

CONTRIBUTED PAPER

Local attitudes toward Apennine brown bears: Insights for conservation issues

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Human-carnivore coexistence is a multi-faceted issue that requires an understanding of the diverse attitudes and perspectives of the communities living with large carnivores. To inform initiatives that encourage behaviors in line with conservation goals, we focused on assessing the two components of attitudes (i.e., feelings and beliefs), as well as norms of local communities coexisting with Apennine brown bears (*Ursus arctos marsicanus*) for a long time. This bear population is under serious extinction risks due to its persistently small population size, which is currently confined to the long-established protected area of Abruzzo, Lazio and Molise National Park (PNALM) and its surrounding region in central Italy. We interviewed 1,611 residents in the PNALM to determine attitudes and values toward bears. We found that support for the bear's legal protection was widespread throughout the area, though beliefs about the benefits of conserving bears varied across geographic administrative districts. Our results showed that residents across our study areas liked bears. At the same time, areas that received more benefits from tourism were more strongly associated with positive feelings toward bears. Such findings provide useful information to improve communication efforts of conservation authorities with local communities.

KEYWORDS

attitudes, brown bear, human–wildlife coexistence, Italy, national park

1 | INTRODUCTION

Managing conflicts and enhancing coexistence with large carnivores is a central concern for conservation practitioners and wildlife policy-makers (Carter, Shrestha, Karki, Pradhan, & Liu, 2012; Dickman, Macdonald, & Macdonald, 2011). Large carnivores are expanding their distribution across the human-shaped landscapes of Europe (Boitani, 2000; Chapron et al., 2014; Enserink & Vogel, 2006), increasing the chances that conflicts surrounding their conservation will develop (Madden & McQuinn, 2014; Redpath et al., 2013). Factors affecting acceptance are multifaceted and context-dependent (Boitani, 1995, 2003; Linnell &

Boitani, 2012), and are thus best understood at a local scale, where the values and interests of different stakeholders stand out (Piédallu et al., 2016; Young et al., 2013). Given that attitudes and acceptance levels of local communities affect large carnivore conservation (Knott et al., 2014; Treves & Bruskotter, 2014), it is important to explore whether and how they vary across space.

Attitudes are positive or negative evaluations of objects (e.g., bears), and are composed of affective/emotional components (e.g., feelings) and cognitive components (e.g., beliefs) (Eagly & Chaiken, 1993; Verplanken, Hofstee, & Janssen, 1998). Based on the cognitive hierarchy framework (Fulton, Manfredo, & Lipscomb, 1996; Vaske &

Donnelly, 1999), attitudes influence individuals' norms (i.e., normative beliefs), referring to what a person believes should or should not be done in a specific situation (e.g., bears should be protected), which in turn influence behaviors (Vaske, 2008; Vaske & Whittaker, 2004). In other words, feelings, beliefs and norms play an important role in shaping how an individual behaves (Vaske & Donnelly, 1999). Local communities are likely to have a higher tolerance for species that contribute significant benefits and that pose a low level of risks. In addition, acceptance can result when individuals hold positive feelings toward a species, when they perceive that they can exert control over it, and when they trust those in charge of managing the species (Slagle & Bruskotter, 2019). While human-wildlife coexistence occurs when neither species inhibits the survival of the other, it represents a dynamic process, with a delicate interplay between positive and negative aspects of human-wildlife and human-human interactions (Glikman, Frank, & Marchini, 2019). Given that human behaviors may at times threaten wildlife conservation, understanding the factors that influence behavior is essential for advancing conservation efforts (Verissimo & McKinley, 2016).

We focused on the attitudes (both feelings and beliefs) of local communities toward Apennine brown bears (*Ursus arctos marsicanus*; hereafter bear), whose endemic population is currently restricted to the Abruzzo, Lazio, and Molise National Park (PNALM) and surrounding areas in central Italy (Ciucci et al., 2017). This bear population is facing serious risks of extinction due to its persistent small size and reduced genetic variability (Benazzo et al., 2017; Ciucci et al., 2015), and is in need of immediate proactive conservation measures (Anonymous, 2011; Ciucci & Boitani, 2008). Despite favorable habitat suitability at the landscape scale, including several protected areas (Falcucci, Ciucci, Maiorano, Gentile, & Boitani, 2009) and adequate connectivity (Maiorano, Boitani, Chiaverini, & Ciucci, 2017), survival of this bear population is threatened by human-related factors. In particular, current levels of human-caused mortality (due to the illegal use of poison baits and shooting), are thought to be incompatible with population growth and expansion (Falcucci et al., 2009; Gervasi et al., 2017; Gervasi & Ciucci, 2018). As bears travel across the protected area and move to lower altitudes to reach key food sources (such as acorns, *Quercus* spp.), they interact with local rural communities, becoming increasingly exposed to disturbance and mortality risks. Occasionally, a few human-habituated or food-conditioned bears recurrently enter villages to depredate poultry (Latini, Sulli, Gentile, & Di Benedetto, 2005), exacerbating the conflict at the local scale (Anonymous, 2011; Ciucci & Boitani, 2008). Nevertheless, conservation policies in the past decades have not been judged entirely effective due to administrative fragmentation and lack of institutional coordination (Anonymous, 2011). For example, a coordinated management of multiple uses within the

PNALM (e.g., livestock grazing, forestry, tourism) has been hindered by the fact that the park is comprised of three different administrative districts (Abruzzo, Lazio, and Molise), which differ in terms of wildlife laws and regulations.

The PNALM is a long-established protected area, initially created in 1872 as a royal hunting reserve (Sipari, 1926), and officially established in 1923, encompassing a relatively small area of the Abruzzo administrative district (Sievert, 1999). Afterwards, several subsequent enlargements took place up to the 1990s, and the area under protection expanded into the Lazio and Molise administrative districts (Ciucci & Boitani, 2008). Three portions of the PNALM (Abruzzo, Lazio, and Molise, including the outer buffer zone) can be recognized not only based on their administrative districts, but also based on their cultural, historical and socioeconomic attributes (for further details see Glikman, 2011; Thompson, 2018). For example, the portion of the territory where the park was first established features a small ski resort and enjoys a greater share of tourists. Its economy benefits significantly from the tourism attraction generated by the park status (Idolo, Motti, & Mazzoleni, 2010). On the contrary, other portions of the PNALM, more recently annexed by the park (mainly comprising the administrative districts of Lazio and Molise), are mainly dedicated to agricultural activities and lag behind in tourist development and attraction. Their visibility still suffers from competition with the established park administrative district of Abruzzo, and their economies do not substantially differ from those of the communities outside the PNALM (Sallustio, Quatrini, Geneletti, Corona, & Marchetti, 2015). Yet, being part of the PNALM entails certain limitations in terms of access to pastures, wood harvest, and land development.

Due to this park's history, coupled with a relatively high degree of geographical isolation, cultural diversity and a variety of land tenure systems within the park (Idolo et al., 2010; Sallustio et al., 2015; Sievert, 1999), it is conceivable that local residents living in different administrative districts of the PNALM may hold different levels of acceptance of bears based on local cost/benefit trade-offs, which in turn is influenced by local attitudes, general and normative beliefs, and local experiences. Furthermore, residents of PNALM have received variable communication from the park about the large carnivores that they are living with, which may have influenced their feelings and beliefs (Glikman, 2011). Conflicts over bear conservation may be further accentuated by differences in legislation regulating compensation programs across our study area. Only recently (i.e., after the completion of this study) has compensation been standardized across all administrative districts and paid by the PNALM. Previous differences in how compensation was paid, and by whom, may influence acceptance of bears across the Park's administrative districts (Latini et al., 2005).

Collecting data at scales where the resolution matches the expected diversities becomes an essential precaution to enhance the role and effectiveness of human dimensions research for wildlife and habitat management (Ericsson, Sandström, & Bostedt, 2006; Morzillo, Mertig, Garner, & Liu, 2007). Based on this rationale, we investigated if and which attitudinal variables most differentiate local residents in the PNALM, where the bear has always existed and, to a certain extent, positively coexisted with local inhabitants (Boscagli, 1999; Febbo & Pellegrini, 1990; Sipari, 1926; Thompson, 2018). Indeed, even though some bears are illegally killed, they have never been extirpated. Specifically, we hypothesized that residents living in different areas of the PNALM hold different attitudes toward bears, based on the known historical and socioeconomic diversity of local communities in the region. Further, we hypothesized that if residents perceive benefits from bears (whether indirect or direct), their attitudes toward bears, park policies and bear conservation measures will be more positive. Despite the long history of coexistence between humans and bears in the area (Febbo & Pellegrini, 1990; Sipari, 1926), no such investigation has ever been conducted, and we expect our findings may disclose patterns that are also relevant for bear-human coexistence elsewhere.

2 | MATERIALS AND METHODS

2.1 | Study area

The current range of the PNALM is 507 km², plus an additional 787 km² of external buffer zone, with an average human population density of 14.6 inhabitants per km² (Ciucci et al., 2015). Other details on the areas' human and physical geography can be found in Glikman, Vaske, Bath, Ciucci, and Boitani (2012) and Ciucci, Tosoni, Di Domenico, Quattrociocchi, and Boitani (2014); Ciucci et al. (2015).

Based on the socioeconomic diversity within the PNALM, we structured the study area for the scope of our survey into Abruzzo Marsica (AM); Abruzzo Fucino (AF); Lazio administrative district (LA); and Molise administrative district (MO) (Figure 1).

The historical heart of the park, AM, is located at higher altitudes, includes the headquarters of the PNALM, most of the touristic attractions, and a ski resort built in the 1970s. In addition, as above mentioned, the majority of the villages in AM are within the park boundaries. By contrast, the most recently acquired area of the PNALM (end of 1990s), AF, is located in the lower plains to the northwest of the park and characterized by intensive agriculture and extraction activities, but little tourism. The MO portion has limited tourist infrastructure and people living there perceive that the national park does not provide economic benefits to local communities (Glikman, 2011). In

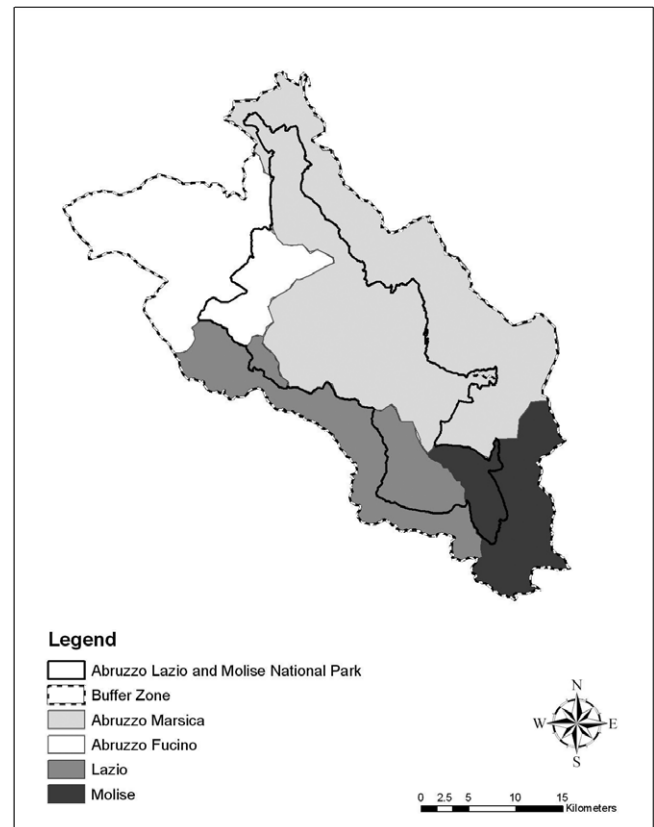


FIGURE 1 The Abruzzo Lazio and Molise National Park (507 km²) and its external buffer zone (787 km²) divided into four portions Abruzzo Marsica; Abruzzo Fucino; Lazio administrative district; and Molise administrative district based on the socioeconomic heterogeneity to match scales of data collection at scales with the resolution of expected cultural diversities

addition, townships in MO are less populated than the other administrative districts, are mostly situated on top of hills and still have several houses in ruins due to the earthquake of 1984 (Sallustio et al., 2015). However, townships in LA have several hamlets, and are more populated and affluent than MO. This difference is due to the historical domination of the Pope (Norcia, 2007) and the high agricultural and truffle production in the Lazio section of the park (Coronas, 2011; Pampanini, Diotallevi, & Marchini, 2012). In both the MO and LA administrative districts, the townships have a stronger socioeconomic dependency on their administrative centers than on the headquarter of the PNALM (Glikman, 2011).

2.2 | Survey design and data collection

This study used a questionnaire containing 28 closed-questions (see Supporting Information S1 for complete questionnaire), and was administered as personal structured interviews. The survey instrument was prepared in English, based on an initial phase of qualitative interviews to identify the key issues, their nature, and their importance from the perspective of various interest groups (e.g., hunters, shepherds, biologists; $n = 44$) (Glikman & Frank, 2019).

While this qualitative data was not used in the analysis, it guided the development of the quantitative items and offered insights in interpreting our results. Following this approach, specific close-ended questions were designed to explore the various components of the cognitive hierarchy such as feelings, diverse beliefs and norms (see S1 for exact item wording, and complete questionnaire). For example, we asked residents their beliefs regarding costs (e.g., bears caused abundant damaged to beehives) and benefits (e.g., tourism) of sharing their territory with bears. In past years, proposals made by local residents to create new ski resorts were rejected by the park authorities. These decisions were supported by biologists, as they were deemed to erode habitat and negatively affect bears. Therefore, we wanted to understand to what extent the residents shared this concern. In addition, we asked residents about their experience with bears (e.g., whether they had seen them in the wild), their beliefs regarding the bear population trend, and whether they thought that bears had entered in their villages. The questionnaire was translated to Italian and back translated to English to ensure accuracy of concepts being tested. The survey instrument was pre-tested and final adjustments were made accordingly. The structured interviews were carried out by native Italian speakers.

A total of 1,611 people were surveyed using a personal structured interview (response rate = 80%), consisting of 402 residents from AM, 400 residents from MO, 410 residents from LA and 399 residents from AF. We determined the appropriate sample size for each community within each study zone based on the most recent national census available at the time (ISTAT, 2001), ensuring that sampling was proportional to the target population (Hall & Hall, 1996; Warner, 2008). A sample size of 400 per zone provides a 95% confidence level with a $\pm 5\%$ margin of error, a generally accepted standard in social science research (Vaske, 2008). Most participants were selected by conducting the structured interview with the first adult contacted in the household. To ensure an equal representation of male and female voices, some interviews were scheduled to guarantee the presence of men at home. At other times, men were randomly approached in public settings using the street-intercept method (Miller, Wilder, Stillman, & Becker, 1997; Rotheram-Borus et al., 2001). In small rural villages, women tend to stay home and men tend to work in the field or spend time in the main squares of the villages socializing (e.g., playing cards). Further details of the sampling method can be found in Glikman (2011).

Most structured interviews were completed within 30 min. Data were collected between November 2006 and June 2007. The principal researcher completed most of the structured interviews ($n = 1,200$), occasionally accompanied by one trained assistant (total of two on the project), who conducted the remaining interviews ($n = 411$). Potential

interviewer bias was excluded a posteriori by statistically testing whether there were any differences in the data collected by the three interviewers.

2.3 | Model variables

We carried out multinomial logistic regression models using *study area* as a response variable with “AM” (the historical heart of the PNALM) as the reference category. We included as explanatory variables: (a) feelings toward bears, (b) the perceived level of damages caused by bears (i.e., beliefs), and (c) the level of support for bear conservation (i.e., normative beliefs) (see Table 1 for exact item wording). Furthermore, we included items coded on a 5-point Likert scale measuring the extent to which respondents (d) feared bears, (e) believed that bears boost tourism, and (f) believed that ski developments negatively impact bears. Finally, we included categorical items measuring: (g) whether respondents had seen a bear in the wild, and their beliefs regarding, (h) whether bears frequently entered villages, (i) the demographic trend in bear population, and (j) the main mortality cause for bears (see S1 for exact item wording, and complete questionnaire). Likert-type scales, characterized by categories that range from negative to positive statements (e.g., from strongly disagree to strongly agree), are an itemized rating scale used to measure the direction and intensity of an attitude toward a specific object (Jamieson, 2004; Likert, 1932).

To condense the original items into a few “latent” components (Tabachnick & Fidell, 2001), we created the first three variables by carrying out a principal components analysis (PCA; Table 1) with varimax rotation using R (R Core Team, 2016) and the R package “psych” (Revelle, 2015). The number of components was determined by carrying out several attempts to generate theoretically meaningful components and by visually inspecting the scree plots (Tabachnick & Fidell, 2001) (see S2). Interpretation was based on the component loadings, which represent the degree of correlation between the original items and the generated components (Table 1). The PCA scores were then included in the model along with the other explanatory variables. Descriptive results of the model variables are presented for AM only (reference category), with other study areas being compared to it in the following sections. Descriptive results of the principal components were computed by averaging across the items that loaded highly (loadings >0.5) on each component. A Spearman's Rho correlation was carried out to measure the extent of association between feelings toward bears and the belief that bears increase tourism (see S3; Kassambara, 2018).

2.4 | Model development

To identify if and which attitudes and norms about bears most differentiated the four study areas, we used the R

TABLE 1 Loadings resulting from the principal components analysis we carried out on the original items of the questionnaire in order to condense them into a few “latent” components. Loadings representing the degree of correlation between the original items and the generated components (only those >0.50 are shown)

Original variables included in the PCA	Principal components		
	1: Affective component of attitudes: Feelings toward bears	2: Cognitive component of attitudes: Perceived damages from bears	3: Normative beliefs: Support for bear conservation
1. Which of the following best describes your feelings toward bears ^a	0.86		
2. To have bears in your region ^b for you is ^c	0.88		
3. It is important to maintain bear populations in your region so that future generations can enjoy them ^d	0.77		
4. Bears cause abundant damages to livestock ^d		0.63	
5. Bears cause abundant damages to beehives ^d		0.81	
6. Bears cause abundant damages to orchards and agriculture crops ^d		0.81	
7. Bears should remain completely protected and it should be illegal to kill them ^d			0.83
8. In areas where there are continuous attacks to livestock, it should be possible to selectively kill bears ^e			0.85

^aVariable coded on a 5-point scale from 1 “strongly dislike” to 5 “strongly like.”

^bRegion refers to the administrative district.

^cVariable coded on a 5-point scale from 1 “strongly negative” to 5 “strongly positive.”

^dVariables coded on a 5-point scale from 1 “strongly disagree” to 5 “strongly agree.”

^eVariable was reverse coded on a 5-point scale from 1 “strongly disagree” to 5 “strongly agree.”

package *nnet* (Venables & Ripley, 2002) to develop multinomial logistic regression models. We used the R package “car” (Fox & Weisberg, 2011) to screen the explanatory

variables against inadequate expected cell frequencies and multicollinearity, by checking that the variance inflator factor (VIF) of all the chosen variables was <3 (Zuur, Ieno, & Elphick, 2010). We carried out model selection with the R package “MuMIn” (Barton, 2016), which calculates the second order Akaike information criterion (AIC) for all possible nested models through data dredging. We used the sample size corrected AIC_c to account for the small sample size relative to the high number of parameters. We generated a confidence set of models by using the cut-off point of 2 AIC_c differences in order to account for all plausible models (Table 2), and estimated the models' coefficients through model averaging. We assessed the goodness of fit of the models in the candidate set by comparing them to null models, using the “lmtest” package in R (Zeileis & Hothorn, 2002), and by calculating both the Nagelkerke and McFadden pseudo R², using the “pscl” package in R (Faraway, 2006; Jackman, 2017). We measured the effect size of the significant variables in the averaged model through their odds ratio. To facilitate the interpretation of odd ratios <1 (i.e., indicating that a predictor decreases the odds of residing in AF, LA, or MO compared with AM), we calculated their inverse proportion and included it in parentheses next to the original odds ratio values (Osborne, 2006). An odds ratio ≥ 1 indicates that a predictor increases the odds of residing in AF, LA, or MO compared with AM. Since diagnostics methods cannot be currently adapted to multinomial logistic regression models (Hosmer & Lemeshow, 2000), we broke down the best model into three binomial logistic regressions containing the observations from AM and each other study zone in turn (Hosmer & Lemeshow, 2000). For each binomial regression we carried out the Hosmer-Lemeshow test, using the R package “ResourceSelection” (Lele, Keim, & Solymos, 2016), to assess goodness of fit and calculated the area under the Roc Curve (AUC), using the R package “pROC” (Robin et al., 2011), to obtain a measure of the models' ability to discriminate between outcomes. Finally, we checked for influential observations and potential outliers by inspecting the residuals.

3 | RESULTS

3.1 | Principal components analysis

Three components were extracted from the PCA conducted on the items measuring attitudes toward bears (Table 1, S2 for scree plot), and together they explained 72% of the variance in the original variables. The components were interpreted as: affective component of attitudes toward bears (29% of explained variance), cognitive component of perceived damages from bears (22% of explained variance), and the normative beliefs regarding people's support for bear conservation (21% of explained variance).

TABLE 2 List of models with $\Delta AICc < 10$. The models included in the candidate set are those with $\Delta AICc < 2$. View Table 1 for details regarding variables PC1, PC2, and PC3

Model no.	Model variables	df	logLik	AICc	$\Delta AICc$	w
1	PC3 + PC2 + other items ^a	45	-1,916.37	3,925.39	0.00	0.39
2	PC1 + PC2 + other items	45	-1,916.97	3,926.59	1.21	0.21
3	PC2 + other items	42	-1,920.15	3,926.60	1.21	0.21
4	PC1 + PC3 + PC2 + other items	48	-1,913.95	3,926.92	1.53	0.18
5	PC3 + other items	42	-1,924.13	3,934.57	9.18	0.003

^aOther items = Bears frequently enter villages + fear of bears + main mortality cause + have seen bear in wild + ski developments impact bears + bears increase tourism + bear pop trend.

3.2 | Participants' characteristics of Abruzzo Marsica

Attitudes toward bears in AM were positive (items 1–3: $\bar{x} = 4.1 \pm 0.1$ SD, Table 1), and the majority of residents (80.6%) agreed that bears boost tourism in their area. Residents were split in their opinion regarding whether bears cause abundant damages (items 4–6: $\bar{x} = 3.1 \pm 0.2$, Table 1), even though they positively supported bear conservation (items 7–8: $\bar{x} = 4.0 \pm 0.1$ on an inverted scale, Table 1). The majority of AM respondents had seen a bear in the wild (66%), believed that bears often enter villages (65%), and exhibited a low level of fear toward bears ($\bar{x} = 2.4 \pm 1.2$). Most respondents (46%) thought the bear population was decreasing, while 29% thought it was stable and 13% thought it was increasing. Most residents (69%) believed that mortality causes other than poaching were prevalent in the bear population, while poaching through poisoning and shooting was mentioned by 11 and 20% of respondents, respectively. Ski resorts were moderately perceived to negatively impact bears (24%).

3.3 | Comparison between AM and the other study areas

We included four models in the candidate set (Table 2), entailing a good model fitness ($\chi^2 = 620.57$ – 632.96 ; $p < 0.001$), a Nagelkerke R^2 of 0.34–0.35, and a McFadden R^2 of 0.14. The binomial models nested in multinomial Model 1 exhibited a good fit (Hosmer and Lemeshow, test $9.05 \leq \chi^2 \leq 12.25$, $df = 8$, $0.14 \leq p \leq 0.68$) and a satisfactory ability to discriminate between outcomes ($0.73 \leq AUC \leq 0.86$).

According to the model's coefficients (Table 3), several variables differentiated between AM and all the other study areas: respondents that believed that bears frequently enter villages and those that had seen a bear in the wild were less likely to reside in AF, MO, and LA (inverted odds ratio = 1.72–4.67 and 1.49–2.63, respectively). Instead, respondents that exhibited a higher level of fear of bears, believed that the bear population is increasing, that shooting is the main mortality cause for bears, and that ski resorts negatively impact bears were more likely to reside in AF, MO, and LA, compared to AM (odds ratios = 1.28–1.40; 2.01–3.22; and 1.56–1.80; and 2.59–4.46, respectively).

The remaining variables differentiated between AM and only some of the other study areas. Respondents that

believed poisoning is the main mortality cause for bears were more likely to reside in AF and LA (odds ratio = 2.00–2.50); respondents with higher levels of perceived threat from bears were less likely to reside in AF and MO (inverted odds ratio = 1.20–1.39); and respondents that tended to agree that bears boost tourism were less likely to reside in LA and MO (inverted odds ratio = 1.63–1.73). Finally, the averaged model suggests that the PCA scores measuring attitudes toward bears and support for bear conservation do not discriminate between any of the administrative districts with certainty.

4 | DISCUSSION

Our findings showed that attitudinal variables toward endangered species may vary locally according to a fine-grain spatial scale. This, both geographically and in terms of what the controversy is, can help policy-makers and administrators identify relevant areas of controversy where public participation and communication efforts are most needed. In this respect, we found several similarities between the attitudes toward bears held by residents of the four study areas of the PNALM. Most importantly, we found that a common ground existed among participants in different administrative districts of the park in relation to positive feelings (PC1) and support for bear conservation (PC3). Similarities between the residents of the four areas of the park can be used to build consensus about the species' conservation across the PNALM, because the greater similarities there are between local communities, the more likely consensus may be found on bear conservation (Piédallu et al., 2016). Communities throughout the PNALM overwhelmingly agree that bears should remain protected. The shared norms arising from consensus over bear conservation goals can be used as a starting platform for engagement activities with local communities, by holding facilitated workshops on how to reduce deliberate or accidental killing of the species. This would turn the focus on to the steps necessary to enhance coexistence with bears, which might be specific communication campaigns or experiential learning courses.

While respondents held uniform feelings toward bear presence and bear conservation, residents of the four areas held different beliefs about the cost and benefits generated

TABLE 3 Averaged model. Parameter estimates were obtained through “full” averaging, whereby parameters are averaged over all models even if a variable is missing from a particular model, in which case the missing variable is replaced by the value 0

	AF ^a			LA ^a			MO ^a			Relative importance					
	Coeff	CI 2.5%	CI 97.5%	OR ^b	Coeff	CI 2.5%	CI 97.5%	OR ^b	Coeff		CI 2.5%	CI 97.5%	OR ^b		
(Intercept)	-1.61	-2.57	-0.64	0.20	1.44	0.58	2.31	4.24	1.88	0.98	2.78	6.54			
Bears frequently enter villages															
Yes ^c	-0.54	-0.86	-0.22	0.58	(1.72)	-1.19	-0.86	0.30	(3.30)	-1.54	-1.89	-1.19	0.21	(4.67)	1
Do not know ^c	0.88	-0.17	1.92	2.40	0.81	-0.21	1.84	2.25	0.20	-0.87	1.27	1.22			
Ski developments impact bears															
Yes ^c	0.95	0.62	1.29	2.59	1.04	0.69	1.39	2.84	1.50	1.13	1.86	4.46		1	
Do not know ^c	0.50	0.00	1.01	1.66	-0.25	-0.82	0.33	0.78	(1.28)	-0.15	-0.76	0.46	0.86	(1.16)	
Pop. Trend															
Decreasing ^d	0.12	-0.25	0.49	1.13	-0.82	-1.21	-0.42	0.44	(2.26)	-1.24	-1.64	-0.84	0.29	(3.44)	1
Increasing ^d	0.97	0.49	1.46	2.65	1.17	0.69	1.64	3.22	0.70	0.21	1.18	2.01			
Do not know ^d	0.31	-0.20	0.81	1.36	0.02	-0.48	0.52	1.02	-0.44	-0.95	0.07	0.64	(1.55)		
Have seen bear in wild: yes ^e	-0.40	-0.72	-0.08	0.67	(1.49)	-1.30	-0.63	0.38	(2.63)	-0.70	-1.04	-0.35	0.50	(2.01)	1
Main mortality cause															
Poisoned ^e	0.69	0.26	1.13	2.00	0.91	0.45	1.38	2.50	0.05	-0.47	0.57	1.05		1	
Shot ^e	0.45	0.08	0.81	1.56	0.59	0.21	0.97	1.80	0.51	0.13	0.90	1.67			
Bears increase tourism ^f	0.16	-0.05	0.37	1.18	-0.49	-0.67	-0.31	0.61	(1.63)	-0.55	-0.75	-0.35	0.58	(1.73)	1
Fear of bears ^f	0.25	0.11	0.38	1.28	0.34	0.20	0.47	1.40	0.32	0.18	0.46	1.38		1	
PC1—Feelings toward bears ^f	0.08	-0.14	0.30	1.08	0.05	-0.12	0.23	1.06	0.07	-0.14	0.29	1.08	0.57		
PC2—Perceived damage from bear ^f	-0.18	-0.34	-0.03	0.83	(1.20)	-0.14	-0.30	0.02	0.87	-0.33	-0.50	-0.16	0.72	(1.39)	0.40
PC3—Support for bear conservation ^f	-0.06	-0.23	0.10	0.94	(1.06)	0.02	-0.12	0.15	1.02	-0.08	-0.27	0.11	0.92	(1.09)	1

Note. Bold values are the odds ratio that are significant. For those values CI do not include 0.

^aReference category = Abruzzo, Marsica.

^bTo facilitate the interpretation of odd ratios <1 as a measure of effect size, we calculated their inverse proportion and included it in parentheses next to the original odds ratio values. An odds ratio less than 1.0 indicates that a predictor decreases the odds of residing in AF, LA, or MO compared with AM; whereas an odds ratio greater than 1.0 indicates that a predictor increases the odds of residing in AF, LA, or MO compared to AM; 95% confidence intervals (CI) are given to estimate the precision of the odds ratios.

^cReference category = no.

^dReference category = stable.

^eReference category = natural/other.

^fThese variables were entered as continuous variables and so the odds ratios refer to a one unit increase in their scale.

by living with bears. Regarding the benefits, residents of AM believed that the presence of bears in their territory provided economic revenue (as seen in other parks: Karanth & Nepal, 2012; Kubo & Shoji, 2014). However, respondents in LA and MO were less likely to believe that bears boost tourism in the administrative district. This might be due to limited tourism infrastructure and no ski resort outside AM (Glikman & Frank, 2019). Residents of MO, and to some extent LA, were disappointed with the PNALM authority, arguing that the park promised them economic revenue through bear conservation that never materialized (Glikman & Frank, 2019).

In comparison to AM, the residents of the other areas were more likely to believe that the bear population was increasing. This is possibly due to an effective increase of bears in the outer areas of the core bear distribution or most likely, to the presence of a few food-conditioned bears causing damage to properties in these areas (P. Ciucci, personal communication, July 10, 2017). Regarding the costs of sharing the landscape with bears, in AM, the perception of damage levels caused by bears was higher compared to the other areas, and so was the perception of bear incursions in villages, which relate to depredation of poultry or access to other anthropogenic food sources. Bears are unevenly distributed in the PNALM, with the highest density found in the center of core bear range, largely overlapping with the AM zone (Gervasi, Ciucci, Boulanger, Randi, & Boitani, 2012). Therefore, it could be speculated that the different perceptions of damage we recorded might reflect a true differential occurrence of damages through the core bear range. Moreover, they may also be influenced by different degrees of compensation efficacy (see below), different communication efforts made by the PNALM authority, and finally they may also reflect different levels of acceptance for bear damages across the park (Treves & Bruskotter, 2014). Indeed, it is possible that while residents of AM do believe there are more damages, the economic benefits they receive from bear tourism and perhaps even the cultural benefits they receive by bear sightings, outweigh the costs of damages they incur (Gebresenbet, Baraki, Yirga, Sillero-Zubiri, & Bauer, 2018; Goodale, Parsons, & Sherren, 2015).

Compared with AM, respondents from all the other study areas, especially LA and AF, were more likely to believe that shooting and poisoned baits were the main cause of bear mortality. In this respect, it may be important to point out that residents of LA and AF revealed that tensions between hunters, and between truffle harvesters who live in the park and who come from outside the park, have resulted in poison baits being used to harm hunters'/truffle harvesters' dogs (Glikman, 2011). Park authorities and administrators should therefore focus on reducing conflict within hunter and truffle harvester groups in LA and AF; and on providing information about bear mortality in AM and MO.

Residents of AF, LA, and MO expressed a slightly higher fear of bears when compared with AM. This suggests that the communities most exposed to bears (i.e., AM) were those less afraid of the species. Within AM, a few bears regularly enter villages and visit orchards near human settlements, where these food-conditioned or human-habituated bears are not perceived as a threat to human safety (Glikman & Frank, 2019). It is probable that this reduced level of fear is due to more frequent positive or neutral experiences (i.e., bears entering in villages), as well as a greater understanding of bear behaviour through observation (i.e., bear sightings), and past communication campaigns carried out by the park authority. To enhance acceptance of bears where they are still perceived as a threat, including areas outside our study area and where bears would be expected to expand their range in the near future, experiential learning programs could be adopted, such as guided tours emphasizing the lack of fatal attacks perpetuated by bears and including conflict-avoidance techniques (e.g., Swenson et al., 1996). In general, communication campaigns that emphasize anecdotes of positive, personal experiences with bears, as well as benefits gained by bear presence, will likely help to reduce fear among residents of the PNALM and elsewhere in adjacent areas (Slagle, Zajac, Bruskotter, Wilson, & Prange, 2013).

4.1 | Conservation implications

Most of the literature in human dimensions of conservation has framed conflict over carnivore as a conflict of positions and values, possibly because most studies have looked at differences between stakeholder groups (Glikman, Bath, & Vaske, 2010; Jones, Keane, St John, Vickery, & Papworth, 2019), rather than exploring geographic variation at a fine spatial scale, as was done here. Values are considered to be deep rooted and difficult to change (Vaske & Donnelly, 1999). Our results show that feelings, norms and values are consistent across the study area, and that, given the importance of cost/benefits beliefs regarding for example the role of tourism, differences may instead stem from the fact that residents within the PNALM seem to have different priorities and interests. Whereas values are mostly considered non-negotiable, priorities and interests leave space to manoeuvre (Holland, 2015). They are manageable, as long as there is social interest and political will to do so.

Although we detected overall positive feelings toward bears and their conservation in our study area, in some of the areas surveyed we revealed issues that, if not properly addressed, may escalate into further conflict. Specifically, some beliefs such as perceived growth in the bear population, fear of bears, and the perception that bears cause significant damages have all been shown in the literature to be related to conflict (Ambarli & Bilgin, 2008). Given the extreme demographic vulnerability of the bear population in PNALM, even a few isolated acts of retaliation could have

fatal consequences for the future of the bear population (Gervasi & Ciucci, 2018).

Our results showed that residents in our study areas liked bears. At the same time, areas with more tourism benefits (i.e., belief that having bears increases tourism) were more strongly associated with positive feelings toward bears. These positive views of bears may inspire more communities to promote tourism initiatives around them. While communities can build tourism infrastructure, once approved by the park administration, the way the tourism initiatives are communicated to current and future tourists will make a difference in how benefits are perceived by communities. Conservation authorities, administrators and policy-makers should build on the predominantly positive feelings, norms and values toward bears that we identified: first, by developing a communication campaign aimed at clearly conceptualizing the desired impact (e.g., the reduction in bear poisoning and poaching, shared positive feelings toward bears, or the preservation of bear critical habitat), second by identifying barriers to implementation (Mckenzie-Mohr, 2000). To accomplish this, park managers could employ focus groups, public consultation sessions, and meetings with key informants within the community.

Our results suggest that simply understanding attitudes is not enough when considering human–wildlife coexistence. Equally important is understanding of the context surrounding these attitudes. In our study case, the disparity in beliefs of bears is clearly context-driven, with each surveyed zone exhibiting patterns of thought particular to that area. Differences in administrative districts legislation, as well as in compensation programs, among the areas we surveyed may further exacerbate conflicts over bear conservation.

5 | CONCLUSIONS

Understanding how attitudes and norms vary across administrative districts and cultural contexts can improve human–carnivore coexistence, by enabling managers to understand how support for conservation and species management is distributed, and to identify areas of controversy where public participation and communication efforts might be most needed. Based on our findings, we recommend better communication with local residents, through which the Park can enhance trust and mitigate conflicts that currently result in behaviors that threaten bear conservation. We suggest the PNALM authority holds workshops that bring together all interested groups (e.g., shepherds, hunters), and build on commonalities between them to develop a socially driven management plan for bears in the region, likely to enhance social acceptance, tolerance, and positive behavior to the extent necessary to support the growth and range expansion of the Apennine brown bear population.

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CONFLICT OF INTEREST

The authors have no conflicts of interest to report.

Author contributions

J.A.G. was a lead author, conceptualizing the paper, contributing to writing all sections. J.A.G. and A.J.B. designed the social science methodology with the contribution of P.C. and L.B.; J.A.G. was the principal researcher of the data collection. A.M. analyzed the data, led the writing of the methods and result section. E.O.D. contributed to writing the introduction, the discussion, and formatting references. P.C. and L.B. coordinated and secured funding for the bear project in the PNALM. All authors assisted with multiple rounds of editing and approved publication.

Ethics statement

Ethical approval was provided by Miami University Ohio Institutional Review Board for Human Subject Research (Protocol Number 02898e).

Data accessibility statement

All relevant data are within the manuscript and its Supporting Information files.

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REFERENCES

- Ambarli, H., & Bilgin, C. C. (2008). Human–brown bear conflicts in Artvin, northeastern Turkey: Encounters, damage, and attitudes. *Ursus*, 19(2), 146–153. <https://doi.org/10.2192/1537-6176-19.2.146>
- Anonymous. (2011). *Piano d'azione nazionale per la tutela dell'orso bruno marsicano (PATOM)*. Quad Cons Nat 37, Ministero dell'Ambiente – ISPRA, Roma, Italy [In Italian].
- Barton, K. (2016). *MuMIn: Multi-Model Inference*. R package version 1.15.6. <https://CRAN.R-project.org/package=MumIn>
- Benazzo, A., Trucchi, E., Cahill, J. A., Maisano Delsler, P., Mona, S., Fumagalli, M., ... Bertorelle, G. (2017). Survival and divergence in a small group: The extraordinary genomic history of the endangered Apennine

- brown bear stragglers. *Proceedings of the National Academy of Sciences of the United States of America*, 114(45), E9589–E9597. <https://doi.org/10.1073/pnas.1707279114>
- Boitani, L. (1995). Ecological and cultural diversities in the evolution of wolf-human relationships. In L. N. Carbyn, S. H. Fritts, & D. Seip (Eds.), *Occasional Publication No. 35. Ecology and conservation of wolves in a changing world* (pp. 3–11). Edmonton, Canada: Canadian Circumpolar Institute, University of Alberta.
- Boitani, L. (2000). *Action plan for conservation of the wolves in Europe (Canis lupus)*. *Nature and environment*, no. 113. Strasbourg, France: Council of Europe Publishing.
- Boitani, L. (2003). Wolf conservation and recovery. In D. Mech, & L. Boitani (Eds.), *Wolves: Behavior, ecology, and conservation*. Chicago, IL: University of Chicago Press.
- Boscagli, G. (1999). Status and management of the brown bear in Central Italy (Abruzzo). In C. Servheen, S. Herrero, & B. Peyton (Eds.), *In: Bears. Status survey and conservation action plan* (pp. 81–84). IUCN/SSC Bear and Polar Bear Specialist Groups: Gland, Switzerland.
- Carter, N. H., Shrestha, B. K., Karki, J. B., Pradhan, N. M. B., & Liu, J. (2012). Coexistence between wildlife and humans at fine spatial scales. *Proceedings of the National Academy of Sciences of the United States of America*, 109(38), 15360–15365. <https://doi.org/10.1073/pnas.1210490109>
- Chapron, G., Kaczensky, P., Linnell, J. D. C., von Arx, M., Huber, D., Andr n, H., ... Boitani, L. (2014). Recovery of large carnivores in Europe's modern human-dominated landscapes. *Science*, 346(6216), 1517–1519. <https://doi.org/10.1126/science.1257553>
- Ciucci, P., Altea, T., Antonucci, A., Chiaverini, L., Di Croce, A., Fabrizio, M., ... Regione Lazio Bear Monitoring Network. (2017). Distribution of the brown bear (*Ursus arctos marsicanus*) in the central Apennines, Italy, 2005–2014. *HYSTRIX: The Italian Journal of Mammalogy*, 28(1), 86–91. <https://doi.org/10.4404/hystrix-28.1-12049>
- Ciucci, P., & Boitani, L. (2008). The Apennine brown bear: A critical review of its status and conservation problems. *Ursus*, 19, 130–145. <https://doi.org/10.2192/07PER012.1>
- Ciucci, P., Gervasi, V., Boitani, L., Boulanger, J., Paetkau, D., Prive, R., & Tosoni, E. (2015). Estimating abundance of the remnant Apennine brown bear population using multiple noninvasive genetic data sources. *Journal of Mammalogy*, 96(1), 206–220. <https://doi.org/10.1093/jmammal/gyu029>
- Ciucci, P., Tosoni, E., Di Domenico, G., Quattrociochi, F., & Boitani, L. (2014). Seasonal and annual variation in the food habits of Apennine brown bears, central Italy. *Journal of Mammalogy*, 95, 572–586. <https://doi.org/10.1644/13-MAMM-A-218>
- Coronas, M.G. (2011). *La diversificazione dell'offerta agrituristica e la sua articolazione territoriale*. (Unpublished Ph.D. thesis). Universita degli Studi della Tuscia di Viterbo, Italy.
- Dickman, A. J., Macdonald, E. A., & Macdonald, D. W. (2011). A review of financial instruments to pay for predator conservation and encourage human-carnivore coexistence. *Proceedings of the National Academy of Sciences of the United States of America*, 108, 13937–13944. <https://doi.org/10.1073/pnas.1012972108>
- Eagly, A. H., & Chaiken, S. (1993). *The psychology of attitudes*. Fort Worth, TX: Harcourt.
- Enserink, M., & Vogel, G. (2006). Wildlife conservation—the carnivore comeback. *Science*, 314, 746–749. <https://doi.org/10.1126/science.314.5800.746>
- Ericsson, G., Sandstr m, C., & Bostedt, G. (2006). The problem of spatial scale when studying the human dimensions of a natural resource conflict: Humans and wolves in Sweden. *The International Journal of Biodiversity Science and Management*, 2, 343–349. <https://doi.org/10.1080/17451590609618155>
- Falcucci, A., Ciucci, P., Maiorano, L., Gentile, L., & Boitani, L. (2009). Assessing habitat quality for conservation using an integrated occurrence-mortality model. *Journal of Applied Ecology*, 46(3), 600–609. <https://doi.org/10.1111/j.1365-2664.2009.01634.x>
- Faraway, J. J. (2006). *Extending the linear model with R: Generalized linear, mixed effects and nonparametric regression models*. Boca Raton, FL: Chapman & Hall/CRC Taylor & Francis Group.
- Febbo, D., & Pellegrini, M. (1990). The historical presence of the brown bear in the Apennines. *Aquilo Series Zoologica*, 27, 85–88.
- Fox, J., & Weisberg, S. (2011). *An {R} companion to applied regression* (2nd ed.). Thousand Oaks, CA: Sage. <http://socserv.socsci.mcmaster.ca/jfox/Books/Companion>
- Fulton, D. C., Manfredo, M. J., & Lipscomb, J. (1996). Wildlife value orientations: A conceptual and measurement approach. *Human Dimension of Wildlife*, 1, 24–47. <https://doi.org/10.1080/10871209609359060>
- Gebresenbet, F., Baraki, B., Yirga, G., Sillero-Zubiri, C., & Bauer, H. (2018). A culture of tolerance: Coexisting with large carnivores in the Kafa Highlands, Ethiopia. *Oryx*, 52(04), 751–760. <https://doi.org/10.1017/S0030605316001356>
- Gervasi, V., & Ciucci, P. (2018). Demographic projections of the Apennine brown bear population *Ursus arctos marsicanus* (Mammalia: Ursidae) under alternative management scenarios. *The European Zoological Journal*, 85(1), 243–253.
- Gervasi, V., Boitani, L., Paetkau, D., Posillico, M., Randi, E., & Ciucci, P. (2017). Estimating survival in the Apennine brown bear accounting for uncertainty in age classification. *Population Ecology*, 59(2), 119–130. <https://doi.org/10.1007/s1014>
- Gervasi, V., Ciucci, P., Boulanger, J., Randi, E., & Boitani, L. (2012). A multiple data source approach to improve abundance estimates of small populations: The brown bear in the Apennines, Italy. *Biological Conservation*, 152, 10–20. <https://doi.org/10.1016/j.biocon.2012.04.005>
- Glikman, J. A. (2011). *Understanding the role attitudes could play in conservation planning for wolves and brown bears in Abruzzo, Lazio and Molise National Park, Italy*. (Ph.D. thesis). Memorial University of Newfoundland, Canada.
- Glikman, J. A., Bath, A. J., & Vaske, J. J. (2010). Segmenting normative beliefs regarding wolf management in Central Italy. *Human Dimensions of Wildlife*, 15(5), 347–358. <https://doi.org/10.1080/10871209.2010.505598>
- Glikman, J. A., Frank, B., & Marchini, S. (2019). Human-wildlife interactions: Multifaceted approaches for turning conflict into coexistence. In B. Frank, J. A. Glikman, & S. Marchini (Eds.), *Human-wildlife interactions: Turning conflict into coexistence* (pp. 439–452). Cambridge: Cambridge University Press. <https://doi.org/10.1017/9781108235730>
- Glikman, J. A., & Frank, B. (2019). Understanding local folklore and attitudes in Apennine brown bear conservation. In I. Convery, O. Nevin, & P. Davis (Eds.), *The bear: A cultural and natural heritage*. Woodbridge, ON; Suffolk, UK: Boydell and Brewer.
- Glikman, J. A., Vaske, J. J., Bath, A. J., Ciucci, P., & Boitani, L. (2012). Residents' support for wolf and bear conservation: The moderating influence of knowledge. *European Journal of Wildlife Research*, 58(1), 295–302. <https://doi.org/10.1007/s10344-011-0579-x>
- Goodale, K., Parsons, G., & Sherren, K. (2015). The nature of the nuisance—damage or threat—determines how perceived monetary costs and cultural benefits influence farmer tolerance of wildlife. *Diversity*, 7, 318–341. <https://doi.org/10.3390/d7030318>
- Hall, D., & Hall, I. (1996). *Practical social research: Project work in the community*. Malaysia: Macmillan Press LTD.
- Holland, A. (2015). Philosophy, conflict and conservation. In S. M. Redpath, R. J. Gutierrez, K. A. Wood, & J. C. Young (Eds.), *Conflicts in conservation: navigating towards solutions* (pp. 19–29). Cambridge: Cambridge University Press.
- Hosmer, D. W., & Lemeshow, S. (2000). *Applied logistic regression* (2nd ed.). New York, NY: John Wiley & Sons.
- Idolo, M., Motti, R., & Mazzoleni, S. (2010). Ethnobotanical and phytomedicinal knowledge in a long-history protected area, the Abruzzo, Lazio and Molise National Park (Italian Apennines). *Journal of Ethnopharmacology*, 127(2), 379–395. <https://doi.org/10.1016/j.jep.2009.10.027>
- ISTAT. (2001). *Istituto Nazionale di Statistica*. Retrieved from www.istat.it
- Jackman, S. (2017). *pscl: Classes and methods for R developed in the political science computational laboratory*. United States studies Centre, University of Sydney. Sydney, New South Wales, Australia. R package version 1.5.2. <https://github.com/atahk/pscl/>
- Jamieson, S. (2004). Likert scales: How to (ab)use them. *Medical Education*, 38, 1217–1218. <https://doi.org/10.1111/j.1365-2929.2004.02012.x>
- Jones, S., Keane, A., St John, F., Vickery, J., & Papworth, S. (2019). Audience segmentation to improve the targeting of conservation interventions for hunters. *Conservation Biology*. <https://doi.org/10.1111/cobi.13275>
- Karant, K. K., & Nepal, S. K. (2012). Local residents perception of benefits and losses from protected areas in India and Nepal. *Environmental Management*, 49(2), 372–386. <https://doi.org/10.1007/s00267-011-9778-1>
- Kassambara, A. (2018). *Ggpubr: 'ggplot2' based publication ready plots*. R package version 0.2. <https://CRAN.R-project.org/package=ggpubr>

- Knott, E. J., Bunnefeld, N., Huber, D., Reljić, S., Kereži, V., & Milner-Gulland, E. J. (2014). The potential impacts of changes in bear hunting policy for hunting organisations in Croatia. *European Journal of Wildlife Research*, 60(1), 85–97. <https://doi.org/10.1007/s10344-013-0754-3>
- Kubo, T., & Shoji, Y. (2014). Spatial tradeoffs between residents' preferences for brown bear conservation and the mitigation of human–bear conflicts. *Biological Conservation*, 176, 126–132. <https://doi.org/10.1016/j.biocon.2014.05.019>
- Latini, R., Sulli, C., Gentile, L., & Di Benedetto, A. (2005). Conflitto tra grandi carnivori e attività antropiche nel Parco Nazionale d'Abruzzo Lazio e Molise: Entità, esperienze e prospettive di gestione. Ciucci, P., Teofili, C. and Boitani, L. (Editors). Grandi Carnivori e Zootecnia tra conflitto e coesistenza. *Biologia e Conservazione della Fauna*, 115, 151–159 [In Italian with English summary].
- Lele, S.R., Keim, J. L., & Solymos, P. (2016). ResourceSelection: Resource selection (probability) functions for use-availability data. R package version 0.2–6. <https://CRAN.R-project.org/package=ResourceSelection>
- Likert, R. (1932). A technique for the measurement of attitudes. *Archives of Psychology*, 140, 1–55. <https://doi.org/10.1037/h0057313>
- Linnell, J. D. C., & Boitani, L. (2012). Building biological realism into wolf management policy: The development of the population approach in Europe. *HYSTRIX: The Italian Journal of Mammology*, 23, 80–91. <https://doi.org/10.4404/hystrix-23.1-4676>
- Madden, F., & McQuinn, B. (2014). Conservation's blind spot: The case for conflict transformation in wildlife conservation. *Biological Conservation*, 178, 97–106. <https://doi.org/10.1016/j.biocon.2014.07.015>
- Maiorano, L., Boitani, L., Chiaverini, L., & Ciucci, P. (2017). Uncertainties in the identification of potential dispersal corridors: The importance of behaviour, sex, and algorithm. *Basic and Applied Ecology*, 21, 66–75. <https://doi.org/10.1016/j.baae.2017.02.005>
- Mckenzie-Mohr, D. (2000). New ways to promote proenvironmental behavior: Promoting sustainable behavior: An introduction to community-based social marketing. *Journal of Social Issues*, 56(3), 543–554. <https://doi.org/10.1111/0022-4537.00183>
- Miller, K. W., Wilder, L. B., Stillman, F. A., & Becker, D. M. (1997). The feasibility of a street-intercept survey method in an African-American community. *American Journal of Public Health*, 87(4), 655–658. <https://doi.org/10.2105/AJPH.87.4.655>
- Morzillo, A. T., Mertig, A. G., Garner, N., & Liu, J. (2007). Spatial distribution of attitudes toward proposed management strategies for wildlife recovery. *Human Dimensions of Wildlife*, 12, 15–29. <https://doi.org/10.1080/10871200601107866>
- Norcia, M. (2007). I monasteri di Sora e Val di Comino (Frosinone). In S. Patitucci Uggeri (Ed.), *Archeologia del Paesaggio Medievale* (pp. 137–161). Sesto Fiorentino, Italy: Edizioni All'Insegna del Giglio s.a.s.
- Osborne, J. W. (2006). Bringing balance and technical accuracy to reporting odds ratios and the results of logistic regression analyses. *Practical Assessment, Research & Evaluation*, 11(7), 1–6.
- Pampanini, R., Diotallevi, F., & Marchini, A. (2012). The market for fresh truffles in Italy between performance and commercial constraints on development: The contribution of the Italian regions. MPRA paper no. 43278.
- Piédallu, B., Quenette, P. Y., Mounet, C., Lescureux, N., Borelli-Massines, M., Dubarry, E., ... Gimenez, O. (2016). Spatial variation in public attitudes towards brown bears in the French Pyrenees. *Biological Conservation*, 197, 90–97. <https://doi.org/10.1016/j.biocon.2016.02.027>
- Redpath, S. M., Young, J., Evely, A., Adams, W. M., Sutherland, W. J., Whitehouse, A., ... Gutiérrez, R. J. (2013). Understanding and managing conservation conflicts. *Trends in Ecology & Evolution*, 28(2), 100–109. <https://doi.org/10.1016/j.tree.2012.08.021>
- Revelle, W. (2015). psych: procedures for personality and psychological research. Version = 1.5.8. Northwestern University, Evanston, Illinois, USA. <http://CRAN.Rproject.org/package=psych>
- Robin, X., Turck, N., Hainard, A., Tiberti, N., Lisacek, F., Sanchez, J. C., & Müller, M. (2011). pROC: An open-source package for R and S+ to analyze and compare ROC curves. *BMC Bioinformatics*, 12(1), 77. <https://doi.org/10.1186/1471-2105-12-77>
- Rotheram-Borus, M. J., Mann, T., Newman, P. A., Grusky, O., Frerichs, R. R., Wight, R. G., & Kuklinski, M. (2001). A street intercept survey to assess HIV-testing attitudes and behaviors. *AIDS Education and Prevention*, 13(3), 229–238.
- R Core Team. (2016). R: A language and environment for statistical computing. R foundation for statistical computing, Vienna, Austria. <https://www.R-project.org/>
- Sallustio, L., Quatrini, V., Geneletti, D., Corona, P., & Marchetti, M. (2015). Assessing land take by urban development and its impact on carbon storage: Findings from two case studies in Italy. *Environmental Impact Assessment Review*, 54, 80–90. <https://doi.org/10.1016/j.eiar.2015.05.006>
- Sievert, J. (1999). Abruzzo national park: Land of dreams. *Environment and History*, 5, 293–307.
- Sipari, E. (1926). *Relazione Sipari. 1997 re-Printing* (p. 309). Pescasseroli, Italy: Ente Autonomo Parco Nazionale d'Abruzzo Lazio e Molise.
- Slagle, K., Zajac, R., Bruskotter, J., Wilson, R., & Prange, S. (2013). Building tolerance for bears: A communication experiment. *The Journal of Wildlife Management*, 77(4), 863–869. <https://doi.org/10.1002/jwmg.515>
- Slagle, K., & Bruskotter, J. T. (2019). Tolerance for wildlife: A psychological perspective. In B. Frank, J. A. Glikman, & S. Marchini (Eds.), *Human-wildlife interactions: Turning conflict into coexistence* (pp. 85–106). Cambridge: Cambridge University Press. <https://doi.org/10.1017/9781108235730>
- Swenson, J. E., Sandegren, F., Heim, M., Brunberg, S., Sørensen, O. J., Söderberg, A., ... Overskaug, K. (1996). Is the Scandinavian brown bear dangerous. Norwegian Institute for Nature Research, Oppdragsmelding, 404.
- Tabachnick, B. G., & Fidell, L. S. (2001). *Using multivariate statistics* (4th ed.). Boston, MA: Allyn and Bacon.
- Treves, A., & Bruskotter, J. (2014). Tolerance for predatory wildlife. *Science*, 344, 476–477. <https://doi.org/10.1126/science.1252690>
- Thompson, R. (2018). *No word for wilderness: No word for wilderness: Italy's grizzlies and the race to save the rarest bears on earth*. Ashland, OR: Ashland Creek Press.
- Vaske, J. J. (2008). *Survey research and analysis. Application in parks, recreation and human dimensions*. State Collage, PA: Venture Publishing, Inc.
- Vaske, J. J., & Donnelly, M. P. (1999). A value-attitude-behavior model predicting wildland preservation voting intentions. *Society & Natural Resources*, 12(6), 523–537. <https://doi.org/10.1080/089419299279425>
- Vaske, J. J., & Whittaker, D. (2004). Normative approaches to natural resources. In M. J. Manfredo, J. J. Vaske, B. L. D. R. F. Bruyere, & P. Brown (Eds.), *Society and natural resources: A summary of knowledge* (pp. 283–294). Jefferson, MO: Modern Litho.
- Venables, W. N., & Ripley, B. D. (2002). *Modern applied statistics with S* (4th ed.). New York: Springer.
- Verissimo, D., & McKinley, E. (2016). Introducing conservation marketing: Why should the devil have all the best tunes? *Oryx*, 50(1), 14.
- Verplanken, B., Hofstee, G., & Janssen, H. J. W. (1998). Accessibility of affective versus cognitive components of attitudes. *European Journal of Social Psychology*, 28, 23–35. [https://doi.org/10.1002/\(SICI\)1099-0992\(199801/02\)28:1<23::AID-EJSP843>3.0.CO;2-Z](https://doi.org/10.1002/(SICI)1099-0992(199801/02)28:1<23::AID-EJSP843>3.0.CO;2-Z)
- Warner, R. M. (2008). *Applied statistics: From bivariate through multivariate techniques*. Los Angeles, CA: SAGE Publications, Inc.
- Young, J. C., Jordan, A., R. Searle, K., Butler, A., S. Chapman, D., Simmons, P., & Watt, A. D. (2013). Does stakeholder involvement really benefit biodiversity conservation? *Biological Conservation*, 158, 359–370. <https://doi.org/10.1016/j.biocon.2012.08.018>
- Zeileis, A., Hothorn T. (2002). Diagnostic checking in regression relationships. *R News*, 2(3), 7–10. <https://CRAN.R-project.org/doc/Rnews/>
- Zuur, A. F., Ieno, E. N., & Elphick, C. S. (2010). A protocol for data exploration to avoid common statistical problems. *Methods in Ecology and Evolution*, 1, 3–14. <https://doi.org/10.1111/j.2041-210X.2009.00001.x>

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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