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Authors: Lucherini, Mauro, and Merino, María José

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Mauro Lucherini and María José Merino

Perceptions of Human–Carnivore Conflicts in the High Andes of Argentina

*The Andean cat (*Leopardus jacobitus*), one of the world's most threatened felids, forms part of the little-known carnivore guild occurring in the dry areas of the High Andes. Although human–carnivore conflicts are among the major causes of carnivore population decline, no data are available on this issue for the High Andes. We report here the results of the first survey of human perceptions of, and attitudes towards, carnivores in the high-altitude Andes of Argentina. Interviews with 50 adults and 226 schoolchildren revealed that pumas (*Puma concolor*) and foxes (*Lycalopex culpaeus*) are considered pests for preying upon livestock and are actively hunted by adults. Although perceptions of the Andean cat and the Pampas cat (Leopardus colocolo) were more positive, especially among schoolchildren, they are also frequently killed by local people. We suggest that, contrary to what was previously thought, hunting might be affecting the conservation status of the Andean cat and of some puma populations in the High Andes of Argentina, and that education strategies may help to improve human attitudes, particularly in the case of the endangered Andean cat.*

Keywords: *Carnivores; interviews; Andean cat; Pampas cat; puma; culpeo fox; perceptions; conservation; Argentina.*

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Introduction

Human–carnivore conflicts are among the major causes of population decline in mammalian carnivores (Treves and Karanth 2003) and can be particularly controversial when the resources concerned have economic value (eg livestock) and the predators involved have a high conservation profile (Graham et al 2005). These conflicts are widespread and occur also in mountain regions, as is the case for snow leopards (*Uncia uncia*) in Asia's highlands (Mishra et al 2003).

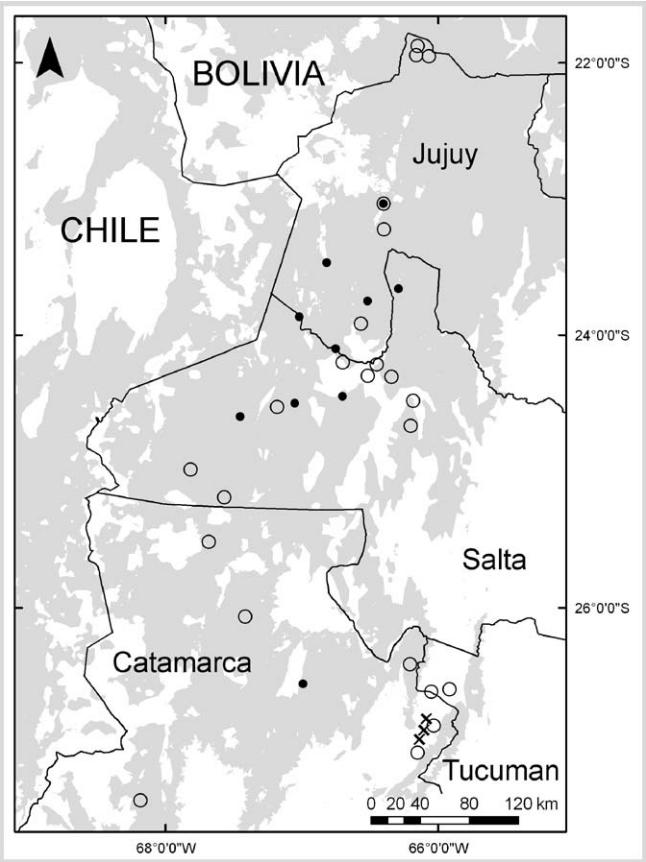
The dry areas of the high-altitude Andes (> 3000 m, also known as Puna) are a South American ecoregion regionally (BSP et al 1995) and nationally (Bertonatti and Corcuera 2000) ranked with the highest conservation priority because of their outstanding biological value, high endemism rate and vulnerable conservation status. Nevertheless, this ecoregion is one of the least-known wilderness areas of Latin America. Vast areas have been only superficially explored and their biodiversity is still little studied (Lucherini 1994).

The Andean cat (*Leopardus jacobitus*), which has been categorized as endangered (Nowell 2002), is the most threatened mammalian carnivore in the High Andes ecoregion (Villalba et al 2004). While this small cat is almost exclusively associated with the High Andes of Argentina, Bolivia, Chile and Peru (Nowell and Jackson 1996; Yensen and Seymour 2000), the Puna is also inhabited to a variable extent by other carnivores: culpeos (*Lycalopex culpaeus*), chillas (*Lycalopex griseus*), pumas (*Puma concolor*), Pampas cats (*Leopardus colocolo*), lesser grisons (*Galictis cuja*) and South-American hog-nosed skunks (*Conepatus chinga*) (Villalba et al 2004). Whereas the Andean cat, because of its delicate conservation status, has recently been the focus of research (García Perea 2002; Lucherini and Luengos Vidal 2003; Perovic et al 2003), the other members of the carnivore guild have so far received little attention (but see Walker et al 2007) and no estimates of populations and trends are available.

Hunting and prey reduction by man have been listed as threatening factors for the survival of the Andean cat (Nowell and Jackson 1996; Villalba et al 2004), and they may potentially affect other carnivores in the region, but the real relevance of these threats for carnivore conservation in the High Andes is almost completely unknown. Studies of human perceptions of carnivores also have been used as a basis for long-term conservation strategies (Conforti and de Azevedo 2003). The Argentine Puna is a dry area, where primary production is low and human communities live almost exclusively off llama (*Lama glama*) and sheep (*Ovis aries*) breeding, while hen breeding is less frequent. The survival of these communities is linked to that of their livestock and, consequently, it may be expected that all carnivores, especially the largest species, are viewed as potential pests. In most cases, livestock ranges freely and is only rarely checked by herders in the High Andes (M. Lucherini, personal observation). This poor husbandry is likely to exacerbate the potential for conflicts. Since carnivore conservation is extremely difficult without the support of local communities (Sillero-Zubiri and Laurenson 2001), negative attitudes, if confirmed, may be of great concern for the conservation of predators in the Puna region and require conservation actions.

The present article aims to explore the existence and extent of human–carnivore conflicts in the high-altitude Andes and their potential consequences for the conservation of carnivore populations in this region. Our main objectives were to understand adult perceptions of and attitudes towards the different carnivores occurring in the area, with particular emphasis on the Andean cat, and schoolchildren's knowledge and per-

FIGURE 1 Map showing the sites where interviews were carried out. Filled circles indicate sites where adults and schoolchildren were interviewed; open circles sites where only adults were interviewed; crosses sites where only schoolchildren were interviewed; solid lines show political borders. Shaded areas indicate the potential distribution of the Andean cat (ie areas between 3500 m and 5500 m). (Map by J.I. Reppucci).



ception of these species. Schoolchildren's attitudes were not investigated because, at their age, they do not take independent initiatives regarding these issues.

Methods

From 2001 to 2005, as part of a conservation project on the Andean cat and during a number of expeditions to the High Andes of northwestern Argentina, we carried out the first systematic interview-based survey of adult villagers (20 to 65-year-olds) and young (9 to 16-year-old) schoolchildren to test the presence of *Leopardus jacobitus* and understand villagers' perceptions of, and attitudes towards, carnivores. Interviews are a widely used technique for surveying mammals, especially carnivores, and for understanding people's perceptions (eg Dietrich 1995; Rabinowitz 1997; Brooks et al 1999; Conforti and de Azevedo 2003; Marino 2003). We interviewed 50 adults (14 women and 36 men) belonging to different families from 33 settlements, and 226 students from 14 rural schools (Figure 1). The area covered by these surveys falls within 4 Argentine provinces (Catamarca, Jujuy, Salta, and Tucumán) and spreads over approximately 89,500 km^2. The settlements we visited were located between 2000 and 4500 m, but our interviews of adults were always aimed at people who either lived in or frequently visited the High Andes areas (herders, in the great majority of cases, or guides).

Interviews followed a semi-structured procedure (Kapila and Lyon 1994) and were based on a standard questionnaire that was not used in the presence of the interviewees. Interviews were informally carried out by 2 or 3 researchers. Here we report the results obtained from the answers to the following research questions: 1) Which carnivores are causing problems of livestock or hen predation? 2) Which carnivores do you usually hunt and why? We defined "perception" as the opinion shown by respondents, while we used the outcome of their actions to define "attitude." Since people's opinions did not differ between culpeos and chillas, or between grisons and skunks, these data were pooled. For the same reason, and for some identification problems, we used the same procedure with data on small cats.

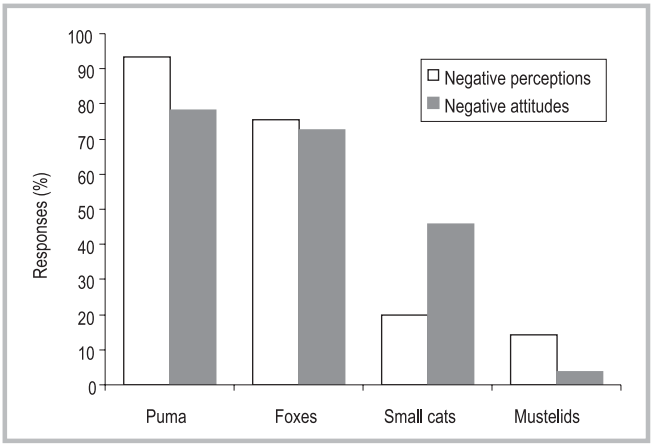
Schoolchildren were individually interviewed through a written form. The questionnaire asked them: 1) to list the wild animals of their region, and 2) to choose between two opposite situations, one showing a man shooting at a small wild cat (interpreted as a negative perception) and the other featuring a man watching a wild cat through binoculars (indicating a neutral/positive perception). To receive more spontaneous answers from schoolchildren, forms were anonymous and the sex of the respondents was not recorded. Results were expressed as a percentage of the responses.

Results

The great majority of the adults who expressed an opinion considered pumas and foxes as pests for preying on livestock (Figure 2). Although the largest fox species occurring in the Puna (*Lycalopex culpaeus*) reaches a maximum body weight of only 11 kg (Jiménez and Novaro 2004), foxes were widely reported as attacking both young and adult goats, sheep, and even llamas, similar to the larger *Puma concolor*. Herders also frequently mentioned that these carnivores were responsible in cases of surplus killing (defined as the slaughtering of more than is required for immediate consumption; Kruuk 1972). Perceptions of smaller carnivores (small cats and mustelids) appeared to be substantially more positive (Figure 2), with the reported cases of predation limited mostly to hens.

More than 75% of adult respondents reported hunting pumas and foxes actively, while this figure decreased to slightly less than 50% in the case of small cats and to only 3.6% for mustelids (Figure 2). Most of the cases of hunting of small felids (56.3%) were revealed only when we specifically asked the interviewees if they possessed some carnivore pelts. As a consequence, the figure we

FIGURE 2 Local people's negative perceptions (percentage of adult respondents who reported problems of predation on livestock) and negative attitudes (percentage of adult respondents who admitted to killing carnivores) related to high-Andean carnivores in Argentina: puma (*Puma concolor*); foxes: culpeo (*Lycalopex culpaeus*) and chilla (*Lycalopex griseus*); small cats: Andean cat (*Leopardus jacobitus*) and Pampas cat (*Leopardus colocolo*); mustelids: lesser grison (*Galictis cuja*) and South-American hog-nosed skunk (*Conepatus chinga*).



report here is likely to be an underestimation of the true frequency of kills of small cats.

Although we were not always able to detect the reasons why carnivores were killed, we found that pumas and foxes were mostly killed as retaliation for the real or imagined killing of domestic animals, or to prevent anticipated livestock predation. The reasons for the negative attitude of local villagers towards small cats were less clear. In some cases, small cats were hunted because they "might prey on chickens or young sheep/goats," but it was also frequently reported that small felids were accidentally killed by shepherd dogs.

Almost all schoolchildren (92.6% of 216 completed forms) reported the presence of carnivores in the area where they lived. Foxes were the carnivores most frequently mentioned (80.6%), followed by pumas (52.5%), while mustelid and small cat frequencies were lower (13.8% and 24.4% respectively). As a comparison, the mountain vizcacha (*Lagidium viscacia*), a rabbit-size rodent very common in the region, was reported by 44.7% of the students.

Schoolchildren were opposed to cat killing in 66.5% of the 215 answers that we obtained.

Discussion

Our data show that local people perceive the existence of conflicts with carnivores in the High Andes of Argentina, similarly to many other areas (Kruuk 2002, for a review), and that, consequently, people's perceptions of large carnivores are clearly negative. In the case of pumas and foxes, this opinion was mirrored by a similarly negative attitude towards them. Only a minority of the respondents passively accepted livestock losses, and the slight difference between the proportions of adults who considered pumas as pests and those who reported killing them was mainly due to the fact that some herders mentioned having trouble finding/killing the animal responsible for the attacks. On the other hand, despite the fact that most interviewees did not reveal a negative perception of the two small cats that are native to the High Andes, we found that killing of these species was relatively widespread. The causes of this practice vary, but appear to be based mainly on the concept that the only good carnivore is a dead carnivore.

In the Patagonia steppe, another ecoregion with low primary production, hunting pressure keeps culpeo numbers low at specific sites and herders have succeeded in eradicating puma populations from most of this vast area (Novaro and Funes 1994; Novaro 1997; Novaro et al 2004). To evaluate the impact of hunting on the High Andes carnivores based on the human attitudes that we recorded, estimates of carnivore population density/trends for this region would be necessary. Nevertheless, because of the low productivity of the Puna, it is logical to expect comparatively large home ranges and low population densities for carnivores (Fuller and Sievert 2001). In this scenario, even moderate losses caused by hunting can have disproportionately negative effects. Since intrinsic biological traits greatly affect the probability of extinction in carnivores (Cardillo et al 2004), it may be expected that the present level of human pressure has different effects on the carnivore species in the Puna.

In the case of the Andean cat, it has been suggested (Nowell and Jackson 1996; Villalba et al 2004) that the effect of hunting is possibly not a major cause of mortality, because: 1) human density in the Puna is low, especially in the southernmost part of the distribution range of *Leopardus jacobitus* (Nowell and Jackson 1996); 2) in some areas of the Puna in neighboring countries, small cat skins are used for traditional ceremonial purposes and are transferred from one generation to the next (Villalba et al 2004). Our data indicate that the situation in Argentina is different. Although small cats are rarely considered to have a negative effect on livestock, the frequency of killing was relatively high and people often claimed that these kills were followed by the long-term disappearance of small felids from the areas surrounding their settlements. Additionally, similarly to what has been suggested for guignas (*Leopardus guigna*; Silva-Rodríguez et al 2007), actual mortality owing to dogs is probably higher than reported, because people are not necessarily aware of what their dogs do when ranging freely. Another reason for concern is that we observed that the traditional respect surrounding cats in other parts of their range is rare in our country (out of the 12 small cat pelts that we recorded in Argentina, only two showed the typical decoration for religious ceremonies). Furthermore, only a few of the people interviewed (mainly in the part of the country bordering Bolivia) were aware of this traditional use of cat pelts. Although a more complete study is needed to understand the true extent of human–carnivore conflicts, we

suggest that in the case of the Andean cat, which has a reduced distribution range and is apparently rare (two of the main biological factors affecting extinction risk; Cardillo et al 2004), hunting may represent one of the main factors affecting its survival in Argentina.

Although small cats are legally protected in Argentina, given the remoteness and large expanse of the Puna region, law enforcement agencies are able to exert very little control over hunting. Nevertheless, other aspects of our results suggest some optimism about the future attitude of local communities towards small cats. Our interviews of young villagers showed that they are well aware of the presence of carnivores in their region. Furthermore, the perception of small species by both schoolchildren and adults is, in most cases, tolerant, especially when compared to that of pumas. This finding deviates from what has been recently reported for Southern Chile, where people's perceptions of pumas were negative, like their perceptions of another small cat, the guigna (Silva-Rodríguez et al 2007). Finally, we found that, frequently, small cats were not actively persecuted by herders; rather, they were killed by shepherd dogs, a kind of "accident" that can be reduced if local people start perceiving the Andean cat as an important component of their own heritage.

While human perceptions of and attitude towards mustelids do not raise particular concern, the situation of the large carnivores is likely to be different. Similar to what has been reported for both species in Patagonia (Travaini et al 2000), and for *Puma concolor* in other areas (Kellert et al 1996, in North America; Conforti and de Azevedo 2003, in Brazil; Silva-Rodríguez et al 2007, in Chile), foxes and pumas are perceived as pests and actively hunted in the High Andes. Based on the reports we collected, the field data available (Lucherini et al 1999), and the more general flexibility and capacity to deal with human persecution of fox-like canids, present levels of fox hunting are probably not a significant threat. This may not be the case for *Puma concolor*. Despite the fact that it is one of the most adaptable felids (Sunquist and Sunquist 2002) and is still widely distributed in Argentina (Lucherini et al 2004), the puma has already been exterminated from many areas in Argentina (Novaro et al 2004; Luengos Vidal et al 2005), and our field surveys have found that it is comparatively rare (Lucherini et al 1999; M. Lucherini, unpublished data). We suggest that puma populations in the High Andes require careful research and monitoring to understand their present status.

Ecological research is fundamental for the conservation of any species (Wilson 2000) and more data are certainly needed for us to understand the impact of human activities on carnivores in the Puna region. However, as recently acknowledged by Ginsberg (2001), autoecological studies, as well as detailed population biology research, should be coupled with simultaneous conservation actions, especially when dealing with small, little-known carnivores and when conservation resources are limited (Clark et al 2001; Macdonald and Sillero-Zubiri 2004). Carnivores can be very powerful focal/flagship species for the conservation of ecosystems (eg Estes 1996; Mech 1996), but we first need to improve their image among local communities.

Since human attitudes towards carnivores tend to be shaped by understanding and knowledge of a particular species (Kellert et al 1996), education is widely recognized as a major part of the equation (eg Hurst 1998; Sutherland 2001; Villalba et al 2004). We found that carnivores are among the best-known fauna and that the small cat is perceived positively among schoolchildren. These findings confirm carnivore charisma, and the fact that specific conservation education strategies, carried out by multidisciplinary teams, may help reduce conflicts, particularly with small species (Silva-Rodríguez et al 2007; Merino et al 2008). However, other tools such as insurance schemes, incentive-driven conservation, and eco-tourism (Hussain 2000; Sillero-Zubiri and Laurenson 2001; Hutton and Leader-Williams 2003; Bagchi and Mishra 2006) should also be explored, since it is unlikely that the negative attitude of adults towards carnivores will be transformed merely through educational programs (Conforti and de Azevedo 2003).

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AUTHORS

Mauro Lucherini and María José Merino
Grupo de Ecología Comportamental de Mamíferos, Cátedra de Fisiología Animal, Departamento de Biología, Bioquímica y Farmacia, Universidad Nacional del Sur, San Juan 670, 8000 Bahía Blanca, Argentina. lucherinima@yahoo.com (M. L.); edugattaller@yahoo.com.ar (M.J. M.)

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