



Original Research Article

All carnivores are not equal in the rural people's view. Should we develop conservation plans for functional guilds or individual species in the face of conflicts?



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ABSTRACT

We tested differences in attitudes towards bears, wolves and lynx among the rural public in Albania and Macedonia through information collected from a questionnaire survey (n = 759). Wolves were the species with the least positive attitudes among the rural public and had the lowest support for conservation compared with bears and lynx. In addition, conflict perception of wolves was higher than for bears and lynx. We argue that, based on species specific differences in public attitudes, conservation initiatives and management plans for large carnivores should deal with wolves separately from bears and lynx, as lower public support for wolves might jeopardise the conservation of the two other large carnivores. Bears and lynx can be potentially treated together in conservation initiatives based on the similar levels of public support for conservation, however, from a conflict-management point of view, all three species need to be addressed separately.

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1. Introduction

Large carnivore conservation remains a challenging endeavour worldwide. Their large spatial requirements and conflicts with humans are the main challenges when it comes to conservation (Gittleman et al., 2001; Woodroffe and Ginsberg, 1998).

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From an ecological perspective, carnivore conservation objectives should be set to ensure the viability of large populations and thus require large areas to fulfil the species' ecological requirements. However, as humans have influenced and fragmented the majority of natural landscapes worldwide, setting aside wilderness conservation areas large enough to sustain viable large carnivore populations is almost impossible, particularly in a European context (Linnell et al., 2005; Woodroffe and Ginsberg, 1998). Conservation must therefore occur in multi-use human-dominated landscapes and as a result conservation ambitions for large carnivores in Europe are constrained by both the fact that humans have modified the natural landscape for millennia, and by the degree of acceptance that local human populations have for their presence (Linnell et al., 2001). Large carnivores cause considerable economic damage throughout Europe, mainly due to livestock depredation (Kaczensky, 1999), and they also sometimes represent a risk for human safety (Löe and Röskaft, 2004). Conserving large carnivores in such human dominated landscapes requires complementing classic conservation biology approaches (Carroll et al., 2001; Noss et al., 1996) with social science research which examines human attitudes toward these species (Bath, 1998; Decker et al., 2001; Manfredi et al., 1996), and the integration of the latter into conservation strategies and programmes.

Within conservation biology there has been a trend for moving away from single-species conservation to more holistic, ecosystem approaches (Groom et al., 2006). The historical developments include ideas such as 'ecosystem management' (Christensen et al., 1996; Grumbine, 1994), and the 'ecosystem approach' (COP, 1998). The motivation is to rationalise the use of limited resources for conservation by focusing on entire ecosystems rather than single species (Christensen et al., 1996). This is further supported by the fact that many ecosystem elements either depend on, or interact with, one another and moreover, they provide a more practical approach for conservation. One way to rationalise this approach is to focus efforts on functional groups of animals or 'guilds' that, given their ecological characteristics and functions, will theoretically ensure the protection of ecosystems at large (Lambeck, 1997; Roberge and Angelstam, 2004; Simberloff, 1998). Large carnivores are a potential target of this 'guild' approach (Carroll et al., 2001; Noss et al., 1996). Across the European continent there is a strong movement for the conservation of large carnivores as a group; grey wolves (*Canis lupus*), brown bears (*Ursus arctos*), Eurasian lynx (*Lynx lynx*) and wolverines (*Gulo gulo*) are often packaged together in conservation efforts and initiatives. Many environmental organisations in Europe base their awareness and fundraising activities on this large carnivore 'guild', and often implement programmes aiming at the simultaneous conservation of all large carnivores (EAZA, 2010; Kirby, 1999; Salvatori, 2013).

Species-specific differences in public attitudes could potentially represent a problem for the 'guild' approach if different species inspire different feelings among the public. Negative attitudes toward a particular species might negatively influence the public's view of the entire guild, including species that the public might not be particularly against or which may even be favoured for conservation (Farhadinia et al., 2017). Attitudes about large carnivores can vary according to a number of factors and variables, often linked to cultural, economic and social circumstances (Kleiven et al., 2004; Roskaft et al., 2007). These differentiations are widely noted even in historical literature and folklore. While wolves have been traditionally depicted as merciless beasts of destruction, evil creatures and are ever-present in legends and stories across the European continent (Dingwall 2001; Marvin, 2012), lynx are hardly talked about in a historical or cultural context and remain a poorly known species for most people (Breitenmoser and Breitenmoser-Würsten, 2008). In addition, wolves and bears have a history of attacking and even killing people and have been feared for this reason, but there is hardly any evidence of lynx or wolverines attacking humans (Breitenmoser and Breitenmoser-Würsten, 2008; Kruuk, 2002; Linnell et al., 2002). Moreover, carnivores are not equal in the level of damage they can inflict on economic activities, with wolves being responsible for most losses of livestock and bears causing more damage on crops and fruit trees (Andersen et al., 2003; Kaczensky, 1999; Swenson and Andren, 2005). Lescureux and Linnell (2010) further argue that people have different perceptions of carnivore species and their characteristics, depending on the species' cultural history, ecology, the level of damage they cause, and their level of interactions with humans.

This study seeks to explore the relative ranking of attitudes toward three species of large carnivores, namely wolves, bears and lynx, within a sample of the rural public in Albania and Macedonia who share their immediate environments with these species. We conducted a quantitative study based on the administration of a questionnaire survey, aiming to collect information on people's perceptions of, and attitudes towards, the three species. This study is the first of its kind in the region and represents a new possibility for modernising wildlife management policies and decision-making processes in these two countries. In addition, it is an exploration of the relative opinions of different species given by the same people within the same sample of the population. As such, it brings new insights in human dimensions research as it is one of few studies in Europe that simultaneously looks at public attitudes towards several species of large carnivores. The specific hypothesis was to test whether public support and attitudes toward large carnivores differ considerably between the three species and the two countries. Based on the results, implications that might arise for current and future conservation and management approaches are discussed. Furthermore, the results are also interpreted in light of similar attitudinal studies that have been conducted in other parts of Europe, especially when it came to exploring the extent to which various individual characteristics (such as age, gender, education) influence variation in general attitudes.

2. Materials and methods

2.1. Study area

The study area is in the regions of eastern Albania and western Macedonia covering a total area of 13,407.2 km² (S1). This area was selected because it is the only area in the region with a documented presence of all three large carnivores (Chapron

et al., 2014; Ivanov et al., 2008; Kaczensky et al., 2013), therefore providing higher chances for respondents to give opinions on all three species. While the brown bear and wolf are considered to have larger and stable populations in both countries, the lynx is evaluated as critically endangered with very few individuals remaining (S2). The lynx in Albania and Macedonia are part of the remaining Balkan lynx population, estimated to be the most threatened indigenous population of Eurasian lynx in Europe, with no more than 40 mature individuals remaining (Melovski et al., 2015).

The survey was conducted in 32 municipalities in Albania and 29 in Macedonia with a cumulative area of 3227.2 km² and 10,180 km² respectively. The cumulative population of the study area municipalities in Albania was 163,500 inhabitants (Institute of Statistics, 2003) with a population density of 50.7 people/km². The study area in Macedonia had 358,600 inhabitants (State Statistical Office, 2007) with a population density of 35.2 people/km². These areas are predominantly rural, characterised by small villages scattered over a largely mountainous and forested landscape. The main human activities are farming, livestock breeding, forestry, collection of medicinal and aromatic plants and other forest products, and hunting. The most commonly kept livestock species are sheep and to a lesser extent cattle, goats, donkeys and horses. In recent decades, these areas of Albania and Macedonia have been facing rural depopulation, with locals migrating out of the area towards big cities in the respective countries or even abroad. However, this abandonment occurred in different periods in the two countries; in Macedonia having its peak in the 1950s and 1960s (Thomas, 1982) and in Albania occurring almost entirely after the collapse of the communist regime in 1990s (King and Vullnetari, 2003). The physical landscape is characterised by agriculture fields in valley bottoms and around villages, forests on mountain slopes, and alpine pastures and meadows at higher elevations. Agriculture and livestock breeding remain rather traditional and occur at a near subsistence level, particularly in Albania (Keçi et al., 2008; Kume et al., 2004).

2.2. Sampling frame and data collection

Only residents 18 years and older were eligible to take part in the survey. Stratified random sampling was used to ensure a proportional representation of the population. A target sample of 400 questionnaires per country was chosen so as to ensure a 95% confidence level and 5% confidence interval (Sheskin, 1985). In total ten interviewers (five in each country) helped in the data collection process, all of whom had received prior training for the survey. All interviews were conducted face-to-face and people were selected on a random approach after entering a given village – e.g. every third person encountered in the street. The field survey extended from April 2007 to January 2009.

2.3. Questionnaire structure

The survey instrument (S3) was a questionnaire developed out of similar research studies in other European countries (Bath et al., 2008; Bath and Majic, 2001; Kaczensky et al., 2004). The questionnaire was adapted according to Albanian and Macedonian contexts and was focused on the three species of large carnivores present in these countries. Questions were organised around general topics such as attitudes, beliefs, knowledge of species, management, personal experiences, and socio-demographic information. There were 46 questions in total, of which 24 were asked for all three large carnivore species, six were questions intended to measure general environmental attitudes of participants, two were management-specific questions concerning respectively lynx and wolves, three questions focussed on related attitudes toward general societal issues, and 11 were questions concerning background socio-demographic information and interviewee profile. Attitudinal items were based on a 5-point Likert scale and scored from 1 (strongly disagree/dislike) to 5 (strongly agree/like).

2.4. Data analysis

All statistical analyses were done in the R statistical environment (Version 3.1.2, R Development Core Team, 2014). Initially we reduced data among the attitudinal questions by performing a principal component analysis (PCA) with Varimax rotation to summarise the types of attitudes measured by the questionnaire items. We used the functions in the R package *Psych* (Revelle, 2014) for the PCA, and did the analysis for all three species together to enable comparisons. Based on a scree plot analysis, we extracted two factors that included the majority of variance in the data (fit = 0.94). We based the interpretation of these two factors on loadings of different variables (responses to specific questions) in each factor. Grouped in the first extracted factor were the responses to questions about support for conservation (SC) of species. The second factor was interpreted as conflict perception (CP) of species, as it included the responses to questions about perception of large carnivores as dangerous and a threat to human livelihoods (Table 1). We used these two factors (SC and CP) as response variables in the downstream analysis. To ease interpretation, we centred and scaled both factors on a scale –2 to 2, where 0 is “neutral” (all answers on the Likert scale).

We used linear mixed effects models with R package *nlme* (Pinheiro et al., 2014) to model the effects of independent variables on SC and CP scores. A set of models was fitted for each of these two factors as the response variables, with explanatory variables selected *a priori* based on the existing knowledge and reasoning about their effects on the response variable (Burnham and Anderson, 2002). Besides existing explanatory variables in the questionnaire, we created a knowledge score (0–15) for large carnivores as a new variable, by summing correct answers given by each respondent in regard to questions on ecology (weight, way of living, diet) and legal status (protection status, payment for compensation) of the three species in each country. Since there was no reason to expect a particular distribution for the response variables (and hence use

Table 1

PCA loadings of each attitudinal question for the two extracted factors. Only values > 0.30 are shown.

Question	Support for Conservation	Conflict Perception
How do you feel about [bears, wolves, lynx]	0.72	−0.30
It is important to save [bears, wolves, lynx] for future generations	0.76	
[Bears, wolves, lynx] attract tourists	0.68	
[Bears, wolves, lynx] cause big damage on livestock	−0.35	0.64
I'm afraid the presence of [bears, wolves, lynx] might cause financial loss		0.69
[Bears, wolves, lynx] that kill livestock should be killed	−0.36	0.57
It is known that [bears, wolves, lynx] kill people		0.57
[Bears, wolves, lynx] reduce prey populations significantly and make hunting impossible		0.65
[Bears, wolves, lynx] should be entirely protected by law	0.69	
I would agree for [bears, wolves, lynx] numbers to increase in [AL, MK]	0.67	−0.31
I think we already have enough of [bears, wolves, lynx] in [AL, MK]	−0.31	0.48
There should be authorised hunting of [bears, wolves, lynx] in [AL, MK]		0.61
% of variance explained by each factor	24	24
Cumulative % of variance explained	24	48

an appropriate link function in a generalized linear model) we used the identity link (Gaussian errors) and transformed the response variable as required. While the CP score had a unimodal symmetrical distribution, and didn't require a transformation, we inverted the data and used the lognormal transform for the SC score, and back-transformed the results for interpretation. Since the explanatory variables were selected *a priori* based on our understanding of the questions, we fitted the full model set for these variables without interactions up to the number of parameters supported by the data. We used 40 data points per parameter as the criteria, where we considered each respondent as a data point. Since each respondent generated three records (one for a set of questions for each species) and these records were not independent, we included the respondent as a random effect variable fitted into the intercept. We used diagnostic plots for the global model in R to check for heterogeneity, non-normality and model outliers. Clear model outliers were removed from the data and were not further explored since there were few. We checked for multicollinearity using Variance Inflation Factors. We checked for heterogeneity in the data by plotting residuals against fixed-effects variables, and included error structure in the model (Zuur et al., 2009). Since the variance for different species and genders varied, we included the correction in the model error structure using varIdent weights (Zuur et al., 2009). The models were ranked using the Second-order Information Criterion (AICc), and we used Akaike's weights to estimate the relative importance of each variable (Burnham and Anderson, 2002). Among the models with the lowest that were within $\Delta AICc \leq 2$, we considered the models with the least parameters as the most parsimonious. These final models (Table 2) for both response variables were checked again for fit and used for inference. Fitting of the full model set, estimation of variable importance and model averaging were done using the R package *MuMIn* (Bartoń, 2014). The process of factors extraction and subsequent model selection are summarised in Appendix S4.

3. Results

3.1. Respondents' characteristics and interactions with large carnivores

In total, 759 people were interviewed during the survey, 397 in Albania and 362 in Macedonia. A detailed descriptive profiling of respondents can be found in Appendix S2. The original sampling design aimed to interview an equal number of men and women. However, because of the conservative and patriarchal nature of societies in the region, it was not always possible to interview enough women, despite having female interviewers in each team. This resulted in a male bias among the respondents (76.9% men and 23.1% women). The bias was higher in Macedonia where only 15% of the respondents were women. The average age of respondents was 43.3 years (range 18–83) and among these the Macedonian sampled population was on average younger (40.5 years) than the Albanian one (45.8 years) [$t(757) = 5.136$; $p < 0.05$]. In respect to residence, the vast majority of respondents (94.6%) in both countries described themselves as being permanent inhabitants in their respective rural municipalities. In Albania, livestock and beehive ownership was higher than in Macedonia, with the majority

Table 2

Support for conservation (SC) and conflict perception (CP) models and the explanatory variables used in them. Explanatory variables with * are a-priori hypothesised interaction variables, which improve the model.

Response variable	Explanatory variables
Support for conservation (SC)	'species', 'interest in hunting', 'gender', 'had damage', 'knowledge species', 'interest in hiking', 'seen captive', 'country', 'education', 'practice hunting', 'species*gender', 'gender*education', 'hunt*education', 'species*knowledge species', 'species*country'
Conflict perception (CP)	'country', 'species', 'education', 'knowledge species', 'gender', 'had damage', 'interest in hiking', 'seen captive', 'interest in hunting', 'has livestock', 'species*has livestock', 'species*gender', 'species*knowledge species', 'country*hunt', 'country*species'

of the respondents claiming to own at least one head of livestock, whereas in Macedonia livestock ownership was rather limited to fewer people (in AL: 48.5% were owners of small livestock, 77.3% owners of big livestock and 6.5% owners of beehives; in MK: 8.3% were owners of small livestock, 29.6% owners of big livestock and 2.8% owners of beehives). Hunting was practiced by more respondents in Albania than in Macedonia (24.1% of respondents in AL, 16.3% in MK).

People in Albania seemed to have more interactions with wolves and bears in the wild when compared to Macedonia as higher incidences of observations, shooting of, and damages from these two large carnivores were reported. The picture was inverted for lynx, with people in Macedonia having reportedly more interactions with the species. Overall, wolves and bears were the species with which people had most interactions, and lynx were the least interacted with. Respondents in Macedonia had more observation experiences of large carnivores in captivity than Albanian respondents. Wolves were reported as the most damage-causing animal in both countries, followed by bears, whereas there were very few reports of lynx causing damage in Macedonia and none in Albania. There seems to be a general lack of knowledge of lynx as a species in Albania. Despite showing a lynx photograph during the interviews, only about one third (33.5%) of respondents in Albania reported knowing the species and were thus able to give answers to the lynx-related items in the questionnaire. Descriptive analysis of interactions with large carnivores are presented in Appendix S2.

3.2. Attitude differences between species and countries

Through the constructed models we explored the effects of single explanatory variables, and their selected interactions, have on the response variables (SC and CP), while controlling for the effect of other variables. The most obvious effect is that of species in SC ($i = 1.00$; “ i ” is the importance of predictor variables expressed in terms of proportion of models that use the variable weighted by each model's Akaike's weight). Bears and lynx enjoy a high support for conservation as they rank the highest in the SC score. Wolves, on the other hand, ranked the lowest among the three large carnivores, being the least favoured species for conservation, among members of the rural public in both Albania and Macedonia (Fig. 1). However, the SC score of wolves is still positive (above zero), indicating that, for the most part, the rural population in Albania and Macedonia is supportive of their conservation. Therefore, it can be argued that all three species enjoy a positive support for conservation in Albania and Macedonia, however, wolves are supported less than bears and lynx.

The support for conservation results are mirrored by the effect of species in conflict perception ($i = 1.00$). Wolves are considered by far the species that evoke a greater conflict perception among a majority of people, bears rank second and lynx rank third and almost neutral in their CP (Fig. 1). While the SC model suggests that bears and lynx enjoy a largely similar support for conservation and wolves are the species that stands out with the lowest support, the CP model separates all three species from each other.

Country differences and their effect on SC and CP, were evident in both constructed models. Support for conservation seemed higher in Albania than Macedonia (when controlling for knowledge, education and gender). The Albanian public had more supportive attitudes for the conservation of all three species, and this difference was higher for lynx and lower for bears (Fig. 1). In addition, in Albania, SC for lynx was the highest among all three carnivores, whereas in Macedonia, bears ranked first in SC, slightly above lynx. Wolves had the lowest SC in both countries.

Interestingly, support for conservation does not seem to be driven by conflict perception, as this was higher in Albania as well. In general, the rural Albanian public perceived wolves and bears as species causing more conflict than their counterparts in Macedonia did. The picture was less pronounced for lynx, the CP of which was close to neutral in Albania and slightly negative in Macedonia (meaning that the majority of the public did not perceive the lynx as a conflict species). In both countries, wolves were perceived as the species causing most conflict (Fig. 1).

3.3. Exploring effects of respondents' characteristics on attitudes

3.3.1. Knowledge about large carnivores

The effect of knowledge was prominent in both models (SC: $i = 0.94$; CP: $i = 1.00$). People with greater knowledge about large carnivores were more supportive of their conservation and perceived fewer conflicts with them than people who knew less about large carnivores (Fig. 2). However, there were differences between species concerning the degree of the effect of knowledge on both models. Knowledge had the most impact on SC for lynx and the least impact for wolf (Fig. 2). In regard to CP, while increases in knowledge had a very strong impact in reducing conflict perception of lynx and bear, it seems to have a very marginal, to almost no, impact in reducing conflict perception of wolves (Fig. 2).

3.3.2. Gender

The gender of respondents was an important predictor in terms of attitudes towards large carnivores, for both SC ($i = 1.00$) and CP ($i = 0.91$). Women were, in general, less supportive of large carnivore conservation and considered them more a cause of conflict than men. The difference in SC metric was the largest for bears, and the least pronounced for lynx. On the other hand, both men and women perceived wolves to be the species causing most conflict and came quite close in that attitude. The difference in the CP metric was, again, largest for bears. With regard to lynx, the majority of men do not consider them as conflict species as their CP is below zero (Fig. 3).

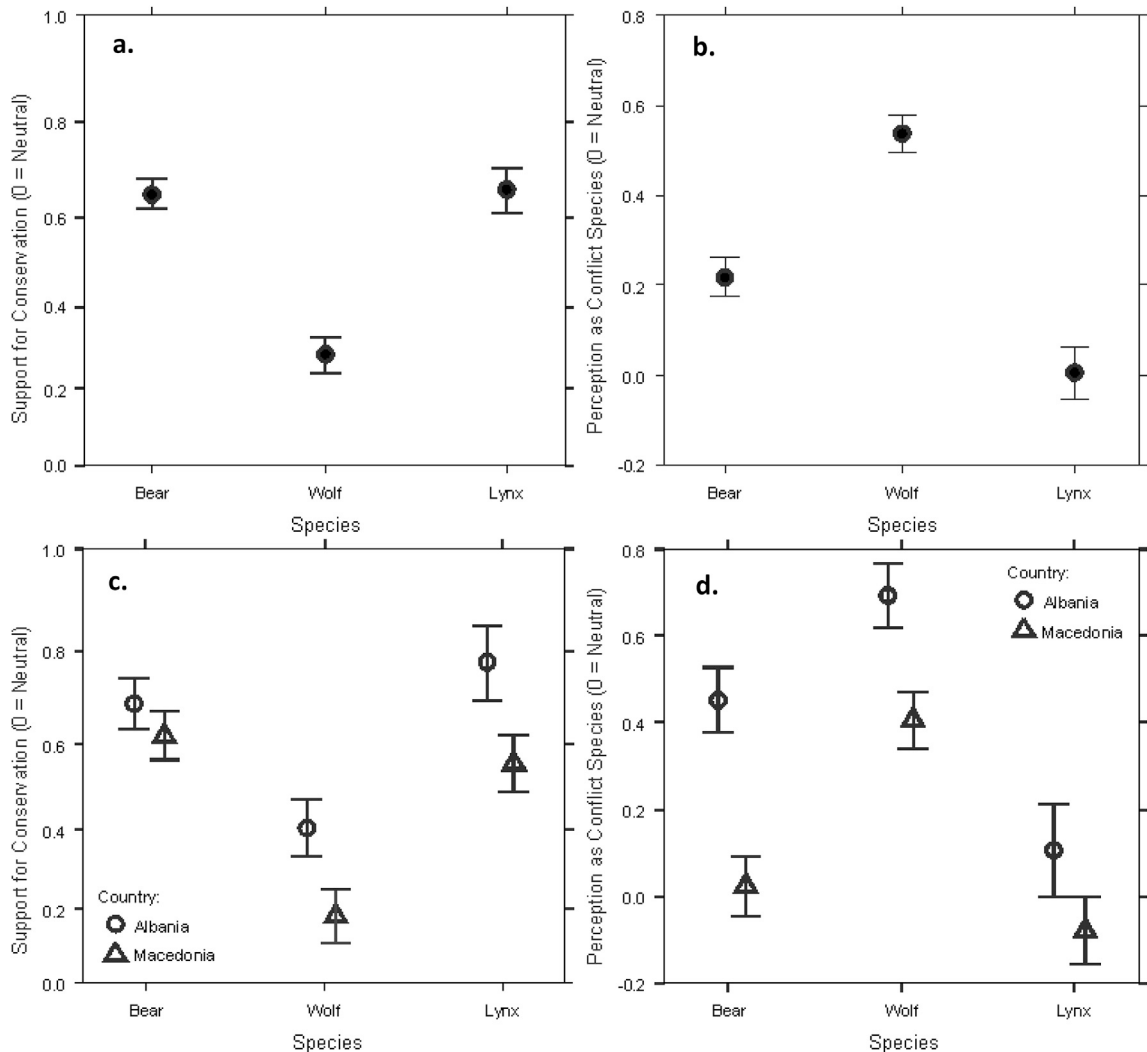


Fig. 1. Effect of species in SC (a.) and CP (b) and of species by country in SC (c.) and CP (d). For SC -2 = most negative, 0 = neutral, +2 = most positive and for CP -2 = no conflict, 0 = neutral, +2 = most conflict. Bears and lynx seem to enjoy a high support for conservation, whereas wolves have by far the lowest support (albeit still positive). Wolves are considered the most conflict causing species, followed by bears, while lynx rank almost neutral in people's conflict perception. All three species are supported more in Albania than in Macedonia, with the difference being largest for lynx and smallest for bear. Simultaneously, all three species are perceived more conflict causing in Albania than in Macedonia.

3.3.3. Education

Our study revealed a strong effect of education on both SC ($i = 0.71$) and CP ($i = 1.00$) models. It seems that higher education levels are associated with an increase in SC and decrease in CP. The effect of education was much stronger for CP than for SC (Fig. 3).

Whilst for the CP model the education variable does not seem to interact with any other variable for improving the model, for SC it interacts with gender and 'interest in hunting'. There seems to be a difference in how men and women, in terms of how their levels of education affects support for large carnivore conservation. Education has a much greater effect on women than it does on men. Increased education in men doesn't seem to have a significant effect on SC, whereas the effect is much stronger for women, for whom, increase in education leads to higher support for conservation. Exploring these effects on a species by species approach, we noticed that the difference in the SC metric between men and women decreased significantly with an increase in education of women. In the case of support for lynx conservation, women with higher education are even more supportive than men with the same level of education, and they come quite close to men in the wolves' case (Fig. 3).

Since our population sample was highly biased towards men (particularly in Macedonia), careful considerations are needed when interpreting the interplays between gender and education. In addition, exploring education levels between genders and countries showed that in general the Macedonian women's sub-sample had a higher level of education than the Albanian one. Most of the women who agreed to partake in the questionnaire survey in Macedonia had tertiary (university)

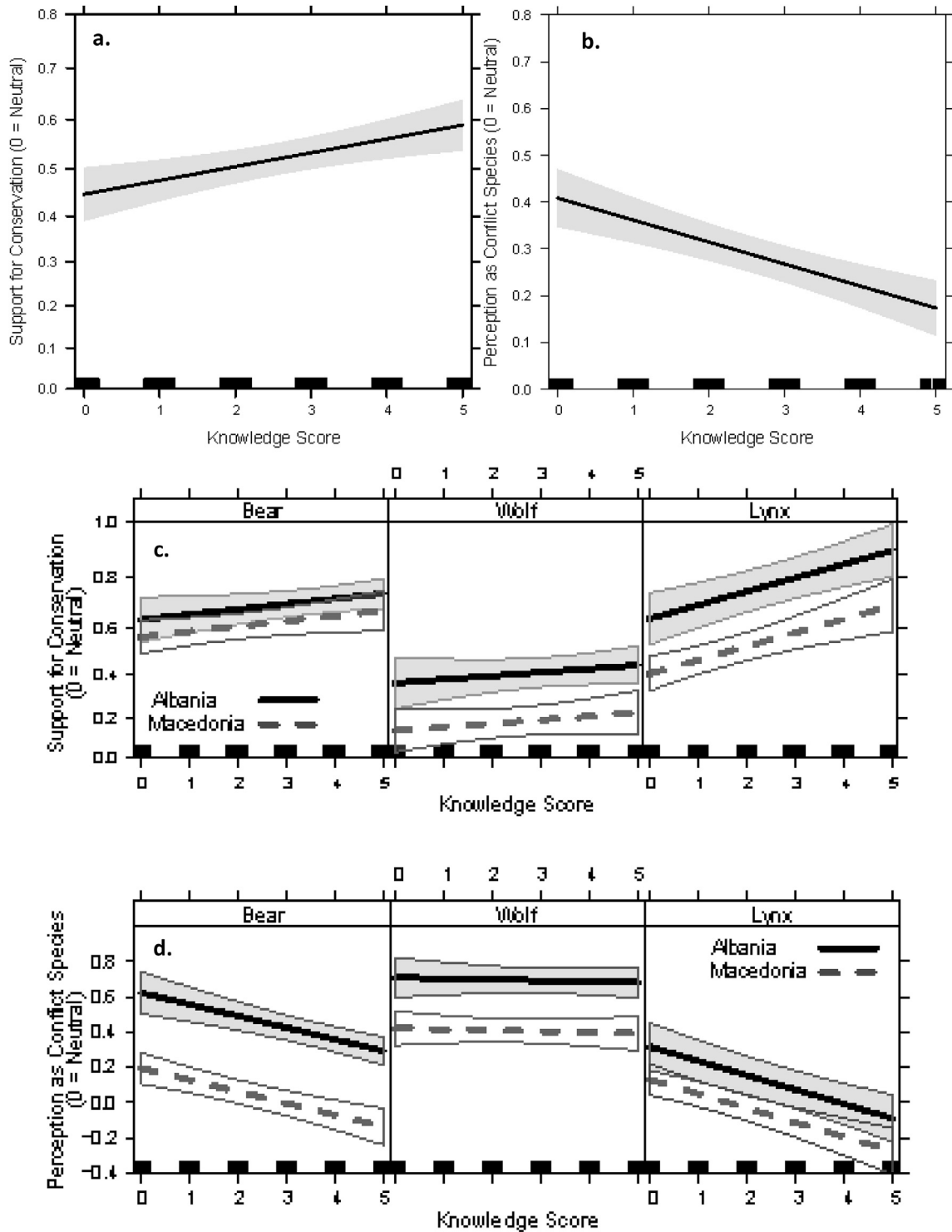


Fig. 2. Effect of knowledge on SC (a.) and CP (b.). Effect of knowledge by species and country on SC (c.) and CP (d.). Higher knowledge about large carnivores leads to higher support for conservation and lower conflict perception. The effect in SC is stronger for lynx and least pronounced for wolf, whereas in CP effect of knowledge is almost negligible for wolf and very strong for lynx and bear.

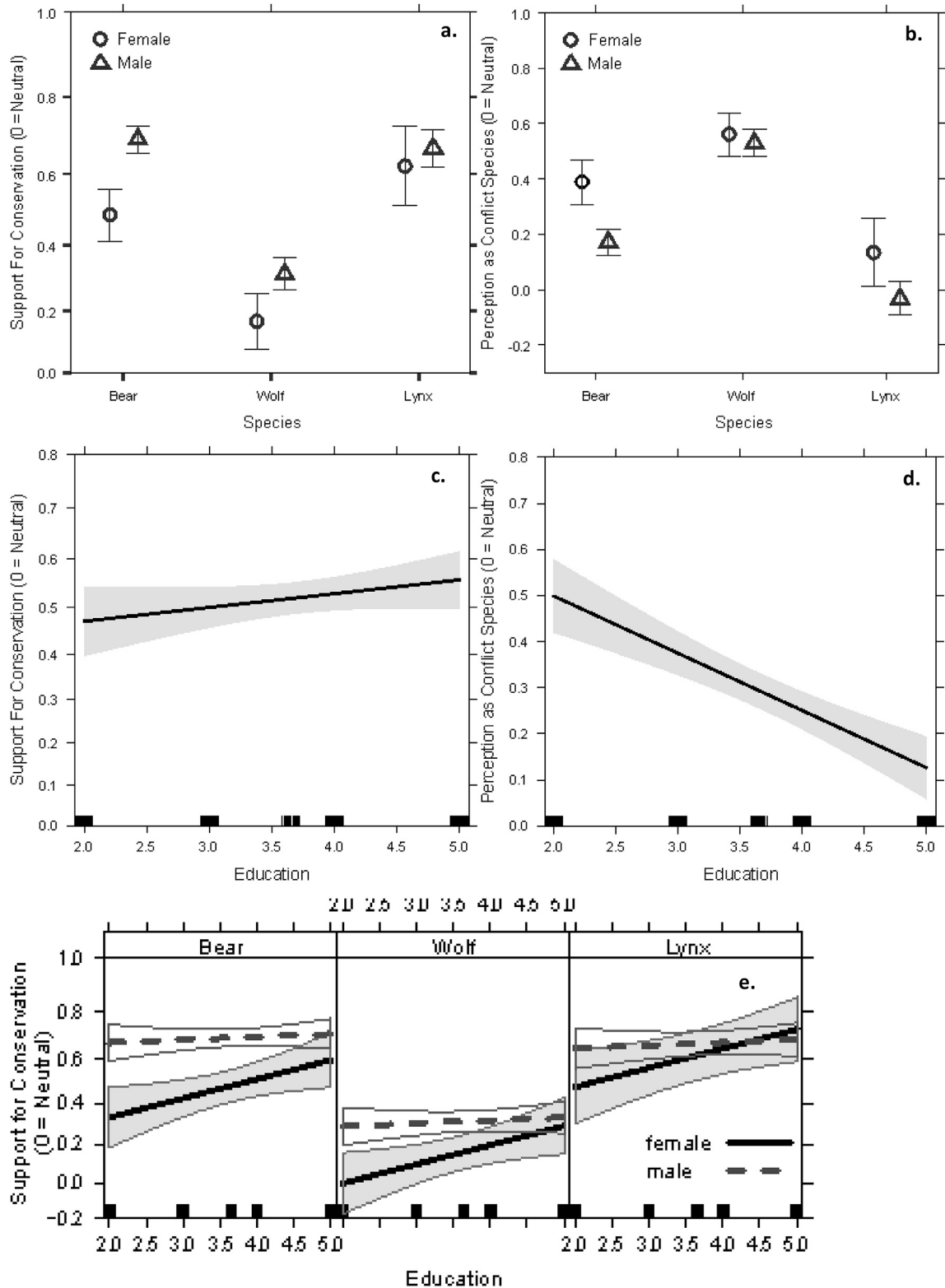


Fig. 3. Effect of gender and education on attitudes towards large carnivores. Effect of gender on SC (a.) and on CP (b.). Effect of education on SC (c.) and CP (d.). Effect of education by gender and species on SC (e.). Men are more supportive of LCs and perceive them less conflict species than women do. Higher education leads to higher support for conservation and lower conflict perception. The effect in SC is stronger for women; higher education in women leads to higher SC than among men.

education, considerably higher than the median education of women in Albania (primary education). The Macedonian subsample seems to be highly biased towards more educated women (for results on descriptive statistics of our sampled population refer to Appendix S2).

3.3.4. Livestock ownership and damages from large carnivores

While 'owning livestock' did not come up as an important predictor in the SC model (importance = 0.29), it seems to have an effect in the CP model, when it interacts with the 'species' variable (Fig. 4). Interestingly, while people who owned livestock perceived wolves and lynx as slightly more conflictful species than people who did not own livestock, the effect for bears was the opposite i.e. owners of livestock had lower perception of conflict than people who did not own livestock.

Experiencing damages from large carnivores came up as an important predictor in both models (SC: $i = 0.99$; CP: $i = 1.00$). As expected, people who had experienced damages from large carnivores were less supportive of their conservation and had higher conflict perceptions than people who had not experienced damages, however these differences in the metrics of both models were low (Fig. 4).

3.3.5. Interest in hunting

The modelling results indicate that 'interest in hunting' has an effect on both SC ($i = 1.00$) and CP ($i = 0.59$) models. Interestingly, the parameter "has interest in hunting" seems to be a much stronger predictor of an effect of hunting than the yes/no parameter of whether a person actually practices hunting, which only came up in the SC model ($i = 0.64$).

It seems that a greater interest in hunting is associated with more support for conservation of large carnivores (Fig. 5). For CP, the 'interest in hunting' variable interacts with the 'country' variable. It seems that an increase of interest in hunting has quite opposite effects on CP with regard to the country concerned. While in Macedonia an increase in interest in hunting is associated with increased conflict perception, in Albania it led to a decrease in conflict perception (Fig. 5).

3.3.6. Interest in hiking

A person's 'interest in hiking' was a very important predictor for both SC ($i = 0.91$) and CP ($i = 0.98$) models. There is a slight increase in SC with increase of interest in hiking. However, there is also a considerable increase in CP with increase in interest in hiking (Fig. 5).

4. Discussion

4.1. The large carnivore 'guild' and implications for conservation

This study demonstrates that there are substantial differences in attitudes towards the different species of large carnivores among the rural public in Albania and Macedonia, with wolves receiving less support for conservation and being more associated with conflicts. Albanians perceived all species as being more conflictful than Macedonians, but also expressed greater support for their conservation.

This research represents the first quantitative study on public attitudes towards wildlife conducted so far in Albania and Macedonia on a representative sample of the rural population, as well as the first to look at attitude differences between countries by using the same standardised research framework. In addition, it is one of few studies in Europe that simultaneously looks at public attitudes towards multiple sympatric large carnivores. Human dimensions studies tend to be focused on single species, with wolves often getting the greatest share of attention (Bath, 2009, 2000; Ericsson and Heberlein, 2003; Majić and Bath, 2010; Nilsen et al., 2007; Williams et al., 2002). There have been a few studies that attempt to look at public attitudes towards several large carnivore species at a time (Andersone and Ozoliņš, 2004; Hunziker et al., 2001; Kleiven et al., 2004; Roskaft et al., 2007; Wechselberger et al., 2005; Wechselberger and Leizinger, 2005), however, most of them remain either descriptive in nature or just focus on the factors that influence individual variability in attitudes. In this regard, the present study is one of the first to make an explicit comparative analysis of the attitudes of the same sample of the public towards different carnivore species.

Large carnivores are frequently treated as a 'guild' in European conservation initiatives based on their similar ecological needs and the similar potential to cause conflict with humans. Human dimensions' research on large carnivores has produced results that call into question the wisdom of this guild approach in conservation and management, primarily because different species of carnivores generate different feelings among members of the public. Kleiven et al. (2004) and Roskaft et al. (2007) conclude that public attitudes of the Norwegian population are quite species-dependent. Norwegians seem to be much more negative towards the larger carnivores, bears and wolves, and more accepting of the smaller ones, lynx and wolverines. More positive attitudes towards lynx are prevalent, even though lynx are documented to cause significantly more damage than wolves and bears in Norway – this is also explained by their higher abundance and wider distribution (Kleiven et al., 2004; Roskaft et al., 2007, 2003). In the Albanian and Macedonian contexts, wolves stand out by having lower support for conservation and higher conflict perception than bears and lynx. The more negative status that wolves have in people's perceptions is probably a reflection of the wolves' greater involvement in conflicts with people, mainly by depredating on livestock (Keçi et al., 2008). Lescureux and Linnell (2010) argue that people's attitudes towards carnivore species are based on their ecological characteristics, the reciprocal interactions between the two, and the infringement that carnivores cause to what is considered 'human space'. As such, wolves are considered as a large 'homogenous' population that is often hard to

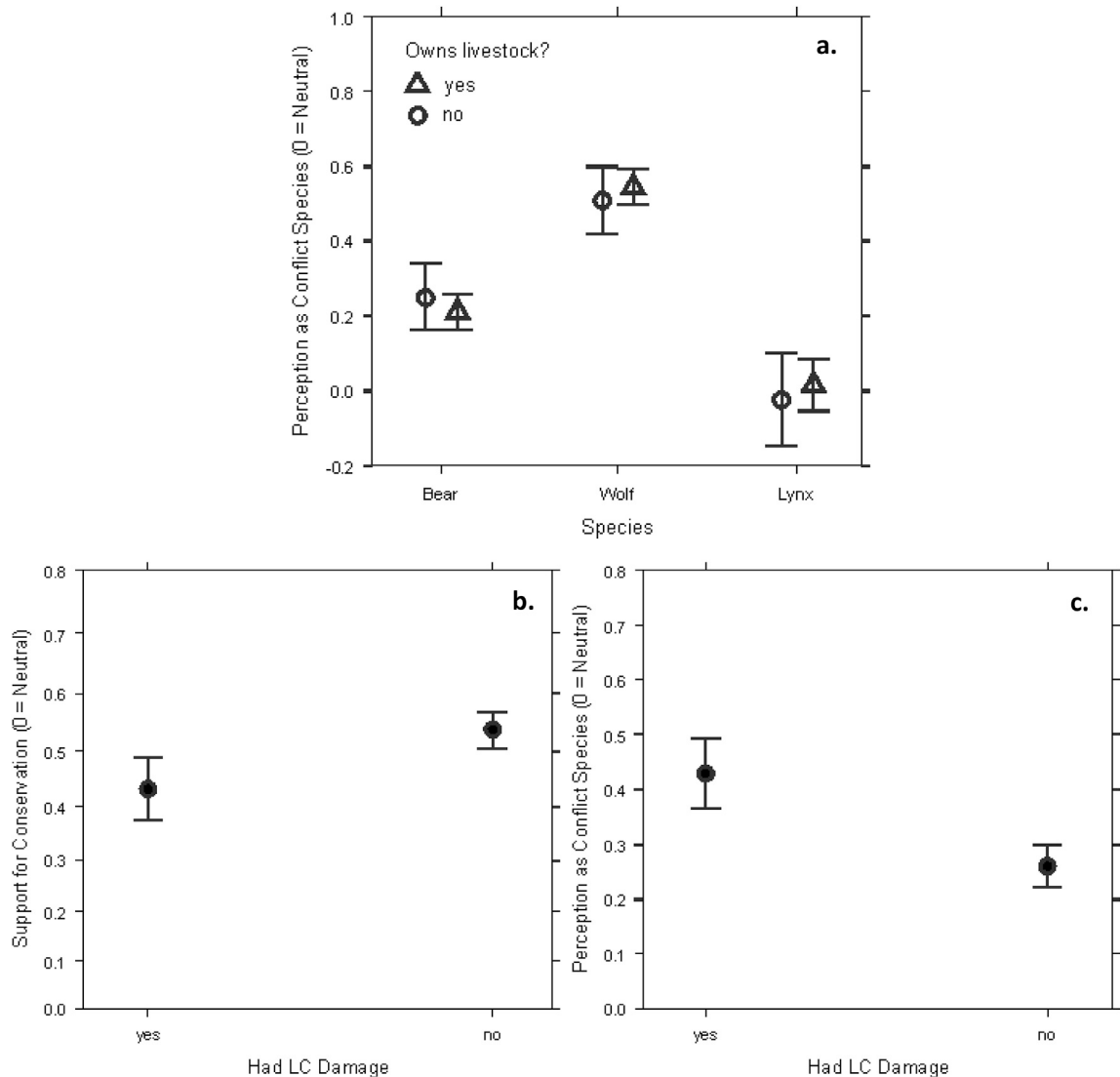


Fig. 4. Effect of owning livestock on CP (a.) and effect of having experienced damage from large carnivores on SC (b.) and CP (c.). Owners of livestock have higher CP for lynx and wolf and lower CP for bear than people who do not own livestock. People who have experienced damage from LCs have lower SC and higher CP than people who have not experienced damage.

control on a local level (Lescureux and Linnell, 2013), as opposed to bears that are often viewed as individuals, and where people feel that they can control the few that adopt undesired behaviours (Lescureux et al., 2011a). Lynx on the other hand are more ambiguous, and even though most studies reveal that they are generally favoured by the local population, they often receive a negative share of opinions due to their cryptic nature, which occasionally gives rise to inaccurate myths of behaviour that make them feared by the local population (Lescureux et al., 2011b).

Between-country differences between Albania and Macedonia validate a further point for the need of local considerations in the conservation and management of large carnivores. As mentioned, the Albanian rural population seems to be simultaneously more supportive of the conservation of large carnivores and perceiving them as more conflictual species than the Macedonian rural population. While at first glance such a situation might appear contradictory, it has explanatory grounds in considering existing differences in rural livelihoods between the two countries and subsequent interrelationships with large carnivores. In Albania, rural communities have largely preserved traditional lifestyles centred on family-based subsistence farming and livestock husbandry (Doempke S., 2010). Almost every village family owns some livestock (Keçi et al., 2008; Kume et al., 2004). Livestock are always looked after and guarded by at least one member of the family when grazing in forests and meadows. In Macedonia, the picture seems to be inverted as livestock ownership is concentrated in the hands of fewer individuals, who specialise in such an activity and make a profit from it by owning larger flocks of livestock (Keçi et al., 2008). The majority of the Macedonian rural population does not own or care for livestock and this could potentially explain the

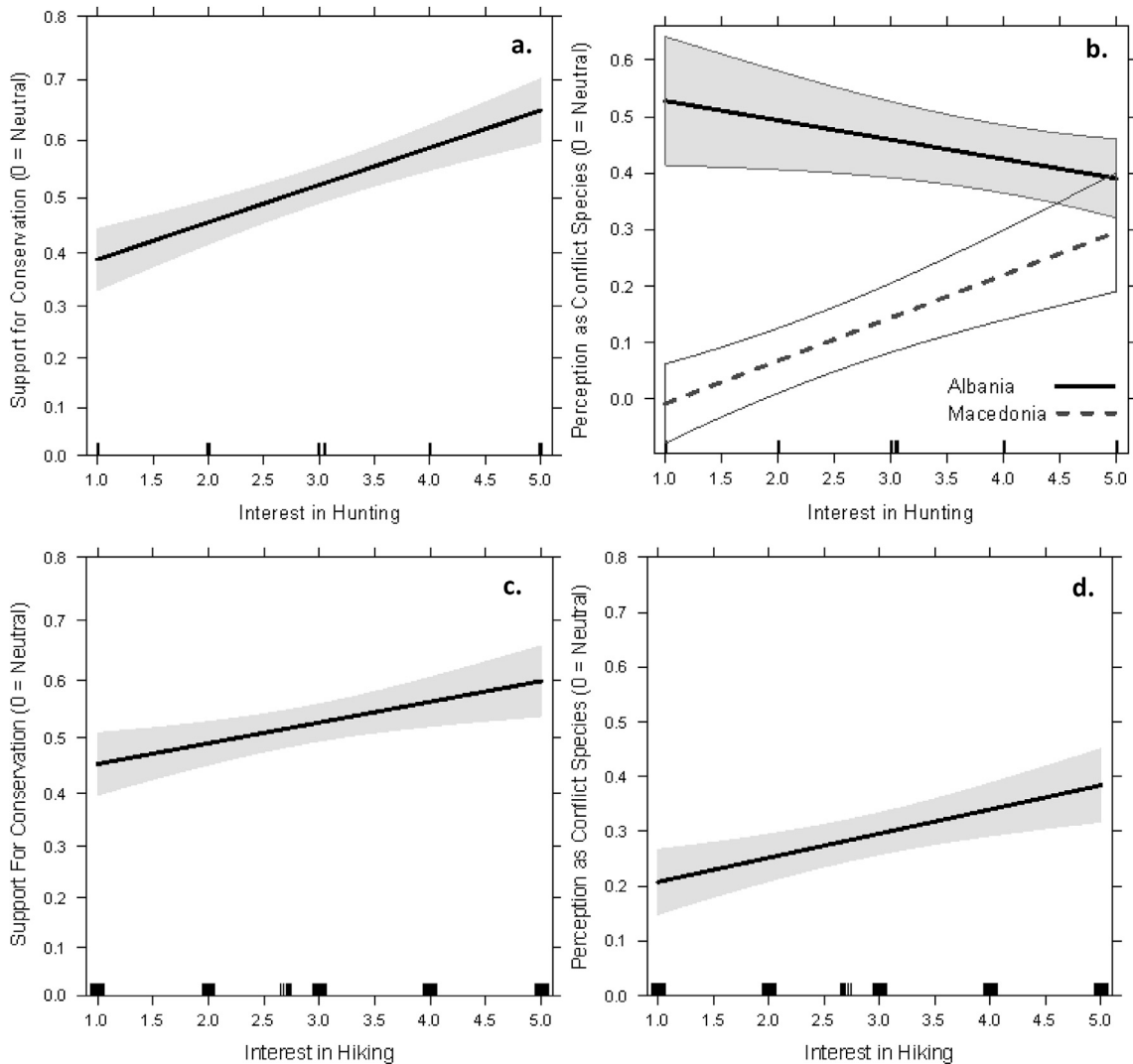


Fig. 5. Effect of interest in hunting and interest in hiking on SC (a, c) and effect of interest in hunting by country on CP (b) and interest in hiking on CP (d). Higher interest in hunting leads to higher SC, whereas it leads to lower CP in Albania and higher CP in Macedonia. Higher interest in hiking leads to higher SC and CP.

overall perception of large carnivores as less of a conflict species than in Albania. Similarly, these very differences in rural livelihoods between Albania and Macedonia can potentially justify the higher support for conservation in the former. The prevalent subsistence farming and stock-breeding observed in Albania ensures a more frequent and close relationship with large carnivores than in Macedonia. Several studies suggest that farmers and livestock owners in societies with more traditional rural livelihoods and subsistence economies tend to show greater tolerance towards large carnivores and have a more positive image of them, than their counterparts in countries with more developed economies and intensive production (Athreya et al., 2013; Boitani, 1995; Dorresteijn et al., 2014; Kellert et al., 1996). These country-specific differences were mirrored also in the number of interactions reported with the large carnivores in the wild. The Albanian rural population has a higher level of interactions with wolves and bears in the wild compared with the Macedonians (S2). The majority of respondents in Albania confirmed having seen bears and wolves in the wild at least once in their lifetime. Higher interactions with large carnivores in Albania are an indicator of rural livelihood differences between Albania and Macedonia and could explain the higher support for conservation shown in Albania.

Lynx, on the other hand, stand out from wolves and bears in that they were rarely seen or interacted with in the wild in both countries. The fewer interactions with lynx in general seem to be consistent with the fact that they are much rarer than wolves and bears in the region (Breitenmoser-Würsten and Breitenmoser, 2001; Kaczensky et al., 2013; Melovski et al., 2015) and their behaviour make them much less visible to humans (Breitenmoser and Breitenmoser-Würsten, 2008). Our survey indicated that lynx were largely unknown animals among the rural public in Albania. About two thirds of respondents in Albania did not even know of the existence of such a species at the time of the survey. On the other hand, lynx was widely

known among the rural Macedonian public. This clear difference in knowledge between the two countries is potentially attributable to the prominent symbolic status that lynx hold in Macedonia and their representation in daily life and culture (e.g. the image of a lynx is portrayed on the 5 Denar coin, the currency of Macedonia).

4.2. Factors influencing attitudes towards large carnivores

In regard to effects of different factors on attitudes, this study largely confirmed what other human dimension research in Europe has generally revealed (Bath et al., 2008; Bjerke et al., 2002; Bjerke and Kaltenborn, 1999; Ericsson and Heberlein, 2003; Kaczensky et al., 2004; Kleiven et al., 2004; Majić et al., 2011; Majić and Bath, 2010; Roskaft et al., 2003). Gender, education, knowledge, and damages to livestock were all strong predictors of attitudes towards all three species. A multitude of human dimension studies across Europe have shown that older generations tend to have more negative views towards large predators and are usually less supportive of their conservation than younger people (Andersone and Ozoliņš, 2002; Bath et al., 2008; Bjerke et al., 2002; Ericsson and Heberlein, 2003; Kaczensky et al., 2004; Kleiven et al., 2004; Majić et al., 2011; Majić and Bath, 2010; Roskaft et al., 2007; Wechselberger et al., 2005). However, this did not seem to be the case for Albania and Macedonia. A potential explanation could lie in the familial and societal structure of rural mountainous villages of Albania and Macedonia, characterised by a strong age-based patriarchal system of governance where the elderly men within families and villages have a leadership role and exert great influence on the younger members of the community (Danaj, 2014; Kaser, 1996). Moreover, the persistence of traditional customary laws and practices, particularly in highland Albania (de Waal, 2005), ensures the continuity of such systems over time and limits generational changes in attitudes.

Interest in hunting seemed to have an effect on the support for conservation of large carnivores and was a much stronger predictor of attitudes than whether a person actually hunted or not. This result might have important implications for using hunting as a management approach in the conservation of large carnivores – and in particular about wolves, due to their lower public support when compared to bears and lynx. Nonetheless, any eventual lethal control management options for wolves need to be exerted cautiously and sustainably, in order to ensure the long-term survival of the population. Various authors have suggested that carefully regulated hunting, conducted and managed by local hunters, is among the most accepted methods for the management of carnivores and can contribute to the reduction of conflicts with locals, increase public acceptance of large predators and even potentially generate income for the local people (Bruskotter et al., 2007; Ericsson et al., 2004; Kaltenborn and Brainerd, 2016; Majić et al., 2011; Treves, 2009). However, careful country-specific considerations should be made when advocating and using hunting as a conflict-mitigation tool, as the effect of hunting interest was opposite in the two countries. While in Albania an increase of interest in hunting was associated with lower conflict perception of large carnivores, in Macedonia this increase seems to lead to higher conflict perception. Such opposite effects may have explanatory grounds concerning differences in hunting traditions between the two countries. In Macedonia there is a longer tradition of recreational hunting, which was particularly well organised during the Yugoslav regime and was conducted in designated and managed hunting grounds (Petkovski et al., 2003). The hunters' community in Macedonia has been organised in associations and clubs for decades. By contrast, in Albania, recreational hunting is a relatively new activity, being fully opened to the broader public only after the collapse of the communist regime in the 1990s and lacking proper forms and norms of control and management. Prior to 1990 recreational hunting was restricted to elite members of the totalitarian government and other trusted members of the community. The longer tradition of recreational hunting in Macedonia and existence of hunting grounds managed by hunting associations, indicate a higher sense of responsibility and ownership towards prey species among hunters and thus large carnivores could be viewed as competitors and a threat to their activity. In Albania, such forms of organisations in hunting are still nascent and not yet consolidated, thus prey species have not yet been 'commodified' as in Macedonia. Hunting interest in Albania seems to be more of an indicator for nature and wildlife appreciation in general, rather than a representation of hunting interests *per se* and perceptions of game ownership among hunters.

Our models indicated that increased interest in hiking in Albania and Macedonia is associated with higher support for conservation. This seems consistent with public attitude findings in other parts of the continent, where studies have shown that people who engage more in outdoor activities tend to have more positive attitudes towards large carnivores than people who do not (Bath, 2000; Roskaft et al., 2003; Wechselberger et al., 2005). At the same time, interest in hiking was associated with higher conflict perception of large carnivores. Among rural inhabitants walking in the forests is a necessary, utilitarian, activity for collecting plants, forest fruits or mushrooms. Given that the presence of large carnivores could be viewed as a physical threat may explain higher conflict perceptions among people with higher interest in hiking.

4.3. Conclusion

The results of this study are interesting in two ways. Firstly, they have clear consequences for the future management of large carnivores in Albania and Macedonia. Because of the lower support shown towards wolves, conservation initiatives that place the bear and lynx into the same category as the wolf would not be advised for the region. Giving wolves a full protection without any management options could lead to an escalation of conflict, much like experiences in nearby Croatia has shown (Bath and Majić, 2001). Conflict escalation with wolves, could spill-over to lynx and bears and be detrimental to the more positive image of the latter. Addressing conflicts with these three species also requires a species-specific approach given the differences in conflict perceptions they evoke among the rural public. Secondly, this is one of very few human-dimension

studies conducted in south-eastern Europe. Based on this experience it is possible to conclude that the method worked well in the Albanian and Macedonian social context (although access to women was difficult and posed sampling limitations) and produced meaningful results. The general factors explaining attitudes towards large carnivores were broadly similar to studies conducted elsewhere in western, central and northern Europe, indicating the broad generality of these patterns.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.gecco.2019.e00677>.

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