Hunting in a Biodiversity Hotspot: *A survey on hunting practices by indigenous communities in Arunachal Pradesh, North-east India*

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SUMMARY

Hunting is regarded as a serious threat to wildlife in Arunachal Pradesh, one of the biodiversity hotspots of India. The state has several indigenous communities who hunt for various reasons. A survey was carried out to examine the hunting practices among four tribes namely *Miju Mishmi, Meyor, Nishi* and *Monpa* inhabiting four districts (Lohit, Anjaw, East Kameng and Tawang). Field work was undertaken for five months in 2006. Household surveys using questionnaires and discussions with hunters were held to understand the hunting patterns, frequency of hunting, techniques and taboos related to hunting by tribal communities. A total of 33 mammals were reported by hunters of which 57% are either threatened, endangered or vulnerable. Use of both guns and locally made traps are widespread and wildlife is hunted for food, traditional customs, income, medicine, sport and to protect crops and cattle. Hunting is mainly carried out in winter season but musk deer and takin are targeted during August and September. People preferred wild meat but tend to consume domestic meat more often. The study highlights the importance of ritualistic hunting among the animist tribes. The number of mammals reported to be hunted varied with tribe, distance to town, and belief system. This survey has provided preliminary data on hunting practices by local tribes but there is a need for further study to determine levels of wildlife biomass extraction and the impacts of hunting on wildlife populations.

1. INTRODUCTION

There is a growing body of literature that demonstrates the significant impacts of hunting on wildlife in tropical forests (Robinson & Bennett, 2000). Impacts of hunting on wildlife populations include declines in vertebrate biomass and shifts in the relative abundance of size classes (Peres, 2000). With improved hunting technologies and penetration into remote forest areas, there is greater wild meat consumption (Robinson & Redford, 1991; Wilkie & Carpenter, 1999). Studies on sustainability of hunting show that species are being extracted much above sustainable limits (Hart, 2002; Hill *et al.*, 1997). Market demands for wild meat have also contributed in pushing the harvest levels of wildlife to unsustainable limits (Fa *et al.,* 1995; Apaza *et al.*, 2002). The effect of hunting by rural people has lead to quantified changes in structure of mammal assemblages (Jerozolimski & Peres, 2003).

India is generally known for its religious protection of wildlife. However, there are areas like the north-eastern states of the country whose culture, socio-economic scenarios and ethnicity contrast with the rest of the country. One such state is Arunachal Pradesh which is culturally more similar to Southeast Asia (Datta, 2007). Wildlife plays an important role in the lives of local people and is used for food, rituals and medicines. The sale of wild meat and wildlife products provides cash income and hunting of wildlife is also for recreation (Elwin, 1959; Furer-Haimendorf, 1962, 1982, 1983; Datta, 2002).

Indian wildlife laws (Anonymous, 1994) prohibits hunting of virtually all large wildlife but in North-east India, the law has been largely ineffective. The northeast region for decades was cut off from the rest of the country and large parts of this region are still not approachable easily. The hilly terrain and lack of road network has hampered the developmental process. Implementation of law and development programs in the region has been weak. Lack of awareness about law has contributed to the existence of widespread hunting practices. As hunting is linked to the culture, local people continue to hunt which may have disastrous consequences on wildlife. We have a very poor understanding of the ecological impacts and societal drivers of hunting in this region. All available information point to wildlife declines in this region, and as yet there is no considered approach to this conservation threat.

Arunachal Pradesh in north-east India is located within the Eastern Himalayan global biodiversity hotspot (Myers *et al.,* 2000) and among the 200 globally important ecoregions (Olson & Dinerstein, 1998)**.** Over 200 mammal species are reported from Arunachal Pradesh including several fascinating, rare or little-known species such as the clouded leopard (*Neofelis nebulosa),*

marbled cat (*Pardofelis marmorata)*, hoolock gibbon (*Hylobates hoolock)*, red panda (*Ailurus fulgens)* and spotted linsang (*Prionodon pardicolor)*. Arunachal Pradesh is also home to 26 different tribal communities who are primarily agriculturalists and hunter-gatherers, mainly dependent on shifting cultivation. These tribal groups practice hunting in some form or the other. In the last decade, human populations have grown accompanied by rapid changes in lifestyle and economies of the tribal communities (Datta, 2007). The lack of a scientific and quantitative understanding of hunting remains a serious lacuna, hampering the designing of appropriate, culturally sensitive conservation strategies.

This study aims to gain an informed understanding of wildlife hunting by tribal communities in Arunachal Pradesh that will help in developing imaginative and innovative conservation strategies.
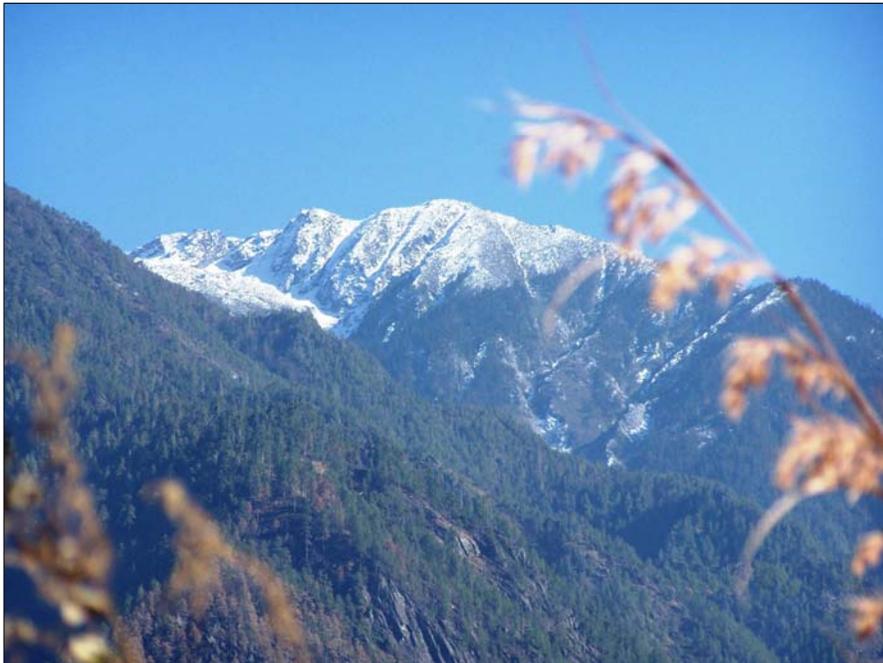
Eastern Himalayas, a global biodiversity hotspot

2. OBJECTIVES AND METHODS

This study is the initial part of a long-term project that is expected to be of 3-4 years duration. The objectives of the long-term project are (1) to determine the range of species hunted, hunting patterns, hunter motivations, frequency of hunting, and document the changes in hunting patterns and their causes (2) to determine the impacts of hunting on key mammalian and avifaunal groups and (3) to document people's attitudes towards wildlife conservation and ways of reducing their dependence on wildlife resources. In this initial survey, I tried to fulfill the first objective and this report focuses on the following objectives:

1. To determine the hunting patterns, frequency of hunting, techniques and taboos related to hunting by tribal communities

2. To determine the species hunted and motivations for hunting.

Field work was carried out for five months starting from January 2006. Data on hunting patterns and practices were collected through interviews at household level and discussions with villagers. Village level data was collected from key informants such as the village headmen (*gaon-burrahs*), school teachers or other important people in the village. Village level information on number of households, number of active hunters and other socio-economic parameters were collected. A standard set of questions (both open and close-ended) were used. Interview questions were prepared before the field work but they went through a series of revision and changes while carrying out the survey. Information on species hunted, motivations for hunting and hunting techniques, hunting frequency (number of forays per month), number of active hunters per village, hunting effort (number of forays before success), distance traveled to hunt, number of guns in a village, whether hunting is in group or solitary activity and hunter preference were collected. To determine the drivers of hunting, socio-economic data on family members, education levels, income levels, land ownership, occupations, religion, festivals and culture were collected.

Discussions with officials in the various departments of the local district administration and local assistants/guides helped to identify and select the villages. Selection was based on the distance from the headquarters and from the predicted number of hunters present in villages. It was made sure that villages that are both remote and closer to headquarters are sampled. In each village, the key informants were interviewed first and then households were visited randomly based on the availability of the people. One male member from each household was interviewed. Hunting data were collected from men because only men hunted. Women participated in discussions on taboos related to consumption of meat and hunting practices. Interviews were conducted with the help of local field assistants who could speak the local dialect and belonged to the same tribe. When required, mammal and bird field guides were used to confirm a particular species. All the interviews

were held in the residence of the villagers. Most interviews were held in the mornings and late afternoons.

Additional information was obtained by recording number and species of animal skulls, skins, teeth, feathers seen displayed in individual households. Religious ceremonies and weddings were also attended to document the role of wild and domestic animals in rituals and other traditional customs.

Information on population, number of villages, forest areas were obtained from block development office/circle office/district headquarters. Interviews and discussions were recorded in a dictaphone and transcribed later. Villagers seemed uncomfortable and wary when I initially attempted recording data in a notebook. The entire interview took around 30-40 minutes. Beyond the initial 20 minutes, it seemed difficult for the villagers to participate. They generally tend to lose interest and patience after some time and on some occasions; villagers were not able to give more time for discussions. In most villages, hunting was not a sensitive issue and people discussed hunting practices openly, however in Tawang and villages close to larger towns and Pakke Tiger Reserve, few respondents hesitated to participate.

Hunters were interviewed using questionnaires

3. STUDY AREA

Arunachal Pradesh in the Eastern Himalaya is one of the two biodiversity hotspots in India (Myers *et al.,* 2000) and has relatively large intact forest areas and low human population densities. The state is uniquely situated in the transition zone between Himalayan and Indo-Burmese regions. The altitudinal range is wide (100 m to above 6000 m), with lowland tropical evergreen and semi-ever green forests occurring up to 1500 m, and temperate oak and conifer forests at higher altitudes. Nine wildlife sanctuaries and two national parks have been established in the state. Four districts were covered during the survey, namely Anjaw, Lohit, and East Kameng districts (Fig. 1).

Figure 1. Arunachal Pradesh: The surveyed districts (Anjaw, Lohit, East Kameng and Tawang) and the surveyed villages marked as dots.
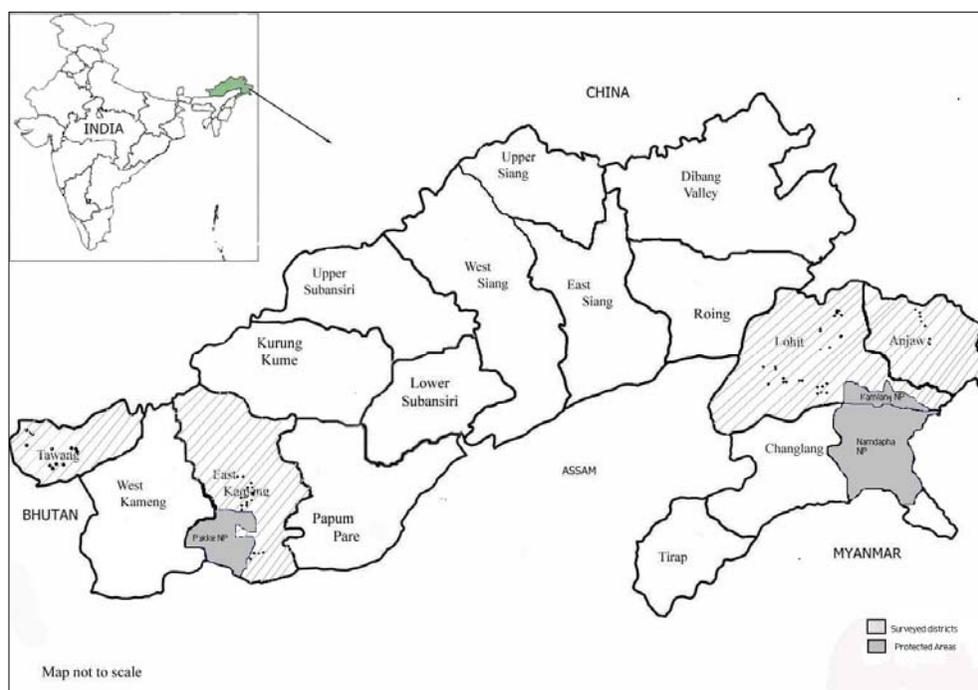
3.1. Anjaw district

Anjaw is a new district carved out of Lohit district in 2004. There are seven administrative circles namely, Hayuliong, Hawai, Walong, Kibithoo, Changlagam, Manchal and Goillong with its headquarters in Hawai. Anjaw district is in the north-eastern extremity of the state bordering China and Burma. The major inhabitants are the *Miju Mishmi*, the *Digaru Mishmi* and the *Meyor* or *Zakhring*. The Walong-Kibithoo area is remote but because of the presence of the Indian army in the area, roads till Kibithoo are motorable. The forests in Anjaw district are classified as Northern Tropical Semi-evergreen Forest (Eastern Alluvial Secondary Semi-evergreen Forest) and Assam Sub-tropical Pine Forest; East Himalayan Sub-alpine Birch/Fir forest (Champion & Seth, 1968). The main occupation is *jhum* or slash-and-burn cultivation and wet rice cultivation is largely not practiced due to lack of adequate flat terrain. The main crops grown are rice, maize, millet and some vegetables. The terrain is more hilly and rugged compared to other districts. Other cash crops grown are cardamom and opium. Opium is grown both for consumption and for sale. Orange plantations were attempted earlier but were completely unsuccessful because of the extreme cold weather conditions. There are no protected areas in Anjaw district and the nearest protected area is Kamlang Wildlife Sanctuary in the adjoining Lohit district.

3.2. Lohit district

Lohit adjoins Anjaw district on the north-east, to the west lies East Siang district and Assam while to the south lies Tirap district of Arunachal Pradesh. There are seven administrative circles in the district namely Sunpura, Tezu, Wakro, Chowkham, Namsai, Piyong and Lekang circles with the district headquarters situated at Tezu. The major tribes inhabiting the district are the *Miju Mishmi*, the *Digaru Mishmi*, the *Khampti* and the *Singpho*. The area has subtropical climate with a diversity of vegetation types with alpine and temperate vegetation in higher areas and tropical wet evergreen forest in foothill areas (Anonymous, 2003a). The main occupation is agriculture, both *jhum* and wet rice cultivation. Crops grown are millet, maize, rice, mustard and vegetables. Orange plantations are widespread and successful. Plantations were started about 15-30 years ago and are an important source of cash income for the villages here (Datta, 2002). Opium is cultivated in several areas in the district. Kamlang Wildlife Sanctuary (786 km^2) is the only protected area in this district.

3.3. East Kameng district

This district lies in the western region of Arunachal Pradesh surrounded by West Kameng in the west, Papum Pare in the east, part of Lower Subansiri in the North and Sonitpur district of Assam. It has ten administrative circles (Seijosa, Pakke Kessang, Richukrong, Seppa, Lada, Bameng, Pipu, Khenewa, Chayengtajo, Sawa). The district headquarters at Seppa lies on the bank of the Kameng river. The major tribes inhabiting this district are the *Nishi*, the *Aka*, the *Miji* and the *Sulung*. East Kameng has two forest divisions namely Seppa Forest Division and Pakke Wildlife Division with 4 and 3 forest ranges respectively (Anonymous, 2003b). Agriculture is the main occupation of the people of this district. *Jhum* cultivation is prevalent in the district, although it is being slowly replaced by permanent cultivation. The main crops of the district are paddy, maize, millet, sweet-potato, chillies and vegetables. The district has one protected area (Pakke Wildlife Sanctuary and Tiger Reserve, 862 km^2) located in the southern part in Seijosa circle.

3.4. Tawang district

Tawang lies in the westernmost part of Arunachal Pradesh which is bordered by Tibet in the north, Bhutan in the south-west and West Kameng district in the east. The district has seven administrative circles – Tawang, Mukto, Thinghu, Lumla, Zemithang, Dudunghar and Jang. The population of Tawang is 38,924 with a human density of 16 persons per km^2 and the decadal growth percentage (1991-2001) is 22.69. The *Monpa* is the major tribe inhabiting Tawang district. Habitat types found in the district are permafrost (areas that consist of barren rocky slopes and glaciers), high-altitude alpine meadows, dwarf rhododendron meadows, rhododendron scrubland, conifer forest, temperate oak forest, subtropical broadleaved forest and forest clearings (Mishra *et al.,* 2004).

4. TRIBAL COMMUNITIES

The number of tribal communities reported through the state according to various sources range. The Anthropological Survey of India has identified a total of 66 communities; of these 63 are scheduled tribes in Arunachal Pradesh (Singh, 1995). In general, 26 major tribal communities are recognized and reported from the state. Out of these, four tribes (*Miju Mishmi*, *Meyor*, *Nishi* and *Monpa*) were chosen for the study based on their culture, geographical location and hunting skills.

4.1. *Miju Mishmi*

The *Miju Mishmi* are one of the three tribes from the *Mishmi* group found in Lohit, Anjaw and Dibang valley districts. The other two *Mishmi* tribes are the *Idu Mishmi* and *Digaru Mishmi*. The *Miju Mishmi* are animistic, a belief system in which nature and its forces are important, consequently some practices involve animal sacrifices to appease spirits. It is believed that the spirits protect the people from disease and other natural calamities. Skulls of wild animals hunted are exhibited in houses as a symbol of hunting traditions and to ward off evil spirits. The animal skulls displayed in houses were used as currency in the past (Chowdhury, 1996). Crops grown by *Miju Mishmi* are millet, rice, maize; yam and buckwheat are the staple crops. Mithun *(Bos frontalis)* is an economic asset and the number of mithuns a person owns indicates the status of the individual.

4.2. *Meyor or Zakhring*

The *Meyor* or *Zakhring* reside only in parts of Walong and Kibithoo circles of Anjaw district along the banks of the Lohit river. They are a small tribal group belonging to the Lamaistic sect of Mahayana Buddhism. In 1981, the total population was 249 (Singh, 1995) and as of 2002, their population stood at 300. They are believed to have arrived from China towards the end of the 19th century and the early part of the 20th century to evade taxes imposed on them by the Chinese government. They live in wooden huts unlike the *Mishmi* long houses. There are only fifteen villages reported to be inhabited by *Meyor* and they are mostly cultivators though recently a few of them have taken to business activities and Government jobs. Rice and wheat are the main food grains and they also consume maize, millet, buckwheat and barley. *Meyor* are farmers and expert hunters and travel to remote areas of the high altitude regions for hunting.

4.3. *Nishi*

The *Nishi* are the most dominant tribal group in Arunachal Pradesh with several clans. The *Nishi* tribe mainly inhabits the south-western part of the state and are spread over several districts; Papum Pare, East Kameng, West Kameng, Lower Subansiri and Kurung Kumey. According to the 1981 census, population of the *Nishi* tribal group was 56,107 (Singh, 1995). The *Nishi* in East Kameng are called *Bangni* (a clan under the *Nishi* group). *Nishi*, also believe in animism and have good hunting skills. Rice along with the pulp of Sago palm is their staple diet. Like the *Miju Mishmi*, the role of mithun is greater in their economy and culture.

4.4 *Monpa*

The *Monpa* inhabit the districts of Tawang and West Kameng. They are mainly followers of Buddhism and predominantly agro-pastoralists (Mishra *et al.*, 2004). They follow the Mahayana sect of Budhhism (Choudhury, 1996) and are largely influenced by Tibetan form of the religion. The *Monpa* in Tawang practice terrace cultivation on rain-fed slopes on the hills. Rice, maize, barley, millet and buckwheat are grown while considerable cash income is earned through rearing of yaks, cattle and sheep (Mishra *et al.*, 2004). Livestock, especially yaks are a valuable economic resource for the *Monpa* and several kinds of processed milk products are sold in large quantities.

Miju Mishmi (top left), *Meyor* (top right), *Monpa* (bottom left) and *Nishi (bottom right)*

5. RESULTS

Four districts in the state of Arunachal Pradesh were surveyed from January 2006 to May 2006. Fifty one villages in Lohit, Anjaw, East Kameng and Tawang districts were visited. An average of 4.7 % of the total villages in each district was covered. Data was collected from 184 villagers from 51 villages of four different tribal communities (*Miju Mishmi*, *Meyor, Nishi* and *Monpa*). I surveyed 13% of the total number of households (1374) in the survey villages. The *Miju Mishmi* and the *Nishi* follow animism with the exception of few families who have converted to Christianity whereas the *Meyor* and the *Monpa* are Buddhist. The villages surveyed ranged in elevation from 165 to 2900 m (Table 1).

In Anjaw district, thirteen villages were surveyed out of which 10 were *Miju Mishmi* villages and the rest were inhabited by *Meyor* tribe. The total number of households in these 13 villages of Anjaw district is 186 out of which 18% households were sampled. Village size varied from 2 to 34 households. The altitude of the villages varied from 700 to 1640 m. Most of the villages were remote and not motorable.

In Lohit District, 64 households in 15 *Miju Mishmi* villages were surveyed which constituted 18% of the total number of households. Village size varied from 7 to 57 households. Although the *Miju Mishmi* are primarily animists, in villages close to Tezu and Wakro towns, some follow Christianity. In East Kameng, fourteen villages were surveyed and the village size varied from 6 to 57 households.

The survey covered an average of 15% of the households in each village in East Kameng. Seven villages were surveyed around Pakke Tiger Reserve in Seijosa, while 7 more were surveyed in the Papu Valley in Seppa circle. All the villages are homogenous and inhabited only by the *Nishi*. Many families have converted to Christianity. In Tawang, nine villages were covered in the district. Village size varied from 7 to 118. Four and five villages in Zemithang and Mukto circle were covered respectively.

5.1. Hunter's profile

The total number of respondents was 184 with an average of 47 per district. Only men were interviewed because women were not engaged in hunting. Respondents belonged to four different tribes namely the *Miju Mishmi* (Anjaw and Lohit district), the *Meyor* (Anjaw district), the *Nishi* (East Kameng district) and the *Monpa* (Tawang district). Out of 184, 62% (114) of them currently hunt wild animals and 38% do not hunt any more or engage in hunting activity.

Data collected from those who currently hunt (n = 114) was used to understand the current hunting patterns and practices. The data from respondents who do not currently hunt was used to

Table 1. Some descriptors of the surveyed districts.

Districts	No. of surveyed villages	Elevation (m)	Indigenous groups	Belief system	Protected Areas	Population	Area	Motorable villages
Anjaw	13	700–1640	*MM,DM,, Meyor*	Animist, Buddhist	None	18,428	--	3
Lohit	15	195-620	*MM, DM, Khampti, Singpho*	Animist	Kamlang WLS	1,43,527	11,402*	14
East Kameng	14	165-1000	*Nishi, Aka, Miji, Sulung*	Animist, Christianity	Pakke WLS & TR	57,179	4,134	8
Tawang	9	2010-2950	*Monpa*	Buddhist	**HH Tsangyang Gyatso	38,924	2,085	5
Total	**51**							

Indigenous groups – *MM – Miju Mishmi, DM-Digaru Mishmi.*
*Area - * 11,402 is the area of both Lohit and Anjaw districts. Anjaw is a new district carved out of Lohit district in 2004*
WLS - Wildlife Sanctuary, TR -Tiger Reserve, **proposed biosphere reserve.
Source: Population Census Data, Arunachal Pradesh, 2001, Statistical Hand Book of East Kameng, Tawang, Lohit districts, 2002-2003. Information on Anjaw was collected from Block Development Office.

understand their perceptions on wildlife, past hunting practices and taboos followed. In this report, 114 respondents who currently hunt will be referred to as active hunters and those who do not hunt as inactive hunters.

Active hunters were only from *Meyor, Miju Mishmi* and *Nishi* tribe (Table 2). Out of 35 persons interviewed in the villages in Tawang, none said they currently hunt. Some villagers used to hunt earlier but have stopped hunting since the visit of Dalai Lama, the spiritual leader of Buddhism. Villagers interviewed in Pangchen Valley of Zemithang circle of Tawang district claimed they never hunted and also mentioned that no one hunts in the valley because of religious reasons. During informal discussions with the villagers in Tawang, people did report hunting to protect their livestock and crops. As hunting is against their religion, people appear to under-report or hide information on true levels of hunting.

Table 2. Percentage of active hunters and inactive hunters across the four tribes.

Tribes	Villages surveyed	Total respondents	Active hunters (%)	Inactive hunters (%)
Miju Mishmi	25	92	88	12
Meyor	3	5	100	0
Nishi	14	52	54	46
Monpa	9	35	0	100

Age group of hunters

Around 53% of the hunters interviewed fell in the age group of 40 to 60 years, followed by 43% (20-40 years) while 4% of hunters were above 60 years (Fig. 2). People start hunting from the age of 10-12 years and most of them continue hunting till their health permits. Young boys below 20 years also join the hunting groups as helpers in carrying loads and for cooking. Most young boys were commonly seen using catapults for hunting birds and squirrels.

Figure 2. Age group of active hunters (n=114)
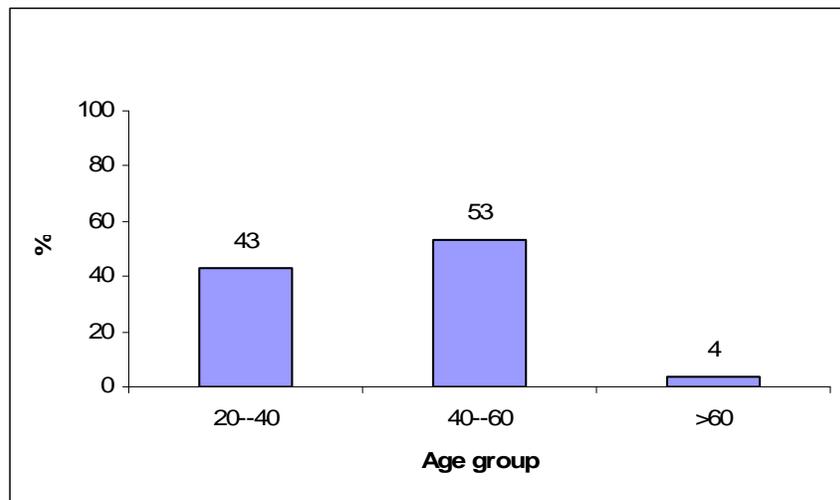
Reasons for hunting

Miju Mishmi, Nishi and *Meyor* reported food as the main reason for hunting followed by money, rituals/customs, and interest in hunting and retaliatory killing of crop-raiding animals (Fig. 3). On some occasions, a hunting trip is carried out for a specific reason as in the case of the *Miju Mishmi*. Wild meat is offered as a bride price by the *Miju Mishmi* during their weddings. Gifting fresh or dried wild meat is a traditional practice during weddings. During these times, villagers undertake hunting trips specifically for large animals. Other villagers also help the bridegroom's family in accumulating baskets of wild meat. Hunting is often also combined with other activities such as collection of bamboo and agricultural work.

Figure 3. Reasons for hunting (n = 157)
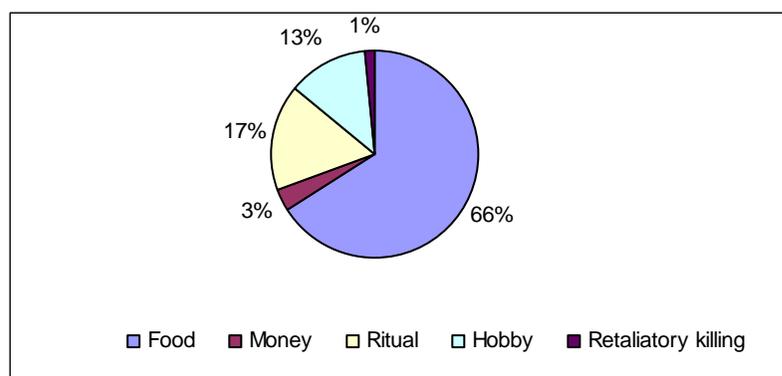
Cash income was an important reason for hunting by the *Meyor* tribe. They are known to trade in wildlife parts in towns in Assam like Tinsukia and Dibrugarh.

Reasons for not hunting

Seventy respondents from *Miju Mishmi*, *Nishi* and *Monpa* tribe said they do not hunt. Among them, 50% were in the age group 41 – 60 years followed by 27% in the age group 20-40 years. Reasons given for not hunting were religion, old age or lack of interest and time (Fig 4). Religion accounted for 46% of the reasons and all respondents in this category were from Tawang district. The government ban on wildlife hunting as a reason accounted for 30% and all the twenty villagers interviewed who gave this reason were from seven villages of Seijosa circle. They reported that they do not hunt because of the government laws that prohibit them from hunting. These villages are close to the Pakke Tiger Reserve and also the site of a long-term Hornbill Conservation Project. The villagers in this area were aware about the wildlife laws.

The two major reasons that villagers cited for not hunting wildlife were ban by the forest department and religion in the *Nishi* and the *Monpa* tribe respectively. In the *Miju Mishmi*, other than old age and lack of interest in hunting, there is no other reason given for not hunting.

Figure 4. Reasons for not hunting (n = 71)

Legend: ◻ Old age ■ Govt ban ◻ Lack of interest/time ◻ Religion

Values shown: 47%, 21%, 30%, 3
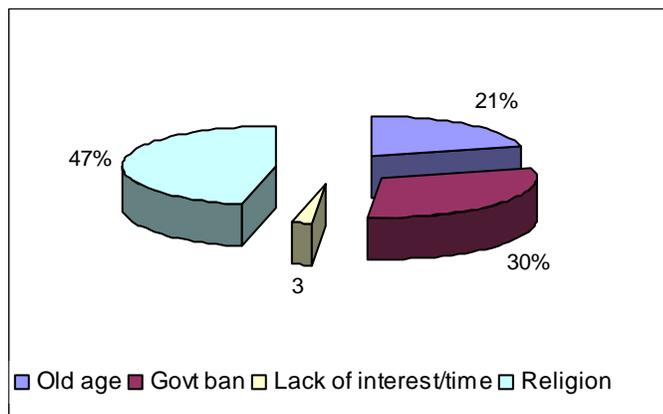
Frequency of hunting

Most hunters do not follow a fixed hunting schedule but they go hunting whenever they feel like. Some hunting trips carried out for cultural or ritualistic reasons may follow a schedule. The *Miju Mishmi* carry out intensive hunting trips before a wedding to accumulate wild meat to be given as bride price. During this occasion, hunting trips can take place more than once a week. For a broader understanding of the hunting patterns, three categories were formed based on hunter's responses.

Fifty percent of the hunters said that they go hunting at least once in a month, 26% frequently hunt (once a week) and 24% go hunting once in 3-6 months a year. Frequency of hunting trips was not significantly different among *Miju Mishmi*, *Meyor* and *Nishi* tribes (Kruskal-Wallis One-way Anova , χ^2= 0.555, df = 2, P = 0.758). In addition, there was also no difference in frequency of hunting trips between two animist tribes; *Miju Mishmi* and *Nishi* (Mann-Whitney U test, U = 1072.00, Z =-0.472, P = 0.637).

Group size of hunters

Hunting is both a solitary and a group activity. Most hunters go in pairs (43%) and 34% hunters said that they go alone. Relatively few hunters (11%) go in larger groups of more than 3 persons. The *Nishi* tribe hunts in larger parties compared to the *Miji Mishmi*. Group hunting was reported to be common in villages in the Papu valley (East Kameng). They take their hunting dogs and at times, in groups of up to 10-15 people.

Time of hunting

A majority (95%) of hunters leave in the early morning for hunting. According to them, the animals come out from their hide in the morning and they are more visible. One hunter in East Kameng said he goes at night too with torch lights. Most hunters (77%) undertake one-day trips while only 7% reported going on longer trips over several days, sometimes for weeks. Longer hunting trips of more than a week were mostly reported by the *Meyor* tribe.

Distance traveled for hunting

Hunters were asked about the distances traveled to hunt 10 years ago and distances traveled at present. The time spent on hunting forays were converted to three distance classes (half day to one day = close to villages, 2-3 days trek= 1-5 km from village, week or more than that= >5 km from village). There is a marked difference in the distances reported between past and present hunting trips. Earlier, hunters did not travel beyond 5 km, whereas 83% of the hunters said at present they travel distances of more than 5 km to hunt (Table 3). However, according to 25% of the hunters, there was abundant wildlife close to villages and that they did not need to go farther to look for wildlife.

Table 3. Distance traveled by hunters 10 years back and now

Distances	10 years back (%)	At present (%)
Close to villages	25	0
1-5 km	75	17
> 5 km	0	83

The difference traveled for hunting 10 years back and now was significantly different (Wilcoxon signed rank test, Z = -8.986, P = 0.000). This points to a possible decline in wildlife populations close to the villages as hunters travel much farther to hunt currently.

Hunters were asked if they hunted in forests that had closed canopy or open canopy. Forests with closed canopy are preferred by villagers for hunting. Most hunters said they hunt in these forests (62%) while 14% of hunters access the alpine and temperate forests to hunt specific high-altitude target species such as the musk deer, takin and pheasants. Hunters believe that hunting is more successful in forests with closed canopy. There was relatively more hunting of high altitude species such as musk deer, takin and pheasants in Anjaw district because of its location in higher elevations and the availability of snow-covered.

Season of hunting

Winter was the preferred hunting season for most hunters (93%). According to hunters, wildlife descends from the higher elevations in winter and hunting is easier then. Hunters also prefer hunting during this season because it is less tiring and they can carry out long treks into the forests. During this season, they are also free from agricultural work as the harvest season is over by October – November. There are some specific times during winter when hunting expeditions are undertaken. Hunters report that hunting success is greater when a rainy night is followed by a bright morning. Hunters also note the phase of the moon and decide whether hunting should be carried out. The preferred phase is on the 7-9th day of the moon month, when there are more chances of a successful hunt. During the rains, hunting trips are generally avoided because of leeches, fear of snakes, unfavourable weather and the risks involved on slippery paths. A small number of respondents said that they hunt in any season.

5.2. Species hunted

A total of 33 species of mammals, 27 species of birds and 2 reptiles were reported as being hunted in Anjaw, Lohit, East Kameng and Tawang. *Miju Mishmi* and *Nishi* reported hunting 73% and 64% of the species, while the *Monpa* and *Meyor* hunted fewer species.

Data on hunted species were gathered based on what hunters reported and the animal remains (skulls/ trophies, skins, carcasses, bones, teeth, meat, feathers/scales) recorded in villages. Based on hunters' reports, barking deer (98%) and wild boar (86%) were the most frequently hunted species, followed by goral, takin, Asiatic black bear, serow and sambar.

Out of 33 mammals that were recorded, only 34% of the species were actually reported by hunters during formal interviews. Hunters appear to report only species that they think are important. Several species that are smaller, or considered unimportant or perhaps caught accidentally were sometimes not reported by hunters. Hunters generally avoided reporting animals that are a taboo. The hunters were not probed further by asking if they hunted a particular species because hunters may tend to exaggerate and such information can be unreliable. During household trophy surveys, discussions with key informants and informal visits, I recorded an additional 21 species that were not reported as being hunted during interviews. Therefore, the number of species hunted is much more than what was reported only through interviews with hunters. The animal trophies, skin and other animal remains were counted and recorded. Birds were often not mentioned, when asked, they reported that several bird species are hunted and they do not keep track of these.

Skins of 29 mammals, 11 mammal skulls and 4 mammal teeth were recorded in households. Information on the articles made from animal parts such as bags, skull caps, war shields and headgear were collected.

In Tawang, though villagers did not report any hunting, animal skins and skulls were recorded from their houses. A total of 12 species of mammals were recorded in Tawang during casual household visits and discussions.

On average, a hunter hunted 4.48 mammal species ranging from 1-11 species. A few hunters were specialized only in trapping birds. The average number of mammal species hunted currently was compared across age groups, tribe, belief system and techniques used.

Tribe: The average number of mammals hunted significantly differed among different tribes (Kruskal-Wallis One-way Anova, χ^2 = 15.66, df = 3, P = 0.000). *Miju Mishmi* and *Meyor* reported 4.5 and 5.6 mammal species respectively per hunter was higher than the number of mammal species hunted by the *Nishi* and *Monpa* tribe.

Age: The hunters from age group 20-40 years hunted an average of 4.9 mammal species, followed by 4.8 and 4.0 by hunters above 60 years. The average number of mammal species hunted was not significantly different between age groups (Kruskal-Wallis One-Way Anova, χ^2 = 4.42, df = 2, p = 0.108).

Hunting techniques: The average number of mammal species hunted were compared across different hunting techniques (those using guns, traps and those who use both the techniques) was highly significant (Kruskal-Wallis One-Way Anova, χ^2 = 15.60, df = 2, P = 0.000). Hunters who used both guns and traps hunted more species (4.5), followed by guns only (3.8) and traps only (2.2).

5.3. Wild meat consumption

Eighty-two percent of villagers prefer to consume wild meat (Fig. 5.). The preference for wild meat was reportedly because of taste as wild meat is considered delicious and it is also believed that wild meat is not contaminated like the meat of domestic animals that eat refuse found in and around the villages.

Figure 5. Preference of wild meat (n = 184)
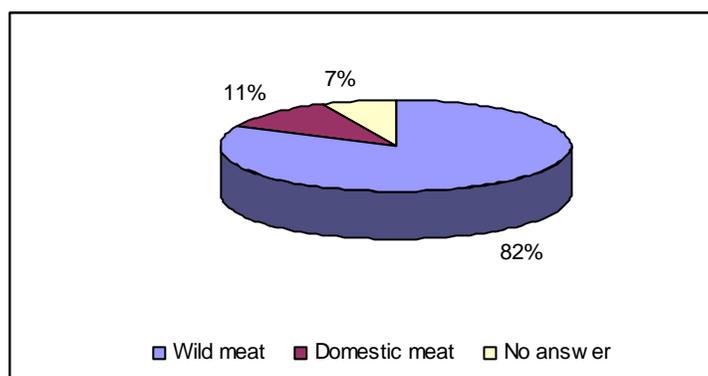
Though wild meat is preferred, the consumption of wild meat was less compared to domestic meat. According to 83% of hunters, they take more domestic meat than wild meat (Fig. 6), 8% stated that they consume more wild meat and for the rest 2%, both wild and domestic meat are eaten in equal amounts.

Figure 6.   Consumption of wild meat (n = 184)
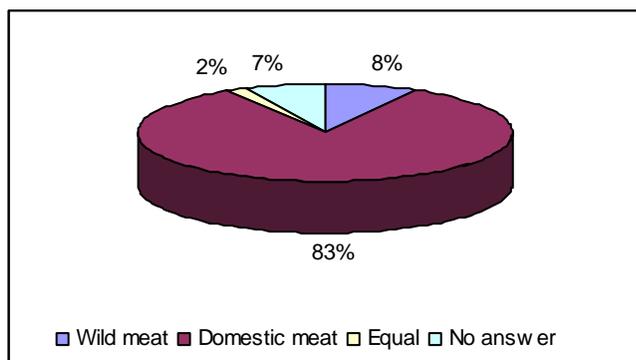
Seven percent of the responses from *Monpa* tribe in Pangchen valley, Tawang district reported that even domestic meat is not consumed because of religious reasons.

Hunters were asked how often they consume wild meat. Forty percent reported consuming wild meat at least once in 1-2 months and 42% said they rarely take wild meat (once in 3-6 months/year). Fifty percent of hunters said that the source of wild meat was from hunting, 16% of the hunters get wild meat as a share from other hunters or as a gift as part of the customs, 14% both hunted or got as a share, while 8% said they bought. Twelve percent did not give any answer. In the *Miju Mishmi* tribe, the custom of gifting baskets of smoked wild meat exists for bride price where the number of wild meat baskets gifted represents the status of the bridegroom. The baskets of wild meat are gifted during the wedding ceremony. One of the weddings attended had 31 baskets of smoked wild meat and the villager said sometimes the number of baskets can go up to 50!! The family members and the relatives of the bridegroom help him in accumulating the smoked wild meat a year before the wedding function. Wedding ceremonies also require a large amount of firewood so more trips to forests for both hunting and firewood are undertaken by the bridegroom and his family members.

Sometimes wild meat is bought from other hunters or from a common place where the wild meat is sold. At village level, there are no local markets where wild meat is sold openly. Whenever there is wild meat for sale, the news is spread through word of mouth and people gather in small numbers and the meat is sold. Thirteen percent of hunters stated that they sell wild meat. In small towns like Seppa (East Kameng) and Wakro (Lohit), hunters report that wild meat is sold in the markets. Villagers in East Kameng close to Pakke Tiger Reserve said there is no wild meat available now because of the ban on sale of wild meat by the Forest Department.

5.4. Economic value of wild species

Hunting is carried out mainly for household consumption as well as trade. Wild meat is sold locally among the villagers. Fresh wild meat costs Rs. 80/- per kg, while dried meat is 100/- per kg (Table 4). Apart from consumption and rituals, some species are targeted for the market by all four tribes. Pods from musk deer and gall bladders of black bear fetch a high price. One *tola* (10 grams) of musk pod is sold for Rs. 5,000. One *tola* (10 grams) of black bear gall bladder (used as medicine) is sold for Rs. 1,600 – 2,000. Most *Miju Mishmi* possess bags made out of bear skin that costs between Rs. 500 and Rs. 1,000 depending on the size of the bag. Three bags can be made out of one bear skin. Some villagers in Goillong circle of Anjaw district reported that otter skins are sold at Rs. 10,000 per skin. The *Nishi* use capped langur skins to wrap the *dao* (machete) which sells for Rs. 500 per piece in Seppa town.

In Anjaw, prices of domestic meat (poultry, domestic pig and goat) is between Rs. 200 and Rs. 250 per kg whereas price of wild meat ranges from Rs. 80 to Rs. 100 per kg. *Miju Mishmi* sacrifice domestic animals during festivals and religious ceremonies. Any person who falls sick calls the priest to perform some rituals and later sacrifices one or two domestic animals for quick recovery. Therefore, domestic animals are very important for animistic tribes and it is kept as reserve in case they are required during a crisis. Thus, the price of domestic meat may be higher than wild meat whereas wild meat is available freely and can be hunted whenever they want.

Table 4. Economic value of wild animals and their body parts.

Species	Body parts	Rs/per unit	Remarks
Any wild species	Meat (fresh)	80/kg	
Any wild species	Meat (smoked)	100/kg	One basket (10-15 pieces of smoked meat)
Bear	Gall bladder	1,600-2,000	One *tola* (10 gm)
Musk Deer	Musk pod	5,000	One *tola* (10 gm)
Otter	Skin	10,000/one skin	Goillong (Anjaw district)
Bear	Skin	500-1,000	3 bags from one skin
Barking Deer	Full animal	4,000-5,000	
Goral	Full animal	4,000-5,000	
Takin	Full animal	15,000-20,000	
Musk Deer	Full animal	15,000-20,000	
Black bear	Full animal	15000-20000	
Barking Deer	Skin	150-200	
Bear	Skin	900-1,000	
Bear	Large skin	2,000	
Chinese Pangolin	Skin/scales	5,000	*Miju Mishmi* (Lohit)
Jackal	Skin	2,000	*Miju Mishmi*, (Lohit)
Leopard/ small cats	Lower jaw	1,500-2,000	for an attachment in *dao* (machete) among the *Nishi* (East Kameng)

Tiger/leopard	Skin	1,000-1,500	Papu valley (East Kameng)
Capped Langur	Skin	500	*As a cover for dao* (machete) among *Nishi* (East Kameng)
Raptors	One wing	1,000	for *Nishi* priests in rituals in Papu valley (East Kameng)
Pheasants	Full bird	200	Walong

5.5. Hunting weapons, techniques and strategies

Hunters either used guns or traps and also both guns and traps. Fifty-eight percent of hunters had guns and those without guns borrowed guns from others. More than 50% of the hunters used both guns and traps for hunting.

Hunters actively pursue animals with guns or bow-arrow. They either go alone or with others in small groups. Hunters in Seppa valley of East Kameng are accompanied by hunting dogs. Dogs help in hunting by chasing the prey towards the hidden hunters. The prey gets tired after a long chase and it is easier for hunters to get the game.

In passive hunting, hunters set traps in the forest and return to the village. The traps are checked after a gap of 3-4 days. Bows and arrows are used for hunting in East Kameng and cross-bows in Anjaw district. The bows are made out of bamboo and the bow string is prepared from a plant fibre. Arrows are made from thin bamboo sticks. While shooting with bow and arrow, a piece of cane is kept in the right hand to guard the palm.

a) Poison arrows: The tuber of a high-altitude herbaceous flowering plant *Aconitum ferox* is made into a paste and applied on the arrow tips. Extract for three arrow tips is made from one small tuber. The extract is highly poisonous and kills the animal immediately.

b) High altitude bamboo: There is a species of bamboo which is found only in the high altitude areas of the state which is used to make arrows for special automatic trigger and release traps. Arrows made out of this bamboo species is more powerful than other arrows and is believed to leave a fatal infection on the target animals.

c) Catapults: Children use catapults to hunt small birds and squirrels. Children can be often seen near the roads and forest edges with small cloth bags with pebbles and marbles with which they hunt birds and smaller animals like squirrels.

Hunting strategies

(a) Hide and seek: Hunters wait for animals near fruiting trees, this is often done during the winter season. They construct a small platform on a tree and wait for animals. Several animals, especially deer visit to forage on fruits.

(b) Imitating animal calls: Hunters imitate calls of deer calves to attract adult deer. As the adult deer approaches, it is hunted. A broken bamboo stick or leaves are used to make such calls. But according to hunters, on some occasions, this call even attracts unwanted large predators like tigers or leopards.

Type of traps

Hunters use different kinds of indigenous traps and eleven types of traps were documented during the survey (Table 5).

(a) Stone traps: Ground-dwelling traps for birds like pheasant, jungle fowls are set on the ground close to some vegetation and ground cover. Other animals like rodents are also targeted using this trap.

(b) Canopy traps: Bow-shaped traps specially set up on the canopy to trap birds. It has a horizontal stick on the bottom of the trap where the fruits/seeds are hung in a bunch. The birds get trapped when they come to eat the fruits.

(c) Twig Traps: A small shrub is bent with a string attached and the trap is set on the ground as a noose. The noose is covered by grass and other vegetation. When the animal steps on it, the animal is caught and is lifted up with the string attached to it. The bent twig is thrown up as the animal is caught and animal is hung up in the air.

(d) Pit fall: This trap is specially set for bears. A large pit of about 2 x 2 m is dug in a place. Several sharp bamboos (0.5 to 1 m) facing upwards are planted on the floor of the pit.

(e) 'Trigger and release' trap: This is set next to the animal trail/forest path. A string is laid parallel to the ground and fixed on the either side of the road. The distance of the string from the ground depends on the animal targeted. A sharp bamboo (high altitude species) is fixed in a nearby bush. Any disturbance on the string triggers the release of the bamboo arrow which kills any animal crossing the path. It is considered as one of the most dangerous kinds of traps, therefore a cross-like symbol is displayed on the trail to warn human intruders. These traps are no more in use in several villages following the death of people due to these traps and the use of this trap is now banned in several villages.

Table 5. Indigenous traps used by tribal communities in Arunachal Pradesh.

Traps	Location	Materials used	Target Species	Usage	Tribe
Stone trap	Ground	Bamboo, large stone	Rodents, ground-dwelling birds	Frequent	*Miju Mishmi*
Kamya (Trigger and release)	Ground	Bamboo, cane	Sambar, barking deer, tiger, leopard wild dog	Rare	*Nishi, Miju Mishmi*
Canopy traps (semi-circle)	On fruiting trees	Bamboo, cane, fruits/seeds	Birds, squirrels, canopy-dwelling small mammals	Frequent	*Nishi*
Loop trap	Both ground and canopy	Nylon wire and bamboo	Birds	Frequent	*Miju Mishmi*
Gum trap	On fruiting trees	Resin, bamboo sticks	Birds	Rare	*Nishi, Miju Mishmi*
Metal triangular traps	On ground, near granaries	Metal, bamboo sticks	Rodents	Frequent	*Miju Mishmi*
Metal wire trap	Ground	Wire and sticks	Carnivores	Frequent	*Nishi, Miju Mishmi*
Hanging stone trap	Canopy	Cane, stone and nut (bait)	squirrels, martens, small mammals	Rare	*Nishi, Miju Mishmi*
Pit fall trap	Ground	Bamboo, grass	Bears	Rare	*Miju Mishmi*
Box trap	Ground	Bamboo, string	Monkeys	Rare	*Miju Mishmi*
Log fall	Ground	Large log, large stones	Porcupine	Frequent	*Miju Mishmi*

Traps for birds

(a) Gum from trees is applied on thin sticks which are planted on fruiting trees that attract several birds. When birds visit the tree for fruits, they get stuck onto these glued sticks.

(b) A thin bamboo ring is formed and an insect is tied and hung in the middle of the ring. The size of the ring varies depending on the size of the bird targeted. When the bird tries to pick on the insect, it gets trapped in the ring.

5.6. Taboos on wildlife hunting

The *Miju Mishmi* and the *Nishi* practice animism where several taboos and rituals related to hunting are observed.

Before hunting

Hunters leave early often before the sun rise. They also prefer that no one sees them when they leave. If any one sees the hunter leaving, and enquires where he is going then it is considered to be a bad luck. Rituals are performed before hunting. If a hunter has been very unsuccessful in securing an animal during his previous hunts, he visits the priest for consultation. The *Nishi* priest sacrifices a chicken to read its liver and foretells the outcome of future hunting events. If hunters have bad dreams before going on a hunting trip, the trip is either cancelled or postponed. Bad dreams include seeing accidents, girls, red flowers and red cloth.

During hunting

When hunters go in groups, they are not supposed to talk, joke or laugh too much. They pray for a good hunt before leaving. Materials needed for the rituals are carried and after a successful hunt, rituals to thank spirits are performed. There are certain beliefs that relate to the outcomes of their trapping efforts. If there is a muscle twitch in the hunter's calf muscle of the right leg, it apparently indicates that an animal has been caught in the trap. If it is on the left leg, it indicates that an animal has been caught in traps set by other hunters. Even at home, while the hunters are away, the family members follow some rules so that hunts are successful. Any guest who arrives while the hunter is out on a hunting trip is never kept waiting outside the house and is asked to straight away enter the house. By doing so, it is believed that the animal that approaches the trap will definitely enter rather than visiting the trap and returning back.

After hunting

After a hunting trip, the hunters return after dark to avoid seeing anyone. There are a few rituals that a hunter has to perform if he has hunted an animal that is taboo.

Taboos on certain species

Tigers are not hunted among the *Miju Mishmi* and *Nishi* tribe. Even sighting a tiger is regarded a taboo. Hunters feel its better not to sight a tiger while they are in the forest. Sometimes, even if a tiger is close to them for an easy kill, they do not hunt it. Hunters say sometimes tigers have been killed only in self-defence. Hunting of any member of the cat family is a taboo and is strictly followed by most of the villagers. If anyone hunts a member of the cat family, an elaborate "religious ceremony" is carried out by sacrificing cattle, mithun and pigs which is expensive and time-consuming. Sometimes, these rituals are performed for 5 days. Hunters stay in the room where

rituals are performed and do not enter other rooms. Food and water is supplied to them by boys. Women do not enter this room. Hunters can go outside their room but cannot enter other rooms and especially women's rooms. On some occasions, these rituals may have to be performed thrice if a tiger is killed. The cost involved in performing these lengthy and rigorous rituals is high, with sacrifice of mithun and cows and several people invited to participate.

The *Nishi* believe that tigers are their elder brothers. Both *Nishi* and *Miju Mishmi* believe that if the tiger is hunted, the person who killed it will either die or will suffer from serious illness or any other disease. It is believed that when the tiger dies, its spirit enters the body of the hunter and kills him to take revenge. If such rituals are not performed, people believe that it would result in the sudden death of 2-3 members of the hunter's family. Tiger teeth are kept by the *Miju Mishmi* priest and are used during performing rituals. The teeth are supposed to have strong spiritual powers. The *Nishi* priest also keeps both tiger teeth and skin. Other than tiger skins, skins of leopard and clouded leopard are also used by priests. Two tiger skins, one leopard skins and several clouded leopard skins were recorded in priest households in Papu valley. Priests believe that tiger skins and other large cats' skins bring spiritual powers and they use them in the healing process and while performing the rituals.

Once a tiger is hunted, consuming tiger meat is not taboo and is eaten only by men. Women do not enter the room where the tiger meat is cooked. Similar taboos are followed for leopards and clouded leopards too. Both *Nishi* and *Miju Mishmi* women reported that they do not eat monkey and tiger meat, although they can consume meat of most other wild animals. In earlier days, it is reported that women never used to eat the meat of any animal with four legs, however things have changed now. *Miju Mishmi* women also do not eat meat of mithun and cow.

Yellow-throated marten *Martes flavigula* is not hunted and not eaten by *Miju Mishmi*. If it gets caught in the traps set for other animals, it is buried in the soil immediately. Hunting of hoolock gibbon is taboo in *Miju Mishmi* villages in Lohit district. Even sighting one is considered extremely inauspicious, especially for pregnant woman who strongly avoid seeing one. It is believed that the sighting leads to the death of the baby. Hoolock gibbon calls are heard frequently in forests around the villages where this taboo is followed.

6. DISCUSSION

There is widespread hunting of wildlife throughout the districts visited. All the four tribes hunt some form of wildlife. The intensity of hunting by these tribes range from complete restriction in some areas where it is a taboo to places where there is no restriction on hunting at all. *Nishi, Meyor* and *Miju Mishmi* hunted without much restriction except in few *Nishi* villages around Pakke Tiger Reserve. Hunting practices were observed to be the least among *Monpa* villages in Pangchen valley in Zemithang circle of Tawang district. This is mainly because of the religious reasons and presence of strong Buddhist values. Pangchen literally means the place where "people have given up sins". In these villages, even consumption of domestic meat and chicken is observed as a taboo. Interestingly, villagers outside the Pangchen valley hunted but were reluctant to provide information.

Food was cited as the main reason for hunting; rituals played a vital role in motivating hunting among animistic tribes (*Nishi* and *Miju Mishmi*). The link between wildlife hunting and the ritualistic practices is the highlight of this survey. Animistic tribes who perform rituals during weddings, deaths, decorate animal skulls in their huts seem to hunt more than Buddhist tribes (*Meyor* and *Monpa*). In *Miju Mishmi* weddings, baskets of smoked wild meat are given as bride price and wild meat is also gifted to the priest during important rituals. Guests who attend the rituals are offered wild meat. In one of the ceremonies attended, a Temminck's Tragopan (*Tragopan temminckii*) was trapped alive to be given as a gift to the local priest. Hunting for ceremonies is reported from Central Africa where primates are targeted and there is a concern for species conservation in these areas as this brings additional responsibility of balancing wildlife conservation with traditions of the local people. Currently, there is large scale conversion of *Miju Mishmi* to Christianity. Interestingly, villagers those who have converted have abandoned the ritualistic way of worshipping spirits and have stopped displaying the animal skulls in their huts but continue to hunt. Hunting practices appear to have not affected even after the belief system is altered.

The *Meyor*, although Buddhist undertake hunting trips to higher altitude for musk deer, takin and black bear and reported selling musk pod, bear gall bladder and other animal skins in towns in the neighboring state of Assam. Income was an important reason for hunting by the *Meyor* tribe. Hunting in Africa is mainly for food and for cash and this has been linked to increase in commercial trade in wild meat and increasing rural poverty (Kumpel, 2006; Fa *et al.*, 2003).

The frequency of hunting did not vary among the tribes but varied based on the purpose of hunting and across the seasons. Studies in other areas in Peninsular Malaysia and Western Himalayas, India (Kuchikura, 1988; Kaul *et al.*, 2004) have also found that most hunting is during winter either because wildlife is more visible in winter compared to other seasons or people have more time to spend on hunting as in this season they are free from agricultural work. The hunting

trips carried for ritualistic reasons were reported to be intense as a given amount of wild meat is required for wedding ceremonies as bride price. The frequency of hunting also depends on the alternate livelihood options available. Hunters during the survey reported that they hunt because they are free in non-agricultural season and there are no other livelihood options available. In Ghana, people depend on hunting for additional income during the lean agricultural period (Cowlishaw, *et al*., 2005). The use of traps and snares by villagers show that hunting is indiscriminate and villagers feel that there is lot of wastage involved in trapping animals. The captured animals often fall prey to scavengers and decay before they can be retrieved.

The distances traveled for hunting seem to indicate a decline in the wildlife population around the villages. Hunters did not travel far to hunt previously but now they travel long distances. Hunters also felt that there is a decline in wildlife populations over the years. Villagers farther from town seem to hunt more. There are several reasons why this could happen. It is possible that wildlife is more abundant in areas that are far from town. Alternatively, lack of employment opportunities and lack of awareness on wildlife law in remote areas could result in more hunting. The most remotely located tribe among the four tribes studied was the *Meyor*. Employment opportunities are few in the region where *Meyor* live compared to other villages closer to towns where employment options in shops and road construction work is available. Additional data is required to support such speculations. In Cameroon, the tribe settled in areas with no roads hunted intensively and for commercial reasons outside the region whereas the tribe living along the road side hunted relatively less mainly for local consumption (Willcox & Nambu, 2007). The difference is attributed to the presence of road. Shivley (1997) reported that distance from the forest was an important determinant of hunting effort. Households farther from forests were less likely to hunt and hunted less often.

The consumption of wild meat was common in villages in Lohit and Anjaw districts. People preferred to consume wild meat but consumed domestic meat more often. Such a trend was observed in studies in Africa where there is a negative relationship between consumption and preference. The mostly highly preferred types of wild meat tend to have low consumption (Kumpel, 2006). Around 30-80% of the protein intake by forest-dwelling people in the Congo basin is derived from hunting (Wilkie & Carpenter, 1999). In the survey villages, this may not be the case as villagers rear domestic livestock, pigs and chicken which are eaten. In a few areas in Lohit and Anjaw district, sambar meat was available for Rs. 60/- per kg whereas chicken were sold for Rs. 200/- per animal. The prices of meat play a very important role in consumption pattern of the local people. Starkey (2004) reported that as wild meat is cheaper than domestic meat, people can afford to buy wild meat more frequently than the domestic meat (Starkey, 2004). In remote villages of

Congo bushmeat price is one third of price of any of the alternative protein sources i.e. chicken, fish or beef (Walsh *et al.*, 2003). Among the *Miju Mishmi* tribe, domestic animals are viewed as reserve products which are needed for sacrifice during medical emergencies. Due to lack of healthcare facilities in these remote areas, villagers tend to rely on the use of domestic meat for curing illness. Wild meat on the other hand is regarded as a resource which is freely available in the forests and can be procured any time. Hunters felt that wild meat is more tastier and unpolluted compared to domestic meat.

Three kinds of hunters were documented during the study. First, are the specialist hunters who target particular species like musk deer, black bear and takin. They undertake long treks, camp in the forest for several days and would mostly return only after they succeed. For instance, one hunter specialized only in trapping birds and was expert in making ground and canopy traps for birds. The second categories are the opportunistic hunters who are more generalist in hunting animals. This type of opportunistic hunting is also reported in other areas (Rao *et al.*, 2005; Duckworth, 1999; Lee 2000). They undertake one-day trips and get whatever animals they capture and trips are mostly in nearby forests. The third categories of hunters are the ritualistic hunters. These hunting trips are carried out only for gathering wild meat to be given as bride price. Ritualistic hunters may fall in either the specialist category or in the opportunistic category.

The level of awareness is low in the region except in villages surveyed around Pakke Tiger Reserve (East Kameng) and in Tawang, where after the visit of the Dalai Lama, people were aware of wildlife laws against hunting. Information on hunting was more easily obtained from a majority of respondents except in a few villages that were close to town. Villagers often provided information without any reluctance and took pride in sharing information on hunting which is part of their culture. However, data on the income, wealth indicators, and education levels of the surveyed households could not be collected because of the unreliability in the information. Obtaining relevant information was difficult because of time, financial and manpower constraints and at times because of the lack of co-operation from some villagers.

This survey highlights the issue of hunting among tribes of Arunachal Pradesh and the concerns for wildlife conservation. Ritualistic hunting and hunting for trade plays an important role in the local culture and the local economy. An in-depth study is required to understand animal abundance and extraction rates. Widespread and indiscriminate of hunting in the state is a matter of concern. As hunting is part of the local people's lifestyle and needs, a better understanding of the factors that contribute in hunting is required to design conservation projects with locally acceptable and sustainable solutions to this problem.

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Appendix A: Species hunted by indigenous groups in Arunachal Pradesh. The tick mark (√) indicates the type of animal parts recorded from hunters.

S. No	Species, Scientific Name	IUCN Status	Skin/ scales	Skull	Teeth
1.	Barking Deer *Muntiacus muntjak*	Lower risk	√	√	
2.	Musk Deer *Moschus* sp.	Lower risk, near threatened	√		
3.	Sambar *Cervus unicolor*	Lower risk		√	
4.	Gaur *Bos gaurus*	Vulnerable		√	
5.	Serow *Nemorhaedus sumatraensis*	Vulnerable	√	√	
6.	Takin *Budorcas taxicolor*	Vulnerable	√	√	
7.	Goral *Nemorhaedus goral*	Lower risk	√	√	
8.	Wild Pig *Sus scrofa*	Lower risk		√	
9.	Asiatic Black Bear *Ursus thibetanus*	Endangered	√	√	√
10.	Malayan Sun Bear *Helarctos malayanus*	Data deficient	√		
11.	Red Panda *Ailurus fulgens*	Endangered	√		
12.	Tiger *Panthera tigris*	Endangered	√	√	√
13.	Common Leopard *Panthera pardus*	Lower risk	√	√	
14.	Clouded Leopard *Neofelis nebulosa*	Vulnerable	√		√
15.	Golden Cat *Catopuma temmincki*	Vulnerable	√		
16.	Leopard Cat *Prionailurus bengalensis*	Lower risk	√		
17.	Chinese Pangolin *Manis pentadactyla*	Lower risk	√		
18.	Yellow-throated Marten *Martes flavigula*		√		
19.	Spotted Linsang *Prionodon pardicolor*	Vulnerable	√		
20.	Wild Dog *Cuon alpinus*	Vulnerable	√		
21.	Asiatic Jackal *Canis aureus*	Lower risk	√		
22.	Rhesus Macaque *Macaca mulatta*	Lower risk	√	√	
23.	Capped Langur *Trachypithecus pileatus*	Endangered	√		
24.	Orange-bellied Himalayan Squirrel, *Dremomys lokriah*	Threatened	√		
25.	Flying Squirrel species	------------------	√		
26.	Malayan Giant Squirrel *Ratufa bicolor*	Threatened Species	√		
27.	Large Indian Civet *Viverra zibetha*	Vulnerable	√		
28.	Common Palm Civet *Paradoxurus hermaphroditus*	Lower risk	√		
29.	Himalayan Palm Civet *Paguma larvata*	Lower risk	√		
30.	Himalayan Crestless Porcupine *Hystrix brachyura*	Vulnerable	√		
31.	Himalayan rat *Rattus nitidus*	Data Deficient	√		
32.	Small-Clawed Otter *Amblonyx cinereus*	Near threatened	√		
33.	Rodent species	------------------			

Appendix B - Questionnaire 1
Hunting patterns, frequencies, techniques and taboos: household level

Date:
Village: Circle: Dist:
GPS location of village:
Religion / cultural belief:
Distance to nearest town:

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1. How old were you when you first hunted?

2. What species do you hunt now?

3. Which species are preferred and why?

4. Preferred time of the day for hunting. Why?

5. What is the duration of each hunting trip?

6. What is the preferred season for hunting? Why?

7. Is there a season/month when there is hunting is restricted. Why?

8. In what kind of forests do you prefer hunting?

9. Do you hunt alone or in group? Why? If in a group, what is a group size?

10. How many hunting trips are made in a month/week?

11. For every 5 times you went hunting, how many attempts were unsuccessful?

12. How many animals did you hunt last year? (off-take rate)

13. Number of active hunters operating in your village:

14. What is the distance traveled to hunt 10 years back?

15. How far do you go now to hunt?

16. Do you own a gun? IF YES, Purchased or made

17. Do you share weapons? ❒ YES ❒ NO

18. What meat is consumed regularly?❒ more wild meat ❒ More Domestic meat ❒ equal

19. How often do you eat meat?

20. Do you buy wild meat? ❒ YES ❒ NO. IF YES, From whom?

21. What is the source of wild meat?

22. What is the cost of wild meat? Cost (Rs/kg) Fresh and Dry

23. Do you sell live animals? ❒ YES ❒ NO . If sold, what is the cost?

24. What are the hunting techniques?

25. Are there any taboos on hunting any animal? If yes, which animals and why?

Questionnaire 2
Household level socio-economic data

Date:
Name of the village:
GPS location:
Family: Village head man / hunter / others

_____

1. No. of family members:
   Male: Female: Children:

2. Education

Age/sex	No education	Education level (list each separately)
Ad males		
Ad females		

3. Livestock/poultry numbers

Type of animal	Total number
Buffalo	
Bullock	
Cow	
Pigs	
Chickens	
Ducks	
Goats	
Mithun	
Other animals	

4. What is your monthly income?

5. Do you have agricultural fields? YES ☐ NO ☐ If yes, area of agricultural land

6. What crops are grown?

7. Do you have land for *jhum kheti*? YES ☐   NO ☐

8. Main religion followed in household:

Questionnaire 3
Socio-economic data at village level

Date:
Village: Circle: Dist:
GPS location of village:

_____

1. No. of households in the village:

2. No. of active hunters in the village:

3. What is the mode of hunting (guns / traps/both?)

4. How many licensed guns do you think your village have?

5. Do all families in the village hunt/trap? If no, how many families?

6. What is the educational level in the village?

7. Is there electricity supply in the village?

8. Does the village have a school? What level?

9. What are the religions/belief followed in the village?

Plate 1: Indigenous traps used in Arunachal Pradesh for capturing wild animals

Traps for capturing birds

um used for trapping birds

Metal wire used as noose to capture mammals

Traps for small ground dwelling mammals

Plate 2: Wildlife species hunted in Arunachal Pradesh

Musk deer skin

Skulls of wild boar, barking deer and himalayan black bear on display in *Miju Mishmi* huts

Temminck's Tragopan

Stuffed leopard cat

Plate 3: Wildlife parts used as part of local people's cultural practices

Capped langur skin as a cover for *dao* (machete), also seen is a carnivore lower jaw

Clouded leopard skin used in a *Nishi* priest's hut

Bag made from himalayan black bear skin

Wild meat served during wedding ceremony