

# Residents' support for wolf and bear conservation: the moderating influence of knowledge

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**Abstract** This article examines the combined influence of cognitions (i.e., impact beliefs) and affect (i.e., feelings) on normative beliefs (i.e., support for management options) about wolves and brown bears. Data were obtained from stratified random face-to-face interviews ( $n=1,611$ ). The survey was conducted in the Abruzzo Lazio and Molise National Park (central Italy), where people have a long history of coexistence with large carnivores. Knowledge was hypothesized to moderate the relationships of beliefs and feelings on support for management actions. Path analyses supported the role of affect in mediating perceived impact beliefs and support for the protection of large carnivores. Knowledge moderated these relationships in the case of wolves but not brown bears. Residents of the national park had more knowledge about bears than wolves, which might partly explain both the stronger effect that knowledge had on the affective component and its lack of a moderating effect on the bear model. Overall, our findings show the positive attitude of residents toward large

carnivores and support the idea of affect being more important than cognition in predicting normative beliefs.

**Keywords** Attitudes · Beliefs · Brown bears · Knowledge · Norms · Wolves

## Introduction

Large charismatic carnivores have considerable cultural symbolism (Kellert et al. 1996; Mech and Boitani 2003; Bruskotter et al. 2009) and are often considered flagship species for broader conservation initiatives (Bowen-Jones and Entwistle 2002). Wolves and bears are legally partially or strictly protected in Europe by the Bern Convention since 1979 and the Habitats Directive since 1992 (see Trouwborst 2010 for a review). Management of large carnivores, however, differs across Europe and is controversial (Karlsson and Sjöström 2007; Bisi et al. 2007; Trouwborst 2010). Carnivores have re-colonized areas where they have long been absent and that are currently inhabited by humans (Boitani 2000; Ericsson and Heberlein 2003). In highly populated countries, predators and humans often live in close proximity, which increases chances of conflict with livestock and other human activities (Blanco et al. 1992; Boitani 1995; Messmer 2000; Petrucci-Fonseca et al. 2000; Kretser et al. 2008; Bisi et al. 2010). Understanding public attitudes, beliefs, and behaviours toward large carnivores is crucial in gauging support for management programs. Such an understanding can make the difference between successful or unsuccessful implementations of conservation projects (Bath 1994; Wilson 2008).

In Italy, bears and wolves are fully protected by national legislation since 1939 and 1971, respectively (Boitani and

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Ciucci 1993; Ciucci and Boitani 2008). On the verge of extinction in the late 1960s (Zimen and Boitani 1975), wolves in Italy (*Canis lupus italicus*) dramatically recovered both in numbers and range by means of natural recolonization (Ciucci and Boitani 2010). Abruzzo Lazio and Molise National Park (PNALM) has one such source population (Zimen and Boitani 1975). The Apennine brown bear (*Ursus arctos marsicanus*) is an endemic, highly endangered population whose range is centered in the PNALM (Ciucci and Boitani 2008).

Despite their protected status and long history of coexistence with humans, wolves and bears are still illegally killed in the park (Ciucci and Boitani 2008, 2010). The enforcement of protection laws in Italy is challenging. Park wardens often fail to prevent illegal killing of carnivores or prosecute poachers (Fritts et al. 2003). From a conservation perspective, it is important to understand whether residents of this national park support the protection of wolves and brown bears, and whether their norms for acceptable management actions are consistent with their feelings and beliefs.

We examined whether residents' support for/opposition to various management options (i.e., normative beliefs regarding selective killing, hunting) toward wolves and bears is predicted by the components of attitudes. In particular, we examined how the cognitive (i.e., perceived impact beliefs) and affective (i.e., feelings toward the species) components of attitudes influence residents' normative evaluation of management options. We believe that these relationships are moderated by knowledge.

### Theoretical approach

Attitudes are positive or negative evaluations of an object (e.g., wolves or bears), and are composed of cognitive (beliefs) and affective (feelings) components (Verplanken et al. 1998; Cooke and Sheeran 2004). The cognitive component refers to beliefs and thoughts held about an object (e.g., wolf/bear) and represents the information an individual possesses about that object, which may or may not be accurate. The affective component consists of the feelings, moods, and emotions in relation to an object or behaviour (Eagly and Chaiken 1993).

While attitudes focus on positive or negative evaluations, norms examine acceptability evaluations (what a person, group, or institution should do). Following Vaske and Whittaker (2004), we define normative beliefs as personal judgements about what is appropriate in different situations. In this study, we used normative beliefs to judge the acceptability of various wolf and/or bear management options.

Beliefs and attitudes are predicted by theory and past research to influence what people believe agencies should do

in particular situations (i.e., normative beliefs) (Whittaker et al. 2006; Bruskotter et al. 2009; Glikman et al. 2010). The direction and strength of these relationships, however, can be moderated by other variables (Vaske 2008) (Fig. 1). Knowledge, for example, has been shown to moderate the relationship between attitudes and respondents' willingness to protect the desert tortoise (Vaske and Donnelly 2007).

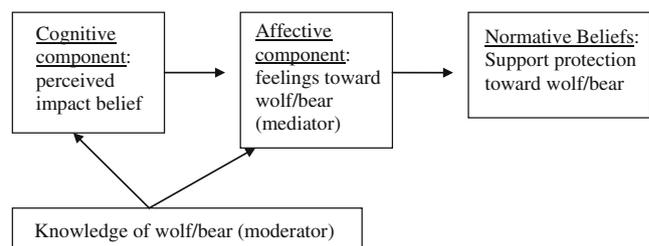
We developed a model to explore how PNALM residents' attitude toward wolves and bears influences their normative beliefs about what an agency should do. Our definition of attitude included both cognitive (beliefs about the impact of wolves and bears on livestock) and affective (feelings toward wolves and bears) dimensions. Based on past research (Vaske and Donnelly 2007), we predicted that knowledge would moderate these relationships. We define knowledge as the extent to which individuals are informed about basic wolf and bear biology (e.g., reproduction, litter size). We hypothesized that:

- H1: Residents with positive feelings (i.e., affect) toward wolves and/or bears will be *more* likely to believe that these species should be protected (i.e., normative belief).
- H2: Residents who believe that wolves and/or bears cause significant damage (i.e., cognition) will be *less* likely to believe that these species should be protected.
- H3: Residents who believe that wolves and/or bears cause significant damage will hold more negative feelings toward these species.
- H4: Residents with more knowledge about these species will hold more positive feelings about wolves and bears.
- H5: Knowledge will moderate the relationship between attitudes (affective and cognitive components) and normative beliefs.

## Methods

### Study area

The PNALM was established in 1923 and has been progressively enlarged to account for critical bear habitat



**Fig. 1** Theoretical framework of the effect of moderation and mediation for the attitudinal models based on the cognitive hierarchy

(Zunino and Herrero 1972; Ciucci and Boitani 2008). This protected area lies approximately 150 km east of Rome, in central Italy, and comprises a core area of 500 km<sup>2</sup> plus an external buffer zone of about 700 km<sup>2</sup>. The park features a mountainous ecosystem with rough topography interspersed at lower altitudes with rural areas, largely used for livestock breeding during spring and summer (Ciucci and Boitani 2008). The human population density averages 0.11 inhabitants per square kilometer. Most people live in the 28 main villages within the park and the external buffer area. All of these villages are much older than the park itself. Since the 1970s, with the changes in the Italian economy, the local economies of these villages benefit from tourism-connected activities (D. D'Amico, personal communication). Wolves and bears have always been present in the park area, and currently, about seven to eight wolf packs (Ciucci et al. unpublished data) and 40 bears (Gervasi et al. 2008) inhabit the park and its adjacent areas. Although the park administration compensates verified wolf and bear livestock depredation and damages to orchards and beehives since the late 1970s (C. Sulli, personal communication), this has not prevented illegal killing of large carnivores (Latini et al. 2005).

#### The survey

A close-ended questionnaire was administrated through face-to-face interviews with 1,611 residents of the PNALM (response rate=80%). Residents were selected proportion-

ally to each township's population size. Demographic data on community populations were obtained from the official 2001 census (Istituto Nazionale di Statistica [ISTAT], [www.istat.it](http://www.istat.it), 2001). The first adult contacted in the household was interviewed; only residents were interviewed. Some interviews were scheduled to ensure that males were at home after working hours. Interviews were conducted between November 2006 and June 2007.

#### Model variables

We used beliefs regarding perceived damage as a predictor (i.e., the cognitive component of attitude). Belief indices regarding the impacts of wolves (Table 1) and bears (Table 2) were based on the residents' level of agreement with questions such as: (a) wolves cause abundant damage to livestock; (b) wolves have significant impact on small or big game species; and (c) bears cause abundant damage to livestock, beehives, and orchards. See Tables 1 and 2 for exact item wording and coding. As noted in Tables 1 and 2, some statements were reverse coded before the scales were computed in order to maintain the same direction throughout all the variables.

We used feelings (i.e., affective component of attitude) toward wolves and bears as a mediator. Additive indices were computed to gauge respondents' general feelings toward wolves and bears, and the importance of wolves/bears in their region (see Tables 1 and 2 for item wording and coding).

**Table 1** Descriptive statistics and reliability analyses (Cronbach's alpha) for attitudes, beliefs, and normative beliefs toward wolves

Question	Mean	Standard deviation	Cronbach's alpha
Attitudes toward wolves	0.63	0.91	0.82 <sup>a</sup>
Which of the following best describes your feelings toward wolves? <sup>b</sup>	0.55	1.05	
To have wolves in your region is for you: <sup>c</sup>	0.70	0.91	
Beliefs about the impact of wolves	-0.11	0.85	0.72
Wolves have a significant impact on big game (e.g., roe deer) <sup>d</sup>	-0.19	1.04	
Wolves have a significant impact on small game (hare). <sup>d</sup>	-0.32	0.98	
Wolves cause abundant damages to livestock <sup>d</sup>	0.16	1.16	
Normative beliefs about wolves	0.94	0.72	0.80
Wolf should remain completely protected (i.e., it should be illegal to kill them) <sup>d</sup>	0.76	0.91	
In the area where there are continuous attacks to livestock, it should be possible to kill selective wolves. <sup>d,e</sup>	0.56	1.13	
The hunting of wolves should be authorized <sup>d,e</sup>	1.10	0.89	
The use of poison baits to control wolves should be authorized <sup>d,e</sup>	1.32	0.67	

Data collected from  $n=1,611$  face-to-face interviews with residents of PNALM (central Italy)

<sup>a</sup> Cronbach's alpha based on two variables

<sup>b</sup> Variables coded on a 5-point scale from completely negative (-2) to completely positive (+2)

<sup>c</sup> Variable coded on a 5-point scale from completely dislike (-2) to completely like (+2)

<sup>d</sup> Variable coded on a 5-point scale from strongly disagree (-2) to strongly agree (+2)

<sup>e</sup> Reverse code

**Table 2** Descriptive statistics and reliability analyses (Cronbach's alpha) for attitudes, beliefs, and normative beliefs toward bears

Question	Mean	Standard deviation	Cronbach's alpha
Attitudes toward bears	1.01	0.75	0.85 <sup>a</sup>
Which of the following best describes your feelings toward bears? <sup>b</sup>	1.00	0.83	
To have bears in your region is for you: <sup>c</sup>	1.02	0.77	
Beliefs about the impact of bears	-0.10	0.80	0.65
Bears cause abundant damages to livestock <sup>d</sup>	-0.40	1.03	
Bears cause abundant damages to beehives <sup>d</sup>	0.03	1.03	
Bears cause abundant damages to orchards and agriculture crops <sup>d</sup>	0.08	1.06	
Normative beliefs about bears	0.99	0.75	0.75 <sup>3</sup>
Bear should remain completely protected (i.e., it should be illegal to kill them) <sup>d</sup>	0.95	0.79	
In the area where there are continuous attacks to livestock, it should be possible to kill selective bears. <sup>d,e</sup>	1.02	0.87	

Data collected from  $n=1,611$  face-to-face interviews with residents of PNALM (central Italy)

<sup>a</sup> Cronbach's alpha based on two variables

<sup>b</sup> Variables coded on a 5-point scale from completely negative (-2) to completely positive (+2)

<sup>c</sup> Variable coded on a 5-point scale from completely dislike (-2) to completely like (+2)

<sup>d</sup> Variable coded on a 5-point scale from strongly disagree (-2) to strongly agree (+2)

<sup>e</sup> Reverse code

We used normative beliefs (i.e., management options) as the criterion variable (Tables 1 and 2). An index reflecting normative beliefs regarding bears was constructed from two variables: (a) bears should remain completely protected (i.e., it should be illegal to kill them) and (b) in the area where there are continuous attacks to livestock, it should be possible to kill selective bears. These items and two additional questions (i.e., the hunting of wolves should be authorized, use of poison baits to control wolves should be authorized) were used to compute a normative belief index for wolves. These management options were added since often an issue, both locally and elsewhere in Italy.

We used basic knowledge on wolf and bear biology as a moderator. Knowledge of wolves and bears was measured using five wolf and five bear-related statements (see Table 3). A multiple-choice format that included a "do not know" option was initially used for coding these knowledge questions. Responses were then recoded as "correct" (1) vs. "incorrect" and "do not know" (0). A composite score was computed by summing the number of correct responses reported by each resident (range=0 to 5 for each species).

### Analysis

The internal consistency of the beliefs, feelings, and management options were examined using Cronbach's alpha (Cronbach 1951); coefficients larger than 0.65 were considered acceptable (Vaske 2008). We followed the Baron and Kenny (1986) recommendations for testing for mediation and moderation using multiple regression analysis.

### Results

There were more males (57%) than females (43%) in the sample ( $n=1,611$ ). Approximately, a third (34%) of the respondents were younger than 39 years of age; about 40% were between 40% and 64%, and 26% were older than 65 years old. Most residents held positive attitudes toward both wolves ( $n=1,133$ , 70%) and bears ( $n=1,372$ ; 85%). More than 60% of the respondents (63% wolves, 61% bears) disagreed with the statements that these carnivores cause significant damage to human property. More than 80% supported the protection of both species (81% wolves,  $n=1,287$ ; 88% bears,  $n=1,419$ ).

Reliability analysis of the affective (i.e., feelings) items toward wolves (Cronbach's alpha=0.82) and toward bears (alpha=0.85) supported the creation of these two computed variables. The reliability coefficients for the perceived impact beliefs regarding wolves (alpha=0.72) and bears (alpha=0.65) were lower but still acceptable. Finally, reliability analysis of normative belief items toward wolves (alpha=0.70) and toward bears (alpha=0.75) supported the creation of these two computed indices (Tables 1 and 2).

Residents were more knowledgeable about bears than wolves. For example, 92% correctly indicated that bears are fully protected in Italy, compared to 78% who were aware that wolves are also completely protected (Table 3). The difference in average number of correct responses between bears ( $M=3.18\pm 1.12$ ) and wolves ( $M=2.30\pm 1.25$ ) was statistically significant ( $t=27.22$ ,  $p<0.001$ ) with a typical to substantial effect size ( $\eta=0.412$ ).

**Table 3** Descriptive statistics for knowledge

	Incorrect <sup>a</sup>	Correct <sup>a</sup>
<b>Wolves</b>		
Are wolves completely protected in Italy? (Yes–No–Do not know)	22	78
How much does the average adult male wolf weight (kg) in Italy? (1–25/26–50/51–75/More than 75/Do not know)	45	55
What is the average pack size of wolves in Italy? (1–5/6–9/10–15/More than 15/Do not know)	58	42
It is generally true that only two members (one pair) of a wolf pack breed in any one year? (Yes–No–Do not know)	78	22
How many times does a wolf reproduce per year? (Once /Twice/Three times/More than three/Do not know)	67	33
<b>Bears</b>		
Are bears completely protected in Italy? (Yes–No–Do not know)	8	92
How many times does a bear reproduce per year? (Once/Twice/Three times/Neither one (it reproduces every other year)/Do not know)	20	80
In the park which is the average litter size of bears? (1–3/4–6/7–9/More than 9/Do not know)	60	40
Is it true that the bear goes into hibernation during winter time in your region? (Yes, but not continuous/Yes, all the winter time/No/Do not know)	20	80
The bear is generally: (A solitary animal/Lives in couples/Lives in groups/Do not know)	75	25

<sup>a</sup> Variable in percentages

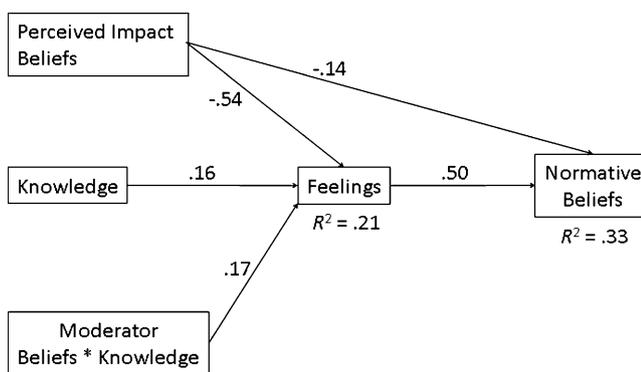
**Mediation and moderation models**

As predicted by hypothesis one, feelings toward wolves ( $\beta=0.50, p<0.001$ ) and bears ( $\beta=0.49, p<0.001$ ) were positively related to normative beliefs concerning the protection of these species. Consistent with hypothesis 2, those who believed that these species cause significant negative impacts on livestock and wild game were less likely to support protection efforts ( $\beta=-0.14, p<0.001$  [wolves];  $\beta=-0.12, p<0.001$  [bears]). In support of hypothesis 3, perceived impact beliefs were negative related with feelings for wolves ( $\beta=-0.54, p<0.001$ ) and bears ( $\beta=-0.36, p<0.001$ ). Together, the two components (i.e., impact beliefs and feelings) of attitude explained comparable amounts of variation in respondents’ normative beliefs regarding wolf (33%, Fig. 2) and bear (29%, Fig. 3) protection.

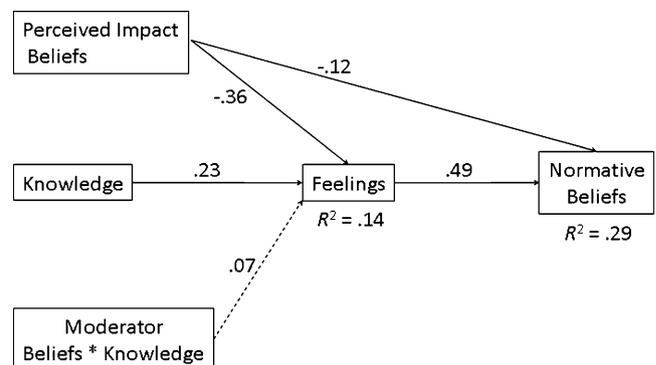
Separate path models indicated that the feelings toward these two species fully mediated the relationship between knowledge and normative beliefs regarding protection. In other words, when knowledge was the only predictor in the

model, there was significant and positive relationship between knowledge and the norm indices. When both feelings and knowledge were predictors in the model, the statistical influence of knowledge on norms disappeared. Consistent with hypothesis 4, residents with higher levels of knowledge were more likely to have positive feelings toward large carnivores (wolves:  $\beta=0.16, p<0.001$ ; bears:  $\beta=0.23, p<0.001$ ) (Figs. 2 and 3).

The causal sequence of beliefs influencing affect (feelings), which in turn influences the behaviours (i.e., normative evaluations), is supported by theory (e.g., see Vaske 2008 for a review) and substantiated by considerable empirical research (Whittaker et al. 2006; Bruskotter et al. 2009; Glikman et al. 2010). The causal influence of knowledge on these variable relationships has received less attention in the literature. Following the Baron and Kenny (1986) recommendation for testing for moderation, we computed an interaction term (i.e., beliefs  $\times$  knowledge). When all three independent variables (i.e., impact beliefs,



**Fig. 2** Path analysis model for wolves



**Fig. 3** Path analysis model for bears. Dotted line stands for non-significance path between moderator and feelings

knowledge, beliefs  $\times$  knowledge) were in the regression predicting feelings toward these species, the interaction term was significant ( $\beta=0.17$ ,  $p<0.001$ , Fig. 2) in the wolf model. A significant interaction term signals a moderating influence (Baron and Kenny 1986); in this case, knowledge moderates the influence of beliefs on feelings. This was not the situation in the bear model ( $\beta=0.07$ ,  $p=0.34$ ; Fig. 3). Knowledge did not moderate the influence of cognitions (impact beliefs) on affect (feelings).

## Discussion

While there have been relatively limited educational materials (e.g., leaflets, brochures) about large carnivores in the PNALM, information campaigns have focused more on brown bears than wolves (D. D'Amico, personal communication). According to our survey, residents in the PNALM showed a higher level of knowledge of bears than wolves, and this may partly explain why knowledge moderated the model for wolves but not for bears. At the same time, the effect of knowledge on the affective component of attitude was stronger for bears than for wolves.

It is generally believed that a high level of knowledge about a species leads to more positive attitudes (Kellert 1985; Bath and Buchanan 1989; Ericsson and Heberlein 2003; Balčiauskas et al. 2010). The acquisition of new information could result in an attitude change for those individuals with low levels of knowledge (Petty and Cacioppo 1986; Prislin 1996; Berninger et al. 2009). However, a high level of knowledge can lead to resistance in attitude change and may reinforce already formed attitudes (Petty and Cacioppo 1986; Kellert et al. 1996; Prislin 1996; Berninger et al. 2009).

Education forms and modifies attitudes through cognitive learning about an object (Eagly and Chaiken 1993; Kellert et al. 1996). Consistent with other studies (Kellert 1985; Bath and Buchanan 1989; Ericsson and Heberlein 2003; Balčiauskas et al. 2010), more knowledge resulted in more positive feelings toward the species, especially bears. Strong affect, whether positive or negative, tends to better predict behavioural intentions (Prislin 1996; Verplanken et al. 1998). Although stronger attitudes are more resistant to change (Petty and Cacioppo 1986; Prislin 1996; Berninger et al. 2009), the positive relationship between knowledge and affect (feelings) toward these carnivores is noteworthy from a conservation/protection perspective. Those with positive feelings might be more interested in learning about wolves and bears and increasing therefore their educational level, which in turn strengthens their positive feelings.

Perceived impact belief had a stronger effect on feelings than on normative belief, supporting the distinction be-

tween cognitive and affective attitude components (Eagly and Chaiken 1993; Verplanken et al. 1998; Cooke and Sheeran 2004). Supporting previous studies (Pate et al. 1996; Bruskotter et al. 2009), perceived impacts were positively related to favouring predator control. Wolves were blamed for damage more than bears, which may explain the stronger relationship between perceived impact beliefs and feelings toward wolves. On average, however, PNALM residents did not perceive either of these large carnivores as responsible for significant damage. It should be noted that the PNALM authority does not make official figures on depredation and compensation costs readily available to the general public. Thus, respondents' impact beliefs are based more on perception than on real data. We suspect perception of the damage may be lower than its real dimension, and it would be interesting to assess if perception would change if real data were known.

The affective component of attitude had more influence on normative beliefs than either of the cognitive components (perceived impact beliefs and knowledge). This finding reinforces what has been referred to as the 'evolutionary perspective' (*sensu* Johnston 1999), suggesting that affect is more important than cognition for predicting norms and behaviours (Trafimow et al. 2004). Contrary to findings from northern Europe (Ericsson and Heberlein 2003; Bisi et al. 2007, 2010), feelings toward wolves and bears were quite positive in the PNALM, and more so for bears than for wolves. As a consequence, there was a high level of resistance to call for lethal control measures for large carnivores. It should be noted that wolves and brown bears were never exterminated from PNALM, providing a likely explanation of why residents in the PNALM hold more positive feelings toward these large carnivores than in other parts of Europe. A long period of coexistence between humans and large carnivores in the PNALM allowed shepherds and large carnivores to co-evolve by means of reciprocal ecological and behavioural adjustments (Boitani 1995). While the effects of this co-adaptation have been described in terms of wolf (Ciucci et al. 1997) and bear (Zunino and Herrero 1972) ecology, our findings reveal how cognitive and emotional components of the local human culture have been shaped by this long coexistence. These cultural components, as well as the traditional ways to cope with large carnivores (e.g., livestock guarding dogs, attended flocks), are local treasures that should be understood, maintained and valued in large carnivore conservation programs at the local scale.

Norms are often predictors of intention to behave, which in turn can sometimes predict actual behaviour. Residents in the PNALM who supported wolf (81%) and bear (88%) protection did not believe control measures were needed and/or acceptable, even if these species caused significant damage. Knowing that wolves and bears are protected in

the park territory tends to support their conservation (Bowen-Jones and Entwistle 2002; Smith and Sutton 2008).

The amount of variance explained by our models suggests that other variables are involved in these relationships. Future researchers are encouraged to consider other psychological and situational predictors that would facilitate our ability to understand the sources of variation.

#### Management and conservation implications

Our findings suggest that feelings are stronger predictors of management options than impact damage beliefs and knowledge about wolves and brown bears. Previous studies (Forgas 1998; Wilson 2008) support the idea that positive attitudes increase cooperation helping to reach an optimal agreement between the parties in a participatory approach, which in turn increases ownership of the outcome, supporting commitment and action of wildlife conservation goals (Messmer 2000; Cvetkovich and Winter 2003; Wilson 2008). A participatory approach could improve dialogue between the park officials and local residents, building stronger trust and credibility. We highlight the need for targeted education campaigns for residents, especially on wolves.

Although we revealed a positive attitude toward wolves and bears among residents, illegal killings still occur in the PNALM (Latini et al. 2005; Ciucci and Boitani 2008). Given our findings, such actions don't seem to be supported by the majority of residents, and poaching is likely under the responsibility of a very few individuals. Sharing the results that the majority wish to protect these large carnivores could trigger group dynamics, whereby residents may actively push for the prosecution of these few individuals found setting poison baits. To further address this conservation challenge, the next human dimensions step should focus on specific interest groups (e.g., trappers, hunters, shepherds, etc.) to help identify those that may share more negative attitudes toward large carnivores and to understand why.

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