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DO WOOD MICE *APODEMUS SYLVATICUS* (L.) ABANDON FIELDS DURING AUTUMN?

ABSTRACT: It is often believed that mice in autumn leave fields and migrate to more hospitable habitats. To test this, mice were trapped and marked in two habitat types: (1) one where immigration from surrounding fields (if it occurred) would substantially dilute the resident mouse population and (2) one where immigration for various reasons was not considered possible. The proportion of mice captured at a second trapping occasion (after autumn ploughing) that constituted recaptures, was similar. This is interpreted as evidence that emigration away from fields during autumn is not an important process.

KEY WORDS: Migration, landscape ecology.

1. INTRODUCTION

During summer, mice in temperate zone rural areas live in both cultivated fields and surrounding areas. However, it is a popular belief that in autumn mice leave fields and invade buildings and other localities that might be more hospitable during winter. There is also some published support for this (Hansson 1981). One explanation for this behaviour is that ploughing in autumn could make fields inhospitable by destroying cover and burrow systems and by covering food.

The study aims to test this hypothesis. I concentrate on one particular setting; I study the possibility that mice invade natural habitat islands in an agricultural landscape. Houses, farms etc. are not included. Also, I study changes in the mice population in these habitat islands that might occur only during the period of autumn ploughing of the surrounding fields as this is the potentially destructive activity.

2. METHODS

2.1. STUDY AREA

The study was undertaken in the province of Dalsland in western Sweden in 1985 and 1986. The study area (12°25' E, 58°40' N) is situated on the border between a flat agricultural area and a predominantly wooded area. 25 km separated the most distant study plots. All study plots had a mixture of dry meadow vegetation and trees (Fig. 1).

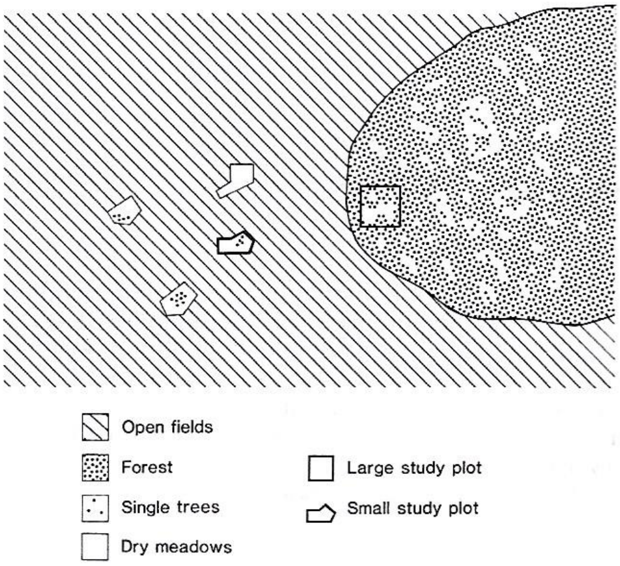


Fig. 1. A simplified map of the study area. Main vegetation types and examples of the two types of study patches are shown

A total of 23 habitat islands in arable fields were studied. Twelve of these were used in 1985 and 15 in 1986. They were covered by a trapping grid, 10 × 10 m; the total number of traps thus depended on island area. There was a total of 92 and 80 traps in the small plots during 1985 and 1986 respectively.

There were four large (50 × 50 m) study plots inside larger non field patches (between 20 and several 100 ha). These patches were largely wooded although there were smaller subpatches of dry meadow vegetation between the trees. The study plots could thus be placed so that their vegetation conformed to that of the smaller plots. These four were all used during trapping periods in both 1985 and 1986. There were 36 traps (6 × 6 in a 10 m grid) in each of them.

2.2. TRAPPING

Each autumn I trapped mice during two periods separated by about 5 weeks. They were timed so that several of the fields surrounding study plots were ploughed between two periods. Traps were, in each period, set on day 1 and checked on days 2 to 5. All mice captured were weighed, individually marked (by toe-clipping), and released at the capture site.

2.3. RATIONALE

Before autumn ploughing I attempted to trap and mark as many as possible of the mice living (1) in the plots where invasion by mice from the surroundings was predicted by the hypothesis ("invasion plots") and (2) in the control plots. As "invasion plots" I considered those small habitat islands that were surrounded by fields ploughed between two trapping occasions. I considered the remaining plots "control plots", that is all those small plots surrounded by fields that had not been ploughed by the time I carried out the second trapping for the season and all large plots. The latter were mainly surrounded by forest. I could therefore assume that invasion, if it occurs, is minimal into control plots.

Invasion means here that an area is subject to a (massive) net immigration. If this takes place one would expect the proportion of unmarked mice at the second trapping period to be higher in the "invasion plots" than in the "control plots".

2.4. HOW SMALL MICE SHOULD BE INCLUDED?

All mice that were found to be unmarked at the second capture period need not be immigrants. They may also have been born since the first trapping occasion, or were too small at that time to be available for capture. These animals have obviously no information for the analysis done here and should not be included in order to avoid "noise". It is therefore necessary to exclude all animals that were below a certain size (at the second capture occasion) from the analysis. Choosing too low a size limit will lead to the inclusion of animals that were not available for marking at the first capture and thus introduce "noise" into the analysis.

Choosing too large a size limit for inclusion means on the other hand that the sample will be small. This means that, even if there really is a difference in the proportion of marked mice in the two samples, from invasion and control plots respectively, we are less likely to find a significant difference in support of the hypothesis. A bias could also be introduced by choosing a too high size limit; if young mice dominate among the migrants, invasion is less likely to be detected then than if old ones do.

The above reasoning supports the need for an exclusion of the smallest animals but also that the limit must not be too high. I determined a reasonable limit in the following way: I assume that recapture rate is size independent for mice above a certain weight and that variation in recapture rate above that size is due to chance. I wish to estimate this size. Below that size recapture rate should decrease gradually until below a certain size no recaptures are expected. The change is gradual if there is a size/age interval in which the capture rate of young mice increases from zero to a fixed level and/or if there is individual variation in the rate of weight increase

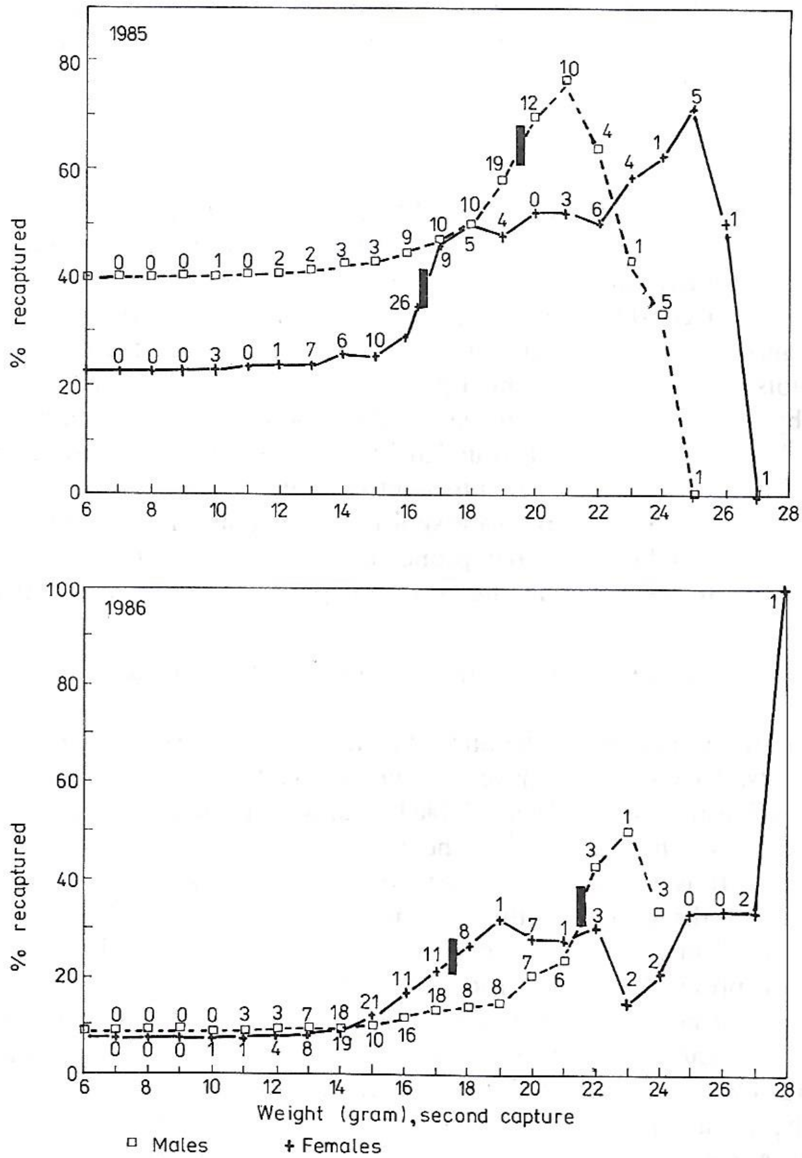
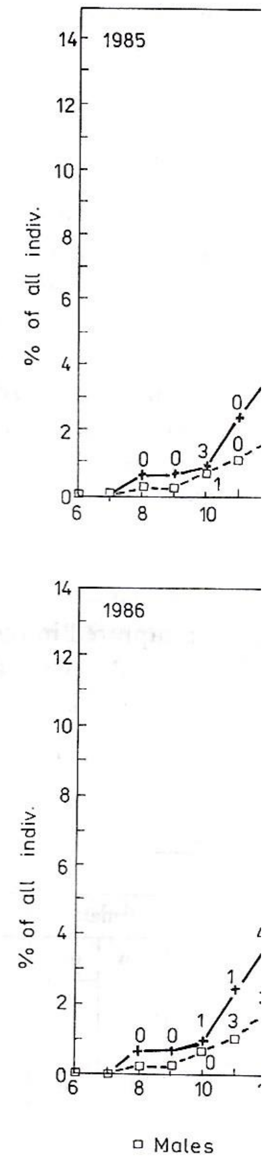


Fig. 2. Graphs used to decide which size classes to include in the analysis
The graph represents the situation at the second trapping period. For each size the graph shows, on the y-axis, the proportion (%) of all mice of the indicated size or above that repressented recaptures. The number of individuals in each size class captured is given above the markers. To the left of the thick marker bars there is a steady decrease in the proportion of mice representing recaptures. This suggests that including such small mice means that one accumulates an increasingly higher proportion of mice that were not large enough to be captured at the first trapping period



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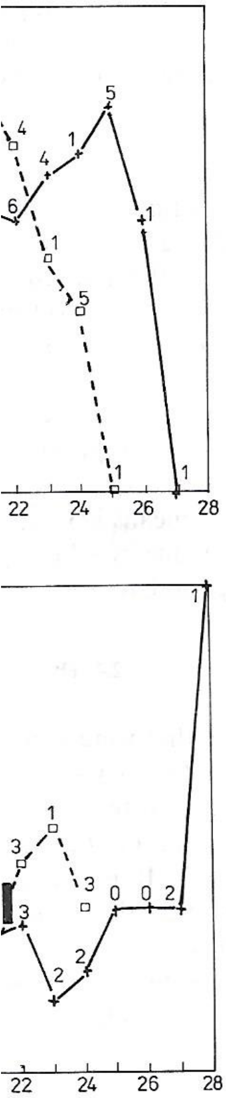

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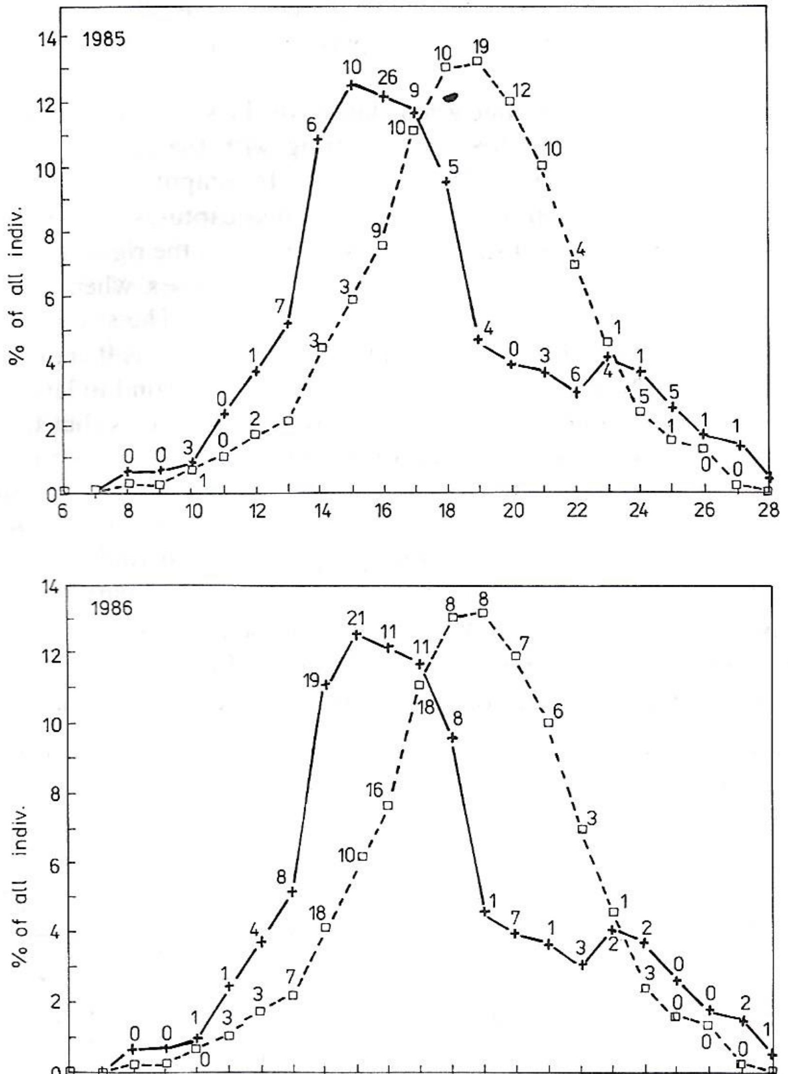

Fig. 3. Size distribution of all males and females captured at the second trapping periods
The values in per cent are running means for five size class. The number of individuals captured in each size class is given above the markers

between the two capture occasions. I wish to include all mice from the size class of constant recapture rate and from the upper part of the class of increasing recapture rate.

To do this I accumulated, by one gram classes for the second trapping period, the number of captured and recaptured mice starting with the highest size class and working towards smaller sizes. For each size I compute the proportion of accumulated number of recaptures of all accumulated captures. This graph (Fig. 2) behaves irregularly in the highest size classes. Moving from the right side to the left it starts a monotonous decrease. This happens at size classes when an increasing proportion of mice was not trappable at the first occasion. The size limit is chosen independently for 1985 and 1986 and for males and females – as there is an obvious size dimorphism (Fig. 3). The limit is drawn just before the second to last size class in the increasing sequence (Fig. 2). The monotonous decrease shows that the inclusion of an steadily increasing proportion of young mice has begun.

3. RESULTS

In the control plots 45% (N = 31 for 2 years) of the mice captured in the second trapping period in two years were recaptures. The total figure for 2 years was almost the same for the potential invasion plots (46%, N = 80) (Table 1).

Table 1. The number of newly captured and recaptured mice in different categories of study plots at the second trap period of each year. Males at least 20 g (1985) and 22 g (1986) and females at least 17 g (1985) and 18 g (1986) are included

Plot type	1985					1986				
	traps	females		males		traps	females		males	
		new	rec.	new	rec.		new	rec.	new	rec.
All control plots	162	4	8	8	3	156	1	1	4	2
large plots	144	4	7	5	3	144	0	1	3	1
small plots (no ploughing)	18	0	1	3	0	12	1	0	1	1
Small plots, ploughing (invasion plots)	74	7	16	13	15	68	5	2	18	4

4. DISCUSSION

The occurrence of an autumn invasion of habitat island by mice is not supported by this study. This indicates either that invasion does not take place at the time or into the habitats that I have studied or that it does not happen at all.

Invasion into a habitat patch is expected the carrying capacity (or a similar measure of suitability) of the patch relative to surrounding habitat increases (e.g.

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decreases less quickly) and the potential invaders have a means of knowing this. Any measure of suitability must of course take intraspecific competition into account.

The habitat islands that I studied supported and abundant mouse population before autumn ploughing and underwent no apparent drastic change in suitability. They were generally small and any mice living close to them in the field should be able to explore them. There were no trappings made in the fields but in another study area I have demonstrated the existence of abundant mouse populations in cropped fields (Loman in press). This is also reported by Green (1979). The existence of such populations is of course axiomatic to the invasion hypothesis. It can of course not be altogether excluded that, e.g., farm buildings become relatively more attractive during the autumn than to the habitat patches studied here. However, based on this study I am inclined to doubt the importance of an autumn invasion. I thus assume that mice have the means of comparing the suitability of fields and habitat islands and chose to remain in the fields. I therefore conclude that the islands are not profitable alternatives for field living mice.

What aspect of fields make them a suitable habitat? In another study I have described mouse burrows that are dug to a depth that reduces their vulnerability to ploughing and that contain abundant food stores (Loman in press). Similar burrow systems were also found by Jennings (1975). I do not suggest that ploughing and other autumn activities in the fields do not affect the mice inhabiting the burrow systems, but I do not think that it is as devastating to the field living populations as one might think. The alternative to remaining in the field habitat is to migrate to another habitat. However, this means competition with the resident mouse population.

Also, the time before autumn ploughing is one when mice living in the fields have the opportunity to hoard large amounts of waste (to humans) seeds in their burrows. A stored resource that should not be abandoned light-heartedly. Similar arguments have been but forth for the sedentary habitats of some food hoarding birds (Ekman 1979, Enoksson 1987). Thus there may even be little reason to expect autumn migration in field living wood mice. This discussion is not concerned with the existence of socially related dispersal movements.

What is the cause of the invasion hypothesis? It seems that mice are predominantly observed during autumn. Flowerdew (1985), summarized several other studies that reported five to tenfold increases from late summer to late autumn. In another study in a south Swedish habitat, with a similar design (four day trapping with live traps), the number of captures per mouse trapped was 1.25 in summer and 1.92 in autumn (Loman in press). This may suggest that mice move more during autumn than summer. Taken together, these observations indicate that there is probably a drastic increase in total mouse activity from summer to autumn. Persons living in a farm or other building may interpret this as an invasion from surrounding habitats.

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5. SUMMARY

Wood mice were captured in habitat islands and other areas close to cropped fields during two autumns. The trapping areas were of two types, those surrounded by ploughed fields and those that were not. The captures were, in each year, done before and after ploughing. All mice were marked at the first capture occasion in each year. At the second capture occasion, about one month later, the proportion of newly captured mice were compared between the two types of trapping areas. Only mice that were sufficiently large to have been available for capture at the first instance were considered (Fig. 2). The same proportion were newly captured mice in both types of trapping area (Table 1). This suggests that ploughing of fields around small habitat islands does not cause a higher rate of immigration to these areas than takes place elsewhere.

6. POLISH SUMMARY

Myszy zaroślowe łowiono w okresie dwóch jesieni na wyspach środowiskowych i innych obszarach przyległych do pól uprawnych. Ustawiono dwojakiego rodzaju powierzchnie łowne: otoczone oraz nie otoczone zaoranymi polami. Każdego roku myszy łowiono przed i po orce. Wszystkie myszy złowione w czasie I serii połowów każdego roku znakowano indywidualnie. Udział myszy nowo złowionych w czasie II serii połowów (ok. 1 miesiąc później) porównywano w dwóch typach powierzchni łownych. Rozpatrywano tylko takie myszy, które były na tyle duże, aby mogły być teoretycznie złowione w czasie I serii połowów (rys. 2). Na obu typach powierzchni stwierdzono jednakową proporcję myszy nowo złowionych (tab. 1). To pozwala sądzić, że orka pól wokół małych wysp środowiskowych nie powoduje wyższego tempa imigracji myszy do tych wysp w porównaniu z innymi miejscami.

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