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Knowledge and Perceptions of Macedonian Hunters and Herders: The Influence of Species Specific Ecology of Bears, Wolves, and Lynx

Nicolas Lescureux · John D. C. Linnell

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Abstract The fact that human—large carnivore relationships tend to be full of material and social conflicts raises applied questions concerning the origin of human perceptions linked to these animals and more theoretical questions concerning the link between identification and relational processes. This study, based on ethno-ethological surveys in the Republic of Macedonia (SE Europe), aims to show that the widely contrasting species specific behavioural characteristics of brown bears, wolves and Eurasian lynx influence local perceptions of these species through the nature and frequency of their interactions with humans. It appears that a high frequency of interactions allows the relational processes to dominate, leading people to modify their actions in response to the behaviour and ecology of the species. However, the fact that the virtual absence of interactions with lynx has not prevented the construction of a particular image of the species also highlights the complexity of the relationship between the level of interactions and people's perception about animals.

Keywords Human—carnivores conflicts · Ethno-ethology · Interaction · Identification processes · Relational processes

Introduction

The carnivorous diet and need for large living areas of large carnivores has led to an age-old competition with humans for space and food, thereby generating a range of material and social conflicts (Treves and Karanth 2003). As conservation legislation leads to the recovery of these species in multiple-use landscapes (Linnell *et al*. 2009; Linnell *et al*. 2001) many conflicts are currently increasing (Bangs *et al*. 1998; Breitenmoser 1998; Fritts *et al*. 1997; Mech 1970; Treves and Karanth 2003). However, the real economic impacts and risks to human safety are not sufficient to explain the intensity of the negative perceptions (Røskaft *et al*. 2003; Røskaft *et al*. 2007) and social conflicts (e.g. Moore 1994) that are often encountered today. Some authors propose that this reflects the long-term persistence of negative perceptions from earlier times (Clark *et al*. 1996a; Clark *et al*. 1996b; Fritts *et al*. 2003; Kellert *et al*. 1996; Lohr *et al*. 1996). However, other authors suggest that prolonged sympatry with large carnivores can lead to a form of coexistence where compromises are made and conflicts are not perceived as being intense (Boitani 1995).

These applied questions raised by conservation biologists have inspired us to examine the issue using concepts and tools borrowed from anthropology. Indeed, asking the question of the origin of negative perceptions towards large carnivores, and the impact that animals can have on these perceptions parallel the more theoretical questions that anthropologists ask about the impact of the environment on human societies. Although several anthropological works have shown that knowledge and perceptions are not disconnected from the intrinsic properties of the environment (Barrau 1975; Descola 1986; Dwyer 1976; Ellen 1993; Friedberg 1974; Ingold 1974; Randa 1986), the recognition of the interactive properties of human-animal relationships took some time to emerge, as it required rethinking the boundary between nature and culture and the place of animals in anthropology (Descola 2005). Now, recent trends in anthropology have attempted to integrate studies

N. Lescureux (✉) · J. D. C. Linnell
Norwegian Institute for Nature Research,
NO-7485 Trondheim, Norway
e-mail: nicolas.lescureux@gmail.com

N. Lescureux
USM 104 Eco-Anthropologie et Ethnobiologie,
Muséum National d'Histoire Naturelle,
Paris, France

of all the living and non-living components of the human environment (Descola 2001; 2005) and to reveal the influence of their behaviours on human practices, knowledge and conceptions of the world (Brunois 2005a; 2005b). Animals are no longer considered as passive objects by anthropology and they have now been integrated into anthropological studies as actors that influence human social life (Ingold 1996).

In this context, the question of the link between negative perceptions and the existence of conflicting relationships parallels the recent debates in anthropology which concern the causal relationship between identification processes and relational processes. While Descola (2005) suggests that sociological realities are subordinated to ontological realities, and thus that identification (by comparison with humans) is formed prior to the establishment of relationships, Ingold suggests that the identity of each actor, human or animal, builds up through the relationship (1996).

This study aims to contribute to the debate concerning the origin of negative perceptions, and the link between identification processes and relational processes, by analysing how rural dwelling hunters and livestock breeders from the Republic of Macedonia are interacting with the three large carnivore species (brown bear, wolf and Eurasian lynx) with which they share the landscape, and how the relatively different behaviours of these predators influence the interactions they have with the rural populations and the perceptions that the rural population has of them. Firstly, the species differences will be analysed according to the degree their specific ecology and behaviour drives them to cross what informants could consider to be "borders" between the spaces they regularly occupy and those where they only rarely venture, i.e. borders between domestic space and wild space, as it exists in occidental thought and language. These borders can even be more precisely defined as the ones between *domus* (the house), *ager* (the cultivated fields), *saltus* (non-cultivated spaces used as pastures) and *silva* (the forest) as they have existed in southern Europe since Roman times (Descola 2004). Indeed, as we will see, the specific ability of the three species to cross these borders can influence the frequency and the place of interactions. Secondly, emphasis will be placed on how the ecological and behavioural characteristics of each species can influence the positive or negative nature of interactions and therefore the possibility for humans to control the frequency of occurrence and the consequences of these interactions. Finally, all these aspects can be merged into a relational concept of reciprocity which can partly explain the different perceptions linked to the three species, which in turn has clear implications for the development of conservation strategies for these species.

Study Site

The study was conducted in the Polog and Yugozapaden regions of Macedonia (municipalities of Tetovo, Gostivar and Mavrovo-Rostushe, see Fig. 1). The area is predominantly rural, consisting of small towns and agricultural areas in the valley bottoms, with forested slopes, and alpine meadows at higher altitudes. The forests are widely used for hunting and forestry, and the alpine meadows are used by both transhumant and resident shepherds from May to October. Villages are scattered throughout the landscape, and have suffered dramatic declines of the human population during recent years. Western Macedonia is occupied by both ethnic Albanians and ethnic Macedonians, with most Albanians in the region around Tetovo. Bears, wolves, and lynx have been continuously present during recent centuries in these regions of western Macedonia's mountains (Ivanov *et al*. 2008; Salvatori and Linnell 2005; Servheen *et al*. 1998). Both ethnic Albanians and ethnic Macedonians were interviewed. While the populations of bears and wolves are large and well connected with those in neighbouring countries, the lynx population is small and effectively isolated which makes it the focus of extreme conservation interest.

Methods

The investigation of the interactions and relationships between humans and large carnivores requires adopting a holistic approach (Lescureux 2006) based on the narratives told by people engaged in these relationships (Ingold 2000), and including an ethno-ethological perspective which aims to identify the impact of animal ecology and behaviour on human knowledge, perceptions and practices (Brunois 2005b).

We conducted ethnological investigations during four months among hunters and livestock breeders from north-western Macedonia's mountains. Semi-structured in-depth interviews were used to explore local knowledge and perceptions concerning bears, wolves, and lynx. The interview guide contained more than 130 questions divided into several sections (a summary of the interview guide can be seen in Appendix-Table 1). The first section dealt with the activity of the informant and contained questions about hunting or livestock breeding practices. The second section was about the nature and frequency of interactions with bears, wolves and lynx. The questions in the third section were focused on exploring aspects of the behaviour (diet, reproduction, hunting, parental care, etc.) of the different species. The fourth section dealt with the perceptions concerning the species (harmfulness, dangerousness) and the opinions about appropriate wildlife management or conservation practices that should be adopted. Finally, the last section contained questions about the definition and

Fig. 1 Location of the Republic of Macedonia and field area

perception of nature in general and recent changes in the landscape. The interview guide ensured that we addressed each topic with informants but we went to other topics when it occurred, and sometimes we were not able to address some questions. Due to the low number of livestock breeders and the low level of overall population in each village, we had to visit 33 villages to obtain a good sample. Interviews were conducted by the ethnographer accompanied by native Albanian or Macedonian speakers, digitally recorded, and later transcribed and translated. A typical interview lasted for one hour or more and they were conducted in cafes, in private homes or directly in the field. A total of 63 people were interviewed, including 34 livestock breeders, and 29 hunters. Where we present a percentage of respondents who answered in a certain way, we provide the sample size (N) of respondents that answered this question, thus the N may vary from question to question.

Results

Our results allow us to describe the behavioural characteristics of each species as perceived by the hunters and livestock breeders. Their knowledge shows us how the species specific behaviours of bears, wolves and lynx can influence the nature and frequency of interactions with people, and thus the perceptions people have of these animals and the practices associated with them. Moreover, the conflict management methods suggested by local people provide insights into the relational mode according to which they coexist with large carnivores.

Bears, Wolves, Lynx: Species Differing in Their Intrusiveness

Examination of our records concerning the nature and frequency of interactions between humans and the three carnivore species allows us to clearly separate the lynx from the bear and the wolf. All the informants, with the exception of two, had seen bears and wolves, often on multiple occasions. On the contrary, only half of the informants had ever seen a lynx and some informants were totally unaware of what kind of animal it is, despite its depiction on one of the most common coins in circulation. Moreover, among the people who have encountered a lynx (N=28), 50% had met it only once during their life and only 21.4% had encountered lynx twice.

As a consequence of these varying interaction levels, bears and wolves are often perceived as being present, or even numerous, whereas lynx are perceived as being rare or even absent. The frequency of interactions is not only linked to the density of the carnivore populations (ecological surveys indicate that lynx are present, but at low density, while wolves and bears are common (Ivanov *et al*. 2008)), but can also vary according to their behavioural patterns, as for example, lynx are known to be very elusive and rarely seen, even when present, compared to wolf and bear.

Even though bears live mainly in the forest, they often enter into the domestic space when they come into the fields and the orchards around the villages in order to feed on high energy forage such as maize or fruits (Stirling and Derocher 1990). One old shepherd remember the first time he saw a bear: "*When I was 20 years old, I saw two bears. They attacked me because I was guarding the maize, and they went into the maize field*." The bears also use the summer pastures in the mountains. Sometimes they are seen peacefully foraging for vegetation alongside cows, but some bears do not hesitate to enter livestock enclosures to kill sheep. Wolf interactions seem to be particularly linked to livestock. Thus, even if wolves are hidden in the deep forest during the day, they often approach humans when attacking sheep in night-time enclosures on summer pastures. They can even come into the villages: "*Now, in winter, the wolves also come to attack dogs in the villages*", boldly crossing physical and conceptual borders that the bear never crosses, contrary to what has been observed in Spain where bears are more often crossing borders than wolves (Bobbé 1993a). In Macedonia, even when hunters encounter wolves, it is often because the latter are attacking their dogs and thus initiating the interaction. Finally, the lynx is perceived as an almost arboreal animal, living only in deep forests and inaccessible rocky terrain. The fact that lynx avoid open habitats results in their rarely being seen close to villages or livestock enclosures, and on the rare occasions that they kill a sheep it happens within, or close to, the forest: "*The lynx can attack domestic animals if he finds them in the forest. He doesn't like to come into villages to catch a prey.*" With their preference for areas distant from the village and meadows, lynx are only rarely met by a few hunters that venture further from the village than others. This is not the case for bears and wolves, with which the interaction is relatively common and can occur within the domestic areas. While encounters with bears are often the result of chance, interactions with wolves are often initiated by the wolves, which interact with humans by attacking dogs and livestock. This could explain why more livestock breeders encounter wolves each year than hunters (43.8%, N=32 vs. 22.7%, N=22). As one shepherd put it: "*Yes, as we are living in the summer pasture, we often see them, we are living with them!*" Thus, the frequency of interactions with the three species and the resulting perceptions of their abundance are partly influenced by their spatial behaviour and their avoidance of human dominated landscapes. The frequency of interactions with large carnivores seems to have an impact on local population's perceptions but this impact depends on the nature of these interactions and the extent to which they influence human lives.

The King, the Monster, and the Ghost

The impact of each species' behaviour on human perceptions of their harmfulness can be first evaluated through the livestock predation events reported for each of the three species. For the western part of Macedonia, an interview survey among villagers conducted during 2006 reports 566 attacks on livestock from wolves, 43 from bears and four from lynx (Keçi *et al*. 2008). Thus, interactions with wolves are frequent, and often more negative than those with bears and lynx. This can be borne out through the accounts our respondents gave from their encounters with wolves, accounts that often recount attacks on flocks or lethal aggression on hunting dogs.

The fact that wolves often killed multiple sheep in each attack strengthened the negative perception of their attacks and people consider that they enjoy killing: "*... and the wolf too, if he takes a sheep, it doesn't mean anything, because he also has to live, but when he comes into the place where they are [enclosed], he doesn't take only one, he kills them all, all the ones he find... he cleans up. We had a case here when he killed 70 in one night!*"

Even if few livestock breeders are exposed to conflict on this scale, the reputation of the wolf for excessive killing is widespread and gave rise to some idioms like the one from Albanian speaking Macedonians who claims that "*the wolf will kill 99 sheep and die at the hundredth*" (see also Elsie 2001). In the case of a wolf attack on a hunting dog, the negative aspect of the interaction is strengthened by the value accorded to the dog; "*[the wolves] destroyed our zagars*[1] *[...] because a zagar costs me 1,000€, and we do not have money to buy them, and we used years to train them*". The determination of the wolf when attacking them is also noted: "*[wolves] would give up a cooked lamb to catch the zagar. They are so much against dogs, that's incredible!*" The perceived voracity of wolves does not seem to be limited to domestic animals. They are also blamed for damage to populations of game animals. Because of their perceived damage to wild and domestic animals, and harmfulness to nature in general, wolves are described as unprofitable monsters. Moreover, no positive

[1] Zagars are hunting dogs from the Balkans

elements are associated with a wolf encounter. At worst, wolves provoke fear, and at best, disdain, "*as if it would be a dog*" (in the negative sense).

This is very different to the case of the bear, sometimes called "*king of the forest*" or "*king of the mountain*". Bear encounters provoke a mix of fear (respect) and excitement, but never contempt. While wolves are driven back by making loud noises: "*Because the wolf, (...) you just say 'toe!' and he goes away*", people will actively use words and sentences when interacting with bears; such as "*bear, go away!*" or even "*you're pretty, you're pretty!*"

Even if interactions with bears are sometimes the result of an attack on livestock, this event is not common. For that matter, most informants considered that bears mostly eat vegetables and that only a few individual bears feed on animals, whether killed or scavenged. "*The one who is carnivorous, he attacks livestock, because we have enough damage here (...), but the other bear, who is herbivorous, who eats vegetation, (...) he doesn't make trouble.*" Moreover, contrary to wolves, with which bears are almost always compared, bears are believed to settle for a single sheep without causing damage to the whole flock: "*[The wolf] is harmful, he doesn't eat, he only cuts the throat and leaves them, while the bear attacks only one and eats it. They do not cause too much damage*."

Bears and wolves seem to form a 'pair' of opposites (Bobbé 1993b; Gray 1978) while the lynx is a species apart. The interactions with the latter, as well as being rare, are often fleeting. Only two probable lynx depredation events were reported to me and the informants were divided concerning the ability of the lynx to attack domestic animals at all. However, the interactions with lynx can be negative because this animal is often perceived as being potentially dangerous for humans. Their presumed arboreal character, speed, and aggressiveness are believed to make them capable of taking humans by surprise, and an encounter with a lynx can provoke fear, more than an encounter with either a wolf or a bear: "*The lynx? He is even more dangerous than the wolf and the bear, because the lynx, if he wants to hurt you, he climbs on a tree, you do not know, you just pass there... and that's why I put up my hood, because he can fall upon you, directly on the neck. He is dangerous!*" This fear of the lynx can be associated with a kind of fear of the unknown, as most of people who had already encountered one consider the lynx as completely harmless. Despite the widespread fear, none of the respondents had ever heard of a case of people being injured by a lynx, while examples of injurious attacks by bears (and rarely wolves) were reported. Although other studies have shown that levels of fear for lynx are less than for bears and wolves (Røskaft *et al*. 2003, 2007), Bath *et al*. (2008) found relatively high levels of fear and low levels of knowledge for lynx in Poland.

Thus, the different behaviours observed by hunters and livestock breeders during their interactions with the three predator species seem to have a noteworthy impact on their perceptions of each species. This is notably the case for the behaviours of bears and wolves, which are often known in detail, but the case of lynx is different. Many informants admitted their ignorance about its behaviour and the perceptions linked to this animal appear more often based on rumours or *a priori* suspicions towards an invisible and mysterious animal than on personal experience.

"Our Bear", "the Wolves", and Maybe Some Lynx…

As a consequence of the differences between the three predators' behaviours, their interactions with humans and the negative character of these interactions are clearly differentiated between the species. This can be sensed in the informants' perceptions of the three species' harmfulness. Only 23.3% of them (N=60) consider bears as harmful animals, while 98.4% (N=62) see wolves as such. In spite of the very low number of attacks on domestic animals, lynx were perceived as harmful by 52.4% of informants who answered this question (N=48).

Nevertheless, it is likely that the perceived harmfulness for each species is not only linked to the damage it is likely to cause but also to the possibility that the local people have to exert a control over these species. Our interviews revealed that some biological and behavioural characteristics of the three species influenced the ability of humans to exert some form of management on individuals and populations.

Bears are perceived as solitary and spatially stable, and as a long-lived species where individuals can live for several dozens of years. Thus, this animal is easily identified, located and can be individualised. These facts enable local people to appropriate individual bears and to talk about them as *their* bear. As they distinguish between carnivorous and herbivorous bears, any damages are not believed to be caused by bears as a species, but by one bear as an individual, who can be "convicted" by the State and shot. Bears are thus perceived as being relatively controllable; 42.6% of informants were favourable to their legal protection,[2] 23% suggested no action against them and 16.4% advocated selective hunting. Management actions on the population level (regulation, population reductions and elimination) were rarely supported or advocated. This confirms the individualised character of the bear, but can also be associated with their low reproductive rates, which was appreciated by most informants.

[2] Of course, several meanings can hide behind the term protection, but in a general way, for informants, protection was a means to preserve the species and even to reinforce its population but was not interpreted as a desire to protect every single individual.

Interestingly, bears are among the few carnivore species where ethologists and ecologists discuss "personality" (Fagen and Fagen 1996) in recognition of the high degree of individual variation in behaviour.

The profile of wolves was quite different. Even though the informants regarded wolves as being territorial in nature, they also reported that wolves always move, following their prey or looking for livestock, moving to summer pastures during the summer and to the vicinity of villages in winter. Hard to localize, the wolves are not possible to individualise due to their group living. Contrary to the bears, they are perceived as a homogenous population rather a collection of individuals and the harmful characteristics are attributed to the entire species and not just to some individuals. Moreover, while they often approach the flocks and are thus seen by livestock breeders, they are rarely encountered by hunters, and they are regarded as being hard to hunt. Numerous and highly mobile, wolves are perceived as hard to control at a local level, especially as they are regarded as having a greater reproductive rate than bears: "*You can kill and kill but if a she-wolf drops pups, that's already a lot of them!*" Thus, the management of wolves as foreseen by informants is never individually targeted (no selective hunting) and often extreme, as 44.4% of them suggested that wolves be exterminated and 34.9% wanted to reduce their population at a national level, while some also suggested extirpation of this species from Europe as a whole.

The case of the lynx was different again. Indeed, their behaviour was little known and they were perceived as being hard to control because of their rarity. In spite of their presumed harmfulness and dangerousness, 45.9% (N=61) of informants suggested protecting lynx while 24.6% considered that no actions were needed because they did not think that lynx were present.

Maintaining Reciprocity and Distance

Through this analysis of the impact of bears, wolves and lynx behaviours on the perception people can have of their harmfulness and the possibilities they have to control individuals and populations, it appears that there are some species specific differences in the degree of reciprocity (in our case the possibility and practice of reacting appropriately against species or individuals that cause harm) in human-carnivore relationships. Reciprocity has been proposed as being necessary for peaceful coexistence between humans and large carnivores (Lescureux 2007), and it also seems to be the case in this study. For example, the relationship with bears seems to be reciprocal. If a bear kills a ewe or a cow from time to time, it can also be shot if the State gives a permit. The individualisation of bears and their association with a limited territory facilitates the establishment of reciprocity at a local level and bears thus enjoy a positive image. Their few intrusions into the domestic space are tolerated as long as they behave "correctly"—in other words as an herbivore.

Relationships with wolves seem to be rather unbalanced. These animals often come to take several sheep and their damage can be relatively important at an individual or regional level. Even if wolf hunting is authorized and encouraged, it seems to be insufficient to control their population and their damages. Permanent shepherding and the widespread use of livestock guarding dogs seem to be widely used (Keçi *et al*. 2008) and relatively efficient against wolves but these mitigation measures are experienced as constraints by livestock breeders, and they do not function in all cases such as in cases of fog or when wolves manage to slip past dogs. Thus, it is difficult for humans to insure any reciprocity with wolves. Although hunters have got what Bobbé called a "right of retort" (Bobbé 1993a) toward the wolves, who are legally classified as a pest, the difficulties inherent to wolf hunting in steep, forested habitats hinders the effective implementation of this right. The repeated and fatal intrusions of wolves into the domestic space creates the impression of an animal that is disrespectful of borders and norms, and simply does not have the right to exist (Knight 2000) among the Macedonian mountains.

The rarity of lynx, not to say their supposed absence does not seem to require any reciprocal relationship. After all, they confine themselves to the wild areas beyond the domestic space and only pose a perceived threat to people going into this domain. Only the fear is reciprocal when a scared hunter causes a lynx to run by shooting at it!

Discussion

The material resulting from this study can make contributions in at least three fields. Firstly, it contributes to the ongoing debates in anthropology concerning the link between relational processes and identification processes. Secondly, the results have a direct application into ongoing projects in the region that seek to foster sustainable rural development and conserve the region's rich biodiversity. Finally, the study allows us to comment on the utility of the ethno-ethological approach in applied and theoretical contexts.

Interactions and Perceptions

As we were aware of the diversity of the processes linked with the emergence of human perceptions about animals, we chose to focus our study on the impact of specific behaviours of the three species on their relational terms with humans. Our results clearly show that the species specific behaviours of bears, wolves and lynx that influence

their interactions with humans have an influence on the informants' perceptions concerning these species. Therefore, we can suggest that in some contexts, the relational process is shaped prior to the identification process. Indeed, it appears that a high frequency of interactions could eventually allow the relational processes to dominate, leading people to modify their actions in response to the behaviour and ecology of the species, especially when animals are individualized. For example, the establishment of an interaction derived relationship with bears is necessary to allow their individual identification as 'herbivorous' or 'carnivorous' and this identification, in turn, conditions the nature of human relationships with this individual bear, practices toward it, and finally the bear's perception of the humans it coexists with. The case of the bear seems to follow Ingold's proposition according to which "*humans and animals constitute themselves reciprocally with their particular identities and purposes*" (Ingold 1996: 131). However, the fact of the virtual absence of interactions with lynx has not prevented the construction of a particular image of the lynx shows the importance of the context and highlights the complexity of the relationship between the level of interactions and people's perception about animals. In the case of the lynx, it is obvious that the image of the animal is almost completely socially constructed and determines practices and emotions associated with it, and thus the relational processes. However, in our case, the lynx appears to be the exception which proves the rule, far less obvious in social sciences, that human relationships with animals are not only socially constructed. As Franklin (1999) argued, suggesting that humans' relationships with animals are socially constructed is not to deny the moral and affective ties between humans and animals. However, reducing human—animal relationships to only being a social construction is to deny the active role of animals and the interactive nature of some human—animal relationships. Rather, the relationships of our informants with animals appears to be a form of negotiation with nature (Bird 1987), and not only a social construction.

Indeed, as it is now well known that predator behaviours are influenced by human practices (Ciucci *et al*. 1997; Mattson 1990; Sunde *et al*. 1998; Swenson *et al*. 1999; Theuerkauf 2003; Theuerkauf *et al*. 2003; Vilà *et al*. 1995), we can suggest that the species specific behaviours of bears, wolves and lynx in Macedonia are themselves partly the results of human practices. Therefore, as we demonstrated the impact of these behaviours on human perceptions and practices, it clearly appears that the relationships our informants have with the three species are the temporary result of their previous interactions in history. Thus, these relationships are not only a consequence of the history humans have of their relations with animals, but also a consequence of the history animals have of their relations with humans (Ingold 2000).

Conservation Implications

From a more applied conservation point of view, it appears that a long coexistence with the species and a better knowledge of its ecology and behaviour do not automatically lead to more positive attitudes or a greater acceptance of their presence. Indeed, while the long-term coexistence with bears appears to have led to a well-balanced relationship and an acceptance of this species in the mountains, this is far from the case for wolves. The large number of interactions with wolves and the resulting experience-based knowledge has not led to an acceptance for their presence as the various conflicts—in their economic, environmental and cultural contexts—are still perceived of as being intense, and wolf behaviour does not permit the establishment of a reciprocal relationship.

The most important message from the point of view of large carnivore conservation is that these key stakeholders have widely different perceptions and attitudes towards the three species. This will require adopting species specific conservation strategies. The general lack of conflict, knowledge, deeply held or consistent perceptions, towards the lynx opens for the possibility of using information to generate local acceptance for their conservation. The overall positive image that bears hold should also allow conservation strategies to be developed as long as they provide some openings for local people to react against the few bears that perceive of as being problematic (Linnell *et al*. 1999). Wolves represent the greatest conservation challenge as there was almost no recognition of their right to coexist with people in the region. This implies that any wolf conservation strategies should not seek to make dramatic changes to current management practices that permit these stakeholders to demonstrate some control over the wolf through wolf hunting (Ericsson *et al*. 2004)—but should rather focus on providing some general frames to ensure that the level of harvest is sustainable. The recognition of stakeholder's knowledge and role in their management could lead to more positive attitudes (Gross 2008) but in our case, stakeholders rather appear to be requesting State intervention against wolves. Certainly, there should not be any major attention drawn to wolf conservation as it could potentially damage local attitudes towards conservation in general and of the bears and lynx in particular (Linnell *et al*. 2000). On the positive side, there was an absence of significant fear towards wolves. Fear has become a major issue in western Europe in areas where wolves are recovering after regional extinction (Ericsson and Heberlein 2003; Linnell *et al*. 2003; Røskaft *et al*. 2003). Although it is somewhat speculative, the

presence of the wolf may actually benefit the conservation of the bear and lynx, by forcing the shepherds to maintain herding practices that are primarily aimed to prevent wolf attacks, but simultaneously prevent bear and lynx attacks, allowing these species to maintain an image of being less conflictful, in contrast to some other regions where bear and lynx are associated with significant conflicts (Kaczensky 1999).

The Ethno-ethological Approach in a Conservation Context

This is among the first ethnographic studies conducted in this region of Europe that focuses on present day human—animal relationships. The narratives provided by the informants were detailed and generally internally consistent (with the exception of lynx). The details of the narratives were also consistent with the findings of parallel ecological studies that were being conducted in the region at the same time, and with the existing natural science literature on large carnivore ecology and human—carnivore relationships. This combination of internal and external consistency indicates that the methodological approach adopted was successful at tapping into a rich source of experience-based knowledge that has been acquired through keen observation and frequent interactions with large carnivores in their shared environment. There are few other comparable studies that have adopted this conceptual approach to human—animal interactions. Rather, traditional ethnographic studies have focused more on the symbolic and cultural importance of animals rather than on the effects of interactions on perceptional processes and practices (Lescureux 2006). Even if there is a symbolic and mythological background in the region concerning large carnivores (Elsie 2001; Gura 2005; Mencej 2006), people rarely referred to it during the interviews and it seems it has no influence on their actual perceptions and practices, with the exception of some beliefs about lynx (sucking blood and jumping from trees). Our informants were all directly concerned by the topic and engaged in interactive relationships with at least two of the three species in their environment. A survey of the general public knowledge and perceptions in Macedonia could be expected to give different results, notably in urban areas, where people are likely to be more influenced by cosmopolitan views of animals such as large predators (Jalais 2008). A more general human dimension survey about attitudes towards predators has been done in western Macedonia and is now under analysis. It will be the topic of a forthcoming paper and will give the opportunity of a comparison with our own results.

Indeed, the last decade has seen an increase in the use of quantitative questionnaire approaches to mapping human attitudes and values (Ericsson and Heberlein 2003; Røskaft *et al*. 2003), and the integration of these data into management planning (e.g. Huber *et al*. 2008; Liukkonen *et al*. 2009). The approaches adopted in this study complement these quantitative approaches in two ways. Firstly, they provide a rapid means to get an overview of local attitudes and views towards a complex issue, such as large carnivores. Secondly, and more importantly, this approach can provide insights into the mechanisms by which attitudes and perceptions are developed which is crucial when interpreting the results of more traditional human-dimensions questionnaires. Together these methods can provide a powerful set of complementary tools to both further our understanding of how animals can influence human culture and society and how it could be possible to influence human and animal behaviours in order to ensure the conservation of endangered species with the minimum of conflict in human-dominated landscapes (Baruch-Mordo *et al*. 2009; Linnell *et al*. 2005).

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Appendix

Table 1 Interview guide used during the survey in Mavrovo-Rostushe municipality (April–June 2008)

Herding practices (HP)[a]
- Do you give a name to the ewes? For example?
- Are you able to recognize the ewes individually?
- Do the different sheep have different behaviours?
- Do you direct the sheep movements or do you just follow them and watch them?
- How do you choose the place to graze?
- In the flock, do you have an animal which is leading? Does it have a special name?
- Do you put bells on sheep? For which purpose?
- Do you put talismans or lucky-charms on sheep? Why?
- Do you sell your products to firms or individuals?

Predation on livestock (PR)[a]
- Are your sheep attacked by wild animals on pasture?
- What is approximately the frequency of attacks? By year?
- What do you do when your sheep are attacked?
- Is-there a variation of attacks according to the season, to the weather?
- Are-there some places in the pasture where the sheep are more vulnerable? Why?
- Can you/do you avoid these places?
- Are your sheep attacked in winter? During the day, the night?
- Is the predation a big problem for livestock breeders here?

Livestock Guarding dogs (GD)[a]
- Are the dogs able to protect your flock?
- Do you give a name to your dogs? Which name?

Table 1 (continued)

- How do you feed the dogs? Does-it cost a lot to feed the dogs?
- When you are on the pasture, are the dogs around you or around the flock?
- Do you buy the dogs? What is the price of a dog?
- How do you train the dogs?
- How do you know if a dog is efficient or not?
- Do you keep the dogs that are not efficient?
- If there were no predators, would you keep the dogs anyway?

The future of livestock breeding in Macedonia (FL)[a]

- Do you enjoy the life of livestock breeder/shepherd? Why?
- Have you chosen to be a livestock breeder?
- Was your father also a livestock breeder?
- Will one of your children be a livestock breeder?
- What is the main problem for livestock breeding in this region?
- How do you see the future of livestock breeders in this region?
- What could be done to improve the situation of livestock breeding?

Hunting (H)[b]

- What kind of animals do you hunt?
- In which period do you hunt these animals?
- How do you hunt (rifle, trap, snare, poison)?
- Do you have hunting dogs? For which game animals?
- What do you do with the harvested animals (keep it, sell it, give it away)?
- Which part do you take from the animals (meat, fur, skin, organs)?
- Do you know if some organs / bones are used in traditional medicine?
- Who taught you to hunt (e.g. father, uncle, friend ...)?
- Do you hunt alone or in a group?
- What do you think about the hunt's organization in this region?

Outdoor activities (OA)

- Do you go to the mountains or to the pasture to gather mushrooms, wild herbs, berries? Which ones and in which season?
- Do you go to the forest to harvest wood?

Knowledge (KN)[c]

- Have you ever seen a bear (a wolf, a lynx)?
- If not, have you ever seen bear's (wolf's, lynx) tracks, scats, and marks?
- How old were you the first time you saw a bear (a wolf, a lynx)?
- How did it happen? What was your feeling?
- Since that time, do you often see the bear (wolf, lynx)? How many times a year?
- What does a bear (wolf, lynx) eat?
- Can a bear (wolf, lynx) catch wild animals? Which ones?
- How does the bear (wolf, lynx) catch wild animals?
- Do you think that the bear (wolf, lynx) is using strategies/plans to hunt?
- Does the bear (wolf, lynx) attack domestic animals? Which ones? How often? When (season, day/night)?
- When does the bear (wolf, lynx) have its breeding season?
- Outside this season, does the bear (wolf, lynx) lives alone or in group?
- When does the bear (wolf, lynx) have its birth season?

Table 1 (continued)

- How many cubs does the she-bear (she-wolf, lynx female) have?
- Who is taking care of the cubs, the male, the female, or both of them?
- How long do the cubs (pups) stay with their mother/parents?
- Do the parents stay together during their entire life?
- How long does a bear (wolf, lynx) live?
- In which kind of landscape it is possible to see the bear (wolf, lynx)?
- Does the bear (wolf, lynx) live 1) outside, 2) in a natural cave or 3) in an excavating den?
- If 3: does the bear (wolf, lynx) excavate its den themselves?
- Does the bear (wolf, lynx) have a territory where the other bears do not enter?
- What is approximately the surface of the bear's (wolf, lynx) territory?

Perceptions (PE)[c]

- Do you think there are a lot of bears (wolves, lynx) in this region?
- Is it good to have bears (wolves, lynx) in this region?
- Do you think that bears (wolves, lynx) are harmful for livestock?
- Do you think that bears (wolves, lynx) are dangerous for humans?
- Do you think that we have to eliminate bears (wolves, lynx)? From the region? From the country? From the world?

Perception of changes (PC)

- Did the creation of the Mavrovo National Park (MNP) have an impact on livestock breeding?[a]
- Did the creation of the MNP have an impact on game animals?[b]
- Did the creation of the MNP have an impact on predators?
- Did the creation of the MNP have an impact on people's way of life?
- Has the landscape changed in this region, the last decades?
- Is there more forest than before? Why?
- Did the area of pasture decrease in recent decades? Why?
- Do you think that the development of forest favours the development of certain wild animals?
- Are wild boars more numerous than before? Are they harmful for the pastures?

Perception of nature and animals (PN)

- What is nature for you?
- Do you think that humans belong to nature?
- What does not belong to nature?
- Do the predators belong to nature?
- Does the wolf belong to nature?
- What is the difference between humans and animals?
- Do animals have consciousness?
- Do animals have a soul? The same as humans have?
- What is, for you, the most intelligent animal (among wild and domestic ones)?

[a] Question or group of questions only asked to livestock breeders

[b] Question or group of questions only asked to hunters

[c] The questions belonging to the knowledge (KN) part were asked successively for bears, then for wolves, and for lynx. The questions belonging to the perceptions (PE) part were asked successively for lynx, then for wolves, and for bears

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