Project Update: September 2019

This update is regarding the social surveys administered and the respective findings and recommendations in the Yala buffer zone region. It will be followed by an update regarding incidents of livestock depredation and the relevant results of regression models.

Results

Respondent characteristics

Respondents (n=61) were divided into five age categories: 18-28 (25%), 29-39 (31%), and 40-50 (34%), 51 + (10%). All respondents owned livestock, and all were male. 74% of respondents were pastoralists, with the remaining 26% of respondents rearing livestock to supplement their agriculture and/or public sector employment.

Variables affecting attitudes towards leopards in Yala

Respondents' attitudes towards leopards was most influenced by how much respondents valued the conservation of all wildlife species around them (0.053 ± 0.009, p=4.85e-07), their level of knowledge about leopard ecology and behaviour (-6.742 ± 2.466, p=0.008), their level of knowledge about the economic importance of leopards (-0.103 ± 0.038, p=0.009) and their socio-demographics (0.022 ± 0.013, p=0.09). Socio-demographics is the only predictor variable that was not statistically significant, however the addition of it into the model improved residual diagnostics, and it was thus kept in the final model.

Table 4. Final model predictors, B coefficients, standard error and upper/lower confidence intervals (CI). * denotes statistical significance.

Predictor	B estimate	Standard error	Upper 95% CI	Lower 95% CI
Importance of conservation of all species *	0.053	0.009	0.070	0.034
Knowledge of leopard ecology *	-6.742	2.466	-11.411	-1.879
Knowledge of leopard tourism benefit *	-0.103	0.038	-0.176	-0.029
Socio-demographics*	0.022	0.013	-0.003	0.047

Livestock enclosures used and conflict mitigations supported

We observed four main forms of livestock enclosures: steel chain-link enclosures with a fixed roof, steel chain-link enclosures with no roof, partial steel chain-link walls with segments of barbed wire and/or thorn brushes, and enclosures made of primarily thorn brushes and lined with barbed wire. The more enclosed and reinforced the enclosure was (i.e. steel chain-link walls with a fixed roof), the better this method served to reduce perceived depredation, with no livestock being lost from leopard attacks if they were kept in these enclosures. As the enclosure became dismantled (i.e. roof was taken off, or walls were supplemented with thorn bushes or barbed wire), the effectiveness in preventing depredation events decreased. Table 5 summarises the percentage of respondents who used each enclosure method, and the average percentage of perceived livestock depredation experienced.

Table 5. Livestock enclosures used by respondents and proportion of perceived livestock depredation

Livestock enclosure materials and method	Percentage of respondents using penning method	Average percentage of perceived livestock depredation
Steel chain-link enclosure with roof	3.28	0.00
Steel chain-link enclosure walls, no roof	11.48	2.86
Partial steel chain-link walls with segments of barbed wire/thorn bushes/sticks	19.67	8.13
Thorn bushes and barbed wire enclosures	65.57	13.07

Various conflict mitigation techniques were proposed to livestock owners, some of which have been tested but to varying degrees. The most practical mitigation techniques we suggested and the level of support they received are as follows: using trained livestock guarding dogs (6.56%), increasing human presence while livestock are grazing (34.43%), increasing human patrols during the night (when perceived depredation incidents take place the most) (36.07%), relocating cattle to lower-risk areas (e.g. further from the national park boundary) (57.38%), light and sound distractions (73.77%) and using

reinforced enclosures (98.36%). Fig.3. displays the results for each mitigation proposed and the percentage of respondents who supported the testing and potential implementation of them.

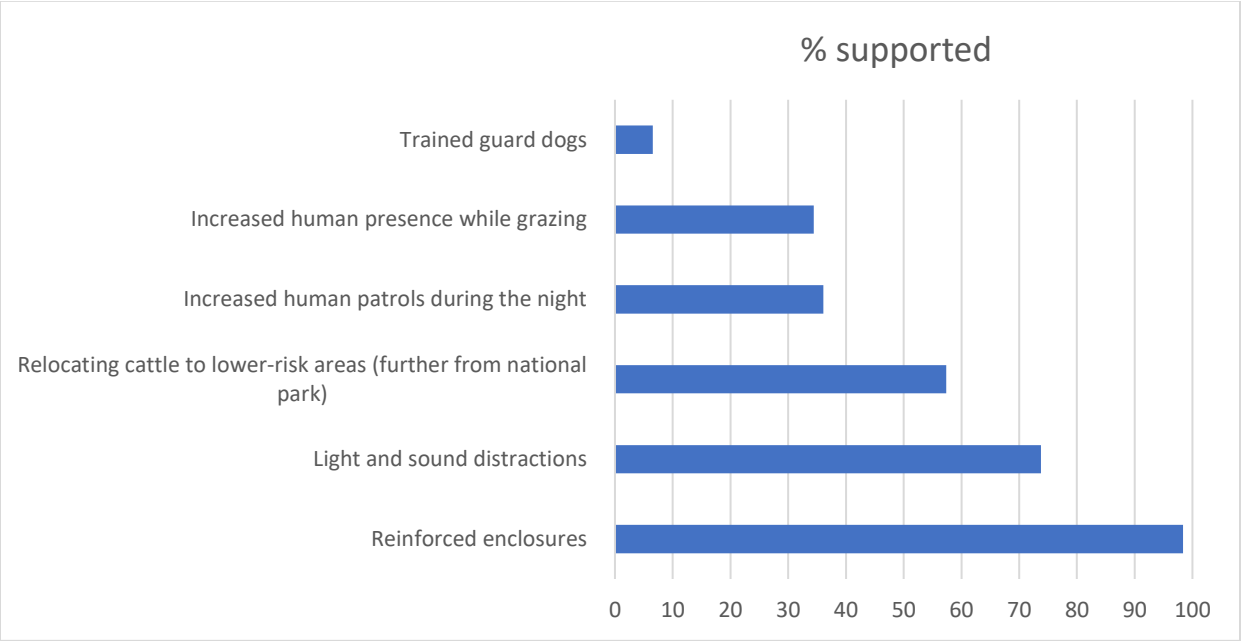

Fig.3. Percentage of respondents who supported the testing of proposed conflict mitigation techniques.

Recommendations

General recommendations for future studies

Surveys provide a quantifiable description of attitudes, trends and behaviour of a population by studying a representative sample [1]. The livestock owners interviewed in the Yala buffer zone region provided what we believe is a representative sample for the region. Further community engagement and interviews should be followed up with questions regarding retaliatory measures being taken and more of a focus on tolerance towards livestock losses, which we omitted from this study. Attitudes and behavioural intentions are often uncorrelated with actual behaviour [2,3] and therefore it is important to assess both attitude and actual behaviour at site-specific contexts. If attitude and actual behaviour are correlated, then assessing these attitude predictors will meaningfully help the design and focussed targeting of mitigations – and if they are not correlated, then expending resources trying to alter attitudes (e.g. through education programs, training) may be a waste of limited resources [4]. Perceived risks and perceived livestock losses may exceed actual livestock losses due to leopards, and we recommend verification of depredation incidents to be conducted over a longer period of time in order to accurately assess livestock depredation caused by leopards. Fostering genuine relationships and building trust with the community is a crucial first step in addressing HWC, and can help facilitate positive attitudes towards wildlife in the future. Engaging with the communities for as long as possible, and demonstrating a willingness to listen and help is a short-term methods for long-term conflict reduction as mitigation measures are tested, monitored and implemented [5]. We found that speaking to livestock owners

in larger groups was an effective way for them to contribute their own experiences and respond to the experiences of others (often people that they knew personally) allowing for open dialogue between livestock owners who each had their own individual experiences to share.

Variables affecting attitudes towards leopards in Yala

In our study site, people's attitudes towards leopards were influenced by four variables that had undergone Exploratory Factor Analysis. While representing only four variables in the model, in reality these four variables encompass many terms and responses into one index, so the amount of data influencing this model is much larger than any other top model in this study. The level to which respondents valued the conservation of all wildlife species around them and the socio-demographics both had positive relationships with attitudes towards leopards. The more respondents value wildlife in general around them, the more favourable they were to leopards. Respondents answered with the same level of appreciation (either positive or negative) for all wildlife species around them 97% of the time, with only 3% of respondents selecting leopards as the one species they do not value, compared to others. The variable socio-demographics comprised of age, number of dependents and number of years spent rearing livestock. As these metrics increased, attitudes towards leopards are more favourable. This can be due to increased age and presence in this landscape giving older respondents more perspective of the realities of living in a buffer zone environment, as they have been experiencing depredation sometimes for decades, and have come to accept it as a natural occurrence when rearing livestock in this habitat. As one respondent said, "My father worked here, I work here, and my son will work here. We have to get used to this." Likewise, multiple respondents with young children (and therefore a higher number of dependents) often told us stories of how happy it made both them and their children to see wildlife around them, especially "cute" species such as the rusty spotted cat (*Prionailurus rubiginosus*).

The level of knowledge about leopard ecology and behaviour, and the level of knowledge of the economic importance of leopards both had negative relationships with overall attitudes. This result is contrary to our hypothesis of a positive effect, and contrary to findings that have shown increased knowledge being an predictor of pro-environmental attitudes (e.g. knowledge about droughts can be predictors of pro-environmental behaviours like water conservation efforts) [6,7]. Our result may be due to the notion that the more respondents knew about how leopards use this shared landscape, the more they could foresee future conflicts with their own livestock and livelihoods. During conversations with respondents, many knew about the preferential selection for calves over native prey, as they "provide an easy meal they don't have to work for", as domesticated cattle lack the natural instincts and defences of wild prey, and are often tied up inside enclosures, limiting their movement. This increased knowledge of leopard prey selection may make these respondents feel more threatened in terms of their calves and the stability of their livelihoods. Similarly, increased knowledge of the economic value leopards bring to the country influenced respondents to be less favourable towards leopards. Particularly in Yala where leopard sightings are a main tourist attraction, livestock farmers who face the realities of living alongside leopard's everyday receive zero compensation and little attention from this industry.


We formed positive connections with community members and government wildlife department staff, giving us greater confidence in our results.

Most effective livestock husbandry methods

Steel chain-link enclosures with a roof were the best way to prevent depredation incidents, with no properly maintained enclosure resulting in any reported depredation. These enclosures are around 10 feet wide x 15 feet long and 5.5 feet high, with a capacity for around 35 calves. The main issue is the expense, and the fact that current enclosures are only given out to limited livestock owners by one luxury hotel in the region as part of a CSR programme. We suggest that they involve the farmers in the process of building these enclosures to reduce construction costs, and to reinforce the fact that they need to be involved in regular maintenance in order to maintain their effectiveness. Only 3.28% of respondents had this form of enclosure, with 11.48% having only the enclosure walls present (i.e. no roof). Removing this roof piece is likely to increase depredation risk of cattle inside, and as such resulted in an average increase of 2.86% of livestock lost. Another major problem we discovered during site visits was that farmers dismantled the steel enclosures, and spaced each panel with barbed wire and thorn bushes in an effort to fit more cattle inside. What this does is reduce the effectiveness of the enclosure, and leopards and enter and kill cattle as a result, with farmers reporting 8.13% of their cattle being lost in this way. Respondents told us that many times when leopards enter these pens, they kill multiple cattle at a time, but only take the carcass of one.

In the trans-Himalayan region of Ladakh, where livestock were increasingly being lost to depredation by snow leopards, rural appraisal methods were used to engage the community and to determine more suitable solutions to promote coexistence, as opposed to government-mandated compensation schemes [8]. With the improved corrals installed and incidents of depredation reduced, this resulted in an increased sense of responsibility and pride from the community, and a greater tolerance of snow leopards. This is an example of a community-created approach that both enhanced local livelihood and facilitated coexistence in the region. Our study site provides an appropriate context where similar collaborative solutions can be applied. The approximate cost of each pen ranges from Rs. 40,000-80,000, depending on the price of steel and the workmanship involved. We believe that encouraging livestock owners to participate in sourcing the materials and constructing the enclosures will help increase their motivation to maintain it (e.g. using leftover motor oil to wipe the chain link to avoid

rust caused from cattle urine, a problem mentioned by many), and allow them to be used for a longer period of time while reducing the overall cost of maintenance.

Mitigations tested and supported by the community

Certain mitigations tested (e.g. light distractions) have different meanings depending on the context. Many livestock owners have tested light mitigations in the form of hanging a flashlight above their cattle pen, to allow it to move with the wind and create some natural movement. This will likely not serve as an effective deterrent. Upon initial conversations, when we suggested trying other light mitigations many livestock owners were against this, claiming to have tried it with no success. However, once we described in detail and showed them variations of light mitigations that they could try (e.g. Foxlights® (Bexley North, Australia), that have worked to reduce depredation by pumas in Chile [9] by changing the colour and frequencies of light emitted), more livestock owners began to show interest. The use of LED lights has also worked in reducing nocturnal depredation incidents in Kenya in areas adjacent to Nairobi National Park [10], and is one method that can be tested with relative ease and affordability in our Sri Lankan study system.

In these larger group meetings, we found that the mitigation supported by the most people was an alternative fencing system, using cheaper materials than steel (which is prone to increased taxes in Sri Lanka). In Hwange National Park, Zimbabwe, using PVC plastic sheets lining the livestock pens have proven to be effective at limiting depredation, though this is used in conjunction with guarding systems. Livestock owners we spoke with told us that using taller (around 3m) plastic sheets may be effective, and an easier method of enclosing their cattle. We also were advised that these pens may only work if kept in open areas, away from any trees that leopards can climb and attack from. We feel that by providing livestock owners with an alternative form of cattle enclosures that they can easily create themselves and maintain, would act to reduce depredation incidents and reduce their dependence on the CSR programs that sporadically donate steel enclosures to specific farmers, leaving others helpless. This alternative penning system, perhaps used in conjunction with affordable light mitigations such as Foxlights®, may serve as a more sustainable and attainable way of protecting livestock.

A group meeting we had to discuss mitigation options and feasibility

Compensation schemes and wildlife premium mechanisms (WPMs)

Compensation schemes are a method used to alleviate loss of livelihood experienced by livestock depredation by predator species. It has been implemented in places such as Brazil, India and Kenya [11–13]. Currently no such scheme exists for livestock depredation experienced in Sri Lanka. For a compensation scheme to be successful, it must be linked to community participation and changes in livestock husbandry practices [5]. Livestock owners estimated a payment of around Rs. 100,000 would be appropriate for each proven livestock lost to depredation, based on the profit earned per litre of milk (Rs. 70/L) and that milk can be obtained for 7 months of the year.

Compensation schemes may be prone to "problems of perverse incentives" [14], for example livestock owners wanting price paid per animal to increase, leading to an unsustainable system. Livestock owners seemed interested but there needs to be a clear way for compensation to work through tourism ventures (e.g. luxury hotels and guests paying into this scheme each safari they go on), as many have lost faith in the government to be able to manage such a scheme. As these farms are located on buffer zone land, it is not recommended to begin a compensation program as it may attract more farmers to the area, also contributing to the problem of overgrazing.

Alternatively, a wildlife premium mechanism (WPM) has been proposed to include specific performance-based payments to help meet conservation goals for endangered species, to be nested within Reducing Emissions from Deforestation and Forest Degradation (REDD+) and other Payment for Ecosystem Services (PES) schemes, that currently lack robust criteria to ensure wildlife conservation occurs when seeking REDD+ payments [15]. Incorporating WPMs can allow stakeholders in developing countries such as Sri Lanka to generate income by recovering and maintaining populations of endangered fauna that also serve as umbrella species, helping to protect other species that co-occur in the same landscapes as well as aiding carbon sequestration efforts [15]. Cattle farmers in Yala voiced frustration at the lack of benefits they receive from leopard-related tourism, with zero respondents claiming they have earned a profit. This is a key challenge outside protected areas: how to get local communities to view large carnivores as net economic assets despite facing issues of livestock depredation experienced on a personal level. WPM may provide such economic incentive to encourage these livestock-rearing communities to conserve populations of leopards outside the national parks, and earn a profit as a result [15]. Communities that received economic benefits through tourism in Nepal were more tolerant of their presence [16], indicating a potential pilot study to be done in Sri Lanka in hopes of finding the same results.

Establishing trust and capacity building with government departments

Our discussions with cattle farmers illuminated a common distrust they felt with the Department of Wildlife Conservation (DWC), who has jurisdiction over the buffer zone habitats adjacent to Yala National Park. Historical unrest and distrust have existed between these two groups, as livestock rearing is technically not allowed in these areas, but has existed for multiple generations. There have been recent improvements in communication between DWC officials and some cattle farmers, however there is a need for a widespread training and capacity-building program that integrates cattle farmers, DWC, the dairy co-operative and relevant NGOs that can provide support for facilitating coexistence. Individuals and institutions involved with any level of HWC need to undergo training and

education regarding the development and implementation of government procedures, local procedures and programs, and what relevant governing laws exist [5]. Cattle farmers told us that even the presence of one or two open-minded DWC staff have made a difference in the communication they have had with the department. Developing a wider training program can help ensure continuity and a sustainable, positive relationship between cattle farmers and the DWC regardless of who specifically is employed at the time.

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