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Snow leopard stewardship in mitigating human–wildlife conflict in Hemis National Park, Ladakh, India

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Introduction

Among large predators, snow leopards (*Panthera uncia*) and co-predators (e.g., wolves *Canis lupus*, lynx *Lynx lynx*) often cause economic losses, engendering animosity from local communities in the mountain ecosystem across south and central Asia (Din et al., 2017; Jackson & Lama, 2016; Maheshwari, Takpa, Kujur, & Shawl, 2010; Schaller, 2012). These economic losses range from around US $50 to nearly $300 per household, a significant sum given per capita annual incomes of $250–400 (Jackson & Wangchuk, 2004; Mishra, 1997). Recent efforts such as improved livestock husbandry practices (predator-proof livestock corrals – closed night shelters with covered roof with wire-mesh and a closely fitting iron or wooden door that can be securely locked at night) and community-based ecotourism (e.g., home stays, guides, porters, pack animals, campsites) are providing alternative livelihood opportunities and mitigating large carnivores–human conflict in the snow leopard habitats (Hanson, Schutgens, & Baral, 2018; Jackson, 2015; Jackson & Lama, 2016; Vannelli, Hampton, Namgail, & Black, 2019). Snow leopard-based ecotourism provides an opportunity to secure livelihoods and reduce poverty of the communities living in ecotourism sites across Ladakh (Chandola, 2012; Jackson, 2015). To understand the role of snow leopard-based ecotourism in uplifting the financial profile of local communities, mitigating large carnivore–human conflict and eventually changing attitudes towards large carnivores in Hemis National Park, Ladakh, India, we compared the estimated financial gains of a snow leopard-based ecotourism to stated livestock predation losses by snow leopards and wolves.

Methods

The Hemis NP extends over 4000 km² in the Ladakh region of the Trans-Himalayan range of Jammu and Kashmir state (Figure 1) (Anon, 2007). Snow leopards and the wolves are the prime carnivore species of the region (Bhatnagar, Wangchuk, & Jackson, 1999). We conducted semi-structured surveys with all 87 households in 17 villages within the Hemis NP. The eldest or main earning member of the family (subject to their availability) was interviewed during the last quarter of 2016. Information was gathered on socio-economics, livestock holdings, predation by wild carnivores, and perceptions for the years 2015 and 2016.

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Figure 1. Location map of villages that were sampled in Hemis National Park, Ladakh, India.
Results

Livestock Predation Patterns

The average livestock holding was 38.56 ± 5.65 animals per household out of which 71% of total holdings were goats or sheep, followed by horses (8%), cows/yak or dzo/dzomo (hybrid of yak and cow) (5%), and mules (0.59%). The highest livestock attacks were recorded in Markha (20%) followed by Sku (17%) and Hankar (16%) villages. The 91 cases of livestock predation reported 3.6% of total livestock predation in the Hemis NP during 2015–2016. The highest number of livestock predation cases were reported in winter (50% in both 2015 and 2016), followed by summer (28% in 2015 and 36% in 2016), Autumn (13% in 2015 and 7% in 2016), and spring (9% in 2015 and 7% in 2016). Most of the incidents took place in pastures (78%), followed by corrals (9%), villages (7%), and crop fields (6%) (Table 1).

Attitudes

Most (64%) of the respondents had positive attitudes towards snow leopards, 28% held negative attitudes, and the remaining were neutral. Over three-quarters of respondents (78%) showed negative attitudes towards Tibetan wolves followed by 13% positive and 9% neutral.

Income Generation from Ecotourism

The ecotourism-based annual income of the residents of the Hemis NP varied between US $123 and $6153 during the study period constituting about 54% of the total income, which used to be 36% in 2005–2006 (Chandola, 2012; Directorate of Economics and Statistics, J&K, 2017). All respondents reported that tourists’ visual encounters of the charismatic snow leopard and associated species (e.g., wolves, lynx, ibex Capra sibirica, blue sheep Pseudois nayaur) are the major contributions in community-based ecotourism.

Discussion

Community-based ecotourism in the Hemis NP is one of the rare ecotourism models that revolve around wildlife, especially snow leopards (Hanson et al., 2018; Vannelli et al., 2019). Respondents claimed that ecotourism led to a shift in their local livelihoods from pastoralism. Ecotourism has brought economic benefits to local communities (Hanson et al., 2018; Jackson, 2015).

<table>
<thead>
<tr>
<th>Total livestock population (and mean holding per household)</th>
<th>Percentage (%) of livestock predation across sites</th>
<th>Data source</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Corral/village</td>
<td>Pasture land</td>
</tr>
<tr>
<td>3977 (50.3 animals/household)</td>
<td>38</td>
<td>62</td>
</tr>
<tr>
<td>3650 (33.8 ± 43.4 animals/household)</td>
<td>30</td>
<td>49</td>
</tr>
<tr>
<td>3494 (38.5 ± 5.6 animals/household)</td>
<td>16</td>
<td>78</td>
</tr>
</tbody>
</table>
Wildlife ecotourism is often used to link wildlife management with economic incentives to promote conservation (Campbell, 1999; Hanson et al., 2018; Vannelli et al., 2019). Locals have now more positive attitudes towards snow leopards and wolves since 1999 (Bhatnagar et al., 1999), and this change is due to the promotion of ecotourism and its financial benefits to the locals (Vannelli et al., 2019). Snow leopard-based ecotourism has risen as one of the major livelihoods for the locals and depends upon assuming greater responsibility for protecting snow leopards.

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