

**Human-wildlife coexistence: attitudes and behavioural intentions towards predators in the Maasai
Mara, Kenya**

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Abstract

Living alongside predators can entail substantial costs both in terms of livelihoods and personal safety. Negative interactions with predators can lead to negative attitudes and behavioural intentions such as retaliatory or pre-emptive killing. As a result, conservation strategies are increasingly adopting human-wildlife coexistence approaches aimed at minimising the costs associated with living with predators by providing direct or indirect benefits. This is done in the hope that people will foster positive attitudes and behavioural intentions towards predators. However, people's attitudes and their behavioural intentions are not necessarily linked, and both need to be understood for conservation actions to be effective. We conducted semi-structured interviews (N = 747) with community members in the Maasai Mara, Kenya, to determine which factors influenced people's attitudes and behavioural intentions towards predators and whether the two were linked. Most interviewees (57.52%) had a positive attitude towards predators as measured by their assertion that people, livestock and predators should coexist. Their attitude was dependent on benefits, occupation, conservancy membership and perceived community ownership of predators, but was not influenced by the costs of livestock depredation. Most respondents who were members of a conservancy were positive towards predators but this differed per conservancy suggesting that, in addition to benefits, conservation politics could influence attitudes. In total, 10.30% of respondents said that they would kill a predator if it killed their livestock. This behavioural intention was only influenced by the respondent's attitude. Understanding the factors that influence attitudes and behavioural intentions will aid future management and coexistence strategies.

Keywords: attitude; behavioural intention; benefits; costs; human-wildlife coexistence; predator; Maasai Mara; tolerance

Introduction

Living alongside predators can inflict substantial costs on local communities through loss of livelihoods and risk of life (Thirgood et al., 2005; Inskip & Zimmermann, 2009; Acha et al., 2017). These costs can often lead to negative attitudes (Kansky & Knight, 2014) or negative behaviours towards predators (Inskip & Zimmermann, 2009; Marchini & Macdonald, 2012). Negative behaviours can include the retaliatory or pre-emptive killing of predators (e.g. Loveridge et al., 2017) and it is believed that this has resulted in the decline or local extirpation of many carnivore populations (Treves & Karanth, 2003). While attitudes can be a useful predictor of behavioural intentions (Kraus, 1995) this is not necessarily the case as the Theory of Planned Behaviour predicts that behavioural intentions can also be influenced by subjective norms and perceived behavioural control (Ajzen, 1991; Fishbein & Ajzen, 2011). Hence it is possible that the underlying determinants of attitudes and behavioural intentions differ (Liu et al., 2011; Harvey et al., 2016). Therefore, understanding the factors that influence both attitudes and behavioural intentions towards wildlife, independent of each other, is essential in informing human-wildlife interventions (Manfredo, 2009; Harvey et al., 2016).

As negative interactions with predators are often considered to be the root cause of negative attitudes and behaviours towards predators (Madden & McQuinn, 2014), minimising these negative interactions has become central to conservation efforts globally (Eklund et al., 2017). Minimising these negative interactions can broadly be achieved through exclusion or coexistence strategies. Exclusion strategies rely on humans and wildlife being separated through, for example, the erection of physical barriers such as fences (e.g. Massey et al., 2014), the removal of wildlife from anthropogenic landscapes (e.g. Treves & Karanth, 2003), the removal of people from wildlife areas (e.g. Karanth, 2007) or a combination of these. However, exclusion policies can lead to negative community attitudes towards conservation (e.g. Ite, 1996) and could have significant ecological consequences. Fencing, for example, is a particularly contentious issue (see Creel et al., 2013; Packer et al., 2013a; Packer et al., 2013b) since it leads to habitat fragmentation and loss of

connectivity between protected areas (Creel et al., 2013). This is particularly important in dryland and migratory ecosystems (Durant et al., 2015) such as the Maasai Mara in Kenya. Coexistence, on the other hand and according to Carter and Linnell's (2016) definition, is a "dynamic but sustainable state in which humans and large carnivores co-adapt to living in shared landscapes where human interactions with carnivores are governed by effective institutions that ensure long-term carnivore population persistence, social legitimacy, and tolerable levels of risk". While it is difficult to influence the adaptation of carnivores, human adaptation can be promoted by minimising the negative effects of predators and fostering positive attitudes through various, usually financial, incentives, a strategy that has proliferated in the Maasai Mara (Homewood et al., 2012; Courtney, 2015).

In Maasailand, efforts to reduce costs include compensation and insurance schemes (e.g. MacLennan et al., 2009; Bauer et al., 2017), fortification of livestock enclosures (e.g. Lichtenfeld et al., 2014) and the use of deterrents (e.g. Ogada et al., 2003). Benefits on the other hand, are largely associated with wildlife-based activities such as tourism. Wildlife, and especially big cats, attract tourists (Mossaz et al., 2015). High predator densities in the Maasai Mara (Broekhuis & Gopalaswamy, 2016; Elliot & Gopalaswamy, 2017) together with the spectacle of the annual wildebeest migration have resulted in the Maasai Mara National Reserve being the highest-earning wildlife area in Kenya (Narok County Council & Trans-Mara County Council, 2012). However, some question whether tourism-related benefits really translate into coexistence with wildlife (Homewood et al., 2012).

Other than socio-economic costs and benefits, factors such as conservation politics could play a role in people's attitudes and behavioural intentions towards predators. Goldman et al. (2013), who describe conservation politics as the "uneven power dynamics related to land-use and conservation decision making", report cases where Maasai killed lions (*Panthera leo*) as a political statement as they felt increasingly alienated by management and let down by government. There are many cases in Maasailand where the Maasai are resentful towards conservation efforts especially when they are prohibited from their cultural practices or excluded from key resources,

such as grazing (Homewood et al., 2012; Goldman et al., 2013; Hazzah et al., 2013; Bedelian & Ogutu, 2017). It has been shown that providing access to resources (Measham & Lumbasi, 2013), including the local community in decision making (Treves et al., 2009) and providing a sense of predator ownership (Dolrenry, 2013), can influence positive attitudes and behavioural intentions towards predators. As such, it is increasingly being recognised that a collaborative, rather than a 'top-down', approach whereby local communities are actively involved in conservation-related decisions, is required for conservation initiatives to be successful (Redpath et al., 2017). Taking a collaborative approach can also overcome the human-human conflict, which is the conflict between humans over the value of predators, that can hinder conservation efforts (Redpath et al., 2015).

In the Maasai Mara, the relationship between coexistence strategies and people's attitudes and behaviours towards predators is unclear. Here we assess whether people's attitudes and behaviours towards predators are influenced by the costs, benefits or factors relating to 'conservation politics'. We hypothesised that costs, as measured by livestock lost to predators, would have a negative effect on people's attitudes and behaviour towards predators, while the perceived presence of benefits would have a positive effect. As management regimes of the various wildlife areas differ in their level of inclusion of the community we hypothesised that this, and a person's sense of ownership over the wildlife, would influence people's attitudes and behavioural intentions towards predators.

Study area

The Maasai Mara landscape in south-west Kenya is home to the Maasai people who, historically, were a semi-nomadic pastoralist community but are now largely sedentary (Seno & Shaw, 2002). Traditionally, Maasai predominantly kept cattle but more recently there has been a shift to small stock, particularly sheep (*Ovis aries*) and goats (*Capra hircus*), as these are more drought resistant (Bedelian & Ogutu, 2017; Broekhuis et al., 2017a).

Subdivision and privatisation of communally owned land surrounding the Maasai Mara National Reserve occurred in 1999 and gave rise to concerns that livestock production would

decrease (Seno & Shaw, 2002) and cultivation and fencing would increase leading to a decline in wildlife (Lamprey & Reid, 2004). As a result, tourism companies partnered with local landowners to form wildlife conservancies where landowners receive a fixed, monthly payment for leasing their land for wildlife-based activities on the condition that the landowner moves off that land and does not cultivate or develop it (Thompson et al., 2009; Osano et al., 2013). At the time this study was conducted, there were nine conservancies of varying size and with their own private management (Fig. 1). Each conservancy is made up of individually-owned parcels of land (range 46 – 850 landowners). Different lease agreements by the conservancies have resulted in different management policies. Conservancy-specific management policies are not publically available for all the conservancies (but see Osano et al., 2013; Bedelian, 2014; Bedelian & Ogutu, 2017), but some of the differences are as follows: lease fees vary per conservancy (US\$30-50 per hectare per year); some conservancies utilise a percentage of tourism revenue to run a multitude of community development programmes (Bedelian, 2014; Courtney, 2015); some conservancies have a board that consists of both tourism partners and landowners, where landowners are included in the decision-making process (Bedelian, 2014) and some conservancies allow for controlled grazing of cattle or enforce a livestock depredation insurance policy, while others do not. As with the Maasai Mara National Reserve, illegal grazing does occur within the conservancies, resulting in fines which can cause animosity, especially during dry periods when resources are scarce (Bedelian & Ogutu, 2017). In the Maasai Mara National Reserve and the conservancies, the tourist lodges offer employment, frequently to local people, and pay additional lease fees to landowners (Thompson & Homewood, 2002; Narok County Council & Trans-Mara County Council, 2012; Bedelian, 2014).

There are no physical barriers between the wildlife areas and the surrounding community, and people, livestock and wildlife come into contact with one another which can result in negative interactions. In the Maasai Mara, Kolowski & Holekamp (2006) found that the main predator species which caused conflict were spotted hyaenas (*Crocuta crocuta*, 53%), leopards (*P. pardus*, 32%) and lions (15%); Kolowski & Holekamp, 2006) but cheetahs (*Acinonyx jubatus*) also occasionally predate

on small stock (Broekhuis et al., 2017b). Broekhuis et al. (2017a) found that during a three-month period, most households had lost an average of 3.5% of their livestock to depredation. This loss can have significant financial implications especially as livestock is the main source of income (Homewood et al., 2012). Furthermore, Maasai people invest a cultural value in livestock that exceeds their economic worth, making losses difficult to bear (Galaty, 1982).

Methods

Data collection

Data were collected using semi-structured interviews (Supplementary Material 1) that were conducted in June and July 2015. Ten Maasai men from the community, who had previous experience in conducting questionnaire-based interviews, were employed to conduct the survey. Before the survey, the interviewers attended a full-day workshop where they were tested on their interviewing and note-taking skills and their ability to use a GPS. The questionnaire was written in English but the interviews were conducted in Maasai. During the workshop each question was discussed and translated into Maasai to ensure consistency in translations between the interviewers.

We were interested in the effect of livestock depredation on attitudes and behavioural intentions, so 820 households that kept livestock were randomly selected for the survey (see Broekhuis et al., 2017a for details). The most senior male of each household was interviewed, as they own the livestock and land, with the interviewer returning at a later date if he was not present. Interviews where data were missing were excluded from the analysis (N = 17). In order to minimise incentives for exaggerating answers, prior to each interview, the interviewee was informed that the survey was independent of the government or any management companies and that no compensation would be provided for livestock losses. Before the interview the purpose was fully explained by the interviewer and the respondents were therefore not misled in any way. Respondents were also informed that they could withdraw from the questionnaire at any time without penalty and that they did not have to answer any questions if they did not want to. The interview commenced only once informed consent was given verbally. All data were treated with

strict anonymity, by removing any personal identifiers, and confidentiality. All respondents agreed to be interviewed.

Assessing attitudes and behavioural intentions

Since predators are not restricted to the wildlife areas and edge effects can have significant negative impacts on protected predator populations (Loveridge et al., 2010), our questionnaire was designed to understand the attitudes and behavioural intentions of people living within or on the periphery of wildlife areas (Fig. 1). Predators are present throughout this area (Madsen, 2017) and we therefore decided to measure attitudes towards predators by asking the question “should people and livestock live alongside predators?”. We defined a “no” or “yes” answer as being a negative or positive attitude respectively. Individuals that were “unsure” (N = 33) were excluded from further analyses. To determine behavioural intentions, respondents were asked “What do you do when your livestock has been killed by a predator?” to which respondents could select one or more of the following answers: nothing, chase predator away, call authorities, call predator projects, kill predator or other. For the analysis, the answers were condensed into those that answered that they would kill a predator and those that did not select this answer. Killing predators is illegal in Kenya and doing so can incur a heavy penalty of a 20 million Kenya shillings fine (US\$ 222,000 exchange rate US \$1 = 90 KES in 2015), life imprisonment or both (Kenyan Wildlife and Conservation Act, 2013 (No. 47 of 2013)). Therefore, this question was asked and interpreted as a hypothetical behavioural intention rather than a self-reported behaviour.

People’s behaviour towards predators can be influenced by several factors including the costs and benefits associated with predators, the inclusion in conservation decisions and having a sense of ownership of predators. To quantify the costs of living with predators, respondents were asked how many livestock they had lost to predators three months prior to the interview. Respondents were also asked whether they thought there were any benefits associated with predators, and if so, what these benefits were. This was an open question and responses were grouped based on their similarities. When asked about their primary source of income respondents

could choose from the following categories: tourism sector, agriculture, pastoralism, business or other. The respondents were then asked whether they leased land to a conservancy, and if so, which conservancy. Respondents who were members of Lemek, Ol Chorro Oiroua, Olarro, Oloisukut and Enonkishu conservancies (N = 23) were excluded from analysis due to small sample size, leaving 747 non-conservancy members and members of Naboisho, Ol Kinyei, Olare-Motorogi and Mara North. Lastly, respondents were asked whether they thought that the predators belonged to the community or the authorities.

Analyses

Respondent's attitudes and behavioural intentions towards predators were analysed separately using a Generalized Linear Model with a binomial error structure and logit link function. For attitudes the response was either yes (people should live alongside predators = 1) or no (people should not live alongside predators = 0). Similarly, for behavioural intentions, the response was either yes (would kill a predator = 1) or no (would not kill a predator = 0) in response to livestock depredation. The predictor variables used to determine attitudes and behavioural intentions were self-reported livestock loss, primary source of income, conservancy membership, and perceptions of whether there were benefits associated with predators and whether the predators belonged to the community. Additionally, we included respondent's attitudes in the behavioural intentions model. The candidate models were ranked using Akaike Information Criterion (AIC) and when one model was superior this was used, otherwise parameter estimates were averaged across models with AIC differences <2 correcting for model weights (Burnham & Anderson, 2002). All statistical analyses were performed in R 3.3.0 (R Development Core Team, 2016).

Results

In total, data from 747 interviews were used to determine people's attitudes and behavioural intentions towards predators in the Maasai Mara, Kenya. Of these, 587 respondents (75.78%) had lost at least one head of livestock to predators during the three months prior to the

interview and 443 respondents (59.30%) thought that there were benefits associated with having predators. The benefits that the respondents named were largely related to tourism, employment, income and development, but some respondents also mentioned ecological benefits (i.e. predators kill herbivores) and aesthetics (Table 1). The majority of respondents derived their primary source of income from pastoralism (n=553, 74%) followed by tourism (n=112, 15%), business (n=46, 6%) and agriculture (n=22, 3%). Of the 747 respondents, 392 (52%) did not lease land to a conservancy and over half of the respondents (n=429, 57.43%) felt that the predators in the area belonged to them rather than to the government or the conservancies.

Attitudes

More than half of the respondents (n=432, 57.52%) thought that people and livestock should live alongside predators. Their response to this question was not associated with the number of livestock that were lost (estimate = 0.008, CI = -0.004 to 0.020) but the belief that predators were associated with benefits did have a positive influence (estimate = 1.709, CI = 1.294 to 2.124). In other words, the majority of respondents who said that predators bring benefits also thought that people and their livestock should coexist with them (Fig. 2). Similarly, the majority of the respondents who said that predators belonged to the community thought that people, livestock and predators should coexist (estimate = 1.286, CI = 0.888 to 1.683, Fig. 2). In addition, a higher proportion of respondents who were members of a conservancy responded “yes” to the question about whether people and livestock should coexist with predators than did respondents who were not members of a conservancy, however, this effect differed per conservancy ($\chi^2 = 135.08$, d.f. = 4, p-value < 0.001, Fig. 2). Of the four conservancies, the majority of the respondents who were members of Olare-Motorogi, Naboisho and Mara North thought that people and livestock should live alongside predators but this was not the case for members of Ol Kinyei. Respondents who were members of Ol Kinyei differed significantly from the three other conservancies (p-value = 0.000) but were similar to respondents who were not members of a conservancy (p-value = 1.000). Occupation

also had an effect ($\chi^2=30.59$, d.f. = 4, p-value < 0.001, Fig. 2) and a higher proportion of respondents working in the tourism industry thought that people and livestock should live alongside predators compared to agriculturists (p-value = 0.001), pastoralists (p-value = 0.001), business people (p-value = 0.001) and other (p-value = 0.034).

Behavioural intention

Only a small number (n=79, 10.30%) said that they would kill a predator if it killed their livestock. The majority of respondents (72.52%) said that they would call the authorities if a predator killed their livestock (Table 2). The behavioural intention of killing a predator if it killed a respondent's livestock was not influenced by the number of livestock that were killed (estimate = 0.008, CI = -0.006 to 0.021), the benefits associated with predators (estimate = -0.309, CI = -0.914 to 0.196), whether the respondent thought that predators belonged to the community (estimate = 0.143, CI = -0.390 to 0.677) or the respondent's occupation ($\chi^2=5.712$, d.f. = 4, p-value < 0.223). However, respondent's behavioural intentions were influenced by their attitude towards predators (estimate = -0.571, CI = -1.048 to -0.101) as the majority of respondents that did not think that people and livestock should coexist with predators said that they would kill a predator if it killed their livestock.

Discussion

The majority of respondents agreed that people and livestock should live alongside predators and this attitude influenced a respondent's behavioural intention towards predators if it killed their livestock. It is possible that, because it is illegal to kill predators, some respondents did not respond truthfully to the hypothetical question whether they would kill a predator if it killed their livestock. Despite this, the results were significant and are likely to be conservative. In addition, the results are corroborated by other studies, especially those that were conducted in Maasailand (e.g. Romañach et al., 2007; Marchini & Macdonald, 2012; Hazzah et al., 2014; Hazzah et al., 2017).

Respondent's attitudes towards predators were influenced by multiple variables but not by the cost of losing livestock. This is similar to findings in other areas (Zimmermann et al., 2005) but it is possible that attitudes could be influenced by loss relative to overall wealth rather than by absolute losses (Romañach et al., 2007; Inskip & Zimmermann, 2009). In addition, costs were measured over a short, three-month time-frame and it is possible that attitudes are shaped by historic or prolonged costs (Kansky & Knight, 2014). Alternatively, experiencing damage might not always be a driver of attitudes (Kansky et al., 2014) as intangible costs, such as fear or alienation, rather than tangible costs, such as direct monetary losses, might be a better predictor of attitudes (Kansky & Knight, 2014).

Our results showed that benefits and employment in the tourism industry had a positive influence on respondent's attitudes towards predators. However, in terms of employment, only a small percentage of the people that were interviewed (15%) got their primary income from being employed in the tourism industry. This is supported by previous findings in the Maasai Mara that income from tourism based activities only contribute to a small proportion of households (Homewood et al., 2012) and favour a small elite (Lamprey & Reid, 2004). Therefore, employment in the tourism industry is likely to only influence the attitudes of a small proportion of the population. However, the majority of the benefits mentioned by the respondents were related to tourism either directly through development, sale of craftwork or visits to cultural *bomas*, or indirectly through leasing land to conservancies for wildlife-based activities. Because of these socio-economic benefits, tourism has increased rapidly in the Maasai Mara (Lamprey & Reid, 2004). While using tourism to link conservation and better livelihoods is a popular tool, it is not always successful (Kiss, 2004). Therefore, care needs to be taken when putting too much emphasis on tourism as high volumes of tourism can have negative ecological impacts (Buckley et al., 2016) which can consequently destroy the tourism product and it can be negatively affected by both national and international events (Homewood et al., 2012). Since the tangible benefits (i.e. employment) were mentioned more often than the intangible benefits (i.e. aesthetic value) we suggest that alternative, wildlife-based incomes,

such as ‘conservation payments’, should be considered. For example, in Belize, people who are part of a jaguar (*P. onca*) camera-trap programme, received payments for captures of jaguars and other key wildlife (Harvey et al., 2016).

A higher proportion of respondents who were members of a conservancy believed that people and livestock should live alongside predators compared to those who did not lease land to a conservancy. This is likely due to the multitude of benefits offered to conservancy members (Bedelian, 2014; Courtney, 2015). However, this was not consistent across the analysed conservancies. Conservancies can provide important resources for livestock in terms of grass, water and salt licks, especially during the dry season (Bedelian & Ogutu, 2017). Prohibiting access to these resources can therefore create animosity. For example, Hazzah et al. (2013) found that restricted access to resources during the dry season was linked to both negative attitudes and behavioural intentions towards lions. As access to resources differ per conservancy, this could reflect the differences in attitudes towards predators between the different conservancy members. In addition, animosity could be increased when herders are fined for grazing in areas or during times when access is prohibited (Bedelian & Ogutu, 2017). Similarly, the presence of compensation (through an insurance scheme which members pay into) and the inclusion of landowners in the decision-making process varied across the different wildlife areas. This inclusion could be an important factor to consider especially as a higher number of respondents who felt that the predators belonged to the community, rather than the authorities, thought that people, livestock and predators should coexist. Inclusion, through a sense of ownership and community engagement, is an important part of effective conservation strategies (Madden & McQuinn, 2014) and our results suggest that conservation politics is likely to influence people’s attitudes. We propose that once management plans are made public, the factors influencing these differences are explored as this would aid future management and coexistence strategies.

We focused our survey on men as Maasai men own the land and livestock and are often associated with the killing of predators, especially lions (e.g. Goldman et al., 2013). However, recent research has shown that women value benefits, such as conservancy membership, differently to men (Keane et al., 2016) and that women may be less tolerant towards predators than men (e.g. Carter & Allendorf, 2016; Harvey et al., 2016). We would therefore advise that women are included in future surveys relating to attitudes and behavioural intentions towards predators. In addition, we measured attitude and behavioural intentions as a dichotomous response but it is likely that both attitudes and behavioural intentions lie on a continuous scale (Treves, 2012). By assessing attitudes and behavioural response on a continuous scale, the strength of these could be measured (Harvey et al., 2016; Hazzah et al., 2017).

It is encouraging that more than half of the respondents thought that people, livestock and predators should coexist especially as exclusion strategies, such as fencing of Africa's wildlife areas (Packer et al., 2013a), are increasingly advocated. However, fencing of an ecosystem such as the Maasai Mara, where free movement is critical for the access of transient resources would be detrimental to both wildlife and people (Notenbaert et al., 2012). Since predator populations are negatively impacted by edge effects (Loveridge et al., 2010), the overall willingness of respondents to coexist with predators bodes well for their conservation. However, a relatively large proportion of respondents (42.48%) felt that people, livestock and predators should not coexist. In the long term, this could have an impact on predator populations as people may look to exclude them from lands out with wildlife areas. Our results suggest that focusing on the benefits, rather than the costs associated with predators, might be a more effective strategy to fostering attitudes of coexistence. In addition, promoting a sense of ownership of predators may enhance a willingness to coexist. We fully acknowledge that more work is needed in order to better understand the complexities of coexistence within this landscape. We propose that future research is conducted within a Theory of Planned Behaviour framework by including factors such as subjective norms and perceived behavioural control (Ajzen, 1991) and we hope that our findings will provide a starting point for that.

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Author contributions

Conceived and designed the study: FB, MK, DKS and NBE. Trained the interviewers: MK and DKS. Supervised data collection: FB, MK and DKS. Informal analysis: MK and DKS. Formal analysis: FB and NBE. Data validation: FB and MK. Wrote the paper: FB and NBE. Reviewed and edited the paper: MK and DKS.

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510

Biographical sketches

512 **Femke Broekhuis, Michael Kaelo, Dominic Sakat and Nicholas Elliot** all work on the Kenya Wildlife
 513 Trust's Mara Cheetah and Lion Projects. The aim of both projects is to enhance coexistence between
 514 predators and people in Maasailand through research and community engagement.

515 Tables

516 Table 1: A summary of the benefits that respondents (n = 747) associated with the presence of
517 predators in the Maasai Mara, Kenya.

Benefit	% of respondents
None	39.74
Employment	26.84
Income	32.39
Tourism	25.16
Development	7.61
Indirect benefits (i.e. building of clinics)	2.58
Kill herbivores and thereby reduce competition for grass	1.68
Kill wildebeest so reduce the presence of diseases that kill livestock	0.39
Aesthetic value	0.65

518

519 Table 2: A summary of the behavioural intentions towards predators in the Maasai Mara, Kenya if a
520 respondent's livestock were killed by a predator.

Behavioural intention	% of respondents
Call authorities	72.52
Chase predator	54.16
Call predator projects *	20.34
Kill predator	10.30
Nothing	13.87

521 *This includes the Mara Cheetah Project, the Mara Lion Project and the Mara Hyena Project.

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