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Community stance towards sloth bear (*Melursus ursinus*) conservation in Odisha, India

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Abstract. *Mardaraj PC, Pirie TJ, Sethy J, Behera S. 2023. Community stance towards sloth bear (*Melursus ursinus*) conservation in Odisha, India. Biodiversitas 24: 2521-2526.* The human dimension is an essential component of extensive carnivore management and conservation. People living in bear habitats often fear encounters with these animals, and negative interactions can significantly affect people's livelihoods, attitudes, and tolerance toward the conservation initiatives of bears. To investigate the effect of such interactions on people's attitudes and livelihoods, we surveyed 510 households through semi-structured interviews located around five reserve forests of the Nilgiri wildlife range in a coastal district of Odisha, India. Gender, education, dependency on the forest, and specifics of bear encounters were the parameters taken to know the villagers' attitudes toward bear conservation. The average age of respondents was 46 (17-88) years; 78.8% (n= 402) were male. There are 37.5% of the respondents below the poverty level with annual incomes less than $ 514 USD. The majority of respondents, 85%, showed favorable opinions regarding sloth bears (*Melursus ursinus* Shaw, 1791), with only 15% expressing a negative perception. Bears were encountered by 87% of the total participants, with 45% encountering a sloth bear weekly. The study identified that 82.9% of villagers were more likely to state sloth bears were problematic rest disagreed with it. The educated interviewer was strongly supporting bear conservation in that landscape. The perspectives of the villagers and their experiences on their adverse feeling toward the bears need to minimize through suggested participatory and community-based mitigation strategies for long time conservation of the sloth bear in the landscape.

Keywords: Attitude, Balasore, coexistence, encounter, human-wildlife interactions, NTFP

INTRODUCTION

In many countries all over the world, and particularly in zones surrounding protected areas, borders between "human" and "wild" spaces have become blurred (Sripal 2015). Negative interactions between people and wildlife can result in the destruction of property, crops, livestock, or even human lives and these create a huge obstacle to conservation efforts in wildlife reserves (Redpath et al. 2015; Fisher 2016). In addition to habitat loss and fragmentation, human expansion into forests is a major contributing factor to the rising human-wildlife conflict (Rathi and Bhatt 2020). Wild animals frequently leave protected areas and enter nearby human settlements. People in forest-dependent villages may enter protected areas where they come close to wildlife, resulting in conflict. Human-Wildlife Conflicts (HWCs) cost many communities a significant amount of money to compensate for, making wildlife conservation an expensive effort on a global scale (Ravenelle 2017). "Ameliorating and mitigating this conflict is critical to the conservation and recovery of many species, and debates about how and whether to coexist with other animals had arisen social, economic and political conflicts within and between human communities" (Redpath 2013). If any of the essential elements for survival such as food, water, shelter, and reproductive partners are scarce in the natural habitat, wild animals may be compelled to migrate to nearby regions, leading to various forms of conflicts (Dar et al. 2022).

Since the inception of human civilization, where they initially started to rely on and contend with other species for resources, humans have had a tense association with wild animals. (Mardaraj 2015). A significant natural resource, forests are essential to preserving the ecological and environmental equilibrium. The depletion of forest resources is the outcome of their excessive exploitation by the local people (Musavi and Khan 2016). Livelihood requirements are fulfilled by collecting different types of forest produce for household consumption, as well as providing subsistence income for the family (Musavi and Khan 2016). Besides timber and bamboo, Non-Timber Forest Products (NTFP) also play a significant role and provide a subsistence livelihood for the forest dwellers residing around the forest areas (Mardaraj 2015; Singh 2018). The high degree of dependence and requirements of the families over many years has resulted in the degrading of the forest habitat and loss of wildlife. The coexistence of people and wildlife, particularly species of the order Carnivora, requires tolerance even in the absence of material loss, as the perceived risk of losses can threaten carnivore survival (Vucetich and Macdonald 2017). The perception of human-wildlife conflict often involves more

than material effects (crop and livestock depredation, property damage). It can originate from attitudes and values embedded in culture and history (Redpath et al. 2013). Identification of the conditions that lead to negative interactions is often confounded by a mismatch between people's perceptions and the actual ecology and behavior of wildlife species and by sociocultural aspects of conflict situations (Suryawanshi et al. 2013; Anand and Radhakrishna 2017; Karanth et al. 2019). Various methods by forest authorities, such as compensation schemes for crop and human lives, have been implemented to conserve carnivores by improving local livelihoods (Van Eeden et al. 2018). But resolving human-carnivore conflict requires a better understanding of people's attitudes toward large carnivores and often complex drivers of these attitudes may involve cultural, demographic, ecological, social, and economic components (Dickman et al. 2014). Understanding the nature of these interactions is essential to mitigating risk on both sides and promoting tolerance due to the ongoing land-use change and resource sharing between wildlife and people (Karanth et al. 2019). It's crucial for managing unfavorable interactions to comprehend what influences a household's decision to adopt mitigation measures (Karanth et al. 2019). Human-bear conflict is a critical example of the increasing competition between people and wildlife for space and resources worldwide (Can et al. 2014).

Bears have a global distribution, with multiple species involved in negative interactions with people, thus providing an opportunity to address this issue (Can et al. 2014). Conflicts between bears and people include any adverse interaction between a person and a bear that is aggressive, defensive, or nuisance in nature. Such conflicts can have ecological, economic, behavioral, safety, psychological, and social impacts, such as crop or livestock damage, destruction of property, and perceived and real threats to personal security, including, rarely, human injury or death (Mardaraj 2015). The conflict between bears and people in India varies (Karanth et al. 2019).

In India, sloth bears (*Melursus ursinus* Shaw, 1791) are the most common species of bears involved in conflicts, which are primarily non-life-threatening events (Singh 2018). Other bear species in India interact with people with less frequency and at different magnitudes of conflict. (Mardaraj 2015). Bears often venture into areas of human settlement, kill livestock, destroy crops, and injure or kill people (Mardaraj 2014). Human-sloth bear interactions have been studied in several protected areas (including buffer zones) across the species' range, where bears encounter people from traditional communities that live in and near forests and subsist on forest resources (Debata et al. 2017; Lamichhane et al. 2018; Singh et al. 2018). If sloth bears and their habitat are to be effectively protected, it is imperative to cooperate with local communities that coexist with these animals. Negative interactions with humans have increased where bears live outside protected areas, and where food and cover for bears have deteriorated because of human activity (Yoganand et al. 2013; Dharaiya et al. 2020). As Bruskotter and Wilson (2014) noted, human tolerance is the main factor determining if larger carnivores, including bears, can survive in a more human-dominated environment. Understanding sloth bear ecology in different conditions can inform responses when negative interactions arise (Bargali and Sharma 2013; Yoganand et al. 2013; Can et al. 2014; Dharaiya et al. 2016). Therefore, it is a priority for sloth bear conservation to conduct studies of human perception towards sloth bear outside protected areas. Thus, this study aims to specifically investigate the local knowledge, attitudes, and tolerance of local people toward sloth bears. Sloth bears are vulnerable and need protection, thus the suggested mitigating strategies for the long term coexistence of humans and sloth bear in the human-dominated landscape will be helpful in the conservation efforts.

MATERIALS AND METHODS

Study species and area

The sloth bear (*M. ursinus*) is native to the Indian subcontinent, subsisting in many habitat types, including wet and dry tropical forests, savannah, scrubland, and grassland, generally below 1500 m elevation (Dharaiya et al. 2020). Previously, the distribution of sloth bears covered almost the entire state except for the coastline. Still, in the last two decades, its distributional range has decreased to half due to habitat destruction by stone mining and local people's forest dependency, diminished food resources and illegal killing (Yoganand et al. 2013; Palei et al. 2018). It is the only bear species found in the eastern coastal state of Odisha, where the study sites are located. Still, it is patchy and distributed across the 12 districts of Odisha in protected and unprotected forests (Mardaraj and Sethy 2015). Northern Odisha is one of the few areas of the country rich in flora and fauna, with a variety of terrains that play a vital role in biodiversity, especially large mammals. The landscape is mostly gently undulating but flat toward the western portion of the study area. A general climate condition is hot and dry with three distinct seasons, summer (March-June), monsoon (July-October), and winter (November-February). The overall vegetation type is tropically dry deciduous, dominated by Sal (*Shorea robusta*). Champion and Seth 1968 classified these vegetation types as northern tropical dry mixed deciduous forests (5B/C2).

The study was conducted in the Nilgiri wildlife range (NWLR) in Balasore, a coastal district in northeastern Odisha (Figure 1). The primary land use in the study area (NWLR) is agricultural land, which covers the highest percentage, 43.39%, and water bodies cover 2%, whereas forest covers 32% of the area (Paikray and Sahu 2019). In rural Odisha, 57% of villages are located on forest fringe areas. Common property forest resources are vital to the life and economy of a vast majority of the rural population. However, these areas experience weak law enforcement and a lower level of protection; hence livestock grazing and collection of Non-Timber Forest Produce (NTFP) is common. Therefore, to know the actual people's perception, villages close to forests boundary were targeted for the study (Figure 1). The affected villages comprise various tribal communities, such as Santhal, Munda, Bathudi, Bhumija, and Kolha, in multiple proportions,

living alongside other Hindu castes. The villagers pursue different livelihood options, but their primary dependence for subsistence and economy is either on paddy cultivation or on the collection of non-timber forest produce (income from the sales of NTFPs is 10.6% annually. Both occupations make people vulnerable to sloth bears and are impacted when the bears visit. Along with the traditional form of agriculture, people also worked as daily wage laborers in various government and non-government agencies (Mardaraj 2015).

Data collection

Data were obtained through a questionnaire survey during 2019 and 2021 from 22 villages close to the forest in 15 Panchayats under nine forest beats of NWLR. The total general population of these 22 villages is 33558. A semi-structured questionnaire was prepared in English and then translated into Odia, the official language spoken by most people in this area. The questionnaire was pre-tested by interviewing 20 people and refined based on responses before data collection began. The local community was approached at specific times of the day (7 am to 9 am and 5 pm to 6 pm) when people were free from their work. Each household is considered one sampling unit, and only one person (preferably the oldest) was interviewed in an informal atmosphere. Before interviews, respondents were asked for verbal consent following an explanation of the research objectives and assurance that all personal information would remain confidential. Participants were made aware participation was voluntary. We clarified that answers to all questions would remain confidential and not be used for any other purpose.

Furthermore, no questions could be considered sensitive (e.g., queries concerning illegal activity). We conducted 510 questionnaires. The generality of the interviewees is listed in Table 1. Interviews were conducted in a friendly environment to gain the interviewees' trust and make the discussions less biased. Each interview was limited to 15 to 20 min. The questionnaire contained fixed-response questions in four sections designed to collect respondents' attitudes regarding sloth bear conservation. The following information was collected: (i) socioeconomic variables (respondents' age, gender, education, family group size, occupation, income, land owner status, and cooking fuel type), (ii) details on villagers' encounters with sloth bear within the past five years (encounter rate (daily, weekly, monthly, no encounter (NA)), the season of encounter (monsoon, summer, winter); (iii) Whether villagers view bears as problematic (yes or no) (iv) villagers' attitude towards conservation of sloth bear (good or bad).

Data analysis

All data were used. Chi-square tests were used to compare overall respondent rates about whether bears were problematic or not. Chi-square tests were then used to determine if there was any association between gender or encounter rate and stating bears were problematic. Binomial logistic regression was used to explore if the perception of sloth bears being a problem was related to the number of attacks within a forest beat, how often bears were encountered, and the gender of the responder and primary fuel source. A backward stepwise elimination was used to find the most significant factor/s, and the final model was compared with a null model using AIC values.

We used chi-square tests to explore whether there was a difference in attitude towards sloth bears and if the attitude towards sloth bears was associated with bear encounter rate or forest beats that had experienced a death. Binomial logistic regression was used to explore if attitudes towards bears were related to the number of attacks recorded within a forest beat, how often bears were encountered, the gender of the responder, and the primary fuel source. A backward stepwise elimination was used to find the most significant factor/s, and the final model was compared with AIC values.

Binomial logistic regression was used to determine what factors influenced whether people believed bears should be protected. Factors included in the full model were; how often bears were encountered, the number of attacks within a forest beat, and education status. A backward stepwise elimination was used to find the most significant factor/s. Based on AIC values, the final model was compared with the null model.

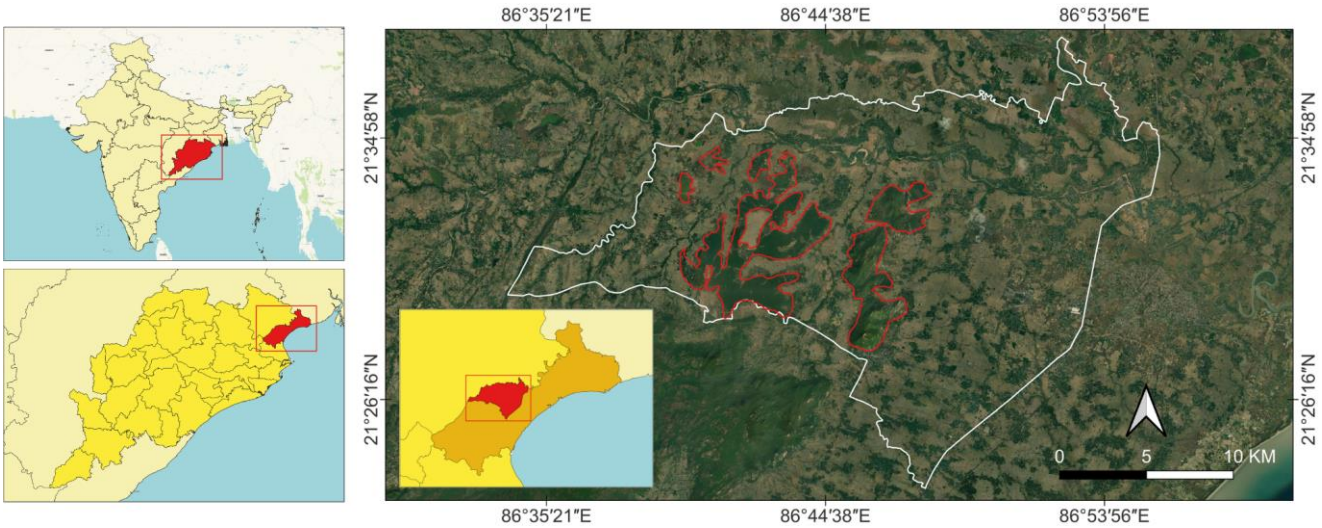

Figure 1. Map of the study area with five reserve forests of the Nilgiri wildlife range in Balasore, Odisha, India

RESULTS AND DISCUSSION

Five hundred and ten households were sampled using purposive sampling methods from a total of 8300 households in 22 sampling villages (mean ± SE; 377 ± 64.05). The head of the family was interviewed to collect all the required information. The average age of respondents was 46 (17-88) years; 78.8% (n= 402) were male, and 21.2% (n=108) were female; maximum living in Kutcha (mud) houses (92.4%). Most respondents in that segment were cultivators, subsistence farmers, sharecroppers, or non-farming laborers. Respondents also had a range of education levels: 47.1% of respondents were illiterate and had never been to school, whereas 27.6% had at least formal school education. In addition, most (37.5%) of the respondent's annual incomes were less than ₹42,000 INR (~ $514 USD) and were categorized as Below the Poverty Level (BPL), and 25.3% of the respondent were landless (Table 1).

When are bears seen, and how often?

Villagers often come across sloth bears in the vicinity of their villages, and we tried to find the seasonal frequency of such incidence from the interviewers. There were five forest beats where people were chased by a bear without injury eight times. However, three forest beats experienced a death from a bear (Nilgiri, Patna, and Sajanagarh). Bears were encountered by 87% of the 510 participants, with 45% encountering a sloth bear weekly, 23% monthly, and 19% daily (Figure 2). Of the 444 participants reporting encounters, sloth bears were mainly encountered during the winter (41%) and summer (40%) seasons, with only 19% in the monsoon. Three of the eight people were chased by a bear without consequence during the winter, three during the monsoon, and two in the summer.

Do people think sloth bears are problematic?

Of the 510 participants, respondents were more likely to state sloth bears were problematic than acceptable (82.9%, $X^2 = 221.36$, df. = 1, $p < 0.001$). There was no significant difference in response between females (N=108) and males (N=402). People who encountered sloth bears weekly were more likely to agree they were problematic than any other encounter rate ($X^2 = 104.05$, df. = 3, $p < 0.001$; Figure 2). The most dominant fuel type used was wood, with 72.9 % (Table 1) of respondents stating it was their primary fuel source. However, it was not found to be a significant factor in influencing whether bears were problematic as the final model was not significant.

Are there any factors that may impact attitudes toward the bear?

Only 14.5% (n=74) of participants had a negative attitude towards sloth bears which was highly significant ($X^2 = 256.95$, df. = 1, $p < 0.001$) (Figure 3). The final model had only bear attacks as the main factor in determining negative attitude, with people significantly more likely to be hostile towards bears by 1.5% with an increase in the number of bear attacks ((R^2 = 2%, CI 0.26 - 2.79%, p=0. 018). The final model had an AIC of 420 compared to 424 for the null model.

Should sloth bears be protected?

Respondents were significantly more likely to state bears should be protected than not ($X^2 = 181.21$, d.f. = 1, $p < 0.001$). However, there was no significant difference between the genders. Only education status was significant in the final model, which explained 5.7% of the variation. College-educated people were 7.7% significantly more likely to respond that sloth bears should be protected than high school, primary school, or non-educated people (R^2 = 5.7%, CI 6.46 - 8.86%; $p<0.001$). The final model had an AIC of 502 compared to 515 for the null model.

Table 1. Responses of the interviewees (n=510) in the Nilgiri wildlife range in Balasore, Odisha, India

Variables	Category	No. of respondent	Percentage
Gender	Male	402	78.8
	Female	108	21.2
Education	College (COL)	26	5.1
	High School (HS)	103	20.2
	Primary (P)	141	27.6
	Illiterate (IL)	240	47.1
Cooking fuel	Kerosine	2	0.4
	Wood	372	72.9
	LPG	136	26.7
House type	Concrete	39	7.6
	Kutcha (Mud)	471	92.4
Land holding	Large (< 1 acre)	62	12.2
	Small (1- 0.5 acre)	266	52.2
	Marginal (> 0.5 acres)	53	10.4
	Landless	129	25.3
Family Income	Upper (< 10.5k INR/month)	33	06.5
	Middle (7k-10.5k INR/month)	41	08.0
	Low (3.5k-7k INR/month)	245	48.0
	Poor (> 3.5k INR/month)	191	37.5

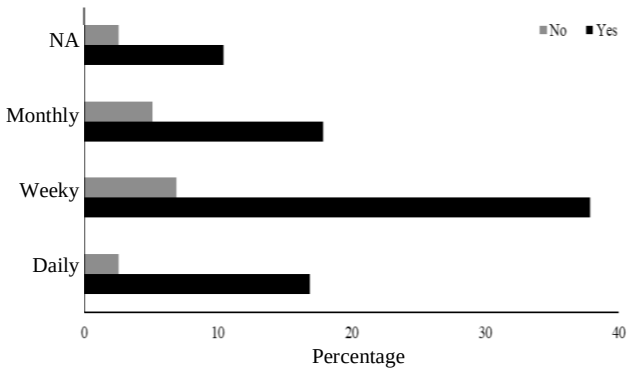

Figure 2. Percentage of survey participants who encountered sloth bears and who responded sloth bears are problematic (yes) or not (no) (n=510)

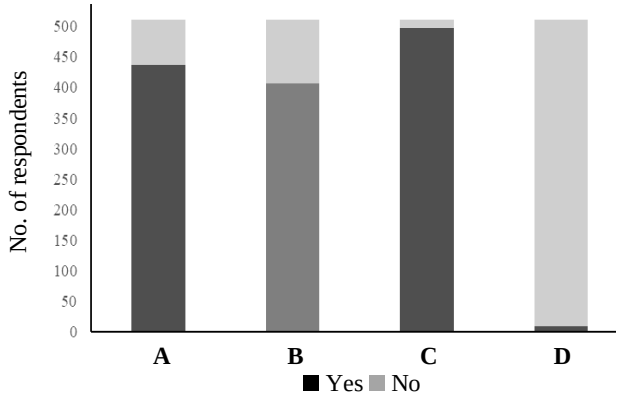

Figure 3. Percent responses of local people toward sloth bears, based on a questionnaire survey of 510 people in the Nilgiri wildlife range in Balasore, Odisha, India. (A. Are Bear problematic, B. Bear need to be protected, C. Wish to protect forest, D. Knowing the Forest Staff)

Discussion

Our household survey data from NWLR provide insights into the relationships between people, sloth bears, and forest resources. Many respondents (97%) considered protecting the forest necessary despite the legal restrictions on resource use and experiencing negative human-sloth bear interactions (Figure 3). We did not find any differences in people's attitudes toward the habitat, but we found differences in attitudes toward sloth bears. Among the total respondent, males were 78.8% and in an average age of 46 years. Studies on human-bear conflict of other bear species have also reported males to be the predominant gender involved (Merkle 2013). Bears were encountered by 87% of the 510 participants, and weekly encounters with the sloth bears were extreme, as conveyed by 237 villagers and n=99 respondents facing sloth bears daily. Sloth bears were mainly encountered during the winter (41%) season. People who encountered sloth bears weekly were more likely to agree they were problematic. We also conclude people with a college degree were substantially more likely to say that sloth bears should be conserved. Higher levels of education were associated with positive perceptions and protective management of wildlife (Mardaraj 2015). In Nepal, around Chitwan National Park, highly educated people were more favorable toward the tiger (Carter et al. 2014). The villagers staying close to the bear habitat support saving the forest and the species, but they argue that wild animals shouldn't invade human settlements. The maximum number of people were living in kutcha houses with minimum basic amenities like drinking water, electricity, toilets and are BPL with very low livelihood. The degree to which humans use the same habitats has also been found to make conflicts more intense. In the agropastoral landscape dominated by humans, the five forest reserves are bordered by a mosaic of vegetation. The bear often be seen in the periphery of the village and comes in contact with humans (Mardaraj 2014). The forest area is used by humans for extraction for bear-interested food resources which are the main driver of bear-human conflict in the landscape.

Protected areas have brought consumptive and non-consumptive benefits, and it is estimated that 90% of the world's poor depend on forests for at least a portion of their income (Lustig and Kanpur 2017). For residents to cooperate with reducing deforestation and forest degradation, they must positively perceive the forest conservation system and attitude toward wildlife. Human-wildlife conflict often causes negative attitudes and finding tolerance for large carnivores will be a continuous challenge in light of growing human populations, shifting land uses, and the effects of climate change, which unquestionably calls for coordinated efforts from conservationists (Bruskotter and Wilson 2014). Villagers have pre-empted a large part of the prime sloth bear habitat for their use. Regardless of the socioeconomic characteristics or the village where the residents lived, firewood was the primary energy source in the study areas. In addition, the housing material came from the forest, such as thatch for roofing material and timber for the house and furniture. Most households depended on fuel wood as their prime source of cooking, followed by other energy sources like LPG. Villagers also collect wood as a livelihood option for selling in the local's market. Most respondents favored the protection of sloth bears, even if they did not want to support the bear population increase in the area. Negative attitudes towards sloth bears are often associated with human attacks. For example, villagers were intolerant of human attack by sloth bears and killed or wounded by sloth bears (Mardaraj 2014). Nevertheless, some respondents doubted that sloth bears and human activities could coexist in shared multi-use landscapes.

In conclusion, there is a gap in communication between the forest staff and the local public, this needs to be addressed (Figure 3). Local residents' involvement and support are essential for the preservation of that area. There is a critical lack of conservation education in this region; thus extensive awareness campaigns were required. Workshops and sharing information and communications technology (ICT) materials are two efficient ways to spread conservation education and research efforts among the stakeholders. The outreach initiatives should convey the behavioral lessons of bears learned from reliable literature and scientific records (Mardaraj 2014). Conservation ideals can be introduced to these locals through education and awareness campaigns about the ecology of sloth bears, and to prevent negative human-sloth bear interactions through proper guidelines. Similarly, knowing how a sloth bear would respond in a specific circumstance might be used to improve current tactics. These lessons will go a long way toward fostering ecological understanding and empathy in people toward these sentient creatures, ensuring human safety, and safeguarding villages. The sloth bears will be recognized for their existence and movement and seen as an equally important component of biodiversity as people. Once the conservation mentality is developed and nourished, the hostility between the two species will undoubtedly trend downward.

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