**Evaluation of human attitudes and factors conducive to promoting human-lion coexistence in the Greater Gir Landscape, India**

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| Abstract: | Human-large carnivore coexistence depends on a complex combination of factors that vary substantially from place to place. The population numbers and distribution range of the Asiatic lion (Panthera leo leo) in |
the Greater Gir Landscape has increased in the past two decades. The challenge has been managing the success of conservation with special focus on the spillover population ranging extensively in human landscapes. We undertook an interview-based survey to understand factors conducive to lion survival in this landscape. Overall people expressed a positive attitude towards lions. There was a distinct contrast between people’s ‘liking’ for lions (76.9% of respondents) as compared to leopards (27.7%) in spite of greater depredation losses to lions (82.6%) than to leopards (17.4%). Younger people and respondents having greater awareness regarding lions expressed positive attitudes. While community discussions on lions had a positive effect, there was no evidence that land-holding, management interventions, personal encounters with lions, or association of lions with religion affected attitudes. Respondents who had experienced livestock depredation tended to express negative attitudes. Respondents with positive attitudes towards lions favoured noninterventionist strategies for managing lions ranging in human settlements. When planning conservation, we advocate the consideration of varied factors influencing local tolerance of wildlife. We emphasize that site-specific human-wildlife conflict issues such as crop-raiding by wild ungulates and variation in peoples’ attitude towards different species should also be considered. Specifically, improved livestock management, motivation of local youth and their participation in awareness campaigns could all further strengthen the prevalent positive attitude to lions.
Dear Editor,

Oryx-18-A-0361 Evaluation of human attitudes and factors conducive to promoting human-lion coexistence in the Greater Gir Landscape, India

Many thanks for your very constructive appraisal of this work. We appreciate your efforts, and those of your reviewers.

We have taken all the observations made very seriously and have sought to make appropriate changes in response to them. We hope you will judge that we have improved the ms sufficiently for it to now be acceptable for publication in Oryx. We are, of course, willing to consider any further suggestions you or your reviewers may have if you judge that it is not.

Below, we have included your review in full and have provided a point by point account of exactly how we have reacted.

Regards

Meena V
Thank you for submitting your manuscript to Oryx—The International Journal of Conservation. I have now received recommendations and comments from reviewers (appended below) and invite you to revise your manuscript. The reviewers have commended this work but have made extensive comments that will require close attention.

We are of course pleased to see that the reviewers have commended the work.

The comments are self explanatory and I do not need to expand upon them except to emphasize that, amongst other matters, Reviewer 1 notes the text is overly descriptive and that the social science analysis requires significant development, and Reviewer 2 notes the need for additional details regarding the ethical clearances received and data management and protection.

We have strengthened the social science background to the extent that is relevant to this work and added appropriate references and re-written the Introduction section.

We have also given the details regarding the ethical clearances

In addition, I note the following matters:

1) Table 1 is cited for the first time in the Discussion, and after Table 1. [‘Table 2 intended?’]

The two tables were cited out of order – we agree that these two tables are also collectively confusing as presented in our first draft- see response to next point.

2) The presentation of Tables 1 and 2 is somewhat confusing. Is Table 1 a summary of the findings from Table 2? If this is the case then I think Table 2 could be moved to the Supplementary Material (it is very long) and the caption of Table 1 needs to be improved accordingly.

Table 1 in the first draft was indeed intended to be an ‘at a glance’ summary of which effects are predictors of attitude, together with the direction and magnitude of the effect for continuous or ordinal predictors (it appears as table 2 in the revision). The superscripts are intended to link to the additional table which contains parameter estimates and their SEs (table 2 in the first draft, Supplementary table SI1 in the revision) and/or to graphics illustrating those effect sizes (Supplementary figure SI2 in the revision).

We agree that the current table 2 could be moved to supplementary material. The caption to what was table 1 (table 2 in the revision) has been substantially redrafted to clarify the links to
supplementary tables and figures. The information in the supplementary table is needed for a full interpretation of the models. We have highlighted the changes in the Figure/Table titles for more clarity.

3) Fig. 1: the various grey shades are not all separately discernible.

The figure has been redrawn to improve the contrasts.

4) Fig. 2 appears to be cited out of order, and it is summarizing analyses presented in the tables. It therefore seems redundant and could be deleted.

Figure 2 was indeed cited out of order wrt figure 3 in the first draft. We have corrected this and both figures have been moved to supplementary material as requested (below).

5) Fig. 3 I don't think we learn anything from this that is not apparent in the text, and it could therefore be deleted.

We are inclined to think this figure is a useful depiction of both the contrasting effect sizes comparing peoples’ preferred action concerning lions and leopards which might pose a threat to stock (or humans), and the relative number of responses in each attitude category for the two species. We would prefer to retain it in the main text but have moved it to supplementary material in the revision (SI5). It has been redrafted for ease of interpretation.

6) It is unclear how Table S1, which does not appear to be cited in the text, relates to the other tables. Please kindly clarify.

Table S1 contains the model parameter estimates for predictors of attitude to leopards. It is cited at the end of the results section. We have clarified this in the new draft.

7) Other than 'Supporting Information Figure 1' (which presumably refers to Figure S1) it is unclear whether the Supplementary Figures have been cited correctly, or are even required.

We have ensured that the supplementary figures are properly cited at the appropriate part of the main text. We believe these figures are a user-friendly depiction of how the responses of interested are related to the predictors.
8) I do not feel that the present text makes a good case for the need for this study ('On this basis, we
explore a combination of variables that predict self-reported attitudes and stated behavior
intention of local people towards lions.). This will require careful thought in combination with the
consideration of the points made by Reviewer 2.

We have redrafted the last paragraph of the introduction to address this point.

9) The Human perception surveys section in the Methods provides no details of how 20% of the
households per village were chosen or how long interviews lasted.

We have added this information to the methods.
The actual calculated sample size for 95% CI for the entire study area would be much lower but
this protocol was followed to have a sample frame that provides the best possible coverage of the
target population to be able to have a stratified sample based on the spread of communities
within the village. The sampling design was adopted in previous studies (published) and the
protocol has been followed as part of the long term study.

10) The Results section is difficult to read as it is replete with percents, numbers and statistics. Most
of these data could be moved into the tables, with the Results section considerably shortened,
summarizing the main points.

We agree that the results text in the first draft is dense with numbers – we have, as advised
created a new table (Table 1 in the revision) presenting many of them and this does streamline
the results section.
Overall the present text is overly long for the content and I therefore request that any revised
manuscript is no longer than 5,000 words (all inclusive except tables).

We have been able to revise and condense the body of the manuscript and bring clarity to what needs to
be conveyed. However, based on the Reviews, additional citations, ethics statements and other
clarifications have increased the word counts. We feel that editing out any part of the text would not
justify statistical results and their interpretation. We request that this be considered and that we are
allowed to restrict ourselves to the journal word limits.
Reviewers' Comments to Author

Reviewer: 1

The research reported here should be commended for the extensive effort to map attitudes towards lions and leopards in the Gir area in India. The authors conclude, importantly, that the direct impact of the animals' presence is not the only, or necessarily the most significant, predictor of attitudes towards lions and leopards. Interestingly, leopards were less popular than lions despite causing less trouble. The authors conclude that cultural factors are crucial when it comes to the development of attitudes towards large carnivores.

We are gratified by these positive sentiments, and agree that one of the most interesting of our findings is the marked contrast between lions and leopards with respect to the link between attitudes, behavioural intention and perceived negative effects.

Fear was an important reason for people to dislike leopards. We present that these differences are one of the important factors in framing attitude towards carnivores and should be incorporated in conservation planning.

While this is certainly plausible, from a social science viewpoint the research comes across as fairly superficial despite its use of advanced statistics. Beyond the purely descriptive, the paper has little to offer in terms of explanations (but the patterns it describes may be interesting enough in themselves). To the extent it refers to social science theory, this is also extremely brief.

And somewhat problematic, e.g. when it comes to outlining the relationship between attitudes and action via “behavioral intentions”. While not an uncommon assumption in some strands of social psychology, it cannot be stated as an obvious causal mechanism, given that cultural studies have demonstrated quite clearly the extent to which conflicts over wildlife is embedded in larger, more general societal tensions that may have little to do with wildlife per se. Such studies exist also in India. At a more general level, the notion that actions are always preceded and guided by “values” and “attitudes” is not universally accepted, and should at least be argued in a somewhat more elaborate way.

In countries like India clearly wildlife and people have historically coexisted and there are traditions and cultural aspects that continue to promote such a living. This is both fascinating and contrasting with the western world.

Asiatic lions are surviving in an agrarian habitat in the midst of human habitations. Based on our previous study, we had established that there is a positive attitude or tolerance towards lions. We ask here: what are the factors working in favour of this achievement.

In order to model positive attitude, we first have to define what we would call attitude – we have chosen the definition from literature and to that extent we touch upon social theory. We set the frame here and do understand that there are other theories on values/attitudes vis-à-vis action but these are beyond the underlying objectives of the study.

Perhaps the earlier draft did not articulate these points well enough and made the study to appear superficial to the Reviewer. We have rewritten the Introduction and some parts of the Discussion to better convey our research and its findings.

Conflicts over wildlife is embedded in larger, more general societal tensions that may have little to do with wildlife per se.
We have put conflict with wildlife in the context of the prevalent agrarian lifestyle using the responses to our questionnaire and have attempted to put these issues in perspective.

It is true that it is difficult to provide an explanation of how cultural factors affect attitudes to large predators based on questionnaire data. Such studies provide, by themselves, only a description of the associations between cultural (and other) factors. We believe that such a description is of considerable interest in itself (a view the reviewer appears to be sympathetic towards), and are a prerequisite for a fuller understanding, and therefore for informing policy aimed at promoting tolerance.

The authors suggest that “fostering cultural tolerance for wildlife can promote species survival in a particular landscape”. What does “fostering” mean here? Who will do the “fostering”? What understanding of “culture” underlays such a notion?

The authors cited the concept of “fostering cultural tolerance” from the literature. We have deleted this reference from our Discussion as it doesn’t strengthen what we want to convey. In a conservation context, the meaning of this is implicit and perhaps better explained in the cited research paper.

Several of the explanations suggested in the discussion, which does indeed venture into a cultural realm, are not derived from the data, but seem to stem from other forms of knowledge the authors have of the area and the culture there. Neither are the generally based on research literature, as far as I can see. Therefore, it is hard to assess the merit of these explanations.

The results of the model indicate that

- Livestock depredation, some community and demographic characteristics are likely to create negative attitudes towards lions
- There are differences in attitudes towards lions and leopards
- The Management interventions that are evaluated to be timely by respondents, are not playing a significant role in sustaining a positive attitude
- Does that indicate that more conflict will lead to animosity?
- While there is no evidence for the questionnaire for religious association with lions, what role does culture have to play for lions to survive?
- We show that both cultural and economic considerations are important for conservation and suggest specific interventions
- This study is also useful in indicating how and what are the myriad factors that combine to promote human-carnivore coexistence for application in other carnivore habitats

We do not believe therefore that the discussion is too detached from the reported findings.

As mentioned, the study presents an interesting overview of attitudes/views that people in the area hold, and this may indeed be useful from a management perspective – not least because the lion management already seems to be quite successful. However, as social science aimed at explaining what is going on, the paper falls short in my opinion.

“Lion management seems quite successful” This statement undermines a lot of conservation planning and intervention that is required to save the endangered cat that forms the basis of both this study and also future studies. The objective of the study is to understand beyond what appears to be successful.
In the next phase, we hope to be able to build on the findings reported here to explore further the combination of factors that contribute to conservation planning. There is a literature on wildlife acceptance capacity (WAC) and how to model it. This is beyond the scope of the current study.

In this version of the manuscript, we have tried to strengthen the main messages conveyed through this work

**Reviewer: 2**

This study of Gir landscape in India is based on robust quantitative analyses of questionnaire survey responses, but more needs to be said about research ethics and data protection issues as good practice in publishing. As such, a clear statement of ethical conduct and ethics approval needs to be provided. The data protection issues also need to be discussed in detail and data management described.

We have added a comprehensive statement concerning the ethical standards of the study.
Evaluation of human attitudes and factors conducive to promoting human-lion coexistence in the Greater Gir Landscape, India

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Abstract

Human-large carnivore coexistence depends on a complex combination of factors that vary substantially from place to place. The population numbers and distribution range of the Asiatic lion (*Panthera leo leo*) in the Greater Gir Landscape has increased in the past two decades. The challenge has been managing the success of conservation with special focus on the spillover population ranging extensively in human landscapes. We undertook an interview-based survey to understand factors conducive to lion survival in this landscape. Overall people expressed a positive attitude towards lions. There was a distinct contrast between people’s ‘liking’ for lions (76.9% of respondents) as compared to leopards (27.7%) in spite of greater depredation losses to lions (82.6%) than to leopards (17.4%). Younger people and respondents having greater awareness regarding lions expressed positive attitudes. While community discussions on lions had a positive effect, there was no evidence that landholding, management interventions, personal encounters with lions, or association of lions with religion affected attitudes. Respondents who had experienced livestock depredation tended to express negative attitudes. Respondents with positive attitudes towards lions favoured noninterventionist strategies for managing lions ranging in human settlements. When planning conservation, we advocate the consideration of varied factors influencing local tolerance of wildlife. We emphasize that site-specific human-wildlife conflict issues such as crop-raiding by wild ungulates and variation in peoples’ attitude towards different species should also be considered. Specifically, improved livestock management, motivation of local youth and their participation in awareness campaigns could all further strengthen the prevalent positive attitude to lions.
Introduction

Conservation of endangered species is much easier within Protected Areas (PAs) where stringent wildlife laws are easier to enforce as compared to safeguarding dispersing wild animals ranging outside PAs in human landscapes (Woodroffe & Ginsberg 1998). Resolving human wildlife conflict (HWC) for carnivores ranging beyond the boundaries of PAs is a particular challenge (Treves et al. 2009). A variety of strategies has been implemented to improve human livelihoods and conserve carnivores affected by conflict with humans (van Eeden et al. 2017).

Highlighting benefits associated with the presence of a species, rather than the perceived negative effects associated with it, can improve people’s tolerance of carnivores (Bruskotter & Wilson 2014). Research on HWC has typically focused on quantifying the severity of conflict in terms of its economic impact (Redpath et al. 2012). However, negative impacts of HWC may account only for tangible socio-economic costs and overlook other less visible costs relating to the health and well-being of local communities (Barua et al. 2013). Similarly, benefits are often ill-defined or based on superficial measures that overlook ecosystem services, ecological and economic benefits associated with the focal species and habitat (Meena et al. 2014).

The coexistence of people and wildlife, particularly species of the order Carnivora, requires tolerance even in the absence of material loss - perceived risk of losses can endanger their survival (Vucetich & Macdonald 2017). The perception of HWC often involves much more than material effects and can originate from attitudes and values that are embedded in culture and history (Redpath et al. 2012). Religious and cultural aspects may be as important as economic and ecological attributes (Kellert 1985).
Human tolerance exhibits considerable geographic variation due, at least in part, to human cultural differences (Dickman et al. 2013). It suggests that principles vetted and validated in one system, might not be applicable without nuanced customization to another geographic location. The capacity of people to tolerate carnivore related risks or conflict is important for sustaining threatened species at a local scale (Carter et al. 2012). This reality has important implications for policies aimed at conflict mitigation and long-term conservation planning (Treves et al. 2009).

This inter-disciplinary complexity summarized by Macdonald (2019), means that it is difficult to understand what drives tolerance at a local scale. Therefore, understanding the complexity of human tolerance and coping mechanisms towards carnivores is important for defining management policies (Treves et al. 2009).

**Understanding tolerance**

The nature of human-carnivore interaction, rates of change in conflict frequency, management response to mitigate conflict, proactive awareness campaigns, individual perceptions, and beliefs and strategies to cope with conflict are important attributes determining tolerance (Carter et al. 2012, Dickman et al. 2011). A combination of such factors can help to ascertain mitigation measures that will most repay investment (Hazzah et al. 2009). A clear-cut understanding of what constitutes tolerance and how intolerance will be manifested is required to be able to integrate in carnivore conservation planning. Bruskotter & Fulton (2012) state that passive acceptance of a species is indication of tolerance. Gebresenbet et al. (2017) interpret tolerance as a responsive behavior that is influenced in part by attitude. Bruskotter et al. (2015) view tolerance as the expression of attitudes in behavior and the stated behavioral intention. Evidence of intolerant behavior towards real and
perceived threats from carnivores is expressed as illegal retaliatory killing (Treves and Bruskotter 2014).

It is possible to model the myriad factors contributing to the survival of a carnivore in a human dominated landscape outside a PA where tolerance towards it is well established. While most studies predict tolerance based on conflict parameters, the present study takes a reverse approach and attempts to model the drivers of tolerant attitude as defined above using the Asiatic lion (*Panthera leo leo*) as a case study. In this landscape, lions are not persecuted, are highly regarded and valued by local people (Meena et al. 2014).

**Asiatic Lion**

The persistence of Asiatic lions and their sympatry with leopards (*Panthera pardus*) presents an interesting contrast combination of circumstances for examining the role of human tolerance for carnivore conservation in the human landscape outside the Gir PA. The lion population is currently estimated to be over 500 due to expansive decadal growth (60%) from 2005 to 2015 (Singh 2017). High human tolerance is attributed to the survival of the 40% of the lion population that resides outside the PA. For people sharing the landscape with lions, the cost (livestock depredation and occasional attacks on people) appear to be greater than potential benefits (livelihood, forest resource extraction). Yet, these people have a positive attitude towards lions, seemingly due to an appreciation of the benefits they derive from the Gir PA, strengthened by a sense of pride in living alongside lions (Meena 2012; Banerjee et al. 2013). However, the larger lion population, now dispersing farther from the PA, has been associated with more attacks on both livestock and people (Meena et al. 2014), raising concerns for both lion survival in the face of reprisals and human well-being (Meena 2012). This calls for better understanding the basis of human-lion coexistence.
Interpretive cognitive processes derived from perceptions, experience and understanding of HWC are herein categorized into six factors including demography, conflict experience, management intervention, knowledge, awareness and religious association with lions. We explore a combination of these variables that predict self-reported attitudes and stated behavior intention of local people towards lions and highlight factors that should be integrated into conservation interventions. We specifically ask, what are the factors that are conducive to the survival of lions in the human landscape in spite of the risks they pose? Does this attitude also extend to leopards?

**Methods**

**Study site**

The Asiatic lion range in the Greater Gir Landscape (hereafter GGL), extends across Amreli, Junagadh, Gir Somnath and Bhavanagar districts in the state of Gujarat in western India. A population of about 300 lions occur in the Gir Wildlife Sanctuary and National Park (hereafter Gir PA) within a compact 1800 km² forest area, while the remaining lions occur as three distinct sub-populations in Girnar WLS (33 lions), Coastal Habitats (50 lions) and Eastern Habitats (117 lions) in a more widespread landscape (Singh 2017). The GGL also supports a population of approximately 500 leopards (Singh 2017). Widespread populations of Nilgai (*Boselaphus tragocamelus*) and wild pig (*Sus scrofa*) in the GGL provide the primary wild-prey base for dispersing carnivores (Singh 2017). Dhari Taluka (sub-district) is located adjacent to the north-eastern boundary of the Gir PA in Amreli district. Millets, cotton, groundnut, wheat, pulses and vegetables, are commonly cultivated in this agro-pastoral landscape. The Gujarat Forest Department (GFD) is responsible for Asiatic lion conservation, a Schedule I species of Wildlife (Protection Act) 1972.

**Human perception surveys**
We surveyed 950 households in 21 villages in Dhari Taluka between July 2016 and January 2017. We used a structured questionnaire survey consisting of open-ended as well as fixed response questions on binary or five-point Likert scales (see SI6). Approximately, 20% of the total households per village were interviewed to ensure all communities within the village were represented. The sampling protocols were chosen consistent with previously applied survey methods as part of a long-term research on Asiatic lions (see Meena 2012, Meena et al. 2014). Interviews were carried out in person by one of us (MV) and a project assistant in the regional Gujarati language. Each interview lasted for at least 15 minutes.

The interview included questions framed to determine the context of HWC issues, opinion about lions and leopards, and information under six major factors hypothesized to influence attitude.

**Contextualizing conflict**

We collected information on the major concerns and priorities of residents in the context of other aspects of their agro-pastoral lifestyle. Respondents were asked to return five cards after ranking them in order of the magnitude of the challenges they personally faced both in agriculture (two of the cards indicated ‘seasonal monsoon and crop yield’ and ‘fluctuating annual market value for crops’) and due to proximity to forest (three cards indicated ‘Threat to human life due to carnivore presence’, ‘livestock depredation’ and ‘crop loss due to wild ungulates’). The respondents ranked the most problematic issue as rank ‘1’ and the least problematical as ‘5’.

**Assessment of opinion**

We posed a range of questions related to opinion on lions and leopards: i) Attitude ['Like', ‘Dislike’, or ‘Indifferent’] ii) Salient Emotion on encounter or sighting [Negative: ‘fear’;
Positive: ‘sense of pride’; ‘happiness’; ‘sense of security’; or ‘mixed’ emotions] iii) Desired status - lion management in village areas [‘none desired’ (local extinction); ‘regulated population’; ‘natural unregulated free-ranging’; ‘more numbers’; ‘more numbers elsewhere’].

Factors influencing opinion

We developed a set of predictor variables indicating respondents’ attitudes towards lions. There were 6 categories of covariates related to population characteristics, conflict experience (livestock depredation or close encounter with lions and leopards), GFD management intervention and effectiveness, social awareness, conflict perception, knowledge and religious association with lions. Respondents’ association of lions with religion was solicited via an open-ended question and later categorized as: i) worship (as a form of god); ii) positive association (religious sentiment or faith); iii) popular belief (aware of prevalent religious association but respondent does not relate or subscribe to it); iv) negative association (as an evil incarnation); v) other association (as “wild animal,” “jewel of the forest,” “national animal,” or “king of the jungle”; and vi) no association (Not aware or No opinion).

Data analysis

For contextualizing HWC, each of the issues represented on the five cards was expressed as the frequency with which they were given a particular rank. If in the respondent’s opinion, any of the issues was not relevant (eg: a shop-owner who had no issues related to agriculture or a respondent having no livestock) or if he did not consider any one of the issues as a problem (irrespective of having a negative effect), the card was noted as ‘not rated’ for the issue. Questions related to the opinion of lions and leopards were expressed as percentage of response in each category. We used chi-square contingency tables to explore the relationship between categorical variables.
Emotions and attitudes as defined above were strongly correlated such that models using either as responses gave similar conclusions. We therefore chose the stated attitudes as the principal response variable. We modeled the association between reported attitudes towards lions and the predictor variables using an ordinal response regression model. We built cumulative mixed-effect models using the clmm2 function from ‘ordinal’ R package (Christensen, 2015) of the R software (R core development team, 2017), and we computed the maximum likelihood estimations of parameters via adaptive Gauss-Hermite quadrature approximation, as is recommended (Christensen 2015). We included village identity as a random factor to account for the clustering of respondents in villages.

First we ran a model using only demographic predictors to take advantage of the complete sample. Following this, we fitted a model including other predictors for respondents who reported livestock ownership.

Two interaction terms were included on the basis of a priori hypotheses about the effect of age on attitude: first that it could depend on whether or not a respondent had experienced livestock loss and second that it could be affected by knowledge about lions. We used the ‘Anova.glm’ function of the RVAideMemoire package (Herve 2018) to carry out likelihood ratio tests (permitting single tests for categoric variables with multiple levels). We report these $\chi^2$ values. Effects sizes for these models were visualized with the R ‘effects’ package (Fox 2009).

To explore links between attitudes and behavioral intent, we fitted a model with the ordinal attitude scale as a predictor. The probability of a respondent opting for ‘No intervention’ in response to how lions and leopards outside the PA near human settlements should be managed was treated as a binary response. ‘Capture and release in forest areas’ and ‘captured and retaining in captivity’ options were combined. For this we fitted mixed models, again
treating village ID as a random predictor, using the lme4 package of the R software (Bates et al., 2015). Graphical methods were used to check the validity of linear trends in the response with ordinal predictors (Johnson 2009).

Results

Contextualizing human-wildlife conflict

‘Crop loss due to wild ungulates’ was ranked 1st (primary concern) by approximately 60% of respondents, and ranked 5th by fewer than 1%. Issues connected to ‘livestock depredation’ and ‘threat to human life’ due to lion movement in the village areas were not rated as significant concerns by 40% and 35% of respondents respectively, whether or not they owned livestock and also irrespective of their conflict experience (Fig., 1). ‘Seasonal monsoon and crop yield’ and ‘fluctuating annual market value of crops’ were not rated by 21% and 17% of respondents, respectively.

Assessment of opinion

Lions

79.6% of the respondents “Liked” lions; 18.9% “Disliked” and 1.5% were “Indifferent” to lions. 48.4% preferred ‘natural unregulated population’, 22.5% opted for ‘more lions’, 11.7% opted for a ‘regulated population’, 14.0% opted for ‘more lions elsewhere’ while 2.8% preferred lions to be ‘extinct’ from the areas around the villages. As a response to the question on salient emotion 53.9% reported ‘fear’, while 24.9% felt ‘pride’, 17.5% reported ‘other’ emotions, 2% felt a sense of ‘security’, while 2% had mixed feelings (both ‘pride’ and ‘security’ (n=1) or ‘pride and fear’ (n=3)).
For lions, responses relating to attitude and emotion were clearly linked. Of those respondents who reported ‘dislike’ of lions, 97.7% reported an emotion of ‘fear’ and 1.7% ‘pride’. Emotion was much more divided among those who reported ‘like’ as their attitude to lions: 56.8% of these respondents reported ‘fear’ and 40.7% ‘pride’ with 2.5% reporting ‘security’ (contingency table, $\chi^2 = 94.3$, P<0.001, using respondents who responded with either ‘fear’ or ‘pride’ and omitting the ‘indifferent’ category (n=720), a subset comprising 96.4% % of those providing an answer to both attitude and emotion questions, n= 747).

**Leopards**

69.9% of respondents “Disliked” leopards; 27.7% “Liked” and 2.4% were “Indifferent” to their presence. 42.7% favored “natural unregulated population”; 7.9% opted for “more leopards”, 9.6% “regulated population”, 1.8% had no opinion, 14.3% preferred “more leopards elsewhere”, and 23.7% said they would prefer leopards to be “extinct” from the areas around the villages. As a response to the question on salient emotion 82.4% reported “fear” as their principal emotion on encountering leopards, while 8.4%% felt “pride”; while 8.8% “other” emotions, 0.3% had ‘mixed’ feelings, while 0.1% felt a sense of “security”.

For leopards, reported attitudes and emotions were also linked (contingency table $\chi^2_{[1]} = 120.1$, P<0.001, using the subset reporting ‘like’ or ‘dislike’ and emotions ‘fear’ or ‘pride’, n = 905); almost all respondents reporting ‘dislike’ of leopards reported ‘fear’ to be their principal emotion (97.1%). Of those who reported ‘liking’ leopards, 71.0% reported ‘fear’ and 29.0% ‘pride’. The small number of respondents who were ‘indifferent’ (n=17) were intermediate: 88.2% (n=15) reported ‘fear’ and 11.8% (n=2) ‘pride’.

**Factors influencing Opinion**
Respondent ages ranged between 15 and 82 years of which 20% were in 15-30 age category, 44% were 31-50 and 36% in >51 age-groups. The majority of interviews (97%) were of men given that women reported being mostly confined to activities around their houses. 63% were farmers, 17% practiced both agriculture and other livelihood activities, 20% were engaged in other livelihoods (animal husbandry, business and other salaried jobs). Over 60% of the respondents were medium to large land-holding farmers. Most were Hindus (94%) and the remainder were Muslims. The ethnic composition of Hindus in these villages was diverse and represented by 18 communities. The dominant communities included Patel (45%), Darbar (15%), Maldhari 10% (Ahir, Rabari and Bharwads).

Livestock was kept by 81.5% of the 950 households surveyed, largely for household consumption with only 18% of the livestock owners rearing livestock for commercial purposes. Cattle (32.9%) were the dominant livestock species, while buffalo (25.3%), goats (22.9%) sheep (18.8 %) and horse (0.1%) constituted the remainder of the total livestock holding (N=7382). Fewer households reared goats and sheep mostly for commercial purposes. Cattle and buffalo were the predominantly reared livestock with a mean number (SD) of 5.5 (5.9) per household.

Just over 44.4% of the livestock owners (N=774) had experienced livestock depredation in the past 10 years; 36.7% to lions, 8.1% to leopards while 1.8% had lost livestock to both predators in the past 10 years. Of the overall depredation incidents (N=346), only 34.9% of livestock owners claimed monetary compensation for losses of which 89 claims were completed or reimbursed (Table 1). In the past 5 years, there were only 18 case of injury due to carnivores of which 9 were severe. However, respondents reported 450 incidents of face to face encounters with carnivores (Table 1). In response to questions on social awareness, conflict perceptions and knowledge overall people agreed that carnivore population and conflict has increased in the last 10 years however, majority did not have specific knowledge.
on lion status and population estimates (Table 1). There was also no strong religious association with lions (Table 1).

**Modeling predictors of attitude towards lions**

Based on individual responses, the model indicated factors that predicted positive or negative attitude towards lions (Table 2). The full output of mixed ordinal models predicting respondent attitude to lions is presented in Table SI1. Attitude to lions was more negative in the older age groups (SI2 a), among women, and among livestock owners that had a large number of livestock heads (SI2 b) or experienced depredation losses (SI 2 c). There was also strong evidence for variation among communities (SI2 d). Knowledge related to lion census and community discussions predicted a positive attitude (SI 2 h) while an assessment of increase in HWC led to a negative attitude (SI 2 e). The size of land ownership and religious association with lions were unrelated to attitudes.

A significant interaction between age and knowledge term (Table2) was explained by the age effect being less marked in the ‘no knowledge’ respondents - ‘knowledge’ effect was most clear in the youngest age class (Fig. SI2f). All respondents in the youngest age class who reported knowledge of the census said they ‘liked’ lions (Fig. SI2f). Respondents who agreed that local people and the GFD should work together for lion conservation had a more positive attitude compared with those disagreeing (Table 2, SI2g). The link between attitude and awareness of the rescue and relocation efforts of the GFD was weak (Table 2). There was no evidence that attitudes to lions were affected by experience of livestock loss to leopards (table 1).

Models predicting attitude to leopards using demographic variables, conflict experience, social awareness, and GFD management variables indicated that older respondents and those
with more livestock tended to hold more negative attitudes to leopards, and that there were
differences among communities (Table SI4, Fig., SI5).

**Attitude as behavioral intent**

For lions, 49.2% of respondents stated a preference for “No intervention” for lions detected
near human settlements, while 44.3% opted for ‘capture and release in the forest’; a further
6.5% opted for ‘capture and retained in captivity’. This pattern varied significantly with
attitude (contingency test, $\chi^2_{[2]} = 113.4, P<0.001$, omitting the ‘indifferent category). Of the
people who ‘Liked’ lions, 57% stated their preference for ‘no intervention’; 39% opted for
‘capture and release in forest areas’, while 4% opted for ‘capture and retaining in captivity’.
For the people who ‘Disliked’ lions, the corresponding responses were 17.2%, 65.6% and
17.3%. For ‘Indifferent’ it was 36%, 43% and 21%, respectively, for the same choices. The
probability that a respondent favored ‘no intervention’ therefore increased with more positive
attitudes to lions (mixed logistic model, $PE = -0.99, SE=0.1, z= -9.08, P<0.001$, Fig., SI5a).

In case of leopards, 42.5% stated a preference for “No intervention” for leopards detected
near human settlements. This pattern varied significantly with attitude (contingency test, $\chi^2_{[3]} = 23.3, P<0.001$, omitting the ‘indifferent category). Of the people who ‘Liked’ leopards,
51.2% stated their preference for ‘No intervention’; 46.2% opted for ‘capture and release in
forest areas’, while 2.7% preferred ‘capture and retaining in captivity’. For the people who
‘Disliked’ leopards, the corresponding responses were 39.2%, 50.2% and 10.5%. For
‘Indifferent’ (N=23) it was 34.8%, 43% and 21% respectively for the same choices. The
probability that a respondent favored ‘no intervention’ for leopards increased with more
positive attitudes (logistic regression, $PE = -0.33, SE = 0.08, z= -4.1, P<0.001$, Fig., SI5b).

That the probability increases more steeply for lions (Fig, SI5a) compared with leopards is
demonstrated by the interaction term in a logistic mixed model including ‘species’ and
‘attitude’ as predictors (LR test for species*attitude interaction: $\chi^2_{[1]} = 7.3$, $P=0.007$, mixed model with village and respondent as random effects).

**Discussion**

**Cultural bias towards species**

Lions are considered to be an integral part of the landscape as a majority of people expressed a positive attitude towards them: 80% ‘liked’ lions compared to a mere 28% who ‘liked’ leopards. The negativity towards leopards was not associated with a greater prevalence of livestock loss to leopards compared with lions – on the contrary, the trend was in the opposite direction. ‘Fear’ was reported to be the dominant emotion much less frequently for lions (54%), compared with leopards (84%) while ‘pride’ was more commonly reported towards lions (25% compared with 8% for leopards). Noninterventionist management strategies were related to positive attitude and were more marked for lions (Fig., SI5). Thus, people’s perceptions of their interaction with carnivores are subject to varying interpretations with respect to the particular animal. While certain problematic species have a high level of tolerance and acceptance among people (Kaltenbon et al. 2006; Saraswat et al. 2015), for certain other species, there is a lower threshold of tolerance regardless of the extent of conflict they are involved in (Farhadina et al. 2017). Suryawasni et al. (2014) observed that attitudes to snow leopards (*Panthera uncia*) in Trans-Himalayan India were more positive than to wolves (*Canis lupus*) and this relationship was not correlated with the amount of economic damage attributed to the species: cultural bias for charismatic species can thus dominate the effect of other predictors. It is therefore important to incorporate such variability in attitude towards sympatric species in conservation planning.

**Survey highlights**
We found that attitudes of local people were linked to behavioral intention: respondents with positive attitudes towards lions were much more likely to favour ‘no intervention’ for lions in human habitation (Fig., SI5). An opinion driven by fear of encountering a potentially dangerous carnivore species frequently, almost on a day-to-day basis, may be very different from the perception of the species in general terms. In our survey, negative attitudes expressed by women towards lions can be attributed to fear. This is also the basis of the negative attitude expressed by communities who are resident in the periphery of villages and more vulnerable to attacks by carnivores. Furthermore, when a given species causes economic loss its acceptability declines to the extent that it becomes vulnerable to direct persecution (Kleiven et al. 2004). Herein, people who experienced livestock loss expressed more negative attitudes towards lions whereas close encounters of people with lions is neither a significant predictor of attitude nor is it a highly rated problem (Table 2; Fig., 1).

Younger respondents expressed more positive attitude and were also better informed about local lion movement, the endangered status of the species and conflict issues. Contrary to the expectation that the opinion of elders in the community would be rooted in cultural beliefs and traditions, older respondents showed a distinct ‘indifference’ to lions and were especially negative if they had faced livestock loss. Respondent status (land-holding) is also not important as a predictor of attitude. Frequent social discussions indicated an avid interest in lions and forest-related topics and such individuals had a positive attitude towards lions (Table 2). Since age, awareness and social discussions significantly influenced positive attitude, conservation awareness campaigns could further strengthen this goodwill towards lions.

**HWC management**
Overall, the GFD management is not a predictor of people’s attitude towards lions - at least for the current observed level of conflict. This also indicates that the negative attitude arising from depredation loss is directed towards lions rather than at GFD as their responsibility. Therefore, given the highly plausible causal relationship, management efforts should focus on reducing losses through better livestock protection measures. Such engagement with local people might also help allay the underlying sense of fear expressed even by a majority of people who ‘liked’ lions. However, individuals who showed disinclination for local people to work with the forest department for lion conservation showed a clear negative attitude towards lions (Table 2, SI2 g). Whether this is a result of the inter-personal relationship of the concerned individual with the local staff needs to be examined and if so, rectified.

Monetary compensation does not necessarily resolve conflict but by alleviating losses, promotes tolerance in people inhabiting wildlife interface areas. The efficacy of compensation for depredation losses, property damage and human injury in HWC mitigation is debatable (Mishra et al. 2003; Bulte & Rondeau 2005; Dickman et al. 2011; Ravenelle & Nyhus 2017). It requires a responsive action from verification, filing and approval of a claim to be considered effective. For instance in Bhadra Tiger reserve, south India, people were less critical of the fact that the compensation scheme underestimated their livestock losses to large carnivores, but were more critical of the bureaucratic procedures involved (Madhusudhan 2003). In the study-area, respondents were appreciative of the commitment shown by the staff in processing their claims but were more critical of the value compensated.

Responsive action to rescue distressed wild animals (trapped or fallen in open wells), relocate problem animals (perceived as a threat to human safety) and treatment of injured or disease stricken animals (wildlife health monitoring) by the GFD was widely appreciated but not a strong predictor of attitude towards lions. Villagers gather to witness these risky and challenging operations undertaken by the GFD staff. These operations are an opportunity for
the GFD to interact closely with local people, to build a trusting relationship and enable an
easy exchange of information with regard to status of wild animals moving unrestrained in
village areas (Table 1, Meena et al. 2014). This manner of dealing with ‘problematic wild-
animals’ has been criticized as being ineffective in HWC mitigation by scientists (see
Athreya et al. 2011). However, at the field-level, GFD officials are under great pressure to act
on the demand of local people; to act swiftly in the best interest of both people and wildlife.
Such an intervention can pre-empt aggressive retaliation by people and can ensure safety of
animals.

Crop-raiding by wild ungulates rated higher than issues related to crop-yield, income from
farming, perceived danger of encountering lions and loss due to livestock depredation (Fig.,
1). Crop raiding has a direct effect on local livelihoods in the agrarian landscape – one might
imagine the presence of lions discourages the attentions of crop-raiding species (Fig., 1). This
should be a key issue to be addressed to win over local support for conservation.

Is there cultural tolerance?

Religious affiliations, cultural norms, beliefs and reverence towards certain species determine
the nature of people’s interaction with wildlife, interpretation and manner of dealing with
HWC (Hazzah et al. 2009; Bhatia et al. 2017; Gebresenbet et al. 2017). A positive cultural
affinity towards animals and their natural environment work largely in favour of wildlife
conservation in India (Khoshoo 1997; Krishna 2010). We found no evidence that religious
association with Hindu deities or reverence towards lions either determined attitude towards
lions or the manner of dealing with conflict issues (Table 2). The remarkable survival of lions
in GGL is associated with the local people’s appreciation of the ecological balance and the
role of the lion as an apex predator in maintaining this balance (Meena 2012). People have a
history of coexistence with lions. Almost all (94%) of our respondents have been resident in
these areas over several generations and for 90%, livestock rearing has been a traditional
practice. Communities such as the Darbars consider their fearless affinity for lions as being
related to their own regal heritage. Sentiments of this nature lead to a sense of pride and
identity of people with lions. Pastoral communities like the Maldharis have settled in this
region for close to 200 years and have a history of coexistence with lions. With this comes an
acceptance of events like depredation as being natural and inevitable when carnivores and
pastoralist share a common habitat. Responses such as “Lions do not eat grass”; or “Lions
will have to hunt and kill for survival” reflect these sentiments. Lions sometimes even enter
people’s houses and kill livestock. The loss notwithstanding, once the livestock is killed, the
carcass is moved to the village edge or open areas where the lion(s) can feed undisturbed.
This comes from a philosophical acceptance of circumstances. Even while rating the
challenges related to crop-yields and profits from farming, people felt that these things
fluctuate, tending to be beneficial in one year and unfavourable in another, in line with the
pragmatic idiom that ‘you win some, you lose some’. Only 17% and 7% of the respondents
who were predominantly farmers rated seasonal monsoon and fluctuating market rates
respectively as their primary problem (Fig., 1).

This cultural acceptance of predation, people’s regard for lions and more so for their own
livestock, are equally important drivers of this tolerant coexistence. For instance, it was
noteworthy how few people (only 34.9%) opted to claim compensation for depredation losses
to which they were entitled. They claimed to have a sentimental aversion to claiming
compensation for their valued livestock. In one of the villages, the money obtained as
compensation for depredation losses is donated to the local gaushala (cattle shelter).
Unproductive livestock are not sold off but are set free in the common village grounds.
Actions such as these are a prevalent norm in most parts of the country (Kolipaka 2015).
Therefore, when the focus is shifted to the people’s overall ethos towards nature rather than
of one-particular animal and its positive and negative influence on the individual, the
persistence of wildlife and their coexistence with people in India can be better understood.

On the other hand, as a result of an historical coexistence and absence of deliberate
persecution, lions are shown to have developed a tolerant coexistence with people.
(Rangarajan 2013). Thus, applying a similar reasoning, resilient survival of lions has been
attributed to its lack of fear and acceptance of people (Rangarajan 2013). Understanding these
cultures and their interaction with wildlife is key to HWC
management.

Through identifying the factors contributing to human-lion coexistence at the interface of the
Gir PA and human settlements, we emphasize the breadth of factors that must be taken into
account, and integrated, during conservation planning. Straddling the balance between
cultural tolerance mechanisms, people’s high regard for lions on the one hand and mobilizing
the interest of local youth with emphasis on awareness creation will be the important role of
GFD and its conservation planning.

Author contributions
Study design: VM, AZ; fieldwork: VM; data analysis: VM, PJ and writing the article: All
authors

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Ethical standards The research was carried out with the necessary approvals and permits from the Gujarat Forest Department, India. Informed consent was obtained verbally from every participant before the interview, and participants were made aware of their rights to voluntarily participate or decline. All participants were informed as to the purpose of the study and were assured that they would not be identified to any third party. It was made clear that responses to all questions would remain confidential and would not be used for any other purpose than had been explained to them. There were no questions that could be judged ‘sensitive’ in the sense of a query concerning illegal activity for example. The study complies with the criteria of the British Sociological Association Statement of Ethical Practice (BSA 2017). The research did not involve experimentation with animals or collection of specimens.

References

Athreya, V., Odden, M., Linnell, J. D. & Karanth, K.U. (2011) Translocation as a tool for mitigating conflict with leopards in human dominated landscapes of India. Conservation Biology, 25, 133-141.

Banerjee, K., Jhala, Y.V., Chauhan, K.S. & Dave, C.V. (2013) Living with lions: The economics of coexistence in the Gir Forests, India. PLoS ONE 8, e49457.

Barua, M., Bhagwat, S. A. & Jadhav. S. (2013) The hidden dimensions of human–wildlife conflict: health impacts, opportunity and transaction costs. Biological Conservation, 157, 309-316.

Bates, D., Maechler, M., Bolker, Walker. B.S. (2015) Fitting Linear Mixed-Effects Models Using lme4. Journal of Statistical Software, 67, 1, 1-48. doi:10.18637/jss.v067.i01.
Bhatia, S., Redpath, S. M., Suryawanshi, K. & Mishra, C. (2017) The Relationship between religion and attitudes toward large carnivores in northern India. *Human Dimensions of Wildlife*, 22, 30-42.

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.

Carter, N. H., Riley, S. J., & Liu, J. (2012). Utility of a psychological framework for carnivore conservation. *Oryx*, 46, 525-535.

Christensen, R. H. B. (2015) ordinal - Regression Models for Ordinal Data. R package version 2015.6-28. [http://www.cran.r-project.org/package=ordinal/](http://www.cran.r-project.org/package=ordinal/).

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.

Dickman, A. J., et al. (2013) The importance of the human dimension in addressing conflict with large carnivores. In *Key Topics in Conservation Biology* (2), (eds., D. W. Macdonald & K. J. Willis), Oxford, Oxford University Press. 2, 110-126.
van Eeden, L. M., et al. (2017) Managing conflict between large carnivores and livestock. *Conservation Biology*, 32, 26-34.

Farhadinia, M. S., Johnson, P. J., Hunter, L. T., & Macdonald, D. W. (2017) Wolves can suppress goodwill for leopards: Patterns of human-predator coexistence in northeastern Iran. *Biological Conservation*, 213, 210-217.

Fox, J. and Hong, J. (2009) Effect Displays in R for Multinomial and Proportional-Odds Logit Models: Extensions to the effects Package. Journal of Statistical Software, 32(1), 1-24. URL http://www.jstatsoft.org/v32/i01/.

Gebresenbet, F., Beraki, B., Yirga, G., Sillero-Zubiri, C. & Bauer, H. (2017) A culture of tolerance: large carnivore coexistence in the Kafa highlands, Ethiopia.

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.

Hervé, M. (2018) RVAideMemoire: Testing and Plotting Procedures for Biostatistics. R package version 0.9-69-3. https://CRAN.R-project.org/package=RVAideMemoire

Johnson, P.E. (2009). Working with Ordinal Predictors. Midwest Political Science Association Research Paper. Retrieved from http://pj.freefaculty.org/Papers/MidWest09/Midwest09.pdf, 2016-01.

Kaltenborn, B.P., Bjerke, T., Nyahongo, J.W. & Williams, D.R. (2006) Animal preferences and acceptability of wildlife management actions around Serengeti National Park, Tanzania. *Biodiversity and Conservation*, 15, 4633-4649.
Kellert, S.R. (1985) Social and perceptual factors in endangered species management. *Journal of Wildlife Management*, 49, 528–536.

Khoshoo T.N. (1997) Conservation of India's endangered mega animals: tiger and lion *Current Science*, 73, 830-842.

Kleiven, J., Bjerke, T., & Kaltenborn, B. P. (2004) Factors influencing the social acceptability of large carnivore behaviours. *Biodiversity & Conservation*, 13, 1647-1658.

Kolipaka, S. S., Persoon, G. A., De Iongh, H. H., & Srivastava, D. P. (2015) The influence of people’s practices and beliefs on conservation: A case study on human-carnivore relationships from the multiple use buffer zone of the Panna Tiger Reserve, India. *Journal of Human Ecology*, 52, 192-207.

Krishna, N. (2010) *Sacred animals of India*. Penguin Books, India.

Macdonald, D. W. (2019) "Mammal conservation - old problems, new perspectives, transdisciplinarity and the coming age of conservation geopolitics." *Agricultural and Resources Economics Review*.

Madhusudan, M. D. (2003) Living amidst large wildlife: livestock and crop depredation by large mammals in the interior villages of Bhadra Tiger Reserve, South India. *Environmental Management*, 31, 0466-0475.

Meena, V. (2012) *Managing Success: Asiatic lion conservation, interface issues and attitudes of local communities in Greater Gir landscape*. Report submitted to RSGs, UK.

Meena, V., Macdonald, D. W., Montgomery, R.A. (2014) Managing success: Asiatic lion conservation, interface problems and peoples’ perceptions in the Gir Protected Area. *Biological Conservation* 174, 120-126.
Mishra, C., Allen, P. McCarthy, T. O. M., M. D. Madhusudan, A. Bayarjargal, & Prins, H. H. (2003) The role of incentive programs in conserving the snow leopard. Conservation Biology 17, 1512-1520.

R Core Team (2017) R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

Rangarajan, M. (2013) Animals with rich histories: The case of the lions of Gir Forest, Gujarat, India. History and Theory, 52, 109-127.

Ravenelle, J., & Nyhus, P. J. (2017) Global patterns and trends in human-wildlife conflict compensation. Conservation Biology, 31, 1247-1256.

Redpath, S. M., et al. (2013) Understanding and managing conservation conflicts. Trends in Ecology & Evolution 28, 100-109.

Saraswat, R., Sinha, A., & Radhakrishna, S. (2015) A god becomes a pest? Human-rhesus macaque interactions in Himachal Pradesh, northern India. European Journal of Wildlife Research, 61, 435-443.

Singh, H. S. (2017) Dispersion of the Asiatic lion Panthera leo persica and its survival in human-dominated landscape outside the Gir forest, Gujarat, India. Current science, 112, 933-940.

Treves, A. (2009) The human dimensions of conflicts with wildlife around protected areas. Wildlife and society: the science of human dimensions, 214-228.

Vucetich, J. A. & Macdonald, D. W. (2017) Some essentials on co-existing with carnivores. Open Access Government August 216-217.
Woodroffe, R. & Ginsberg, J.R. (1998) Edge effects and the extinction of populations inside protected areas. *Science*, 280, 2126–2128.
Table 1 Responses to factors influencing local attitude towards lions: variables are in bold and response choices for questions within each variable is indicated in brackets. All responses are expressed as overall percent response (N=950)

| Survey Item                                                                 | Response (%) |
|----------------------------------------------------------------------------|--------------|
| **Conflict Experience**                                                    |              |
| [Lion, Leopard]                                                            |              |
| Have you experienced livestock depredation, if so by which animal? (N=346) | 82.6 17.4    |
| Have you had close encounters? (N=450)                                     | 66 34        |
| **Management intervention and effectiveness**                               |              |
| Monetary compensation for losses (N=89)                                    |              |
| How would you rate compensation amount against value of depredated livestock? | 70 12 9 9    |
| How would you rate efficiency of processing of claims                      | 38 14 22 25  |
| Would you make the effort to communicate information related to forest/wildlife in your village/farm? [Yes, No, Not sure] | 82 11 7      |
| Should local people support the efforts of GFD* in forest conservation?    | 33.7 48.7 10.2 5.5 2.4 |
| **Social Awareness**                                                       |              |
| [I witnessed, I heard, Not aware, No incident]                             |              |
| Are you aware of depredation incidents in the village in the previous year? | 67.2 18.9 2.5 11.1  |
| Are you aware of GFD Animal rescue operations?                             | 83.6 12.1 4.3 - |
| How often do you discuss subjects related to forests and lions with friends and community members [Never, Sometimes, Often] | 25.5 52.3 22.2 |
| **Conflict Awareness** (trends for past 10 years)                          |              |
| [Strongly Agree; Agree; Neutral; Strongly Disagree; Disagree]              |              |
| There has been increase in conflict (depredation and attacks)              | 61.5 21.6 9.1 7.5 0.3 |
| Conflict increase due to increased carnivore population                    | 27.8 29.0 22.7 15.4 5.1 |
| Conflict Increase due to increased human-livestock numbers                 | 13.1 25.5 23.1 34.1 4.2 |
| Conflict is perceived to be increased due to media reporting               | 5.9 18.4 38.6 33.9 3.2 |
| **Lion population trend in past 10 years**                                 |              |
| [Increased; decreased; remained same; No idea]                             | 88 3 1 8     |
| **Knowledge about lions**                                                  |              |
| [Aware; Partially Aware; Not Aware]                                        |              |
| Global Status and Latest lion census estimate                              | 13 36 51     |
| **Religious association with lions**                                       |              |
| [Positive Association; Popular belief; Negative Association; Other Association; No Association; No Opinion] | 37 7 2 6 46 2 |

* Gujarat Forest Department
### Table 2

| Variables                        | Effect of predictor on Attitude to Lions | Method          |
|----------------------------------|-----------------------------------------|-----------------|
| **Socio-Demographic parameters** |                                         |                 |
| Age                              | More negative in the older age groups \(^1,3\) | \(\chi^2[1]=12.7, \ P<0.001\) |
| Gender                           | More positive attitudes for men\(^1\)   | \(\chi^2[1]=3.5, \ P=0.06\) |
| Livestock keeping                | Greater livestock holding more negative\(^1\) | \(\chi^2[1]=3.2, \ P=0.07\) |
| Land-holding (status)            | No association with land-holding\(^1\)  | \(\chi^2[1]=0.12, \ P=0.73\) |
| Community                        | Strong evidence for variation among communities\(^1,3\) | \(\chi^2[9]=29.0, \ P<0.001\) |
| **Conflict Experience**          |                                         |                 |
| Livestock depredation to lions   | Greater livestock loss more negative\(^2,3\) | \(\chi^2[1]=4.7, \ P=0.02\) |
| Direct Encounter of people       | No effect of reported close encounter    | \(\chi^2[1]=0.6, \ P=0.43\) |
| Livestock depredation to leopards| No association                           | \(\chi^2[1]=0.71, \ P=0.40\) |
| **GFD Management**               |                                         |                 |
| Value of financial compensation  | No association                           |                 |
| People’s participation in GFD’s conservation goals | More positive for those agree compared with those disagreeing | \(\chi^2[1]=35.0, \ P<0.001\) |
| **knowledge**                    |                                         |                 |
| Global status of lions           | No association\(^2\)                     | \(\chi^2[1]=1.98, \ P=0.15\) |
| conflict had increased in the previous ten years | More negative for those who agreed\(^2,2\) | \(\chi^2[1]=3.8, \ P=0.05\) |
| Knowledge of lion census estimate | More positive for those who are aware$^2$ | $\chi^2_{[1]} = 15.7$, $P<0.001$ |
|----------------------------------|---------------------------------------------|---------------------------------|
| Interaction: Knowledge of census and respondent age | Knowledge effect more marked among younger age category | $\chi^2_{[1]} = 7.7$, $P=0.006$ |
| **Social Awareness**             |                                             |                                 |
| Participation in social discussions on lions and forest topics | Frequent discussions associated with more positive attitude | $\chi^2_{[1]} = 5.9$, $P=0.01$ |
| Awareness about wild-animal rescue and relocation by GFD | The link between attitude and awareness of GFD efforts was weak | $\chi^2_{[1]} = 1.83$, $P=0.15$ |
| **Religion**                     |                                             |                                 |
| Religious association with lions | No association with attitude                | $\chi^2_{[4]} = 6.3$, $P=0.18$ |
Figure 1. Contextualizing human-wildlife conflict in Dhari Taluka, India based on challenges faced in agriculture (‘seasonal monsoon and crop yield’ and ‘fluctuating annual market value for crops’) and proximity to forest (‘Threat to human life due to carnivore presence’, ‘livestock depredation’ and ‘crop loss due to wild ungulates’) by 950 respondents. Individual ranking of the five issues expressed as the frequency with which they were assigned a particular rank. Cards that did not apply to an individual or when not classified as a problem in respondent opinion were ‘not rated’.
SUPPLEMENTARY INFORMATION

SI1. Table SI1 Parameter estimates in models predicting attitude to lions, demography model (a), and full model (b). [was table 2]

SI2. Figure SI2. Effect size plots for ordinal response models predicting attitudes to lions. generated using R ‘effects’ package (Fox, 2009). [was figure S1].

SI3. Table SI3. Parameter estimates in models predicting attitude to leopards [was SI1].

SI4. Figure SI4. Effect sizes in ordinal models predicting attitudes to leopards [was SI3].

SI5. Figure SI5. Logistic model predicting probability of a respondent opting for the ‘allow to move unrestrained’ in response to the question about desired management of lions (a) and leopards outside protected areas and near human habitation. Raw data shown ‘jittered’ at 0 and 1. (x axis: Attitude with values 1 = ‘dislike’, 2= ‘indifferent’, 3 = ‘like’). [was figure 3]

SI6. Interview questionnaire [was SI4]

Table SI1. Parameter estimates in mixed ordinal models predicting respondent attitude to lions (1=’dislike’, 2=’indifferent, 3 = ‘like’, hence positive Parameter Estimates (PE) indicate more positive attitude). Model SI2a included demographic variables alone. Full model (SI2b) included socio-demographic factors, conflict experience, GFD management, social awareness, knowledge, and religion with self-reported attitude towards lions based on questionnaire survey of 990 people in Dhari Taluka, India between July 2016 and January 2017. Significant relationships are indicated in bold

| Variables               | Predictor levels                      | PE  | SE  | z value | P    |
|-------------------------|---------------------------------------|-----|-----|---------|------|
| SI1a. Only socio-graphic factors |                                       |     |     |         |      |
| Socio-Demographic parameters |                                       |     |     |         |      |
| Age (years)             | Ordinal, 3 age classes                 |     |     |         |      |
|                         | 1 : <30; 2 : 31-50; 3: >50             | -0.47 | 0.13 | -3.51   | 0.000 |
| Gender (ref =female)    | Categoric,                             |     |     |         |      |
|                         | Levels Male, Female                    | 0.82 | 0.43 | 1.92    | 0.055 |
| Land-holding (bigha)    | Ordinal,                               |     |     |         |      |
|                         | 0: no land                             | -0.04 | 0.11 | -0.35   | 0.730 |
|                         | 1: 0.4 - 4.4                           |     |     |         |      |
| Livestock-holding (numbers) | Ordinal | P | 0.05 | 0.075 |
|-----------------------------|---------|---|------|-------|
| 0: No livestock             | -0.26   | 0.15 | -1.78| 0.075 |
| 1: 1-9                      |         |    |      |       |
| 2:10-30                     |         |    |      |       |
| 3: 31-100                   |         |    |      |       |
| 4: >100                     |         |    |      |       |

| Community                   |         |   |     |       |
|-----------------------------|---------|---|------|-------|
| 1: Maldhari-Ahir, Bharwad (ref level) |         |   |     |       |
| 4: Brahmin                  | 1.50    | 0.72 | 2.08 | 0.038 |
| 5: Dalit                    | 0.33    | 0.48 | 0.70 | 0.486 |
| 6: Darbar                   | 1.46    | 0.43 | 3.37 | 0.001 |
| 7: Kadhia, Kumbhar          | 0.27    | 0.49 | 0.55 | 0.580 |
| 8: Koli                     | 0.84    | 0.53 | 1.56 | 0.118 |
| 10: Patel                   | 0.55    | 0.34 | 1.62 | 0.106 |
| 12: Muslim                  | 1.00    | 0.51 | 1.97 | 0.049 |
| 13: Devipujar               | -0.82   | 0.63 | -1.30| 0.193 |
| 14: Others                  | 1.67    | 0.59 | 2.85 | 0.004 |

SI1b. All factors

**Socio-Demographic parameters**

| Gender Male                  | 0.20    | 0.53 | 0.37 | 0.71 |
|------------------------------|---------|------|------|------|
| Age                          | -0.41   | 0.21 | -1.96| 0.05 |
| Land-holding                 | -0.09   | 0.14 | -0.67| 0.50 |
| Livestock-holding            | -0.36   | 0.17 | -2.13| 0.03 |

**Conflict Experience**

| Livestock depredation        | Categoric |   |     |       |
|------------------------------|-----------|---|------|-------|
| 0:N; 1:Y                     | -1.52     | 0.74 | -2.05| 0.04  |
| Category                                                                 | Scale                  | Mean | SE  | Median | P-value |
|-------------------------------------------------------------------------|------------------------|------|-----|--------|---------|
| Direct human-lion encounter                                             | Categoric              | -0.20| 0.25| -0.78  | 0.43    |
|                                                                         | 0:N, 1:Y               |      |     |        |         |
| GFD Management                                                          | Ordinal                | -0.72| 0.12| -5.78  | 0.00    |
| Agreement on people’s participation in GFD’s conservation goals         | 1:SA; 2: A; 3: N; 4:D; 5: SD |      |     |        |         |
| Social Awareness                                                        | Categoric              | -0.27| 0.32| -0.86  | 0.38    |
| Awareness about wild animal rescue and relocation by GFD                | Witnessed (ref level)  |      |     |        |         |
|                                                                         | heard about it         |      |     |        |         |
|                                                                         | not aware              |      |     |        |         |
| Perception of community discussion re lions                              | Ordinal,               | 0.27 | 0.11| 2.43   | 0.01    |
|                                                                         | 0: Never; 1: Rarely; 2: Sometimes; 3: Often |      |     |        |         |
| Knowledge                                                               | Categoric              | 8.39 | 3.20| 2.62   | 0.00    |
| Knowledge of lion Census estimate 2015                                   | (0 : N, 1 : Y)         |      |     |        |         |
| Global status of Asiatic lion                                            | Categoric              | -0.32| 0.22| -1.40  | 0.16    |
|                                                                         | (0 : N, 1 : Y)         |      |     |        |         |
| Perception of lion population trends                                     | Ordinal                | -0.38| 0.37| 2.43   | 0.32    |
|                                                                         | 1:increased, 2:same, 3:increased |      |     |        |         |
| Agreement concerning human-carnivore conflict increase in previous 10 years | Ordinal                | 0.28 | 0.15| -1.01  | 0.00    |
|                                                                         | SA:1; A:2; NO:3; D:4; SD:5 |      |     |        |         |
| Religion                                                                | (ref= negative)        |      |     |        |         |
| Religious association related to lions                                   |                        |      |     |        |         |
| Positive association related to religion                                |                        | -0.95| 0.53| -1.80  | 0.07    |
| None                                                                    |                        |      |     |        |         |
| ‘Other’ Associations                                                     |                        | -2.14| 0.93| -2.29  | 0.02    |
| Commonly believed but respondent does not subscribe                     |                        | -0.85| 0.67| -1.27  | 0.20    |

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| Age* experience of stock loss | Interaction effect | 0.43 | 0.30 | 1.42 | 0.16 |
|--------------------------------|--------------------|------|------|------|------|
| Age* knowledge of lion population | Interaction effect (Fig. SI2f) | -2.67 | 1.14 | -2.36 | **0.02** |
Figure S12. Effect sizes in ordinal response models predicting attitudes to lions.

a) Age effect (demography model)

b) Livestock size effect (demography model)
c) Livestock lost to lions? (0 = N, 1 = Y, all effects model)

![Graph showing attitude vs. stock lost to lions]

d) Community/caste (demography model). Codes for x axis as in SI1.

![Graph showing attitude vs. caste]
e) Reported perception that conflict has increased in last ten years (all effects model, Likert scale predictor from Strongly Agree = 1 to Strongly Disagree = 5 on x axis)

f) Interaction between age category and reported knowledge of lion census estimate (0 = no knowledge, 1 = aware)
g) Opinion on cooperation between people and forest department (all effects model, Likert scale predictor from Strongly Agree = 1 to Strongly Disagree = 5 on x axis)

![Graph showing attitude vs agreement on cooperation]

h) Reported respondent awareness of discussion about lions and other forest related topics (x axis 0=never, 1= rarely, 2= sometimes, 3= often)

![Graph showing attitude vs awareness of discussion re Gir]
Table SI3

Output of mixed ordinal models predicting respondent attitude to leopards (1=’dislike’, 2=’indifferent, 3 = ‘like’, hence positive Parameter Estimates (PE) indicate more positive attitude). Variables included socio-demographic factors, conflict experience, GFD management, social awareness, knowledge with self-reported attitude towards leopards based on questionnaire survey of 990 people in Dhari Taluka, India between July 2016 and January 2017.

Coefficients:

| Variables                                | Estimate | Std. Error | z value | Pr(>|z|) |
|------------------------------------------|----------|------------|---------|----------|
| Gender Male                              | 0.51575  | 0.55298    | 0.933   | 0.35098  |
| Age (years)                              | -0.34545 | 0.12146    | -2.844  | 0.00445 ** |
| Land-holding (bigha)                     | 0.15405  | 0.10605    | 1.453   | 0.14634  |
| Livestock holding (numbers)              | -0.33939 | 0.15431    | -2.199  | 0.02785 * |
| Livestock depredation                    | 0.20483  | 0.31713    | 0.646   | 0.51835  |
| Direct human-leopard encounter           | -0.09993 | 0.24706    | -0.404  | 0.68588  |
| Heard about carnivore rescue and relocation by GFD | -0.08903 | 0.28642    | -0.311  | 0.75592  |
| Not aware of carnivore rescue and relocation by GFD | -0.39802 | 0.51266    | -0.776  | 0.43753  |
| Agreement on human-carnivore conflict has increased in last 10 years | 0.01688  | 0.09541    | 0.177   | 0.85956  |

Figure SI 4. Effect sizes in models predicting attitudes to leopards.

a) Community/caste effect (demography model)
b) Livestock size category (demography model)

c) Age category (demography model)
Figure SI5. Logistic model predicting probability of a respondent opting for the ‘allow to move unrestrained’ in response to the question about desired management of lions (a) and leopards (b) outside protected areas and near human habitation.
Assessment of cultural parameters conducive for lion conservation in Gir landscape

Research questionnaire for village-level interviews
Questionnaire Structure

I. DEMOGRAPHICS .................................................................................................................... 3
II. LIVESTOCK RELATED DETAILS .......................................................................................... 3
III. EXPERIENCE ...................................................................................................................... 4
IV. KNOWLEDGE .................................................................................................................. 9
V. SOCIAL NORMS ............................................................................................................... 9
VI. RELIGION/RITUAL/ART/Architecture ............................................................................... 9
I. DEMOGRAPHICS

1. Date:
2. Village Name:
3. Name of person:
4. Male/Female Age:
5. Number of household members:
6. Religion
   - Hindu
   - Muslim
7. Caste (Specify):
8. Resident since:
   - Born (Resident)
   - Migrant (past 10 years)
   - Migrant (since 11-20 years)
9. How much land-holding do you have (bigha):
   - 0.4–4.4
   - 4.5–8.4
   - 8.5–16.4
   - >16.5
10. Occupation
   - Agriculture
   - Daily wage labour
   - Animal husbandry
   - NTFP (non-timber forest produce) collection
   - Self-employed/business
   - Employed in Forest department
   - Other government job
   - Others

II. LIVESTOCK RELATED DETAILS

11. What is the size of Livestock holding

| COW          | BUFFALO          |
|--------------|------------------|
| Calf | Ox | Female |
| Pregnant | Productive | Non productive |
| Calf | Male | Female |
| Pregnant | Productive | Non productive |

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12. You been rearing livestock for the past (years)

☐ <10    ☐ 11-20    ☐ 21-30    ☐ <31

13. Compared to your livestock holding 10 years ago, today it has

| Increased by | Decreased by | Remained the same | Do not know | Other (state below) |
|--------------|--------------|-------------------|-------------|--------------------|
| 10%          | 10%          |                   |             |                    |
| 20%          | 20%          |                   |             |                    |
| 30%          | 30%          |                   |             |                    |
| 40%          | 40%          |                   |             |                    |
| 50%          | 50%          |                   |             |                    |

14. What do you rear livestock for

☐ Commercial purpose    ☐ household consumption

15. If you deal in sale of milk and milk products what is the average monthly income from livestock rearing

Rs.

16. Typically what are the measures you take to protect your livestock from predation?
(Supervised grazing by day, Building/enhancing of boundary wall around the house, secure corral for the livestock, Avoid forest and forest edge areas, others (specify))

17. Approximately how much do you think you might have spent last year on guarding livestock from predation (Average monthly)

Rs.

18. List priorities of your life

Monsoon and crop yield; Market rates for crop; Threat to life; livestock predation; Crop raiding

III. EXPERIENCE

• Livestock loss

19. Have you ever experienced livestock loss due to predation?

☐ Previous year (2015-16)    ☐ 1-5 years back    ☐ 6-10 years back

20. Which animal attacked your livestock?

☐ Lion    ☐ Leopard    ☐ Both
21. How many incidents of livestock predation have you experienced in the past year (2015-16)?

22. Details of livestock loss due to predation in the previous year

- Buffalo
- Cow
- Goat
- Sheep

- Female
- Lactating
- Non lactating

- Male
- Calf
- Sub-adult
- Adult

23. In your village, during the last one year, are you aware of other incidents of livestock loss due to predation?

- Yes, I heard
- Yes, I have witnessed an incident involving somebody I know
- I think so, may be
- Not aware
- No

24. Have you ever claimed monetary compensation provided by forest department for loss due to predation?

- Yes
- No, I have not experienced any loss
- No, I decided not to claim

25. If you have had predation loss and have claimed compensation, what is your feedback on the compensation scheme

|                          | Poor | Fair | Good | Very Good | Excellent |
|--------------------------|------|------|------|-----------|-----------|
| Compensation Amount      |      |      |      |           |           |
| Claim related procedures |      |      |      |           |           |
| Processing and refund    |      |      |      |           |           |
| Others (specify)         |      |      |      |           |           |

26. What does this loss mean for you?

- Loss in income
- Personal loss
- Both

27. If you been in a situation where you have lost your livestock to predation give 3 words that describe your state of mind or emotion relating to the incident

28. Among factors that threaten the well-being of your livestock

|                          | Significance |
|--------------------------|--------------|
|                          | None | Least | Moderate | Great | Greatest |
| Predation Risk           |       |       |          |       |          |
| Natural cause related to health and disease |       |       |          |       |          |
| Resource availability owing to seasonal changes |       |       |          |       |          |
● **Encounter with people**

29. What is the frequency of your sighting of lion and leopard in a month?

|       | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|-------|---|---|---|---|---|---|---|
| Lion  |   |   |   |   |   |   |   |
| Leopard |   |   |   |   |   |   |   |

30. When you had sighted a lion/leopard what time of day was it?

| FREQUENCY OF SIGHTING | Once | Twice | Thrice | 4 times | 5 times | 6 times | 7 times |
|----------------------|------|-------|--------|---------|---------|---------|---------|
| Not very often       |       |       |        |         |         |         |         |
| Average              |       |       |        |         |         |         |         |
| Very often           |       |       |        |         |         |         |         |

**LION**

- Early morning (Dawn)
- Day-time
- Evening (Dusk)
- Night

**LEOPARD**

- Early morning (Dawn)
- Day-time
- Evening (Dusk)
- Night

31. Have you had a close encounter with lion or leopard?

- [ ] Yes, with lion
- [ ] Yes, with leopard
- [ ] Yes, with both
- [ ] Never
32. Describe your experience (circumstance, way of dealing and emotions)

33. What was the lion/leopard’s reaction to your presence during the encounter
   - [ ] It was not aware of my presence
   - [ ] Was aware but unperturbed by my presence
   - [ ] It was aware & moved away from the spot
   - [ ] Displayed aggression on seeing
   - [ ] It attacked on seeing me

34. If attacked, were you injured?
   - [ ] Yes, severely
   - [ ] Yes, mildly
   - [ ] No

35. If you have been attacked and injured by lion and leopard what is your feedback on the compensation scheme

| Compensation Amount | Poor | Fair | Good | Very Good | Excellent |
|----------------------|------|------|------|-----------|-----------|
| Claim related procedures |      |      |      |           |           |
| Processing and refund |      |      |      |           |           |
| Others (specify)     |      |      |      |           |           |

36. What sort of animal is the lion – describe in your own words? (associated characteristics, adjectives used, positive and negative points)

37. In your opinion the presence of lions in your village vicinity means
   - [ ] Reduction in crop loss due to wild ungulates
   - [ ] Security and safeguard for the village and forest
   - [ ] Threat to human life
   - [ ] Economic loss due to livestock predation
   - [ ] Having to follow stringent rules and laws imposed in name of conservation

38. What is your attitude toward the following

|          | Like | Indifferent | Dislike | Do not know |
|----------|------|-------------|---------|-------------|
| Leopard  |      |             |         |             |
| Lion     |      |             |         |             |
39. If you have been in a situation where you have come face to face with lion/leopard give 3 words that describe your state of mind or emotion relating to the incident

40. What is your emotion toward the lion

☐ Pride   ☐ Security   ☐ Fear   ☐ Others (Specify)

41. What is your emotion toward leopard

☐ Pride   ☐ Security   ☐ Fear   ☐ Others (Specify)

42. According to you in the past ten years, lion population has

☐ Increased   ☐ Decreased   ☐ not changed   ☐ No idea

43. Livestock predation and carnivore attack on people has increased in last ten years

☐ Strongly agree   ☐ Agree   ☐ No idea/neutral   ☐ Disagree   ☐ Strongly disagree

44. The perception of increase in human-carnivore conflict in past 10 years is because of greater communication and media attention

☐ Strongly agree   ☐ Agree   ☐ No idea/neutral   ☐ Disagree   ☐ Strongly disagree

45. More records of incidents related to livestock predation and carnivore attack on people in past ten years is because of increase in human population and reduction in natural habitats

☐ Strongly agree   ☐ Agree   ☐ No idea/neutral   ☐ Disagree   ☐ Strongly disagree

46. More records of incidents related to livestock predation and carnivore attack on people in past ten years is because of increase in carnivore population

☐ Strongly agree   ☐ Agree   ☐ No idea/neutral   ☐ Disagree   ☐ Strongly disagree

47. In your opinion what should be the nature of carnivore population in the village habitats

|          | Extinct | Regulated Population | Natural unregulated population | No opinion | More Numbers | More numbers elsewhere |
|----------|---------|----------------------|-------------------------------|------------|--------------|------------------------|
| Lions    |         |                      |                               |            |              |                        |
| Leopards |         |                      |                               |            |              |                        |

48. What would you do if you come across an injured or distressed wild animal in your farm or village vicinity

☐ Inform local forest department staff   ☐ Inform sarpanch   ☐ Inform Van Mitra

☐ Not do anything

49. Are you aware of the forest department animal rescue and relocation operation?

☐ Yes, have witnessed   ☐ Yes, have heard about it   ☐ No, not aware
50. According to you, lions and leopards moving outside forest in village areas should be

☐ Allowed to move unrestrained  ☐ Captured and relocated
☐ Captured & retained in captivity

51. Do you think local people and Forest department should jointly work towards lion conservation?

☐ Strongly agree  ☐ Agree  ☐ No idea/neutral  ☐ Disagree  ☐ Strongly disagree

IV. KNOWLEDGE

52. Are you aware of lion population numbers (latest 2015 census)?

53. Where else would you find the Asiatic lions apart from Gir?

V. SOCIAL NORMS

54. How often do people in your community talk about lions attacking people?

☐ Never  ☐ Rarely  ☐ Sometimes  ☐ Often

55. What happens here when a lion appears on someone’s land?

☐ It is chased away  ☐ We will contact forest department  ☐ We carry on as usual
☐ Be alert and avoid approaching it

56. What would you neighbours expect you to do, if a lion came onto your land?

VI. RELIGION/RITUAL/ART/Architecture