Conservation payments in a social context: determinants of tolerance and behavioural intentions towards wild cats in northern Belize

Rebecca G. Harvey, Venetia Briggs-Gonzalez and Frank J. Mazzotti

Abstract Carnivores are valued by conservationists globally but protecting them can impose direct costs on rural, livestock-dependent communities. Financial incentives are increasingly used with the goal of increasing people's tolerance of predators, but the definition of tolerance has been vague and inconsistent. Empirical correlations between attitudinal and behavioural measures of tolerance imply that attitudes may be a valid proxy for behaviours. However, theoretical differences between the concepts suggest that attitudinal tolerance and behavioural intention to kill cats would have different underlying determinants. We surveyed 112 residents within a forest–farm mosaic in northern Belize inhabited by jaguars *Panthera onca* and four other species of wild cats. A conservation payment programme pays local landowners when camera traps record cat presence on their land. Results indicated that tolerance was associated with gender and participation in the camera-trapping programme, whereas intention to kill cats was associated with cultural group (Mennonites vs Mestizos), presence of children in the home and, to a lesser extent, tolerance. Neither dependent variable was significantly related to depredation losses or economic factors. Results suggest that monetary payments alone are unlikely to affect attitudes and behaviours towards carnivores. Payment programmes may be enhanced by accentuating non-monetary incentives, leveraging social norms and targeting specific groups with information about risks and benefits associated with carnivores. By empirically separating two concepts commonly conflated as 'tolerance' we clarify understanding of how social forces interact with financial incentives to shape people's relationships with predators.

Keywords Attitudes, behavioural intentions, carnivores, conservation payments, gender, jaguars, norms, tolerance

Rebecca G. Harvey (Corresponding author), Venetia Briggs-Gonzalez* and Frank J. Mazzotti Department of Wildlife Ecology and Conservation, University of Florida, Fort Lauderdale Research and Education Center, 3205 College Avenue, Davie, Florida 33314, USA. E-mail rgharvey@ufl.edu

*Also at: Lamanai Field Research Center, Indian Church Village, Orange Walk, Belize

Received 22 September 2015. Revision requested 5 November 2015. Accepted 16 May 2016.

Introduction

Carnivores are often valued as flagship conservation species because their protection may have cascading benefits for many other species and ecosystem services (Ripple et al., 2014). However, their significant land requirements and predatory behaviour often create conflicts between conservation and other human activities, particularly in relation to livelihoods (Redpath et al., 2015). Depredation of livestock is the most frequent source of conflict involving large felid carnivores, such as lions *Panthera leo*, tigers *Panthera tigris*, leopards *Panthera pardus* and jaguars *Panthera onca* (Inskip & Zimmermann, 2009). Thus, coexistence with these predators may impose severe economic costs on rural, livestock-dependent populations (Bagchi & Mishra, 2006; Bauer et al., 2015). When predators kill livestock, people sometimes respond through retaliatory killings that can lead to population declines of already threatened species (Dickman et al., 2011).

Given the high conservation and existence value of carnivores at the global scale, conservationists increasingly use financial incentives to help local people escape from poverty and to encourage coexistence. Incentives take a variety of forms, including compensation for losses, insurance, revenue-sharing, and conservation payments (Dickman et al., 2011). In the latter approach people are paid for desired environmental conditions such as the maintenance of carnivore populations on private land. Such payments are increasingly attractive as a means of involving private landowners in conservation, particularly in areas where wildlife habitats and agricultural lands overlap (Nelson, 2009). Compared to compensation schemes, which despite some successes are prone to moral hazard, fraud and financial problems (Dickman et al., 2011; Bauer et al., 2015), conservation payments are considered a direct and cost-effective way of incentivizing coexistence with wildlife (Ferraro & Kiss, 2002; Bulte & Rondeau, 2005; Zabel & Holm-Müller, 2008). However, rigorous evaluation of payment programmes is needed to demonstrate the extent to which they benefit both people and predators (Nelson, 2009; Persson et al., 2015).

The research presented here is part of an ongoing socio-ecological study to evaluate a conservation payment programme in northern Belize. The programme incentivizes landowners to monitor and conserve wildlife by paying them when camera traps record the presence of jaguars, other cat species, and prey species on their land. The

conservation goal is to stop retaliatory killings of wild cats in response to livestock losses. Ecological objectives are to determine presence or absence of wild-cat species in the study area and identify potential predictors of felid habitat (Briggs-Gonzalez & Mazzotti, 2014). Social–psychological research objectives, addressed here, are to understand how the incentive programme, other economic factors, and social forces influence residents' tolerance of and intention to kill wild cats. This integrated study contributes to a growing body of research seeking to re-conceptualize and improve coexistence between people and wild animals (Fisher, 2016).

Tolerance is widely considered to be a determining factor in successful carnivore conservation (Bruskotter & Wilson, 2014; Treves & Bruskotter, 2014). However, the meaning of tolerance is frequently assumed to be intuitive and therefore it is not defined in conservation literature (e.g. Naughton-Treves et al., 2003; Karanth & Chellam, 2009; Ripple et al., 2014). In empirical studies tolerance and intolerance are defined inconsistently, at times as an attitude (e.g. Zimmermann et al., 2005; Lindsey et al., 2013) and at times as a behaviour or behavioural intention (e.g. killing a carnivore; Romañach et al., 2007; Hazzah et al., 2009; Marchini & Macdonald, 2012). This lack of clarity leads some to conflate attitudes with behaviour, assuming for example that negative attitudes towards a predator will lead to its persecution (Soto-Shoender & Main, 2013; Delibes-Mateos, 2014).

Scholars have attempted to clarify the definition of tolerance by examining relationships between its attitudinal and behavioural components. Bruskotter & Fulton (2012) conceptualized tolerance as the passive middle of a behavioural continuum between intolerance and stewardship, similar to the concept of wildlife stakeholder acceptance capacity (Carpenter et al., 2000) in implying that passive acceptance may change into negative action if a population gets too big. In an empirical test of this hypothesis Bruskotter et al. (2015) found strong correlations between attitudinal measures and a composite measure of behaviours towards wolves, concluding that attitudes can be used as a valid proxy for behavioural tolerance. However, they cautioned that single-item behavioural measures may not correlate strongly with attitudes, and that attitudinal measures do not provide specific information about the types of behaviours people may engage in. Other researchers found a strong association between negative attitudes and the specific intention to kill carnivores, concluding that 'influencing attitudes to carnivores can reasonably be expected to produce concomitant alterations in persecutory behaviour' (Thorn et al., 2015, p. 274).

Here we look deeper than the correlation between attitudes and behaviours, to examine differences in their underlying determinants. We start from the premise that tolerance is an attitude that exists on a separate continuum from behaviours (Treves, 2012). In contrast to the notion of a single continuum (Bruskotter & Fulton, 2012), this view is more consistent with theoretical traditions in human dimensions research separating attitudes from behaviours in a cognitive hierarchy (e.g. Fulton et al., 1996). Attitudes are internal states composed of beliefs plus emotion and built upon a foundation of broad, enduring values. Behaviours, on the other hand, are observable acts that may be influenced by specific attitudes but are more closely related to external factors such as social context and norms (i.e. a social group's shared understanding of how individuals should behave; Heberlein, 2012). Behavioural intentions are theoretically the closest antecedent of behaviour (Ajzen, 1985) and have been correlated empirically to the behaviour of killing jaguars (Marchini & Macdonald, 2012). Based on these basic theoretical distinctions we expected that determinants of attitudinal tolerance would differ from determinants of behavioural intentions to kill wild cats. Given the lack of social-science research related to wild cats in this locale, we took an exploratory approach guided by the following three research questions.

To what extent do economic factors and depredation losses drive tolerance of and behavioural intentions towards cats? Economic losses are often assumed to be a primary determinant of retaliatory killings, implying that a reduction in financial losses (e.g. through incentive programmes) will improve tolerance (Treves & Bruskotter, 2014). Tolerant attitudes and behaviours have been correlated with general economic factors, including land tenure and wealth (Zimmermann et al., 2005; Romañach et al., 2007; Marchini & Macdonald, 2012), size of landholdings (Marchini & Macdonald, 2012), dependence on livestock (Bagchi & Mishra, 2006), and access to alternative income sources (Lindsey et al., 2013). More specifically, loss of livestock to depredation has been associated with both negative attitudes (Naughton-Treves et al., 2003; Zimmermann et al., 2005; Lindsey et al., 2013; Thorn et al., 2015) and likelihood of killing carnivores (Romañach et al., 2007; Hazzah et al., 2009). However, many of those effects were not strong, and in some studies they were not statistically significant (Conforti & de Azevedo, 2003; Karlsson & Sjostrom, 2011).

Is the local conservation payment programme influencing tolerance and/or behavioural intentions? To the extent that economics affects both attitudes and behaviours, we would expect financial incentives to increase tolerance and reduce carnivore killings. There is some evidence of both in the literature. Relatively tolerant attitudes were detected among residents of a village with a livestock insurance programme (Bagchi & Mishra, 2006), and among Swedish farmers who received subsidies to predator-proof their

farms (Karlsson & Sjostrom, 2011). However, compensation payments did not influence tolerance or approval of lethal control of wolves (Agarwala et al., 2010). Sweden's conservation payment programme was credited with the recovery of wolverine *Gulo gulo* populations as a result of decreased poaching (Persson et al., 2015), and compensation programmes were linked to decreases in lion killings on Maasai communal lands (Hazzah et al., 2014; Bauer et al., 2015). However, aggregate-level studies cannot always distinguish between direct effects of payments and other factors that may reduce poaching, such as increased monitoring (Persson et al., 2015) or broader community benefits such as employment and health services (Bauer et al., 2015).

Beyond economic losses and incentives, what social factors affect tolerance of and intention to kill cats? A number of studies have pointed to the importance of sociocultural influences on people's responses to predators. Social identities produce deeply rooted, value-laden attitudes that are unlikely to change as a result of experiences with carnivores (Naughton-Treves et al., 2003; Thorn et al., 2015). Identity-linked attitudes can sometimes be polarized (e.g. fear vs care of carnivores), particularly among those most affected by carnivore management (Lute et al., 2014). When an individual identifies with a social group, they act according to its norms sanctioning or prohibiting behaviours towards wildlife (Marchini & Macdonald, 2012). Specific cultural or religious beliefs also sometimes motivate action (e.g. not protecting livestock from predators out of a belief that God will protect them; Hazzah et al., 2009). Understanding how these forces operate within specific social contexts is important for ensuring inclusiveness of participatory conservation. Gender, in particular, is frequently overlooked with respect to its role in shaping human–wildlife conflicts (Gore & Kahler, 2012). Men and women often play distinct social and economic roles, which produce gender differences in interactions with and perceptions of wildlife (Ogra, 2008). Here, we consider the roles of gender, culture and other socioeconomic factors, including conservation payments, in a particular context of human–carnivore coexistence. Specifically, our aim is to identify how these factors differentially affect tolerance of and behavioural intentions towards wild cats.

Study area

The New River/New River Lagoon area of Orange Walk District, Belize, is a mosaic landscape of savannah and secondary growth of moist tropical lowland broadleaf deciduous forest (Lambert & Arnason, 1978), and private lands of pasture and small farms, or *milpas*. The study area is bordered by protected lands of the Programme for Belize and the Lamanai Archaeological Reserve, and encompasses three villages with a total of c. 200 households (Fig. 1).

One of the villages, Indian Creek, is a Mennonite settlement. Mennonites are an Anabaptist religious group that originated in 16th century Switzerland (Roessingh, 2007), migrated to Russia, and later to Canada, Mexico and Belize. They continue to live in exclusive, self-regulating communities with distinct ethnic and religious identities, yet they are active in the business sphere and they dominate Belize's agricultural market (Roessingh, 2007). Mennonites generally espouse a utilitarian view of nature (Curry, 2000) and employ large-scale, mechanized farming practices that have implicated them as major contributors to deforestation in Belize (Trapasso, 1994) and elsewhere in Latin America (Noss & Cuéllar, 2001).

Residents of the other two study villages are predominantly Mestizo (of mixed Mayan and European descent). The village of Indian Church consists mainly of subsistence farmers who grow vegetables and raise livestock. The village of San Carlos is a farming cooperative that produces vegetables for the national market (V. Briggs-Gonzalez, pers. obs.). A local papaya farm (Eagle Produce) and a local tourism lodge (Lamanai Outpost Lodge) employ several community members.

The region is home to populations of five cat species: the jaguar, puma *Puma concolor*, ocelot *Leopardus pardalis*, jaguarundi *Puma yagouaroundi* and margay *Leopardus wiedii*. The jaguar and margay are categorized as Near Threatened on the IUCN Red List, and the other three species are categorized as Least Concern (IUCN, 2014). Belize's felid assemblage is suffering widespread population declines throughout its range. Threats include habitat loss and fragmentation, illegal trade in pets and body parts, poaching of the wild prey base, and retaliatory killing in response to depredation of livestock and poultry (IUCN, 2014). Jaguars are the most prominent species involved in conflicts with people in the study area. However, we refer collectively to wild cats because preliminary data indicate that respondents commonly do not distinguish between the species.

In a 6-month period in 2010 eight calves were killed in the study area. Landowners offered a bounty that led to the killing of two jaguars. In an attempt to stop retaliatory killings the University of Florida collaborated with Lamanai Field Research Center in August 2010 to launch an incentive-based cat conservation programme (Briggs-Gonzalez & Mazzotti, 2014). Camera traps were installed on participants' land, and landowners travelled 3–20 km to bring the memory cards to the Research Center office. Photographs were collected every 2 weeks for an initial 6-month period, and monthly thereafter. Landowners were paid USD 125 for a photograph of a newly recorded wild cat, USD 50 for a photograph of a previously recorded individual and USD 5 for a photograph of a prey animal.

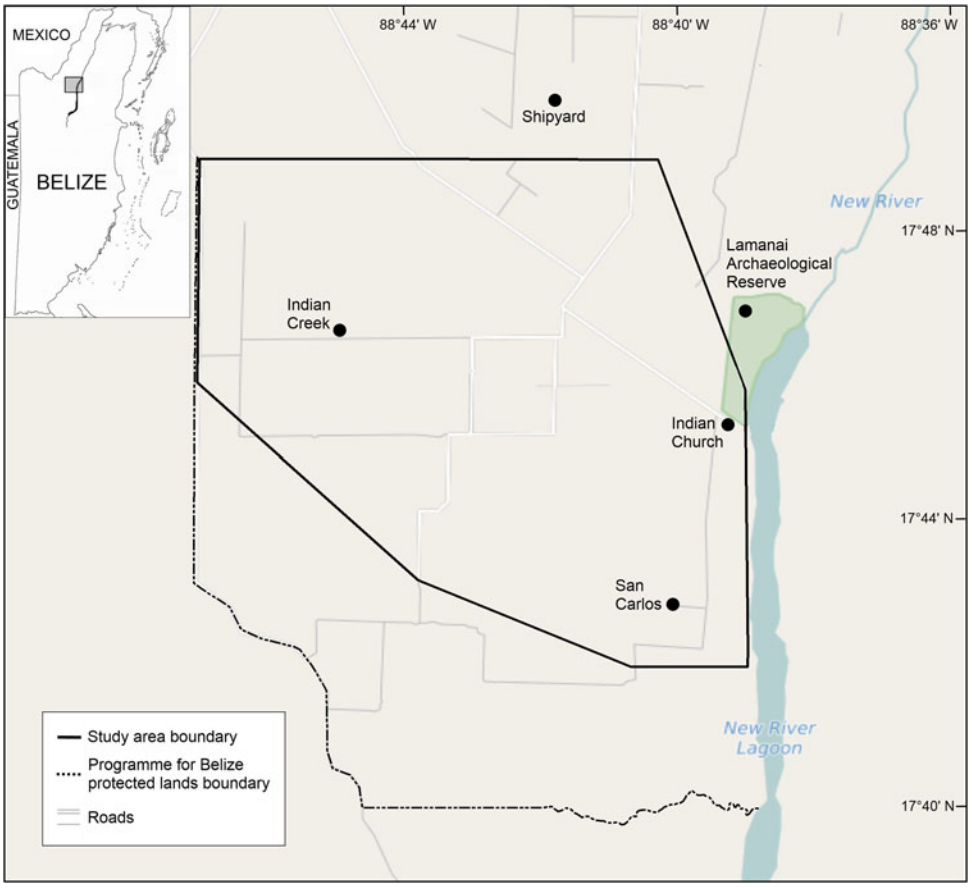

FIG. 1 The 112.5 km² site of a conservation payment programme involving the villages of Indian Church, Indian Creek and San Carlos, in Orange Walk district, Belize, bordered by the Lamanai Archaeological Reserve and protected lands of the Programme for Belize, which extend to the south and west of the boundary line. (Background layer © OpenStreetMap and contributors, CC-BY-SA)

Methods

Survey procedures and measures

During June–August 2012 we went door-to-door in the three villages and conducted structured interviews with 112 household decision makers. With this sample size we can represent the population of c. 200 households with 95% confidence and close to a 5% sampling error (Dillman et al., 2014). Interviews lasted c. 45 minutes and respondents were paid BZD 10 for their participation. The majority of interviews were conducted in Spanish, with German translators used as needed. We targeted household decision makers because the survey included specific questions about farming, livestock husbandry and household economics. However, this method resulted in a greater number of men than women (and no Mennonite women) in our sample. To reduce gender bias we separated men and women in bivariate analyses and controlled for gender in multivariate analyses.

We measured experience with wild cats by showing respondents photographs of the five species and asking which they had seen in the wild. We asked when they last saw a cat, if they had seen cats on their land, and if a cat had ever killed any of their domestic animals or those of their neighbours. We asked if they knew about the camera-trapping programme and if they had participated.

We asked seven questions (Table 1) to measure tolerance of jaguars and other wild cats (modified from Naughton-Treves et al., 2003; Lindsey et al., 2005). Principal component analysis, with oblique Promax rotation, indicated that the items measured the same underlying concept (factor loadings = 0.47–0.81). We summed the five dichotomous and two three-point variables into a 10-point tolerance scale (Cronbach's $\alpha = 0.82$).

To assess behavioural intention to kill a cat, we asked respondents whether they agreed or disagreed with the statements 'I would shoot a wild cat if it threatened my domestic animals' and 'If I were hunting and saw a wild cat, I might shoot it' (Naughton-Treves et al., 2003). These two items did not create a reliable variable (Cronbach's $\alpha = 0.55$), so we combined them with three other dichotomous variables (Table 1) assessing approval of killing cats in various scenarios (Naughton-Treves et al., 2003). These five items loaded onto a single component (factor loadings = 0.66–0.87), which we summed into a six-point 'intention to kill' scale (Cronbach's $\alpha = 0.82$).

We asked about respondents' land and livelihood, including size of landholdings, cattle and other farm animals owned, and sources of household income. A respondent's household was defined as having off-farm work if any of the following was reported as a source of income for their household: service staff at tourism lodge, other tourism

services, Eagle Produce, or other off-farm work. A final, socio-demographic section included questions about age of respondents, where they grew up, the number of adults and children in the household, and whether children visited the home regularly. Gender and cultural group (Mennonite or Mestizo) were self-evident and were recorded by interviewers.

Data analysis

Data were analysed in *SPSS Statistics 22* (IBM, Armonk, USA). We considered $P < 0.10$ as statistically significant because of our relatively small sample size. When respondents chose not to answer a question or gave a response of 'no opinion' these cases were treated as missing values and excluded from analyses.

We used χ^2 tests to compare three groups (Mennonite men, Mestizo men and Mestizo women) in terms of socio-economics, experience with wild cats, tolerance, and intention to kill. Next, we ran a series of bivariate Mann–Whitney *U* tests to determine if there were differences in tolerance and behavioural intention based on eight dichotomous independent variables: cultural group (Mennonite/Mestizo), gender, children living in or visiting the home, Belize nativity (grew up in/outside Belize), off-farm work, seen wild cats on land, had domestic animal killed by a wild cat, and participated in camera-trapping programme.

We performed a multiple linear regression to predict tolerance based on the eight dichotomous variables listed above plus three continuous variables: age, size of landholdings, and number of cattle owned (cows, calves and bulls). We ran another multiple linear regression with the same 11 variables to predict intention to kill wild cats, followed by a second step in which we added tolerance as a predictor variable to assess its additional explanatory contribution.

We treated both ordinal response variables as continuous because the models met the assumptions of linear regression. We tested for independence of observations using a Durbin–Watson test. We examined scatterplots and partial regression plots visually to confirm linear relationships between dependent and independent variables, and we examined normal probability plots to assess normal distribution of residuals. We assessed variance inflation factors to test for multicollinearity, and used the Koenker test (robust for small sample sizes; Koenker, 1981) to test for homoscedasticity. Observations that included complete data on all of the final model variables were included ($n = 77$).

Results

Experience with wild cats

Our sample included 39 Mennonite men, 54 Mestizo men and 19 Mestizo women. Socio-economic characteristics of each group are summarized in Table 2. All Mestizo men indicated that they had seen at least one wild cat, compared to 79.5% of Mennonite men and 63.2% of Mestizo women ($\chi^2 = 19.06$, $P < 0.001$). Based on the five photographs presented to them, respondents reported seeing jaguars most frequently (56.3%), followed by jaguarundis (50.0%), pumas (41.1%), ocelots (28.6%) and margays (20.5%). Thirty percent had seen a cat on their own land, and 27.7% reported having a domestic animal killed by a wild cat. Mennonites (43.6%) were more likely than Mestizo men (20.4%) or women (15.8%) to have experienced depredation ($\chi^2 = 7.72$, $P = 0.021$). On average, respondents who experienced depredation owned more land (67.7 vs 28.5 ha, $t = -1.73$, $P = 0.087$), more cattle (26.0 vs 5.2, $t = -2.69$, $P = 0.011$) and more of all types of animals (54.5 vs 20.6, $t = -3.08$, $P = 0.004$). Seventy-six percent of respondents knew about the camera-trapping programme, and 21 (18.8%) were participating (six Mennonite men, 14 Mestizo men and one woman).

Tolerance

Women were less tolerant than men, based on responses to all seven questions used to measure tolerance (Table 1). Mennonite men were less likely than Mestizo men to 'want the number of other wild cats... to increase' and to 'believe there is a problem with jaguars in the area' but they were more likely to 'see any problems with having wild cats in the area'.

Scores on the tolerance scale (mean 6.10 ± SD 2.72, range 0–9, median 7, skewness −1.18) were significantly higher among men than women (Mann–Whitney *U*, $Z = -4.30$, $P < 0.001$), among those who had seen cats on their land than those who had not ($Z = 2.03$, $P = 0.042$), and among programme participants than non-participants ($Z = 2.67$, $P = 0.008$). Tolerance scores did not differ significantly based on cultural group ($Z = 0.45$, $P = 0.643$), Belize nativity ($Z = 0.93$, $P = 0.350$), children in the home ($Z = 1.14$, $P = 0.256$), off-farm income ($Z = -0.01$, $P = 0.996$) or experience of depredation ($Z = 1.44$, $P = 0.151$).

Multicollinearity was not a problem in the linear regression model: the highest bivariate correlation between independent variables was $\phi = 0.43$ ($P < 0.001$, between Mennonite and Belize nativity), and the highest variance inflation factor was 2.18 (for Belize nativity). A Durbin–Watson statistic of 2.21 confirmed independence of residuals. The Koenker test suggested homogeneity of variance, $\chi^2(11) = 14.80$, $P = 0.192$. The independent variables explained 44.0% (adjusted R^2) of the variance in tolerance score, and the model was statistically significant ($F(11, 65) = 6.42$, $P < 0.001$). Two of the 11 variables significantly predicted higher tolerance: male gender and participation in the camera-trapping programme (Table 3).

TABLE 1 Survey questions used to measure tolerance of and intention to kill wild cats in the New River area of Belize, with responses according to cultural group/gender, and χ^2 and P values.

Survey questions	Responses (%) Mennonite men (n = 39)	*Mestizo* men (n = 54)	*Mestizo* women (n = 19)	χ^2	P
Tolerance of wild cats (Cronbach's α = 0.82):					
In the next 5 years do you want the number of jaguars *Panthera onca* in the New River area to increase, decrease or stay the same?					
Increase	55.6	55.1	25.0		
Stay the same	38.9	32.7	12.5	26.73	< 0.001
Decrease	5.6	12.2	62.5		
In the next 5 years do you want the number of other wild cats in the New River area to increase, decrease or stay the same?					
Increase	51.6	80.0	31.3		
Stay the same	41.9	17.8	12.5	38.80	< 0.001
Decrease	6.5	2.2	56.3		
If you could choose between having wild cats in the area or not having them at all, which would you choose?					
Wild cats present	71.9	85.2	36.8	16.44	< 0.001
Wild cats not present	28.1	14.8	63.2		
Are there advantages to having wild cats in the area?					
Yes	72.2	70.4	42.1	5.92	0.052
No	27.8	29.6	57.9		
Do you see any problems with having wild cats in the area? (Reverse-coded)					
Yes	57.1	26.9	72.2	14.35	0.001
No	42.9	73.1	27.8		
I believe there is a problem with jaguars in this area. (Reverse-coded)					
Agree	13.5	42.3	94.7	34.09	< 0.001
Disagree	86.5	57.7	5.3		
I believe there is a problem with other wild cats in this area. (Reverse-coded)					
Agree	0	7.4	57.9	37.85	< 0.001
Disagree	100	92.6	42.1		
Intention to kill a wild cat (Cronbach's α = 0.82):					
I would shoot a wild cat if it threatened my domestic animals.					
Agree	43.6	22.6	38.9	4.85	0.089
Disagree	56.4	77.4	61.1		
If I were hunting and saw a wild cat I might shoot it.					
Agree	42.1	0	26.3	26.60	< 0.001
Disagree	57.9	100	73.7		
I think a wild cat should be killed if it...					
Attacks and injures one domestic animal					
Yes	46.2	14.8	31.6	11.00	0.004
No	53.8	85.2	68.4		
Kills one domestic animal					
Yes	53.8	20.8	47.4	11.63	0.003
No	46.2	79.2	52.6		
Kills two or more domestic animals					
Yes	87.2	58.5	77.8	9.51	0.009
No	12.8	41.5	22.2		

Intention to kill wild cats

Mennonite men were most likely to say they would kill cats and favour killing cats on all five measures, Mestizo men were least likely and Mestizo women were in the middle (Table 1). Scores on the intention to kill scale (mean 1.87 ± SD 1.71, range 0–5, median 1, skewness 0.62) were negatively correlated with tolerance (Pearson $r = -0.24$, P = 0.035). Based on bivariate tests, Mennonites scored higher than Mestizos (Mann–Whitney *U*, $Z = 3.53$, $P < 0.001$), and people who had seen cats on their land scored higher than those who had not (Mann–Whitney *U*, $Z = 1.65$, P = 0.099). Scores did not differ significantly based on gender ($Z = 0.87$, P = 0.385), children in the home ($Z = 1.25$, P = 0.213), Belize nativity ($Z = -0.12$, P = 0.903), off-farm work ($Z = -0.69$, P = 0.488), experience of depredation ($Z = 1.57$, P = 0.116), or programme participation ($Z = 1.11$, P = 0.266).

TABLE 2 Socioeconomic characteristics of survey respondents, with χ^2 and P values.

Respondent characteristics	Responses (%)			χ^2	P
	Mennonite men (n = 39)	*Mestizo* men (n = 54)	*Mestizo* women (n = 19)		
Age					
< 30 years	43.6	27.8	26.3	10.76	0.377
30–50 years	51.3	59.2	52.7		
> 50 years	5.1	13.0	21.1		
Belize nativity					
Grew up in Belize	100	64.8	47.4	23.14	< 0.001
Grew up outside Belize	0	35.2	52.6		
Children living in or regularly visiting the home					
Children	92.3	85.2	73.7	3.64	0.162
No children	7.7	14.8	26.3		
Size of landholdings					
No land	12.8	30.8	5.6	34.31	< 0.001
< 8 ha	7.7	25.0	72.2		
≥ 8 ha	79.5	44.2	22.2		
Types of animals currently owned					
Cattle (cows, calves, bulls)	92.3	24.1	21.1	48.63	< 0.001
Poultry (chickens, turkeys, ducks)	71.8	25.9	52.6	19.51	< 0.001
Horses, donkeys, mules	84.6	11.1	0	66.13	< 0.001
Pigs	23.1	0	0	18.32	< 0.001
Sheep, goats	17.9	0	0	13.98	0.001
Number of cattle owned					
None	7.7	75.9	78.9	49.64	< 0.001
1–10	51.3	9.3	10.5		
>10	41.0	14.8	10.5		
Household income sources					
Off-farm work	66.7	77.8	84.2	2.53	0.283
Crops	71.8	50.0	21.1	13.50	0.001
Livestock	53.8	20.4	21.1	12.92	0.002

In the initial multiple regression model the 11 independent variables explained 18.0% (adjusted R^2) of the variance in intention to kill, and the model was statistically significant ($F(11, 97) = 3.16$, P = 0.001). Intention to kill cats was significantly related to Mennonite membership ($\beta = 0.52$, P < 0.001), female gender ($\beta = -1.10$, P = 0.015), children in the home ($\beta = 1.05$, P = 0.035), and growing up outside Belize ($\beta = -0.98$, P = 0.051).

With tolerance added to the final model, multicollinearity was still not a concern, the Durbin–Watson statistic was 2.24 and there was homoscedasticity: Koenker $\chi^2(11) = 12.25$, P = 0.426. Tolerance explained an additional 6.7% of the variance, bringing the adjusted R^2 to 24.7%. The model was statistically significant, $F(12, 64) = 3.07$, P = 0.002. Mennonite membership, children in the home and lower tolerance significantly predicted intention to kill cats. Effects of gender and Belize nativity dropped out when tolerance was controlled (Table 4).

Discussion

Experience of depredation did not significantly affect either tolerance or behavioural intention to kill wild cats. Rates of depredation by jaguars in the study area are low compared to regions with intensive cattle ranching, such as in Brazil (Marchini & Macdonald, 2012), and compared to other species, such as snow leopards *Panthera uncia* (e.g. Bagchi & Mishra, 2006) and lions (e.g. Hazzah et al., 2009). Thus, personal experience of depredation may not be severe enough to influence tolerance (Conforti & de Azevedo, 2003; Agarwala et al., 2010). Livestock losses may also be decoupled from attitudes and behavioural intentions as a result of the relative affluence of some of our respondents (Zimmermann et al., 2005; Thorn et al., 2015) and relative lack of financial dependence on livestock (Bagchi & Mishra, 2006; Karlsson & Sjostrom, 2011). These communities are not suffering economic impacts as serious as those borne by poor subsistence farmers in Africa, who are more likely to respond to depredation with retaliation (Romañach et al., 2007; Hazzah et al., 2009). None of the economic variables studied (off-farm work, size of landholdings, head of cattle) significantly affected either tolerance or intention to kill. This finding supports the argument that economics are less important than socio-cultural influences on attitudes and behaviours towards carnivores (Naughton-Treves et al., 2003; Marchini & Macdonald, 2012; Goldman et al., 2013; Thorn et al., 2015).

TABLE 3 Results of a multiple linear regression model used to predict tolerance of wild cats, scored on a 10-point scale.

Variable[1]	$B \pm SE$[2]	β[3]	P
Mennonite (Mestizo)	−0.388 ± 0.642	−0.065	0.548
Male (female)	4.226 ± 0.692	0.600	0.000
Children in home (none)	0.665 ± 0.686	0.092	0.336
Grew up in Belize (grew up elsewhere)	0.759 ± 0.735	0.131	0.306
Age	0.007 ± 0.022	0.031	0.769
Size of landholdings	−0.001 ± 0.001	−0.120	0.203
Number of cattle owned	−0.016 ± 0.011	−0.146	0.173
Household members work off-farm (do not)	0.220 ± 0.570	0.036	0.701
Seen cats on land (have not)	0.775 ± 0.616	0.123	0.213
Lost domestic animal to cats (have not)	0.798 ± 0.600	0.127	0.189
Camera-trapping programme participant (not)	1.393 ± 0.695	0.192	0.049
Constant	0.877 ± 1.342		0.516

[1]For categorical variables, comparison categories are in parentheses.
[2]Unstandardized regression coefficient ± standard error.
[3]Standardized r coefficient.

TABLE 4 Results of a final multiple linear regression model used to predict intention to kill a wild cat, scored on a six-point scale.

Variable[1]	$B \pm SE$[2]	β[3]	P
Mennonite (Mestizo)	2.182 ± 0.490	0.560	0.000
Male (female)	−0.669 ± 0.661	−0.145	0.315
Children in home (none)	1.322 ± 0.526	0.278	0.015
Grew up in Belize (grew up elsewhere)	−0.866 ± 0.564	−0.228	0.129
Age	0.009 ± 0.017	0.063	0.610
Size of landholdings	−0.001 ± 0.001	−0.083	0.454
Number of cattle owned	−0.001 ± 0.009	−0.016	0.896
Household members work off-farm (do not)	−0.366 ± 0.434	−0.092	0.402
Seen cats on land (have not)	0.371 ± 0.475	0.090	0.437
Lost domestic animal to cats (have not)	−0.090 ± 0.463	−0.022	0.847
Camera-trapping programme participant (not)	0.602 ± 0.545	0.126	0.274
Tolerance	−0.165 ± 0.094	−0.251	0.086
Constant	2.043 ± 1.025		0.051

[1]For categorical variables, comparison categories are in parentheses.
[2]Unstandardized regression coefficient ± standard error.
[3]Standardized r coefficient.

However, social factors did not overshadow effects of incentives as found by Naughton-Treves et al. (2003). Participation in the camera-trapping programme had a positive effect on tolerance but it is not yet clear if the programme is changing attitudes or if those who elected to participate were already more tolerant than others. Nonetheless, the lack of relationship between economics and tolerance suggests that the programme may have broader benefits beyond direct payments. Research found that compensation for depredation by wolves did not change attitudes directly, yet compensation programmes were widely supported and expected by residents as a mechanism to appeal for help (Naughton-Treves et al., 2003; Agarwala et al., 2010). The mere existence of a payment programme may assure residents that their concerns are being taken seriously, thus enhancing their tolerance of carnivores (Karlsson & Sjostrom, 2011). Open-ended comments from respondents supported this view: when asked about the programme's benefits 43% referred only to direct payments whereas 57% mentioned other benefits, such as learning about cats, conserving nature and promoting tourism. Only 3 of 75 respondents (4%) said they wanted the monetary value of payments to be increased. Thus, beyond its economic impacts the programme offers participants a direct, tangible conservation experience (i.e. checking the camera traps, altering land practices to attract cats), which may increase their appreciation of nature and thus their tolerance of cats (Harvey et al., 2015).

Of all independent variables gender had the strongest effect on tolerance. Previous research found that women are more fearful (Kaltenborn et al., 2006) and perceive greater risk from carnivores, yet are less approving of lethal control (Zinn & Pierce, 2002). The low tolerance we identified among women is probably related to their perceptions of

risk (Bruskotter & Wilson, 2014). Although not reported here, women were more likely than men to agree with the statements 'I believe I am personally at risk from wild cats' and 'I believe that wild cats would attack a human without being provoked.' Women's intolerance explained their greater intention to kill cats (i.e. the effect of gender disappeared when tolerance was controlled), so communication that aims to increase tolerance may influence women's potential actions as well. Communication should be delivered separately for men and women to address each group's specific concerns, recognizing that women's identities may be based in part on their fear of wild cats (Lute et al., 2014). However, focusing too much on fear and coping mechanisms can make risks more salient and decrease tolerance (Slagle et al., 2013). Communication is likely to be most effective by focusing on ecological and aesthetic benefits of jaguars and other cats, and on how to cope with risks (Bruskotter & Wilson, 2014).

Gendered perceptions of risk are related to differences in livelihood activities that shape interactions with wildlife (Gore & Kahler, 2012). In the study area men generally have more responsibility for farming and more direct contact with carnivores. However, women are responsible for the family in addition to earning wages outside the home and thus may bear a disproportionate share of the hidden costs of human–wildlife conflict, such as increased workload, decreased nutrition or psychological trauma (Ogra, 2008). Research is needed to qualitatively assess hidden costs of living with cats, and any barriers women may perceive to participating in the camera-trapping programme. Adjusting the programme to include non-monetary payments (e.g. food, childcare) may help to offset hidden costs and enhance women's participation (Ogra, 2008). Future research also should aim for representative samples of women and men. Our method of targeting household decision makers led to potential bias. Our results overlook the views of Mennonite women and may also misrepresent the population of Mestizo women because six of the 19 Mestizo women we surveyed had no men in their households (VBG, pers. obs.). Compared to other women these single-female heads of households may feel more vulnerable to cat attacks and less able to protect their families.

Determinants of behavioural intention differed from determinants of tolerance. Cultural group (i.e. Mennonite) was the strongest predictor of intention to kill cats. Elsewhere, cultural traditions alternatively condone (Marchini & Macdonald, 2012; Goldman et al., 2013) or inhibit (Figel et al., 2011) the hunting of large cats. Mennonite theology emphasizes the idea that nature (as well as people) must suffer to be useful to the creator (Genzinger, 1995). Although this utilitarian viewpoint may be moderated in part by the Mennonites' ethic of personal piety and suspicion of wealth, it may fuel anti-conservation attitudes; for example, Mennonites in one study expressed scepticism about the concept of species endangerment (Curry, 2000). By contrast, all Mestizo respondents who indicated their church affiliation specified the Roman Catholic Church, which is relatively accepting of environmental messages and traditional cultural beliefs (Noss & Cuéllar, 2001; Hazzah et al., 2009).

However, deeply held religious values would presumably shape attitudes; the finding that cultural group only affected behavioural intentions suggests that social norms are the driving factor (Heberlein, 2012). In Amazonia and the Pantanal of Brazil, ranchers and cowboys believe that killing jaguars is common and met with approval (Marchini & Macdonald, 2012). This norm is linked to the cultural identity of *Pantaneiros* and their economic role as cattle ranchers. A similar but perhaps less aggressive norm of killing jaguars may exist among Belizean Mennonites. They too play an important economic role as agricultural producers and have a unique cultural and linguistic identity that separates them from the broader society. Although Mennonites have been in Belize since the 1950s, their insularity makes them suspicious of government and other outsiders (Roessingh, 2007) and may disconnect them from national priorities (e.g. environmental protection) and symbols (e.g. the jaguar). These factors could produce a norm of protecting livelihood over local wildlife.

A similar protective norm may explain why presence of children in the home predicted behavioural intentions. Tolerance also contributed to the final model but less so than being a Mennonite or having children. These social group identities were directly related to behavioural intention (unlike gender, which had an indirect effect), so trying to influence these groups' attitudes (e.g. through risk communication, as described above) is not likely to affect their behaviours. A structural fix, which attempts to change behaviours without relying on a change in attitudes, is more likely to be successful (Heberlein, 2012). The conservation payment programme is a structural fix that exhibits preliminary signs of success: the bounty was lifted and residents (even Mennonites, who traditionally do not reach out to authorities) now readily contact Lamanai Field Research Center for help with cats (V. Briggs-Gonzalez, pers. obs.). Some participants also reported changing their farming practices in response to the programme (e.g. moving cattle around, using donkeys as guard animals, or increasing vigilance over new calves). However, we have not yet detected an effect of the programme on residents' behavioural intentions to kill wild cats.

Social norms can be leveraged to increase the impact of incentive programmes. Residents' decisions to participate are contingent in part on the decisions of their neighbours (Chen et al., 2009). Thus as more people follow their neighbours in joining the camera-trapping programme, cat conservation may eventually become normative, making financial incentives essentially irrelevant. Future research

could track this process by measuring explicitly both descriptive (what neighbours are actually doing) and perceived norms (what people believe their neighbours are doing) in relation to conservation behaviours and intentions to kill cats. More specifically, working with norms can help to engage otherwise inaccessible cultural groups; for example, the Kenyan Lion Guardians programme enlists respected Maasai warriors to dissuade others from killing lions by emphasizing both economic benefits and cultural values (e.g. caring for community members who may lose employment if lions are killed). This programme, integrated with compensation payments, resulted in a near-total cessation of lion poaching (Hazzah et al., 2014). Similarly, employing Mennonite leaders to recruit participants and deliver conservation messages in culturally appropriate ways may increase Mennonite involvement and, over time, shape new norms that inhibit community members from harming cats.

There are two main implications of our findings, for this study site and beyond. Firstly, they illustrate a case in which economic factors have minimal influence on both attitudes and behaviours towards carnivores. Here and possibly in other locations where depredation rates and/or dependence on livestock are low, financial incentives alone are unlikely to affect how people feel and act towards these animals. Persson et al. (2015) noted that the success of conservation payment programmes depends on matching the incentives to the specific needs and desires of a community. Based on our findings, we add that this process must extend beyond dollar amounts to consider incentives, communication approaches and recruitment strategies within a holistic social context. Secondly, our results confirmed our expectation that tolerance and intention to kill carnivores would have different determinants. Had we used attitudinal tolerance as a proxy for behaviour (as advocated by Bruskotter et al., 2015; Thorn et al., 2015) we would have concluded that women were most likely to kill cats, and participants in the incentive programme least likely. This result would exaggerate the success of the incentive programme and focus too narrowly, and perhaps fruitlessly, on changing the attitudes of women. Rather, our findings suggest that incentive programmes may be enhanced by providing non-monetary benefits, leveraging social norms to increase participation, and targeting specific groups with information about carnivore risks and benefits. By empirically separating two concepts commonly conflated as tolerance, this research clarifies our understanding of the forces, beyond direct economic losses and payments, that shape people's relationships with the predators sharing their landscape.

Acknowledgements

We thank Matt Thornton, Jessica Iverson and Lauren Watine for assistance with conducting interviews, and Benjamin Wahl for translating for German-speaking Mennonites. The staff of Lamanai Outpost Lodge provided useful feedback on pilot interviews. We are grateful to Peter Deuck of Eagle Produce for providing staff time to conduct interviews. Abdul Ramirez assisted with field work and Ruben Arevalo helped to introduce us to several interviewees. We thank the owners of Lamanai Outpost Lodge, Mark Howells and Blanca Manzanilla, for immeasurable logistical support. We are very grateful to all community members who participated in the study. We thank Michiko Squires and Jennifer Nestler for assistance with *ArcGIS*. This paper benefited from comments provided by two anonymous reviewers.

Author contributions

RGH developed the survey instrument, analysed data, and wrote the majority of the manuscript. VBG established contacts in the study site, conducted field research, trained and supervised assistants and contributed to the article. FJM initiated the conservation payment programme, developed research questions and contributed to the survey instrument and article.

References

Agarwala, M., Kumar, S., Treves, A. & Naughton-Treves, L. (2010) Paying for wolves in Solapur, India and Wisconsin, USA: comparing compensation rules and practice to understand the goals and politics of wolf conservation. *Biological Conservation*, 143, 2945–2955.

Ajzen, I. (1985) From intentions to actions: a theory of planned behavior. In *Action Control: From Cognition to Behavior* (eds J. Kuhl & J. Beckmann), pp. 11–39. Springer, Heidelberg, Germany.

Bagchi, S. & Mishra, C. (2006) Living with large carnivores: predation on livestock by the snow leopard (*Uncia uncia*). *Journal of Zoology*, 268, 217–224.

Bauer, H., Müller, L., Van Der Goes, D. & Sillero-Zubiri, C. (2015) Financial compensation for damage to livestock by lions *Panthera leo* on community rangelands in Kenya. *Oryx*, http://dx.doi.org/10.1017/S003060531500068X.

Briggs-Gonzalez, V.S. & Mazzotti, F.J. (2014) Camera trapping wild cats with landowners in northern Belize. *Caribbean Naturalist*, 17, 1–13.

Bruskotter, J.T. & Fulton, D.C. (2012) Will hunters steward wolves? A comment on Treves and Martin. *Society & Natural Resources*, 25, 97–102.

Bruskotter, J.T., Singh, A., Fulton, D.C. & Slagle, K. (2015) Assessing tolerance for wildlife: clarifying relations between concepts and measures. *Human Dimensions of Wildlife*, 20, 255–270.

Bruskotter, J.T. & Wilson, R.S. (2014) Determining where the wild things will be: using psychological theory to find tolerance for large carnivores. *Conservation Letters*, 7, 158–165.

Bulte, E.H. & Rondeau, D. (2005) Why compensating wildlife damages may be bad for conservation. *The Journal of Wildlife Management*, 69, 14–19.

Carpenter, L.H., Decker, D.J. & Lipscomb, J.F. (2000) Stakeholder acceptance capacity in wildlife management. *Human Dimensions of Wildlife*, 5, 5–19.

Chen, X., Lupi, F., He, G. & Liu, J. (2009) Linking social norms to efficient conservation investment in payments for ecosystem services. *Proceedings of the National Academy of Sciences*, 106, 11812–11817.

Conforti, V.A. & De Azevedo, F.C.C. (2003) Local perceptions of jaguars (*Panthera onca*) and pumas (*Puma concolor*) in the Iguaçu National Park area, south Brazil. *Biological Conservation*, 111, 215–221.

Curry, J.M. (2000) Community worldview and rural systems: a study of five communities in Iowa. *Annals of the Association of American Geographers*, 90, 693–712.

Delibes-Mateos, M. (2014) Negative attitudes towards predators do not necessarily result in their killing. *Oryx*, 48, 16.

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*, 108, 13937–13944.

Dillman, D.A., Smyth, J.D. & Christian, L.M. (2014) *Internet, Phone, Mail, and Mixed-Mode Surveys: The Tailored Design Method, 4th edition*. Wiley, Hoboken, USA.

Ferraro, P.J. & Kiss, A. (2002) Direct payments to conserve biodiversity. *Science*, 298, 1718–1719.

Figel, J.J., Durán, E. & Bray, D.B. (2011) Conservation of the jaguar *Panthera onca* in a community-dominated landscape in montane forests in Oaxaca, Mexico. *Oryx*, 45, 554–560.

Fisher, M. (2016) Whose conflict is it anyway? Mobilizing research to save lives. *Oryx*, 50, 377–378.

Fulton, D.C., Manfredo, M.J. & Lipscomb, J. (1996) Wildlife value orientations: a conceptual and measurement approach. *Human Dimensions of Wildlife*, 1, 24–47.

Genzinger, P.G. (1995) *Mennonite representations of nature in the nineteenth century*. MA thesis. University of Waterloo, Ontario, Canada.

Goldman, M.J., Roque De Pinho, J. & Perry, J. (2013) Beyond ritual and economics: Maasai lion hunting and conservation politics. *Oryx*, 47, 490–500.

Gore, M.L. & Kahler, J.S. (2012) Gendered risk perceptions associated with human–wildlife conflict: implications for participatory conservation. *PLoS ONE*, 7(3), e32901.

Harvey, R.G., Perez, L. & Mazzotti, F.J. (2015) *Not* seeing is *not* believing: volunteer beliefs about Burmese pythons in Florida and implications for public participation in invasive species removal. *Journal of Environmental Planning and Management*, 59, 789–807.

Hazzah, L., Dolrenry, S., Naughton-Treves, L., Edwards, C.T., Mwebi, O., Kearney, F. & Frank, L. (2014) Efficacy of two lion conservation programs in Maasailand, Kenya. *Conservation Biology*, 28, 851–860.

Hazzah, L., Mulder, M.B. & Frank, L. (2009) Lions and warriors: social factors underlying declining African lion populations and the effect of incentive-based management in Kenya. *Biological Conservation*, 142, 2428–2437.

Heberlein, T.A. (2012) *Navigating Environmental Attitudes*. Oxford University Press, New York, USA.

Inskip, C. & Zimmermann, A. (2009) Human–felid conflict: a review of patterns and priorities worldwide. *Oryx*, 43, 18–34.

IUCN (2014) *The IUCN Red List of Threatened Species v. 2014.1*. http://www.iucnredlist.org [accessed 28 July 2015].

Kaltenborn, B.P., Bjerke, T. & Nyahongo, J. (2006) Living with problem animals—self-reported fear of potentially dangerous species in the Serengeti Region, Tanzania. *Human Dimensions of Wildlife*, 11, 397–409.

Karanth, K.U. & Chellam, R. (2009) Carnivore conservation at the crossroads. *Oryx*, 43, 1–2.

Karlsson, J. & Sjostrom, M. (2011) Subsidized fencing of livestock as a means of increasing tolerance for wolves. *Ecology & Society*, 16, 16.

Koenker, R. (1981) A note on studentizing a test for heteroscedasticity. *Journal of Econometrics*, 17, 107–112.

Lambert, J.D.H. & Arnason, J.T. (1978) Distribution of vegetation on Maya ruins and its relationship to ancient land use at Lamanai, Belize. *Turrialba*, 28, 33–41.

Lindsey, P.A., Du Toit, J.T. & Mills, M.G.L. (2005) Attitudes of ranchers towards African wild dogs *Lycaon pictus*: conservation implications on private land. *Biological Conservation*, 125, 113–121.

Lindsey, P.A., Havemann, C.P., Lines, R., Palazy, L., Price, A.E., Retief, T.A. et al. (2013) Determinants of persistence and tolerance of carnivores on Namibian ranches: implications for conservation on Southern African private lands. *PLoS ONE*, 8(1), e52458.

Lute, M.L., Bump, A. & Gore, M.L. (2014) Identity-driven differences in stakeholder concerns about hunting wolves. *PLoS ONE*, 9(12), e114460.

Marchini, S. & Macdonald, D.W. (2012) Predicting ranchers' intention to kill jaguars: case studies in Amazonia and Pantanal. *Biological Conservation*, 147, 213–221.

Naughton-Treves, L., Grossberg, R. & Treves, A. (2003) Paying for tolerance: rural citizens' attitudes toward wolf depredation and compensation. *Conservation Biology*, 17, 1500–1511.

Nelson, F. (2009) Developing payments for ecosystem services approaches to carnivore conservation. *Human Dimensions of Wildlife*, 14, 381–392.

Noss, A.J. & Cuéllar, R.L. (2001) Community attitudes towards wildlife management in the Bolivian Chaco. *Oryx*, 35, 292–300.

Ogra, M.V. (2008) Human–wildlife conflict and gender in protected area borderlands: a case study of costs, perceptions, and vulnerabilities from Uttarakhand (Uttaranchal), India. *Geoforum*, 39, 1408–1422.

Persson, J., Rauset, G.R. & Chapron, G. (2015) Paying for an endangered predator leads to population recovery. *Conservation Letters*, 8, 345–350.

Redpath, S.M., Bhatia, S. & Young, J. (2015) Tilting at wildlife: reconsidering human–wildlife conflict. *Oryx*, 49, 222–225.

Ripple, W.J., Estes, J.A., Beschta, R.L., Wilmers, C.C., Ritchie, E. G., Hebblewhite, M. et al. (2014) Status and ecological effects of the world's largest carnivores. *Science*, 343, http://dx.doi.org/10.1126/science.1241484.

Roessingh, C. (2007) Mennonite communities in Belize. *International Journal of Business and Globalisation*, 1, 107–124.

Romañach, S.S., Lindsey, P.A. & Woodroffe, R. (2007) Determinants of attitudes towards predators in central Kenya and suggestions for increasing tolerance in livestock dominated landscapes. *Oryx*, 41, 185–195.

Slagle, K.M., Zajac, R.M., Bruskotter, J.T., Wilson, R.S. & Prange, S. (2013) Building tolerance for bears: a communications experiment. *The Journal of Wildlife Management*, 77, 863–869.

Soto-Shoender, J.R. & Main, M.B. (2013) Differences in stakeholder perceptions of the jaguar *Panthera onca* and puma *Puma concolor* in the tropical lowlands of Guatemala. *Oryx*, 47, 109–112.

Thorn, M., Green, M., Marnewick, K. & Scott, D.M. (2015) Determinants of attitudes to carnivores: implications for mitigating human–carnivore conflict on South African farmland. *Oryx*, 49, 270–277.

Trapasso, L.M. (1994) Indigenous attitudes, ecotourism, and Mennonites: recent examples in rainforest destruction/preservation. *GeoJournal*, 33, 449–452.

Treves, A. (2012) Tolerant attitudes reflect an intent to steward: a reply to Bruskotter and Fulton. *Society & Natural Resources*, 25, 103–104.

Treves, A. & Bruskotter, J. (2014) Tolerance for predatory wildlife. *Science*, 344, 476–477.

Zabel, A. & Holm-Müller, K. (2008) Conservation performance payments for carnivore conservation in Sweden. *Conservation Biology*, 22, 247–251.

Zimmermann, A., Walpole, M.J. & Leader-Williams, N. (2005) Cattle ranchers' attitudes to conflicts with jaguar *Panthera onca* in the Pantanal of Brazil. *Oryx*, 39, 406–412.

Zinn, H.C. & Pierce, C.L. (2002) Values, gender, and concern about potentially dangerous wildlife. *Environment and Behavior*, 34, 239–256.

Biographical sketches

Rebecca G. Harvey researches human dimensions and her interests include environmental attitudes, invasive species, carnivore conservation, climate change and environmental education. Venetia Briggs-Gonzalez is a wildlife ecologist whose research focuses on species' interactions, mating systems, and human–wildlife interactions in Belize, Panama and the southern USA. Frank J. Mazzotti is interested in conservation planning, threatened species, impacts of human activities on fish and wildlife resources, and landscape ecology.