

Influence of Habitat Characteristics on Winter Social Organisation in Field Roe Deer

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Cibien C., Bideau E., Boisaubert B., Maublanc M. L., 1989: Influence of habitat characteristics on winter social organisation in field roe deer. *Acta theriol.*, 34, 14: 219—226 [With 1 Table & 3 Figs].

Winter social structure in field roe deer was compared in three populations living in habitats which differed by wood abundance and distribution. Changes in field attending and grouping tendency (gregariousness and group size) were observed in the three areas: increasing between October and January and decreasing from March onwards. But this seasonal trend was more marked as the habitat was more open (low diversity and high visibility between roe deer). Grouping in open habitats can be understood as a way of being protected against predators when shelter is lacking (better detection) or can be supposed to permit control on conspecifics which live in the same area.

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1. INTRODUCTION

Social organisation in mammalian populations is partially influenced by environmental conditions (Struhsaker, 1969; Crook, 1970; Crook *et al.* 1976, Leuthold, 1977; Poole, 1982). This is confirmed by many works on intraspecific variability of social organisation in ungulates (Eisenberg, 1966; Leuthold, 1966; Jarman & Jarman, 1979; Gautier, 1982; Lott, 1984). Habitat structure is one of the factors influencing social organisation. It was found that ungulates develop grouping tendency with increasing habitat opening: impala (Leuthold, 1970), gazelle (Walther, 1972), wapiti (Franklin *et al.*, 1975), white tailed deer (Hirth, 1977), greater kudu (Evans, 1979), fallow deer (Schall, 1982).

Several studies show that the winter roe deer gather around larger groups in agroecosystem than in forest (Zejda, 1978; Bresiński, 1982; Stüwe & Hendrichs, 1984, Maublanc *et al.*, 1985, 1987) and that the group composition changes. In forest habitat, the most frequent association is male+female+kids (less than one year old) whereas in agroecosystem, sev-

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eral families live together in large groups (Bideau *et al.*, 1983, Maublanc *et al.*, 1987).

Are there two kinds of social organisation in roe deer or are there gradual variations related to characteristics of each habitat? What is the determinism and function of grouping? To answer these questions, social organisation of roe deer in winter was compared in three populations living in agrocenosis, characterized by different abundance and distribution of woods.

2. MATERIAL AND METHODS

Three populations were studied using the same method. Every month, 4 car trips were driven slowly along the same way (about 20 km/h). To locate and identify the animals with binoculars (10×40) and telescope ×22 or ×40, the observer stopped the car for a few minutes. Trips were performed alternately in opposite directions, twice midday and twice before night, from November to April when crops were low. When a deer or a group of deer was detected, the following parameters were recorded: (1) hour, (2) geographic position on a map (scale 1/10000) squared (each square=1 ha), (3) number of animals in the group, (4) sex and age composition of the group, (5) number of animals performing one of the following activities when the group was detected (instantaneous sampling; Altmann 1974): feeding, resting, observing, moving, running away, social behaviour, (6) type of crop or habitat.

The growth stage of crops was recorded every month (height and phenological stage)

Each study area was characterized by its landscape diversity and topography:

The diversity (alternance of crops and woods or edges) was evaluated using the Shannon index (Shannon Wiever, 1949, in Baudry 1985). Study areas were divided into 64 ha squares each. Six transects were defined in each square. Occurrence of crop and wood was noted every 50 m along transects. The number of crop-wood, wood-wood and crop-crop intervals was recorded. A note of diversity was given for each square using the Shannon formula (Shannon & Wiever, 1979, in Baudry 1985). Diversity index H equals 0 if there is one type of habitat in the square, *i.e.* if it is homogenous and equals 1 for the highest heterogeneity.

Topography measurements were performed to compare the distance of visibility between deer in the three study areas. Nine stakes (1.2 m high=deer height) were arranged as a square (three for each side and one in the middle). Intervals between stakes were 400 m. From each stake and from external points (400 m from stakes), it was determined whether all the others stakes could be seen. An index of visibility, V , was calculated for every study area as "the number of stakes which were seen vs total number of stakes". Two apparatuses were placed in Z1 and Z2 and four in Z3.

A minimum number (MN) of roe deer living in the study areas was determined as the number counted during the best winter trip.

An indicator of grouping tendency, R , was calculated as the number of deer counted during a trip divided by the number of groups.

3. STUDY AREAS

The study was conducted in the northern part of France (Picardie). Three areas were chosen: Le Verguier (Aisne) (Z1), Monceaux (Oise) (Z2), and Croix Molineaux (Somme) (Z3). These areas are agroecosystems characterized by large production of cereals (maize and barley) and sugar beet. Deer density was low: 5 to 8/100 ha. Woods and edges were differently scattered and exhibited rather low covering rate (Table 1).

4. RESULTS

4.1. Fields Attending Pattern

Fig. 1 shows for each study area and monthly during periods of good visibility (October to May), percent T of minimum number (as MN in

Table 1
Habitat characteristics of the study area. See methods for explanation.

Characteristics	Study area		
	Z1	Z2	Z3
Area (ha)	2000	1000	6000
Minimum number of roe deer	58	80	329
Wood percentage	6	8	5
Visibility	0.17	0.35	0.41
Diversity	32	47	63
Crops (%): maize	40	39	39
sugar beet	33	8	22
winter barley	0	37	6
potatoes	9	2	7
peas	3	—	9

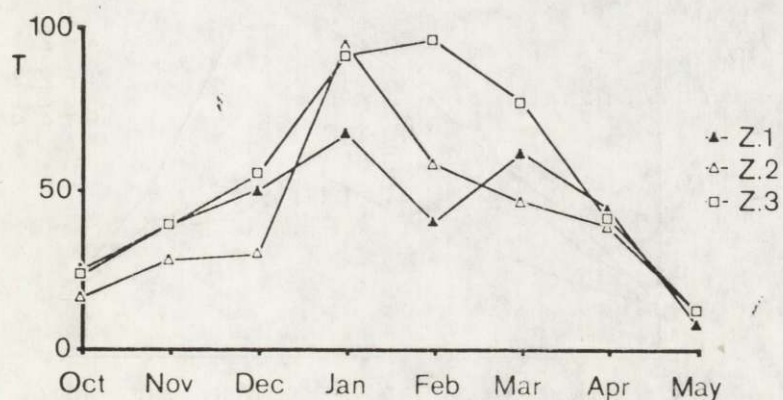


Fig. 1. Monthly evolution of field attending T as a percent of minimum number (MN in methodology).

methodology) observed as a mean during a trip census. We noted similarity of pattern in all study areas with T increasing between October and January followed by a decrease from March to May. In every case, the maximum value, different according to study areas, was reached between January and March. Ranging from 80 to 100% in Z3, T stayed around 50% in Z1 whereas Z2 showed an intermediate situation with 95% in January and 45% in March. In Z3, animals attending fields were always under good conditions for observation from January to March whereas in the other two areas (Z1, Z2) part of these animals stayed hidden in the woods.

4.2. Grouping Tendency

Grouping index R (see methodology) followed the same pattern as field attending (Fig. 2.). Increasing in the 3 places between October and December, it decreased from March to May. However, it rather exhibited a higher rate in Z3 during the winter: 7.5-10 vs 4.5-7.5 in Z2 and 2.5-5.5 in Z1.

Looking at distribution of size group in January and February (2-5 units, 6-10, more than 10) (Fig. 3), we observed: (1) on Z3 deer belonged preferentially to groups of more than 10 units. (2) On Z2, the 3 classes showed neighbouring values. (3) On Z1, roe deer were most frequently observed in groups of 2-5 units (significant differences among the three places: Z1-Z2, $\chi^2=115$ $p<0.01$; Z2-Z3, $\chi^2=448$, $p<0.01$; Z1-Z3, $\chi^2=305$, $p<0.01$).

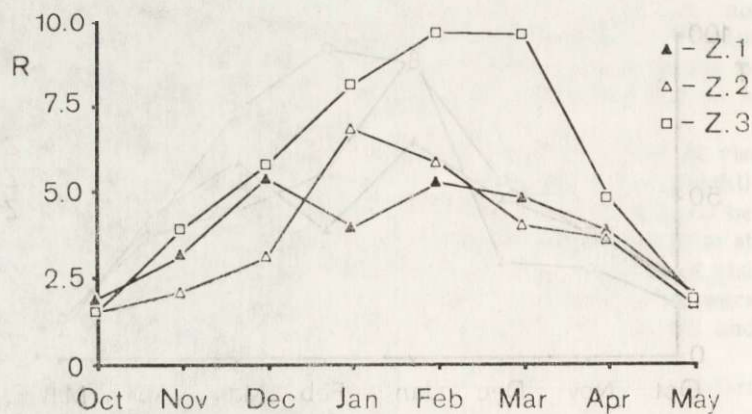


Fig. 2. Monthly evolution of grouping index R (see methodology).

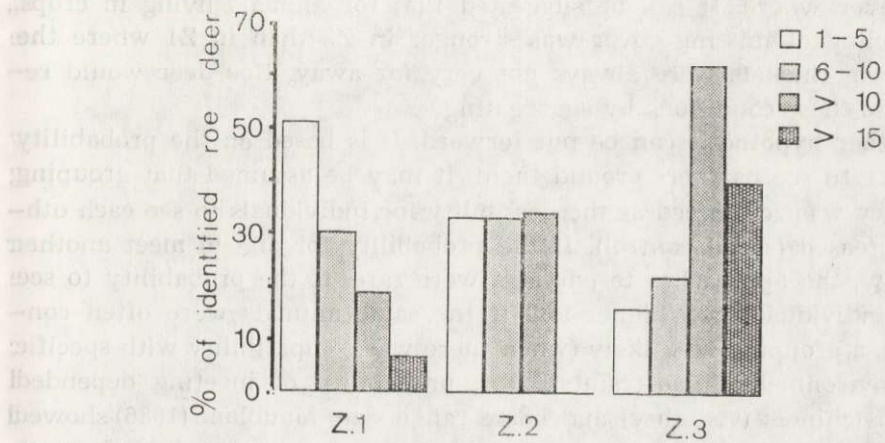


Fig. 3. Roe deer distribution in different group sizes in winter.

5. DISCUSSION

Use of crops and grouping tendency followed a similar chronology in the three areas. These two parameters were observed primarily in November, were maximum in January and February and decreased until their disappearance in May, as shown in agroecosystem by other authors (Zejda, 1978; Maublanc *et al.*, 1985). The intensity of this phenomenon could be related to habitat characteristics. It was more intense in the very open and flat habitat Z3. Groups very often exceeded 10 individuals of all ages and sexes. In the patchy habitat Z1, the most current group size was 2-5 animals. These groups did not differ from winter groups observed in the forest (Bideau *et al.*, 1983). Z2 was an intermediate habitat: the three group sizes were observed. So, grouping seems related to habitat characteristics, especially to its patchiness (spatial distribution of wooded places).

What is the determinism of winter group size variation in field roe deer? Food search could not be considered as a predominant factor: cereal fields provided unlimited food amounts and were widely distributed over the study areas. Thus, an excessive exploitation of special places was unlikely. Intensity of predation and disturbance were the same in the three areas. Hunting and highly mechanized agricultural activities were equivalent. It may be assumed that roe deer do not perceive in the same way some environments characterized by different levels of patchiness. In Z3, visibility was greater because wooded places were limited to a few areas whereas in Z1, an edge or a thicket could be seen

from everywhere. It can be suggested that for animals living in crops, the feeling of missing cover was stronger in Z3 than in Z1 where the sheltering thickets were always not very far away. Roe deer would respond to these conditions by aggregating.

Another hypothesis can be put forward. It is based on the probability for deer to see partners around them. It may be assumed that grouping tendency was reinforced as the possibility for individuals to see each other increased (social control). If the probability for one to meet another was low, the approaches to partners were rare. If the probability to see other individuals was higher and if the same animals were often concerned, a grouping was likely (when there was compatibility with specific and environmental constraints). But, probability of meeting depended upon patchiness (visibility) and home range size. Maublanc (1986) showed that there was always a wooded part in an annual home range. Studying four radiocollared females, this author found that the annual home range size increased as wooded part of range decreased. Extending home range can be related first to the feeding requirement in open field (*i.e.* diversifying) and secondly to behavioural changing against predators, characterized by extensive flight (it is impossible for deer living in fields to hide during winter in low crops). Roe deer were distributed over the whole study area and lived on relatively small home ranges, because the wooded places were patchily distributed. The probability for individuals to meet each other was low and family social structure was observed (Bideau *et al.*, 1983).

In Z3, most of the woods represented a thin band at the periphery of the study area. The animals lived in overlapping large home ranges. The probability of meeting was great and led to the grouping of many animals. In Z2, with an intermediate distribution of woods and edges, the modality of grouping was also intermediate.

It may be suggested too that the probability of meeting was related to the population density, but it must not be taken into account in this case because the densities were comparable in the three areas.

What can be the function of grouping? In a group, an individual have some benefits in terms of time and energy. Living near the animals which constitute its usual social environment, it reduces the time allowed for their control and watching and benefit of their experience. The grouping gives it a greater potential to detect disturbances and predators with a shorter time allowed by individual to watch.

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WPLYW CHARAKTERYSTYCZNYCH CECH ŚRODOWISKA NA STRUKTURĘ SOCJALNĄ SARNY POLNEJ W ZIMIE

Streszczenie

Badano zimową strukturę socjalną w 3 populacjach sarny polnej bytujących w środowiskach różniących się stopniem zalesienia (Tab. 1). We wszystkich populacjach zarówno tendencje do przebywania na polach jak i skupienia się w grupy (stadność i wielkość grup) wzrastały od października do stycznia, a malały od marca (Ryc. 1, 2). Tendencje te były silniejsze w środowiskach bardziej otwartych, o małej różnorodności i dobrej widzialności między osobnikami (Ryc. 3).

Formowanie grup na terenach otwartych może być sposobem obrony przed drapieżnikami w okresie braku pokrycia osłonowego, lub też może pełnić rolę kontroli socjalnej w stosunku do osobników zamieszkujących ten sam teren.