

Fragmenta Theriologica

Use of Radio Tracking to Improve the Estimation by Track Counts of the Relative Abundance of Red Fox

TELEMETRIA JAKO METODA ZWIĘKSZAJĄCA DOKŁADNOŚĆ OSZACOWAŃ WZGLĘDNEJ LICZEBNOŚCI LISIA OPARTYCH NA TROPIENIACH

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Radio tracking of red foxes *Vulpes vulpes* (Linnaeus, 1758) in Coto Doñana (SW Spain) was used to obtain a correction factor to transform the number of fox trails crossing a transect into an index of relative abundance, expressed as individual foxes per km. Results prove that the patterns of fox movement and the transect position greatly influence the data obtained through track counts.

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1. INTRODUCTION

Track counts have been an useful technique to estimate carnivores relative abundance (*e.g.* Heptner *et al.*, 1967, and papers of Soviet authors cited there). In these works it is usually assumed that the individual rate of daily passing across the transect is constant. Thus, a direct relationship could be established between absolute abundance of tracks and relative abundance of the species.

The aim of this note is to record how many times per day an individual fox *Vulpes vulpes* (Linnaeus, 1758) crossed a linear transect on an homogeneous sand dune habitat of southwestern Spain, and how the pattern of fox movements and the situation of the transect can affect the estimations of red fox relative abundance by track counts.

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2. STUDY AREA AND METHODS

The study was done from December 1984 to February 1985 (*i.e.* late fall and mid winter) inside the Doñana Biological Reserve, SW Spain (see Allier *et al.*, 1974, for a vegetational account and Delibes, 1980, for a short description).

Four adult male foxes were captured with neck snares and padded Victor No. 2 steel traps. The animals were immobilized with a combination of ketamine hydrochloride and tiazine hydrochloride in doses of 3.75 mg of each product per kilo of body weight. They were fitted with a radio transmitter working in the 151 Mhz range (Biotrack, England) and released at the capture places. Seven 24 hour-periods of continuous radio tracking (one bearing per hour) were done (four for one animal and one for each one of the three others) by using conventional radio telemetric techniques. Movements on each period were depicted on a map. Next, we registered the daily number of times each individual crossed a 3.3 km long straight fence transect that went accross the home ranges of the four animals.

To apply our results to a real situation, monthly counts of fox trails crossing a 1.3 km stretch of the same fence transect were performed on the same seasons. The day before of the counts we cleared off the census route with a sweep mounted on rollers or else we waited for three days after the last rain (see Rau *et al.*, 1985, for more details).

Relative abundance (individuals/km) will be obtained by dividing the absolute number of trails crossing the transect by the average individual rate of daily crossing and by the transect length in km.

3. RESULTS

Each radio equipped fox crossed the fence between zero and six times a day (mean \pm standard error = 2.86 ± 0.7 ; $n=7$). As the number of crossings was about the same in both directions (*i.e.* inside or outside the transect), suggesting the animals were resident in the area, we reported only the total number. All the moves were at night in accordance with the temporal activity pattern of the species in the area (authors, unpublished).

The numbers of trails crossing the transect were 1 (December), 5 (January) and 8 (February). This means 0.77, 3.85 and 6.15 trails/km respectively, or 0.27, 1.35 and 2.15 individual fox/km (Soviet authors usually present their results as number of trails/10 km; see Heptner *et al.*, 1967).

To evaluate the effect of the transect location on the results we depicted a "typical pattern" of daily fox movement by averaging each hourly radio location (*i.e.* computing 25 "activity centers", *sensu* Hayne, 1949). On this sketch eight equally spaced "simulated" transects were drawn (Fig. 1). From the figure it is clear that the position of the transect will greatly influence the data obtained through track counts. It must be noticed that this kind of bias will be particularly important when nonpermanent or imaginary transect lines are run (*e.g.* ski paths).

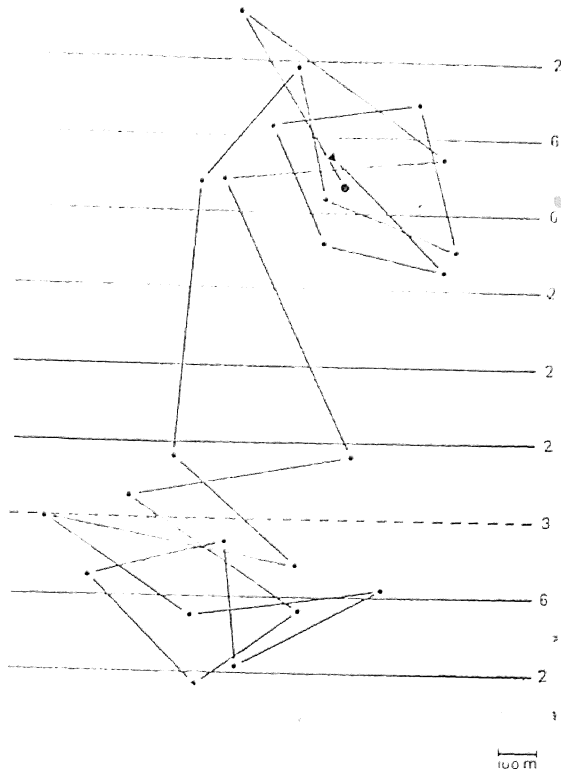


Fig. 1. "Typical pattern" of red fox daily movement in the study area, obtained by averaging each hourly radio location ($n=7$ 24 hour-periods of radio tracking). The beginning and the end of the moves are represented by a dot and a triangle respectively. The fence transect (dashed line) and other eight simulated transects are shown together with the number of crossings on each one.

4. DISCUSSION

Radio tracking has been previously used to evaluate the reliability of drive counts (Tester & Heezen, 1965) and as a useful tool to complement spot-light counts (von Schantz & Liberg, 1982) and mark-recapture estimations of abundance (Greenwood *et al.*, 1985). In this paper we used radio tracking to improve the estimations of red fox relative abundance obtained by track counts.

As usually performed, track counts can be taken only as gross trend measures of population size (Pulliainen, 1980). A better use of this method needs: (a) to meet a large sample size in order to decrease the variance of the estimators (Mooty & Karns, 1984), (b) to know the individual rate of daily passing across the transect, (c) a clearing of the census route to prevent overtracking, either by using a special "sweeping device"

(Alvarez *et al.*, 1981) or waiting for the weather to do the work (*e.g.* Brand *et al.*, 1976), and (d) to assume that the animals are neither attracted nor repelled by the transect (*i.e.* when roads or fence transects are employed). We focus on (b) in this study.

We are aware of a number of potential criticisms to this work, mainly the exclusive use of males in our experiment (but home range sizes and daily movements of males and females were about the same in the study area; authors, unpublished) and the short number of track counts (but they were used only as an example case). Nevertheless, our data prove that the daily patterns of movement of the animals and the transect position greatly affect the results of the track count method used to estimate carnivore abundance.

Thus, radio tracking appears as a helpful tool in order to obtain correction factors for each species, kind of habitat and season, which could improve the reliability of the method and favour a better sampling design. This will be specially relevant when rare or endangered species are involved, as in these cases a short variation in numbers can deserve particular attention.

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