

Fragmenta Theriologica

On the Diet, Size and Use of Home Range and Activity Patterns of a Red Fox in Central Spain

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A radio-tagged adult male fox, *Vulpes vulpes* (Linnaeus, 1758), has been monitored for seven months in Central Spain. The diet, determined by scat analysis, picked up in its home range, was unspecialized. The home range size was 113 ha. It used a daily average of the 35.6% of the home range, mainly with a zig-zag movement pattern, selecting positively human settlements. The rest sites changed frequently and the activity was mainly nocturnal.

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1. INTRODUCTION

The Red fox, *Vulpes vulpes* (Linnaeus, 1758), has been the subject of many studies in Northern, East and Central Europe. However, in Mediterranean Europe its ecology is still poorly understood. As far as I know, there are a few papers about the feeding habits in the Iberian Peninsula (see Calviño *et al.*, 1984), Mediterranean France (Reynolds, 1979), Mediterranean Italy (Pandolfi, 1983; Ciampalini & Lovari, 1985) and in Bulgaria (Atanassov, 1958; Peshev, 1965). The present study describes the first results on diet, size and use of the home range, rest site selection and activity patterns of a single radio-tagged male fox in Central Spain.

2. STUDY AREA, MATERIAL AND METHODS

The study was carried out in the Sierra de Guadarrama, 60 kilometers North of Madrid (40° 45' N, 4° W), a mediterranean mountain range reaching 2400 m. The area inhabited by the fox was 1400 m above sea

level and consisted of small woodlots of *Quercus pyrenaica* Willdenau, 1805, *Pinus silvestris* Linnaeus, 1753, scrubland and pasture (for a detailed description of the study area see Rivas Martínez, 1963). During the study (May—November 1984), the monthly average of the minimum temperatures was always above 0°C. The rainfall was 835 mm, most of it during the months of May and November and no important snowfalls were registered (see Gandullo *et al.*, 1976).

The fox was captured May 5, 84 with a paddle leghold trap. It was a male weighing 4.800 kg, about 13 months of age (judging from the teeth). After being injected with 60 mg of ketamine hydrochloride (Ketolar) and 70 mg of tiazine hydrochloride (Rompún) it remained asleep for 90 minutes. It was fitted with a Biotrack transmitter unit, on the 151 MHz range. Both transmitter and collar weighed 190 g. Bearings were taken from a car with a LA-12 receiver and a 3 element hand-held Yagi antenna (AVM Instruments). The fox was tracked for 12 complete periods of 24 hours, taking at least one location each hour; in between many more locations were taken up to 523. Signal was received for the last time 15.11.84. For the study of the diet, scats were monthly picked up within the home range of the fox; 98 scats were analysed. Home range was estimated by the smallest convex polygon (Macdonald *et al.*, 1980). To determine the preferent selection by the fox of any of the biotopes within the home range, Ivlev's electivity index E (Jacobs, 1974) was used; E varies from 1 to 0 for negative selection, from 0 to +1 for positive selection. The distance runned daily was estimated adding the distances measured between two successive locations taken each hour.

3. RESULTS

Diet was varied, consisting in animals, vegetables and litter (Table 1). Home range size was about 113 ha. It was limited in the North and East by a paved road that separates two different biotopes, and in the South and West by a forest way that runs by a stream. We can distin-

Table 1
Percentage of prey occurrence in fox scats during the study period.

Basic prey	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Mean
Small mammals	85.7	50.0	12.5	48.7	33.3	11.1	41.8	38.1
Rabbits	35.7	0.0	0.0	7.4	11.1	0.0	0.0	9.3
Insects	21.4	100.0	87.5	92.9	81.5	83.3	33.3	47.4
Vegetables (mainly blackberries)	14.3	0.0	25.0	28.6	63.0	77.8	58.3	70.1
Litter	7.1	0.0	37.5	21.4	40.7	33.3	16.7	26.8
Number of scats	14	4	8	14	27	18	12	13.9

guish 3 biotopes within the home range (Fig. 1A): (a) a grazing plot mixed with thick scrubland, with high occurrence of rabbits and blackberries, that occupies the 63.5% of the whole home range, (b) a stone-pine (*Pinus silvestris*) stand with low rabbit density (28.9% of the home range), (c) a human settlement with few scattered houses and no natural thick vegetation (7.7% of the home range); this area provides many litters,

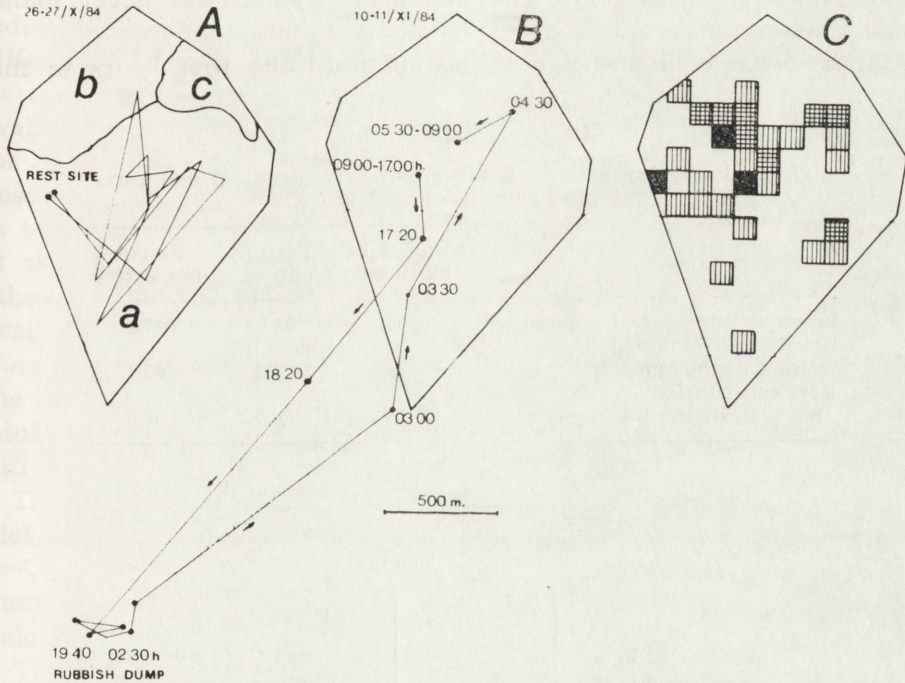


Fig. 1 A — Usual zig-zag movement pattern. a, b, c — indicates the different biotopes within the home range. B — “Excursion” outside the home range with straight movement pattern. C — Rest sites. Vertical bars=1–2 records. Crossed bars=3–4 records. Black squares=4–6 records. Each square=1 ha.

especially during the summer. From 149 locations during the activity period, 67.8% were in area (a), 11.4% in (b) and 20.8% in (c). Ivlev's electivity index was +0.0321, -0.4322 and +0.4609 for each area respectively. Thus, it seems the fox selects positively the human settlement and negatively the pine forest. The mean distance runned daily was 4.9 kilometers ($n=12$, range=6.3—3.4, $\sigma=1.18$), with minimum values in the summer months. In 11 of the 12 24-hour periods tracking, the animal used 11.4—68.8% of the home range ($\bar{x}=35.6\%$, $\sigma=18.31$) with a zig-zag movement pattern (Fig. 1A). During the last 24 hour period it made a trip to feed in a rubbish dump (often used for illegal trapping) 2.5 km outside the closed edge of the usual home range. This move-

ment took place after the recent disappearance of another radio-tagged male fox that inhabited that area. The movement pattern was straight (Fig. 1B). Five days later, the signal was no heard any more.

The rest site changed frequently (Fig. 1C). The existence of a thick scrubland seemed a necessary condition for its selection. The meteorology and the proximity to human settlements or roads did not seem to influence rest site selection. The individual studied was never found inside a den.

Activity was mainly nocturnal, lasting until the first hours in the

Table 2
Night activity, day activity (except the early morning) and early morning activity of a male fox.

Time	Number of locations	Percent active	Percent not active
Between sunset and sunrise	297	82.8	17.2
Between 2½ hours after sunrise and sunset	176	4.6	95.4
Between sunrise and 2½ hours later	50	50.0	50.0

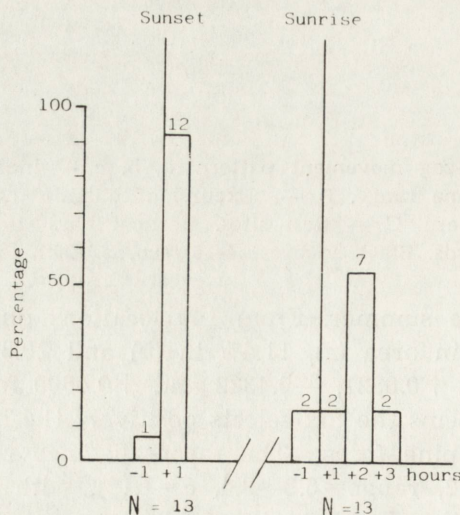


Fig. 2. Beginning and end of the nocturnal activity of a male fox in relation to sunset and sunrise. The data are expressed as a percentage of the observations in the first, second and third hour before or after sunset or sunrise. On the top of the bars, the number of records is indicated.

morning (Table 2). The start of activity used to take place within the hour after sunset, ending between 1 hour before and 3 hours after sunrise (Fig. 2).

4. DISCUSSION

Generalization should not be made with data obtained from a single individual, however, nothing seems to indicate the existence of a great difference between these results and the ones found in other areas of Europe. The diet is unspecialized and it apparently depends on the food availability. The size of the home range is within the limits established for adult males in other studies, although it is closer to the small ranges described by Macdonald (1981), Kolb (1984) and Mulder (1985) than to the bigger ones found by other authors (Maurel, 1980, 1983; Boitani *et al.*, 1984). These preliminary results are in agreement with those of other studies in which small home ranges are related with high food availability (*i.e.* Heptner & Naumov, 1967; Ables, 1975; Macdonald, 1981). Current works confirm the existence of high amounts of food within the home range of the radio-tagged male, which is shared with several adult females, some of them not breeding. The activity patterns do not differ from those obtained elsewhere (*i.e.* Maurel, 1980).

There is a positive correlation between the amount of rabbits in the diet and the extension of the home range section covered each night ($p < 0.05$; Spearman's rank correlation coefficient). However, the small number of scats picked up monthly and the lack of evidence that they belong to the fox studied make us take this results with caution.

The fact that the fox changed very frequently its rest site during spring and early summer suggest that this male did not participate actively in the rearing of cubs.

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Some Unusual Dental Conditions in Sheep

ANOMALIE UZĘBIENIA OWCY

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This report is to place on record two instances of supernumerary teeth in sheep, and the finding of an unerupted malposed incisor in a third sheep. There is no history available concerning these particular cases, nor any attempt to explain or measure the incidence of supernumerary teeth in these animals. It is suggested that the malposed incisor could have resulted from injury. The suggestion is supported by analogy with injury to incisor teeth of children.

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1. INTRODUCTION

The writer is a dentist and anthropologist who has had a lifetime interest in comparative dental anatomy. New Zealand has many farms.