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The influence of park access during drought on attitudes toward wildlife and lion killing behaviour in Maasailand, Kenya

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SUMMARY

Minimizing the inherent conflict between protecting fauna and flora and accommodating the needs of the local communities is one of the greatest challenges facing protected area (PA) management in developing countries of the world. Allowing pastoralists access to PAs and their resources remains a contentious issue in southern Kenya, where retaliatory killing of African lions (*Panthera leo*) by Maasai pastoralists has caused a steep decline in the lion population, threatening local extinction. Previous studies that have shown that local people often have negative attitudes toward PAs; here PA policy during times of hardship is linked to attitudes toward lions and behavioural intentions. Different access policies to grazing inside Tsavo and Nairobi National Parks during the 2008/2009 drought influenced Maasai attitudes toward lions and their propensity to kill them. A semi-structured questionnaire ($n = 206$) and a multivariate model examine the relative importance of PA access and 11 additional predictors on individuals' attitudes and reported inclination to kill lions. Access for livestock to PAs, benefits from wildlife and higher education were associated with positive attitudes toward lions and a lower reported propensity to kill. The success of lion conservation in Maasailand may depend upon recognizing and accommodating pastoralists' inherent vulnerability to drought-induced livestock mortality.

Keywords: Africa, attitudes, community, conservation, hunting, Kenya, lions, livestock, people-park interactions, protected areas, resource access

INTRODUCTION

Protected areas (PAs) were created to ensure the long-term survival of natural flora and fauna (Myers *et al.* 2000; Bruner *et al.* 2001). However, their value for biodiversity conservation has recently been questioned (Hayward 2011). Many people appreciate the aesthetic or recreational value afforded by PAs (Putney & Harmon 2003); others, particularly poor rural communities which rely on natural resources to cope with and rebound from environmental hardships, view PAs as a threat to their livelihoods (McSweeney 2005). Access rights to PA resources is a contentious issue, rooted in the classification of PAs as 'natural areas of land and/or sea, designated to: (a) protect the ecological integrity of one or more ecosystems for this and future generations, (b) exclude exploitation or occupation inimical to the purposes of designation of the area and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible' (see Dudley 2009). These definitions, particularly the second one, leave little room for flexibility of PA policies during times of environmental crisis. However, in some countries there has been a shift in PA philosophy in favour of allowing local resource use in recognition of human welfare needs in and around PAs (Naughton-Treves *et al.* 2005).

Numerous studies on park-people relations have shown that more lenient PA policies, which permit access to PA resources, result in more positive attitudes and relationships with PA managers and wildlife (Lewis *et al.* 1990; Allendorf *et al.* 2006). Conversely, when conservation policies limit access to PA resources, local people not only suffer greater vulnerability to hazards and risks of impoverishment (McSweeney 2005; Adams & Hutton 2007), but they also display increased resentment toward wildlife and conservation (Adams & Infield 2001). Local people's attitudes play a critical role in PA conservation success, and therefore negative experiences with PAs may facilitate various transgressions, including killing of wildlife, which may be symbolic of anti-PA sentiment (Chardonnet 2002; Mukherjee 2009).

Over one million square kilometres of land have been set aside as national parks and game reserves in Africa (Hitchcock 1990). These areas are often adjacent to rural communities that rely heavily on neighbouring PA resources. As human populations around protected lands increase (Wittemyer *et al.* 2008; but see Joppa *et al.* 2009), so do rates of human-wildlife conflict (Harcourt *et al.* 2001). For example, carnivores that roam between PAs through encroaching human communities cause significant damage to livestock (Holmern *et al.* 2007), often leading to retaliatory killing of carnivores (Kissui 2008; Hazzah *et al.* 2009).

Households closer to PAs tend to experience higher rates of human-wildlife conflict (Naughton-Treves 1997) and in turn express more negative attitudes toward wildlife and PAs than those living further away (Newmark *et al.* 1993). Many studies that quantified these attitudes focused primarily on sedentary agricultural communities living adjacent to PAs (Naughton-Treves 1998; Gillingham & Lee 2003). Furthermore, the

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narrow geographical scope of previous studies may have failed to include communities' experiences across a more extensive landscape (Dar *et al.* 2009), particularly during times of hardship and vulnerability. This is especially relevant in pastoral areas where both livelihood security and wildlife movements are highly vulnerable to stochastic climatic events (Western 1982).

In pastoral systems, mobility is an essential strategy in variable environments (Niamir-Fuller & Turner 1999). People and livestock travel great distances in search of resources, thus proximity to PAs and resulting conflict with wildlife may be less relevant in predicting attitudes and subsequent behaviour than is reliable access to PA resources. Few efforts have been made to quantify attitudes and socioeconomic variables and connect them to conservation behaviour (Adams & Hutton 2007; Anthony 2007).

The Maasai of southern Kenya are an ideal study group because of the importance of Maasailand to lion conservation (IUCN 2006). Traditionally, during times of heightened environmental crisis, the Maasai of this region have relied on access to PAs to ensure livestock survival. However, recent exclusionary PA policies in the last decade have altered their customary reliance on PAs (Butt 2011). The 2008/2009 drought period in Kenya, one of the most severe in recorded history (ACC [African Conservation Centre] 2009; Associated Press 2009; USAID [United States Agency for International Development] 2010), provided an opportunity to test the influence of PA access during times of drought on Maasai attitudes toward lions and their propensity to kill lions. Based on the assumption that local perceptions of risk and vulnerability are intensified by PA restrictions, particularly during drought, and that these perceptions ultimately influence attitudes, we predicted that respondents who were permitted access to PA resources would exhibit more positive attitudes toward lions and less motivation toward killing them.

Using a semi-structured questionnaire, we relied on factor analysis and multivariate models to examine the relative importance of park access and 11 other variables to predict individuals' attitudes and reported inclination to kill lions. Although this analytical approach cannot identify causal mechanisms affecting attitudes, it documents the relationship between experience with PAs during drought, attitudes toward wildlife, and the motivations for lion killing. Other studies have shown that local people often have negative attitudes toward PAs (Akama *et al.* 1995; Shibia 2010); we go a step further and link PA policy during times of hardship to attitudes toward lions and behavioural intentions.

METHODS

Study area

The Amboseli Ecosystem of southern Kenya comprises the 5975 km^2 region between Amboseli, Chyulu Hills, Tsavo and Kilimanjaro National Parks. It is divided into group ranches which are communally owned by Maasai pastoralists (Grandin 1991). To ensure variability in PA use and drought experiences, we studied Maasai attitudes towards lions on three group ranches covering 3500 km^2: Mbirikani (1229 km^2), Olgulului (1471 km^2) and Eselenkei (748 km^2) (Fig. 1), and a total population of *c.* 27 000 Maasai.

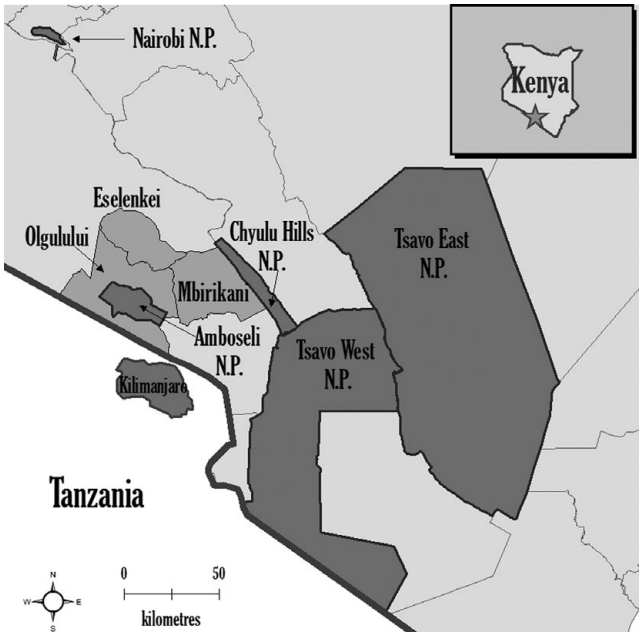

Figure 1 National parks used during the drought and focal study communities.

These semi-arid areas experience erratic rainfall of 158–553 mm yr^{-1} (Altmann *et al.* 2002). Droughts are frequent and have been recorded at least once a decade since 1930 (Campbell 1999). Multi-year droughts cause drastic increases in livestock mortality (Ellis & Swift 1988). The drought of 2008/2009 yielded just 190 mm of rain in Amboseli in 2008, followed by 140 mm in 2009; never have two consecutive years with such low rainfall been recorded (Altmann *et al.* 2002; J. Altmann & S. Alberts, unpublished data 2010). Maasai in the study area lost > 65% of their livestock holdings to the drought, while large wild ungulate numbers declined by 75% (ACC 2009).

The Amboseli Maasai have a long history of lion killing (Western 1982; Lindsay 1987), traditionally recognizing two types of lion hunting: *Olamayio* and *Olkiyioi*. *Olamayio* is a coming-of-age ritual that brings prestige to the warrior who first spears the lion (Saitoti 1988; Hazzah *et al.* 2009; Goldman *et al.* 2010), whereas *Olkiyioi* killings are carried out in retaliation for livestock depredation. Hazzah (2011) suggested that *Olkiyioi* hunts are slightly more prevalent (55%) then *Olamayio* hunts (45%). These two types of hunts are delineated by motivation: *Olamayio* is driven by a strong desire to demonstrate bravery and obtain social acceptance, whereas *Olkiyioi* is driven by a warrior's traditional responsibility of defending personal property and grazing land. We used a factor analysis to test if Maasai motivations for lion killing

are distinct or overlapping, and how PA access affects these different behavioural motivations.

PA accessibility is an important determinant of livestock survival during times of extreme drought (Western 1982; Butt 2011). In 2008, the normal dry season grazing areas within the group ranches lacked both pasture and water, so herders moved their animals into PAs that still had both, specifically, Tsavo and Nairobi National Parks. Access restrictions in these two Parks, in addition to the active control of tourism-related ecological impacts (Cohen 1978) have prevented the severe land degradation that characterizes most of the non-protected parts of the ecosystem (Akama *et al.* 1995).

Communally-owned group ranches lack sufficient incentives to encourage accountable stewardship of resources (Hardin 1968), thereby leading to loss of plant/soil productivity (Okello *et al.* 2009) and a reduction in the availability of dry season grazing (Western 1994). The lack of grazing areas was further exacerbated by the formation of Amboseli National Park (hereafter Amboseli NP) in 1974, which resulted in restrictions on access to the dry season grazing areas in the Amboseli swamps (Worden 2007). With nowhere else to find pasture during drought, access to PAs became particularly important for the Amboseli Maasai.

Tsavo East and West Parks (hereafter Tsavo NP) (22 812 km^2) annually attract > 200 000 tourists and Nairobi National Park (hereafter Nairobi NP) (117 km^2) annually attracts *c* 120 000 tourists. Tsavo NP falls within the broader Amboseli region, whereas Nairobi NP, 200 km to the north, does not.

Between November 2008 and September 2009, after the seasonal rains failed, many herders left the Amboseli region in search of better grazing areas, initially moving their livestock to Tsavo NP. Starting in May through October 2009, others moved to Nairobi NP; 10–20% of their cattle died on the journey north. Kenya Wildlife Service (KWS) permitted herders to enter Nairobi NP to graze only during restricted hours (only at night with a mandated departure time by dawn) and unarmed (KWS warden, personal communication 2009). In contrast, at Tsavo NP, herders were forbidden from entering at any time; KWS used helicopters and vehicles to patrol the area (Ausseill 2009; L. Hazzah, personal observation 2009). Many herders entered the Park anyway, since in past drought years they had been permitted access (Barrow *et al.* 2000); the majority were fined, arrested and/or chased out. These opposing park policies allowed us to study how exclusionary processes and subsequent conflict during times of crisis influence attitudes toward lions and future prospects for coexistence.

Sampling and survey instruments

In October 2007 to January 2008, preceding the drought, we collected data on livestock holdings for all households ($n = 425$) across 18 communities (villages) that had a functional borehole (well) that charged livestock owners a per head fee to water cattle. Borehole authorities provided records of herds visiting each water point; we verified this data by visually counting cattle in each area. These two sources of data on herd size did not differ significantly (±5 head of cattle). For our post-drought questionnaire, we randomly selected households ($n = 206$) from the list of households with livestock holdings.

Only Maasai men were interviewed, as they have primary responsibility for livestock herding and household decision-making. Particular attention was paid to pre-testing the Likert scales to ensure optimal reliability and validity. After pilot testing the questionnaire for three months ($n = 40$, and three focus groups) on different group ranches and with a diversity of ages (20–80 years) and wealth groups (1–4000 cattle), we interviewed 71 members from Mbirikani, 80 from Eselenkei and 55 from Olgulului ($n = 206$). Each respondent belonged to a different household.

All questionnaires were written and conducted in the Kimaa language by a single Maasai interviewer to avoid interviewer bias (Browne-Nunez & Jonker 2008). 'Translation/back-translation' was used to increase the reliability of the translated questionnaire (Behling & Law 2000). This was done five times with three different translators to ensure accuracy. The questionnaire was composed of five sections: sociodemographic and economic, livestock losses, experience with the park, and two separate five point Likert-scales on attitudes toward lions and motivations behind lion killing.

The attitude scales were developed using a series of statements regarding attitudes toward lions, ability to coexist with lions, and potential behavioural responses to lion killing (Dunlap *et al.* 2000; Zimmermann *et al.* 2005) (Table 1). Although investigating general attitudes toward a subject (for example lions) can inform policy, it is unlikely to be of use in predicting a specific behaviour (Heberlein 1981; St John *et al.* 2010); we therefore asked respondents specific questions about killing lions. Since one aim of conservation is to reduce lion killing, we needed a separate focused measure of attitudes towards the act of killing a lion (Fishbein & Manfredo 1992). Even though reported acceptance of lion killing behaviour is only a proxy measure of tolerance and behavioural intent, and may not necessarily always reflect actual lion killing behaviour, it is a relevant indicator of resentment against lions and the risk people pose to them.

Data analysis

We used factor analysis to reduce the respondents' answers into smaller sets of factors to measure validity and to identify the number of constructs being measured by a set of items (Browne-Nunez & Jonker 2008). We analysed all data using Statistical Packages for the Social Sciences (SPSS) PC version 18.0 (SPSS Inc., Chicago, USA), and there were no missing data. We first ran principal components analysis (PCA) on the two attitudinal scales to decide on the initial number of factors to extract, based on eigenvalues exceeding 1 and close inspection for a clear break in the scree plot (Cattell 1966; Tabachnick & Fidell 2007). The overall purpose of PCA is

Table 1 Items included in the factor analysis and the percentage of respondents who agreed/strongly agreed with each statement.

Statement items	*Agreement rate (%)*
I feel lions have the same rights as livestock to live on this land	78
I feel that lions are beautiful animals	75
God would want me to protect all the wildlife	80
Lions deserve protection	79
Lions have a right to exist	84
It is important to me that my grandchildren see lions	85
The lions in the ecosystem is a national treasure	86
I am worried about the future of the ecosystem's wildlife	40
I appreciate the role that lions play in the natural environment	56
I like to watch lions in their natural environment	75
I am concerned about over-hunting in the ecosystem	36
I would like to communicate more with conservation scientists	90
If my cow was killed by a lion it is acceptable to kill it	58
If a lion entered my boma I would kill it	82
Snaring a problem lion is acceptable	45
Traditional hunts are acceptable	10
I would kill a lion just for fun	11
I will kill a lion to defend my property	85
It is acceptable for young boys to kill lions to practice their hunting skills	10
Killing a lion for prestige/status is acceptable	10
When I see a lion it is acceptable to kill it	11
If a family member was injured by a lion it is acceptable to kill it	92
If my father asked me to go kill a lion in revenge of our cows, it is acceptable to kill it	40

to extract maximum variance from the data set with each component. PCA is also very useful as an initial step in factor analysis, as it can reveal a great deal about the maximum number and nature of factors (Tabachnick & Fidell 2007).

Next, we used exploratory factor analysis with principal axis extraction and promax rotation to extract the number of factors determined by the scree plot. Factor solutions with different numbers of factors were examined before the most representative and parsimonious model was identified. We used the Tabachnick and Fidell (2007) rule of thumb of 0.32 as the minimum loading for keeping an item, removing any factor loading that was less than 0.32 as it was unlikely to provide a significant contribution to the overall model.

We used Cronbach's alpha to determine the reliability and internal consistency of the original scales and the resulting factors, setting the criterion for good reliability at 0.70. The higher the value, the greater the evidence that it is tapping an underlying latent variable or factor (Tabachnick & Fidell 2007). The statements within each factor were combined into a single additive score, which is standard when there are no missing data (Zimmermann *et al.* 2005). Answers to each statement were coded from zero to four (strongly disagree, disagree, unsure, agree, and strongly agree). The codes were summed to create a combined score for both scales: the higher the score in the attitude scale, the more positive their attitudes were toward lions, whereas the higher the score in the killing propensity scale, the higher their propensity to kill a lion.

Block entry linear regression

Prior to running a regression analysis, we tested the variance inflation factor and checked the variance decomposition proportions; both tests confirmed that there was no collinearity present among the predictors. Lastly, we ran additional diagnostic tests to check for outliers, influential observations and heteroscedasticity (Fox 1997). Two cases exceeded the normal levels in all tests and were removed from the analysis to avoid skewing the regression coefficient estimates.

Block-entry linear regression was employed to determine if additional information regarding PA access improved prediction of attitudes toward wildlife and lion killing behaviour beyond that afforded by differences in other social, economic and ecological predictors. These key variables were drawn from literature on attitudes toward large carnivores (Parry & Campbell 1992; Dickman 2008) and those related to PA experience emerged from pilot interviews and participant observation (Table 2). The second block includes all 12 predictors and the parameter estimates are analogous to a standard multiple regression analysis.

PA access was controlled for as a single block entry and as a nominal variable, with one category that included respondents who were given permission to access the PA (namely the Nairobi NP) and the other category for those who experienced total exclusion (namely Tsavo NP), regardless of whether or not they still entered the park illegally. There are obvious differences between Nairobi and Tsavo National Parks, including distance from the Amboseli ecosystem and park history, that were not included in the analysis due to difficulty in quantifying these variables. However, Akama *et al.* (1995) found little variation in wildlife damage and attitudes between communities adjacent to these PAs; all held negative attitudes toward the PAs. Additionally, our interest here was the effect of PA access on attitudes toward wildlife, thus we focused primarily on access rights rather than on PA characteristics. To further investigate the results of the regression, we ran univariate tests, including the Mann Whitney U test, Kruskal-Wallis and chi-square tests, as appropriate. All tests were two-tailed unless indicated otherwise.

RESULTS

Characteristics of respondents and national parks

Survey respondents were divided into three age categories: 35% were warriors (aged 18–29), 43% junior elders (aged 30–42) and 22% elders (aged 43 and above). Eighty per cent of those interviewed had never attended school, 11% had completed primary school, and fewer than 10%

Table 2 Description of variables included in the linear regression. *We recorded all costs incurred during the drought (including park fines, transportation of cattle, trespassing and pasture fees) and divided the total costs by park fines to get a relative proportion of costs incurred by the park. **The predator compensation fund (PCF) was created to reimburse people for livestock lost to predators in order to increase local tolerance of carnivores (for details see Maclennan *et al.* 2009).

Predictor	*Explanation*	*Variable type*
Park access	Park access during the drought	Two categories: restricted = 0, permitted = 1
Age	Respondents age group	Three categories: warrior = 0, junior elder = 1, elder = 2
Education	Respondents level of education	Three categories: none = 0, primary = 1, secondary+ = 2
Religion	Respondents religious affiliation	Two categories: non-Christian = 0, Christian = 1
Benefits	Received wildlife benefits (such as employment or scholarships)	Two categories: yes = 0, no = 1
Cattle wealth	Actual cow wealth	Continuous: (0–362)
Proportional loss	Actual proportion of herd lost during the drought (counted cattle before and after drought)	Continuous: (0–1)
Perceived loss	Reported number of livestock lost during the drought	Continuous: (0–765)
Park fine*	Proportion of drought costs attributed to Kenyan Wildlife Service fines	Continuous: (0–1)
Depredation loss	Reported proportion of herd lost due to depredation	Continuous: (0–1)
Times compensated**	Number of time compensated for depredation in 1 year	Continuous: (0–12)
Paid bribe	Did respondent pay a bribe to enter a park?	Two categories: no = 0, yes = 1

had completed secondary school. Fifty-eight per cent of interviewees reported that they were Christian and attended church an average of four times a month; the remaining 42% followed indigenous beliefs. Thirty per cent of the interviewees reported that they received benefits from conservation, either from employment, compensation or educational bursaries/scholarships. Prior to the drought all respondents owned livestock, with a mean herd size of 71 cattle (range = 1–1023, SD = 120). Subsequent to the drought, the average herd size was reduced to 25 (range = 0–661, SD = 84), an overall loss of 65%.

Eighty-five per cent of respondents attempted to bring their cattle into a PA during the drought; of these, 50% went to Tsavo (60% were from Mbirikani, 49% from Olgulului and 36% from Eselenkei), 49% went to Nairobi NP (64% from Eselenkei, 51% from Olgulului and 40% from Mbirikani), and only 1% went to Amboseli NP, as it had little pasture available. Respondents who did not visit a park or were turned away from Tsavo NP either took their cattle to Tanzania, the Mombasa region of the Kenyan coast and/or rented a plot of land near Nairobi. When speaking to people about their PA choice, they often stated that they had customarily gone to Tsavo NP, because in the past there had been a tacit agreement with the warden to allow them access to certain grazing areas; however, during this drought, the general 'agreement' changed and all access to Tsavo NP was denied.

Reasons for choosing a specific PA were not specifically explored, but there was seemingly no association between the following predictors and the chosen PA: number of cattle owned ($z = -1.210$, $p = 0.226$), age of respondent ($\chi^2 = 1.409$, $p = 0.843$), education level ($\chi^2 = 8.359$, $p = 0.063$), reported depredation rates ($z = -1.464$, $p = 0.143$), or perceived or actual livestock loss during the drought (perceived: $z = -0.277$, $p = 0.782$; actual: $z = -1.397$, $p = 0.082$). There was a significant relationship between religion and PA selection ($\chi^2 = 10.359$, $p = 0.033$), with 65% of Christians attempting entrance to Tsavo NP while 35% used Nairobi NP; however, additional diagnostic tests eliminated any suspicion of collinearity (see Methods).

Factor analyses on attitudinal Likert-scales

The Cronbach's alpha reliability test for the original attitude scale was reliability (0.77). PCA revealed the presence of five components with eigenvalues exceeding 1, and the scree plot suggested we retain two components for the factor analysis. The rotated solution with two factors revealed the presence of a number of strong loadings and all items loaded significantly on only one component (Table 3). The two factors correlated at the 0.41 level, and explained a total of 48.1% of the variance, with Factor 1 contributing 40% and Factor 2 contributing 8%.

The internal consistency of Factor 1 was high (Cronbach's alpha = 0.89) but Factor 2 was less reliable (Cronbach's alpha = 0.60), failing the 0.7 criterion, and was consequently eliminated from further analysis. All items in Factor 1 were summed and used as the dependent variable for the regression. All questions that loaded strongly on Factor 1 suggested a strong reported desire to have lions and other wildlife around now and in the future; and was called 'existence value'.

The Cronbach's alpha reliability test for the lion killing behaviour statements had a coefficient of 0.85, confirming the validity of the scale. PCA suggested a two-factor model, with eigenvalues over 1, and a clear break in the scree plot between the second and third component. The rotated solution with two factors revealed the presence of several

Table 3 Pattern matrix of wildlife attitude items: two-factor model using principal axis factoring with Promax rotation ($n = 206$).

Statement items	*Factors*	
	1	*2*
Lions have a right to exist	0.929	–0.176
God would want me to protect all the wildlife	0.806	–0.018
It is important to me that my grandchildren see lions	0.741	–0.069
I feel that lions are beautiful animals	0.724	0.077
Lions deserve protection	0.692	–0.004
The wildlife in the ecosystem is a national treasure	0.643	–0.026
I like to watch wildlife in their natural environment	0.623	0.098
I feel lions have the same rights as livestock to live on this land	0.556	–0.008
I would like to communicate more with conservation scientists	0.483	0.184
I appreciate the role that wildlife plays in the natural environment	0.455	0.321
I am concerned about over-hunting wildlife in the ecosystem	–0.054	0.753
I am worried about the future of the ecosystem's wildlife	–0.009	0.589

Table 4 Factor loading matrix of lion killing propensity items: two-factor model using principal axis factoring with Promax rotation ($n = 206$).

Statement items	*Factors*	
	1	*2*
Killing a lion for prestige/status is acceptable	0.894	–0.074
I will kill a lion just for fun	0.865	–0.110
Traditional hunts are acceptable	0.792	–0.025
It is acceptable for young boys to kill lions to practice	0.718	0.085
When I see a lion it is acceptable to kill it	0.673	0.110
If a lion entered my boma I would kill it	–0.045	0.740
I will kill a lion to defend my property	–0.117	0.693
If a family member was injured by a lion I would kill it	–0.160	0.633
If my cow was killed by a lion it is acceptable to kill it	0.134	0.628
Snaring a problem lion is acceptable	0.191	0.523
If my father asked me to go kill a lion in revenge of our cows . . .	0.127	0.443

strong loadings and all items loaded significantly on only one factor (Table 4). The two factors related to killing behaviour were not highly correlated with each other (0.32). The two-component solution explained a total of 51% of the variance. Both factors passed the Cronbach reliability test with an alpha coefficient of 0.88 for Factor 1 and 0.78 for Factor 2.

All the items that loaded on Factor 1 revealed a social element of lion killing (for example gaining prestige with the community, entertainment or thrill), and illustrate that lion killing is not always provoked by livestock depredation; we named this factor 'socially motivated'. The questions that loaded strongly on Factor 2 centred on lion killing that was motivated by protecting and defending livestock and human life from problem lions, which we called 'defence motivated'. Respondents with a higher defence-motivated score were more inclined to kill a lion that posed a threat to themselves, family members or livestock, whereas those with higher social motivation were inclined to kill a lion to gain prestige or for fun. Finally, we used the summation of each factor (existence, social and defence), as dependent variables for the linear regression analysis.

Variables affecting attitudes toward lions (existence values)

Block entry linear regression combined 12 attitude predictors that were not collinear (Table 5), with PA access representing the first block. When access to a PA, specifically Nairobi NP, is included in the entire model of predictors, it most strongly contributed to explaining a person's wildlife existence values ($\beta = 0.252$, $p = 0.002$), followed by those who received wildlife benefits ($\beta = = -0.205$, $p = 0.007$). Education and religion also influenced wildlife existence values. Respondents who had no authorized access to grazing in Tsavo NP had less desire to see wildlife exist then or in the future.

Variables affecting attitudes toward socially-motivated lion killing

Restricted PA access remained a strong predictor of socially-motivated killing propensity ($\beta = -0.208$, $p = 0.010$), even when combined with the 11 other predictors (Table 6). Among respondents, Christians were more likely to approve of socially-motivated responses ($\beta = 0.354$, $p \leq 0.0001$). In addition to Christianity and access restrictions, respondents who paid a bribe for access, those who reported lack of benefits from wildlife and those with low education levels all displayed statistically significant socially-motivated killing responses.

Surprisingly, although Christians reported receiving more conservation benefits than non-Christians ($\chi^2 = 6.405$, $p = 0.011$), they indicated a greater acceptance of socially-motivated killing. In other words, our finding that benefits improved attitudes towards wildlife and reduced approval of lion killing, did not necessarily hold true for Christians, among whom faith seems to be a stronger predictor.

Variables affecting attitudes toward defence-motivated killing propensity

Although PA access remains significant ($\beta = -0.197$, $p = 0.014$) when included in the full model, there are four additional predictors with greater influence, indicated by their standardized beta values (Table 7). Perceived livestock loss strongly influenced defence-motivated killing response ($\beta = 0.314$, $p = 0.004$), suggesting the importance that perceptions play in predicting behaviour. Additionally, lack of perceived benefits from conservation, lower education levels and age all contributed markedly to predicting

Table 5 Block-entry linear regression (dependent variable = existence values). Step 1: park access model ($r^2 = 0.090$, F = 17.47, $p \leq 0.0001$, AIC = 1434.1), Step 2: all 12 predictors ($r^2 = 0.218$, F = 2.32, $p \leq 0.0001$; AIC = 1274.6).

Model		*Unstandardized coefficients*		*Standardized coefficients*	*t*	*Sig.*
		B	*Std error*	*Beta*		
1	(Constant)	29.828	0.751		39.742	0.000
	Park access	4.816	1.152	0.305	4.180	0.000
2	(Constant)	35.856	2.693		13.316	0.000
	Park access	3.976	1.286	0.252	3.092	0.002
	Age	–1.259	0.798	–0.119	–1.578	0.117
	Education	1.874	0.810	0.178	2.313	0.022
	Religion	–2.745	1.325	–0.175	–2.072	0.040
	Benefits	–3.493	1.270	–0.205	–2.750	0.007
	Proportional loss	–1.625	2.773	–0.048	–0.586	0.559
	Perceived loss	0.005	0.009	0.069	0.624	0.533
	KWS fine	–3.876	2.598	–0.115	–1.492	0.138
	Paid bribe	0.782	1.423	0.044	0.549	0.584
	Times compensated	–0.221	0.232	–0.076	–0.953	0.342
	Depredation loss	–5.302	6.260	–0.061	–0.847	0.398
	Cattle wealth	0.007	0.018	0.045	0.390	0.697

Table 6 Block-entry linear regression (dependent variable = social-motivated killing behaviour). Step 1: park access model ($r^2 = 0.080$, F = 15.52, $p \leq 0.0001$, AIC = 1316.6), Step 2: all 12 predictors ($r^2 = 0.258$, F = 3.40, $p \leq 0.0001$, AIC = 1172.9).

Model		*Unstandardized coefficients*		*Standardized coefficients*	*t*	*Sig.*
		B	*Std error*	*Beta*		
1	(Constant)	5.535	0.557		9.929	0.000
	Park access	–3.371	0.856	–0.289	–3.939	0.000
2	(Constant)	–0.089	1.939		–0.046	0.963
	Park access	–2.429	0.926	–0.208	–2.623	0.010
	Age	0.534	0.574	0.068	0.930	0.354
	Education	–1.348	0.583	–0.173	–2.310	0.022
	Religion	4.096	0.954	0.354	4.295	0.000
	Benefits	2.007	0.914	0.159	2.195	0.030
	Proportional loss	2.313	1.997	0.093	1.159	0.248
	Perceived loss	–0.008	0.006	–0.146	–1.351	0.179
	KWS fine	1.699	1.870	0.068	0.909	0.365
	Paid bribe	2.525	1.025	0.191	2.464	0.015
	Times compensated	–0.003	0.167	–0.001	–0.017	0.986
	Depredation loss	0.326	4.507	0.005	0.072	0.942
	Cattle wealth	0.006	0.013	0.050	0.442	0.659

defence-motivated killing. Religion's strong influence in predicting wildlife existence values and socially-motivated killing disappeared in this analysis, illustrating the strength of more immediate factors, suggesting that respondents inclined to approve of defence-motivated killings are more concerned with immediate survival of their livestock (for example by killing a problem lion that is threatening their cattle) than with other considerations.

DISCUSSION

Our findings indicate that access to PAs during times of crisis had a stronger positive influence on Maasai attitudes toward lions and their associated likelihood of killing them than the more conventional predictors of attitudes (such as proximity to PA, wealth and human-wildlife conflict experience). Since PA access was significant for both social- and defence-killing motivations, it suggests that PA access, in addition to conflict mitigation strategies to reduce livestock depredation, is important for lion conservation.

The data support our prediction that access to PAs positively affects attitudes and lion killing behaviour. PA access was significant, not only as a single block entry, but remained so when combined with the 11 other predictors, indicating that experience while in the PA (even when the PA was 200 km away from their home) influenced attitudes toward lions and both reported killing behaviours.

Table 7 Block-entry linear regression (dependent variable = defence-motivated killing behaviour). Step 1: park access model ($r^2 = 0.040$, F = 7.11, $p = 0.008$, AIC = 1312.2), Step 2: all 12 predictors ($r^2 = 0.264$, F = 2.22, $p \leq 0.0001$, AIC = 1132.9).

Model		*Unstandardized coefficients*		*Standardized coefficients*	*t*	*Sig.*
		B	*Std Error*	*Beta*		
1	(Constant)	17.909	0.520		34.434	0.000
	Park access	–2.128	0.798	–0.200	–2.666	0.008
2	(Constant)	13.211	1.760		7.508	0.000
	Park access	–2.093	0.840	–0.197	–2.490	0.014
	Age	1.593	0.521	0.224	3.055	0.003
	Education	–1.971	0.530	–0.277	–3.721	0.000
	Religion	1.294	0.866	0.123	1.495	0.137
	Benefits	2.760	0.830	0.240	3.325	0.001
	Proportional loss	2.854	1.812	0.125	1.575	0.117
	Perceived loss	0.016	0.006	0.314	2.924	0.004
	KWS fine	–1.403	1.698	–0.062	–0.826	0.410
	Paid bribe	1.053	0.930	0.087	1.132	0.259
	Times compensated	0.166	0.152	0.085	1.091	0.277
	Depredation loss	–2.433	4.091	–0.042	–0.595	0.553
	Cattle wealth	0.017	0.012	0.167	1.483	0.140

The majority of studies on park-people relations focus on how access to PA resources predisposes people to value the PA or conservation in general (Fiallo & Jacobson 1995; Holmes 2003; Ormsby & Kaplin 2005). Our results suggest that access to PA not only increases Maasai attitudes toward lions specifically (existence value), but also reduces their propensity to kill lions. We believe that these findings are linked to the issue of wildlife ownership. A recent study found that the majority of Maasai living in the Amboseli region felt that the government owned the wildlife (Western 2012). Therefore, if the government is flexible about PA access and understanding of Maasai vulnerability to drought-induced livestock mortality, then the Maasai would be more likely to reciprocate respect towards wildlife (Akama *et al.* 1995). The link between Maasai attitudes and behaviour and their relationship to PAs was documented by Western (1982, 1994) who found that once Maasai received revenue from Amboseli NP and were provided permanent water outside of the Park, they stopped killing rhinoceros (*Diceros bicornis*) and other wildlife. Conversely, there are ample studies, both within Maasailand and beyond, that found that denial of PA access correlates with negative attitudes toward wildlife and higher propensity towards 'protest' killing of wildlife (Lindsay 1987; Chardonnet 2002; Mukherjee 2009).

In addition to PA access, two influential predictors emerged from each regression: benefits and education level. Only one-third of respondents stated that they received benefits from carnivores; 50% of those stated employment as their main benefit, followed by compensation payments, and educational bursaries and scholarships. Out of all the benefits reported, employment resulted in higher wildlife existence values and a lower approval of lion killing. Similar to other findings (Anthony 2007; Shibia 2010), employment was the most important benefit from conservation realized by Maasai, positively influencing attitudes toward lions and reducing killing propensity. Our finding is not surprising since conservation-related employment often relies on maintaining wildlife populations to ensure continued employment benefits. Indirectly, conservation employment may also cultivate more positive attitudes through exposure to, and presumably appreciation of, the economic role of wildlife and conservation (Anthony 2007) and, ultimately, PAs. Conversely, those that receive no benefits, in this study two-thirds of respondents, might believe that eliminating wildlife or profiting from illegal harvesting of natural resources is to their economic benefit.

In addition to park access and wildlife benefits, education was an important predictor of people's attitudes and their propensity to kill lions. Numerous studies of attitudes toward wildlife and conservation support the supposition that higher education and age are associated with increased interest in the environment and, more specifically, with more positive attitudes toward wildlife (Dunlap & Catton 1979; Akama *et al.* 1995; Shibia 2010; Tessema *et al.* 2010). Older and less educated members in the community were more likely to have personally experienced past injustices from the PAs and wildlife (Newmark *et al.* 1993; Shibia 2010), resulting in more negative attitudes.

CONCLUSIONS

The primary function of a PA is to protect the fauna and flora within its boundaries, with hopes that wildlife will thrive. Studies have indicated that allowing humans to access PAs can lead to high levels of biodiversity loss and land degradation (Terborgh 2004; Locke & Dearden 2005). Conversely, other studies indicate that some of the biodiversity loss observed in PAs stems from restricting human activities within PA boundaries (Gichohi 1990; Adams & McShane 1996; Pimbert & Pretty 1997; Western & Gichohi 2008). It is estimated

that 65–80% of Kenya's lions and other wildlife live outside the safeguarded 'islands' of PAs (Ottichilo *et al.* 2000; Western *et al.* 2009) and it is in this context that wildlife, especially lions, repeatedly come into conflict with human communities. Without these key dispersal regions outside of the PAs, wildlife populations would decline rapidly and the ecological integrity and resilience of the PAs would be greatly compromised (Campbell *et al.* 1991).

For conservation of wildlife to succeed in Maasailand, encouraging a positive relationship between the communities and the PAs based on continued benefits and trust will allow for more positive attitudes and lower predilection toward killing lions and other wildlife. This may include a highly regulated policy of PA access or the reestablishment of historical grass refuge/banks (such as the swamp lands in Amboseli) where only communities adjacent to PAs can access these areas during times of intense drought. Setting up a self-regulating system based on the Maasai traditional political institutions (group of elders within a community decide and execute a herding management plan for a community and resolve any grazing disputes; Spencer 1988) could reduce possibilities of freeloaders from external communities seeking access to the PA.

In summary, our findings strongly suggest that PA policies should recognize that during times of severe droughts, when pasture and water is scarce elsewhere, permitting access to PAs could improve local attitudes toward lions and other wildlife. Certainly, wild herbivores are also at risk during times of hardship, so PA policy needs to weigh the costs of permitting livestock access to PAs against the benefits of a greater conservation ethic. These findings are consistent with other studies of park-people conflict in the developing world, which found that flexible PA policies may improve local tolerance of wildlife (Newmark & Leonard 1993; Fiallo & Jacobson 1995; Allendorf *et al.* 2006). This may be particularly true for pastoralists who live in highly stochastic environments where livelihood security often hinges on access to resources within PAs.

In Kenya, tourism is the largest earner of foreign exchange, contributing US$ 350–500 million annually (Sindiga 1995; Okello *et al.* 2008), and has the potential to generate substantial revenue for local communities, contributing to the protection of PAs and wildlife. Currently, however, very little of that income is realized by the communities surrounding PAs; only *c.* 4% of Amboseli NP revenue reaches local communities within the ecosystem (Groom 2007; M. Okello, personal communication 2011). Much of that 4% remains in the pockets of the local elite, which only serves to further exacerbates people's disenfranchisement. However, even if tourism can provide sufficient economic benefits to rural communities, this study suggests that reliable access to PA resources during times of severe drought and heightened risk appears to be a more important determinant of attitudes and reported conservation-related behaviour. If efforts to protect lions are to succeed, conservationists and PA authorities must recognize and make accommodations for pastoralists' inherent vulnerability to drought-induced livestock mortality. Although accommodation may conflict to some degree with conservation goals, it may be critical to ensuring the success of the long-term biodiversity conservation remit of PAs.

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