ACTA THERIOLOGICA
Vol. 22, 25: 349—354, 1977

Estimation of Population Density of the Common Vole in Poland: An Analysis of Owl Pellets

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Caboń-Raczyńska K. & Ruprecht A. L., 1977: Estimation of population density of the common vole in Poland: an analysis of owl pellets. Acta theriol., 22, 25: 349—354 [With 1 Fig.].

On the basis of 804 samples of the barn owl and the tawny owl pellets from the whole area of Poland estimation was made of relative density of the common vole. Average population density of *M. arvalis* was worked out using the square networks of 2,500 km² of the *UTM* system. Mean density values was graded as follows: 0—19% low; 20—39% medium; 40—59% high; over 60% very high. The western and south-western parts of Poland are distinguished by a high and very high density of the common vole population. In the remaining parts of Poland the high density value is reserved for some of territorial enclaves. Medium and low density of *M. arvalis* population is characteristic for the rest part of Poland. Similar results has been obtained by other authors using the questionnaire method.
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1. INTRODUCTION

Mass occurrences of the common vole, *Microtus arvalis* (Pallas, 1779) were investigated both in western (Simm & Skuratowicz, 1950) and south-eastern parts of Poland (Migula *et al.*, 1970). Similar researches have been the object of our earlier work (Caboń-Raczyńska & Ruprecht, 1970). They concerned evaluation of the population density of the common vole by means of analysis of owl pellets collected over a wide area of Poland. Corresponding assays of evaluation of *M. arvalis* were carried out also in France (Saint-Girons & Spitz, 1966) and in Hungary (Schmidt, 1971—72; Schmidt *et al.*, 1973).

Importance of such investigations for agriculture as well as possession of owl pellets collected all over Poland enabled the authors to investigate the frequency of occurrence of *M. arvalis* in owl diets and to trace zones of its mass appearance in the country. Attempts were made to collate the relative density of the common vole with the classification of soils and prognosis of mass occurrences of this species (Adamczewska-Andrzejewska, 1974; Bandomir *et al.*, in preparation).

2. MATERIAL AND METHOD

Seven hundred samples of owl pellets were investigated together with hundred four samples analysed already by others (Czarnecki *et al.*, 1955; Cais, 1963; Ruprecht, 1964 and 1971; Kulczycki, 1964). Unpublished data from M. Sc. thesis at the Poznań University were also taken into account.

Most of the pellets collected in years 1950—1976 belonged to the barn owl, *Tyto alba* (Scopoli, 1769), part, however to the tawny owl, *Strix aluco* (Linnaeus, 1758). A sample of pellets consisted of a single collection from one owl roost. The percentage of vole occurrence among other mammals was estimated for every sample collected. Only samples containing more than 30 individual *Micromammalia* were taken under consideration in our calculations. Population density of *M. arvalis* was worked out using the square networks of the *UTM* system. Mean percentage of density was calculated for a surface-unit equal to 2,500 km² *i.e.* a square 50 km wide. Usually 1 to 55 samples fall to one surface unit. Mean density value of *M. arvalis* population was graded as follows: 0—19% low; 20—39% medium; 40—59% high; over 60% very high.

3. RESULTS

The western part of Poland, particularly Kotlina Śląska and Sudety Mts, Ziemia Lubuska, Nizina Wielkopolsko-Kujawska and the western part of Pojezierze Pomorskie are distinguished by a high density value of the vole population. In the remaining parts of Poland the high density value is reserved for territorial enclaves and occurred among others in Pojezierze Mazurskie (square *DE* and *EE*) in Nizina Mazowiecko-Podlaska (*CD*), Podlasie (*FD*), in Beskid Sądecki Mts (*DV*) and in the eastern part of the highlands (*FA*) — Fig. 1. Such high density is characteristic chiefly for highly fertile and fertile soils. Possible exception can be the high density value of vole population in the Beskid Sądecki Mts (*DV*) which has poor soils (Strzemski & Witek, 1970).

Low population density of *M. arvalis* is characteristic for east Poland — especially for Wyżyna Lubelska and Podlasie, Pojezierze Suwalskie including. Similarly low density is observed in the region of Góry Świętokrzyskie and the east part of Pojezierze Pomorskie (Fig. 1), which usually are distinguished by vast forests encompassing arable field enclaves (cf. Strzemski & Witek, 1970).

Medium density is characteristic for the rest of Poland, *i.e.* one third of it which comprises, in general, wide lowlands, some uplands, both having various types of soils.

4. DISCUSSION

Knowledge of the population density of the common vole over the whole range of Poland has great economic importance considering per-

iodical mass occurrences and damages wrought by this species. Therefore localization of particularly threatened fields, together with a suitable prophylactic local action should be the first step in opposing disaster (Simm & Skuratowicz, 1950).

Our method has, of course, a restricted practical use. It is best fitted for registration of threatened zones and areas exposed to mass occurrences of *M. arvalis*. It cannot, however, substitute for provisional defence

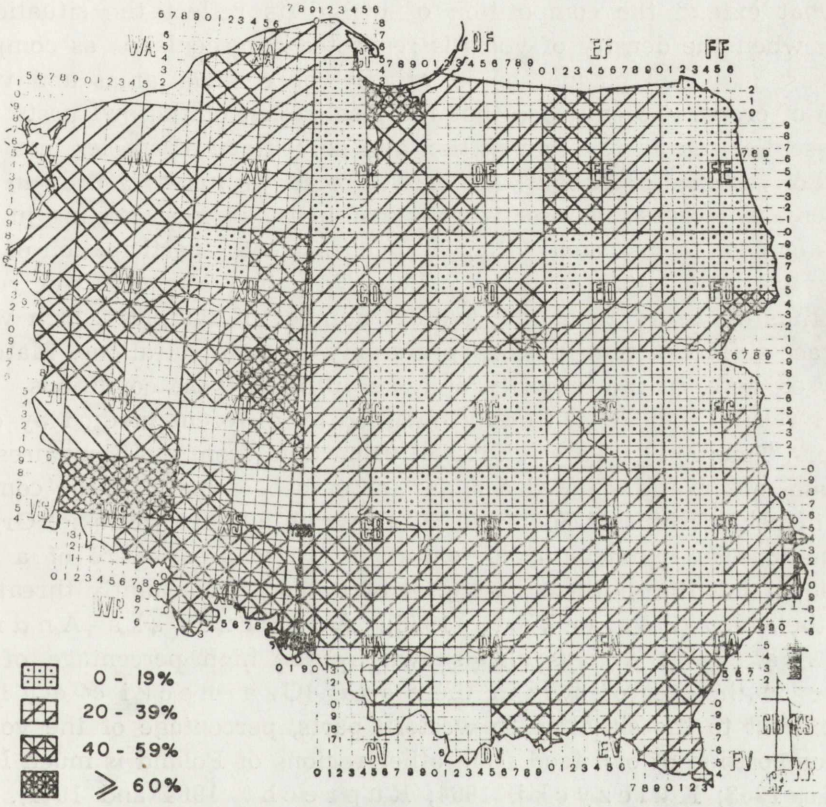

Fig. 1. Relative density of *Microtus arvalis* in Poland, as determined by average percentage of its remains in owl pellets.

actions based on current controls and registrations of mass appearances of the vole which is threatening the crops. The majority of samples of owl pellets consisted of single rich collections representing a deposit of food of many years standing. This kind of samples can be considered as the most appropriate for evaluation of the mean percentage of *M. arvalis* in the fauna of small mammals of the open country. However,

the value of this method can be restricted if one takes samples only from one season or of one year standing. Such collections depict only extreme situations deducted from the amplitude of fluctuations of the number of basic types of mammals eaten by the owls. Therefore objective results were achieved only by combining the results of all samples found on one surface unit, a square of 50 × 50 km. Of course some limited areas containing enclaves of great population density of the vole need not give representative values of their density. It is not yet clear to what extend the composition of owl diets reflect the situation in years when the density of voles is restricted to greenlands as compared to years in which plagues of *M. arvalis* cover wider areas and varied types of crops. It seems also that the localization of the owl nests plays an essential role in the composition and percentage of species in a sample. For instance neighbourhood of wet meadows means a drop in field species and increase in insectivorous mammals, whereas nesting in open fields or near farms (small villages) favours greater participation of field and synanthropic species in the pellets. To gain really objective results it is thus necessary to handle a great number of samples which would embrace different time periods preferably of long durations. Materials analysed here, in the majority of cases fulfilled these conditions.

Our results coincide with data obtained by different method by other authors. Thus Migula *et al.* (1970) using data from questionnaires and personal observations noted a slight increase of density of the common vole in voivodeships of Kieleckie, Krakowskie and Rzeszowskie. Greater fluctuations in numbers of *M. arvalis* in these areas were of a local character, but the south-western part of Poland is constantly threatened by the vole (Romankow, 1973; Adamczewska-Andrzejewska, 1974). It was also shown by the high percentage of this species in the diet of owls in these areas (Czarnecki *et al.*, 1955). In contrast to the situation in western parts, percentage of the vole in the composition of owl food from other regions of Poland is much lower (Cais, 1963; Kulczycki, 1964; Ruprecht, 1964 and 1971). This means that these regions are not threatened by a possibility of mass appearance of voles over larger areas. And this is reflected by a constantly low percentage of *M. arvalis* in samples collected few times a year from Lubelszczyzna (Caboń-Raczyńska & Ruprecht, 1970).

Our method permitted to fix regions of a relatively high population density of *M. arvalis*. The data in a considerable degree matched the results of few years investigations undertaken for whole Poland by the Institute of Ecology of the Polish Academy of Sciences (Bandomir *et al.*, in preparation). Mean values of density obtained by us for definite areas agree completely with the density values characteristic for these

areas in years of mass occurrence (for instance 1972 and 1975). This concerns, first of all, the south-western provinces, as well as small local regions scattered over different parts of Poland.

It seemed reasonable to relate high degree of population density of the vole — therefore possibility of mass appearance — to the soil conditions, since maximum density of voles was ascertained by us in regions with highly fertile soils and poor in forests. On the contrary, on territories ecologically unfavourable as regards geographical configuration, soil and afforestation, mass appearances can occur only when farming continuity is disturbed (Migula *et al.*, 1970).

Data obtained by our method depict as close a picture of true population density of *M. arvalis* as gained either by a questionnaire method or by direct counts of the rodents. It seems therefore that this method can be applied to control the fluctuations of the number of common vole on terrains threatened by its mass occurrence.

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Accepted, March 12, 1977.

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OCENA ZAGĘSZCZENIA POPULACJI NORNIKA ZWYCZAJNEGO W POLSCE: ANALIZA ZRZUTEK SÓW

Streszczenie

Na podstawie 804 zbiorów zrzutek sów z terenu całej Polski obliczono względne zagęszczenie *M. arvalis*, przypadające na jednostkę powierzchni 2,500 km². Przeciętne zagęszczenie nornika zwyczajnego przedstawiono na siatce *UTM*, przyjmując następującą skalę: 0—19% niskie; 20—39% średnie; 40—59% wysokie oraz powyżej 60% bardzo wysokie (Fig. 1). Stwierdzono, że wysokie i b. wysokie zagęszczenie tego szkodnika ma miejsce w południowo-zachodniej i zachodniej części Polski, znanych z masowych pojawów tego gatunku. Średnie i niskie zagęszczenie *M. arvalis* cechuje natomiast pozostały obszar kraju. Względne zagęszczenie *M. arvalis* w Polsce pokrywa się w znacznym stopniu z danymi z prognoz, uzyskanymi za pomocą ankiet.