SOME ASPECTS OF VICUÑA *Vicugna vicugna* BEHAVIOUR IN LAGUNA POZUELOS, JUJUY, ARGENTINA

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Abstract: Vicuñas *Vicugna vicugna* were studied in Laguna Pozuelos Reserve (NW Argentina) in the dry-winter and wet-summer seasons. Animals walked and grazed less in summer than in winter. We did not find a marked daily pattern of activities, except from going to drink water in the dry season. After and before this movement alert increased. Males were more alert than females which grazed more. The mean family group was very similar as other vicuñas populations.

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1. Introduction

The vicuña *Vicugna vicugna* is a small (average 45 kilograms) wild South American Camelid that lives in a high ecosystem called Altiplano or Puna (Koford, 1957). The distribution of the species includes the Neotropical Region Andean-Patagonian Domain with two provinces: Puna and Altoandina. The habitat is typically a high plateau of more that 3,500 meters above sea level with a xerophilic steppe. Arid, cold and windy (Cabrera, 1976). The distribution includes 5 provinces in the Northwest of Argentina. South American Camelids have important physiological and ethological adaptations to those extreme conditions. In the case of the vicuña, we can say that : "Vicuñas are environmentally low -impact grazers"(Baied & Wheeler, 1993). The vicuñas habitat have different anthropic uses and in most part of their distribution vicuñas share the habitat with domestic camelids as lamas *Lama glama* and exotic cattle as sheep, cows and goats. In some wild areas they are sympatric with the other wild camelid, the guanaco *Lama guanicoe.*

Vicuñas are important in terms of the ecology of the Puna as they are the biggest wild grazers in the steppe, and in terms of the economy of local people as they have the finest animal fibre in the world (Franklin, 1982). The value of that fibre put on risk the survival of vicuñas in the 60s. Vicuñas are now classified as **LRcd** (Lower risk: conservation dependent) in the 1996 Red List of threatened Animals (IUCN) that means that vicuñas are not vulnerable only because conservation efforts, the cessation of which would result in the taxon qualifying for one of the threatened categories within a period of five years. In two countries (Perú and Chile) and in one province of Argentina (Jujuy) vicuñas are classified in the appendix II of CITES with management exploitations plans on going. In other provinces of Argentina, the species might be protected until they increase their populations.

Most of the work on ecology and behaviour of vicuñas has been made studying Peruvian vicuñas *Vicugna vicugna mensalis* (Koford, 1957; Franklin, 1974, 1983). Argentinean vicuñas belongs to another subspecies (Wheeler, 1991) *Vicugna vicugna vicugna* with some differences in the colour and the lack of the frontal chest. The species has the southern distribution in Argentina.

The Argentinean vicuñas has been studied for several years in Laguna Blanca (Catamarca), Abrapampa (Jujuy) and Laguna Brava (La Rioja) (Vilá, 1994, 1995; Vilá & Roig, 1992; Vilá & Cassini, 1993). Some populations were sedentary while others migrated in relation with the steppe quality. They have territories with all-year round families and bachelor groups. Compar-

ing different populations from Perú, Chile, Bolivia and Argentina, the family groups showed a very stable structure in number of animals with a mean of one male, three to four females and two offspring (Vilá & Roig, 1992). The inter individual distance between females in a family group is approximately 2.6 meters and the males tend to be a little apart from their females. The bachelor groups were unstable and the animals are very close and moved in a synchronised way (Vilá, 1995). Vicuñas uses dung piles.

The mating system was described as resource defence poligyny with female's defence as well (Vilá, 1992). Most of the aggressive encounters were initiated by the territorial males and the intensity was low with other territorial males (symmetric contest) and high against bachelors (Vilá, 1992).

The Laguna Pozuelos is located in a high altitude intermontane basin at 3,600 m above sea level within the Dry Puna region of Jujuy Province, NW Argentina. The area is protected by several local and international organisations: the lagoon is a Natural Monument since 1981 and a Ramsar location since 1992; the basin has been incorporated in 1991 into UNESCO's World Biosphere Reserve System (MAB). In the area under study, man, sheep, cattle and lamas share the same habitat with the vicuñas. Within this region, conditions are found of reduced atmospheric pressure, widely fluctuating diurnal temperature (about 20 °C), frequent frosts (in winter, temperatures below -20 °C) and reduced moisture (scarce and seasonal rain: 100-250 mm per year, concentrated from December to March) (Thomas & Winterhalder, 1976).

The observation zone chosen was towards the south of Pozuelo's basin, near the Cincel river. It was characterised by patches of different types of soil and vegetation. The predominant vegetation along the Cincel river consists of Tolares *Parastrephia* sp. associated with shallow water beds (Cabrera, 1978). Distant from the river the soil becomes sandier and is covered by shrublands of canjia *Tetraglochin cristatum*, tolilla *Fabiana densa*, añagua *Adesmia horridiuscula*, chijúa *Baccharis boliviensis* with some perennial bunchgrasses *Festuca* sp. that occur in between .

The objective of this work was to study vicuñas in an area with high chances to be elected for a sustainable project and where the animals share their area with local people and their domestic animals. More specifically we wanted to study aspects of vicuñas behaviour in relation to sex and social status and daily activities, as well as compare their behaviour in winter and summer.

Another aspect of this work was to analyse the relation and valorisation of the locals in relation to this wild animal.

2. Methods

Two field trips were made. One in August 1996 (winter and dry season) and one in January 1997 (summer and wet season). Vicuñas were studied in the southern zone of Pozuelos Reserve.

Standardised behavioural sampling methods (Altmann, 1974) were used in both field-trips allowing us to compare the data. Observations were concentrated on vicuñas that lived around the observation hut and were observed from 08:00 to 19:00hs with the aid of a 20x40 telescope and 10-40x63 binoculars. Behaviours were classified (Vilá, 1990) according to the following states: i) grazing, when the animal was standing or walking very slowly with its head close to the ground; ii) walking, or low displacement with head up; iii) running, iv) lying, when resting on the ground; v) standing, with its head up as well as for events detailed as: a) alertness, when standing with the head high and ears erect; b) rolling; c) grooming and e) vocalisations. Scan sampling with instantaneous record (Altmann, 1974) was used: every 30 min in January and every 15 min in August; the study area being scanned 360° from one fixed point. The following information was recorded on a map: type of group, group composition, group location and individuals' activities such as: move (walk or run); stand; lie; graze and alert. Groups were identified before the scan and between scans they were viewed continuously in order to identify the territorial males, which were sometimes at some distance from their families.

In January, time-allocations for males, females and bachelors were registered using focal-animal sampling. Each animal was observed for 15 minutes and behaviour was recorded using the "zero-one occurrence" sampling method (Altmann, 1974) for states (stand, walk, run, lie and graze). Because of its relative short du-

Table 1 - Mean frequences (and SD) of vicuñas observed in different diurnal activities in summer (January-wet) and winter (August-dry) in Pozuelos Reserve (Jujuy-Argentina) and results of the comparison with ANOVA for Kruskall-Wallis.

Activity	Summer	Winter	ANOVA
Walk	0.17 (0.12)	0.18 (0.03)	H=13.1, p=0.0003***
Lie	0.09 (0.10)	0.04 (0.07)	H=26.8, p=0.0001***
Graze	0.56 (0.07)	0.60 (0.03)	H=5.15, p=0.02 *
Stand	0.09 (0.01)	0.07 (0.12)	H=9.87, p=0.002 **
Alert	0.07 (0.07)	0.09 (0.12)	H=2.43, p=0.8 NS

ration, the events (alert, roll, groom, vocalisations) were recorded using the "all occurrences" sampling method (Altmann, 1974). In January, during heavy electric storms data could not be taken Care was taken to choose individually-identified animals in the focal samples, in order to have independent data. As the animals were not marked, error must be allowed for this circumstance. Data was analysed by an ANOVA for Kruskall-Wallis test.

3. Results

3.1 Social Organisation

The mean number of animals observed in the scans was 22.13 (sd=11.78, min=4, max=93). The mean number of animals in family groups was 1: 3.45: 1.73 (male: females: calves).

3.2 Winter and Summer activities

To analyse the differences in behaviour from one month to another, ANOVA for Kruskall-Wallis test was performed (Tab. 1). No differences between months were found for the alert behaviour. On the other hand, animals walked and grazed significantly less (walk H=13.1,p=0.0003; graze H=5.1, p=0.023) but lay and stood more (lie H=26.8, p=0.000; stand H=9.9, p=0.002) in summer (January) than in winter (August).

3.3 Daily pattern of activities

In summer (January) there were no significant differences in behaviours between any particular hour of the day (p>0.05). On the other hand, in winter (August) differences were found in walking (H=20.9, p=0.007) and alertness (H=23.15, p=0.003). The alert behaviour reached its maximum peak just before and after walking (Fig. 1).

3.4 Drinking behaviour

The observation area was divided into zones according to distance from the river: close, intermediate and distant. The number of animals in any activity in each zone was related to the total number of animals in that zone (i.e. animals grazing close to the river/total animals in the scan in the zone close to the river). A difference in spatial distribution of vicuñas was observed.

During the dry season (August) the animals

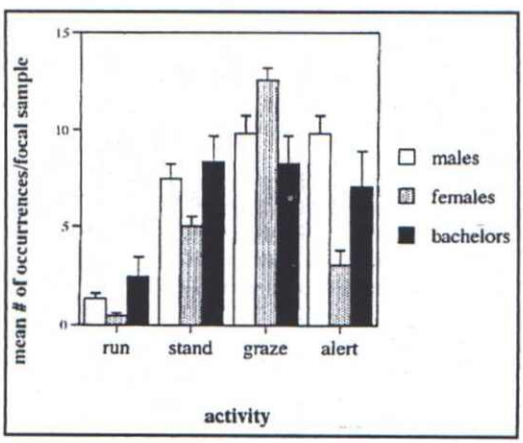

Figure 1 - Daily patterns of graze, lie, walk, alert activities (mean frequencies± SD) in August 1996 (winter) in Pozuelos Reserve (Jujuy-Argentina).

were located most of the daylight time close or at an intermediate distance from the Cincel River. In January animals occupied a distant zone from the river which was covered by puddles from which the animals could drink.

3.5 Time-allocation to different activities

Rolling, grooming and vocalisations were eliminated from the analyses because of their low frequency of occurrence.

The null hypothesis that the frequencies of behaviour were equal for male, female and bachelor was tested using an ANOVA for Kruskall-Wallis test. No significant differences were found for walking and lying ($p>0.05$). On the other hand, this revealed a highly significant differences in running ($H=6.05$, $p=0.0485$), standing ($H=8.56$, $p=0.0138$), grazing ($H=10.39$, $p=0.0056$) and alertness ($H=16.15$, $p=0.0003$).

Separate tests (Tukey HSD for unequal n) were then carried out to compare behaviours between each animal type (male-female; male-bachelor; female-bachelor). Bachelors were found to run more than females, males stood and were more alert than females and females grazed more than bachelors. On the other hand, territorial males spent more time alert than females and bachelors (Fig. 2).

4. Discussion

The mean number of vicuñas in family groups

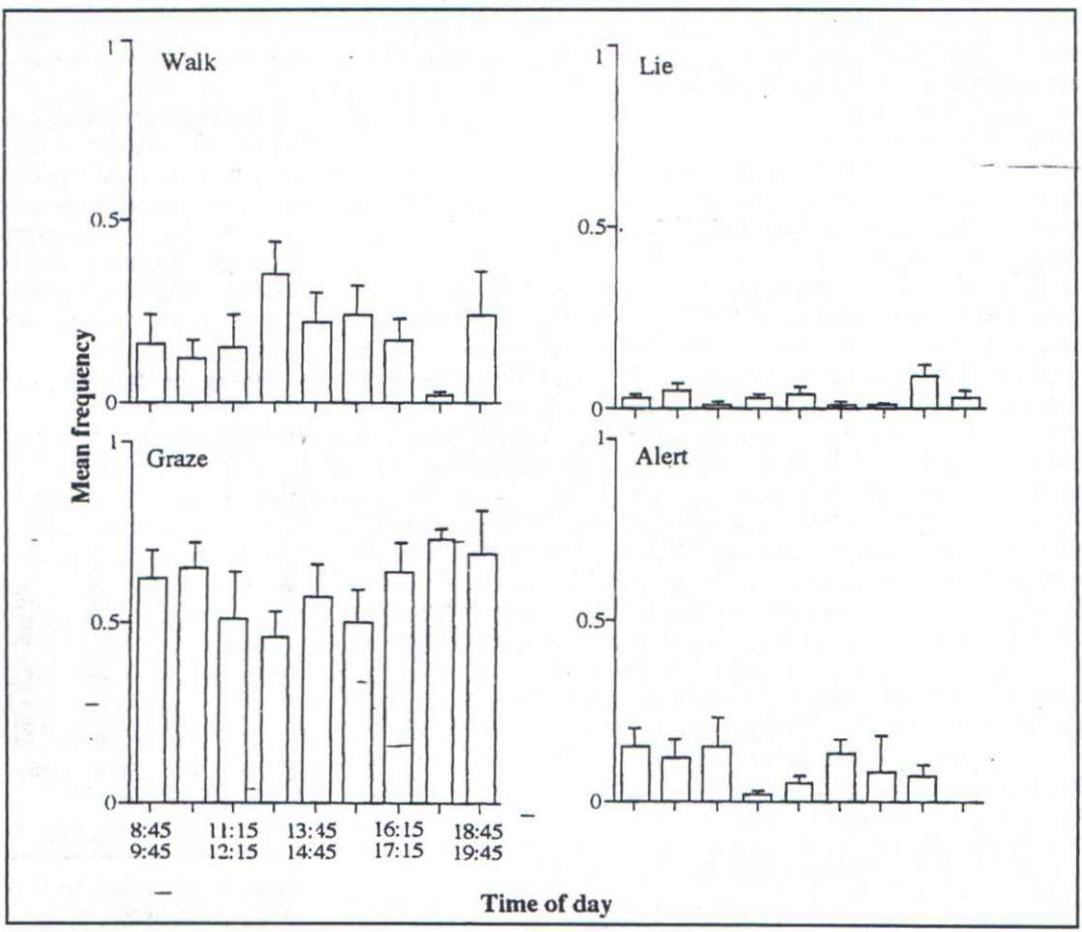

Figure 2 - Mean occurrences of run, stand, graze and alert in relation with type of animal.

found in this study (1:3.45:1.73) was very similar as those found by other authors in other vicuñas populations. Vicuñas have some particularises, although they are polygynic they do not have sexual dimorphism and they have year-round families. A female can live several years with the same male which can fathered of all the calves of that female. Such a stable number of animals in the family groups can be analysed in terms of costs and benefits. Vilá & Cassini (1992) showed that there were an increase in vigilant behaviour by males in relation with the number of females in their families at the expense of grazing.

In this study, we found again that females grazed more than males and males were more alert than females, a classic result in vicuñas (Bosch & Svendsen, 1987; Vilá & Cassini, 1994). Other ungulates behave in the same way during reproductive season, like impalas (Jarman & Jarrman, 1973), deer (Bier & Mc Collough, 1989; Cederlund, 1981) and feral horses (Duncan, 1980; Rubenstein, 1986).

In this study we found that the most frequent activity was grazing (as in most wild ungulates, for a revision see Vilá & Cassini, 1993) and vicuñas grazed more in winter than in summer . One previous paper which compared seasonally activity patterns showed that vicuñas grazed more in autumn than in summer (Vilá & Cassini, 1993). In that paper Vilá & Cassini took the data in February (peak of births) and April (beginning of autumn) . In this study we compared January (before births of the calves, in fact there were no new-born animals in the area) and advanced winter and we found the same tendency. The increase in time grazing in the autumn-winter is typical from the desert ungulates. A similar result can be found in the domestic camelids and sheep in the Puna area in Perú (Pfister *et al.*, 1989) while the opposite with animals foraging more in summer can be found in several northern wild ungulates (Cederlund, 1989).

In this study we could not find a strong pattern of foraging and resting like is typical from savannah ungulates in the summer, but in winter (the dry season) we found a rhythm of going to drink. Vicuñas are "obligate drinkers" so they have to drink free water every day (Franklin, 1974) and of course this affect ecology, behaviour and habitat use.

Before and after going to drink an increased in alert behaviours was found. The main cause can be the alteration of the territories boundaries when the animals went to drink in the river. The vicuñas of Laguna Pozuelos were not studied before this study in a systematically way. We were surprised that we replicated most of the results found in another vicuñas populations showing some common patters of behavioural ecology that are very adaptive to the harsh environment in which this beautiful animal lives. The importance of this kind of studies is crucial for management plans of the area, as it is impossible to manage a resource unknown (Vilá, 1996).

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