

## Short Communication

# Differences in stakeholder perceptions of the jaguar *Panthera onca* and puma *Puma concolor* in the tropical lowlands of Guatemala

JOSÉ R. SOTO-SHOENDER and MARTIN B. MAIN

**Abstract** We conducted a survey questionnaire to assess and compare public perceptions and knowledge of jaguars *Panthera onca* and pumas *Puma concolor* among two stakeholder groups likely to come into conflict with these large carnivores: cattle ranchers living near protected areas and inhabitants of two villages located within the multiple-use forest of the Maya Biosphere Reserve, Guatemala. We tested whether stakeholder group (i.e. rancher or villager) or previous experience with livestock attacks by carnivores predicted a negative perception of jaguars and pumas. The odds of people fearing an attack on humans by these felids and of recognizing the ecological importance of these species was best explained by stakeholder group. Villagers exhibited a more negative perception towards these felids than did cattle ranchers. Our results highlight the importance of tailoring conservation programmes in high risk areas to the needs of specific stakeholder groups. Further research is needed to understand which factors (i.e. ecological settings, socio-economic differences) best explain these differences and whether these differences in perception vary within groups. Programmes that work with local people to assess the ecological importance of large predators and the true risks of carnivore attacks on livestock and humans along with low-cost conflict mitigation measures should be implemented to increase the level of tolerance towards these carnivores.

**Keywords** Guatemala, human–carnivore conflict, jaguar, livestock depredation, local perceptions, Maya Biosphere Reserve, puma

Negative perceptions towards large predators, and hence their persecution, may be influenced by fear of attacks

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on humans, fear of livestock depredation, and lack of knowledge of the predators' ecological importance. We surveyed villagers living within a multiple-use forest and cattle ranchers on the outskirts of protected areas to (1) assess local knowledge of the ecological role of the jaguar *Panthera onca* and puma *Puma concolor*, (2) examine local perceptions of these large felids based on real and perceived risks to livestock and humans, and (3) determine whether perceptions of these felids are influenced by either history of livestock depredation or stakeholder identity.

Both groups surveyed reside and raise livestock within a human–wildlife interface and thus are at constant risk of coming into conflict with carnivores. Nevertheless, the impact of livestock depredation by carnivores does not affect all ranchers (Soto-Shoender & Giuliano, 2011) and villagers (J.R. Soto-Shoender, unpubl. data) in the area equally. Because attitudes towards wildlife may also be influenced by past and present interactions (Kellert et al., 1996) we hypothesized that ranchers and villagers with prior history of livestock losses would be more likely to hold negative perceptions of jaguars and pumas than those who had not suffered any attacks. The villagers surveyed live within a protected area, are required to carry out sustainable and low impact forest activities, derive direct and indirect benefits from the forest and wildlife, and are in constant contact with local conservation organizations and occasionally participate in conservation programmes. In contrast, the cattle ranchers live outside protected areas, do not benefit from forest conservation, and are not commonly approached by conservation organizations (J.R. Soto-Shoender, pers. obs.). As a result of these differences we also hypothesized that villagers would hold a more positive perception towards these two felid species than ranchers and would be more aware of the ecological roles played by these felids.

This study was carried out in the Petén District, the largest and northernmost district of Guatemala (Fig. 1). For a full description of the study area see Soto-Shoender & Giuliano (2011). The two villages surveyed within the multiple-use zone of the Maya Biosphere Reserve were Carmelita and Uaxactun (Fig. 1), which have c. 355 and 693 inhabitants, respectively (Grunberg, 2000). The main activities carried out in the villages of the Reserve are small-scale agriculture and the harvest of timber and non-timber forest products (Hayes et al., 2002). Villagers keep

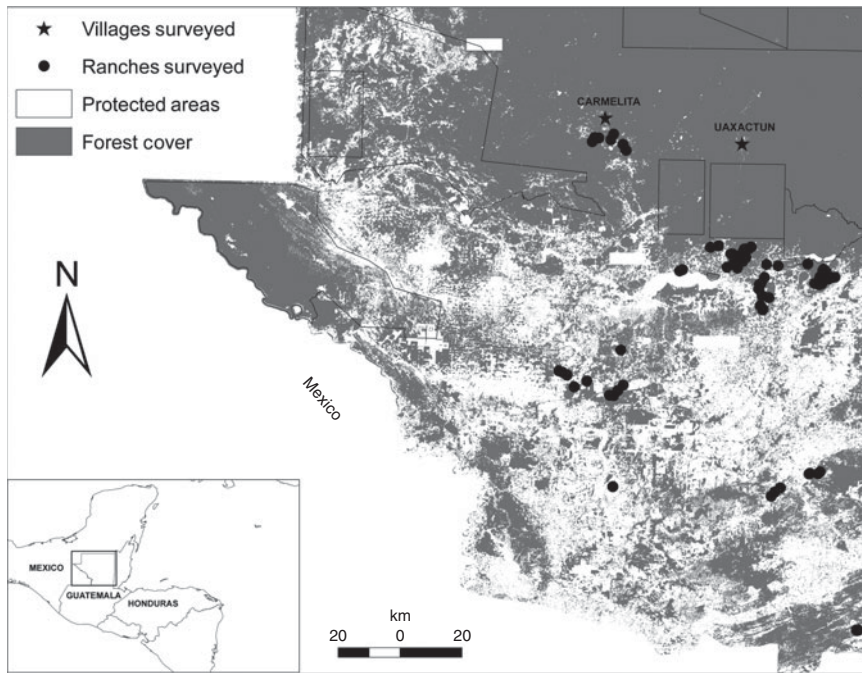


FIG. 1 The study area, showing the villages and ranches surveyed in the Petén District, Guatemala, in 2007. The inset indicates the location of the main map in Mesoamerica.

livestock such as poultry, swine, horses, mules and dogs (J.R. Soto-Shoender, unpubl. data). In contrast, most cattle ranchers surveyed live outside the Reserve, along the borders of this and other protected areas, or near large unmanaged tracts of forest (Fig. 1). The main livestock raised are cattle, with some ranches holding other livestock such as poultry, horses, or dogs (J.R. Soto-Shoender, unpubl. data).

A semi-structured questionnaire survey (Table 1) was conducted by JRS-S and trained field assistants from May to August 2007. A negative perception of jaguars and pumas was identified if a person responded that these animals were not important ecologically and/or were dangerous to people and livestock. We surveyed only adult males (> 18 years old) who were either the head of the household (in the case of villagers) or ranch owners or administrators who had been working for at least 5 years on a ranch. For a detailed description of how surveyed ranchers were selected see Soto-Shoender & Giuliano (2011).

We performed a logistic regression analysis for yes/no questions (uncertain answers were discarded) where cell counts were > 5 (number of responses), with previous livestock attacks and stakeholder group as the independent variables. We modelled the odds of an affirmative answer to each question for villagers and for respondents with a prior history of attacks. Statistical significance was measured using the Wald  $\chi^2$  statistic. For questions with cell counts < 5 we performed Fisher's exact  $\chi^2$  test to examine association between response and category (stakeholder group or history of livestock depredation by carnivores; Zar, 1999). Statistical significance was measured at  $P < 0.05$  for all analyses. All statistics were calculated with SAS v. 9.2 (SAS Institute, Cary, USA).

TABLE 1 Questions used in the semi-structured survey of villagers and cattle ranchers of Petén District, Guatemala (Fig. 1), in 2007.

- |                                                                                      |
|--------------------------------------------------------------------------------------|
| 1. Have you suffered any livestock attacks by carnivores in the last 5 years? Yes/No |
| 2. How did you know it was an attack by a carnivore?                                 |
| 3. Are jaguars important for the forest and wildlife? Yes/No                         |
| 4. Why/why not?                                                                      |
| 5. Are jaguars dangerous to people? Yes/No                                           |
| 6. Are jaguars dangerous to livestock? Yes/No                                        |
| 7. Are pumas important for the forest and wildlife? Yes/No                           |
| 8. Why/why not?                                                                      |
| 9. Are pumas dangerous to people? Yes/No                                             |
| 10. Are pumas dangerous to livestock? Yes/No                                         |

We surveyed a total of 172 villagers (124 and 48 people from Uaxactun and Carmelita, respectively) and 72 cattle ranchers throughout the Petén District. All households of the two villages were surveyed, whereas the number of ranchers surveyed was limited by access to ranchers and logistical constraints. Forty-three (25%) households in the villages reported having suffered livestock attacks, and 22 (31%) ranchers reported attacks by carnivores on their livestock. For a description of ranches surveyed see Soto-Shoender & Giuliano (2011).

The proportion of people surveyed that believed jaguars and pumas are important components of the forest was greater for ranchers than for villagers (Fig. 2). Affirmative answers to our question regarding the ecological importance of jaguars were significantly influenced by stakeholder group ( $P = 0.02$ , Fisher's exact test) and history of attacks

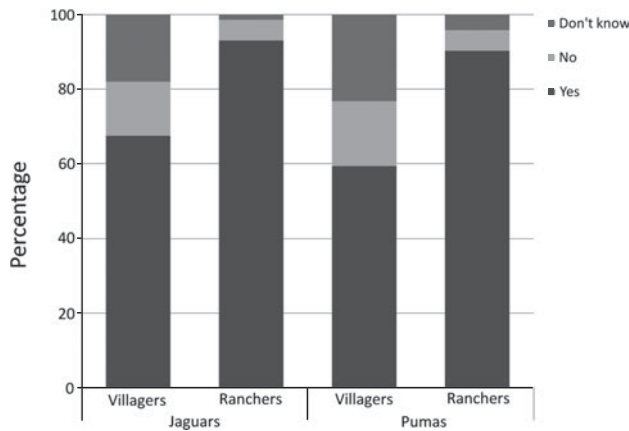


FIG. 2 Percentage of villagers and cattle ranchers in the Petén District (Fig. 1) responding Don't know, No and Yes to survey questions 2 and 6 (Are jaguars and pumas important for the forest and wildlife?)

( $P = 0.003$ , Fisher's exact test), whereas an affirmative answer to the same question for pumas was only influenced by stakeholder group ( $P = 0.003$ , Fisher's exact test). The odds of an affirmative answer to whether jaguars were important were 3.7 times higher for ranchers than for villagers, whereas the odds of an affirmative answer to this question were 3.4 times greater for ranchers and villagers that had not suffered any attacks.

Most villagers believed jaguars (79%) and pumas (78%) posed a danger to people, in contrast to ranchers (38% for jaguars and 29% for pumas). Affirmative answers to a fear of these felids attacking people were associated with

stakeholder group but not with history of attacks (Table 2). Most people interviewed believed jaguars (95% for villagers and 92% for ranchers) and pumas (94 and 86% for villagers and ranchers respectively) attack livestock, and no statistical significance was found among the predictor variables for either jaguars or pumas for this question (Table 2).

Our results indicated that a negative perception of jaguars and pumas was mostly explained by stakeholder group, with prior history of livestock attacks exerting little influence on local perceptions. Overall, the attitudes of ranchers towards jaguars and pumas were more positive than those of villagers. Therefore, our hypothesis that there is a more positive perception and increased knowledge of carnivores amongst villagers was rejected. Similar to our study, Naughton-Treves et al. (2003) found factors such as social identity and occupation to be important predictors of attitudes towards wolves *Canis lupus*. Johansson & Karlsson (2011) concluded that individuals within different stakeholder groups shared their cognitive interpretation of brown bears *Ursus arctus* and wolves and this explained the different levels of fear stakeholder groups exhibited towards these species. Although we did not collect socio-economic information, we believe members of each stakeholder group in our study have similar socio-economic status, social identity, level of education and past experience (Barton Bray et al., 2008; Grandia, 2009). Therefore, perceptions of wildlife in the area may be strongly influenced by the social group to which an individual belongs (Dickman, 2010). Nevertheless, further research is needed to clarify whether

TABLE 2 Logistic regression analysis, with Wald  $\chi^2$  statistic, for survey questions 5 and 9 (Are jaguars and pumas dangerous to people?) and 6 and 10 (Are jaguars and pumas dangerous to livestock?) asked of villagers and ranchers in the Petén District (Fig. 1). Odds of an affirmative answer were modelled for villagers and respondents who suffered livestock attacks. Total number of respondents per stakeholder group is given by n.

Question/predictor variable	Test statistics					
	Estimate	SE	$\chi^2$	df	P	Odds ratio estimate
<b>Are jaguars dangerous to people (n = 158 villagers, n = 71 ranchers)?</b>						
Stakeholder group	0.90	0.16	33.12	1	<0.0001	6.06
Attack history	0.09	0.17	0.30	1	0.59	1.2
<b>Are jaguars dangerous to livestock (n = 172 villagers, n = 74 ranchers)?</b>						
Stakeholder group	0.64	0.46	1.93	1	0.17	3.62
Attack history	-0.24	0.47	0.27	1	0.60	0.62
<b>Are pumas dangerous to people (n = 156 villagers, n = 70 ranchers)?</b>						
Stakeholder group	1.08	0.16	43.40	1	<0.0001	8.66
Attack history	-0.15	0.17	0.77	1	0.38	0.74
<b>Are pumas dangerous to livestock (n = 172 villagers, n = 77 ranchers)?</b>						
Stakeholder group	0.33	0.39	0.73	1	0.39	1.95
Attack history	-0.01	0.43	0.0009	1	0.98	0.98

these differences may be because of specific factors such as education, livelihood patterns and ecological settings. It is also important to determine whether there is variation within each stakeholder group, as we surveyed only adult males.

Our results suggest that certain stakeholder groups may be less tolerant of jaguars and pumas, and killing of carnivores may vary locally and regionally. Additional research that identifies and examines how perceptions differ among groups is needed to determine whether killing of these felids varies in areas occupied by distinct stakeholder groups. Understanding the attitudes and impacts of different stakeholder groups on carnivore populations is needed for the design and implementation of conservation programmes tailored for specific areas and target groups.

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### Biographical sketches

JOSÉ R. SOTO-SHOENDER has worked in wildlife research and conservation programmes in the tropical lowlands of Guatemala for 11 years and is interested in understanding and mitigating the impacts of human activities on neotropical wildlife, especially carnivores and their prey. MARTIN B. MAIN's research interests focus primarily on behavioural ecology of large carnivores and ungulates as influenced by competition, predation, habitat quality and human disturbance.