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The Effect of Some Habitat Factors on the Spatial Distribution of a Hare Population during the Winter

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Bresiński W., 1983: The effect of some habitat factors on the spatial distribution of a hare population during the winter. Acta theriol., 28, 29: 435—441 [With 2 Tables].

Examination was made of the effect of agrarian structure, urbanization of the area, forest-field habitat distribution, and the amount of tree stand in fields on the winter distribution of a hare population, *Lepus europaeus* Pallas, 1778, paying particular attention to the age and sex structure of a population of this species. It was found that the agrarian structure and number of trees in fields did not exert any significant effect on differences in the density of the hare population, although such density is affected by the urbanization of the area and the forest-field habitat distribution. Fewer numbers of young individuals were found in urbanized areas. Density of hares in small forests was significantly greater than in fields as the result of the animals moving from fields to wooded land.

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1. INTRODUCTION

The spatial distribution of a population is to a great extent determined by the ecological conditions in which the given species lives. It creates a variety of living conditions for these animals and consequently different possibilities of survival (Petrusewicz, 1965; and others). The kind of crop, agrarian structure, tree stands and degree of urbanization of the area affect biotope preferences and cause differences in density, and also the distribution of the hares in groups (cf.: Pielowski, 1966, 1979, 1981; Möller, 1971; Jezierski, 1972, 1973; Bresiński, 1976; Bresiński & Chlewski, 1976; Rimathe, 1977; Schröpfer & Nyenhuis, 1982; and others). No examination has been made in these studies of the elements of population structures of here.

The purpose of the present study was to examine the effect of agrarian structure, urbanization of the area, forest-field habitat distribution and the number of tree stands in fields on the winter spatial distribution of a hare population, *Lepus europaeus* Pallas, 1778, taking age and sex structure of this population into consideration.

2. STUDY AREA

The studies were made in the experimental area about 15.000 ha in extent of the Research Station of the Polish Hunting Association at Czempiń, situated in the western part of Poland. The area consists mainly of fields, the dominating form of agriculture being large-scale fields (about 70%). The remainder of the area is occupied by individual farms. The village buildings are more or less compact. Two railway lines about 25 km in length run through the study area. There are also about 60 km of beaten tracks with medium intensity of vehicular traffic. The area is poorly wooded (about 6.8%). There are 6 small forests from about 50 to about 800 ha in extent, and there are a large number of shelterbelts, which in 1974 covered about 1.9% of the fields (Bresiński & Chlewski, 1976). The numbers of hares in autumn in the study area was maintained on a level of 41.8 in 1974 (Pielowski, 1975) and in 1975 44.8 individuals per 100 ha (unpubl. data).

3. MATERIAL AND METHODS

The studies were carried out in December and January 1974/75 and 1975/76. The hares were caught in nets, using the net quadrangle system (cf. Pielowski, 1979). The boundaries of the various capture areas were entered on a map with scale 1 : 25 000, and their area next defined by means of a planimeter. These areas were differentiated in respect of agrarian structure (size of field area), amount of tree stands in the area, urbanization and forest-field habitat distribution. In order to ascertain the effect of urbanization of fields parts of the area were selected in which at least two of the three accepted factors (building in the area, beaten tracks, railway line) were either directly bounding or situated within the capture area.

The sex of the animals was ascertained by inspection of the external genitalia and age by feeling the thickening of the ulnar epiphyse (cf. Pielowski, 1979). Two age classes were distinguished — young animals up to the age of about 9 months, and old adults over 9 months old. Estimates of age of the hares obtained for

Table 1

Number and size of sample areas and number of hares caught during seasons 1974/75 and 1975/76.

	Capture date		Total
	9 Dec. '74— —20 Jan. '75	3 Dec. '75— —24 Jan. '76	
No. of capture areas	76	51	127
Size of capture areas, ha	4,890	4,129	9,019
min, max, avg	10; 137; 64	10; 188; 81	10; 188; 71
No. of hare caught			
From 1 area, $\bar{N}$/100 ha	31,9	35,1	33,4
min, max, avg	2; 131; 20	8; 105; 28	2; 131; 24
Total	1,559	1,451	3,010
Males juv[1], ad[1]	373; 399	395; 341	768; 740
Females juv[1], ad[1]	423; 364	448; 267	871; 631

[1] After allowing for corrections.

these studies during the period November—January no longer give completely objective results, since during this period the ulnar epiphyse disappears. Pielowski (1975) defined the extent of the error incurred depending on the time at which the examination was carried out. Calculation was made on the basis of these data and corrections introduced for material collected during the course of the studies. The basis of further analysis consisted in the number appropriately amended by the corrections of hares caugh in different capture areas. Significance of differences for calculated averages was defined using the Student t test for independent groups.

During the studies total of 3010 hares were caught (Table 1) from capture areas, situated in different parts of the experimental area, which covered a total of approximately 9019 ha (about 30% of the total area).

4. RESULTS

Agrarian structure does not significantly contribute to differences in the density of hare populations (Table 2). It was only in small fields that the density of young females was significantly higher than those of old animals ($p<0.02$).

Fields affected by urbanization factors were characterized by lower number of hares than in areas beyond the influence of this factor ($p<0.05$, Table 2). This is shown chiefly in young individuals ($p<0.02$) including females ($p<0.02$). This factor did not cause differences in the density of old adults.

In small forests the density of hares was about five times greater than in fields round wooded areas and about twice higher than in fields at a distance from woods (Table 2). It was only in the case of young females in small forests and in fields at a distance from them that these differences were not statistically significant. In small forests there were more young males than females ($p<0.05$). While in fields near woods the density of old females was significantly higher in comparison with young individuals ($p<0.05$). A similar situation was found in areas at a distance from woods, but there the reverse tendency occurred — a larger number of young females than of old adults ($p<0.05$).

In fields wooded to different degrees no statistically significant differences were found in the density of hares (Table 2). It was only when the percentage of tree cover of fields was 5 or more percent that density was significantly greater for young animals ($p<0.05$) *i.e.* only for females ($p<0.02$).

We also failed to find significant relations between density of hare populations and the degree of tree cover of fields (Table 2). In very large fields, on the other hand, such relations were found for young individuals ($p<0.05$), but for males only ($p<0.01$). In small fields they were significant for females ($p<0.05$) and in this only old adults ($p<0.01$)

Table 2

Average density of hares according to sex and age groups in different habitat variants ($\bar{N}$/100 ha).

Item	No. capture areas	Ad. + juv.	Juv.	Ad.	M	F	M juv.	F juv.	M ad.	F ad.
Avg. study area	127	38.1	19.8	18.3	19.2	18.9	9.3	10.5	9.9	8.4
Agrarian structure										
Large fields	64	37.8	19.3	18.4	19.0	18.8	9.0	10.4	10.0	8.4
Small fields	37	35.0	19.5	15.6	17.1	17.9	8.6	10.8	8.5	7.1
Urbanization of area										
Urbanized fields	19	33.9	15.2	18.6	16.5	17.4	6.6	8.6	9.8	8.8
Field beyond reach of urbanization	38	38.3	21.6	16.8	19.3	19.1	10.4	11.2	8.9	7.8
Field-forest distribution										
Open fields	95	35.8	19.0	16.8	17.6	18.0	8.7	10.3	9.0	7.7
Field near forest	7	14.2	6.6	7.5	7.0	7.1	4.3	2.4	2.8	4.8
Small forest	7	69.5	32.8	36.8	37.9	31.8	19.3	13.4	18.6	18.3
Degree of tree cover of fields, %										
0.0	7	44.2	21.4	22.7	22.1	21.9	8.5	12.9	13.7	9.0
0.1—0.5	43	37.7	19.2	18.5	18.8	18.7	8.8	10.4	10.1	8.4
0.6—1.0	26	32.3	16.9	15.4	16.1	16.3	7.8	9.1	8.2	7.2
1.1—2.5	20	33.3	16.1	17.2	15.4	17.8	6.9	9.2	8.5	8.7
2.6—5.0	8	34.8	19.3	15.6	20.2	14.7	10.7	8.5	9.4	6.2
5.1 and more	15	40.3	24.3	15.4	20.3	19.9	11.6	13.2	8.7	6.7
Correlation coefficient of degree of tree cover in fields and density of hares*										
Large fields	67	+0.098	+0.253[1]	—0.046	+0.184	+0.001	+0.352[2]	+0.104	+0.008	—0.105
Small fields	37	+0.256	+0.199	+0.240	+0.087	+0.380[1]	+0.130	+0.216	—0.017	+0.400[2]
Total fields	119	+0.082	+0.166	—0.015	+0.115	+0.021	+0.229[1]	+0.077	—0.003	—0.029

* Significant correlation coefficients are marked: [1] when $p \leqslant 0.05$ or [2] when $p \leqslant 0.01$.

With joint analysis of large and small fields these relations were significant for young males ($p<0.05$).

5. DISCUSSION

The results of these studies provide confirmation of the earlier established fact that the density of hares living in urbanized areas is lower (Pielowski, 1966; 1979). It was, however, found that this applies chiefly to the lower numbers of young animals in these areas. This may be the result of increased mortality due to wheeled traffic or stray dogs and cats, the lack of experience of young individuals tempted to the verges of traffic routes or near to buildings by the attractiveness of the feeding places (Pielowski, 1979). Although the degree of direct effect of the above predators on mortality in a hare population is slight, the constant disturbance and fear they introduce may result in the hares moving away from near villages (Pielowski, 1976). The situation may be made worse by the hares moving away from roads and railways during the daytime (Pielowski, 1979), and the young hares born there, as being more settled individuals (Pielowski, 1972) inhabit such areas to a lesser degree.

Differences in the density of hares in areas near woods and open fields were observed earlier by Pielowski (1966) and Bresiński & Chlewski (1976). In winter the density of these animals in areas near wooded land is about 60% lower than in open fields. In autumn and spring, on the other hand, these differences are only about 15% (Bresiński & Chlewski, 1976). It is likely that hares migrate from areas near woods to small forests, where they find suitable shelter and easily accessible food supplies even with thick snow cover. Safety considerations also play a part here — avoidance of areas near woods intensively visited by foxes and winged predators. The significantly greater density of hares in small forests is certainly due to these animals searching for suitable places in which to live, to enable them to survive during the unfavourable living conditions of the winter period. This may in effect lead to generally decreased total mortality in the hare population (small forest+the field surrounding it). Attention has been drawn by Schröpfer & Nyenhuis (1982) to the favourable importance of small forests to the numbers of hares, and to a roe deer population, by Pielowski & Bresiński (1982). It would seem that small woods as a permanent element of a field habitat constitute an important biocenotic factor, providing variety in living conditions for game animals.

Shelterbelts constitute a not unimportant element in differentiation of density of hare populations (cf. also: Pielowski, 1966; Möller, 1971; Bre-

siński & Chlewski, 1976). It is only in areas with a large number of shelters (over 5%) that more young animals are encountered. This may be the result of reduced natural mortality due to the agrotechnical activities of man, weather conditions and predators, in comparison with fields providing less shelter. The relations between the number of shelters and density of young individuals in large fields is particularly clear, that is, in places where shelterbelts form the chief source of shelter for these animals. Increase in the density of females, particularly of old adults, in small fields is observed with increase in the degree to which such fields are wooded. It may be that females, in preparation for the reproduction period, search for quiet places in the intensively frequented fields of individual farmers.

Agrarian structure is not an significant factor causing differences in the density of hare populations (cf. also: Bresiński, 1976). It is, however, difficult to interpret the differences observed in the density of young and old females in small fields.

To sum up it may be said that agrarian structure and degree of tree cover of fields do not significantly affect differences in the density of hare populations during winter, but that urbanization of the area and the forest-field habitat distribution have a significant effect. The lower density of a hare population in urbanized areas is determined chiefly by the low numbers of young individuals, but in areas near wooded land, by the hares moving into the wood. It would seem that small forests in fields constitute an important biocenotic factor affecting the numbers of hare populations.

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WPŁYW NIEKTÓRYCH CZYNNIKÓW ŚRODOWISKOWYCH NA ROZMIESZCZENIE PRZESTRZENNE POPULACJI ZAJĄCA W OKRESIE ZIMOWYM

Streszczenie

W latach 1974/75 i 1975/76 na terenie doświadczalnym Stacji Badawczej Polskiego Związku Łowieckiego w Czempiniu, badano wpływ struktury agrarnej, urbanizacji terenu, układu środowiskowego las—pole oraz stopnia zadrzewienia pól na zimowe rozmieszczenie przestrzenne populacji zająca. Szczegółową uwagę zwrócono na strukturę wiekową i płciową populacji tego gatunku. Stwierdzono, że struktura agrarna oraz stopień zadrzewienia pól nie wpływają w istotny sposób na różnicowanie zagęszczenia populacji zająca (Tabela 2). Natomiast urbanizacja terenu oraz układ środowiskowy las—pole w istotny sposób wpływają na to zjawisko. Na terenach zurbanizowanych jest to wynikiem niższej liczebności osobników młodych, natomiast na terenach przyleśnych rezultatem przemieszczania się zajęcy do lasu. Zagęszczenie tych zwierząt w lasach śródpolnych jest istotnie wyższe w porównaniu z polami.