary to suggestions in the farming press. Allowance can therefore be made for difficulties of installation caused by factors such as rocky soils and tree roots. Some rabbits were observed to climb over fences rather than use the tunnels (Allan 1995), while others will still attempt to breach the fence by digging and tunnelling. However, general habituation to the tunnels occurs within a few days, and attempted breaches of the fence line have been recorded to diminish with time (Mackintosh 1994; Allan 1995). Rabbits which habituate to the tunnels will use them as hiding places in times of danger, such as upon the approach of human beings or dogs indicating that fear of the tunnels has disappeared (Fuchs pers. observ.).

The sex ratio of rabbits caught at the four experimental locations (Table 4) was variable but always more females were caught than males. With the exception of Location 3, the ratios were similar to the results of studies reported by Thomson and Worden (1956) where the ratio of males to females was 100:131-132 for three-quarter grown or fully grown animals. They noted that the ratio could vary according to the methods of capture used.

Economic comparisons with traditional trapping methods supported the use of the traps as a feasible on-farm practice. The employment of a full-time professional trapper on the study farm resulted in nearly 5,000 rabbits being removed over a period of 14 weeks. However, despite the sale of rabbit carcasses to a local game dealer, there was still a net cost of £0.39 per rabbit to the farm. The installation of the tip trap system allowed the cull of rabbits to continue, using unskilled farm labor rather than the skilled labor of a trapper. If the initial high cost of installation of the traps was depreciated over the expected ten year life of the system, a small profit of £0.13 per rabbit was generated.

Although the market for wild rabbit meat in the UK has been very low since the arrival of myxomatosis, there is a potential to use a system of traps not just to maintain populations at an acceptable level, but to harvest rabbits for the human market. Rabbits caught by tip traps will provide undamaged carcasses and command a higher price than shot rabbits, where the body has been damaged by the passage of a bullet or lead shot.

Table 4. Percentage of rabbits of different sex caught by tip traps at four different locations in North East Scotland in 1994 and 1995.

	Location 1 June-August 1994	Location 2 June-August 1994	Location 3 June-August 1995	Location 4* February-May 1995
Females	45 (125)	68 (112)	62 (343)	47 (142)
Males	36	32	14	33
Juveniles	19	0	24	20+
Total Percentage	100	100	100	100
Number Caught	120	138	70	84

*Data supplied by J. Osborne, Royal Society for the Protection of Birds.

+No juveniles caught before April 20.

Figures in brackets indicate sex ratio:males=100.

The time allocated to taking a single rabbit under the traditional system was 7.1 minutes (Table 5). This estimate was based on the trapper working a 40 hour week, though in practice the working week was often in excess of 50 hours, which would have given a real value in excess of 8 minutes per rabbit caught or killed. The estimated time taken to activate and empty a single tip trap was 15 minutes, resulting in a much reduced time of 1.8 minutes (of unskilled labor) per rabbit. The tip trap was, therefore, more efficient in terms of time needed to trap a single rabbit, compared with traditional methods.

The difference in numbers of rabbits caught per trap per trapping occasion on the experimental sites—2.3 in 1994, 1.3 in 1995 (excluding the occasions when myxomatosis affected the colony)—compared with 7.7 catches on the case study farm and may be explained in part by the very high pest population on that farm. However, a complete system of traps and fences was integrated onto the study farm, whereas at the experimental sites, only individual boundaries between warren and affected fields were studied. In 1995, complaints from a neighboring farm to the experimental area suggests that some of the rabbits were foraging in a different direction from the study area (Allan 1995). This indicates that the traps are better used as a complete system and not as a "piece-meal" attempt to protect small areas.

Table 5. Comparative costs of tip trapping compared with traditional methods of catching rabbits (1993).

Period of Control	Traditional Trapping January 1993-April 1993	Tip Trapping August 1993-March 1994
Weeks of Control	14	31
Labor Costs Allocated to Control	£2,770.85	£326.00
Costs	£1,151.46	£611.50*
Total Costs	£3,922.31	£937.50
Number of Rabbits Caught	4,708	2,698
Income From Sale of Rabbits	£2,058.20	£1,349.00
Profit/Loss Rabbit	Loss £0.39	Profit £0.15
Average Labor Time to Catch One Rabbit	7.1 minutes	1.8 minutes

*Cost of installation of tip trap network: £6115.00. Straight line depreciation equivalent to 10% per annum as capital items have an expected life in excess of ten years.

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