

## CHARACTERISTICS OF THE IBERIAN WILD GOAT *CAPRA PYRENAICA HISPANICA* OF MADRONA AND SIERRA QUINTANA (SPAIN). THE SUCCESS OF PRIVATE MANAGEMENT

L. SÁNCHEZ HERNÁNDEZ

Apartado n.º 52. 28760 Tres Cantos, Madrid. Spain.

E-mail: [luismadrona@tiscali.es](mailto:luismadrona@tiscali.es)

**ABSTRACT.**— *The Real Club de Monteros, an association of Spanish hunters, has been supporting research on the Madrona Iberian wild goat. This is one of the least studied populations of Capra pyrenaica in Spain and was nearly exterminated from the Madrona range in the middle of the 20<sup>th</sup> century, when there were possibly less than 20 individuals. Our aim was to determine the distribution area of the goat, estimate its relative density and population structure, and detect possible threats to its conservation. Observations were concentrated during the rut in the years 2000 and 2001. Madrona wild goats are very wary of humans and very difficult to observe. Long flight distances and brief sightings have been recorded. Line transects were not feasible, so goat numbers were determined by the repeated counts method. The population structure differs according to the study areas as a result of its gradual dispersion. Continued poaching has reduced the average age of males and has seriously affected the older age classes.*

**RÉSUMÉ.**— *Le Real Club de Monteros, association de chasseurs espagnols, a financé une étude du bouquetin ibérique sauvage de la Sierra Madrona. Il s'agit d'une des populations de Capra pyrenaica les moins étudiées d'Espagne et elle avait à peu près disparu de ce massif à la moitié du XX<sup>ème</sup> siècle, avec peut-être moins de 20 individus. Nous avons déterminé l'aire de répartition du bouquetin, en estimant sa densité relative et la structure de sa population, de façon à détecter les risques éventuels pour sa conservation. Les observations ont été concentrées durant la période de rut en 2000 et 2001. Ces bouquetins se montrent très inquiets de la présence humaine et ils sont très difficiles à observer. Un survol à distance et de brèves observations ont été effectuées. L'abondance des bouquetins était déterminée par la méthode des comptages répétés. La structure de la population est différente pour les différentes zones étudiées, à cause de leur dispersion graduelle. Le braconnage continu a réduit l'âge moyen des mâles et a sérieusement affecté les classes les plus âgées.*

**RESUMEN.**— El Club Real de Monteros, una asociación española de cazadores, ha financiado el presente estudio sobre la cabra montés de Sierra Madrona. Esta población es una de las menos estudiadas de *Capra pyrenaica* en España y fue casi exterminada de la Sierra Madrona a mediados del siglo XX, cuando probablemente había menos de 20 individuos. El objetivo del estudio es determinar su área de distribución y estimar su densidad relativa, estructura poblacional y amenazas de conservación. Las observaciones se tomaron durante el celo de 2000 y 2001. Las cabras monteses de Madrona son muy asustadizas y difíciles de observar. Se han obtenido breves observaciones y grandes distancias de huida. La abundancia de la cabra montés se determinó por el método de conteos reiterados, ya que el método de transectos lineales no era fiable. La estructura poblacional varía en distintos lugares del área de estudio debido a la dispersión gradual de la población. El furtivismo ha reducido la media de edad de los machos y ha afectado seriamente a las clases de edad más viejas.

**Key-words:** Iberian wild goat, *Capra pyrenaica*, distribution, population structure, Madrona, Spain.

## 1. Introduction

*Capra pyrenaica* was nearly exterminated from the Sierra Morena range in the middle of the 20<sup>th</sup> century, due to over-hunting, its natural population was confined in the Sierra Madrona, in the Eastern Sierra Morena, where there were possibly less than 20 individuals.

The Real Club de Monteros, an association of spanish hunters, has been supporting research on the Madrona Iberian wild goat since the spring of 2000.

This native goat has survived even though it is not located in a Natural Protected Area and has been managed mainly by landowners and game keepers. The owners of some big-game hunting estates have a traditional interest in the Madrona goat, which has proved to be essential to preserve the species.

There is little information in the literature on the Madrona wild goat (CHAPMAN & BUCK, 1910; TRIGO DE YARTO, 1961; CADENAS, 1999; SÁNCHEZ, 2001). Most references are brief accounts of sightings along with general descriptions of the distribution of wild goat in Spain (DE LA PEÑA, 1984; FANDOS, 1989, 1991; LÓPEZ, 1995).

The population underwent an extended bottleneck between 1930's and the 1960's and demographic recuperation has been slow. At the beginning of the 1980's the species began to disperse from its survival territory.

Our aim was to determine the distribution area of the goat, estimate its relative density and population structure and detect possible threats to its conservation.

## 2. Study area

Sierra Madrona is inside the Eastern part of the Sierra Morena (Spain) in the South of the province of Ciudad Real (Castilla-La Mancha) and borders with the Northern of the provinces of Cordoba and Jaen (Andalusia), with an estimated area of 350 km<sup>2</sup> (Figure 1).

These ranges are made up of Armorican Quartzite. The almost uninterrupted succession of rock offers areas where the goat is well protected, even though the Sierras are quite low in altitude (peaks of 1300 m.). It is surprising that the species has been able to survive under these conditions in this type of middle Spanish range. It probably would have gone extinct in the 18<sup>th</sup> century in regions with similar characteristics in central Spain (Montes de Toledo, Villuercas or Peña de Francia).

The bioclimatic layers include the meso-Mediterranean and supra-Mediterranean (RIVAS-MARTÍNEZ, 1987). Annual rainfall is between 500-700 mm with marked summer droughts. We have found a reduced seasonal availability of water in the upper levels of the sierra. The Real Club de Monteros, has promoted the installation of artificial watering holes, which is thought will greatly improve the territory occupied by the Madrona goat.

The sclerophyllic vegetation is dominated by holm oak *Quercus rotundifolia* and strawberry tree *Arbutus unedo*, a significant amount of pyrenean oak *Quercus pyrenaica* and widely distributed cork oak *Quercus suber*, Juniper *Juniperus oxycedrus* in rocky enclaves and reforested populations of maritime pine *Pinus pinaster*.

The Madrona goat occurs in a red deer hunting territory on estates closed off by hunting fences. These hunting fences, 2 meters high, are not obstacles for the wild goats in the steeper areas. The human resources used to manage deer can also be used to help protect wild goats. Private game keepers and forest rangers cannot eliminate poaching but can help to discourage it.

In the Eastern Sierra Morena there are nuclei of *Capra pyrenaica* that have been reintroduced in private estates. Although we concentrated on the native goat of Sierra Madrona, we also obtained information on the nearest populations of reintroduced wild goats.

Wild boar *Sus scrofa* is another abundant ungulate in the area. Mouflon *Ovis orientalis musimon* is present as well as roe deer *Capreolus capreolus* although it is being replaced by red deer. There is still a residual population of wolves *Canis lupus* and in addition breeding pairs of Imperial eagles *Aquila adalberti*, one of the most endangered birds in the world.

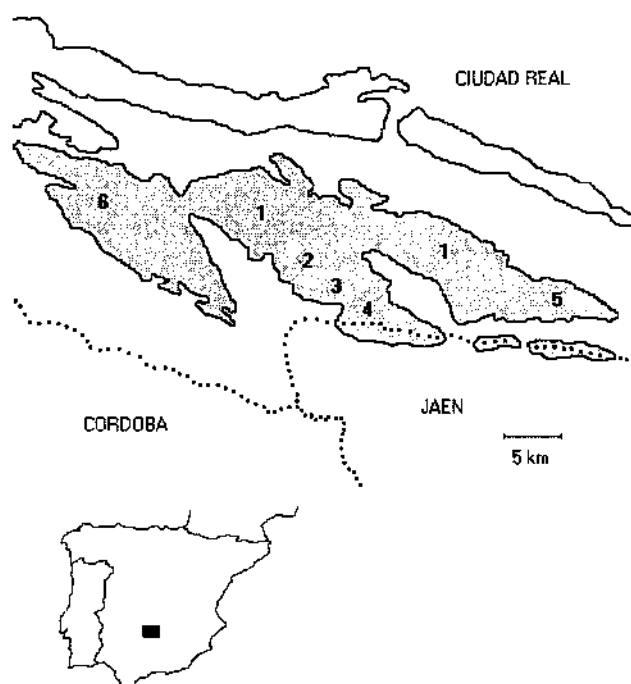


Figure 1. The Madrona Range. 1: Sierra Madrona. 2: Dornilleros. 3: Navalmanzano. 4: Quintana. 5: Rebollera. 6: Sierra de la Garganta.

### 3. Methods

Observations were concentrated during the rut (October to January) in the years 2000 and 2001. Aspects of the reproduction and distribution of the male groups were also studied in other months of the year (March-April, June-July). In order to delimit the geographic distribution of the native Madrona goat, sightings were described using the UTM cartography co-ordinate system (1x1 km), at a scale of 1:25.000.

Madrona wild goats are very wary of humans and very difficult to observe. Line transect was not feasible, so goat abundance was determined by the repeated counts method (SEBER, 1982; McCORQUODALE *et al.*, 1988; TELLERÍA, 1896; ALADOS & ESCÓS, 1995). Which estimates total abundance as  $N = 2 N_m - N_{m-1}$ , where  $N_m$  is the maximum count and  $N_{m-1}$  the next largest count.

Individuals were identified by their physical characteristics and re-sightings in order to describe the specific groups and their movements. It took several weeks

to become familiar with the different groups of goats and this had to be performed after each new rut. Individuals physical characteristics, development and age were estimated by telephotography *a posteriori*. For the first time, it has been possible to obtain a sample of representative photographs of the Madrona wild goat.

Additional data included observations during trophy hunting by stalking males and deer hunting by driven hunt (Spanish "monteria", a very common practice in the half Southern of Spain). Possibly, hunting deer with hounds influences the flight behaviour of *Capra pyrenaica*. The flight distance of the Iberian wild goat, after seeing humans, has been studied by ALADOS & ESCÓS (1995). In Madrona, we noted the time that the goats remained in sight of the observer and flight distance. We classified the observations into time and distance intervals. Time range: 10 intervals from 1 second to +120 minutes. Distance range: 9 intervals from 1 m. to +800 meters. The flight response (distance/time) was compared between Madrona *Capra p. hispanica* and *Capra p. victoriae* from reintroduced population in the North-west of the Iberian Peninsula (Sierra de Francia) in a hunting territory, where only stalking is practised.

The wild goat herds were grouped into six size intervals (1, 2, 3-5, 6-10, 11-15, 16-20). The population structure was determined using the frequency (percentage) of observations distributed by sex and age class. The sex of individuals over one year of age were differentiated by their sexual dimorphism. Age was estimated by external characteristics including body development, length and number of growth rings on the horn and fur colour. The difficulty of the direct observations increased the error in age estimation. Thus, animals were grouped into age intervals with the help of photographs and field experience. There were five age classes (in years) for males (1-2, 3-4, 5-6, 7-8,  $\geq 9$ ) and four for females (1-2, 3-6, 7-10,  $>10$ ).

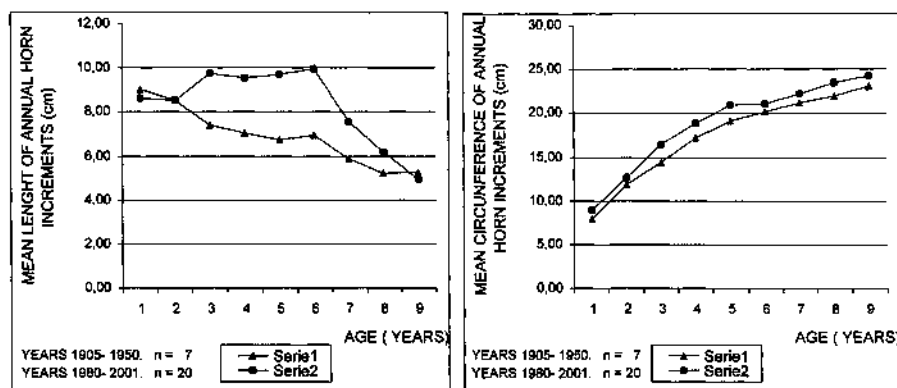


Figure 2. Mean Length and circumference of annual horn increments of males. Native Iberian wild goat of Madrona.

Biometric measurements of the horns of trophy males were taken from private collections. For data on individual development the length and circumference of each annual growth ring on both horns (Figure 2) were measured. To define the general morphology of the horns the total length, outside spread and the distance between points was assessed. No female skulls were available in the trophy collections but the remains of two females were found in the field, one of which had been eaten by a wolf.

The Owners of big game estates, game keepers, forest rangers and the local hunters were interviewed to estimate the male goats killed by poaching.

#### 4. Results

##### *Distribution*

The Madrona goat is currently located in the North of the Sierra Madrona and in Sierra Quintana (to the South), an area of about 90 km<sup>2</sup>. The low density of goats has not favoured natural re-population of the central Sierras of Dornilleros and Navalmanzano although a small group of females seems to have moved to this area.

In Western Madrona (Sierra de la Garganta), there is a reintroduced population of *Capra pyrenaica hispanica* from the Sierra de Cazorla (Jaén). More recently, some individuals of *Capra pyrenaica victoriae* were reintroduced. The height of the fences installed around the borders of the estate were increased to impede animals from escaping. There have been some isolated observations of wild goats outside the fenced area, at points quite far away from each other.

There are other reintroduced populations of *C. p. hispanica* from Cazorla to the East of the Madrona which disperse towards the North in ranges parallel to Madrona. There, contact with the native goat is improbable.

The current locations of the native Madrona wild goat can be segregated into three areas. Incidentally, it is considered unwise to print any map of the Madrona wild goat habitat due to poaching interests.

- Area I. Survival area (12 km<sup>2</sup>).

This is where the species survived during the 1950's and was home to the founder population for subsequent natural dispersal. Here the composition and behaviour of the flocks may be more representative of the present situation: greater average size of the groups and greater percentage of adult females.

- Area II. Stable repopulated areas (17 km<sup>2</sup>) .  
These territories are the most favourable for expansion from the original nucleus in Area I. The composition of the groups should reflect recent settlement: lower average group size and less adult females.
- Area III. Unstable areas (46 km<sup>2</sup>).  
These territories have been occupied recently and others have very low densities of females for unknown reasons. They could be peripheral or outer territories but also intermediate stages between Area I and Areas II. In the future some of these areas could become new Area II.

#### *Relative densities*

Animals were identified by several individual characteristics. Monitoring and the repeated census of the groups allowed us to estimate occupation throughout most of the territory (Table 1). Almost 4 % of adult females did not participate in the active rut, they remained separated from the mixed herds.

Table 1. Estimated occupation and relative densities.

Territory	Estimated No. of wild goat	Area (km <sup>2</sup> )	Relative density	No. Counts
Area I	85	12	7.1	22
Area II	58	17	3.4	29
Area III	78	46	1.7	35
Total	221	75	2.9	86

#### *Population structure*

We performed 669 repeated observations and analysed 637 to classify herds size (Figure 3), 563 (84,15% of total) to calculate the distribution of age intervals (Figure 4), male and kid to female ratio (Figure 4). The marked differences in sex-ratios and composition in age shows different strategies between sexes, using the territory during the rut seasons (Table 2). The percentage in Area III is not shown due to its variability.

#### *Flight response*

The extraordinary wild nature and behaviour of *Capra pyrenaica* in Madrona impedes field observations. Long flight distances and brief sightings have been

recorded. To a certain extent, the flight response of *Capra pyrenaica* in Madrona, determined the sightings. Specifically fifty percent of the Madrona wild goat (in Area III) were observed from 500 to 800 meters and 15 to 30 minutes intervals (median distance: 511,53 meters; median time: 17 minutes 36 seconds). This could be explained taking into account the fact that in Madrona, hunting by driving deer and wild boar with dogs is common, and by the fact that there is a low level of outdoor tourism in most of the territory. *Capra p. victoriae* are especially tolerant of humans (habituation) in stalking territories with higher level of outdoor tourism. So, fifty percent of the *C. p. victoriae* sightings in the Sierra de Francia range occurred from 30 to 50 meters and 60 to 120 minutes intervals (median distance: 41,58 meters; median time: 89 minutes 8 seconds).

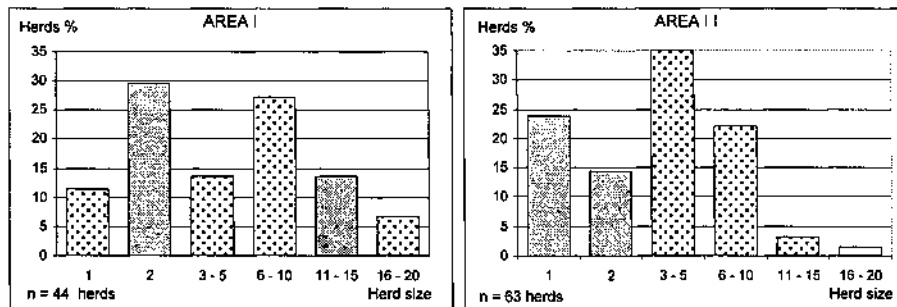


Figure 3. Herds size frequency of Madrona *Capra pyrenaica hispanica* ( including both sexes). Rut 2001.

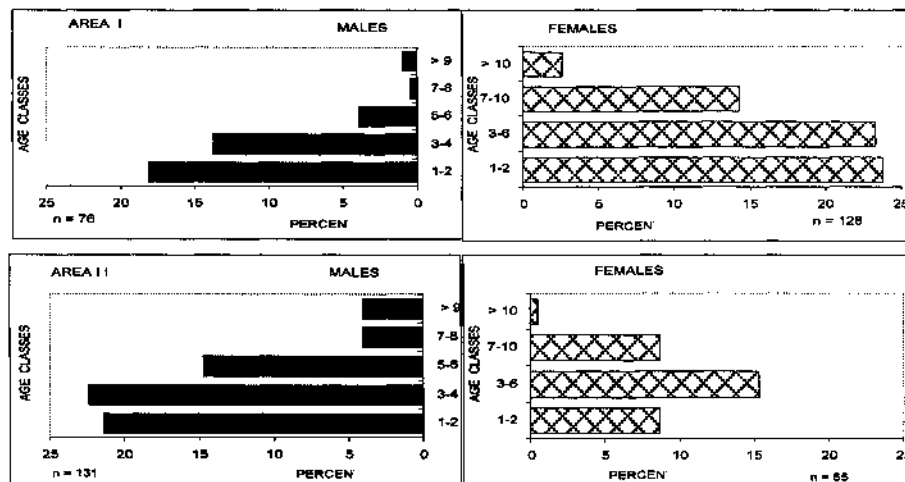


Figure 4. Composition in age classes and sex of Madrona wild goat population. Rut 2001.



# CHARACTERISTICS OF THE IBERIAN WILD GOAT *CAPRA PYRENAICA HISPANICA*

Table 2. Madrona and Sierra Quintana wild goat population. Rut 2001.

Area (km <sup>2</sup> ) Sierra Madrona range	350
Area (km <sup>2</sup> ) with presence of Madrona native wild goat:	90
Area (km <sup>2</sup> ) surveyed:	75
Altitude (meters) range of observations :	600-1280
Number of repeated counts:	86
Number of wild goats herds:	132
Mean herds size $\pm$ SE (range):	4,82 $\pm$ 0,35 (1-18)
Male to female ratio (males/females)	
Area I	0.59
Area II	2.01
Kid to female ratio (kids/ females)	
Area I	0.53
Area II	0.58
Mean density /km <sup>2</sup> $\pm$ SE (range):	2,9 $\pm$ 0,23 (0,6-7,1)
Estimated number of wild goats:	221

## Illegal trophy hunting.

In the middle of the 20<sup>th</sup> century, poaching led to the extermination of the wild goat in Sierra Quintana, and reduced their numbers to a historical low in the North of the Madrona. In the 1990's, as the goat began to disperse from its original nucleus, poaching would have accounted for approximately fifty males accross the age range. In the same decade, legal trophy hunting would have caught 1 to 2 males annually until 1998. Since that year it has been impossible to develop a program of legal trophy hunting due to poaching.

Animals that are captured illegally cannot be studied or compared in the future. Their data is lost and cannot be officially entered for the record book of trophies (at least with their real origin), which makes it difficult for the owners of the estates to obtain funds from legal hunting.

## Behavioural observations

An interesting finding was the high frequency of tree climbing in goats of all ages. They are probably taking advantage of this food resource in a different way than other competing ungulates, including the mouflon.

Frequency of tree climbing in Madrona *Capra pyrenaica* :

1 tree climbing observation/3,8 herd observations (n=174 herds).

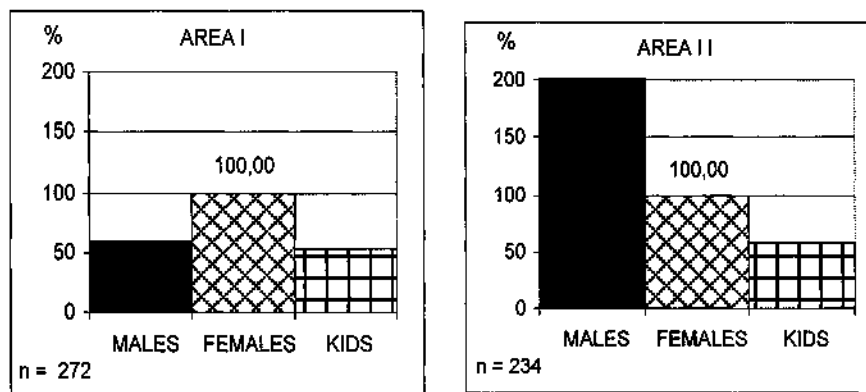


Figure 5. Male and Kid to female ratios (/100 ♀♀) in rutting season.

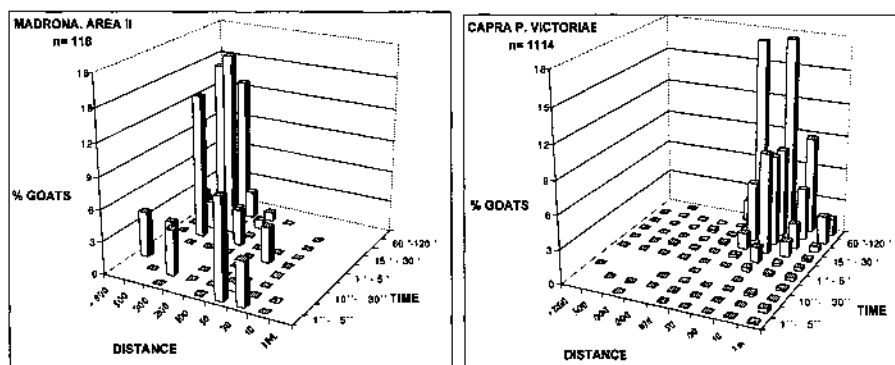


Figure 6. The flight response (distance/time) of the Madrona *Capra p. hispanica* and *Capra p. victoriae* from NW of Spain.

## 5. Conclusions

- There is a native population of *Capra pyrenaica hispanica* in Sierra Madrona (in the eastern Sierra Morena) which is dispersing in a natural way from its original survival area.
- After repeated census (n=86), we estimate a population of 221 individuals in an area of 75 km<sup>2</sup>; with relative densities between 0,6 and 7,1 (wild goat/km<sup>2</sup>, mean 2,9 ± 0,23 SE). The mean herd size for native wild goat at Madrona was 4,82 ± 0,35 SE. The population structure differs according to the study area (survival area and stable repopulated areas).

- Continued poaching has reduced the average age of males and has seriously affected the older age classes. Survival is difficult for males above 7 years old and almost impossible for 9-year olds.

**Acknowledgements.** This work was supported by The Real Club de Monteros (R. C. M.). Our thanks are due to Mr. Íñigo Moreno de Arteaga, Marquess of Laula and R. C. M. President, to Mr. Cesar Fernández de la Peña, R. C. M. Secretary and manager of hunting territories on Madrona; to Mr. Ricardo López de Carrizosa, Duke of Algeciras, and Mr. Andrés Elosúa Rojo (owners of hunting estates), to Mr. Guillermo Reparaz Valhonrat (experienced wild goat hunter), to Mr. Lázaro García Muñoz, Mr. Manuel Adán Rodríguez and Mr. Santiago Fernández Viso (game keepers). Grateful thanks are also extended to EGA, Wildlife Consultants, organizer of the III WCMU.

### References

- ALADOS, C. & ESCÓS, J. (1995). Ecology and behaviour of the Iberian wild goat. *National Museum of Natural Sciences Monographs*, n.º 11, 329 pp. Madrid. (In Spanish).
- CADENAS, D. (1999). The Iberian wild goat of Sierra Madrona. In GÓMEZ, M. F. *The Iberian wild goat. Hunting Notebook*, 9: 78-80. Madrid. (In Spanish)
- CHAPMAN, A. & BUCK, W. J. (1910). *Unexplored Spain*. Edward Arnold, 456 pp., London.
- DE LA PEÑA, J. (1984). Spanish population of *Capra pyrenaica* in 1982. C. I. C. *Symposium*, Pontresina. (In French).
- FANDOS, P. (1989). Distribution of the Iberian wild goat. *Quercus*, 36: 20-26. (In Spanish).
- FANDOS, P. (1991). The Iberian wild goat (*Capra pyrenaica*) in the Natural Park of Cazorla, Segura and Las Villas. *Technical Collection*, Icona, 176 pp., Madrid. (In Spanish).
- LÓPEZ, A. (1995). Gredos and the Iberian wild goat. In TROITIÑO, M. A. *Gredos: Territory, Society and Culture*: 173-202. Gran Duque de Alba Institution & Marcelo Gómez Matías Foundation. Ávila. (In Spanish).
- MCCORQUODALE, S. M.; EBERHARDT, L. L. & EBERHARDT, L. E. (1988). Dynamics of a colonizing elk population. *J. Wildl. Mgmt.*, 52(2): 309-313.
- RIVAS-MARTÍNEZ, S. (1987). *The vegetation map of Spain. Memory*. Technical Series, Icona, 268 pp., Madrid. (In Spanish).

- SÁNCHEZ, L. (2001). The Iberian wild goat of Sierra Madrona. *Hunters*, 52: 6-11. (In Spanish).
- SEBER, G. A. F. (1982). *The estimation of animal abundance and related parameters*. Charles Griffin & Company Ltd., 654 pp., London.
- TELLERÍA, J. L. (1986). *Handbook for the census of terrestrial vertebrates*. Raíces, 278 pp., Madrid. (In Spanish).
- TRIGO DE YARTO, E. (1961). The Iberian wild goat in Spain. *Caza y Pesca*, 217: 12-14. (In Spanish).