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Article

The King of the Forest: Local Knowledge About European Brown Bears (*Ursus arctos*) and Implications for Their Conservation in Contemporary Western Macedonia

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Abstract

From a conservation point of view, Macedonia's brown bear (*Ursus arctos*) population appears to be a key link in the distribution of one of Europe's largest brown bear populations, the Dinaric-Pindos population. The lack of information concerning the bear population in the Republic of Macedonia and bear acceptance by local people inspired us to explore local knowledge and perceptions concerning bears that could be relevant for their conservation. Accordingly, we adopted a qualitative approach using semi-structured interviews to determine how the specific behaviour and ecology of bears can influence, through interactions, local peoples' knowledge and perceptions. Our results show that due to numerous interactions, the informants' knowledge appeared to be detailed and consistent, both internally and with existing scientific literature about bears. Bear specific behaviour allows them to be located, individualised and thus appropriated by villagers, and also to be identified as an alter-ego. For the villagers, the occasional harmfulness of a bear is not the result of a general characteristic of bears in general, but of some individual bear's behaviour. Finally, bears enjoy a relatively good image as long as local people can react against individuals that cause damage. However, direct or indirect poaching of bears is still a main concern for the Macedonian brown bear's conservation.

Keywords: human-bear relationships, Macedonia, brown bear, *Ursus arctos*, conservation, local knowledge, perceptions

INTRODUCTION

The combination of human population growth, advances in hunting technology, and changes in livestock husbandry changed the nature of conflicts between bears and humans during the nineteenth and twentieth centuries, and resulted in the near eradication of bears from western, southwestern, northern and central Europe (Breitenmoser 1998). However, in the last three decades, following the growing importance of wildlife conservation as a public issue, international treaties have mandated the restoration of large carnivore populations. Moreover, the recently developing combination of rural abandonment and reforestation provides a potential increase in habitat quality (Falcucci *et al.* 2007). However, even with these trends very few large wild areas remain to serve as refuges (Linnell *et al.* 2000, 2001, 2002). Therefore bears have to live in close proximity with humans in more or less human modified landscapes. Although public attitudes towards large carnivores have generally become more positive, it has to be

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noted that this positive attitude appears to mainly come from urban people, who are not facing the problems eventually caused by such animals (Karlsson & Sjöström 2007). The new positive attitude is not always shared by rural people, especially livestock breeders and hunters, who are often opposed to carnivore recovery, because of livestock depredation (Linnell *et al.* 1996; Kaczensky 1999), competition for wild ungulates (Ericsson & Heberlein 2003), and potential danger for human safety (Swenson *et al.* 1999b; Löe & Røskaft 2004).

The situation is somewhat different in several eastern European countries where bears persist in higher numbers and are regarded as a valuable game species; hunters actively contribute (through practical actions such as feeding and paying compensation for livestock depredation) to maintain bear populations (Kaczensky 1999; Kaczensky *et al.* 2004). In the Republic of Macedonia, bears were historically present across the country (Servheen *et al.* 1998), but loss of habitat led to a reduction in their distribution. Today the bear range in Macedonia is confined to the mountainous regions situated along its western, northwestern, and southwestern borders with Kosovo, Albania, and Greece, where most forests survived. Data about current bear status in the region are very limited. A roughly estimated population of 160 to 200 brown bears live in Macedonia (Arcturos 1997; Melovski & Godes 2002). Until 1988, the bear had no legal status in Macedonia, and there were no rules or limitations on bear hunting (Swenson 2000). Bears have been classified as a game species since 1988 and since 1996 they are protected according to the Hunting Law[1]. Although culling of individual bears is occasionally allowed by the Ministry of Agriculture, Forestry and Water Management, notably when they are causing damage, poaching still exists, and bears are direct (deliberately targeted) or indirect (e.g., getting caught in snares set for other species) victims of this illegal activity. From the point of view of conservation, Macedonian bears are a key link in the distribution of one of Europe's largest, continuously distributed, brown bear populations—the Dinaric-Pindos population. They provide a crucial link between bear populations in the Greek Pindos mountains and those in the Dinaric mountains of Slovenia, Croatia, Bosnia and Montenegro (Zedrosser *et al.* 2001; Huber 2002). It is therefore important that effective conservation strategies exist that ensure their persistence in the face of the dramatic socio-economic changes which the countries of this region are currently undergoing.

Considering the lack of information concerning the bear population in Macedonia, and that the future of bears will mainly depend on their acceptance by local people (Kaczensky 2000), it seems urgent to uncover information about knowledge and perceptions of people concerning bears. It could be relevant for bear conservation, due to the current increased awareness of the need to focus on the people who share the landscape with carnivores as much as on the ecological issues when developing a conservation strategy. In contrast to other studies that have used quantitative questionnaire based approaches (Kaczensky *et al.* 2004) we adopt an ethno-ethological approach (Brunois 2005) using semi-structured interviews. This study builds on a general conceptual approach which seeks to determine how the specific behaviour and ecology of different predator species can influence, through interactions, local people's knowledge and perceptions concerning predators (Lescureux & Linnell 2010).We specifically seek to understand how the image of the bear is constructed through bear-human interactions and the role played by experience-based knowledge and culturally transmitted knowledge. In this context, human-wildlife relationships have not been studied in Macedonia (like much of southeast Europe), making it interesting to explore human-bear relationships. It was therefore necessary to gather local knowledge, perceptions and beliefs in this particular country where few—or even no—data exist concerning this topic, and where rural abandonment (Totev & Shahollari 2001) might quickly lead to a breakdown in knowledge transmission. Thus, in order to grasp, not only the perception of the bears, but also the interactive process by which their image is constructed, we adopted some of the methods and conceptual frameworks that are used in anthropology (see Ingold 1988, 1996, 2000; Descola 2005) to explore local knowledge and perceptions of bears among rural people in the western mountains of the Republic of Macedonia in southeastern Europe.

MATERIAL AND METHODS

Of the key stakeholder groups, we focused on two, livestock breeders and hunters, because these are the groups most often involved in conflicts with bears through depredation on livestock and competition for wild prey. Moreover, in any region they tend to be the most knowledgeable about wildlife, as they are more often engaged in interactive relationships with wild animals. Semi-structured in-depth interviews were used to explore local knowledge and perceptions. The questionnaire (cf. Appendix), divided into several sections, contained more than 130 questions, but following the informant's narrative the discussion was allowed to go in other directions. The first section comprised questions about the activity of the informant and contained practical/technical 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 about the behaviour (diet, reproduction, hunting, parental care, etc.) of different species of bears, wolves, and lynx. The fourth section dealt with perceptions concerning the species (harmfulness, dangerousness) and opinions about appropriate management practices. The last section contained questions about the definition and perceptions of nature in general and recent changes in the landscape. Due to the low number of livestock breeders, and even the low overall level of human population in each village, we had to visit 33 villages to obtain a good sample of respondents. Interviews were conducted by the ethnographer (Lescureux) accompanied by native Albanian or Macedonian speakers, recorded, and later transcribed and translated. Transcriptions and translations of recorded interviews were done together by the ethnographer and the translator in order to catch the meaning of each sentence and each word

through their description by the native speaker. The use of different translators for field work and translation allowed controlling the interview process through a back translation of the questions. Interviews were conducted in cafes, in private homes or directly in the field. A typical interview lasted for one hour or more. A total of 63 people—including 34 livestock breeders, and 29 hunters—were interviewed.

The study was conducted in Polog and Yugozapaden regions of Macedonia (municipalities of Tetovo, Gostivar, and Mavrovo) during 2007 and 2008 (Figure 1). The region is predominantly rural, consisting of towns and agricultural areas in the valley bottoms, with forested slopes, and alpine meadows at higher altitudes which varied from 450 m above msl to 2000 m above msl. Villages are scattered throughout the landscape, but have suffered dramatic declines of the human population during recent years. There is little industry, and lifestyles in the villages are traditional and poor. Rural abandonment has led to dramatic social and economic changes in the region during the last 20 years (Totev & Shahollari 2001; UNDP 2001). The region is occupied by both ethnic Albanians and ethnic Macedonians, with most Albanians in the region around Tetovo. A reproductive population of brown bears (*Ursus arctos*) is known to occupy the region. In addition, wolves (*Canis lupus*) and lynx (*Lynx lynx*) are present. The relevant prey community is represented by roe deer (*Capreolus capreolus*), chamois (*Rupicapra rupicapra*), wild boar (*Sus scrofa*), and brown hare (*Lepus europaeous*). The main livestock species is sheep, followed by cattle; few horses and goats are also present. The forests are widely used for hunting and forestry, and the alpine meadows are used by both transhumant and resident shepherds.

RESULTS

In western Macedonia, it is relatively hard to find livestock breeders and hunters who have never seen a bear. Indeed, 97% of informants (n=63) had encountered bears, and of the people who gave a frequency (n=55), 38% reported to having seen bears at least each year, and 27% reported having seen them often. Most of the time, the first interaction with a bear occurred between the age of 10 and 20 years, when children went to work in the pastures as shepherds or to accompany hunters' groups for the first time. As a result of their relatively frequent interactions with bears, hunters and livestock breeders developed a detailed knowledge about bear ecology and behaviour, mixing experience-based knowledge, elements of their traditional knowledge, and (mainly for hunters) written material from hunters magazines and manuals.

The Solitary Life of the Bear

> "The bear has a solitary life. They group together only when they mate, one male, one female, and normally, the female keep cubs with her during two to three years, until they are independent, and after that they keep their own territory." (A livestock owner from Bitushe, Macedonia).

For a large majority of informants (93%, n=55), be they hunters or livestock breeders, the bear is a solitary animal: "Bears are not living in a pair or in a group, they are always going alone." This assertion is mainly based on their experience since each time they see a bear, it is alone: "As we usually see the bears singly, I think we would see the others [if they were in group]." A few informants weren't able to answer, and one reported to have seen a group of bears, a phenomenon which can occasionally occur, and about which local ecological information is missing (Stirling & Derocher 1990). If adult bears are viewed as solitary animals, it was understood that they have to meet together during the year in order to reproduce. However, there is an obvious disparity among informants' answers when questioned about the mating season of the bear. Of the informants (n=55), 21.8% thought bears mate during autumn, 12.7% thought bears mate during winter, 9.1% thought bears mate during spring and 5.5% thought bears mate during summer, and 50.9% of the informants admitted they did not know. Few of them matched the mating period given by scientific studies, which is mainly in spring, from May to early July (Spady *et al.* 2007). As informants noticed, female bears also live with their cubs until their dispersal. When questioned about the birth season of the bear, 30.4% of the informants (n=56) admitted they did not know the answer. 37.5% of them stated that birth occurred during spring, 1.8% during summer, 5.4% during autumn and 25% during winter. The answers about the birth season of the bear were less disparate than for the mating season and several of them matched the birth period given by scientific studies, which is mainly in winter, from early January to the end of February (Spady *et*

Figure 1
Location of the Republic of Macedonia and field area

al. 2007). However, considering that it is quite difficult to observe mating and birth in bears, it is possible that some hunters' knowledge about mating and birth period come from television or literature, as showed by this example: "I do not know exactly but according to the literature […] she might give birth during January. It means that she mates in April, March-April, while in January she gives birth. She keeps the cubs during 9 month while she gives birth each four years." The fact that the majority of answers given corresponded to a birth season in spring can be explained since informants cannot see bears with cubs of the year before they emerge from the winter dens and that, for them, the bear should 'logically' give birth in spring, as other animals do in general: "[The female bear gives birth] now, in spring. Almost all wild animals mate in autumn to give birth in spring because in winter, there is nothing to eat. She gives birth in spring because there is food to feed the cubs."

For 67.3% of informants (n=55), female bears give birth to up to two cubs, and for 20% of them, to up to three cubs. There is neither a strong disparity in answers, nor a significant difference between hunters and livestock breeders. Moreover, the answers correspond to the results of scientific studies on the bear's litter size, which is usually between two and three (Zedrosser & Swenson 2005; Dahle et al. 2006). When questioned about the duration of maternal care, 21% of the informants (n=53) answered they did not know how long cubs will stay with their mother, 21% gave a duration less than or equal to one year, 34% a duration between one and two years and 25% a duration which can be up to three years. Thus, apart from a few of them, the majority of informants suggested in their answers that cubs remain with their mother during a long period, at least one year and sometimes up to three years. These lengths of maternal care are in agreement with data from different countries (Dahle 2003; Dahle & Swenson 2003a; Zedrosser *et al.* 2007).

Concerning the factors which could influence the length of maternal care, many informants explained that after two or three years, cubs are rejected by their mother: "The cubs stay two years with their mother. They grow up very slowly the first year, they are quite small. […] the second year she is already pregnant, she is waiting for new cubs, and she chases them away, all of the two or three cubs, so they can look for their own territory." For other informants, the cubs leave their mother by their own volition: "They stay with their mother during maybe one year and a half, until they are ready to reproduce, then they separate, and the rest of the time, they only go with their mother." Recent studies showed that family breakups mainly occur during mating season and when an adult male is present (Dahle & Swenson 2003b), so it seems that females do not chase away their cubs because they are pregnant. Besides, some informants confirmed this assertion, telling that the she-bear cannot reproduce for three years: "The she-bear has a tradition. Until the cubs are three years old, she doesn't make cubs, until they are able to live by their own. Bears are their own master. This is their nature [*natyra e tyre*, in Albanian]".

The Unadventurous Existence of the Bear

Many informants (75%, *n*=55) considered the bear to be a territorial animal. Hunters were more numerous in giving this answer (86%, *n*=28) than livestock breeders (63%, *n*=27). Some informants gave a strict definition of territoriality in bears, i.e., living in a territory where other bears are not allowed to enter: "Yes [they have a territory], it must be like that. For example, one is here, the other is there, and they can't stand each other, they fight!", and they mark it: "Like each animal, the bear also marks his territory, either by peeing, or by… he marks his territory and he can feel if another animal came by." However, other informants were less strict concerning the territoriality of the bear and just assumed that bears have a home range: "Bears have borders that I do not know. They are acquainted with the territory they inhabit. They are not nomads", in which they have their habits: "Yes, they have a limited territory, they live where they live. They have their pathways and their specific places and that's why they are easy to find." For some informants, the bear stays in the place where it is born: "Yes, they have a territory, where he was born and all the surroundings, where he is accustomed to walk, that's his territory. […] Changing the place from this region to another one? No, he will not go, he has got a territory." Some hunters added that it was rather the male who was territorial and mostly during the mating period: "Yes, bears have a well defined territory, and that is mainly the male who defines the territory, in the mating period. And in that period, he doesn't let other animals enter, be they wild or domestic. They have their territory and they delimit their territory by urinating. The other bears who come, they understand, they smell the odour of urine and they move away."

Few respondents could give estimates about the size of the territory. Sometimes they clearly said they did not know and sometimes they answered with general terms like "all the forest" or "this mountain". However, some informants tried to evaluate the approximate size of a bear's territory, giving quite different results, as exemplified by the two following sentences: 1) "In our place, for example, on a surface of 20 sq. km, there could be five… each 20 sq. km you can certainly find five bears, sometimes ten, it depends of the place." 2) "I do not know, maybe with a diameter of 20 or 30 km. They mark the territory in which they get around." For perspective, two bears studied with radio-telemetry in Plitvice National Park in Croatia had a home range of approximately 50 sq. km with seasonal variations and a larger home range during October and November (Huber & Roth 1986). This seasonal variation of the bear's home range was recognised by some informants, like this hunter: "[The territory] depends on the food. The bear from here[2] can go to eat around Gostivar and come back here. He travels long distances when he is looking for food, especially in autumn, and he comes into the territory of other bears, and that way they fight together."

Inside their home range, bears travel across different landscapes and it seems that they have preferences concerning the landscape in which they live. Following the informants'

statements, bears live mainly in forested areas and rocky places, far from human activity: "[They are often] in beech and oak forests, in the mountains, in the rocks", and they even chose the densest forest: "[They rather live] in the undergrowth [*chestak* in Macedonian]." However, the bears are less afraid to go in more open areas at night: "Generally, during the day, bears are in the forest near rocks and caves, and during the night they can be encountered everywhere. On the country road, there are people and vehicles, in the mountain, close to enclosures, so during the day they hide." This spatio-temporal segregation between bears and humans has already been observed in other places (Mattson 1990). The bear's preferences can also change with seasons, as this hunter explained: "You can find bears in more open areas, but they generally are in the forests. Now, as soon as sheep are back [in the mountains] in June, they could be more often encountered in more open areas, in the evening and early in the morning. And during summer, they can be encountered more often in the period when strawberries, raspberries, and blackberries are ripening […] and also in autumn, when there are plums, apples, pears, cherries." Even if they sometimes come into orchards or fields to feed on crops and fruits, bears are not normally known to come into villages, as wolves do, but it seems it could happen exceptionally: "A few years ago, bears attacked here, they attacked a flock, here, in the village! He broke the door and he took some sheep." However, the situation can change because of garbage dumps: "Generally, [bears live] in the mountains but lately, they often attack in villages, where there are dumps. They have developed the habit to go near dumps. But generally they are in the mountains."

Even though bears can go everywhere, informants saw the den site as an important place in its territory. Even those who think that bears do not have a territory affirmed that bears are attached to their den: "No, [the bear] doesn't have a territory. You can see him in Tresonche today and if he find preys here, he will be here, but they have their own den [*legishte*, in Macedonian] to sleep, and they come back here." For the majority of informants, the bear's den site is generally a natural cave: "No, these are natural caves. They find them as such but they lay it out, they put something in it to make it better" even if this cave could be laid out to be more comfortable: "They find it in the rocks, but the bed, they make it with juniper or such things […]." As this informant said: "[bears are living in] natural caves, because there are many rocks here!" Thus, the popular toponymy retained some particular places: "Yes, they have a den, made from rocks as usual. From this, there are places which took names like bear's cave [*shpella e arushës* in Albanian]" or even some areas: "There is a place there called 'the land of bears' [*Mechkarija* in Macedonian]."

However, some informants claimed that bears are mainly digging their den: "No, alone, they dig their den alone, their hole. For example, you have a small rock here, and they begin to dig, dig, dig, with their claws and they get out the dirt, they go in there." Interestingly, many informants were more circumspect and explained that several solutions are possible: "Sometimes these are natural caves and sometimes they can find inaccessible places and they dig." Some of them explained that this could be due to the age of the bear: "Generally, they find a cave in dry and rocky places. It is possible they dig a little bit in the cave, but in general they use caves. We found cases in which bears dug but in general only young bears are doing that. If the cave is occupied by an older bear, the youngest dig around roots. It is possible to find such shelter, too." It seems that the better place to dig the den is under pine roots: "They can find place in natural caves but they also excavate in the forest under pine trees. They dig and they enter under pine trees." As informants described, bears seek remote places to make their dens, for example elevated areas: "They change, it depends… If he is attacked by somebody, he changes, because they make [their den] in rather high places where it is difficult to access. He also knows the danger" or deep forests: "Generally, they search for places where there are the most trees. They find a cave and they continue to dig it." These observations of bear denning behaviour correspond very well with that documented from ecological studies of telemetry-equipped bears in the similar habitats of Slovenia (Petram *et al.* 2004).

It is obvious that for informants, the bear den is used in the winter period, since they know that bears sleep during this period: "Generally, in winter, they live in inaccessible caves, high in the rocks. We saw some caves, several caves. They are quite deep. He stays there and during winter he doesn't go outside. In spring, he goes out." Thus, the bear's den is like his house and it is closed during winter: "Each year, he spends winter there, it's like his house. He closes the entrance in winter. He closes the entrance with rocks and soil, or anything he finds, and he stays there until spring, he doesn't go out of there until March." For some informants, bears can also go in their den from time to time all through the year: "He stays in the cave during winter but from spring, it is rather outside, he goes outside, when the weather is nice. They can also sleep in the cave but they rather sleep outside. The weather is hot and he doesn't need to go into the cave, because he is strong and he has no adversary in summer that can hurt him." However, it seems that bears have other places than their "winter" den where they can go to rest: "[…] in summer he has other caves which can be at the edge of rivers or anywhere else, while in winter he comes back to his own den. For example, you see him in the forest above rocks and he digs and stay there, and another day you see him in another place."

Some informants also questioned the assertion that bears sleep during winter, sometimes in a radical way: "There is a thing on which I disagree with science. We learnt when we were kids that the bear is sleeping during winter but that's not true! Maybe if there is a storm during some days… A 500 kg bastard cannot sleep all winter!" and sometimes with more subtle explanation based on observation and experience: "[The bear] doesn't sleep all the time. That's wrong what was told to us that he doesn't walk when there is snow. He also walks on snow, because I met him even in winter, when there was 30 cm of snow." Several explanations were given by respondents to explain why active bears could be seen during winter. Firstly,

some informants proposed that hibernation was not the same for "herbivorous" and "carnivorous" bears' (see next section): "Yes, I saw bears in autumn, when the time has come to go into the den, because there are two kinds of bears, the herbivorous and the carnivorous. The one who is herbivorous hibernates quite late at the end of December while the carnivorous one hibernates in the middle of December. According to literature, he sleeps for six weeks or one month and a half." Secondly, some informants assumed that these bears, which are not hibernating during winter, were insane or even dangerous. Finally, other informants explained that the weather could influence the bear: "If the winter is very cold, the bear begins to hibernate earlier and if the winter is very hot, later." Some hunters even observed recent changes in the behaviour of the bear: "It is well known that during winter, bears sleep in caves, but in recent years, when we were hunting, it came to us that we met bears who were walking around during all winter. Now, there is not much snow, maybe because of climate change, and there is no more hibernation [*zimski son* in Macedonian, i.e., wintry sleep]." By comparison, across the range of brown bear distribution there is a clear pattern of the period of winter sleep being shorter in areas with milder winters (Linnell *et al.* 2000).

Herbivorous and the Carnivorous Bears

One of the most important characteristic of bear behaviour as perceived by informants is that while some of them affirmed that bears are omnivorous (13%), strictly herbivorous (8%) or strictly carnivorous (2%), the majority of respondents (75%, n=60) consider that this animal could exist in either herbivorous or carnivorous states: "Some of them only eat plants, fruits… they feed on fruits. He also feeds on ants, honey, the one who eats herbs. But the other, the one who eats meat, he doesn't eat that… and the herbivorous bears doesn't attack livestock." A few informants affirmed that bear diet can change and that a herbivorous bear could turn carnivorous: "If there is not enough food, and if the bear tries to eat meat, he becomes a scavenger, but generally they are herbivorous and they eat wild and cultivated fruits." However, they generally considered herbivorous bears and carnivorous bears as clearly distinct individuals, even distinct species. Indeed, some informants maintained that there are physical differences between herbivorous and carnivorous bears. First of all, informants often considered that it was mainly the biggest bears that were able to attack livestock: "[…] the small ones cannot attack flocks, only the big bears can attack, those who are 250 or 300 kg, only they are strong enough, and not the cubs." Of course, this could be a question of age, older and bigger bears behaving in a more carnivorous manner. Indeed, it has been demonstrated to be the case in other countries that adult males are more often involved in depredations (Mattson 1990). However, it seems that for informants, the difference in size is directly linked to the diet and not to the age: "The one who eats herbs; even if he is in the middle of the flock he doesn't attack livestock. And the one who eats meat, he causes damages, and he is also bigger and more powerful, while the others are middle-sized."

Moreover, as this livestock breeder explains, it is possible to recognise carnivorous bears by their colour: "[…] it depends on the bear. Some of them are scavengers and often attack. For example, these bears we call black, they are scavengers, they frequently attack, and the others don't." In this example, the herbivorous bear is said to be brownish and yellowish while for other informants, it is yellow or even red. Sometimes the colours are reversed and the carnivorous bear is yellow while the herbivorous one is black. The shape of the nose seems to be important, too: "It is possible to recognise scavenger bears even by their nose. Those who graze have short noses and the scavengers have long noses, and they are yellow." It is unclear where this knowledge comes from, since this hunter told me: "According to the literature we refer to, the carnivorous one, by his head, he has got a shorter mouth and longer teeth, as herbivorous, this is a similar sort of bear but he has got a longer mouth, and we distinguish them like that." It is noteworthy to remember that there can be strong intra-specific variations in the skull's shape among bears (Stirling & Derocher 1990; Ohdachi *et al.* 1992), and that inter-specific variations are often correlated with differences in diet (Mattson 1998), although there is no scientific study supporting the existence of two forms of brown bear in the region.

We analysed the occurrence of different terms describing the composition of bear diet in the informants' answers. Concerning the general terms, 43 informants cited herbs, 22 informants cited fruits, 10 informants cited plants (75 occurrences corresponding to herbivorous diet), and 30 informants cited meat. Plants and herbs were not described individually, and informants just said bears eat herbs since they saw them grazing, except when it concerns domestic crops. Then, maize was the most cited (nine occurrences), while wheat and barley appeared only twice, and oats only once. Among fruits, pears were the most cited with 11 occurrences, followed by apple (nine occurrences), apricot (five occurrences), chestnut, raspberry, dogwood fruit, blueberry, and plums (four occurrences each). Among animals, livestock was spontaneously cited by 17 informants while wild animals are only cited by nine informants.

Indeed, many informants maintained that bears can not catch wild animals, except when the wild animals are sick or injured: "For example, here there are roe deer and chamois, but the bear has no chance to catch chamois, unless he finds some sick or injured by wolves and he can catch that, because he alone cannot run to catch a chamois or a roe deer." For those informants, the reason why bears cannot catch wild animals is that they are slow: "Because he cannot run them down. […] Because he is big and they, the other wildlife, they are lighter, he cannot run them down." Thus, the wild boar, which is considered slower than others, is often cited as a potential prey (15 occurrences), behind roe deer (17 occurrences) and followed by chamois, and hares (6 occurrences each): "Yes, it happened that bears attack wild boars, but they cannot run the others down." However, it is possible for the bear to catch wild animals by surprise, lying in wait: "As soon as the bear smells an animal, he approaches him hiding, he takes care

that wind is blowing in his direction. The bear takes much care about that." Another solution proposed for the bear is to catch animals when they are sleeping: "Generally, the bear attacks wild animals when they are sleeping. He knows their exact location and he attacks. […] The roe deer is too fast, he runs faster than the bear and that's why he cannot catch him. He can catch the roe deer only if he is sleeping, if he is dazed. Otherwise it is not possible." However, some informants disagreed with this general view of bear as a slow animal: "I saw the bear. You see, he seems plump, like lazy, but listen to me, he appears to be even faster than… the wild boar, because the wild boar is not faster than the bear!" and even considered it as more nimble than the wolf: "I do not know exactly if he can catch wild animals, but I know that the bear is fast, too, because the bear can also climb rocks. Because it happened to me that I saw a bear and how he came into the rocks. He came and he went out like a chamois, while the wolf cannot enter."

Among domestic animals killed by bears, sheep are the most cited (35 occurrences), followed by cattle (33 occurrences), horses (18 occurrences), and donkeys (7 occurrences). However, many informants considered that bears have a preference for cattle: "The bear doesn't want sheep as much as he wants cows" Indeed, in Albanian the meat situated between the shoulder blades in cows is called the bear's meat (*mishi i arushës*) as they attack cows on this part. Other informants affirmed bears have a preference for donkeys: "I heard that above all, the bear prefers donkey's meat." If the occurrence of each animal as part of bear diet is compared to the proportion of each animal among livestock in Macedonia (248,000 cattle and 1,244,000 sheep), it appears that the bears could have a preference for cattle.

Even if domestic animals are often cited as potential prey of the bear, few informants considered livestock as a regular part of the bear's diet: "Yes, the bears attack [livestock] but very rarely, only if they are exhausted or if there is not enough food. It can happen when they awake in spring." Sometimes they are even seen in the pasture, grazing peacefully near cattle: "I saw a bear, together with cows and he didn't attack them. He was eating ants. He was turning rocks over and eating ants. I saw that myself, he was grazing with cows and he didn't touch the cows." However, for one hunter, this peaceful behaviour of the bear is a strategy to attack cows: "For example, if he wants to attack a cow, he pretends so much to be harmless that he can get into the flock. He can approach them. Yes, he pretends to be mad, as if he doesn't catch sight of them, and he hunts them as soon as he approaches. That's the way he attacks more often." Contrary to the wolves, bears do not dare to attack when the flock is protected: "The bear is not dangerous for livestock, because he can hunt but in general he doesn't get into enclosures, if the enclosure is well protected, if there are good dogs and good shepherds, in this case, the bear cannot attack."

Moreover, their damages to livestock are generally not seen as important since they just take an animal once in a while: "[The bear] is one of the polite animals that take just one sheep at a time and, in general, he chooses the strongest sheep. It happens that several sheep die when a bear comes into [the sheep enclosure] but it is only because they are afraid and they begin to suffocate, but the bear just takes one sheep and goes away." This is contrary to wolves, with which bears are almost always compared: "[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." This can be sensed in the informants' perceptions of the bear's and wolf's harmfulness. Indeed, only 23.3% of them (n=60) consider bears as harmful animals, while 98.4% (n=62) for example, see wolves as harmful. Finally, attacks from bears appear to be localised, and although bears are known to be able to attack livestock, several livestock breeders have never had bear attacks and some regions seems to be spared: "[Bears are eating] plants, roots. They do not attack. They never attacked in our region", while some others seem to have recurrent problems with bears: "In the village, some years [flocks] are attacked and some years not. Two years ago, a bear got into here and killed my ram. The bear attacked me (i.e., my flock). There are a lot of bears here." As bears can adopt the habit of feeding on human food (Mattson 1990), it is also possible that some problematic bears could attack livestock in a region (Linnell *et al*. 1999). Apart from meat and plants, bears were reported to eat honey (10 occurrences), but the few beekeepers who were interviewed did not complain as they had well protected beehives. Bears were also reported to eat worms, fish, and more interestingly, ants, as this phenomenon has been well studied (Cicnjak *et al.* 1987; Swenson *et al.* 1999a).

The bear's diet during winter is a great mystery for informants as many of them wonder how this animal can survive without eating during winter. Thus, many of them (mainly in ethnic Albanian villages) reported that bears gather bones which they hide in their den to eat during winter: "I heard old people saying that from what [the bear] is eating during summer, from cows and sheep, he salvages bones and he brings them in the cave where he is living. He eats meat during summer while he keeps the bones for winter […]." Others affirmed they saw the bear's den with bones inside: "[The bear] has got a cave, he stays there regularly and it happened I found bones he gathered in this cave." Eating the bones could even have an effect on the fact they are sleepy: "The bear, [eats] what he salvages, the bones… because when licking them, they become soft and he sleeps more, he is like doped. That's what we say in our region: you sleep like a bear." However, some informants disagreed with that fact, arguing that bears are not eating bones, but licking their feet: "Somebody told me that during summer [the bear] brings bones to eat during winter, but that's their fantasy! They only stay cooped up during winter and they lick their paws." This behaviour could be a way to cheat hunger: "Because God gave it that as he can feel like if he would feed. When he becomes strained, he is hungry, he also chews tree's roots, and he also licks his feet, but it comes to him to kill time." This myth that bears can survive during denning period by licking their paws was also found in North America, northern Europe and

Siberia, and seems to be linked with annual shedding of foot pads by bears (Rogers 1974).

The Human-like Bear

Knowing bear behaviour and considering the many similarities between bears and humans, informants showed tendencies to identify themselves with this animal. The comparison between bears and humans could be based on physical characteristics: "The bear is the animal closest to man. I already killed a bear, but it was a mistake. And I saw other people killing them. If you see the paw of the bear, it's exactly like the human hand. The she-bear looks like the woman, too, the breast… it's like a human being." The fact that bears can stand on two feet is also important: "You can think it is a real human being. His paws are also interesting, he walks on two feet."

However, the physical shape of the bear is not the only similarity with humans, and its behaviour is also taken into account by informants to compare it with human beings. Thus, the bear is often perceived as the most intelligent animal. Its main characteristic is to be a very cautious animal, "like humans", taking care of its cubs, preparing its bed, eating fruits, rarely attacking livestock, and taking only one sheep when it needs one. These behaviours are appreciated by the informants, all the more so as many of them consider that the bear is able to reason: "The most intelligent wild animal is the bear. His intelligence is the biggest. That's because the bear knows exactly, he thinks about what to do. Its reasoning on certain things is really close to the human one. He knows exactly what to do. Other animals are less intelligent." Moreover, contrary to the wolf, which is viewed as really wild, the bear is a tameable animal, and is perceived as a gentle animal, not far from domestic ones: "The bear is intelligent. The wolf is the most wild, he is a quite wild animal, and he doesn't come close to humans. You can teach the bear, but never the wolf." In Albanian the bear was sometimes described as *butë*, which means 'soft', but also 'domesticated'. Thus, the bear is perceived as an animal with which it is possible to communicate: "Thus, you can get on with bears. […] They have conscience like humans." That is why, contrary to the wolves, which are driven back by making loud noises: "Because the wolf, […] you just say [shouts] 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!"

DISCUSSION

This is among the first ethnographic studies conducted in this region of Europe that focuses on modern day human-animal relationships. The narratives provided by the informants were detailed and generally internally consistent. The details of the narratives were also consistent with the findings of parallel ecological studies that were being conducted in region at the same time, and also consistent with the existing natural science literature on bear biology and human-bear 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 local knowledge that has been acquired through keen observation and frequent interactions with large carnivores in their shared environment.

The data collected and described above give a good insight into the behaviour and the ecology of the Macedonian bear, as viewed by rural hunters and livestock breeders. The majority of informants' descriptions were consistent with the existing literature about bears, apart from facts which are difficult to grasp by hunters or livestock breeders without specific technical research equipment (such as rarely observed events like mating, and the events within the winter dens). As a consequence of numerous interactions with bears, the knowledge of local informants is quite detailed and appears to be mainly based on their own experiences. Thus, as they are well known, the bear's particular behaviour and ecology will have an impact on the way hunters and livestock breeders perceive this species, and build their opinion about its status and management. Surprisingly, we barely hear any legends about bears, despite the generally rich mythology associated with this animal in European countries (Pastoureau 2007), and in the Northern Hemisphere in general (Hallowell 1926; Alford 1930; Ewers 1955; Cushing 1977; Janhunen 2003). Instead, the informants told us about their direct personal experiences.

Interaction and Knowledge

First of all, it seems that the behaviour of the bear is partly responsible for the relatively high level of interactions with people. Indeed, the frequency of interactions with a species is not only linked to the density of its population, but can also vary according to the density of the human population, the nature of human activities, and the behavioural patterns of the species. In Macedonia, even though bears mainly live in the forest and are considered by informants as a forest animal, they often enter into the domestic space when they come into the fields and the orchards around the villages to feed on maize, fruits, and sometimes enter garbage dumps, which are present in almost all mountain villages (as in Macedonia, the garbage is disposed of in a concentrated place, generally a sloping place in the outskirts of the village). Moreover, bears also use the summer pasture in the mountains, and if they are sometimes seen foraging for vegetation alongside cows, some of them occasionally enter livestock enclosures, or even barns, to kill sheep. Of course, this behaviour is linked to the presence of human food resources, which can influence bear behaviour and drive them to come close to human settlements in order to feed on high energy forage (Mattson 1990). Anyway, the fact that bears are not very elusive and do not hesitate to enter the domestic space is very important, as it leads to a relatively high level of interactions with humans, thus contributing to the fact that bears are a well-known species. Moreover, as interactions with bears are many, bears are often perceived

by informants as being common, or even numerous, in their region. However, it has to be noticed that in general, hunters have more interactions and are more knowledgeable about bears than shepherds. This could indicate that the interactions between humans and bears occur more often when humans go into the 'bear world' (forest and mountains) than when bears enter the 'human world' (villages, summer pastures, etc.).

Individualisation and Appropriation

Bear presence in the surroundings of a village is well known by the villagers working, walking or hunting in the area. Since they think that bears are solitary and territorial animals, and being a long-lived species which can live for several dozen years, villagers do not consider that there are many different bears around. Rather they believe that there is one, or at most a few, bears living in the surroundings. Indeed, for many informants, the bear which is coming in the orchard or in the pasture, not so far from humans, is always the same, and for a long time. Thus, this animal is easily identified, easily located and can be individualised. These perceptions enable local people to appropriate individual bears and to talk about a bear as 'their' bear, or the bear living in their region. This bear can be described according to its colour or the shape of the face, and sometimes they even give the bear a name: "There was one here, in XXXX, he was called King-Kong, but they killed him. They are rare, they are black bears… He was called King-Kong." This local perception of bears as individuals parallels some modern ethological research which has quantified individual behavioural traits in bears and even refers to bear 'personality' (Fagen & Fagen 1996).

Harmfulness and Management at the Individual Level

This individualisation of the bear, combined with the perception of their diet, which drives informants to make a distinction between herbivorous and carnivorous bears, strongly influences their opinion concerning the management of bear populations. Indeed, apart from the damage to beehives, the main problem reported about bears was livestock depredation, since orchards do not seem to be much used anymore in northwestern Macedonia, due to rural abandonment. However, even if interactions with bears are sometimes the result of an attack on livestock, this event is not reported as being common, and the bear is not perceived as causing much damage, in contrast to the wolf. Bears and wolves seem to form a 'pair of opposites' as suggested by Bobbé (1993), where the wolf takes the 'bad' role while the bear appears to be 'good'.

Nevertheless, it is likely that the perceived harmfulness for each species is not only linked to the damage they are likely to cause but also to the possibility that the local population has to assert control over these species. As the bear can be identified, localised and individualised, it appears as an animal which is manageable, all the more as it is perceived as an intelligent, cautious, and understanding animal with whom it is possible to interact and communicate. Thus, even if it causes some damage, 42.6% of informants were favourable to the legal protection of bears[3], 23% suggested no action against the bears, and only 16.4% advocated selective hunting of bears, which can be easily explained by the fact that informants consider damages to be the consequence of the behaviour of one specific bear, and not the consequence of the behaviour of bears in general: "They should not be hunted, they are not so dangerous, but they must be controlled and the bear who attacks must be convicted." Management actions at the population level (regulation, population reduction, and elimination) were rarely suggested by informants. This confirms the individualised character of the bear, but can also be associated with their low reproductive rates, of which most informants are aware. Finally, the bear appears as a real actor in the informants' worldview, an alter-ego with which it is possible to interact properly, and which has its place in the forest, even if it is just as an "ornament of the mountains". Indeed, it appears that in Macedonia, the bear remains "the king of the forest"—to directly quote a Macedonian hunter—as it was in almost all of Europe before the expansion of Christianity (Pastoureau 2007).

Conservation Implications

The results portray an animal that enjoys a respected and positive image among local hunters and livestock producers, despite the recognition that bears are responsible for some conflicts such as livestock depredation and crop raiding. The perceptions that the informants have of bears appear to be based very much on their own direct interactive experiences with bears. Relatively little of the rich mythology that bears are associated with was referred to in the interviews. There appear to be few social barriers to bear conservation emerging from our material, although it seems important that locals have the option of reacting against individual bears that cause damage. In other words complete protection without the possibility of exceptions could well be counter-productive as it would remove the feeling of control over the situation that local informants felt.

CONCLUSION

Few other studies have focused on the effects of human-wild animals' interactions on perceptions and practices. Traditional ethnographic studies have generally focused on the symbolic and cultural importance of animals, which were often considered as passive objects and their image as the result of human social construction (Lescureux 2006). Our results show that local knowledge can be constantly updated and developed through interactions with animals, and can drive people to contest both scientific and 'traditional' knowledge. During our interviews, people were rarely referring to the regional mythological and symbolical background (see Elsie 2001; Gura 2005; Mencej 2006) and even denied it. In the same way, they have access to some of the results from scientific research through hunters' magazines, and

reject contradictions with their own experiences. Thus, the impact from hunters' magazines and TV documentaries on local ecological knowledge is something that should be addressed in the future, from both the social science and the conservation science point of view. However, it appears that local knowledge about the bear's ecology and behaviour is constructed in a very active way in interaction with bears and the environment. As bears are responsive to human practices, the human-bear relationship we observed seems to follow Ingold's proposition according to which "*humans and animals constitute themselves reciprocally with their particular identities and purposes*" (Ingold 1996: 131). Therefore, any conservation action towards potentially conflicting species should take this reciprocity into account, and favour a context that allows the maintenance of this reciprocity without threatening the species' population, thus avoiding the emergence of conflicting situations or the aggravation of existing conflicts.

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Notes

1. The Bear is protected according to the Hunting Law. The 1996 Hunting Act introduced significant changes. According to s. 12, 15 the bear is under absolute protection and bear hunting is permanently banned. There is an exception nevertheless. Hunting might be allowed with a MAFWM permission for scientific and educational purposes, for zoos and natural history museums, for breeding and the prevention of contagious diseases, as well as when the species is causing damages (s. 17, 18 par. 4). In case the species causes damages, the MAFWM is issuing a hunting permission following the advice of the government's administrative body competent for environmental protection. Although the country has not yet ratified the CITES and Rio Conventions, the Bern Convention has been in force since 1999. (Law on Hunting, 1996. Ministry of Agriculture, Forestry and Water Management of Republic of Macedonia. Official Gazette of RM 20/96.)
2. A place approximately 20 km from Gostivar city but he can be talking about the commune, which is close to the Mavrovo commune.
3. Of course, the term 'protection' can have several meanings, but was mainly regarded by informants as a mean to preserve species and even to reinforce its population.

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APPENDIX

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

Herding practices (HP, only asked to livestock breeders)

- Do you give a name to the ewes? For example?
- Are you able to recognise 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, only asked to livestock breeders)
- 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, only asked to livestock breeders)

- Are the dogs able to protect your flock?
- Do you give a name to your dogs? Which name?
- 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, only asked to livestock breeders)

- 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, only asked to hunters)

- 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, asked successively for bears, wolves, and lynx)
- Have you ever seen a bear?
- If not, have you ever seen bear's tracks, scats, and marks?
- How old were you the first time you saw a bear?
- How did it happened? What was your feeling?
- Since that time, do you often see the bear? How many times a year?
- What does a bear eat?
- Can a bear catch wild animals? Which ones?
- How does the bear catch wild animals?
- Do you think that the bear is using strategies/plans to hunt?
- Does the bear attack domestic animals? Which ones? How often? When (season, day/night)?
- When does the bear have its breeding season?
- Outside this season, does the bear lives alone or in group?
- When does the bear have its birth season?
- How many cubs does the she-bear have?
- Who is taking care of the cubs, the male, the female, or both of them?
- How long do the cubs stay with their mother/parents?
- Do the parents stay together during their entire life?
- How long does a bear live?
- In which kind of landscape it is possible to see the bear?
- Does the bear live 1) outside, 2) in a natural cave or 3) in an excavating den?
- If 3): does the bear excavate its den themselves?
- Does the bear have a territory where the other bears do not enter?
- What is approximately the surface of the bear's territory?

Perceptions (PE, asked successively for bears, wolves, and lynx)
- Do you think there are a lot of bears in this region?
- Is it good to have bears in this region?
- Do you think that bears are harmful for livestock?
- Do you think that bears are dangerous for humans?
- Do you think that we have to eliminate bears? 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?
- Did the creation of the MNP have an impact on game animals? (only asked to hunters)
- 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 (wild or/and domestic)?