

# **THE BIOLOGY AND MANAGEMENT OF MOUNTAIN UNGULATES**

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## CHAPTER 15

## Group Size and Composition of the Spanish Ibex (*Capra pyrenaica* Schinz) in the Sierras of Cazorla and Segura

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### Abstract

The study was carried out in the Sierras of Cazorla and Segura, in the southeastern part of the Iberian Peninsula. Field work lasted one year (from February 1982 to January 1983). For each observation the size and composition of the group and the characteristics of the habitat were recorded. The rut in the population of ibex under study begins earlier than for the alpine ibex (*C. ibex*) and Walia ibex (*C. waliae*), and finishes earlier. In January and February the mixed groups begin to break up into male and females-kids groups. From April to October herds of juveniles (of both sexes) form, during which time the females give birth and rear their newborn. Groups of juveniles and of females-kids predominate in habitats of high vegetation density, mixed groups being more frequent in habitats of sparse vegetation. During the spring and autumn, in their movement to and from the rutting grounds, the male groups occur more frequently in areas of more dense vegetation. Group size is usually larger in open areas than in those of denser vegetation, mixed groups being the largest. With regard to the males attached to those mixed groups, the younger their age the longer they remain in them. Finally, the considerable intensity of tourist pressure on the area during the summer months causes a break-up of the groups of females with kids, as the animals have to move away and hide in areas of denser vegetation, where food is of poorer quality.

### Introduction

The Spanish ibex (*Capra pyrenaica*) lives in isolated populations

distributed throughout the Iberian Peninsula. This study concentrated on the population of the Cazorla and Segura mountain ranges, the animals being currently ascribed to the subspecies *C.p.hispanica*.

The size and composition of social groups are important features of social structure. Referring to this, Jarman (1974) establishes five categories of social groups for African antelopes, demonstrating a relationship between feeding behaviour and group size, e.g. grazing species, to a great extent unselective, may be in large groups as the grass on which they feed can bear much pressure, whereas the browsing species, which are much more selective concerning their diet, live in small groups or are solitary.

As to the advantages of living in a group, most authors (Brock & Riffenbergh, 1960; Cushing & Harden Jones, 1968; Hamilton, 1971; Vine, 1971; Altmann, 1974; Bertram, 1978; Siegfried, 1980; Lipetz & Bekoff, 1982; Underwood, 1982) agree with the idea that individuals in a group reduce their vulnerability to predation through an increase in vigilance. Here Jarman (1974) adds the idea that herds can sometimes exceed their optimum size, thus losing the advantage of alarm communication when they are attacked.

It is worth remembering, however, that a given species can show a distinct social strategy according to the habitat occupied. Thus, solitary species such as roe or white-tailed deer, on the rare occasions in which they occupy open habitats, often group together in herds (Geist, 1974b).

In general, the members of the Caprinae subfamily are highly gregarious species, living in herds of females with kids and young or in all-male groups. This segregation of the sexes in adults is only broken during the rut, when they form mixed groups of both sexes and all ages. However, there are exceptions in the most primitive taxa, i.e. the serow and the goral (Schaller, 1977).

Groups of young animals of both sexes occur in the Caprinae during the period when females are giving birth, as also happens in the alpine ibex (Couturier, 1962), Himalayan tahr (Caughley, 1967) and moufflon (Pfeffer, 1967). It also appears to be common for the males to separate themselves from the females for some time, the extent of bisexual aggregation varying with the species, e.g. in Punjab urial, wild goat, and Asiatic ibex, the males

remain with the females throughout the year, whereas in chiru, mountain goat, argali, bighorn and Himalayan tahr, the sexes separate only during certain periods (Schaller, 1977). Moreover, segregation of the sexes also appears to be related to the habitat occupied: in Walia ibex the males spend more time with females than in alpine ibex (Nievergelt, 1974, 1981). Furthermore, according to Couturier (1962) the population density of alpine ibex influences herd composition.

I thank F. Alvarez for revising an earlier draft of this chapter and J. Gonzalez for the computer programming of the statistical analysis.

## Material and Methods

### Criteria for Age and Sex Classes

*Old males:* males older than 8 years (those having a black stripe on the flanks, especially conspicuous in winter).

*Adult males:* males between 4 and 8 years old; their size is bigger than that of adult females and the black stripe on their flanks is thinner than on old males. Their horns, when seen laterally, are S-shaped with the tips pointing upwards and inwards.

*Subadult males:* males between 2 and 4 years old; same body size as adult females or slightly bigger; horns larger and thicker than adult females. The horns are not yet S-shaped and their tips are bent backwards.

*Yearling males:* males between 1 and 2 years old; body size smaller than adult females; their horns similar to the adult females, but thicker.

*Adult females:* horns well developed and maximum body size for females.

*Yearling females:* females with both horns and body size smaller than adult females. Data concerning this class must be taken with some caution as such females can be confused with adult ones, if seen from afar and if there is no other individual class serving as a reference.

*Kids:* individuals between 2-3 months and 1 year old; horn size clearly smaller than yearling males or females.

*Newly born:* animals up to 2 or 3 months old, until their horns are clearly visible.

### Group Types

The following group types were considered:

*Mixed groups:* in which adult or subadult animals of both sexes are found.

*Females-kids groups:* adult females with kids or newly born. They may be accompanied by yearling males or females.

*Yearling groups:* yearling males or females, possibly some subadult males as well.

*Male groups:* males of all ages.

### Data Recording

The study was conducted between February 1982 and January 1983.

In July and August few data were collected because of the huge tourist pressure in the study area, making the work difficult and the results less reliable. Thus, data for these months must be taken with some caution and considered suggestive only.

In the study area the ibex live together with four other species of ungulates: red deer, fallow deer, moufflon and wild boar. Hunting and poaching exert a fairly great pressure on all these species. Records included the number of individuals present in each observed group, their age and sex classes, place, habitat, date and time of the day. Observations were made either by car or on foot. When by car, the vehicle was stopped and I waited for the ibex grouped together to flee and, as the flight was not usually fast, it was also possible to record the size of the group and the relevant age and sex classes. When it was not possible to record the full size and composition of the group the observation was removed from the records.

### Study Area

The study was conducted in the National Reserve of the Sierras of Cazorla and Segura: an area of 71,000 ha located in the south east of the Iberian Peninsula, latitudes 37°45' and 38°10' and longitudes 2°40' and 3°00'. The highest peak of these mountains is 2,107 m a.s.l.

Areas above 1,200 m have winter snowfalls, the snow remaining all winter over 2,000 m, whereas in the lower areas the snow is scarce and the temperature sometimes reaches above

40°C in summer. The mean annual temperature of these mountains is about 13.5°C. Rainfall varies in different areas of the mountains, generally being around 1,500 mm annually.

The nature of the area includes mostly Mediterranean woodland, ilex being the main shrub, on limestone rocks.

Mountains have been reafforested with *Pinus nigra*, *P. pinaster* and *P. halepensis*, which, together with *Quercus ilex*, are the main tree species.

For the purpose of this study, two habitats with ibex were considered:

- Open habitat: A low vegetation density, either because of a rocky surface with oaks and other bushes growing in the hollows, or because of grassland with few or no trees. This habitat supplies the ibex with valuable food.
- Closed habitat: A high vegetation density with space between bushes or trees smaller than 8.6 m.

## Results

The percentage of animals present in each of the different kinds of groups observed, referring to the total of animals observed, changes significantly ( $\chi^2 = 259.4$ ,  $p < 0.001$  for mixed groups;  $\chi^2 = 112.4$ ,  $p < 0.001$  for females with kids groups;  $\chi^2 = 21.1$ ,  $p < 0.01$  for yearling groups;  $\chi^2 = 130.5$ ,  $p < 0.001$  for male groups) throughout all months of the year (Figure 15.1).

Thus, although mixed groups occur throughout almost all the year except August, the highest ratio of animals in these groups is from November to February (Student-Fisher test,  $t = 7.3$ ,  $\alpha = 0.01$ ). On the other hand, the females-kids groups increase from February onwards and reach their maximum in August, the month in which mixed groups are not found and in which the young, born the previous year, join their mother again after the period dedicated to the birth and care of the newly born (from May onwards) is over. It is worth pointing out that, although the birth season reaches its peak in May, some newly born are still found in the autumn and early winter.

The mixed groups begin to scatter during January and February, forming male groups and females-kids groups. The latter two group sizes increase as the mixed groups decrease.

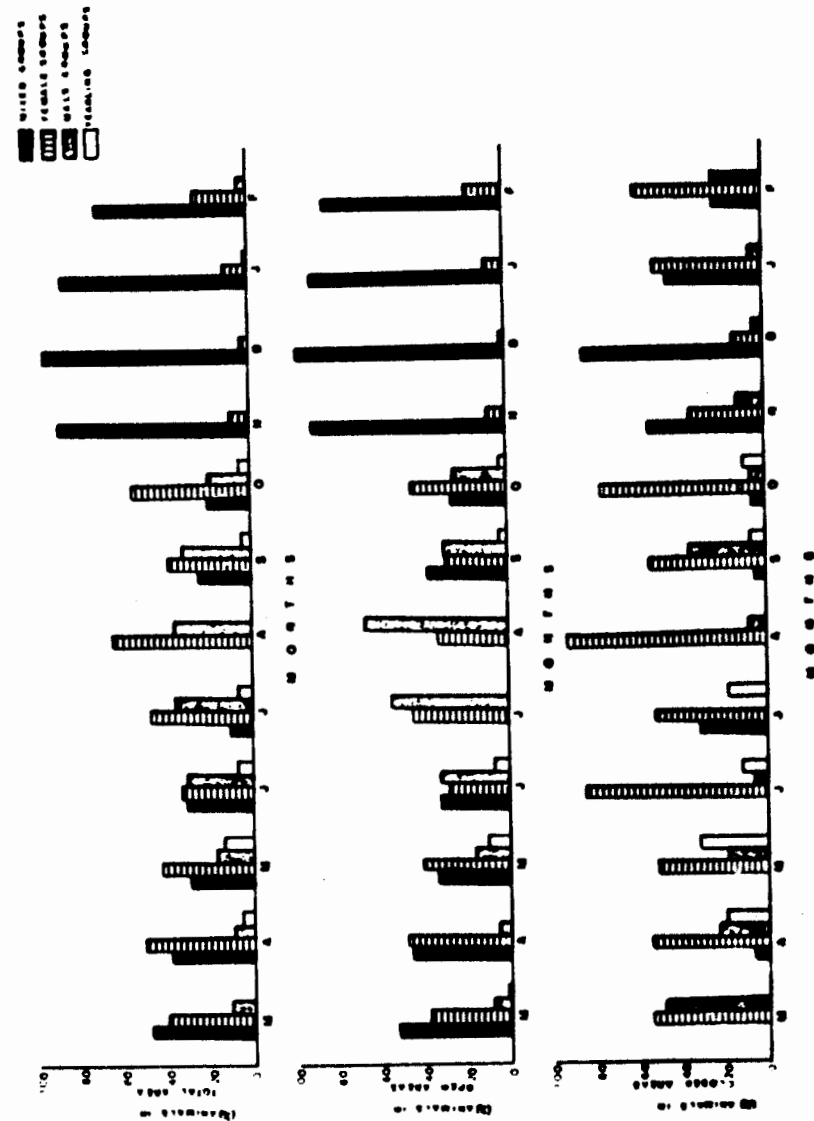


Figure 15.1: Relative Percentages of Animals in Different Group Types Throughout the Year

reaching their maximum in July and August. The male groups reach their peak during the warm months, particularly from June to September (Student-Fisher test,  $t = 6.8$ ,  $\alpha = 0.01$ ).

The frequency of mixed groups is greater in open habitats than in wooded ones throughout the year (Wilcoxon test,  $T = 4$ ,  $\alpha = 0.01$ ), whereas females-kids groups and yearling groups prevail in closed habitats (Wilcoxon test,  $T = 4$ ,  $\alpha = 0.01$ ,  $T = 1$ ,  $\alpha = 0.005$  respectively). The male groups are more numerous in wooded habitats than in open ones in February, March, April and May, shifting to open habitats in June, July and August, when the grass begins to grow. Differences are, however, not statistically significant (Wilcoxon test,  $T = 39$ , NS).

Figure 15.2 (mixed groups) shows that the number of individuals in open habitats exceeds that in wooded ones (Mann-Whitney test,  $U = 27$ ,  $\alpha = 0.01$ ).

The maximum number reached for mixed groups in open habitats coincides with the rut (November-December): sometimes between 40 and 50 individuals at the beginning of the rut. The minimum number occurs in the summer months.

There are more females-kids groups in open habitats (Mann-Whitney test,  $U = 24.5$ ,  $\alpha = 0.01$ ). On the other hand the number of individuals is very uniform in wooded habitats (Kolmogorov-Smirnov test,  $D = 0.017$ , NS).

A greater number of individuals seems to occur in male groups in open habitats than in wooded ones, reaching its maximum in March in both kinds of habitat, gradually decreasing in the following months, with its minimum at rut time; however, these differences are not significant (Mann-Whitney test,  $U = 52.5$ , NS).

If one evaluates the distribution of each class in the types of groups and habitats (Figure 15.3), it is observed that most females are found in mixed groups from November to February ( $\chi^2 = 235.6$ ,  $p < 0.001$ ;  $t = 6.7$ ,  $\alpha = 0.01$ ), whereas the majority of them are found in females-kids groups during the remaining months of the year.

In the warm months the percentage of females in wooded habitats increases ( $\chi^2 = 186.2$ ,  $p < 0.001$ ;  $t = 5.73$ ,  $\alpha = 0.001$ ).

The kids are distributed between females-kids groups and mixed groups in the same manner in which their mothers are, except from May to July, during which time some kids can be found in yearling groups (Figure 15.3).

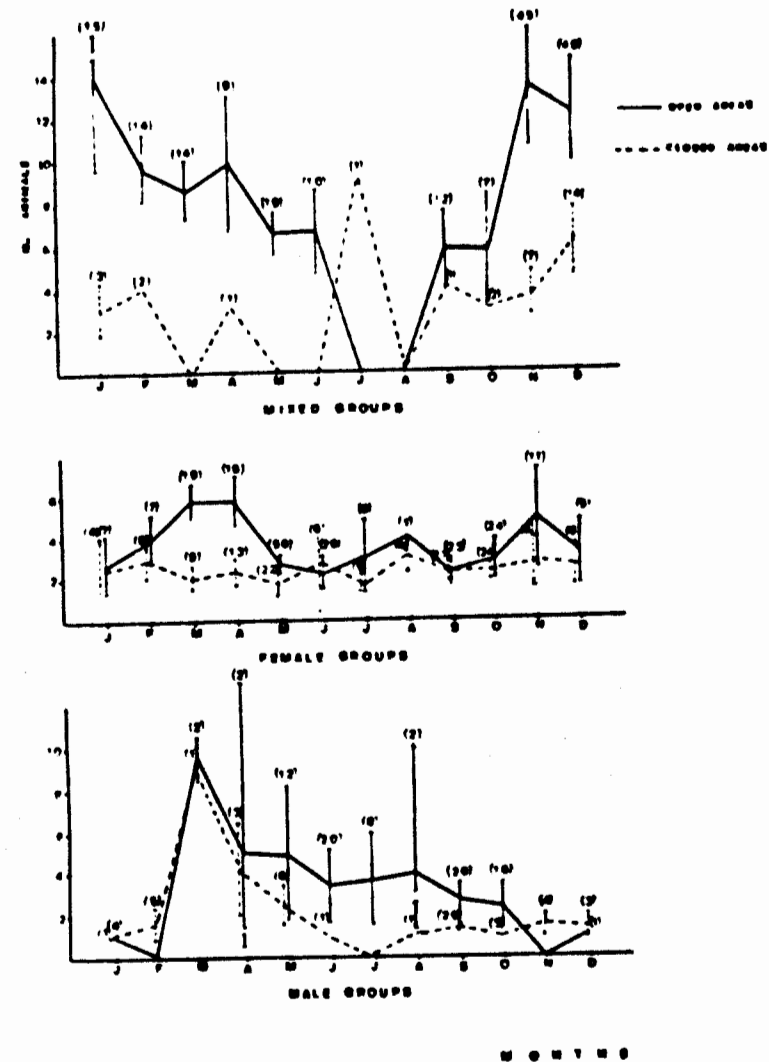
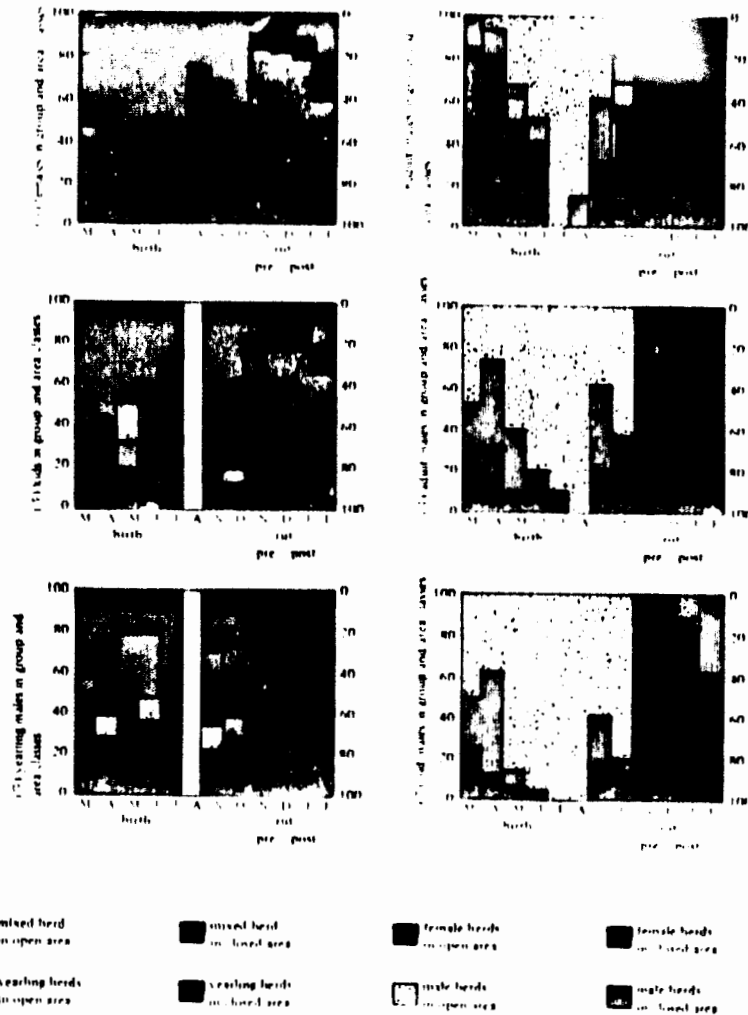


Figure 15.2: Mean Herd Size of the Different Group Types in Open Areas and Closed Areas. The numbers in parentheses show the number of groups observed and vertical lines show the standard error of the mean.

The young males are distributed in every type of group. So from November to February (inclusive) they are found mainly in mixed groups and, in the remaining months, in the different groups and habitats (Wilcoxon test,  $T = 0$ ,  $\alpha = 0.05$ ).



**Figure 15.3:** Proportion of the Different Types of Groups Located in Open and Dense Vegetation Habitats

The subadult males are found in large numbers in mixed groups from October to May (Wilcoxon test,  $T = 0$ ,  $\alpha = 0.05$ ), although from March onwards they shift to the young groups and male groups, the highest percentage occurring later in the summer.

The shift from subadult males from mixed groups to male groups is gradual, through the yearling groups.

ibex less than two years old group together from April until October. Their group size reaches its maximum in May, the month when the highest number of births occurs.

The adult males are found in mixed groups in a high proportion (greater than 90 per cent) between the months of November and February, shifting to male groups in the remaining months of the year (Wilcoxon test,  $T = 0$ ,  $\alpha = 0.005$ ). Such a shift seems to occur gradually, when these animals start living in wooded habitats.

Old males spend less time with the females than subadult males ( $\chi^2 = 90.1$ ,  $p < 0.001$ ). So, in November and December, the proportion of old males in the mixed groups is greater than 90 per cent, decreasing in January and February and especially in May.

The movement of old males from some types of groups to others occurs when the animals are in habitats of denser vegetation.

**Discussion**

If one compares the percentage of individuals living in mixed groups of *Capra pyrenaica* on the Sierras of Cazorla and Segura with the data provided by Nievergelt (1974) for *C. ibex* and *C. walia* (Figure 15.4), the period with the greater proportion of individuals in mixed groups, coinciding with the rut, appears to begin earlier in *C. pyrenaica* than in the other species, and the proportion appears to decrease somewhat earlier. In the remaining months of the year, when the proportion of individuals living in mixed groups is less than the average, the Spanish ibex is generally intermediate between the Alpine and the Walia ibex, probably in relation to relevant intermediate weather conditions.

It is worth emphasising that even outside the rut the Spanish ibex shows a male group size (3.0) intermediate between those recorded for the Alpine and Walia ibex (7.6 and 1.5 respectively).

The separation of males and females to form different groups grazing in separate areas, at higher altitude for male groups, as in *Cervus elaphus* (Burckardt, 1958), is explained, according to

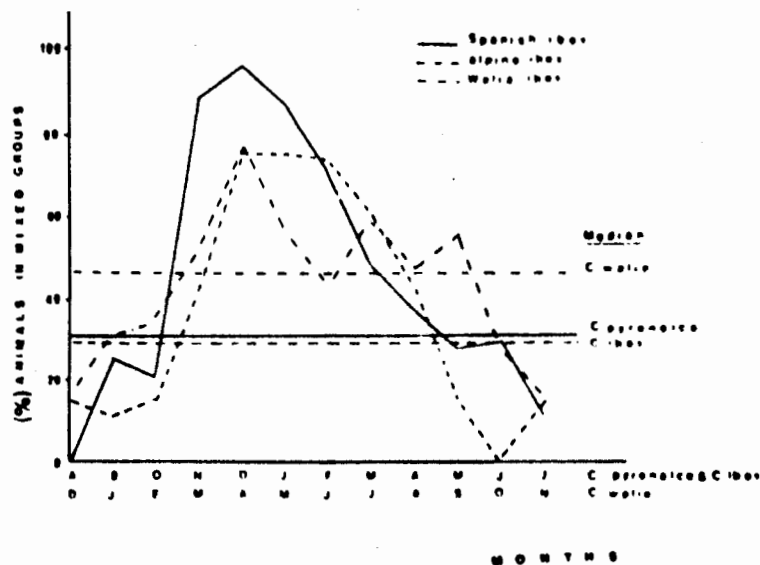


Figure 15.4: Proportion of Mixed Groups in Spanish Ibex, Compared to Walia Ibex and Alpine Ibex (data of the last two species from Nievergelt, 1974).

Geist (1974a,b), by the need of these age classes not to compete for food. This behaviour corresponds to that described for the Alpine ibex (Couturier, 1962): when the population density is high, the adult males and females segregate into separate groups, whereas, when the population density is low, as occurs in recently established colonies, both sexes are grouped together.

The pattern depends on the fact that the yearlings are expelled from the female groups at the time of new birth or immediately afterwards. The first to separate from the female groups are young and subadult males.

Comparable behaviour has been shown for many other species of ungulates (Alpine ibex, Couturier, 1962; feral Soay sheep, Grubb & Jewell, 1966; Himalayan tahr, Caughley, 1967; moufflon, Pfeffer, 1967; feral goats, Rudge, 1970).

The number of individuals living in different kinds of groups changes in accordance with the type of habitat. In habitats with a high density vegetation, the females-kids groups and the yearling groups predominate, probably in relation to the protection that

the vegetation provides against predators and man. On the contrary, the mixed groups are found chiefly in habitats with low vegetation density; the larger size of these groups determines the habitat selection.

Male groups are more frequent in wooded habitats during the months in which they are moving from the winter areas to the summer ones, which are mainly open habitats.

In general, for our ibex, group size is bigger in open habitats than in closed ones, just as for other species of ungulates, e.g. roe deer and white-tailed deer (Geist, 1974b), probably because of the advantages that grouping provides against predators (Mirth, 1973; Altmann, 1974; Estes, 1974; Jarman, 1974; Underwood, 1982), or because the higher visibility possibly allows them to maintain the group cohesion (Ewer, 1968; Walther, 1972). In the same way Walther (1978) compared the groups of *Oryx beisa* observed in open habitats with those observed in closed habitats and reached the same conclusions. Jodra (1981) also observed similar behaviour in fallow deer.

The size of mixed groups is greater than that of the other types of groups; this is also true with Punjab urials (Schaller, 1977), fallow deer (Jodra, 1981) and mule deer (Koutnik, 1981), reaching its maximum size on the rut.

The size of female groups in open habitats is somewhat smaller from May to October, contrary to what we might have expected, as in the case of Walia ibex (Nievergelt, 1981). A possible cause of this difference is the effect of tourism on the group size. The grazing areas are the places chosen by tourists to go camping, and this causes the groups to break up and flee to places of greater vegetation density, where it is easier to hide.

In the wooded habitats the group size of females with kids does not change throughout the year. This is not the case for male groups, in which a distinct peak is observed in March, coinciding with the peak in open habitats. The increase in size of the male groups is probably due to the seasonal movement that takes place in March from the winter areas to the spring-summer areas. On the other hand, movement from summer areas to winter areas, in September and October, does not produce large herds, probably because the males do not tolerate one another near the rut.

Older males show a definite peak in staying in mixed groups than younger males, as also occurs in Walia ibex (Nievergelt,



1974, 1981) and Punjab urial (Schaller, 1977). One may conclude that the younger the males, the longer they stay with females (but on the rut, older males chase them out).

Yearling males, when they separate from adult females during the birth and first days of rearing the kids, group together with other yearlings, some even joining the adult male groups, as Couturier (1962) also observed for the alpine ibex.

On the other hand, it is important to emphasise that females and young are hidden in dense vegetation during the warm months, probably because of tourist pressure, which is detrimental to their nourishment as their food requirements would be better satisfied in grassland.

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