The ethnic diversities in animal-human interactions in former Jammu and Kashmir State- India

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Abstract

Background: Cultural diversity in the Himalayan Mountain regions is closely linked to biodiversity, as there is a very close relationship between the local fauna and cultures. Religious rules and rituals also reinforce this relationship. Research has proven that these relationships are complex and differ based on a variety of factors.

Methods: There has been almost no research to explain the animal human interaction and commercially important animal species in different ethnic communities of Jammu and Kashmir. The present study was conducted throughout 2019–2020 and data were gathered through open and closed-end semi-structured interviews and group discussions.

Results: We found 10 species of mammals, 7 species of birds, and 7 species of fish were commercially important and playing a vital role in the economy of the local ethnic communities (*Kashmiri, Pahari, Hanji, Bakarwal, Changapa*). Among the documented species, seven species were unique to *Hanji*, followed by 4 species to *Pahari,* 3 to *Kashmiri* and 2 species to *Changapa*. The heat map classified predators into three groups that were recognized based on indicator species. Eight main predators (*Selenarctos thibetanus*, *Vulpes vulpes*, *Herpestes auropunctatus, Canis familiaris, Felis catus, Canis lupus, Panthera uncia,* and *Panthera pardus*) preying the documented species were recorded across the entire study area. *Bos taurus primigenius, Bos Taurus* and *Gallus gallus domesticus* played a significant role in the cultural and religious ritual aspects, whereas *Capra aegagrus hircus, Equus ferus caballus* and *Gallus gallus domesticus* were commonly used as a livelihood source among local communities.

Conclusions: Present study enlightened the interaction between the local fauna and cultures, meanwhile the study is first in its kind to document the livestock species with commercial value and specific communities associated with them in the former state Jammu and Kashmir.

Keywords: Commercial species; Economy; Ethnic groups, Jammu and Kashmir

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Background

Since the beginning of human civilization, animal resources have held great importance for human life with different animal species used in medicine (Saleem *et al.* 2021), diet (Rauf *et al.* 2017), faith (Alves *et al.* 2012), and a source of livelihood (Alves *et al.* 2012; Mughal *et al.* 2020). Working with animals is beneficial to one's well-being (Beetz *et al.* 2012), and they have an important role in the economy.

The National Research Council of the National Academies (2015) called for the food animal industry to prepare for larger food consumption demands that are expected to arise from a growing global population. Currently there are over 7.6 billion people in the world (United States Census Bureau2020) and many of them rely on the animal protein provided by livestock. The per head supply of red meat, poultry, and fish totaled 65,4kg in the United States, each with comparative percentages of 51%, 42%, and 7%, respectively in 2017 (Bentley 2019). According to the United Nations (2019) the current world population will be increasing to 9.7 billion people by 2050. Meeting the nutritional needs of this population sustainably and furnishing its demand for animal products will require significant research and development (R&D) so that the present productivity can be sufficiently enhanced to meet the much-heightened future demands (National Research Council of the National Academies 2015).

India is an agrarian nation with a total of 11.6 % of the world's livestock, the Indian livestock sector stays one of the largest in the world. (Shanmathy *et al.* 2018). The number of animals slaughtered for meat consumption includes cattle (3.05 million), buffalo (11.9 million), sheep (50.8 million), goat (97.2 million), and poultry (2.81 billion) (livestock-animal-production-statistics-of-India-2019/). India has surpassed China as the world's largest milk producer, accounting for 20.17 % of global milk production. India produces about 5.65 % of the world's eggs, 3 % of the world's beef, and has the world's largest population of dairy animals (Shanmathy *et al.* 2018). The latest data from "National Dairy Development Board" indicate that there is a total of 535.8 million livestock and 851.8 million poultry in India (NDDB. Gov. of India 2020), and that the country currently has an annual fish production of about 9.06 million metric tons, holding second place in the world in total fish production (Fisheries and aquaculture Gov. of India 2020).

Jammu and Kashmir, including Ladakh, have a valuable livestock resource in the form of cattle, buffalo, sheep, goats, poultry, and other animals. The states estimated livestock population is 160.407 million, with 31.569 million cattle, 39.204 million sheep, 7.889 million buffaloes, 18.136 million goats, 58.311 million fowls, and 5.298 million ducks (Mir *et al.*2016). Grasslands, meadows, woodland, waste, barren, and fallow make up 44 % (1061000 ha) of the total area of the state (2416000 ha) (Digest of Statistical2003-04 GO J&K). Around 70% of the population lives in rural areas and works in agriculture and related industries, such as livestock rearing. These people belong to different ethnic communities which are facing backwardness in economy and other aspects. The most common ethnic communities associated with livestock, are Gujjar, Pahari, Bakarwal, however Hanji community is only one associated with fish (Gairola *et al.* 2014). The number of livestock units per 1000 human population in the state is 736 animals, compared with a national average of 409 animals/1000 human population (Ahmad *et al.*2018). The estimated livestock population (excluding poultry) of the state is 9200842 which shares about 1.78 percent of the country's total livestock population. Traditionally specific tribes or communities are known for specific animals as their source of livelihoods. In the present study, our primary aims were to document the livestock species with commercial value and ethnic communities associated with them to form a base line study which can assist the stake holders to draft policies for overcoming the economic challenges faced by the said ethnic communities residing in the remote areas.

Material and Methods

Study Area

Jammu and Kashmir (Fig.1), formerly one of the largest princely states of India and recently bifurcated into two union territories (Jammu & Kashmir and Ladakh) by Central Government of India, is bordered to the northeast by the Uygur Autonomous Region of Xinjiang (China), to the east by the Tibet Autonomous Region (China), and the Chinese-administered portions of Kashmir, to the south by the Indian states of Himachal Pradesh and Punjab, to the southwest by Pakistan, and the northwest by the Pakistani-administered portion of Kashmir. It has a geographic area of 281382 km^2. Inhabiting ethnic communities include *Chowpan, Gujjar*, *Bakarwal, Dard*, *Kashmiri, Pathan, Pahari* (Gairola *et al.* 2014). The communities mostly associated with commercial livestock species in Kashmir and Jammu regions are *Kashmiri, Gujjar, Pahari, Hanji*, and *Bakarwal*. However, Changapa is the only ethnic group associated with livestock in Ladakh. The various languages spoken by these ethnic groups are Urdu, Kashmiri,

Pahari, Changskhat and Gujjari. About 68.3% population follows the religion of Islam fallowed by Hinduism (28.4%), Sikhism (1.9%), Buddhism (0.9%) and Christianity (0.3%) (Gov. of Jammu and Kashmir 2020). For present study different documenting areas (Fig. 1) were selected based on rich ethnic population communities interacting with species having commercial value.

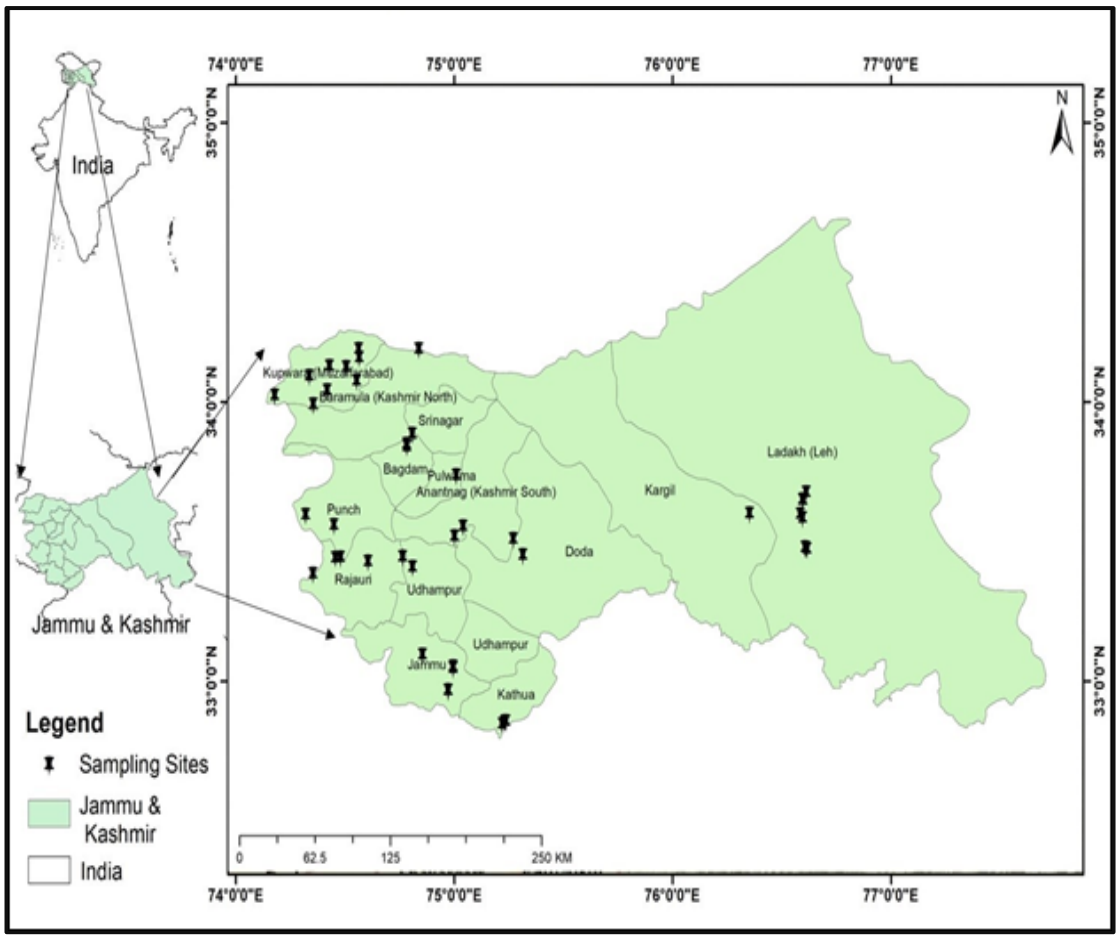

Figure 1. Map of Jammu and Kashmir, India and point showing survey sites in the erstwhile state Jammu and Kashmir.

Survey and Data Collection

The present study was conducted during 2019–2020. Data were collected through open and closed-end semi-structured interviews and group discussions following Haq *et al.* (2020), after obtaining oral prior informed consent from the participants. The information was documented from the different groups of the study area, such as shepherds, herders, fishermen, cattlemen, and Local veterinary center staff (Table.1). Field-based personal observations, and additional information both informal and formal discussions along with photographs (Fig.2) were also conducted. The field study was carried out in diverse age-sex groups (young, old, and middle) (Table.1). The informants were also questioned for their views about the commercial species for self-consumption or livelihood generation. The collected data for (Table. 2) included the local name, use, cost, predators, feed, and fodder of the documented species.

Data Analysis

The questionnaire form was compiled in an ordered form and data was organized in Microsoft excel sheets and analyzed. Questionnaire data was initially analyzed for the basic categorization of the respondent's gender, age groups and literacy ratio, etc. Interaction analyses among animal species and predators was carried out by heatmap analysis. To produce the heat map, we used absence/presence data for showing the distribution of the species, and

the analysis of clusters grouped the species having similar predators (Haq *et al.* 2020).The Sorensen's (Bray-Curtis) distance similarity coefficient based on presence/absence data was used for the identification of the significant differences among diverse animal species and predators (Sorensen 1948).The Venn diagram was created by using Bioinformatics & Evolutionary Genomics software (Altaf *et al.* 2021). (http://bioinformatics.psb.ugent.be/cgi-bin/liste/Venn/calculate_venn.htpl*).*

Bos taurus ***Bos grunniens***

Anser platyrhynchos domesticus ***Capra aegagrus hircus***

Schiothorax plagiostomus ***Equus africanus asinus***

Figure 2. Photograph of few commercially important species sited during field study.

Table 2. Documented commercial species across cultural group.

Species	Zoological name Local name Family	Habit	Usage	Predators	Natural Feed	Market value Owner value Interconnector value (*Indian rupees*) (*Per kilogram*)	Ethnic Groups
Mammals							
Ox	*Bos taurus primigenius* (Linnaeus, 1758) Daand, (Bovidae)	Herbivore	Meat offal Dung Ploughing	*Panthera pardus* (Leopard) *Selenarctos thibetanus* (Black Bear)	Natural pastures Forest lands Paddy grass Tree leaves Maize straw Maize Community lands	300 220 250	*Kashmiri* *Bakarwal* *Pahari*
Cow	*Bos taurus* (Linnaeus, 1758) Gaav, Gaan (Bovidae)	Herbivore	Meat offal Dung Milk	*Panthera pardus* (Leopard) *Selenarctos thibetanus* (Black Bear)	Natural pastures Forest lands Paddy grass Tree leaves Maize straw Maize Community lands	300 220 250	*Kashmiri* *Pahari* *Bakarwal*
Buffalo	*Bubalus bubalis* (Linnaeus, 1758) Meains♀, Kata♂, Meensa♂ (Bovidae)	Herbivore	Meat offal Dung Milk	*Panthera pardus* (Leopard) *Selenarctos thibetanus* (Black Bear)	Natural pastures Paddy grass Tree leaves Maize straw Community lands	300 220 250	*Pahari*
Sheep	*Ovis aries* (Linnaeus, 1758) Kath♂, Gab♀, Laayla♂, Payhaad♀ (Bovidae)	Herbivore	Meat Pellets Milk Wool	*Panthera pardus* (Leopard) *Selenarctos thibetanus* (Black Bear) *Herpestes auropunctatus* (Mangoos)	Tree leave Natural pastures Community lands	500 300 380	*Kashmiri* *Pahari* *Bakarwal* *Changpa*

Goat	*Capra hircus* (Linnaeus, 1758) Chaavaj♀, Chaavul♂, Bakrie♀, Bkra♂ (Bovidae)	Herbivore	Meat Pellets Milk Wool	*Panthera pardus* (Leopard) *Selenarctos thibetanus* (Black Bear) *Herpestes auropunctatus* (Mangoos)	Tree leave Natural pastures Community lands	300 380 500	*Kashmiri* *Pahari* *Bakarwal*
Horse**	*Equus ferus caballus* (Linnaeus, 1758) Gur♂,Maadyaan♀Kooda♂, Koodai♀, Zaniskari♂♀ (Equidae)	Herbivore	Chariot (Tanga, Rada)	*Panthera pardus* (Leopard) *Selenarctos thibetanus* (Black Bear)	Tree leave Natural pastures Community lands Paddy grass Tree leaves	60000 57000 58000	*Kashmiri* *Pahari* *Bakarwal* *Changpa*
Donkey**	*Equus africanus asinus* (Linnaeus, 1758) Khota♂, Khotee♀ (Equidae)	Herbivore	Beast of burden	*Panthera pardus* (Leopard) *Selenarctos thibetanus* (Black Bear)	Tree leave Natural pastures Community lands Paddy grass	25000 23000 24000	*Pahari* *Bakarwal*
Camel	*Camelus dromedarius* (Linnaeus, 1758) Oohont♂, Oonntdni♀ (Camelidae)	Herbivore	Meat	*Panthera pardus* (Leopard) *Selenarctos thibetanus* (Black Bear)	Tree leave Natural pastures Community lands Paddy grass	300 180 230	*Pahari*
Pashmina goat	*Capra aegagrus hircus* Changthangi♂♀, Nor♂, Lowak♀ (Bovidae)	Herbivore	Meat Pashmina Milk	*Panthera pardus* (Leopard) *Selenarctos thibetanus* (Black Bear)	Tree leave Natural pastures Community lands Paddy grass Forest lands	600 320 420	*Changpa*
Yak	*Bos grunniens* (Linnaeus, 1766) Yak, Dri, Nak (Bovidae)	Herbivore	Milk Meat Wool	*Panthera pardus* (Leopard) *Selenarctos thibetanus* (Black Bear)	Tree leave Natural pastures Community lands Forest lands	350 200 250	*Changpa*

Birds							
Duck	*Anas platyrhynchos domesticus* Bataich♀, Baatuk♂ (Anatidae)	Omnivore	Egg Meat Droppings	*Herpestes auropunctatus* (Mangoos) *Vulpes vulpes* (Fox)	Maize Paddy Small Insects Aquatic weeds	620 350 500	*Kashmiri*
Goose	*Anser anser domesticus* Anz♀♂ (Anatidae)	Omnivore	Egg Meat Droppings	*Herpestes auropunctatus* (Mangoos) *Vulpes vulpes* (Fox)	Maize Paddy Small Insects Aquatic weeds	700 500 550	*Kashmiri*
Rooster	*Gallus gallus domesticus* (Linnaeus, 1758) Kukur, Kukud (Phasianidae)	Omnivore	Meat Droppings	*Vulpes vulpes* (Fox)	Maize Paddy Small Insects	550 400 460	*Kashmiri* *Pahari*
Hen	*Gallus gallus domesticus* (Linnaeus, 1758) Kakar, Kukadi (Phasianidae)	Omnivore	Egg Meat Droppings	*Vulpes vulpes* (Fox)	Maize Paddy Small Insects	450 350 370	*Kashmiri* *Pahari*
Kashmiri jungle fowl	*Gallus sonneratii* (Temminck, 1813) Bndkukud♂♀ (Phasianidae)	Omnivore	Meat	*Herpestes auropunctatus* (Mangoos) *Vulpes vulpes* (Fox)	Maize Paddy Small Insects	1000 600 800	*Pahari*
Broiler	*Gallus gallus domesticus* Boiler (Phasianidae)	Omnivore	Meat Droppings	*Herpestes auropunctatus* (Mangoos) *Vulpes vulpes* (Fox)	Maize Paddy Small Insects	160 100 130	*Kashmiri* *Pahari*
Hill Pigeon**	*Columba rupestris* (Pallas, 1811) Kotur♂♀ (Columbidae)	Omnivore	Meat	*Vulpes vulpes* (Fox)	Maize Paddy Small Insects Natural pastures Forest lands	20000 19000 18000	*Kashmiri*

Fish							
Alghad Snow trout	*Schizopyge niger* (Heckel, 1838) Ale Gad (Cyprinidae)	Herbivore	Meat Fish waste	*Selenarctos thibetanus* (Black Bear)	Phytoplankton's Aquatic weeds	450 200 300	*Hanji*
Hill trout	*Schizothorax plagiostomus* (Heckel, 1838) Khont (Cyprinidae)	Herbivore	Meat Fish waste	*Selenarctos thibetanus* (Black Bear)	Phytoplankton's Aquatic weeds	400 180 250	*Hanji*
Chirruh Snow trout	*Schizothorax esocinus* (Heckel, 1838) Chhurru (Cyprinidae)	Herbivore	Meat Fish waste	*Selenarctos thibetanus* (Black Bear)	Phytoplankton's Aquatic weeds	400 200 300	*Hanji*
Kunar Snow trout	*Schizothorax labiatus* (McClelland, 1842) Chush (Cyprinidae)	Herbivore	Meat Fish waste	*Selenarctos thibetanus* (Black Bear)	Phytoplankton's Aquatic weeds	400 200 300	*Hanji*
Common carp	*Cyprinus carpio* (Linnaeus, 1758) Punjab Gad (Cyprinidae)	Omnivore	Meat Fish waste	*Selenarctos thibetanus* (Black Bear)	Phytoplankton's Aquatic weeds Zooplanktons Small Insects	350 170 250	*Hanji*
Brown trout	*Salmo truttas* (Linnaeus, 1758) Punjab Gad (Salmonidae)	Carnivore	Meat Fish waste	*Selenarctos thibetanus* (Black Bear)	Zooplanktons, Small Insects	350 200 275	*Hanji*
Rainbow trout	*Oncorhynchus mykiss* (Walbaum, 1792) Punjab Gad (Salmonidae)	Omnivore	Meat Fish waste	*Selenarctos thibetanus* (Black Bear)	Phytoplankton's Aquatic weeds Zooplanktons Small Insects	350 200 280	*Hanji*

♀♂ are used to symbolize the gender name, ♂: for male name, ♀: for female name ♀♂ for both male and female name.

Species are not valued as whole individuals.**

Demographic details of respondents and their views about the commercial species

We conducted interviews with 260 informants, of whom 93 were from Jammu, 119 from Kashmir, and 48 were from Ladakh. During the survey respondents comprised an uneven distribution of male-female ratio, where 205 were men, and 55 were women. The fewer number of female participants could be due to the reason that women remain indoor having less exposure to remote sites and many of them also showed reluctance (Haq *et al.* 2020a; Asif *et al.* 2021). Most of the respondents were old-aged (44.23%), followed by middle aged (37.30%), and young (18.46%). More than half of the respondents were without formal education (63.84%). The respondents interviewed included Shepherd's (33.70%), Herders (21.53%), Local veterinary centers (4.23%), Fisherman (20%), and Cattlemen (21.15%). Selected respondents belonged to the four ethnic groups (*Kashmiri, Hanji, Pahari, Bakarwal, Changapa*) (Table 1).

Table 1. Demographic status of the respondents from the study area.

Demographic features	**Number of people**	**Percentage**	**Bio-geographic provinces**		
			Jammu	Kashmir	Ladakh
Ethnic groups			*Pahari* *Bakarwal*	*Kashmiri* *Pahari* *Bakarwal* *Hanji*	*Changapa*
Religion			Hinduism Islam Sikhism	Islam Sikhism	Tibetan Buddhism
Language			Hindi Pahari	Kashmiri Pahari	Changskhat
Respondents	260		93 (35.76%)	119 (45.76%)	48 (18.46%)
Education					
Illiterate	166	63.84	59	73	34
Primary education	50	19.23	16	25	9
Secondary education	32	12.30	13	15	4
Higher education	12	4.61	5	6	1
Age range					
Young (18-26 Years)	48	18.46	15	25	8
Middle (56-75 Years)	97	37.30	33	45	19
Old (27-55 Years)	115	44.23	45	49	21
Profession					
Shepherds	86	33.07	25	40	21
Herders	56	21.53	18	23	15
Local veterinary centers	11	4.23	3	7	1
Fisherman	52	20.0	26	26	0
Cattlemen	55	21.15	21	23	11
Gender					
Male	205	78.84	75	94	36
Female	55	21.15	18	25	12

A large portion (78%) treated commercial species as the backbone of the rural economy. In contrast (13 %) believed that it's an orthodox source of income, society needs to come over and look into other means of income like real estate.

Results

Classification of Documented species

The present study documented 24 commercial species. Documented species were broadly classified into mammals (44%), birds (28%), and fish (28%), (Fig. 3a) further classified based on nutrition most species were herbivores (60%) followed by omnivores (36%) and carnivores (4%) (Fig. 3b). Altaf *et al.* (2017) reported the use of different animal

species with commercial usage in Pakistan; meanwhile, the use of fish in different cultures was also reported in the other parts of the Himalayas (Altaf *et al.* 2018).

Unique and Common Species Across Cultures

The Venn diagram (Fig. 4) shows that 7 species (*Schizothorax esocinus, Cyprinus carpio, Schizothorax labiatus, Schizo pygeniger, Oncorhynchus mykiss, Salmo trutta Schizothorax plagiostomus),* were unique to the *Hanji* ethnic group, followed by 3 species (*Bubalus bubalis, Camelus dromedarius, Gallus sonneratii)* unique to *Pahari,* 3 species *(Anas platyrhynchos, Columba rupestris, Anser anser domesticus)* unique to *Kashmiri*, 2 species (*Bos grunniens, Capra aegagrus hircus*) unique to *Changapa*. However, 3 species (*Gallus gallus domesticus* (rooster), *Gallus gallus domesticus* (broiler), *Gallus gallus domesticus* (hen) were found common in *Kashmiri* and *Pahari* followed by 2 species (*Bos taurus primigenius, Equus africanus asinus)* common in *Bakarwal* and *Pahari*, 2 species (*Bos taurus, Capra hircus*) in *Bakarwal, Kashmiri* and *Pahari*, 2 species (*Ovis aries, Equus ferus caballus)* in *Bakarwal, Changapa, Kashmiri* and *Pahari*. Similar use of species (animals, birds, fish) across different ethnic groups were also reported by Altaf *et al.* (2017); Altaf *et al.* (2018) from Pakistan Himalaya.

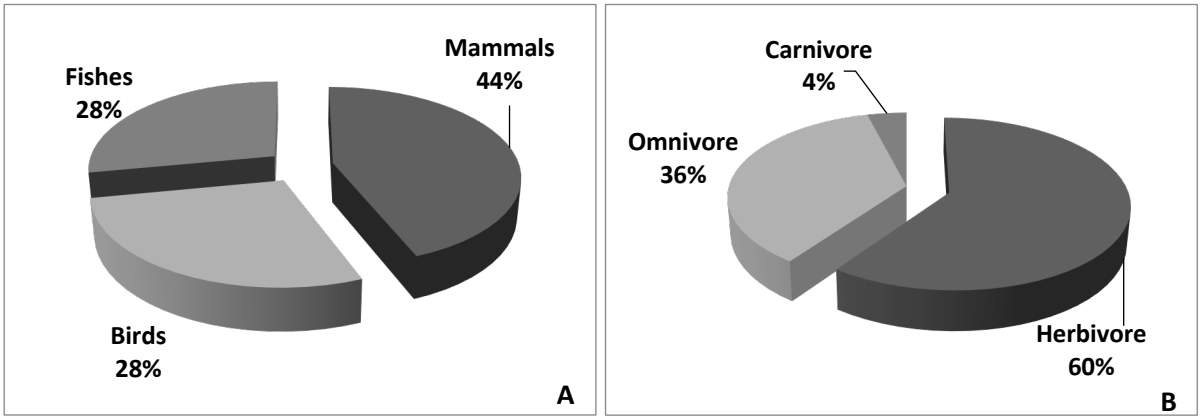

Figure 3. (A) Percentage of documented species. (B) Percentage of documented species based on nutrition.

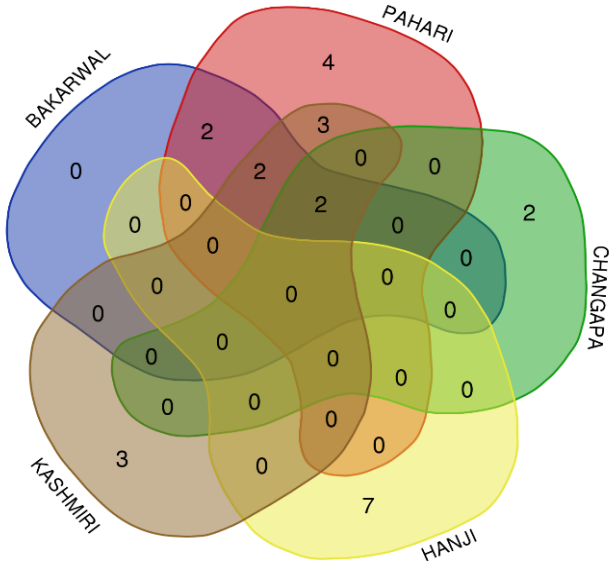

Figure 4. Venn diagram representing species overlap across different ethnic communities.

Diversity and Usage Across Ethnic Communities

Species and usage with respect to Kashmiri

A total of 11 commercial species were recorded, of which 5 species (ox, cow, sheep, goat, horse) belonged to mammals, 6 belonged to birds (duck, rooster, goose, broiler, hen, hill pigeon). These species belonged to a variety of families and the dominant families were Phasianidae (N=3), Bovidae (N=3) (Table 2). Similarly, Mahawar and Jaroli (2007) reported various animals with the commercial value from Rajasthan – India. Meat was the prime part used as food followed by offal. Globally meat is considered a rich source of protein and poultry meat production has increased by 1,144% in the last 50 years (Hoffman and Falvo 2004).

Horse is used for transport i.e.: Horses are tied to a chariot-like carriage locally called *Tanga* (Fig. 5) which carries passengers. Meanwhile, species like Sheep, and Goat were used mostly for milk and wool apart from meat. Wool obtained from the Sheep is used for making shawls and blankets. Earlier a hand-made blanket was made in the valley (Kashmir) from wool called *Chaadar.* Now *Chaadar* making has vanished due to the availability of low-cost

blankets in the market, along with this their pellets from Sheep and Goat are used in orchid cultivation as manure, similarly, the dung from Cow, Ox and the droppings of rooster, hen, and broiler are also used as organic fertilizers. Dung is first decomposed in a pit for more than a year and then used. Duck and Goose are used to lay eggs. Hill pigeon is mainly used as a recreational bird and sometimes also used for bush meat. Ox is used for ploughing the field (Table 2). Likewise, Altaf *et al.* (2017) also reported the interaction levels between animal species and humans from Pakistan which is having the geographical contiguity with Jammu and Kashmir.

Species and usage with respect to Pahari

The *Pahari* community mentioned 13 commercial species, among which 8 species, (ox, cow, buffalo, sheep, goat, horse, donkey, and camel) belonged to mammals and 4 species (rooster, hen, Kashmiri jungle fowl, broiler) belonged to birds, no fish species were recorded. Likewise, the *Kashmiri*, meat was the mostly consumed, followed by offal. Most species belonged to Bovidae (N=5) followed by Phasianidae (N=4) (Table 2). Species like cow, sheep and goat are primarily used for milk. Sheep and goat are also used for wool. Camel is used mainly for meat, hen for eggs. Horse and donkey are used as beasts of burden and except for these two species all others are used for meat. Kashmiri jungle fowl is consumed as food.

The *Pahari* community is highly marginalized community. Many of them are seen in upper hilly areas and have a strong relation with their animal fauna as they use them in agricultures, also trade them and earn the livelihood. Jina *et al.* (1996) reported usage of animal fauna in the former Jammu and Kashmir.

Figure 5. Chariot-like carriage called Tanga

Species and usage with respect to Bakarwal

The nomadic *Bakarwal* are mostly dependent on livestock. We documented six species (cow, ox, sheep, goat, horse, and donkey) from this ethnic group. All recorded species belonged to mammals, with 4 species (cow, ox, sheep, and goat) from Bovidae and 2 species (horse and donkey) from Equidae (Table 2). The documented species are a real asset to the ethnic community as they are permanently dependent on these species for survival and lacking modern amenities creating a bond at social, economic, and emotional levels. Species like sheep, goat and cow are used for milk and often meat, at the same time these species are sold for money. Dutta *et al.* (2021) also reported the dependence of *Bakarwal* on livestock and lack of modern conveniences. In Jammu and Kashmir, this tribe migrates seasonally from Jammu province to Kashmir and vice versa to avoid unavailability of feed and to protect from the harsh climate.

Species and usage with respect to Changapa

The *Changapa* from Ladakh has few resources for survival and is mainly nomadic like the *Bakarwal*. The present study documented 4 commercial species (sheep, horse, yak and Changthangi (pashmina goat)) from mammals, among which 3 species (sheep, Changthangi, and yak) belonged to the family Bovidae and 1 species (horse) belonged to Equidae, the ethnic group mainly used these species for milk, wool, (pashmina) (Table2), and in few cases for meat. This tribe is dependent on the livestock, and milk is praised and considered an elixir. Milk is composed of organic compounds including fat, protein, carbohydrates, water, and solids particles (Hamad and Baiomy 2010; Merlin *et al.* 2015) and meets almost all nutritional requirements. Sheep is used mainly for meat during winters and the Changthangi is used for wool, (*Pashmina*, Pashm).

Meat composition is a different cause of the impacts of different factors like feed, water, breed, sex, etc. (Keeton and Eddy 2004; Hui 2012; Cheung and Mehta 2015; Haidar and Bashir 2021). Jina *et al.* (1996) reported the use of sheep for meat and Changthangi for *Pashmina* (Pashm). It is believed that *Pashmina* is the finest fiber of all goat hair. The milk of Changthangi is also highly praised and is believed to give strength to the body and protect from jaundice and cough. Chellappandian *et al.* (2014) also reported its use against jaundice from Tamil Nadu in India. Mola *et al.* (2020) reported the use of milk against cough in Ethiopia.

The *Changapa* live in challenging conditions (harsh climate) without modern facilities and the above said species are only to assist for overcoming these harsh, challenging environmental conditions creating a unique animal human bond in the said region of study area. Martos Martinez-Caja (2021) also discussed the humans and animal's species to face the challenging times.

Species and usage with respect to Hanji

Hanji, a community from Kashmir, is mainly living near water bodies like (Dal, Wular, Manasbal, and Jhelum) and depends on fish for livelihood. We documented seven fish species (*alghad* snow trout, hill trout, common carp, *kunar* snow trout, *chirruh* snow trout, rainbow trout, brown trout) among which 5 were from family Cyprinidae and 2 were Salmonidae. The *Hanji* community is known for fish throughout the valley (Kashmir). They are seen on the shores of water bodies, also they move from one place to another for sale of fish. While documenting we observed a strong economic bond between *Hanjji* community and fish. Similarly, Muhammad *et al.* (2017) reported the interaction between fishes and the Punjabi people Pakistan. Fish were used primarily for meat (Table 2). Locals usually consume these fish for famous recipes like *Muj Gaad*, *Nadur Gaad*. The fish waste in Kashmir is believed to increase the growth of bottle-gourd and cucumber plants. Fisheries form an important constituent of the economy of Jammu and Kashmir and contribute a significant 23% to its Gross State Domestic Product (GSDP) (https:// knskashmir.com Dec 2016; Rashid & Singh 2020). In addition to this, fisheries are linked with agricultural activities and contribute to the economy of the state and generate self-employment (Rashid & Singh 2020).

Feed Habit

The present study documented a variety of natural feeds (Fig. 6) in the form of, natural pastures, forest lands, paddy, paddy grass, tree leaves, maize straw, maize, aquatic weeds, community lands, phytoplankton, small insects, and zooplanktons for the commercial documented species. The present study documented only natural feeding sources as commercial feeds are expensive, and the local population believes that the use of natural herbs keeps animal species healthy and protects them from various diseases. Different studies from the Jammu and Kashmir have reported the use of medicinal herbs for the wellbeing of livestock (Dutta *et al.* 2021; Dar *et al.* 2018) For winter, when the vegetation is dormant the farmers make use of hay, dried tree leaves, etc., which are processed in autumn. The birds feed on insects like ants, earthworms, beetles, bark beetles, and grasshoppers, along with this they also take advantage of agriculture by consuming grains of paddy, maize, wheat, etc.

Market value

For any commercial species, the market value is an important parameter that rises and falls because of various factors like demand, production, inflation (Boyd *et al.* 2001). Our documented species' market value ranged from 200 to 1000 Indian rupees per kilogram (Fig. 7; Table 2). Normally intermediary traders buy the animals from the owner and sell them to the market and the market venders to the customers. In this small commercial chain naturally the price increases from a primary seller to the final customer (Primary owner > Interconnector > Market > Final Customer). The maximum price per kg was observed in Kashmiri jungle fowl with a market value of 1000Rs/kg, interconnector value 800 Rs /kg, and basic owner value 600 Rs/kg.

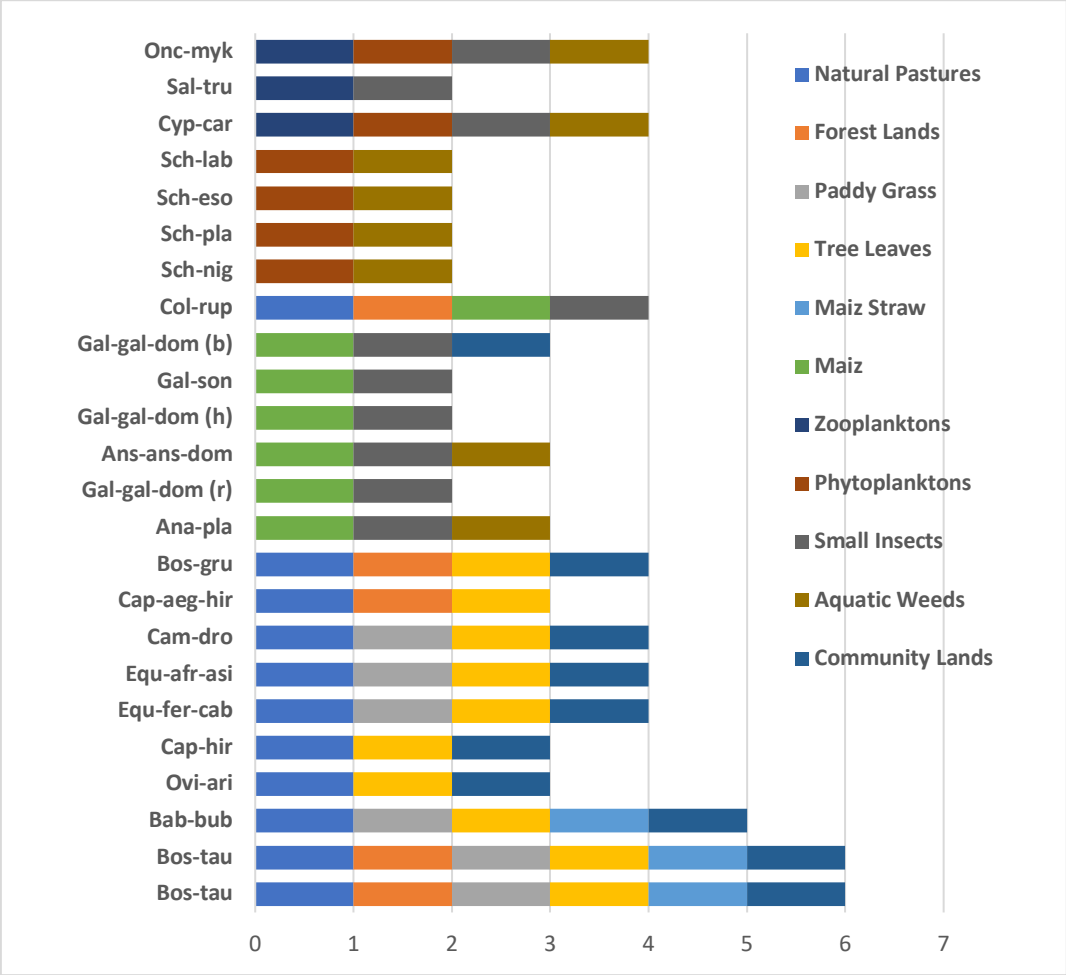

Figure 6. Feed pattern of commercial species**.**

The lowest price/kg was seen in Broilers with a market value 160 Rs/kg, interconnector value 130 Rs/kg, and basic owner value 100 Rs/kg (Fig. 7). This can be explained by the fact that Kashmiri jungle fowl is captured from the forest by the *Pahari* people which requires a lot of time and energy, hence is valued high. On other hand, Broilers are reared in farms for meat hence the value is low. Indigenous fish (*alghad* snow trout, hill trout, *chirruh* snow trout, *kunar* snow trout) are more highly valued than exotic fish (common carp, brown trout, rainbow trout), because locally it is believed that the indigenous species have traditional medicinal uses like increasing milk production in lactating mothers, increasing virility, provide strength to the body, smoothen the skin. Raina and Petr (1999) also reported the higher value of indigenous fish than exotics. Three species (horse, donkey, and hill pigeon) were always valued with a market value of 60000 Rs, 25000 Rs, 20000 Rs, basic owner value was 57000 Rs, 23500, Rs and 18000 Rs, and the interconnector value was 58000 Rs, 24000 Rs, 19000 Rs respectively. The price of the species fluctuated. The owners often sold the species directly to the market, even on some special occasions like festivals, marriage, parties the owner directly sells the species to the consumer for meat, bypassing the market and intermediaries.

Cultural and religious uses

Many of the documented species had a strong relation with local cultural aspects and religion. In the valley (Kashmir) ox is used to plough the backyard, a ritual locally called "*Goongul*". This ritual is having the message that one who will work hard in fields during the season will get fruits in the end. People with Hindu faith believe that the ox is the vehicle (Vahana) of Lord Shiva, cow is treated as sacred and called "*govmata"* or *Kamadhenu* and worshiped. Cow udders symbolize four objectives (*Purushartha*), (i.e., dharma or righteousness, *artha* or material wealth, *kama* or desire, and moksha or salvation); her horns symbolize the gods, her face the sun and moon, and her shoulders the god of fire (*agnidev*). As these animals are linked with the faith, the people of the respective

religion do not use them for commercial purposes. Muslims generally do use these animals for commercial purposes and in their religious ceremonies, like on Eid, they sacrifice animals like, cows, ox, sheep, camel, and buffalo. At the same time, Muslims use these animals in marriages, funerals, festivals, and other special occasions.

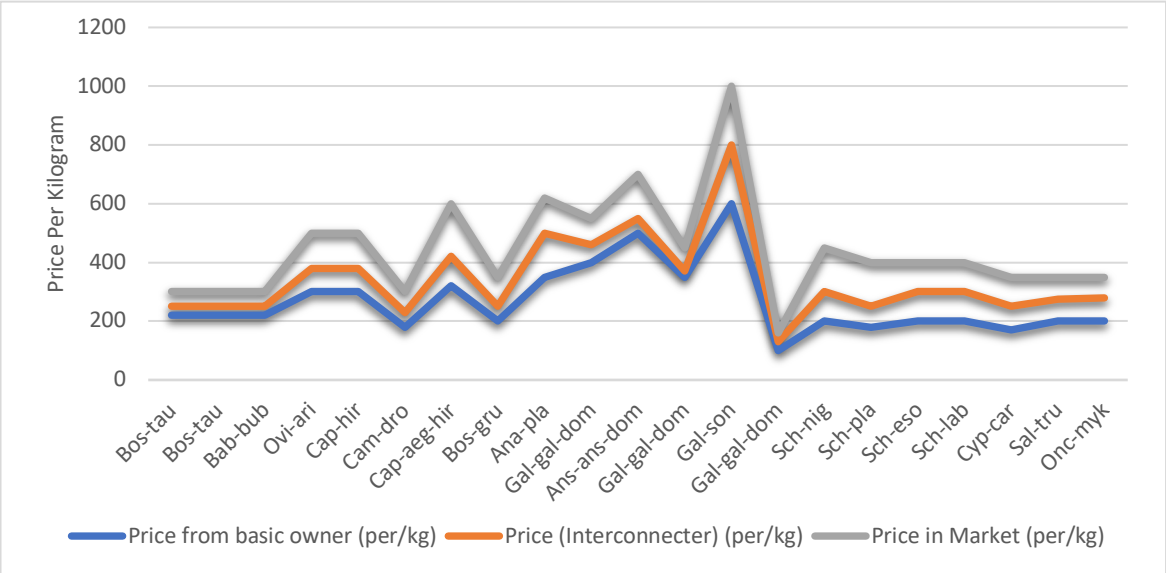

Figure 7. Market value of commercial livestock species.

The rooster is praised in Muslim culture as it crows in the early morning to announce prayers. Many Islamic scholars say that the rooster receives the signal for crowing from an angle called "Deek", which is why in Arabic the rooster is named as "Deekun". In Buddhism yak is treated as sacred animal, and it is believed that yak head, eyes intestine, hair, hoofs, and heart are transformed into sun, moon, stars, rivers, lakes, forests, and mountains, meanwhile, bones represent the symbol of purity, strength, and courage. Sikhs believe that there is a spark in every animal's soul and don't own such sacred animals. Magicians use the blood of the pigeon to perform black magic. Likewise, some fish are also used for black magic, these magicians in Kashmir are called *Jooadgar,* in Jammu *Tantaric* and in Ladakh *Langtoo*. Sheep is regarded as synonymous for a healthy and masculine body structure, and donkey is attributed to foolishness. Changthangi is unique to *Changapa* and is used to produce unique wool called *Pashmina*. Shawls are made from this *pashmina* which are having a very high price in the international market. These Shawls are so smooth that they can be made to enter through a ring easily (Wani *et al.* 2009). The Hanji community sundries the fish and fingerlings in summer for later usage in winters, these dried fish are called *Hugaad.*

Potential Threats to the commercial species

The commercial species documented from the present study do face some potential threats like diseases and predation. We focused on the predation part to document the top main predators seen locally by the livestock owners.

Predation

Predation is the main factor that causes mortality in livestock. The present study documented eight main predators (*Selenarctos thibetanus*, *Vulpes vulpes*, *Herpestes auropunctatus, Canis familiaris, Felis catus, Canis lupus, Panthera uncia,* and *Panthera pardus*) causing casualties (Table 2). These predators have been reported from various parts of Himalayan region (Ahmad *et al.*2020; Haq *et al.*2020). The heat map (Fig 8) shows the relationship between predators and prey in the study area and classified the predators into three groups that were recognized based on indicator species i.e., group 1st with *Selenarctos thibetanus*. Group 2nd with *Canis lupus, Panthera uncia,* and *Panthera pardus*. Group 3rd with *Vulpes vulpes*, *Herpestes auropunctatus, Canis familiaris, Felis catus.*

In Ladakh *Panthera uncia, Canis lupus,* and *Selenarctos thibetanus* were found affecting the commercial species especially, as these threatened carnivores are often found close to human habitation and sometimes prey on peoples' livestock. A carnivore depredation study revealed three villages in Gya-Miru (Ladakh) lost 1.9 livestock

heads per household per year, resulting in a monetary loss of $12,120 (Namgail *et al.* 2007). In Jammu and Kashmir *Panthera pardus, Selenarctos thibetanus, Vulpes vulpes,* and *Herpestes auropunctatus* were causing depredation of commercial species. Rao *et al.* (2002) reported the commercial species depredation from Nanda Devi Biosphere reserve India. Globally, at least two dozen species of terrestrial carnivores' prey on commonly found domesticated animal species (Inskip and Zimmermann2009; Nyhus 2016), it for this people around the world including our selected study area have expressed deep hostility towards large carnivores. The local inhabitants while going through the loss of the animal species were found to be in the capacity to take revenge by killing the predator species resulting human wildlife conflict and ultimately posing a threat to wildlife biodiversity.

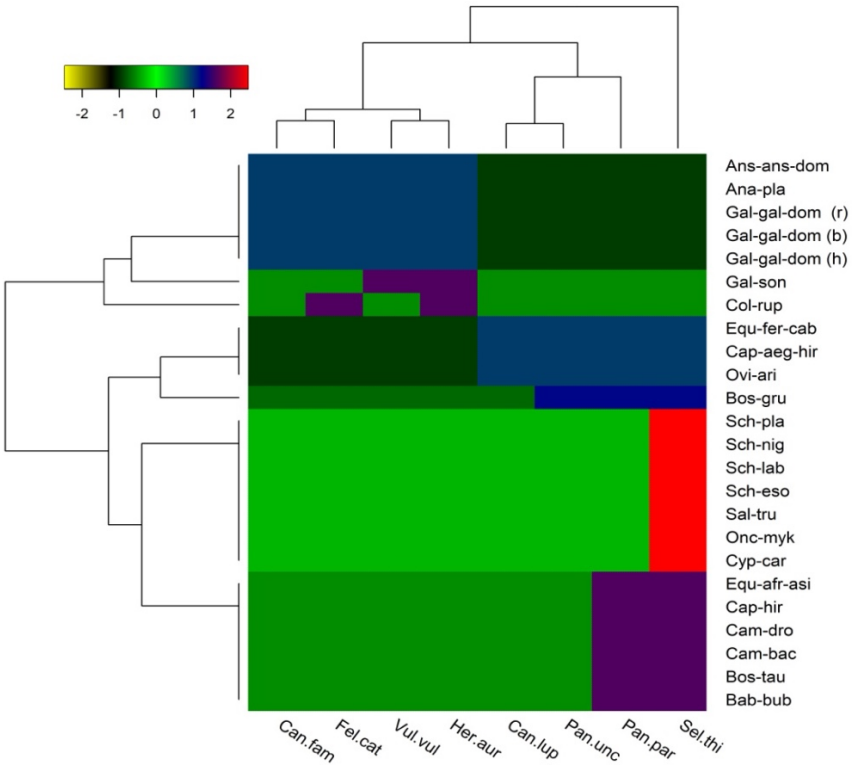

Figure 8. Two-way cluster showing relationship between predicator and commercial species.

Conclusions

The interaction between people and nature is important for the well-being of mankind. The fauna is a vital asset and has a direct implication for local livelihoods. Different species are specific to particular ethnic groups, forming an important part of their culture, economy, and agriculture, as in the present study fish were found specific to *Hanji,* Kashmiri jungle fowl to *Pahari* and Changthangi specific to *Changapa*, playing a vital role in the economy of these ethnic groups. Understanding the usage of commercial species in a specific ethnic group will help the stakeholders to draft better policies to overcome economic crises. Conservation mitigating measures can be put into action to overcome human wildlife conflicts due to predation which in turn would prevent the killing of wild animals and would safeguard the diversity of wild fauna in the Himalayan region. The ethnic groups of Jammu, Kashmir and Ladakh hold specific beliefs on utilization of parts of different animals, and most of the population in these regions are non-vegetarian.

Declarations

Ethics approval and consent to participate: All the participants provided prior informed consent before the interviews.

Availability of data and materials: Data is available from the first author.

Competing interest: The authors declare that they have no competing interests.

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Author contributions: MH carried out the field study. SMH and MH analyzed and interpreted the data and results. MH and SMH wrote the manuscript. UY, SH, MA, RWB revised the manuscript. All authors read and approved the final manuscript.

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