Habitat use by roe and red deer in Southern Spain

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San José, C., Braza, F., Aragón, S. & Delibes, J. R., 1997. Habitat use by roe and red deer in Southern Spain. *Misc. Zool.*, 20.1: 27-38.

Habitat use by roe and red deer in Southern Spain.– In order to analyse how altitude, cover, and botanical diversity may be involved in the habitat preferences of roe deer (Capreolus capreolus) and red deer (Cervus elaphus) in Southern Spain, 44 plots in four linear transects were established in 'Los Alcornocales' Park (Cádiz). The results revealed a certain degree of spatial interaction between the two species in spring and summer. Roe deer selected the lowest altitudes during the territorial period (March-August) and red deer selected the same low altitudes in spring and summer. This interaction could be particularly important during the fawning season. Roe deer selected high cover and high botanical diversity of tree stratum, which could be related to food habits and to the ability of roe deer to produce multiple births.

Key words: *Capreolus capreolus, Cervus elaphus*, Habitat preferences, Southern Spain.

(Rebut: 16 VII 96; Acceptació condicional: 28 I 97; Acc. definitiva: 21 III 97)

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The research (project number 8/89/013) was supported by Instituto Andaluz de Reforma Agraria (Junta de Andalucía)-CSIC and S. Aragón had a Predoctoral Grant (FPI) from the 'Ministerio de Educación y Ciencia'.

ISSN: 0211-6529

Introduction

In Southern Spain roe deer (*Capreolus capreolus*) and red deer (*Cervus elaphus*) are sympatric only in the mountain ranges of Cádiz-Málaga (Braza et al., 1989b; Aragón et al., 1995b) but, while the red deer population has progressively increased in this area during the last ten years, a marked decrease in the numbers of roe deer was detected in the 80's (Braza et al., 1989a). Several reasons have been put forward in order to explain this trend in the roe and red deer populations. A high influence of density-independent factors on population dynamics of roe deer (Bobek, 1977) makes this species particularly vulnerable to drought in this area. On the other hand, inappropriate hunting management has affected both roe and red deer populations: the hunting season for roe deer during the fawning period has had a very negative effect on the reproductive rate and on fawn survival in Cádiz. At the same time, management plans have led to a significant increase in the number of red deer in some areas (averages of 34.0 red deer/100 ha and 5.09 roe deer/100 ha; Braza et al., 1994a). Furthermore, previous studies in the mountain ranges of Cádiz have revealed that roe deer reach the highest values of density (9.6 roe deer/100 ha; Braza et al., 1994a) where red deer are almost absent, thereby suggesting a possible interaction between red deer and roe deer.

Regarding the interactions between the two species, a certain level of dietary overlap has been referred to by different authors (Goffin & De Crombrugghe, 1976; Hearney & Jennings, 1983; Staines & Welch, 1984; Goffin, 1985). In Cádiz, roe and red deer eat the same plant species but show different levels of preferences which, in theory, could mean a low level of overlap (Braza et al., 1994a). However, it has to be taken into account that the high number of red deer (bigger in body size than roe deer) in the area could represent a negative pressure on some food resources preferred by roe deer.

There is little information available regarding space competition between roe and red deer, although some authors have reported that roe deer are seldom found where red deer are present in any numbers, evidencing a certain level of space segregation between both species (e.g. Wildash, 1951). In some cases, it seems likely that red deer have increased in many localities at the expenses of roe deer simply because the forests have been altered and roe deer is more sensitive than red deer to environmental changes (Batcheler, 1960).

Since 1989 an area of 170,000 ha of cork oak forests in the mountain ranges of Cádiz has been protected ('Los Alcornocales' Park). In absence of large predators, the management of roe and red deer populations is a very important element in this area and accounts for the conservation of this ecosystem. In this paper, we analyse how particular variables related to structure and physical characteristics of the habitat may be involved in the habitat preferences of roe and red deer in Southern Spain. Furthermore, a relatively simple method to obtain basic periodic information necessary for the management and conservation of these wild deer populations is described.

Material and methods

Study area and population

'Los Alcornocales' Park, where both deer species are present, includes mountain ranges that stretch northwards from the Strait of Gibraltar, and are characterized by mean altitudes of 400-500 m (to a maximum peak of 1092 m) (fig. 1). Despite the high rainfall (approx. 1000 mm annually), mainly occurring between October and April, the most significant climatic factor is a long dry summer (mean temperature in the hottest month: 24-26°C; n = 35 years). During this season, water sources are scarce and concentrated at the bottom of the ravines, where vegetation conserves humidity, while the hillsides support a more typical Mediterranean xerophytic woodland.

The characteristic vegetation of 'Los Alcornocales' Park is a rather homogeneous cork oak (*Quercus suber*) forest. However, a Thermomediterranean layer of vegetation (consisting of sclerophylous forests with species such as *Olea europaea*, *Ceratonia*

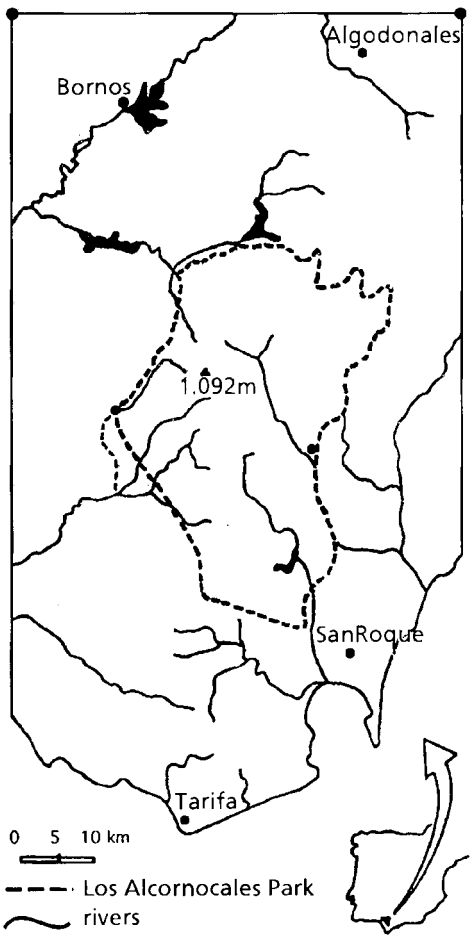

Fig. 1. Study area.
Area de estudio.

siliqua and *Pistacia lentiscus*), and a Mesomediterranean layer (where the sclerophylous forests of *Quercus suber* appear associated to the species *Quercus rotundifolia, Erica* sp., *Arbutus unedo*, and *Quercus faginea*, species which appear in the most humid regions) (RIVAS-MARTÍNEZ, 1987) can be differentiated.

A representative area of 5000 ha was selected as the study area within 'Los Alcornocales' Park.

The distribution of both deer species in the study area has principally been determined by historical factors. The red deer are the result of reintroductions carried out from 1956 onwards. The indigenous roe deer population is at the southern limit of the species' world-wide distribution. It is of particular interest that as it is isolated from other populations in Spain it may be considered a distinct Mediterranean ecotype (ARAGÓN, 1993; ARAGÓN et al., 1995a; ARAGÓN et al., in press).

Hunting of both deer species is allowed in the study area, but therein roe deer were not hunted during the study period.

Methods

The study area consisted of four linear transects (two in each category of bioclimatic layer), each with eleven circular plots of 80 m^2 hundred meters apart. The 44 plots represent a sample area of 3520 m^2. This method is a useful tool to determine habitat preferences and seasonal distribution of deer (BATCHELER, 1960; BRAZA et al., 1994b).

The plots (n = 44) were characterized by the variables: altitude, cover and botanical diversity (table 1). These variables were selected based on previous results (BRAZA et al., 1994a) in which a multivariate analysis method revealed that altitude, cover and botanical diversity are the main factors affecting the distribution of roe and red deer in the mountain ranges of Cádiz. Mean slope of transects varies from 10.5° to 18.7°.

Altitude was the same for all plots in each transect, since the precision of the altimeter was higher than variations in each transect. It should be noted that the uniform value of altitude for plots of the same transect probably determines a certain level of similarity between plots within each transect because some characteristics of the habitat are related to particular values of altitude.

Cover (C) refers to the proportion of an area covered by the vertical projection of plant crown to the ground surface. It was calculated measuring the two maximum perpendicular diameters (D1, D2) of a single plant per plot, and multiplying the surface obtained [assimilating the surface to an ellipse, $\pi(D_1 \times D_2)/4$] by the number of individuals of each species found within the plot (GYSEL & LYON, 1980).

Table 1. Characteristics of the 44 plots included in the analysis: AL. Altitude (m); CTS. Cover of tree stratum (m^2); CSSS. Cover of superior stratum of shrub (m^2); CISS. Cover of inferior stratum of shrub (m^2); DT. Botanical diversity (n° species) of tree stratum; DSSS. Botanical diversity (n° species) of superior stratum of shrub; DISS. Botanical diversity (n° species) of inferior stratum of shrub.

Características de las 44 parcelas del análisis: AL. Altitud (m); CTS. Cobertura arbórea (m^2); CSSS. Cobertura del estrato superior de matorral (m^2); CISS. Cobertura del estrato inferior de matorral (m^2); DT. Diversidad botánica (n° especies) arbórea; DSSS. Diversidad botánica (n° especies) del estrato superior de matorral; DISS. Diversidad botánica (n° especies) del estrato inferior de matorral.

Plot	AL	CTS	CSSS	CISS	DT	DSSS	DISS
1	225	72.72	26.46	5.37	2	2	6
2	225	1.09	18.88	7.90	1	3	5
3	225	65.48	11.37	1.95	5	3	5
4	225	0.00	13.20	14.58	0	2	10
5	225	48.00	25.47	4.59	3	5	5
6	225	44.77	15.59	4.93	2	5	7
7	225	25.84	53.10	0.00	2	3	0
8	225	84.35	5.88	3.17	1	2	8
9	225	108.16	59.13	9.68	4	5	7
10	225	43.10	5.94	3.55	3	3	5
11	225	33.19	190.64	12.62	1	5	6
12	110	0.00	26.82	6.80	0	2	8
13	110	16.67	45.8	3.64	2	4	9
14	110	7.54	10.71	1.17	2	7	6
15	110	58.90	56.78	8.05	1	6	8
16	110	22.69	31.17	7.53	1	5	8
17	110	78.54	70.08	7.62	1	3	7
18	110	79.00	22.70	7.85	3	3	5
19	110	78.54	64.20	7.77	1	6	4
20	110	48.39	31.80	12.42	1	4	3
21	110	47.20	14.11	0.62	2	3	2
22	110	44.76	33.24	13.16	1	6	1
23	350	48.21	29.49	5.37	1	7	6
24	350	7.86	9.31	9.78	1	2	11
25	350	11.22	3.36	8.76	1	2	9
26	350	7.50	18.20	1.93	2	4	12
27	350	38.63	31.88	12.06	1	3	11

28	350	28.35	0.18	19.85	3	1	9
29	350	44.17	33.08	2.25	1	1	4
30	350	104.59	18.39	3.97	2	2	8
31	350	21.79	106.26	3.56	1	4	11
32	350	48.26	9.89	18.67	1	1	10
33	350	22.24	32.64	2.25	3	2	12
34	700	22.81	37.20	9.40	1	2	4
35	700	5.61	34.98	21.07	1	5	7
36	700	51.42	29.22	19.70	1	7	7
37	700	29.08	70.23	19.94	3	3	6
38	700	60.33	9.81	5.07	1	1	8
39	700	3.62	16.71	17.66	1	3	12
40	700	59.70	14.83	6.18	1	2	7
41	700	25.98	32.20	47.66	1	3	9
42	700	4.42	130.63	22.97	1	3	11
43	700	62.22	18.79	23.70	2	5	11
44	700	33.63	49.60	39.98	2	10	13

Following HAIR (1980), we measured the diversity (D) by counting the number of different botanical species present in each plot.

Three separate strata of vegetation were considered in order to calculate cover and botanic diversity: a) tree stratum (TS higher than 3m), b) superior stratum of shrub (SSS from 1.5 to 3m), and c) inferior stratum of shrub (ISS less than 1.5m).

The transects were visited monthly from August 1989 to July 1990, recording all signs of roe and red deer presence (tracks, beddings and pellets). Every trace of roe and red deer found in the plots was removed after each visit. The frequency of visits was decided after evaluating the time of disappearance of traces over the time: pellets never disappeared in less than one month; permanence of tracks and beddings was variable but similar for both roe and red deer. These fluctuations were therefore not considered relevant for comparisons between species. Discrimination between tracks of both species was possible by differences in size and form (the rare cases of doubt were not included for analysis).

Data of presence-absence of roe and red deer in the 44 plots were analysed over the year. Variations related to the different variables considered were tested within months by the Mann-Witney U test; comparison of means between both deer species was made by the Wilcoxon test (SIEGEL, 1972). We assume for statistical analysis the independence between plots separated by 100 m.

Results

Mann-Witney U test revealed a significant selection of particular altitudes by roe and red deer in some particular months: red deer showed fewer fluctuations than roe deer on altitudes selected over the year (see fig. 2, tables 2,3). Both species selected lower altitudes in spring and summer (fig. 2), with significant levels in March ($Z = -2.0$, $p = 0.0454$), May ($Z = -2.54$, $p = 0.0109$), June ($Z = -3.33$, $p = 0.0009$), and August ($Z = -2.31$, $p = 0.0209$) for roe deer; and March ($Z = -4.01$, $p = 0.0001$), April ($Z = -3.23$, $p = 0.0012$), May ($Z = -2.39$, $p = 0.0166$), and

Table 2. Habitat characteristics selected by roe deer over a year: $\bar{x}$. Mean; SD. Standard deviation. (For other abbreviations see table 1.)

Características del hábitat seleccionadas por el corzo a lo largo de un año: $\bar{x}$. Media; SD. Desviación estándar (Para otras abreviaturas ver tabla 1.)

		Months												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
	n	4	5	11	14	10	16	11	5	30	16	13	5	140
AL	$\bar{x}$	346.2	394.0	237.7	295.7	192.5	212.8	325.0	158.0	334.3	330.0	255.3	415.0	291.4
	SD	255.4	296.0	170.9	195.5	98.2	154.9	257.7	107.3	222.5	228.2	216.6	260.1	80.5
CTS	$\bar{x}$	47.7	34.8	49.2	44.2	61.0	44.0	43.1	46.2	38.9	38.0	38.8	19.8	42.1
	SD	24.3	25.9	36.0	23.8	37.2	31.3	38.3	33.9	31.2	30.8	29.7	27.4	9.8
CSSS	$\bar{x}$	25.1	52.4	44.0	40.2	40.2	26.7	35.5	34.7	34.1	39.7	38.2	45.0	38.0
	SD	23.6	14.9	52.3	50.9	20.9	18.7	26.4	24.9	28.5	51.2	20.7	50.8	7.6
CISS	$\bar{x}$	9.6	14.7	6.5	8.4	5.9	6.4	8.2	8.0	10.3	9.0	7.7	11.4	8.7
	SD	7.4	15.7	5.1	6.9	3.7	4.8	5.9	3.0	9.6	7.7	6.7	9.9	2.6
DTS	$\bar{x}$	2.0	1.5	1.3	1.9	2.0	1.7	1.9	1.6	1.5	1.6	1.7	1.8	1.9
	SD	2.0	0.8	1.3	0.9	0.9	1.1	1.0	0.9	1.1	1.2	0.9	1.9	0.2
DSSS	$\bar{x}$	4.5	5.0	4.0	4.2	3.8	3.9	3.7	3.2	3.6	3.5	4.1	2.8	3.9
	SD	2.3	3.1	1.6	1.8	1.6	1.6	1.7	0.8	1.6	1.6	1.6	0.4	0.6
DISS	$\bar{x}$	7.2	8.8	7.1	6.6	6.3	6.8	7.7	6.6	8.1	6.7	7.8	7.0	7.3
	SD	1.7	3.8	2.7	3.3	2.9	2.8	2.6	2.6	2.5	2.8	2.5	4.5	0.7

June ($Z = -2,49$, $p = 0.0126$) for red deer (Mann-Witney U test; $n = 44$). During the autumn (October: $Z = -2.17$, $p = 0.0301$, for red deer; November: $Z = -2.19$, $p = 0.0284$, for roe deer; Mann-Witney U test; $n = 44$) low altitudes were still selected (fig. 2).

Regarding cover of the tree stratum, roe deer tended to select plots with higher tree cover in spring and summer than in the rest of the year, though a significant level was only reached in May ($Z = 2.13$, $p = 0.0333$; Mann-Witney U test; $n = 44$) (fig. 3, table 2).

A preference for higher levels of cover at the superior stratum of shrub was found for roe deer in February ($Z = -2.42$, $p = 0.0154$; Mann-Witney U test; $n = 44$). Roe and red deer preferred low cover at the inferior stratum of shrub over the year (fig. 3); a significant level in June for roe deer ($Z = -2.29$, $p = 0.0218$), and in March ($Z = -1.95$, $p = 0.05$) and May ($Z = -1.96$ $p = 0.04$) for red deer (Mann-Witney U test; $n = 44$).

Roe deer preferred higher tree diversity, particularly in March, and a higher diversity at the inferior stratum of shrub in September ($Z = -2.36$, $p = 0.018$, and $Z = -2.13$, $p = 0.0334$, respectively; Mann-Witney U test; $n = 44$) (fig. 4, table 2).

As regards red deer (fig. 4, table 3), the botanical diversity of any strata of vegetation had no significant influence on monthly habitat selection by this species (Mann-Witney U test; $n = 44$).

Comparing the means of plots selected by roe and red deer over a year (tables 2, 3), significant differences were only found with respect to botanical diversity of the tree stratum: roe deer selected plots with higher tree diversity than red deer ($Z = -2.581$, $p = 0.01$; Wilcoxon test; $n = 12$).

Table 3. Habitat characteristics selected by red deer over a year: $\bar{x}$. Mean; SD. Standard deviation. (For other abbreviations see table 1.)

Características del hábitat seleccionadas por el ciervo a lo largo de un año: $\bar{x}$. Media; SD. Desviación estándar. (Para otras abreviaturas ver tabla 1.)

		Months												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
n		26	24	30	33	32	28	29	13	42	26	23	10	316
AL	$\bar{x}$	314.2	273.1	232.1	271.2	279.8	274.6	285.1	293.0	349.0	286.7	341.5	487.0	307.3
	SD	210.4	167.0	97.1	167.2	164.8	177.6	169.5	213.7	228.3	198.7	237.5	277.6	64.9
CTS	$\bar{x}$	40.1	40.7	43.8	40.0	39.2	42.7	42.3	38.8	38.0	41.8	43.2	32.6	40.3
	SD	29.3	30.2	30.5	28.6	30.6	31.8	30.1	33.1	27.0	30.6	29.3	27.5	3.0
CSSS	$\bar{x}$	41.4	39.1	35.6	34.6	33.0	29.3	38.1	28.7	35.2	37.4	37.7	27.9	34.8
	SD	42.6	40.3	37.4	35.8	36.0	23.2	42.0	18.8	36.0	37.4	19.3	14.9	4.3
CISS	$\bar{x}$	9.9	9.1	7.6	9.4	8.0	8.5	8.7	8.6	10.7	8.7	10.3	8.8	9.0
	SD	11.7	9.1	4.8	9.1	5.5	5.6	6.4	5.6	9.9	8.2	9.6	7.7	0.9
DTS	$\bar{x}$	1.5	1.7	1.6	1.6	1.7	1.7	1.6	1.3	1.5	1.7	1.6	1.4	1.6
	SD	1.1	0.9	1.1	1.0	1.1	1.1	1.0	0.6	0.9	1.1	0.9	0.5	0.1
DSSS	$\bar{x}$	4.0	3.7	3.4	3.7	3.5	3.5	3.6	4.0	3.6	3.9	4.0	3.6	3.7
	SD	2.0	2.2	1.6	1.7	1.7	1.7	1.7	2.1	1.9	2.0	2.3	2.1	0.2
DISS	$\bar{x}$	7.1	7.5	6.9	7.2	7.4	7.2	7.2	7.3	7.4	7.5	7.4	6.3	7.2
	SD	3.1	3.3	2.9	3.0	2.8	2.7	3.1	2.2	3.0	2.8	2.7	2.6	0.3

Discussion

Despite the difficulty in analysing the interaction between two species with different spatial and social behaviours, and different historical origins in a very wide area, and despite the limitation of methods, the exploratory nature of the research justifies the discussion thereof with the view to generate further studies which may contribute to the conservation and management of roe and red deer in Mediterranean habitats.

The fluctuations in the altitudes selected by roe deer over the year, in contrast with the relatively constant mean altitude maintained by red deer in their ranging behaviour, constitute an interesting difference in the space distribution of the two species. This result probably reveals a higher sensitivity of roe deer to seasonal bioclimatic variations and environmental changes in comparison with red deer.

At this point it should be taken into account how roe deer selected the lowest altitudes during the territorial period (March-August). In Cádiz these low areas selected by roe deer are the deep, dark, closed gullies which constitute protected refuges and conserve humidity during the dry season. As pointed out by Bobek (1977), food resources are an important factor determining the number of resident roe bucks and does during the summer season. During the long and dry summer in the cork oak forests of Cádiz, probably the available resources of the deep gullies (where the only permanent water sources are located) determine the carrying capacity of the habitat.

Furthermore, red deer also select low

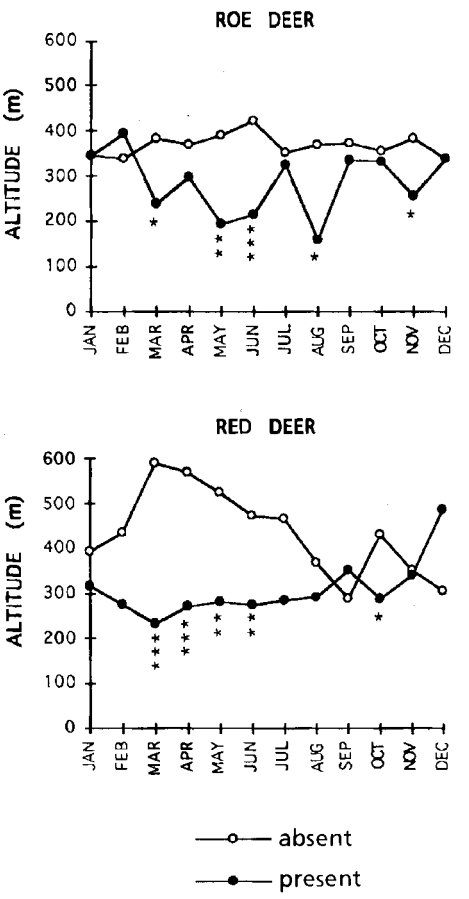

Fig. 2. Mean altitude of plots with presence/absence of roe and red deer over the year: n. Number of plots; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; Mann-Witney U test.

Altitud media de las parcelas con presencia/ausencia de corzo y ciervo durante un año: n. Número de parcelas; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; *test de la U de Mann-Witney.*

altitudes throughout most of the spring and summer. A space interaction between roe and red deer may therefore exist in this period. Such interaction could be particularly important during the fawning season which is May for both species. Since roe and red deer use a 'hider' strategy during the fawning season (Guinness et al., 1978; Jullien et al., 1992) particular conditions of the habitat may determine the selection of similar places for hiding fawns by both roe and red deer.

Our results suggest that while red deer do not select particular cover (at any strata of vegetation) during the fawning season, roe deer do prefer high levels of tree cover in May. Therefore, although both species coincide in selecting the same low altitudes in spring and summer, there is a certain level of segregation between them during the fawning season, since roe deer prefer higher levels of tree cover.

In general, roe deer give birth to two fawns per year while red deer give birth to only one fawn (Chapman & Chapman, 1971; Putman, 1988). It seems that species with the ability to produce multiple births are particularly susceptible to nutritional or abiotic influences, because both litter size and the proportion of females conceiving can be affected by such factors (Bunnell, 1982). Our results support this hypothesis, since roe deer selected a greater tree diversity than red deer. This finding is also in line with the food habits of roe deer, a selective-concentrate feeder (Putman, 1988), which, in Southern Spain, include a high level of ligneous plants (Fandos et al., 1987; Braza et al., 1994a). There is evidence that nutrition of roe and red deer females during winter and spring influences their body condition and fecundity (Clutton-Brock et al., 1982; Loudon, 1982; Ratcliffe & Mayle, 1992).

Another aspect to be considered is the difference between the population regulation mechanisms of red and roe deer. The roe deer reproductive rate probably results from spring social regulation of the population through territorial behaviour (density-independent reproductive rate) (Bramley, 1970; Strandgaard, 1972; Bobek, 1977) while population density regulates red deer populations by affecting reproductive rates and mortality (Clutton-Brock et al., 1982).

Considering the low variability in the number of corpora lutea per female roe deer found in different wild European populations (average of 2.0 ± 0.2; Bobek, 1977), it is probable that the very low reproductive rate detected in the roe deer population of Cádiz (Braza et al., 1994a) could be caused

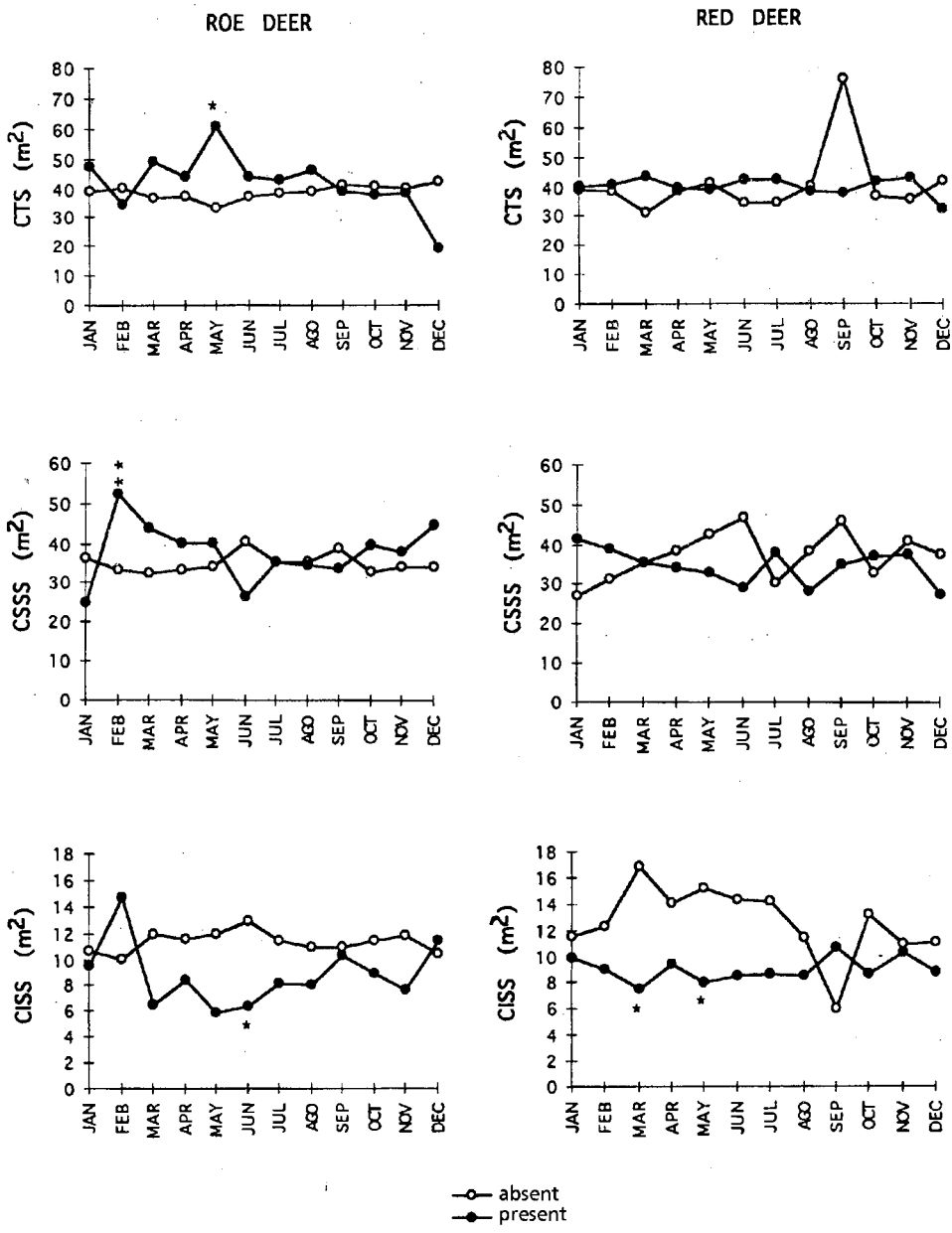

Fig. 3. Mean cover of the different strata of vegetation of plots with presence/absence of roe and red deer over the year: n. Number of plots; * $p < 0.05$; ** $p < 0.01$; Mann-Witney U test. (For other abbreviations see table 1.)

*Cobertura media con presencia/ausencia de ciervo y corzo durante un año: n. Número de parcelas; * $p < 0.05$; ** $p < 0.01$; test de la U de Mann-Witney . (Para otras abreviaturas ver tabla 1.)*

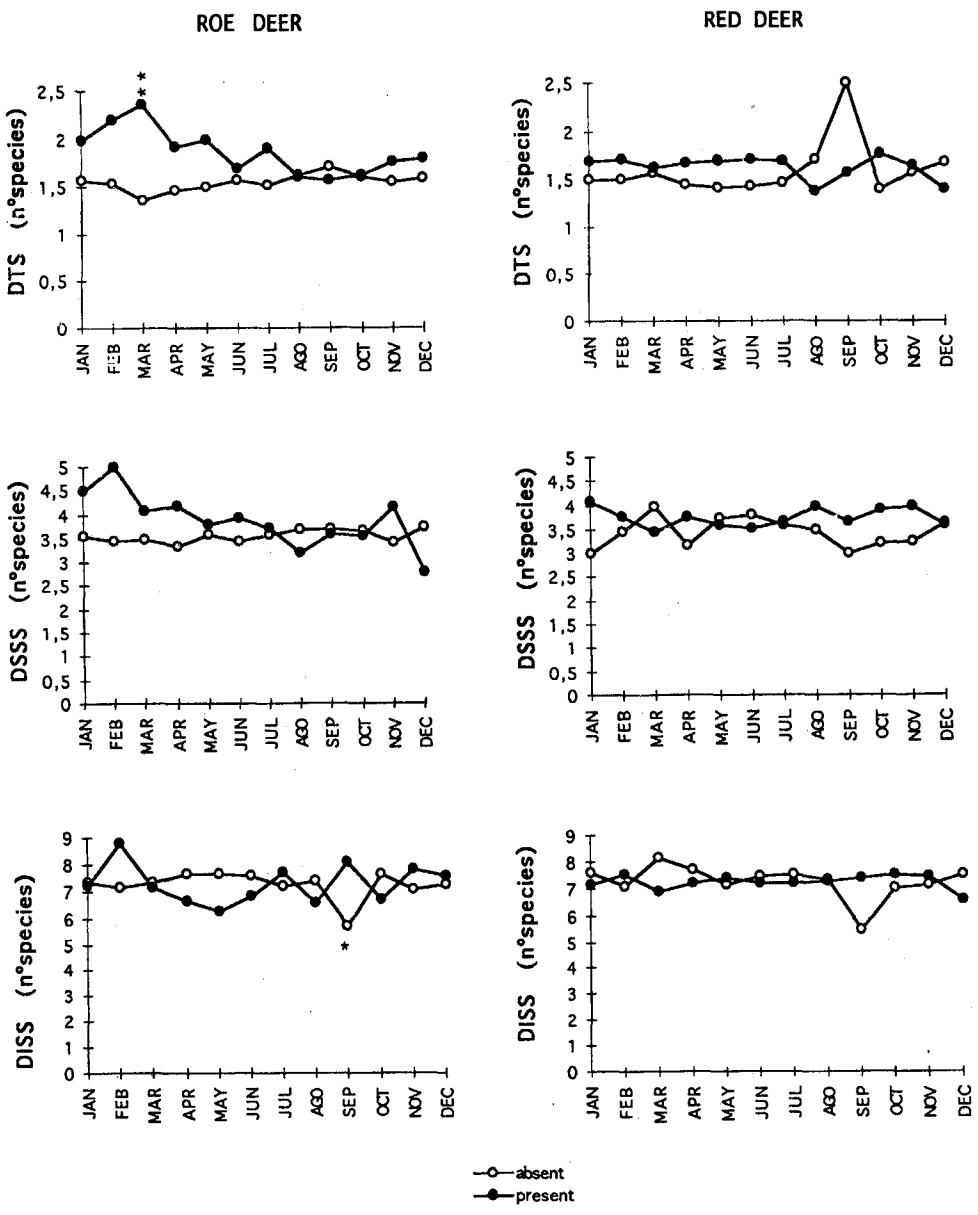

Fig. 4. Mean botanical diversity of the different strata of vegetation of plots with presence / absence of roe and red deer over the year: n. Number of plots; *p < 0.05; ** p < 0.01; Mann-Witney U test. (For other abbreviations see table 1.)

*Diversidad botánica media con presencia / ausencia de ciervo y corzo durante un año: n. Número de parcelas; * p < 0.05; ** p < 0.01; test de la U de Mann-Witney. (Para otras abreviaturas ver tabla 1.)*

by miscarriages or by a high mortality rate of fawns during their first days of life. This fawn mortality may result from infections (GIRAUD, 1984; LEÓN et al., 1994), but it is probably also a consequence of the impact of predators (i.e., *Vulpes vulpes*) on fawns and the interaction detected with red deer during the fawning season.

Taking into account that roe deer from the mountain ranges of Cádiz can be considered a locally isolated ecotype (ARAGÓN, 1993; ARAGÓN et al., 1995a; ARAGÓN et al., in press), future studies are necessary to evaluate the factors directly influencing the regulation of this population. Such information about the interactions with red deer will help us to understand the adaptive mechanisms of these two species to the Mediterranean xerophytic forests.

Acknowledgements

We thank the 'Consejería de Medio Ambiente' and the 'Oficinas de los Parques Naturales de Grazalema y de Los Alcornocales' for their collaboration in our field work. We thank Dr. Bideau for the revision of the manuscript. We thank also Enrique Collado for his help in statistic analysis and in the discussion of our paper, and Alicia Prieto for the last correction of the manuscript.

Resumen

Uso del hábitat por el corzo y el ciervo en el sur de España

Con objeto de analizar la influencia de la altitud, cobertura y diversidad botánica en las preferencias de hábitat del corzo (*Capreolus capreolus*) y el ciervo (*Cervus elaphus*) en el Sur de España, se establecieron 44 parcelas en cuatro transectos lineales situados en el Parque de "Los Alcornocales" (Cádiz) (fig. 1). Los resultados revelaron un cierto grado de interacción espacial entre ambas especies en primavera y verano. El corzo seleccionó las altitudes mas bajas durante el período territorial (marzo-agosto) y el ciervo seleccionó igualmente altitudes bajas en primavera y verano (fig. 2). Esta interacción espacial puede ser particularmente importante durante el período de cría. El corzo seleccionó altos niveles de cobertura y diversidad arbórea (figs. 3, 4, tabla 2), lo que podría estar relacionado con los hábitos alimenticios del corzo, así como con su capacidad de partos múltiples. Corzo y ciervo seleccionaron preferentemente un bajo nivel de cobertura en el estrato inferior arbustivo (fig. 3). La diversidad botánica no tuvo aparentemente influencia en la variación estacional de la selección de hábitat por el ciervo (fig. 4, tabla 3).

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