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STUDIES ON THE EUROPEAN HARE. XXXVII.

Estimating by Spotlight the Population Density of the European Hare

OCENA ZAGĘSZCZENIA POPULACJI ZAJĄCA ZA POMOCĄ REFLEKTORA

Bo FRYLESTAM

Frylestam B., 1981: Estimating by spotlight the population density of the European hare. Acta theriol., 26, 28: 419—423 [With 2 Tables & 1 Fig.].

The possibility of estimating European hare population density by spotlights at night was tested in three study areas in southernmost Sweden. Mean number of hares counted at night did not significantly differ from those counted at day-time. Number of hares flushed by a line trailing between two cars was used to measure hare density in open fields. Number of hares at night at consecutive counts varied around the 95% confidence interval and gave a reliable measure of the actual population density. The number of hares recorded in relation to the size of the sampling area in a pasture showed that too small sampling areas and few and scattered plots will result in a large variation between consecutive counts. The area should be extended until the variation between counts is within the 95% confidence interval. Population density can be reliable estimated only when counts are made in open areas, under similar weather conditions, and with short intervals.

[Dept. Anim. Ecol., Ecology Building, S-223 62 Lund, Sweden]

1. INTRODUCTION

Two methods have mainly been used to estimate the size of European hare populations: belt assessment and capture-recepture. Belt assessments are made by beaters walking along line transects, usually 100 m wide, in representative areas (Pielowski, 1966, 1968, 1969; Möller, 1968, 1971; Rajska, 1968; Jezierski, 1973). Population densities were found to be generally overestimated by about 20% with this method (Pielowski, 1969). The second method, based on capture-recepture and marking, has been used mainly in Poland (Andrzejewski & Jezierski, 1966; Pielowski, 1969) and Denmark (Abildgård *et al.*, 1972), and was considered the more accurate of the two (Pielowski, 1969).

Night counts of hares by spotlights have been proposed as a useful third method. Eltringham & Flux (1971) counted hares and other nocturnal animals in African savannah from a car with hand-held spotlights. They concluded, however, that the method only provided information on population fluctuations, not on absolute densities. In Switzerland, hares were counted from cars along field roads in agri-

cultural areas (Pfister, 1969; Pfister & Rimathe, 1973; Rimathe, 1977; Salzmann-Wandeler & Salzmann, 1973); in Poland, the distribution and numbers of roe deer and hares in cultivated fields were studied by this method (Kałuziński & Bresiński, 1976).

In this paper, experiences from night counts of hares in South Swedish habitats are summarized, and the reliability of the method is evaluated.

2. METHODS

In three study areas, two being farmland and one a pure pasture area, sampling plots representing different types of land use were selected. The plots measured from 2 to 18 ha. All could be reached by car, and in most cases observed from more than one direction. Hares were counted in spring (Febr./March) and in autumn (Oct./Nov.), usually on five occasions during each season in 1974—1976. Counts were made in clear weather between 20.00 and 23.00 hours local time. A 12-volt halogen spotlight was used in combination with a pair of binoculars (7×50) held on the top of the lamp. Hares could be well observed at a distance of 300 m, thus an area of max. 28 ha could be observed when both sides of the road were covered. During the counts, whistles were intermittenly sounded by the observer to cause hidden hares better to expose.

The reliability of night counts was tested in a pasture area against the population density as estimated in the following way: a trailing line, 100 m long, was dragged between two cars driven back and forth in the sampling plots. All hares sitting in lodges were assumed to be flushed by the line. The same area (1.96 km²) was covered in both night- and day-time counts. Furthermore, the variation in number of hares recorded at consecutive counts was compared with the 95% confidence interval, as was also the variation in hare numbers in relation to the size of the sampling area when plot area was cumulated.

3. RESULTS AND DISCUSSION

Distribution of hares in the sampling area and the total number of hares recorded did not differ significantly between night- and day-time samplings (Table 1). Possibly the lower number of hares obtained at day-time might be because not all hares have their lodges in open fields, but close to edges of woods and marshes inaccessible to the cars. However, as hares exclusively feed in open places in spring and autumn, the mean number obtained by night counts was a relatively accurate estimate of population density.

Table 1

Comparison of hare numbers obtained during night and day-time counts in a pasture area (1.96 km²). Sampling plots situated adjacent to each other in the area were lumped to four plots in the table. $\chi^2=1.97$, $P>0.05$

	No. of hares observed				
Time	Plot 1	2	3	4	Total
Night	16.3	9.7	10.3	5.3	41.6
Day	12	6	14	6	38

Hare numbers recorded at consecutive counts in spring and autumn in three study areas during 1974—1975 ranged closely around the 95% confidence interval (Table 2). For area No. 1 (pasture) the hare numbers are compared to number of sampling plots and acreage of the sampling

Table 2

Hare numbers obtained by night counts in three study areas in Southern Sweden 1974—1975. The mean numbers of observed hares are given together with 95% confidence interval.

Area	Season	No. of counts	Min.	Max.	$\bar{x}\pm SD$	Range at 95% confidence interval
Revinge	Spring	5	27	36	31.4±4.4	27— 36
„	Autumn	5	42	54	48.4±4.4	44— 53
„	Spring	5	21	30	24.2±4.4	20— 27
„	Autumn	4	28	36	31.7±5.0	27— 37
Vasatorp	Spring	5	62	70	65.8±4.8	61— 70
„	Autumn	5	72	86	80.0±4.8	75— 85
„	Spring	4	47	64	55.0±5.3	50— 60
„	Autumn	5	74	82	78.4±4.8	74— 83
Ven	Spring	5	40	61	49.8±8.3	41— 58
„	Autumn	5	141	165	154.0±8.3	146—162
„	Spring	3	53	63	58.0±10.7	47— 68
„	Autumn	5	103	127	114.4±8.3	106—126

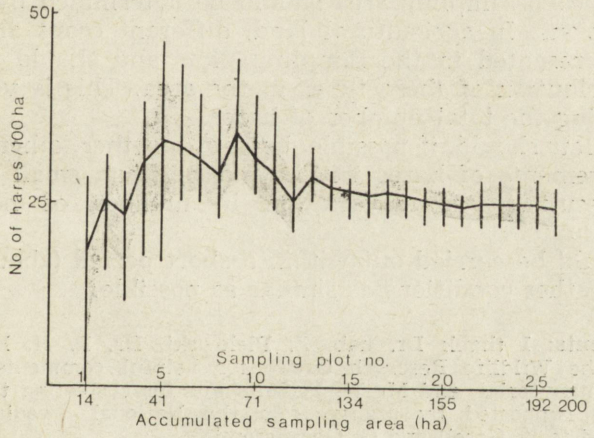

Fig. 1. Density of a European hare population in a pasture area in relation to the size of the sampling area. The figure is based on hare numbers recorded at five consecutive counts in up to 26 plots in autumn 1974 and given as mean and ranges. Shaded area indicates the 95% confidence interval.

area (Fig. 1). Obviously, too few and scattered plots and a restricted sampling area will result in different means as well as large variations in hare numbers between counts. Additional sampling plots and an extension of the sampling area lead to the mean value tending to stabilize and the variation to decrease, mostly due to the reduced effects of random grouping and movements of hares. Salzmann-Wandeler & Salzmann (1973) and Rimathe (1977) found that differences in hare numbers between several counts during a sampling period were almost negligible. However, when samplings were extended over several weeks or months, significant differences between counts occurred due to changes

in weather and the behaviour of hares (Salzmann-Wandeler & Salzmann, 1973).

The experiences from night counts in this and other studies (Salzmann-Wandeler & Salzmann, 1973; Rimathe, 1977) indicate that the method provides an accurate way of estimating European hare population densities. The method is also much more time- and personnel-saving than traditional methods.

4. CONCLUSIONS

As night counts of hares have to be modified according to local conditions — presence of roads, land use, topography, etc. — standardization of the method should be restricted to the following main points:

Night counts of hares can only be successfully carried out in open areas. Sampling plots containing woods, scrubland, and farms must be checked from several directions, otherwise several "blind" patches will be overlooked.

The size of each sampling area should be determined by the environmental conditions. In agricultural land, different crops and field types should be represented in the sampling plots and should correspond to the total distribution of these types in the area. This is very important when estimating the total number of hares.

Sampling plots should, if possible, be kept together, otherwise aggregation and movements of hares within and between small and scattered plots will result in large variation in number of hares between consecutive counts.

Counts should be carried out within a short period (about a fortnight) and under weather conditions as similar as possible.

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