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ACTIVITY PATTERN, HOME RANGE AND HABITAT PREFERENCE BY COYOTES *(CANIS LATRANS)* IN THE MAPIMI BIOSPHERE RESERVE OF THE CHIHUAHUAN DESERT, MEXICO

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Many studies describe the size of coyote (*Canis latrans*) home ranges but, as noted by Laundrè and Keller (1984), far fewer papers have attempted to relate the used area to environmental parameters. Additionally, few ecological studies on coyotes have been conducted in the southern part of their range and most of them were on food habits (Pérez-Gutiérrez *et al.*, 1982; Delibes *et al.*, 1989). Further, most of the ecological research on coyotes has been conducted in productive areas, where they are usually considered as a pest (Voigt and Berg, 1987), while studies on the species in desert areas are scarce (Hernández et al., 1994). In this paper we describe the field behaviour of two coyotes in a desert area of central Mexico, discussing the relationships between home range shape and size and vegetal formations in the Mapimí Biosphere Reserve.

STUDY AREA AND METHODS

The area is located in the Mapimí Bolsón area of the southern Chihuahuan desert, at the vertex among the Mexican States of Chihuahua,

Durango and Coahuila (26° 40'N, 103° 45'W). It is a level plain (ca. 1,100 m) with poor drainage. Climate is arid, with irregular summer rains (ca. 260 mm/year) and mean monthly temperatures ranging from 12°C in January to 28°C in June and July (Cornet, 1988). As a rule, the vegetation is low and scattered. Montaña (1988) made a map of the Reserve characterizing 14 vegetal formations according to growth-form and dominant species. The main formations in the study area were:

A.- Located on hills and characterized by creosotebush (*Larrea tridentata*), pricky-pear (*Opuntia rastrera*) and *Fouqueira splendens* (22% of the area in Fig. 2).

B.- Located at orographic elements on alluvial fans and dominated by tall woody plants (mesquite, *Prosopis glandulosa*) and an herbaceous stratum (*Hilaria mutica*) (31%).

C.- Located along intermittent water courses and characterized by denser tall woody vegetation (dominated by mesquite) and grasses (dominated by *H. mutica and Sporobolus airoides*) (7%).

D.- Located on foothills and characterized by dense mesquite woods and *H. mutica* grasslands, also including low woody (creosotebush) and suculent (prickly-pear) (31%).

E.- Others, (9%).

Two coyotes, an adult male weighing 14 Kg and a subadult female weighing 7 kg when captured (it lately became adult and likely increased weight during the study), were captured with padded Nº 3 Victor steel traps. They were immobilized with a mixture of Ketamine and Acetylpromazine, adjuved with Atropine, and provided with radiocollars (Wildlife Materials Inc.) working in the 151 MHz range. They were located by triangulation from a vehicle, close enough as to be fairly sure of the occupied habitat. The coyotes were hourly located sequentially over 24-hour periods (seven periods for the female and three for the male) and sporadically at different times of day and night. In all, they were located 323 times from May 1985 to April 1986 (119 locations for the male and 204 for the female).

Patterns of daily activity were estimated from rates of movement (Palomares and Delibes, 1991), i.e. distances (km) covered in an one-hour interval at different times of the day. To evaluate differences in the activity cycles, a two-way ANOVA (with sex and hour as variables) was performed on the daily-movement data.

Two approaches to the estimation of home range size and shape were made. To render comparisons possible with other studies, the minimum convex polygon (Mohr, 1947) was used. With this procedure a large importance is given to isolated locations far from the centers of activity. Therefore, we

eliminated peripheral records to describe a reduced convex polygon including 90% of all locations. Centers of activity were determined by the grid method described by Laundré and Keller (1981). Differences between the observed frequencies of location in each vegetal formation and the expected frequencies were analyzed through a chi-square test, being the null hypotesis that coyotes were not associated to any particular vegetation type inside their home range (convex polygon with all locations). The analysis of utilization-availability data was made following Neu *et al.* (1974).

Results and Discussion

Both coyotes showed similar moving activity patterns (P= 0.88). Differences between time-periods of activity, however, were highly significant (P= 0.03). Based on these results, the activity data in each time period for both male and female were pooled. To enhance the main trends in the daily cycle, a running average smoothing procedure was performed before plotting the data. In agreement with other studies (Bekoff, 1982; Andelt, 1985), both animals seemed to prefer sunrise and sunset hours to get on the move (Fig. 1). The highest activities were observed between 0600 and 0900 h in the morning and between 1900 and 2200 h in the evening. Their mean daily travelled distance (15.3 Km for the male and 13.8 Km for the female) were greater than those reported in some semiarid biotopes of Nebraska and Texas (Andelt and Gipson, 1979; Andelt, 1985).

Male home range size was smaller than that of the female, considering all locations (6.87 and 15.25 km^2, respectively) as well as the reduced polygon including 90% of locations (3.0 and 5.25 km^2) (Fig. 2). The female had two centers of activity (one on the west and the other on the east of her home range), whereas the male had only one at the center of his range, indicating a more compact use of space. These differences could be due to the age of the animals. The male showed a very constant pattern of home range use, without distinct temporal changes, as could be expected from an adult, resident individual. On the contrary, the subadult female predominantly used the western half of her home range at the beginning and the end of the study, and the eastern half in the interposing months, suggesting an individual searching for a definite home range.

The home range sizes of these coyotes are in general smaller than those reported in other studies (Bekoff, 1982), but agree quite closely with those reported by Andelt (1985), who determined average coyote home range sizes of 4.5 km^2 in a semiarid grassland of Texas.

When home ranges are superimposed on the vegetation map (Fig. 2), size and shape of the home ranges seem to be associated to the distribution of plant formations, specially if the reduced ranges are considered. This suggests a general preference for habitat D. The distribution of locations on each habitat confirmed this preference by both individuals, as the frequency of time spent in habitat D was significantly higher than that expected by chance ($P < 0.001$; for the male and $P = 0.013$ for the female; Table 1). This

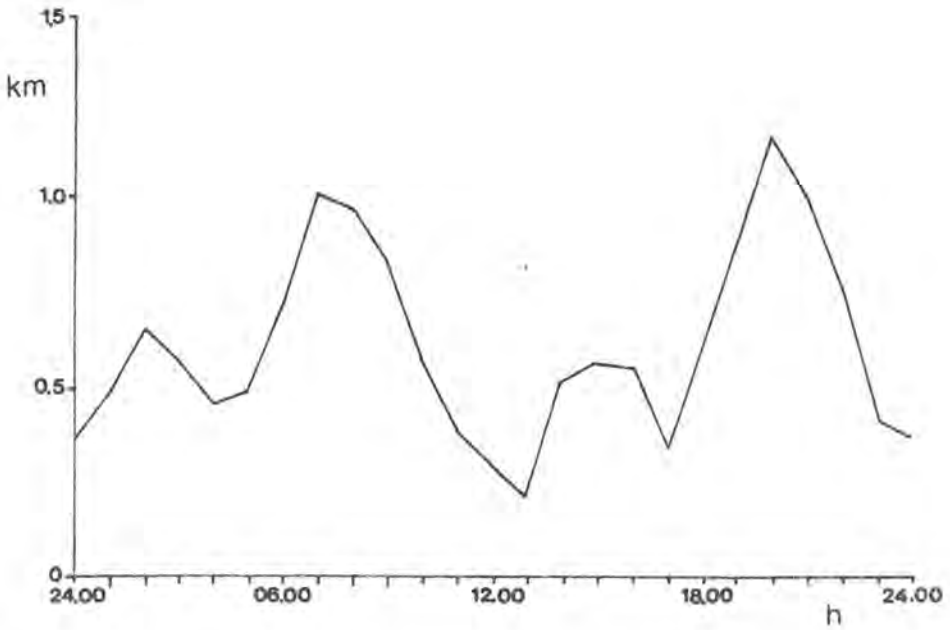

Figura 1 Combined average activity pattern of two coyotes at Mapimí Biosphere Reserve, estimated as the mean distance (km) travelled by hour, as a function of the time of the day (n=10 24-h tracking periods).

Patrón promedio de actividad combinada de los dos coyotes en la Reserva de la Biósfera de Mapimí. La cantidad de actividad ha sido estimada en base a la distancia media en kilómetros recorrida por hora a las distintas horas del día (n=10 períodos de radio-rastreo de 24 horas).

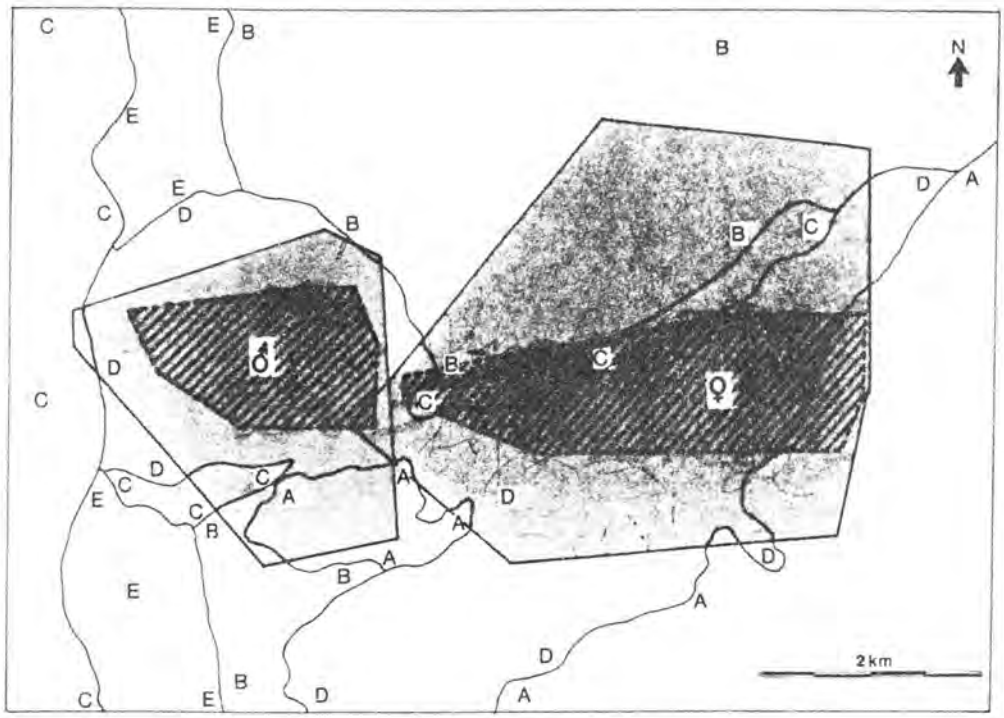

Figura 2. Home ranges of one male and one female coyotes at Mapimí Biosphere Reserve superimposed on a vegetation map of the study area (vegetal formations A to E are described in the text). The minimum convex polygons (m.c.p.) including all locations are shaded, and the m.c.p. including 90% of locations are striped.

Areas de campeo de dos coyotes, un macho y una hembra, en la Reserva de la Biósfera de Mapimí, sobreimpuestas sobre un mapa de vegetación del área de estudio (las formaciones vegetales, de la A a la E, aparecen descritas en el texto). Los Mínimos Polígonos Convexos (m.c.p.) que incluyen todas las localizaciones aparecen sombreados, los m.c.p. que incluyen sólo el 90% de las localizaciones aparecen rayados.

vegetation type is relatively scarce in the Reserve, and is the denser and, structurally and floristically, the most complex vegetation type in the area (Montaña, 1988). Woodrats (*Neotoma* sp.), which feed on prickly-pears, are abundant here (Grenot and Serrano, 1981) and both prickly-pears and woodrats are important food items in the coyote diet in Mapimí, as the former occurred in 44% of the summer faeces (n=147) and the second in 25% of the spring faeces analyzed (n=143)(Hernández and Delibes, in press). All the other vegetal formations inside the home range of both coyotes were utilized less than expected (Table 1).

TABLE 1

Observed proportion of locations of both coyotes on each type of vegetation and expected proportion according to the surface occupied by these vegetal patches on each home range. Vegetal formations are described in the text. P= probability of use according to availability. (++) "preferred" P< 0.001; (+) "preferred" P< 0.05; (—) "avoided" P< 0.001; (-) "avoided" P< 0.05.

Proporciones observadas de las localizaciones de ambos coyotes en cada tipo de vegetación y proporciones esperadas de acuerdo con la superficie ocupada por dichas manchas de vegetación en las áreas de campeo correspondientes. Las descripciones de las formaciones vegetales aparecen en el texto. P=probabilidad de uso de acuerdo con la disponibilidad (++)= "preferida" P< 0.001; (+) "preferida" P< 0.05; (—) "evitada" P< 0.001; (-) "evitada" P< 0.05.

	Vegetal formations	Observed proportion	Expected proportion	P
Male	A	0.02	0.18	—
	B	0.02	0.03	-
	C	0.03	0.06	-
	D	0.93	0.73	++
Female	A	0.10	0.11	-
	B	0.15	0.36	—
	C	0.01	0.07	—
	D	0.74	0.46	+

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Key words: Coyote, *Canis latrans*, Chihuahuan desert, habitat, activity, Mexico.

Resumen

Actividad, área de campeo y uso del hábitat del Coyote (Canis latrans) *en la reserva de la Biosfera de Mapimí, desierto de Chihuahua, México.*

Durante un año se ha radio-rastreado en el desierto de Chihuahua a un coyote macho adulto de 14 Kg y a una hembra subadulta que en el momento de la captura pesó 7 Kg. Ambos ejemplares fueron más activos al atardecer y al amanecer que durante el resto del día. Las distancias medias recorridas diariamente fueron de 15 km por el macho y 14 km por la hembra. El área de campeo anual del macho fue de casi 7 km^2 (3 km^2 para el 90% de las localizaciones) y la de la hembra de 15 km^2 (5 km^2 para el 90%), probablemente porque la última era un animal todavía no residente cuando comenzó a ser rastreado. Ambos individuos mostraron preferencia aparente por la vegetación de pie de cerro, caracterizada por los bosquecillos de mezquites y la presencia de nopales o chumberas (*Opuntia* sp.), cuyos frutos son un alimento frecuente de los coyotes, especialmente en verano.

Palabras clave: Coyote, *Canis latrans*, Desierto de Chihuahua, hábitat, actividad, México.

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CARACTERISTICAS DE LOS REFUGIOS DIARIOS Y ESTACIONALES DE *TESTUDO GRAECA* EN DOÑANA

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La caracteristica fundamental que distingue al Orden *Chelonia* es la presencia de un caparazón oseo externo, que ejerce funciones complementarias de defensa contra predadores y protección frente a cambios bruscos de temperaturas y desecación (Carr 1969, Pritchard 1979, Lambert 1981, Pulford et al. 1984, Hailey 1989). Asimismo en muchas especies terrestres las extremidades y en especial las partes que quedan expuestas al exterior