Study on the trends of bushmeat consumption and traditional hunting on wild fauna by Indigenous community living near protected area in Nagaland.

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Master's Degree in Wildlife Science

By

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Certificate

This is to certify that **Ms. Satemmenla Longchar** has carried out original research titled ***"Study on the trends of bushmeat consumption and traditional hunting on wild fauna by indigenous communities living near protected area in Nagaland"*** in partial fulfilment of Master's Degree in Wildlife Science from Saurashtra University, Rajkot. The study was carried out under our supervision from December 2012 to June 2013. We hereby certify that this work has not been submitted for any other degree to any other university.

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Acknowledgement

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~ Paulo Coelho, The Alchemist

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~Isaiah 41:13

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Summary

Bush- meat Hunting is an integral part of a man's life specially people living in an indigenous community. This practice has evolved since primeval time. This has been rooted in the culture and traditions which plays an influential role in keeping those practices alive. Hunting is an art. And these arts are an integral part of shaping a man's role in the society. This is however becoming a calamitous action in destroying wildlife, often driving them into extinction-at global and local scale. With the over growing populations in the world and a huge demands for wildlife globally, for consumption, medicinal values, for clothing, and traditional adornments, these factors eventually lead to extermination of species at a rapid speed.

Nagaland is in a region recognized as a biodiversity hotspot, in spite of the rampant hunting activities across the state. My study site Intanki National Park is located in Peren District of Nagaland. This park is categorized as Northern subtropical broad leave forest type. This park adjoins neighboring state of Assam's Dhansari reserve forest and hence an important area for connectivity for species.

I conducted my field study from December 2012 to April 2013 in Intanki National park, Nagaland. I choose 6 sites for my study based on hunting intensity. A total of 60 transects of 1 km each was walked on the human and animal trails for estimating abundance of both mammal and birds separately. Along with that 240 plots for tracks and pellet count were sampled to estimate relative mammal abundance index. Camera traps sampling at each of the 6 sites vary from 50-99 trap nights. Relative density estimation of mammals from pellet results highest in site Camp2 with1.75 (0.34) and least in the community reserve with 0.22 (0.09), whereas relative density estimation for track plot was highest in site Longkhor Disa (1.4 (0.22) and least in community reserve (0.37 (0.02). For mammals the density estimation was 25.02 (3.64),for the bird's density, the highest was found in small sized birds with cluster size of 114.38 per sq.km, lowest density was for ground dwelling birds at 13.68 birds per sq.km.

Site Occupancy (Ψ) and species richness for birds and mammals from camera traps and transect (n=60) was estimated at six sites. Data indicates that species richness of birds is highest in camp 2 (38) and least in Hatibu Disa (25). Richness of mammals was higher in the community reserve (20) and least in Hazab Disa area (5). The capture rate of all the species was higher in junction camp where as the lowest photographic capture rate was obtained from Hazab Disa.

I surveyed a total number of 94 households and 16 hunters across 6 villages. From the questionnaires it was found that the Indian muntjac, common palm civet, jungle fowl and wild pig are the most preferred species with 100% positive response from 94 households surveyed, for consumption. Traditional hunting techniques are being replaced by the modern Guns for killing animals. Besides, demand of wild animal for traditional medicinal usage also contributes to the hunting of animals.

It was observed that hunting does not impact species richness. However, in mammals, there is negatively impact on ungulates (pellet density and encounter rate). For birds, the significant negative effect is found only on the medium sized birds. Equilibrium density (density to support hunting) was calculated by Individual hunted per year per 100 sq.km / growth rate. In my study, the deficit of species due to hunting was found most effective on Indian muntjac and Common palm civet. Over harvesting of this species through hunting will result in decline of the species population.

I estimated sustainability of hunting and found out that most of the species are hunted beyond sustenance level; hence, if this is continuous, it might result in the population and local extinction. In conclusion, in a society where bushmeat is an essential source of proteins, it is important to realize the current status of wild fauna and hence emphasis should be given to control and promote alternative.

CHAPTER1

Introduction

1.1. Context

Hunting has always been an integral occupation of human society ever since the evolution of man 1.8 million years ago. It was the first step ever taken by Homo *sapiens* for survival, food and defense and was constantly aided with the various inventions of hunting paraphernalia. This is still very much prevalent today (Alves and Rosa 2009). Rampant hunting, for meat and game has pushed large numbers of animal species to the brink of extinction (Madhusudan 2002). The realization of this fact has prompted people to set certain rules and regulations to control the rapidly declining animal biodiversity. Creation of protected areas across the country provides safe haven for wild animals from being hunted, yet many indigenous hunting practices occur in many places which is often hard to stop due to traditional and cultural practices continuing since ages.

Bushmeat hunting (or wild meat) can be defined as the harvesting of wild animals in tropical and sub-tropical countries for food and for non-food purposes, including medicinal use (CBD, 2011). This practice of pursuing, capturing, or killing wildlife has provided the primary source of protein for human since time immemorial. While hunting retains this critical role in some cultures, agriculture and animal husbandry make killing wildlife a non-subsistence activity for most people. Modern hunting is divided into two types: extermination hunting, which is targeted at eliminating species that compete with agricultural practices or threaten human safety or for their own consumption of proteins by maintaining their culture and tradition which are often termed as local hunting. The other form of hunting is hunting certain selected species, which are often driven by regional and global market demands for their high-value by-product and is termed as commercial hunting as it is aimed at generating income. This market hunting can be commercialized and turn into recreational hunting which focuses on social activities including sport (Peterson 2008, Madhusudan 2002). Hunting has an incredibly diverse ecological history and it is said that the hunters have caused 23% of known species extinctions, also while modifying the landscapes (Peterson 2008).

My study area, Nagaland has the northern subtropical forest formation and the forests in the state can be categorized as Tropical Semi Evergreen, Tropical Moist Deciduous, Subtropical Broadleaved Hill, Subtropical Pine and Montane Wet Temperate Forests (Govt. of Nagaland 2012). It lies in a region recognized as global biodiversity hotspots as it is the confluence of Indo-Malayan and Indo-Chinese biogeographic zones (Meyer N et al 2000, Srivastava A. 2006). Nagaland is a storehouse of traditional and indigenous ecological knowledge. More than sixteen major tribes across the state have its own distinct dialect, culture, customs, rituals, food habits, and lifestyle; with these characteristics it makes Nagaland one of the richest treasures of indigenous ecological knowledge.

Today's scenario is scarred with depletion of wildlife species increasing rapidly, and is not helped by introduction of modern weaponries. The wildlife crisis echoes pitifully in the whole state of Nagaland as people turn a blind eye to the situation. These issues of wildlife hunting should be taken into primary consideration in efforts concerning conservation as well as research so as to provide a solution to conserving wildlife with sustainable utilization of wildlife in culturally wildlife-dependent indigenous communities of Nagaland.

1.2 Review of literature

Hunting is a major threat to conservation of wildlife. This activity has increased in recent years for several reasons, including deforestation, increase in human population, and increased access to hunters and traders for remaining forests as a result of road construction and forest fragmentation and even the use of efficient modern hunting methods has resulted in the loss of traditional hunting controls (Milner-Gulland & Bennett 2002). In addition to this, another contribution to this factor is human greed, which with its lack of scientific reason and complexity in the environment often rules out simple approaches (Struksaker, 2001). Recently, the rapid acceleration in loss of tropical forest species owing to unsustainable hunting occurred first in Asian forests (Hance, 2009). For example, within the past 40 years, large vertebrate species have been extirpated in Vietnam largely due to hunting. Similarly, in the present scenario, Africa is now experiencing species loss across wide areas and, in the next 10–20 years, losses are likely to be recorded in even the remotest parts of Latin America (Milner-Gulland & Bennett 2003). Approximately 500 million people are believed to be living in or at the edge of the tropical forests. They are some communities across the globe where they depend on the forests for many

important products and environmental services. World's 150 million native or indigenous people population of forest-dependent rely on forests for sustenance and unsustainable usage of wildlife and exploitations has created a lot of loss in the tropical forests and has resulted in local extinction (Bennett & Rao 2002). Hunting is a human livelihood issue since it results in the loss of wildlife resources for the inhabitants of tropical forests. It has been considered a threat to the conservation of tropical wildlife but the scale has increased greatly in the recent years. In tropical forests today, the abundance of wildlife is more closely associated with patterns of hunting than with factors such as forest type or its protected status (Woodroffe & Ginsberg 1998). Hunting activities have the potential to impact not only the targeted species but also the whole ecosystem

Hunting has led to many species going extinct. Some of the earliest flagship which became extinct over 4,000 years ago was wooly mammoths mainly due to hunting for its hide, ivory, meat and fur. Dodo, an endemic bird in Mauritius which was last reported in 1662, was driven into extinction due to human settlement. Besides hunting the bird, there were other factors on the island, for instances the cats and dogs which also contributed in driving the species into extinction (Atkinson 1996). However in most recent extinctions the actual mechanism of hunting has been well documented across the globe. For instance, the largest recent marsupial carnivore, the Tasmanian wolf or thylacine, native to continental Australia, Tasmania and New Guinea, was shot and poisoned into oblivion by sheep farmers in the 1920s and 1930s (Paddle 2000). The North American sea mink was obliterated in the late nineteenth century for its fur, and the sea otter almost shared its fate for the same reason, in the early 20th century. The 'wolf' of the Falkland Islands, which is related to the South American fox-like canids, was still there when Charles Darwin visited the first half of the nineteenth century. It preyed on sheep, and also carried a useful pelt, it has existed since the 1880s only in museums (Kruuk 2002). Passenger pigeon went into extinction in the early 20th century due to hunting as they were highly populated and hence, were shot for consumption. Quagga a sub species of plain zebra of South Africa went into extinction due to over hunting, the last captive individual died in 1867. People have hunted mammals for at least 40,000 years in tropical Asian forests and this period has seen global extinction of the giant pangolin, *Manis palaeojavanica* but there was no strong evidence for unsustainable hunting pressure until the last 2000–3000 years, when elephants, rhinoceroses, and several other species were progressively eliminated from the large parts of their ranges (Corlett 2007). Recent extinction of animals in the Asian continent is the Baiji river dolphins in

china which went into total extinction in 2006. Besides these, there are other animals which become locally extinct because of hunting by mankind for all the wrong reasons, for instances brown bear and wolf in Britain, plights of Pandas in Asia, and Polar bears in the arctic are critical, with the population almost at risk eventually becoming critically endangered animals in the world, however with global warming and excess of hunting animals for its hides, fur and fat is at the brink of extinction. In India, some examples of extinct animals due to hunting are cheetah, which was last shot in 1947, local extinction of lions in the central part of India, now restricted only in Gir, Gujarat, Sumatran rhino has been extinct from the country (Rangaranjan, 1999), evidence of the Sumatran rhino has been recorded even in Nagaland (Choudhary 2005). However one horned rhino is also at great risk due to illegal activities and human influences, now this endangered animal is restricted only in Northeastern part of India- Assam, West Bengal and Terai region of Nepal. Tiger is another species which is at risk in the country due to hunting and poaching, these factors have led to extinction of sub-species of tiger like the Javan tigers in 1979, Caspian tiger in the beginning of 20th century. However, these extinctions have triggered India to conserve the nations' pride i.e. - the royal Bengal tiger in the 1974 by launching the Tiger project.

In many developing countries, the killing of wild animals for commercial purposes for bushmeat trade is a significant factor in the reduction of biodiversity and represents a major threat to the survival of many populations (Clapham & Waerebeek, 2007). Hunting by humans is believed to be the most significant factor which has driven many large wildlife species to extinction. The wild prey species have high amount of animal protein and hence the tendency to prefer wild meat, making them vulnerable to hunting (Madhusudan and Karanth 2002, Malla 2009). Bushmeat hunting is influenced by the increase in human population and poverty, weak governance, and inadequate law enforcement (Mfunda & Roskaft, 2010). This poverty stricken condition lead to hunting in most developing countries in Africa, Southeast Asia and Indian Sub-continent, and hence wild food, especially bushmeat, provides a vital source of protein and income for rural households and are heavily dependent on it (Merode 2004, Madhusudan & Karanth 2002, Hilaluddin 2005).

Different choices and practices of hunting vary across the globe. For instance, research conducted in Serengeti showed that, hunting preferences of the hunters differed between Western

and Eastern part of Serengeti, where the latter preferred small and the former, medium to big sized wildlife though mostly for economic activity in Western Serengeti (Mfunda & Roskaft 2010). These high-levels of bushmeat hunting have threatened wildlife populations and resulted in local extinction of some species (Mfunda & Roskaft 2010). However, vulnerability of wild species also makes it tempting for the hunters to hunt the animals making it highly endangered (extinction) because of the high demands in the market as well (Palazy et al 2011). The trophy hunt is more valuable than hunting because the meat is included in the trophy hunt as a byproduct. Also wildlife trophy hunting has increasingly replaced traditional meat hunting in some countries (Naevdal, et al 2012). Besides, hunting of wildlife as a pest is a major issue which also occurred historically as in the case of Wayanad district, Kerala, which was a prime elephant hunting area and records show that one man alone killed 300 animals in the region (Menon, V., Sukumar, R. & Kumar, A. 1997). Meanwhile in Sri Lanka at least 3500 elephants were hunted in between 1845-48, where the elephants were consider as a nuisance to human. However, in India, although sport hunting was prohibited by 1972, hunting elephants for protecting humans and their crops and homes continued till much later (Menon, V., Sukumar, R. & Kumar, A. 1997). These hunting practices and preferences are also driven and influenced by the cultural attachment to wildlife (Mfunda & Roskaft 2010)

Indeed, hunting has always been a hindrance and a threat in the conservation of wildlife, yet it has been culturally rooted in our country. Hunting is one of the greatest conservation challenges in a tropical wildlife (Velho, et al 2010). However, hunting by local communities is among the most widespread threats to Indian wildlife, yet, the understanding of its nature, extent, and impacts on wildlife has been poorly studied (Madhusudan & Karanth 2004). Humans have been hunting wildlife in tropical forests for 100,000 years or more, but consumption has greatly increased over the past few decades (Milner-Gulland & Bennett 2002). Eastern Himalaya and Indo-Myanmar biodiversity-hotspot complex is particularly vulnerable to hunting. In a study on hunting across the country, reported 114 species of mammals, out of which a total of 94 mammal species across the Indo-Myanmar and Eastern Himalayan biodiversity hotspot complex, are reportedly hunted (Velho.et al 2010). These wildlife species are mostly for consumption, as food is one of the main motivations for hunting, however, the preference for wild meat was reportedly based on taste as people believed that wild meat is not contaminated like the meat of domestic animals (Aiyadurai et al 2010). It has resulted in the wild meat crisis which is a challenge for

conservationists, as an urgent, widespread and complex issue across the globe (Milner-Gulland & Bennett 2003).

Recent studies indicate that hunting by indigenous people is no longer sustainable in many regions especially in tropical countries where humans have lived and hunted for thousands of years (Tidemann & Gosler 2010, Pangua-Adam & Noske 2010). However in the past, cultural factors had a major influence on hunting practices, for instance putting certain restriction in their community or in their society on which species to hunt, when to hunt and who could hunt, though now these traditional practices are lost. This factor is attributed mainly because of the fact that many indigenous people in the tropics were animistic or paganist, though mostly because of religious taboos (Aiyadurai et.al 2010). Traditional societies employ food taboos on animal species for a number of reasons which benefit number of threatened populations of species, including endemic and keystone species from such taboos (Colding 1998). Food taboos are the basis of strong ethics which is referred in the aspect of their environment in case of species diet, medicinal use and emic aspect which is referred to some taboo based on the animal behavior and smell (Begossi, 1992). Religious ethics can also be a reason for this food taboo or it can be simply avoidance of certain species which have turned into tradition and eventually end up as a food taboo (Meyer-Rochow 2009). Whatever the reason maybe in the culture and traditions with respect to taboos, it has still contributed in conserving number of wildlife. Besides many indigenous communities across the globe for instances, South America is believed in origination of their ancestor from certain species of birds and hence hunting of these species were prohibited. Now in this modern scenario these traditional beliefs were breaking down and those bird species are hunted by clans itself (Pangua-Adam & Noske 2010).

Current status of research in the subject area

Martin, Caro & Kiffner (2012) on "prey preferences of bushmeat hunters in an East African savannah ecosystem", highlights the importance of treating humans as apex predators in modern day Africa. They tested whether derived indices of preference were affected by the proportional density, its habitat preference, and body mass of the mammalian prey. The result they got was that hunters tends to be opportunist and rarer species are taken in the ecosystem also enabling information for wildlife managers to predict what hunters take most from protected areas.

However in the Indian scenario very limited research has been done, some research on Wildlife hunting was done by Aiyadurai et.al. 2010) on hunting by indigenous tribes in Arunachal Pradesh. The research was a survey on the cultural practices that has influenced hunting within the community of four districts in Arunachal Pradesh and its belief system. It also looks on the species which are mostly hunted and determinant of hunting and off take of animal in those four districts. The research looks into the anthropological issues amongst the community, and the population dynamics of the species hunted.

Besides, Velho et al 2012, reviewed hunting studies and describes the hunting sites in India, to identify the species and geographic regions which is mostly at risk and also assessed their legal protection in those areas and highlighted the deficit knowledge of hunting of wildlife in the country.

However, less work has been done in Nagaland regarding effect of hunting on wildlife conservation. Some work by the state government on state-wide biodiversity survey of Nagaland has been initiated with collaboration of scientists from the National Centre for Biological Sciences (NCBS). They have pointed out the hunting as the main threats to conservation of biodiversity.

1.2 Rationale, objectives and approach

1.2.1. Rationale: The purpose of my study is to understand the factors influencing hunting with respect to today's scenario in a landscape in-habituated by indigenous communities. This study will highlight major threats to wildlife owing to hunting. Through this study I will be able to gauge the status of the species hunted, assess factors influencing preference of wildlife species by hunters and the extent of hunting, and socio and cultural aspects of hunting.

1. 2.2. Objectives: The objectives of this dissertation are to

I. Assess the impact of hunting- on species richness, abundance and persistenceof species
II. To study the socio-economic aspect of hunting –consumption, utilization and traditional usages of wildlife
III. To check the impact of hunting on wild fauna

1.2.3. Approach: The information obtained and described in this thesis was through a combination of approaches:

- One month of reconnaissance survey (December 2012) and 4 months of intense fieldwork (January 2013 till April 2013) in Intanki National park, in regards to estimation of abundance of wild animals which are hunted by the local people. Data collection includes estimation of animal's abundance using techniques and methods like camera traps, transects for both animals and birds, track plot and pellet count.
- Socio economics survey was done based on interview survey for household (n=93), hunters (n=16) and market survey (n=7) using both structured and semi-structured questionnaires. Interviews for the socio-economic survey were carried out with the villagers and the hunters, prior permission from the *gamburas* or the village headman. 10 percent of the total village was taken into consideration for the survey.
- Review on the existing scientific literature on bushmeat.

1.3. Study area

Intanki National Park (25°32'10.33" N and 93°32'59.55" E elevation of 1223 ft.) is located in Peren district of Nagaland, which has a total population of 94,054 with 80153 population in the rural area and the rest 14801 in urban area (Govt. of India, Ministry of Human Affairs, 2011). The whole park is spread over an area of 202 km² with its altitude varying from 200 m to 682m. The Park border with the neighboring state of Assam and is located on the banks of Dhansiri River and forms a conterminous patch of forests with Assam's Dhansiri Reserve Forest. This park is an important corridor area for wildlife between the two states, as it connects the fragmented patches of forests between the two states. Intanki however comprises of both the plain and hilly areas and is characterized by moist deciduous riverine forest and hill forest with mixed composition of vegetation.

This Park is blessed with a rare array of diverse species in comparison to many other forests patch in Nagaland. With the unique geographic location, as being a lowland forest type in comparison with the hilly terrains which is widespread across Nagaland, it harbors many wild species, 40 species of mammals were recorded in my study area from 7 order and 17 families.

Diverse species of avifauna is present in the park, Intanki national park has 4 species of hornbill - the great hornbill (*Buceros bicornis*), Oriental pied hornbill (*Anthracoceros albirostris)*, Wreathed hornbill (*Rhyticeros undulates*), and the rare-Brown hornbill (*Anorrhinus austeni).*

1.3.1. Study sites

Five sites were taken inside Intanki National park and one nearby community reserve as my study sampling area. These areas were chosen based on the hunting intensity and activity in the Park after a reconnaissance survey by interviewing the villagers and the forest staff.

1. **Longkhor Disa:**

   Geographical location: N25.61464 and E093.41103

   (Figure 1.1)

   This area is located on the North West part of the park. It adjoins the Dhansari reserve forest, Assam. The two state boundaries has been demarcated by Dhansari River that flows between them. It is a dense forest and a mixture of both moist deciduous forest as well as riverine forest vegetation. The topography of this region is slightly undulating. This region borders with Assam forest where heavy logging takes place through most of the seasons except monsoon. This area is heavily used by the hunters or the loggers as it has connectivity with Assam forest.

2. **Junction camp:**

   Geographical location: N25.6924 and E093.53226

   (Figure 1.1)

   Located at the northern part of the National park, this area is earlier a part of Intanki National park which was encroached by nearby villagers, which were eventually evicted from the park. The area was closed to the village Buisuimpuikam which is just 4 km. community forest is nearby and hence human entry to the forest is common sighting. Dhansari River runs through this sites also demarking the area from Assam. The Forest here is mostly moist deciduous, with some patches of grasslands which provides a good habitat for the elephants in Intanki. This site is closest to the villages around Intanki, and hence NTFP collections are quite frequent by the villagers.

3. **Camp 2**

Geographical location: N25.64782 and E093.50729

(Figure 1.1)

This area is located north of the park. This area is farther away from the village but quite accessible for illegal activities. Occurrences of activities by the insurgents inside the forest was also seen in this location (fishing and hunting), besides timber logging. This area is also a moist deciduous forest with some patch of riverine forest and patches of grassland.

4. **Hatibu Disa**

Geographical location: N25.64998 and E093.49536

(Figure 1.1)

This is located north-west of the park. The terrain is undulating throughout the area. This region borders with Assam sharing boundaries with villages (1 km away) and river Dhansari demarcates the boundary. The area is accessible through Assam and illegal activities like hunting, and timber logging takes place.

The forest here is a dense mixed forest, with some riverine forest vegetation.

5. **Hazabdisa (Bonkolong):**

Geographical location: N25.56907 and E093.45284

(Figure 1.1)

This zone is located south-east of the park. The landscape consist mostly of rugged terrain across the area. Tuilong River cuts across this area, providing good water sources. The vegetation in this area comprises of moist deciduous forest, bamboo and bananas. The terrain is quite rugged in comparison with the other five locations. Accessibility inside the forest from the village is just 6 km, and this area is most sought by hunters in the region. Apart from hunting, illegal logging is also carried out in the area.

6. **Bonkolong community reserve:**

Geographical location: N25.57114 and E093.48057

(Figure 1.1)

This area was considered as the hunting zone, and adjoins Intanki National park. Here "balu nudi" or Tuilong River acts as a boundary between the two patches of forest, which flows toward Intanki River. The vegetation comprises of bamboo, and mixed forest. This

area also adjoins the community paddy field. The village is just 2 km away from the community reserve, and is heavily used by the villager for NTFP collections.

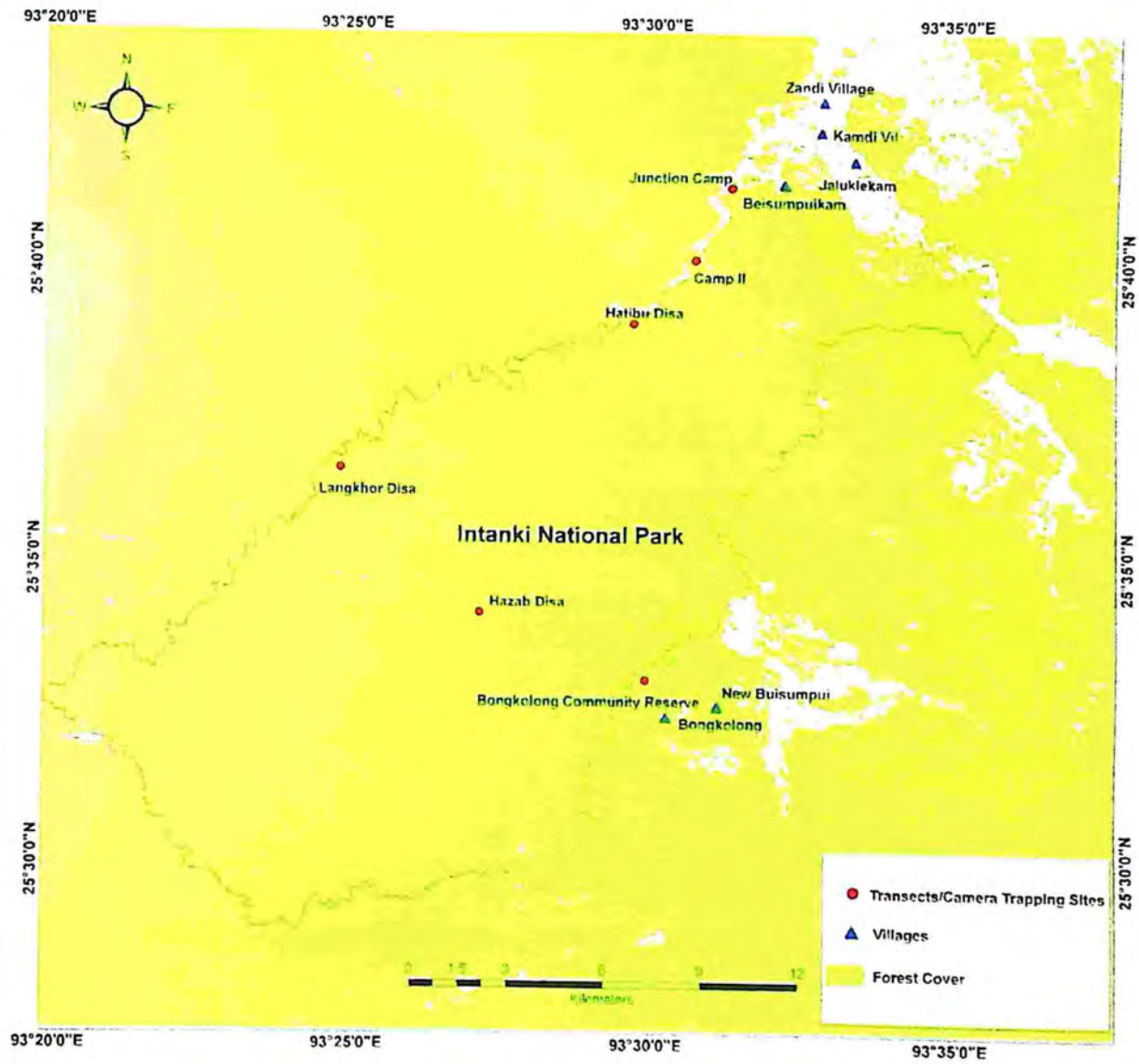


Figure: 1.1 Forest cover map of Intanki National Park with the site locations, and village surveyed

CHAPTER 2

Abundance and Species richness

2.1. Introduction

Hunting of bushmeat is carried out across the areas in Nagaland. This illegal activity is part of subsistence of the local people as a protein requirement of families, immediate community trade in the villages, and commercial supply to the urban area. Hunting is also considered as a part of sports activities by people from both rural and urban areas, hence causing a severe threat to wildlife population. Many of these hunting activities are now commercialized. With the demand of bushmeat from the society, this activity has increased in recent times with the consequences of causing local extinctions. Most studies in bushmeat hunting indicate decline of the species richness and abundance in these regions. This leads to the vulnerability of many species often driven to extinction. With habitat disturbances, and other anthropogenic pressure from the people (Isaac and Cowlishaw 2004) within and outside the forest it results in the decreases of animal abundance and species richness.

2.1.1 Biodiversity of Nagaland: Nagaland has the northern subtropical broadleaved hill forest (Champion and Seth 1968). The vegetation has an important role to play in the biodiversity, providing a good habitat for wild fauna and flora. However, there has been heavy depletion of flora and fauna now, as with increase of human populations and demands for more NTFPs (Non Timber Forest Product), encroachments, commercial logging, hunting and poaching are a common occurrence in most of the forested area in Nagaland. Wildlife has been indiscriminately hunted and in the process many important species such as Tiger, Elephant, Sambar, Hornbills, Hoolock gibbon, etc. which were found in great numbers have become rare besides many floral species have also been wiped out with the destruction of natural forests. However, a large amount of biodiversity still persisted in spite of the vigorous anthropogenic activity. During my study, 3cat's species of Northeast India (Clouded leopard, Marbled cat and Leopard cat) were recorded along with other mammalian species (table 2e). Also Austen's brown Hornbill, a rare species of hornbill is seen in my study area.

(Refer Appendix III for Mammal checklist recorded from Intanki National park during the 4 month field work)

2.1.2. Conservation issues: Conservation issues in Nagaland is a paradoxical challenge, with cultural, ethical, morale values and histories embedded in it, it is indeed a strenuous factor for conservation. It is confounding to understand the narrow mindset of the society in accepting the need and challenges of wildlife crisis across the state. With the demand of bushmeat from the town nearby for the very reason of having a cultural attachment in consuming bushmeat or as a traditional medicine with the adroitness of curing ailments miraculously, has contributed to the ignorance of conservation of wildlife in the society. Another major factor in this issues is the infiltration from the militants (UGs) in the state. With the invasions in all the activities by the UGs, it becomes a challenge to partake conservation. It is indeed a long way for the society to accept its lapse especially in the field of wildlife conservation but nevertheless it is essential to highlight the woes of the wildlife status and bring awareness in conservation.

2.2. Question addressed

What is the abundance and richness of hunted species?

2.3. Methods.

2.3.1. Camera traps: Camera traps were used to detect presence and abundance of animals. Photographic capture rates were used to estimate relative abundance and overall encounter/capture rates for commonly hunted species. I placed one camera in each 1x1sq.km grid.A total of 553 trap nights across 6 hunted sites in Intanki National Park yielded capture of 19 species of mammals and birds (table 2d).

2.3.2 Transects: Line transect based distance sampling was carried out for mammal and bird abundance. Ten transects were laid randomly in each of the 6 sites in Intanki national park .Each transect was 1 km long and these ten transects were walked for mammals and birds at different time interval, with an effort of 10 km per site i.e. the first walk for mammals, taking a perpendicular distance for sightings from the trail, similarly, on return, birds transect was performed along with the pellet and track plot. Habitat characteristic and anthropogenic pressure was also quantified for each transect.

2.3.3 Indirect sampling techniques (for pellets and tracks): Track plots (15x2m) and quartet for pellet were laid along 10 transect at every 250 meter. These signs were used to generate encounter rate (Datta, Anand & Naniwadekar 2008). At each of the 6 sites 40 plots were laid, total of 240 plots were enumerated. The data generated was analyzed in EXCEL for track and sign abundance

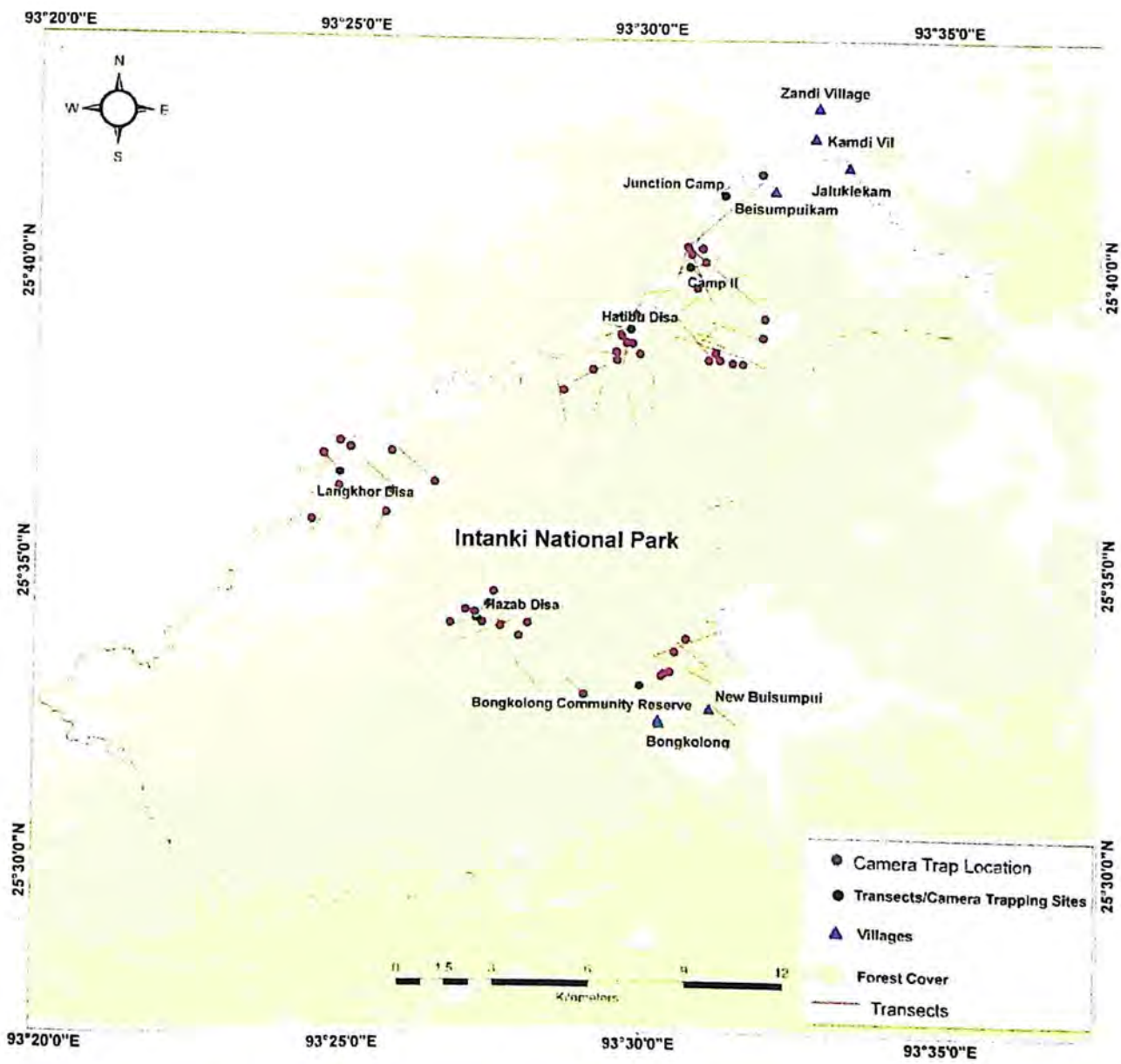


Figure: 2.1 Forest cover map of Intanki National Park with the site locations, camera trap location, transects sites and village surveyed

2.4. Analyses

To determine the abundance of the animal and bird's species at each site, the data was analyzed using DISTANCE 6.0 (Thomas et.al 2010).Post-stratifications was done for both mammals and birds based on its sites as well as different species. The mammals were stratified into Ungulates and arboreal (refer Appendix IV for the stratification of species),Birds were grouped- size wise(small birds includes birds of size12cm to 21 cm, medium size birds includes sizes of 23cm to 38cm, big birds includes the size range of 40cm +, ground birds includes all the pheasants, partridges and quails). Total effort for transect was 60 Km across six sites. Species richness of the mammals and birds is based on the results from camera traps and line transect. Program PRESENCE was used for the occupancy and richness estimation

For species richness, pellet and track plots data (each of 40 plots in 10 transects, a total of 240 plots all together) was also used.

To estimate the species capture rate:

Capture rates of mammals and bird's species using camera traps was estimated as - *((No. of photo captured/ (No. of camera site 'x' X No. of days 'x') X no. of sites)) X 100.* (Carbon et al 2001)

The total species richness of the animal was calculated as "Ψ" x *no. of species observed.* Where no. of mammals observed (camera traps and transects) = 20 mammals

2.5. Results

2.5.1. Abundance and species richness: Separate estimation for both mammal and bird abundance, with group and individual data are shown in table 2a and 2b.

Density of all mammal species /sq.km was estimated as 28.77±5.34 individual./sq.km. While density for arboreal mammal was 28.89±6.09 individual. /sq. km. Detection probability for all mammals was 0.29 while it was 0.41 for arboreal mammals and 1.58 for ungulates (table 2a, Appendix I).Individual density (individual/sq.km) for all birds was 645.23± (60.18) with a detection probability of 0.01±0.94, small size birds 392.39±46.45individual, Medium sized birds density was 188.26± 26.62, big bird 42.14±10.19 individual/sq.km and the ground birds22.44±6.75 individual/sq.km. (Table2b, Appendix IV b).

Table2 (a) Density and abundance of all mammals–arboreal mammal, ungulates for 60 transects (60 km) using Program DISTANCE6.0 in six study sites of Intanki National Park 2012-2013

Analysis	Effort (Km)	Number of group	Model fitted	AIC value	X2 value p-value	Mean Cluster size (SE)	Density(SE)		ESW* (SE)	E.rate* (SE)
							cluster	individual		
Mammals	60	56	Half normal cosine	110.75	2.42 (0.29)	1.32 (0.11)	21.78 (3.64)	28.77 (5.34)	18.64 (2.42)	0.93 (0.12)
Arboreal mammals	60	44	Half normal cosine	307.69	0.41 (0.52)	1.29 (0.85)	22.43 (4.4)	28.89 (6.09)	16.34 (2.24)	0.73 (0.1)
Ungulate	60	8	Half normal cosine	19.57	1.58 (0.21)	1	2.22 (1.1)	2.22 (1.17)	29.99 (12.75)	0.13 (0.01)

*E-Rate-Encounter rate; ESW-Effective Strip Width

Refer Appendix IV a & b for the mammal sighted in mammal transect and birds sighted in bird transect.

Table 2b. Density and abundance of all bird species with bird size of –small sized birds, medium sized birds, big bird sized birds and ground dwelling birds for 60 transects (60 km) using Program DISTANCE6.0 in six study sites of Intanki National Park 2012-2013

Analysis	Effort (km)	No of sightings	Model fitted	AIC value	X^2 (p-value)	Mean Cluster size (SE)	Density (SE)		ESW (SE)	Encounter rate (SE)
							Group	Individual		
Total birds	60	398	Half Normal cosine	617.70	0.01 (0.94)	2.96 (0.15)	217.91 (17.02)	645.23 (60.18)	15.23 (0.90)	6.63 (0.34)
Small sized birds	60	209	Half normal (Cosine)	1291.17	2.3 (0.50)	3.43 (0.24)	114.38 (10.95)	392.39 (46.45)	15.23 (0.90)	3.48 (0.24)
Medium sized birds	60	135	Half normal (Cosine)	796.31	0.64 (0.98)	2.55 (0.22)	73.88 (8.30)	188.26 (26.62)	15.23 (0.90)	2.25 (0.2)
Big sized birds	60	29	Half normal cosine	330.33	1.00 (0.91)	2.66 (0.33)	15.87 (3.31)	42.14 (10.19)	15.23 (0.90)	0.48 (0.09)
Ground dwelling birds	60	25	Half normal (Cosine)	411.04	1.00 (0.90)	1.64 (0.29)	13.68 (3.35)	22.44 (6.75)	15.23 (0.90)	0.42 (0.09)

To estimate species richness, we used occupancy estimation framework following Mackenzie et al (2002) on the detection history (1/0) of species in the regional pool (rows) across sampling units: transects and camera traps (columns). This exercise estimated the proportion of species of the regional pool present in a particular site (Ψ) after accounting for species non-detection (p). Species richness was estimated by multiplying site specific Ψ with total number of species in the region.

Table 2c. Species richness for birds from transects and mammal from camera traps and transect (n=60) using Program PRESENCE 4.1 in six sites of Intanki National park, Nagaland 2012-2013.

Site	Capture rate of all the species	Number of Transect	Ψ, birds (SE)	Sp. Richness (birds)	Ψ, mammal (SE)	Sp. Richness (mammal)
Longkhor Disa	22	10	0.46 (0.11)	28	0.66 (0.26)	13
Junction camp	15	10	0.45 (0.06)	27	0.633 (0.16)	13
Camp2	12.22	10	0.63 (0.07)	38	0.33 (0.14)	7
Hatibu Disa	15	10	0.41 (0.06)	25	0.57 (0.16)	11
Hazab Disa	3.7	10	0.51 (0.07)	31	0.24 (0.11)	5
Bonkolong Community reserve	5.05	10	0.5 (0.07)	30	1 (0.00)	20

Species captured:

Table 2d. Species capture rate at each site (per100 camera trapping nights) of Intanki National Park, Nagaland 2012-2013.

SPECIES	Longkhor Disa	Junction camp	Camp2	Hatibu Disa	Hazab Disa	Bonkolong Community reserve
Barking deer	4	2.50	2.22	2.5	1.85	1.01
Clouded leopard	-	-	-	1.25	-	-
Common palm civet	2	-	-	-	-	-
Elephant	-	0.63	1.11	2.5	-	-
Human	-	2.50	2.22	3.75	1.85	2.02
Jungle fowl	2	1.25	-	-	-	-
Large Indian civet	6	1.25	-	1.25	-	-
Leopard cat	-	1.25	-	-	-	-
Marbled cat	2	-	-	-	-	-
Mongoose	2	0.63	-	-	-	-
Pangolin	-	0.63	-	-	-	-
Porcupine	-	1.25	-	1.25	-	1.01
Sambar	-	-	2.22	-	-	-
Small Indian civet	-	0.63	-	-	-	-
Squirrel*	-	-	1.11	-	-	1.01
Wildpig	-	0.63	-	-	-	-
Yellow throated marten	2	-	-	-	-	-
Bird**	2	1.88	2.22	1.25	-	-
Pheasant	-	-	1.11	1.25	-	-
Brown hornbill***	1	-	-	-	-	-

*squirrel species- Hoary bellied Himalayan squirrel, orange bellied Himalayan squirrel, 3-stripped squirrel.

**bird species includes-green pigeons, whistling thrush, tit, Indian robin, warbler.

*** Ad libidium sightings

Pellet counts and track plot

Average encounter rate of mammals was estimated from 240 plots based on pellets and tracks as the *number of signs of all species/plots (n=40/region)*. Here the average encounter rate from pellet results highest in Camp2 (1.75) and least in the community reserve (0.22), whereas encounter rate for track plot was highest in Longkhor Disa (1.4) and least in community reserve as well (0.37) (table 2e).

Table 2e. Average mammalian track and pellet encounter rate (n=240) using PRESENCE 4.1 in six sites of Intanki National Park, Nagaland 2012-2013

Sites	No. of plots	Pellet Index (SE)	Track plot Index (SE)
Longkhor Disa	40	0.77(0.14)	1.4 (0.22)
Junction camp	40	1.12(0.13)	1.3 (0.17)
Camp2	40	1.75 (0.34)	1.1(0.14)
Hatibu Disa	40	1.35 (0.26)	1.37 (0.25)
Hazab disa	40	0.55 (0.14)	0.87 (0.05)
Bonkolong Community reserve	40	0.22 (0.09)	0.37 (0.02)

2.6. Discussion

Arboreal mammal consisting of squirrels, yellow throated marten, common palm civet, results in highest density (22.43 per sq.km) and least was the ungulate density (2.22 per sq.km) comprising of Indian Muntjac, Sambar and Wild Pig. In bird's, the highest density was found in small sized birds (114.38 per sq.km), and the least was estimated for ground dwelling birds (13.68 per sq.km).

Species richness for birds estimated from transect, and mammal from camera traps and transect (n=60) at six sites shows the birds richness to be highest in camp 2 and least in Hatibu Disa. And for species richness of mammals, it was higher in the community reserve and least in Hazabdisa area. The capture rate of all the species was higher in junction camp where as the least photographic capture rate was estimated in Hazab Disa.

Sign encounter rates of all mammalian species were used to surrogate total mammalian abundance. Estimation for encounter rate of pellet count was found to be highest in camp2, and least in community reserve. For track plot the encounter rate was found to be highest in Longkhor Disa and least in the community reserve itself. This can be due to the factor that more hunting activities is undertaken within the community reserve that determines in decrease of animal and eventually decline of ungulate species in that location.

Many of the species are difficult to find in a tropical rain forest (Robinson and Bennet 2000), due to the dense canopy, the detection probability of species decrease. However detection probability of mammals like muntjac Sambar and wild pig is low due to rarity of the species because of hunting.

Gallery 1. Camera traps pictures for estimating abundance.

a. Marbled cat

b. Yellow throated marten

c. Common palm civet

d. Large Indian civet

e. Porcupine

f. Pangolin

g. Indian muntjac

h. Wildpig

i. Leopard cat

j. Small Indian civet

k. Herd of elephants

l.Sambar

m. Clouded leopard.

n. Austen's brown hornbill (*Anorrhinus austeni*) pic courtesy: Nzumlak

CHAPTER 3

Socio-economics and hunting

3.1 Introduction

Most wildlife hunting is often triggered by the demand from the urban areas which has become a trend in recent years (Milner-Gulland & Bennett 2003). It has become a means of livelihood for the common people. Besides the commercial value another aspect in the Naga society is the cultural ethics which prompt the society in hunting practices. Earlier times, these practices were often measured to see the agility of a men's strength often practiced as sports and sustenance (Ao 2009). Many of the cultural ethics are linked with certain superstitious taboos (Aiyadurai et.al 2010), which has resulted in controlled wildlife consumptions or hunting. However in today's context with the modernization in the society, these hunting are more focused on the socio-economic value rather than the ethical cultural value. The cultural ethics that once hold certain rules and taboos has loosen up leading to indiscriminate hunting practices solely for commercial purposes.

Most of the villages depend on the agriculture for their sustenance. With less accessibility to the nearby town and city, and no poultry product selling around the village periphery, the majority of the people are dependent for meat either from the house grown poultry's or the wild meat by hunting. Many indigenous societies across the globe are dependent on the bushmeat for their sustenance as well as a means for livelihood (Milner-Gulland & Bennett 2003), often at the cost of wildlife which has led to extinction of many species around the globe.

3.2. Methods

I have conducted semi-structured interview in six villages. The villagers were divided into hunters and consumers of wild meat. The hunters were surveyed by snowball sampling method (Frank & Snijders, 1994) and consumers by arbitrary selection of households in a village.

Snowball sampling is a non-probability based sampling technique that can be used to gain access to populations for information which are hard to get or hard to reach from a desired populations or individuals (Frank & Snijders, 1994). This method of sampling was applied in the present

study to get information about activities of hunter's. Household survey in arbitrary manner was conducted to get information on family income, consumption of meat and quantity of bush meat hunted.

Village council plays an important role in controlling the welfare of the village activities. Hunting is one such activity that the village council looks into so as to control excess hunting. Among the 6 village surveyed, only 1 village did not have particular rules for hunting activity from the council. To avoid biased answers from the villagers, I explained to the respondents the purpose of my research, and was not meant for legal action against anybody as the villagers were quite wary due to the strict rules employed by the Nagaland Forest Department. The interviews were based on friendly approach with casual interactions on assorted topics, alongside, observations on the family's environment and lifestyles.

I visited the state library for the literatures on cultural activities and folklores and interviewed the elders in the villages to check the authenticity of the cultural activities. Field assistants were supervised by me, who held under graduate degree, and were from that particular region. During the survey, 2 young staff member from Intanki National Park protection team (Nagaland Forest Department) volunteer to provide assistance in collecting data during the questionnaire survey. Their identity was kept discrete from the villagers to get an unbiased response from the villagers.

A total of 94 households (Table 3a) and 16 hunters (Table 3b) were interviewed from 6 villages. Market survey for bush meat sale was done in 3 commercial towns (Dimapur, Kohima, and Jalukie). Consumption for the poultry meat was also estimated for the protein consumptions apart from the wild meat.

The hunting intensity per site was determined by the following factors-encounter rate and occasion of the hunters in my transect sites and the number of the hunter's picture captured by the camera traps, along with the respondents activities and preference sites from the questionnaires. The other factor includes the security of the area from the forest department, areas which the department could not access to it easily, in short-less security.

Table 3a. Villages where random household survey was conducted

Village	Number of households	Number of random household surveyed
Buisuimpuikam	558	45
Zangdi	130	13
Jalukiekam	63	6
Kamdi	57	5
New Buisuimpui	100	10
Bonkolong	130	14

Table 3b. Villages where questionnaire survey (Snowball methods) was conducted on hunters.

Village	Hunter's surveyed
Buisuimpuikam	3
Zangdi	4
New Buisuimpui	2
Bonkolong	7

3.3. Data analysis

The data was analyzed in SPSS using the socio-economics factors that influence the bushmeat intake in the surveyed villages. Generalized linear model (GLM) and Pearson correlation was used to determine the factors that influence the bush meat consumption.

3.4. Results and discussion

3.4.1 Hunting method and hunting activity: From the questionnaire survey, hunting techniques used in the 6 villages were recorded to see the most preferred technique used for hunting. From the 16 hunters surveyed, techniques and weapons which were mostly used for hunting was recorded. The results showed that hunting using guns was the most preferred technique followed by traps, catapults and least by snares. Apart from these hunting techniques, no other forms of hunting were observed in the present survey (Figure 3a).

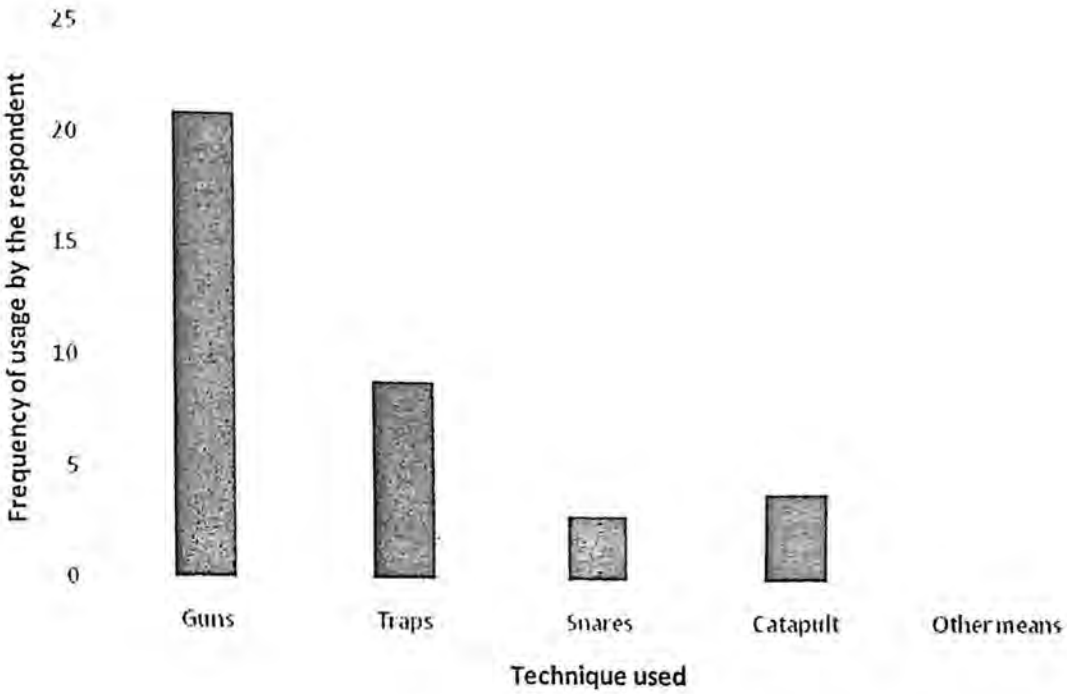


Figure 3a. Techniques used for hunting

Hunting activity:

Most actively hunted locations were generated from the 6 villages through camera trapping, encountering occasion of hunters in the forest and by questionnaires. This sources of combination from the data gives the total hunting intensity of each sites (table 3c). Hence from the result the hunting intensity was highest in Longkhor Disa and Bonkolong community reserve. However for the photos captured and encounter occasions, it was highest in Junction camp. Hunter's preference area, high hunting activities and other factors like less security in the protected area was highest in Hazab Disa followed by Longkhor Disa (Table 3c)

Table 3c. Hunting activities (site wise) in and around the 6 study sites.

Site	No.photos + Encounter occasion	Hunting activities from interviews	Hunter's preference	Other factor	Total Hunting intensity
Longkhor Disa	19	10	11	11	51
Junction Camp	29	2	0	0	31
Camp2	21	2	2	0	25
HatibuDisa	8	9	8	16	41
HazabDisa	3	12	12	16	43
Bonkolong Community Reserve	24	9	9	9	51

3.4.2. Species Hunted: As per the results of the village questionnaire survey, at least 21 mammalian species are being hunted, excluding birds species which are being hunted at a large scale for consumption. The most hunted animals are the barking deer, wild pig, common palm civet and jungle fowl. The high rate of hunting of these species is triggered by the public demand for these species (figure 3b). Here Mithun was considered as feral cattle in that area.

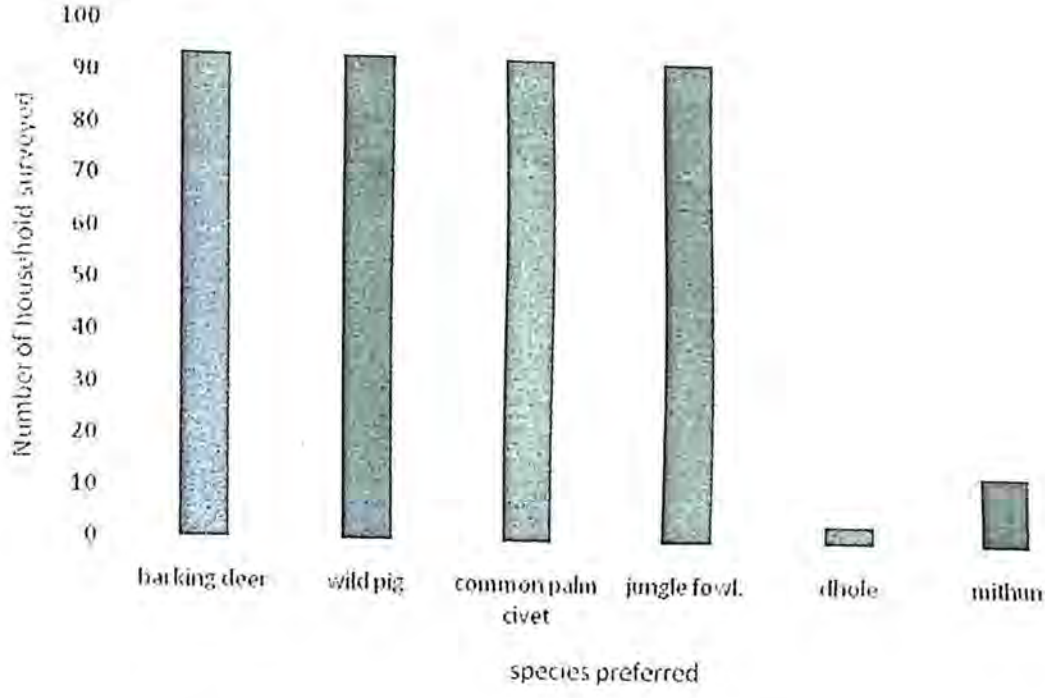


Figure 3b. Species most hunted due to high demand.

3.4.3. Bushmeat consumption and livestock consumption:

From the questionnaire survey data, the per capita wild meat consumption per annum for the 6 villages is generated by calculating the total wild meat consumed by the whole village per annum by the total number of household surveyed. The total wild meat consumed by the 6 villages per month was 1934.44 kg. The average consumption of wild meat per capita from the 6 villages was 2 kg of wild meat per month. As per the results of the estimate, Jalukiekam showed the highest consumption of wild meat per capita followed by New Buisuimpui and Kamdi (figure 3c). The total wild meat consumed by the whole village per annum was calculated by average kilos of meat purchased by individual village per annum which results in 23213.31 kg from the 6 villages per annum. The results showed that Buisuimpuikam is the highest purchaser of the wild meat and Kamdi the least buyer (Figure 3d). Similarly, the total poultry and livestock consumption by the whole village from the 6 villages results in consumption of 4459.11 kg per month. On total consumption annually it will be 53509.32 kg of meat annually. In village wise consumption, Buisuimpuikam village exceeds the other villages in the livestock consumption by whole village (per annum) (figure 3e).

Table 3d. Kilos of meat consume by the household in percent

Village	Buisuimpuikam	Zangdi	Jalukiekam	Kamdi	New Buisuimpui	Bonkolong
Total number of household	558.00	130.00	63.00	57.00	100.00	130.00
Proportion of household hunting	0.07	0.31	0.33	0.00	0.20	0.43
Proportion of household occasionally hunting	0.04	0.08	0.33	0.20	0.30	0.14
Proportion of household not hunting	0.89	0.62	0.33	0.80	0.50	0.43
Total frequency for the no. of wild meat purchased per month	4.60	4.23	4.00	5.60	2.30	2.07
Av. Kilos of wild meat purchased	1.77	1.77	2.50	2.00	2.15	1.79
Total wild meat consume by whole village per month in kg	985.80 (67.87)	230.00 (28.13)	157.50 (19.92)	114.00 (0.00)	215.00 (24.77)	232.14 (14.79)
Total no of poultry consume per month in kg	3.84	3.85	6.33	5.60	3.90	5.43
Total poultry consume by whole village per month in kg	2145.20 (161.52)	500.00 (54.77)	399.00 (45.03)	319.20 (58.68)	390.00 (87.49)	705.71 (105.30)

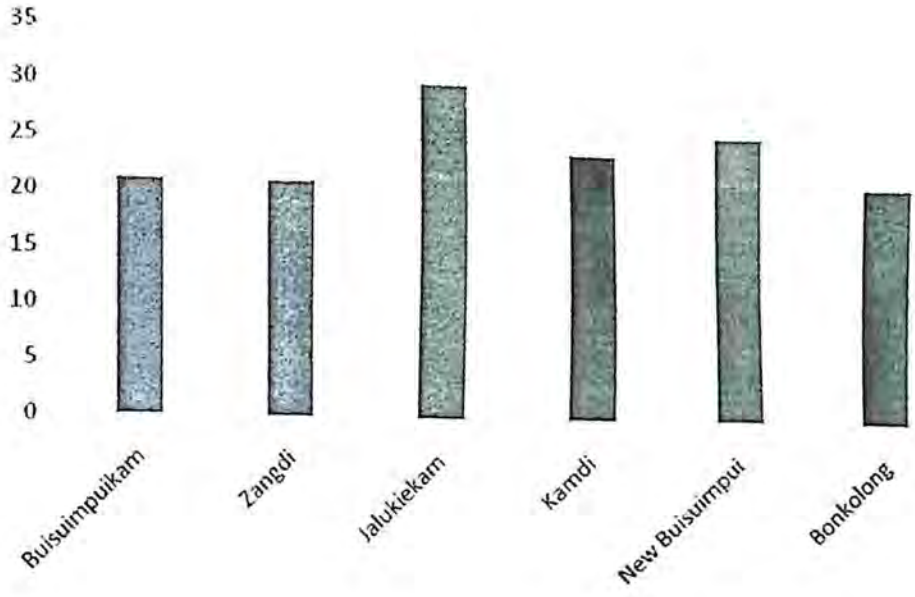


Figure 3c. Per family wild meat consumption per annum (in kg)

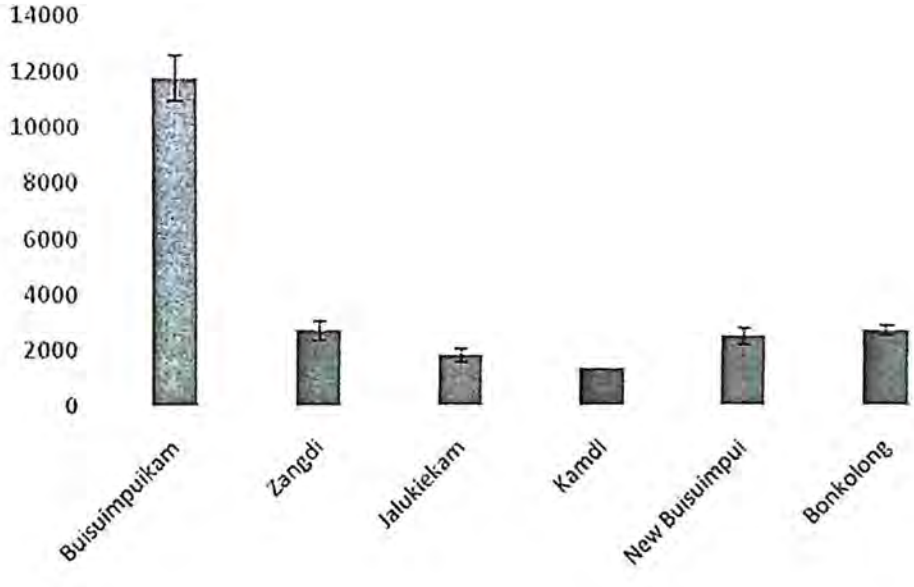


Figure 3d. Wild meat consumed by the whole village per annum (in kg)

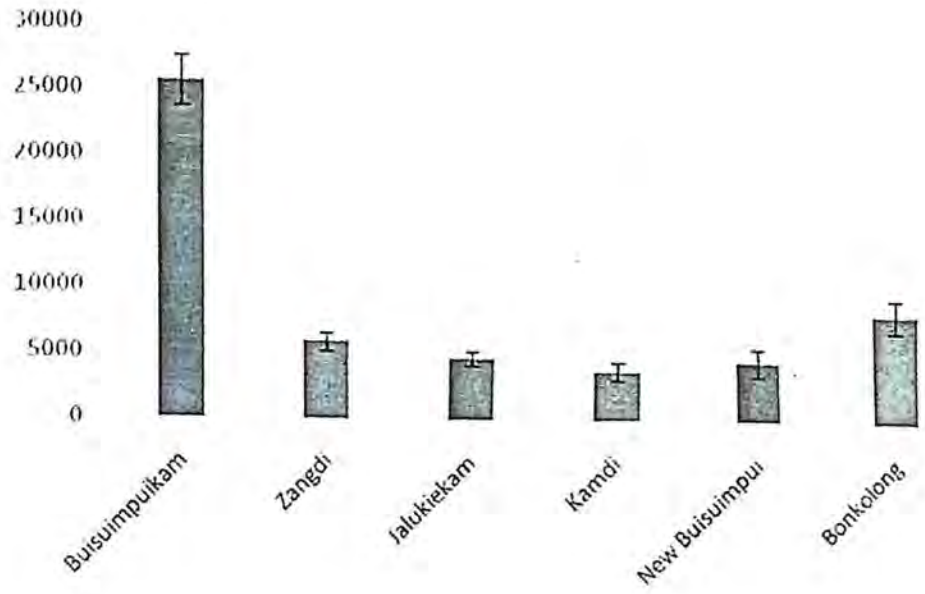


Figure 3e. Livestock/poultry consumed by the whole village per annum (in kg)

3.4.3.1. Factors affecting bushmeat consumption: Here Generalized Linear Model was performed to extract information relating to the factors affecting bushmeat consumption. Variables like the amount of bushmeat purchased, distance of the villages from the forest, family wealth and annual income of the family was taken into consideration for their influence on extent of hunting. The results showed that bushmeat consumption was significantly (p=0.040)influence by the family wealth. With increase of family wealth, there is more significance of consuming and purchasing of wild meat. Crop yield and distance travelled for hunting shows .00 on the parameter estimates, as it might contribute to the factors that the yield of crops and the distance travelled for hunting might tend to be constant in all those household surveyed.

Table 3e. Parameter Estimates for factors influencing hunting in surveyed villages

Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test		
			Lower	Upper	Wald Chi-Square	df	Sig.
(Intercept)	1.102	.3321	.451	1.753	11.009	1	.001
Distance travelled for hunting	.000	.0142	-.029	.027	.002	1	.963
Forest distance	.059	.0456	-.030	.148	1.678	1	.195
Family wealth	.220	.1072	.010	.431	4.229	1	.040
Annual income	-9.622E-8	1.2714E-7	-3.454E-7	1.530E-7	.573	1	.449
Crop yield	.000	.0005	.000	.001	.876	1	.349
(Scale)	1[a]						

3.4.3.2 Ethnozoological usage of Wildlife

Table3f: Wildlife usage of different species collected from the questionnaire survey

Species hunted	Reason	Parts use
Muntiacus muntjac	Consumption and commercial	Some patch of hair on muntjac is cook along with the cleaned meat, believed to have medicinal property like cleansing the intestinal system (sources from Zangdi village, Chakesang), the tail of muntjac used as a key chain
Paradoxurus hermaphroditus	Consumption	Fats of this civets is a delicacy (specially the winter fats), the tails used as a key chains, the meat is supposed to give energy for the hunter (sources from Zangdi village)
Sus scrofa	Consumption and ornamentation	Meat, and teeth used for ornaments specially on traditional head gear of Konyak tribes, traditional choker(necklace)
Rusa unicolor	Meat, antler	Antler for decorating house or as gifts
Jungle fowl *(Gallus gallus)*	Consumption	Meat, soup consumed, to give strength during sickness.
Felis bengalensis	Consumption	Skin used for decoration, making seat cover
Arctonyx collaris	Consumption	The fats of this animal is considered a delicacy especially during winter
Hylobates hoolock	Consumption	The blood of hoolock is sought after by many local practitioners, as it is believed to cure people suffering from TB, also absence of Iron odor from the blood,
Hornbill	feather and meat	Feather for traditional head gears, for men and woman (both the tail and the wing feather), meat often preferred in winter as the meat has less elasticity in winter.
Elephas maximus	Consumption and ornamentation	Meat, tusk and the bones of the elephant is used to make armlets for traditional attire, also the scrapped skin is used for cough and cold

Hystrix indica	Consumption	For meat consumption, bile is used to cure asthma,
Macca mulatta	Consumption	Believed to cure mumps when the teeth of this animal is scrap on the affected area
Arctictis binturong	Consumption and medicinal	Bile is consumed for various medicinal reason
Martes flavigula	Consumption	Meat consumed only by old people
Manis pentadactyla	Commercial	Commercial demand for the scales -per kilo 10000-15000 Rs, use specially for medicinal reason
Bandicota bengalensis	Medicinal	Skin used for blood clotting, a favorite local band aid for the hunters of Zeliang community
Cuon alpinus	Pest	Meat is consumed
Common hoopoe *(Upopa epops)*	Medicinal	Meat is roasted along with the feather, as it is believed to cure kidney stones.
Bos frontalis	Consumption and ornamentation	Meat consumed and the head is sold (for decoration)
Naemorhaedus griseus	Consumption	For Meat consumption.

3.4.4. Traditional demeanor with wildlife: Tradition and culture has always influence the society with its ethical essences. This influence has always been passed on through the ages by oral traditions (Ao 1999). This dictum and practices of tradition and culture are still a trend in modern society.

Historically from the oral traditions of the Naga society, hunting is an acquired art. This skill of hunting has been practiced by the warriors on big wild animals such as tiger, leopard and bears. These practices sharpen their skill in hunting and ultimately a warrior's reputation depends on the amount of animals he killed along with the enemies head. Wildlife has also webbed with the vibrant culture, many costume of Nagaland has a significant meaning, and bigger wild animals like tiger, elephant, and mithun painted on the traditional Male shawls, also tiger claws and teeth worn as a necklace, elephant ivory as an armlet and wild boar tusk as a choker necklace, this indicates the power, strength and the agility of men in the society. Female however represent

beauty and grace and hence feathers of bird usually adorns a female attire like hornbill tail feather for her hair, light colored bird feather-usually worn as an earrings.

Folktales plays an important role in the Naga society, these tales were mostly originated from what the society has considered as the most vital social institution of culture and traditions known as the "Morung" or the dormitory for the youths, where story telling were a part of amusement as well as art of learning one's own belief of their culture and tradition in the morung. These kinds of exposure and amusements from the society have enabled to pass these tales to the present scenario of modern society. However with the influence of western culture across the state, the aroma of the ancient tradition of Nagas is diminishing in the society , yet these kind of oral traditions reminds the present society about keeping the identity of Naga culture and our ancestors even though the society change with each passing generation and modernization.

Some of the folk tales from Nagaland are similar in theme and motif amongst the other tribes of the region, however each tribe has their own way of storytelling as well as relating the incidence but each story usually has their own ethical, moral background and message to the people. It reflects the ancestral ways of living, their beliefs, taboos and superstitions, traditions and culture, all blended together forming the folk tales, which enhances Naga's rich culture and make its own distinction of culture from others.

Fables from Nagaland are passed down orally from generation to generation, it is said in Ao folktale about the script of Nagas, wherein one of the Naga ancestor had made a script and had in-scripted those writings on a hides of an animal, as paper were not known those times, while he kept it for preservation by drying it upon a fireplace, a dog happened to pass by his kitchen, the strong odor from the drying skin motivated the dog to steal it and chewed it up in the absences of his owner and thus losing the script before the Man could passed it on to other and hence Naga lost its script- to a dog.

Those fables are from the times when Christianity has not dawn on the Land, but from the Nature worshipping times, hence, Nature plays a key element in all the fables of Nagaland and indeed it was revered, worshipped and appreciated. There are songs and dances with regards to worshipping of nature, with a story behind it and with each tribes with their unique ways have

mark their identity in making the fables a story to remember and has enthralled the listener of all ages over years.(See Appendix II for folktales.)

Children learning to make bird trap from their father

3.5. Discussion

In this study, Semi-structured Questionnaire survey was used to record information's about hunting activities in and around Intanki National park as to what are the reasons for continued hunting like what motivates the hunter, what are the species commonly hunted, entry or exit point of hunting, cost of hunting materials, group size of hunters, preferred hunting locations, seasonality, hunt descriptions (like preferred area, pursuits), enforcement and changes in hunting over time. Through household survey information on the members in the household, household wealth, property, field owned, occupations, incomes and meat consumptions. These variables determine the frequencies with which households consumed bushmeat as opposed to livestock meat, poultry and fish and to relate that to income, wealth, and other characteristics often used in household surveys (Schenck et al 2006, Wilcox and Nambu, 2007).

Weapons used for the hunting was estimated, and from the questionnaires, the most common weapons are modern weaponry like air gun, kartoos gun, and .22 rifles. Kartoos gun is the most favored among the locals as they can modify their cartridge (local made). These local made cartridges comprised of the cap and the shell with air gun's bullet grinded into balls. Depending on the size of the animals to be hunted, the size of these balls in the cartridge was adjusted accordingly.

Traditional techniques for hunting practice has been minimize over the years but some common methods like snares and traps are still practiced. Snares are used for mostly larger animals like *Bos frontalis*, traps however is used for both mammals and birds. Some of the common traps used for trapping birds are -

- Bow like trap: bamboos or cane stick are most preferred for this kind of trap because of its elasticity and flexibility (image a).
- Bow for catapulting: a bow shape, with bamboo stick tied with a strip of cane tied on both the end instead of the string. Very common technique, used preferable for shooting birds (image b)
- Glued stick/container: common method used for catching birds alive. A bamboo stick is smeared with *Ficus* tree sap as they tend to be very sticky, or trees that secrete sticky glue saps.
- Traps: pit fall traps (image c)
- Noose with tree branch trigger (image d)

Factors affecting bushmeat consumption

Family wealth was estimated to have an impact on the wild animal hunting. The most important factor influencing the appreciation of bush meat consumption was the households with better income. They participated more in the purchasing or consuming bushmeat as the price of the poultry product tends to be higher than the wild meat (Wilkie and Godoy 2001, Apaza et al 2002), for instances a kilo of wild pig cost 100 rupees whereas poultry pig cost 150/140 rupees per kilo (questionnaire surveys) (Table 3g).The less income families are more directly involve in the bushmeat hunting as the poultry becomes slightly expensive and difficult to get it as well. The main income for the 6 villagers was agriculture, mainly rice cultivation. Two methods of cultivating rice are practiced-the paddy fields and the Jhum (slash and burn). Jhum cultivation is a dry agricultural practice and it is not preferable in the study area. However Jhumming is still practice to cultivate some cash crops like ginger, *Colocasia esculenta*, chilly, etc. Rice yields from the paddy fields are an important factor in determining the wealth and income of the household.

Table 3g: Price variations between species in village, city, and hunter's price from the questionnaire survey.

Species	Village market price	Hunter's price	Selling prices in the city/town market area
Domestic Pig and Wild pig	140-150 per kg for Domestic pig	100 Rs for Wild pig	150 -180 Rs on wildpig
Barking deer	150 Rs per kg	120-140 Rs per kg	1000-1500 Rs (lump sum sale of body parts
Poultry Fowl and Jungle Fowl	150-350 Rs for poultry fowl (depending on the size)	150-350 Rs on Jungle fowls	400-600 Rs on Jungle fowl
Civets and small cats	-	800-1500 Rs	2000-2500 Rs

Wildlife usages:

Another reason for bushmeat consumption is demand for zoo-therapy and demand for exotic taste of wild meat by the society. Hunting for wildlife has assorted reasons across many parts of the world (Ferreira SF et al 2009). This practice of zoo-therapy has a strong historical account with distribution across the world (Alves and Rosa 2005). Wild animal and its product are used in a wide variety of ways in many indigenous societies for various reasons like for food, in cultural activities, ornaments, medicines, as pets etc (Alves 2009, Alves et al 2009, Aiyadurai 2011, Santos-Fita et al 2012). More than 1500 animal species have been reported to have some medicinal use in traditional Chinese Medicine (Alves and Rosa 2005, Chakravorty et al 2011). However many zoo-therapeutic resources include many threatened species and this has caused a lot of loss of wildlife, with some species even driven into extinction. It is presumed that all human cultures have a developed system of using animals as medicines (Costa-Nero ad Marques, 2000). In Naga culture, treatments via zoo-therapy have been a part of traditional practice and are believed to cure many forms of ailments (Jamir and Pal 2005, Kakati and Doulo 2002, Kakati, Ao and Doulo 2006) This indigenous practices has come a long way over the years. Even

with the introduction of the modern medicines and facilities, these Wildlife usages are still preferred over modern medicines. Some wildlife usages for various purpose listed out during the questionnaire survey is given in the table (Table 3f).

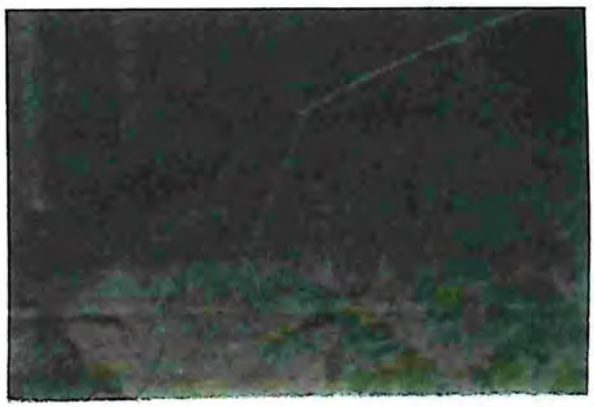
It is important to know why people eat bush meat and the role that bushmeat consumption plays in household nutrition and income. It is crucial to develop politically acceptable ways to manage wildlife hunting and trading and stop the unsustainable exploitation of wildlife (Schenck et al 2006). Many families are often indulged in hunting due to economic conditions, which often results in major contribution to bushmeat exploitation (Martin et al 2012) and wild meat is cheaper as compare to the livestock, as well as alternative sources of income for sustenance (Solly, 2004). Demand of bushmeat from the market in the urban area is another crucial factor in depletion of wild fauna (Jenkins et al 2011). It is crucial to include food security for the local people while making distinct developmental goals for biodiversity conservation to check the problems arising from off take of wild meat (Rentschand Damon 2013). It is often overlooked by the society the importance of wildlife. In a society where bushmeat is an essential sources of proteins, it is important to realize the current status of wild fauna and hence emphasis should be given to control and promote alternatives.

Gallery 2. Images of hunting techniques:

a. Bow trap

b. Bow like catapult

c. Pit fall trap



d. Noose ring trigger

e. Catapults

f. Hunter with his asset-gun

g. Noose trap

(image c and g: photo coutesy-**Lansothung Lotha**)

Gallery 3. Hunter's catch

a.Rihang Ki (Morung of Zelinag community)

b. Hunter's trophy collection

c. Common palm civet

d. Hill partridge

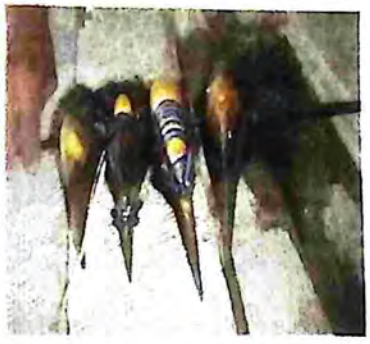
e. Asiatic brush tail porcupine

f. Butchered wild pig meat

g. Grey peacock pheasant tail

h. Hoolock gibbon skull

i. Oriental pied cask



j. Oriental, wreathed and Brown hornbill cask

k. Slow loris hand

(Image b. photo courtesy: **Yimvolong**)

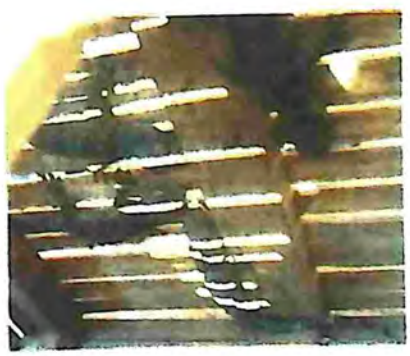
Gallery 4. Market trades of wildlife.



a,b,c: wood sculpture with real wildlife's casks, antlers and horns.



d. Himalayan Palm civet e. Indian muntjac f. Butchered Indian Muntjac

g.Bull frogs for sale . h.Tokay geeko for sale

5 Gallery Wildlife as pets:

a. Rhesus macaque

b. A young Kuki lass with her pet monkey

6. Gallery: Wildlife in Traditional costumes

a. Head gear of Konyak tribe b.Konyak tribe with full costume c. Angami tribe

(picture b and c: photo courtesy to **Imna Longchar**)

7. Miscellaneous picture

a 

c. 

d. 

Picture **a**. UGs inside National Park **b**. Intanki protection team interrogating UGs about the illegal hunting inside the park **c**. a young Zeliang lass picking snails using porcupine quill **d**. Irei interviewing a village (questionnaire survey)

Gallery 8. Photographic images from the camera traps showing the activity of human in the study sites.

CHAPTER 4

Impact of hunting on species richness and abundance

4.1. Introduction

Most of the species loss in the ecosystem is either due to habitat loss or hunting of wildlife (Peres 2001), this impact has a major effect in depletion of wildlife. However in many tropical forests, hunting is a major factor in the decrease of wildlife (Milner-Gulland & Bennett 2002, Robinson and Bennet 2000). This affliction on the wildlife can be due to the importance of having wild life as source of protein for the rural peoples living in or near tropical forests. However, the resource can easily be overexploited and games species can become locally depleted, or even extinct (Robinson and Redford 1994). This uncontrolled activity during the recent past has contributed a lot of factors in decrease of species richness and abundance. Intanki National Park is the only area in the lowland area of Nagaland with a large chunk of forest sustains a diversity of wildlife. However with the anthropogenic pressure like hunting, logging and fishing, much of the wildlife has been exploited. It is crucial to study and understand the impact of hunting on species richness and abundance.

4.2. Methods

Refer Chapter 2 (for abundance and species richness) and chapter 3 (for socio-economic) for data collection.

4.3. Analysis

Abundance and richness of species are deeply affected by human's interventions and activities. To check the impact we evaluated the impact and sustainability of hunting. Population density (chapter 2) and hunting intensity were estimated (chapter 3). The Area impacted by hunting activities was taken as a radius of 5 Kilometer distance (based on interviews) from the village center (using ArcGIS 9.1). The total area impacted by hunting of 6 villages was 180sq.km (Figure 4.1). Twenty species were found to be most hunted from hunter's questionnaires survey (table 4b).

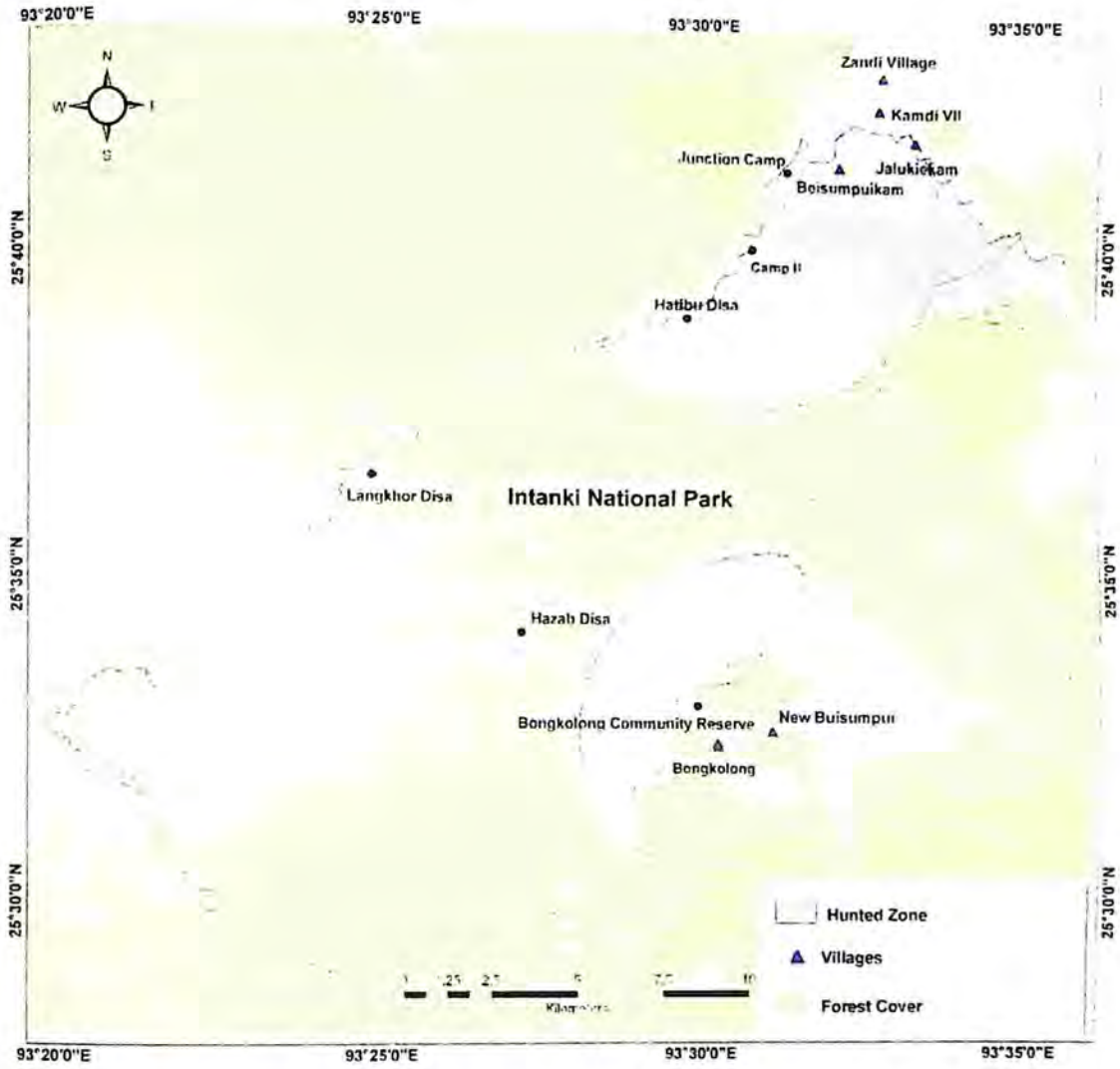


Figure 4.1 Area impacted by hunting taken from a radius of 5 km from the center of the 6 villages

Equilibrium density to sustain current level off hunting:

To estimate the population densities required to sustain the current hunting pressure, we estimated the number of individuals killed and intrinsic growth rate of various hunted species. Intrinsic growth rate of a species was estimated from its average body weight, following the formula: $1.5xW^{-0.36}$(Caughley and Krebs, 1983), where W is female body weight (Kg). I estimated the species offtake by computing total meat consumed by six villages per annum from household interviews, and the relative contribution of each species among all the hunted species from hunters' responses. Product of these two values provided the amount of meat consumed for

each species within the area impacted by hunting activities (180 sq km) scaled to 100 sqkm. Dividing this value by the average edible meat from a typical individual, I computed the number of individuals likely to be hunted per 100 sq km for each species. To estimate the equilibrium density of each species (density required to support this level of hunting), I divided the number of individuals hunted/100sqkm by the species intrinsic growth rate. Species-specific equilibrium densities (recruitment = offtake or maximum sustained yield) reported in Table 4b.

Maximum sustained yield of ungulates:

Implementing a similar technique as described above, I estimated the maximum sustained yield (sustainable offtakes at the current population densities) for ungulate species from their intrinsic rate of growth and field densities. Since Indian muntjac, Sambar and wild pig contributed 0.5, 0.25, and 0.25 proportion of the total ungulate density (220/100 sq.km), I estimated their density as 110, 55, and 55 per 100 sq.km respectively. I multiplied ungulate species-specific growth rates and densities to estimate the recruitment rate, which is akin to the maximum sustainable yield.

4.4 Result

4.4.1. Relation between species richness and abundance with intensity of hunting:

The relationship between the species richness and abundance of both mammals and birds per site was evaluated using linear regression and Pearson co-relation. It is found out that there is significant negative impact of hunting on the Ungulate (pellet density, r^2 = -0.8, p=0.04) and encounter rate r^2= -0.72, (p=0.10) and medium sized birds abundance (r^2 = -0.78, p=0.06). However no significant impact of hunting was found on track plot density, arboreal mammal abundance, small sized birds, and large sized birds with hunting. Species richness of both the birds and mammal shows no relations with hunting. (See table 4a.)

Table 4a. Estimation of relations between abundance and species richness with hunting intensity by Pearson's co-relation, where r is the Pearson correlation and p is the significant value (2-tailed).

Variables	Co-relation co-efficient with Hunting intensity. (r)	p
Pellet density	**-0.828**	**0.042**
Track plot density	-0.328	0.526
Ungulate encounter rate	**-0.728**	**0.101**
Arboreal mammal abundance	-0.402	0.429
Small sized birds abundance	-0.071	0.894
Medium sized abundance	**-0.783**	**0.065**
Big sized bird abundance	0.023	0.966
Ground bird abundance	0.023	0.966
Species richness for birds	-0.51	0.302
Species richness for mammals	0.548	0.261

4.4.2. Equilibrium density to sustain current level off hunting:

Equilibrium density per species –specific was estimated to check the current level of hunting and density equilibrium for each species are reported in Table 4b.

Table 4b Estimation of equilibrium number per 100sq.km per species

Species hunted	**Body Mass of Species**	**r= rate of growth**	**Meat Consumed total**	**No of individual killed in six villages per year**	**Individual hunted per year(180 sq.km) per 100 sq.km**	**Equilibrium number/density per100 sq.km**
Muntiacus muntjac	15	0.57	219.51	219.51	121.95	215.52
Paradoxurus hermaphroditus	4	0.91	219.51	878.04	487.80	535.67
Sus scrofa	50	0.37	123.48	37.04	20.58	56.10
Rusa unicolor	120	0.27	54.88	7.32	4.07	15.19
Felis bengalensis	5	0.84	219.51	658.5	365.9	435.4
Arctonyx collaris	7	0.74	54.88	117.60	65.33	87.75
Hylobates hoolock	6.6	0.76	96.04	218.26	121.26	159.46
Elephas maximus	1500	0.11	13.72	0.14	0.08	0.71

Hystrix indica	5	0.84	13.72	41.16	22.87	27.21
Macca mulatta	5	0.84	13.72	41.16	22.87	27.21
Arctictis binturong	12	0.61	27.44	34.30	19.05	31.08
Martes flavigula	2	1.16	27.44	205.8	114.3	97.8
Manis pentadactyla	13	0.60	219.51	253.28	140.71	236.19
Bandicota bengalensis	0.2	2.68	27.44	2057.92	1143.29	427.01
Cuon alpinus	18	0.53	41.16	34.30	19.05	35.96
Bos frontalis	650	0.15	82.32	1.90	1.06	7.24
Naemorhaedus griseus	20	0.51	13.72	10.29	5.72	11.20

Maximum sustained yield of ungulates:

For maximum sustained yield of ungulates, I estimated166.9 ungulates/100 sq.km should be recruited to balance the off take of hunting from the six villages.

Deficit of species due to hunting:

Four species- *Muntiacus muntjac, Sus scrofa, Rusa Unicolor, Paradoxurus hermaphrodites* were taken into consideration, as these species are preferred and hunted most by the hunters also consumption of these species were are also high (chapter 2), besides field density of the four species were also quantified (table 2a).Hence for deficit of these species due to hunting was estimated by subtracting the field density of the species with the density required to sustain current level of hunting which is the equilibrium density. The species density were generated from the field density (Table 2a), here the density was generated from 100 sq.km (number of species observed x 100 sq.km / 2 x transect walk effort (60km) x Effective striped width/ 1000 meter). To obtain the deficit difference for each species, it was calculated by subtracting the field density to equilibrium density in 100m sq.km. The negative value implies the deficit of individuals in the population, the more the negative value the higher the individuals extracted from the populations from hunting. In the species equated for deficit difference, *Paradoxurus hermaphrodites* (-433.67) and *Muntiacus muntjac* (-104.36) showed the most deficit with the highest in *Paradoxurus hermaphrodites* this overharvesting of this species more than the available density could result in the population decline. *Rusa Unicolor* and *Sus scrofa* is least

affected by the hunting with 40.38 and -0.53 respectively. Species which falls on the negative valuere present the deficit due to hunting which will eventually strain the balance of species diversity in the area and hence liable to crash. (Refer table 4c). For *Rusa Unicolor* and *Sus scrofa* Hunting does not affect species deficit, this can be due to the factors like the detection probability of those species are low or it can also contribute to low preference to hunt the species. (Figure 4a).

Table 4c: Deficit differences in species due to hunting with the available field density

Species	**Density**	**Equilibrium density in 100 sq.km**	**Deficit difference**
Muntiacus muntjac	111.14(38.89)	215.51	-104.36
Sus scrofa	55.57(27.5)	56.1	-0.52
Rusaunicolor	55.57(27.5)	15.19	40.38
Paradoxurus hermaphroditus	101.99 (51.2)	535.67	-433.67

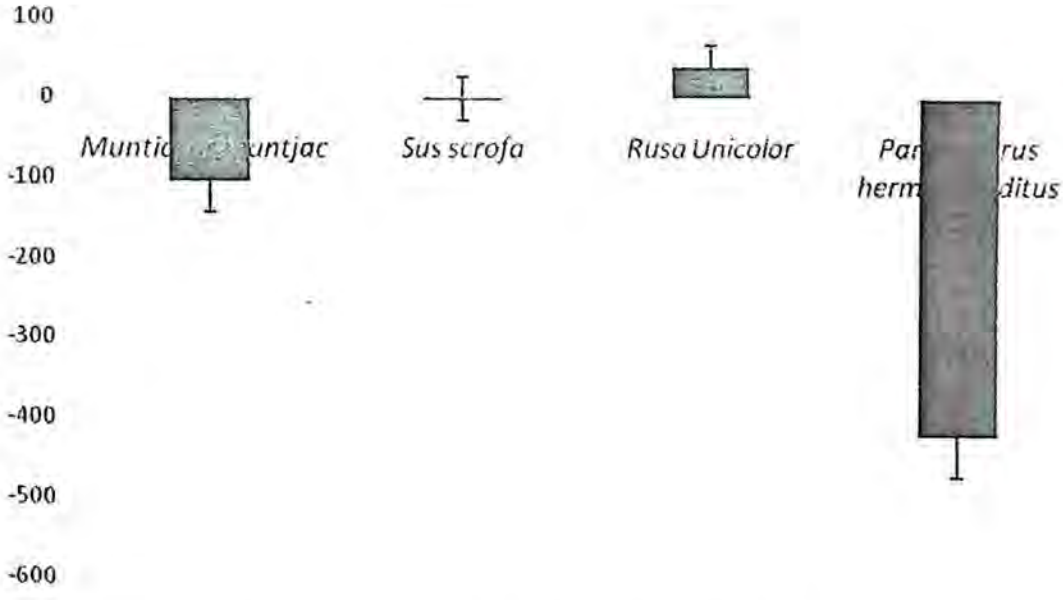


Figure 4a. Deficit of species due to hunting

4.5 Discussions

Wildlife hunting has always been an ancient practice (Aiyadurai 2011) this relation of human and wildlife has always existed in the society. The dependency of man on wildlife for food,

medicine, cultural adornment, etc. (Alves 2009, Alves et al 2009, Aiyadurai 2011, Santos-Fita et al 2012). This relation has indeed intrigue human's understanding of wildlife usage which often leads to the demand of wildlife products leading it to uncontrolled extraction of wildlife. This unsustainable activity by human has led to extinction of many species with the recent extinction of Formosan Clouded leopard in Taiwan (Project Biwan 2013). Besides wildlife hunting, habitat are crucial for all animal to survive. With anthropogenic pressure in around those habitats, it is becoming a major factor in the decline of wildlife.

Here from my estimation of the relation between species richness and abundance intensity of hunting it is found that the species richness does not have any significant effect on the hunting intensity. However, in mammals, there is negatively significant impact on ungulate pellet density and encounter rate. For birds, the significant negative effect is found only on the medium sized birds (table 4a). This factors can be due to the higher variability on the data and small sample size.

Impact by hunting is a deteriorating factors on the species richness(Bodmer et al 1997) and with the adaptation of more hunting techniques by man, local extinctions from overhunting are more common(Robinson & Redford 1991). This overhunting has also been triggered by the market demand (Bodmer et al. 1994, Jenkins et al 2011), which affects the species richness of the animals. However in spite of the declination of richness of species, it provides great incentives to the hunter. As more the animals are hunted, the greater a hunter's bushmeat off take which will result in the high proportion of meat being sold (Kumpel et al 2010). Hence providing an important alternative sources of income for livelihood for most hunters.

Caughley and Kreb's equation on the growth rate (Caughley and Kreb 1983) is most effective on ungulates. Here from the study, available density was considered for the deficit difference of the mammals. In the percentage of the surplus and deficit the negative value represent the deficit of each individual within a 100 sq. km. The increase in the negative values will represent in the population lapse of the particular species. In my study, deficit difference (available-hunted density) was highest on the Indian muntjac (-104.36) and common palm civet (-433.67). Common palm civet is most hunted among the two. It can be due to the reason of easy to hunt types, as the hunters usually has tricks of the trade to catch these species, also preference of these meat especially in winters and medicinal properties (table 3f) also contributed to the high off

take of these species. Hence, eventually, decrease of these individual species in the population due to excess hunting, will result in the decline of this species population.

This continuous off take of species beyond the hunting carrying capacity might result in the population decline of that species. This off take of such species are due to the preference of such species for consumption for meat, medicinal properties (refer table 3f), and demand for traditional adornments in case of Hornbills. However in case of species like Sambar and Elephant, there is surplus in the percentage of the species in that 100 sq.km, as the hunting carrying capacity and the individual hunted per year is low, this can be due to the factor that the even though the species are present and hunted by the hunters, the detection probability of those species are low, in case of Elephant, the low preference to hunt this species by the hunter contributes to it.

Conservation is a challenge in an area where the inhabitants are indigenous tribal community. This makes it harder for the society to proceed further in conservation as the dependency of the locals on forest and its products are immense. Hunting animal is a huge issue and should be taken into primary consideration in efforts concerning conservation as well as research so as to provide a solution to conserving wildlife with sustainable utilization of wildlife in culturally wildlife-dependent indigenous communities of Nagaland. More enhancements on conservation ethics and knowledge should be spread among the communities, through village council, educational centers, and Church ministry. Substitutes for the high protein consumption is very important and this can be achieved by improving the livelihood of the locals, especially the communities living near the national park with incentives to compensate for the wild meat. Another addition to the compensation would be encouraging the locals to participate more in poultry and livestock rearing with proper butchers and meat suppliers with affordable price to purchase the extra protein required.

Important factor in conservation issues among the locals are the employment problem which is a common obstacle amongst the youth. With implementation of beneficial conservation activities, the locals also gets to earn their living like substitute conservation related jobs like forest watchers or Nature guides to the hunters (specially the budding hunters) and other income related conservation work, benefiting both the wildlife conservations and the village community. However the ultimate conservation issues in Intanki National Park would be solved if there could

be solution to resolve the illegal hunting activities of the Underground Militants in Nagaland. Intanki National park being an important location and good connectivity with the adjoining forest from neighbor state should consider it as a high priority to conserve biodiversity in a larger landscape.

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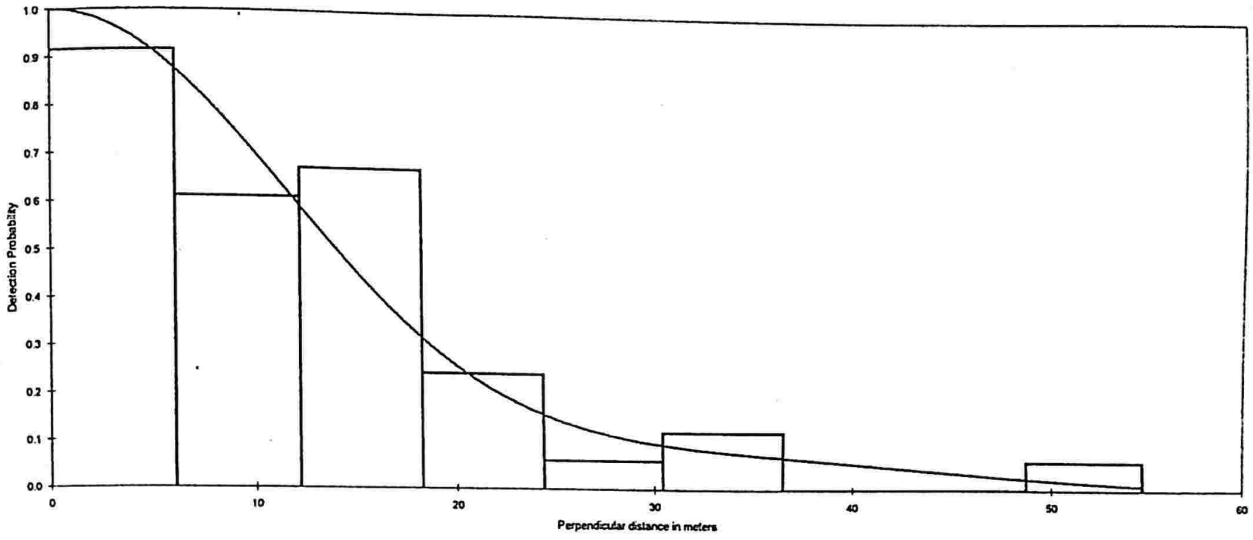
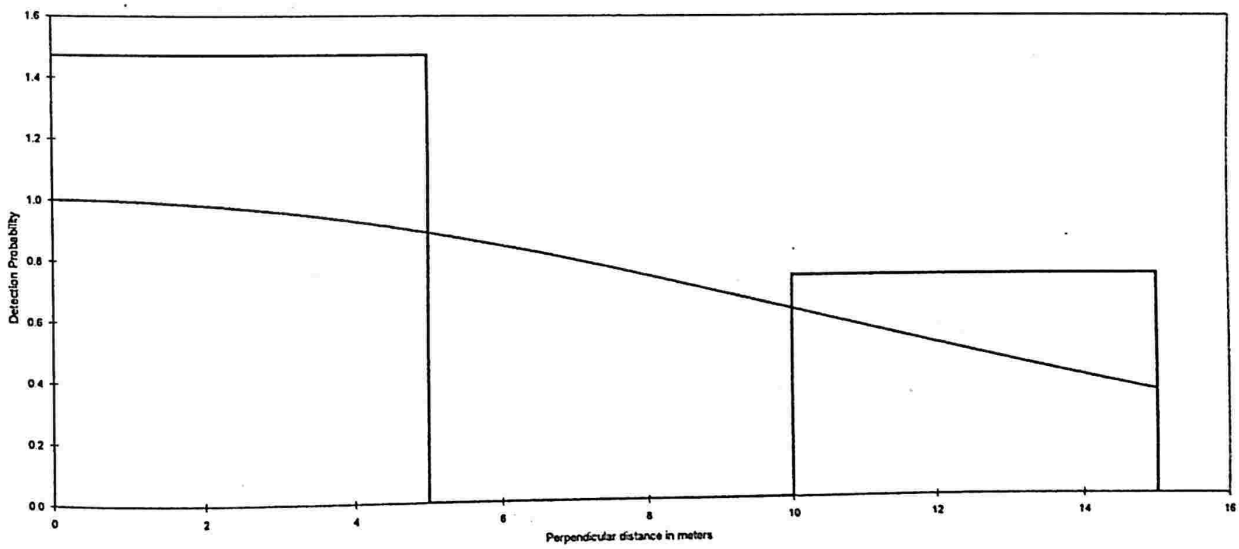
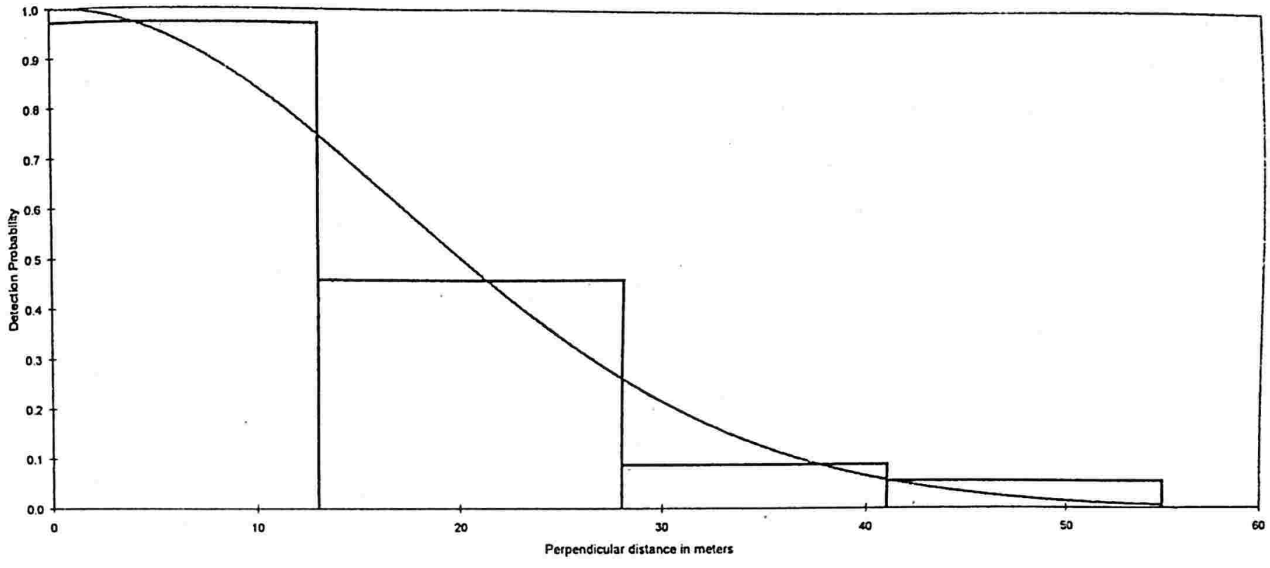
APPENDIX I



Detection probability Curve for Arboreal animals with perpendicular distance truncated at 55m and the fitted detection function for the best fit modelling , CDS half normal (Cosine adjustment).



Detection probability Curve for Ungulates with perpendicular distance truncated at 15m and the fitted detection function for the best fit modelling, CDS half normal (Cosine adjustment).



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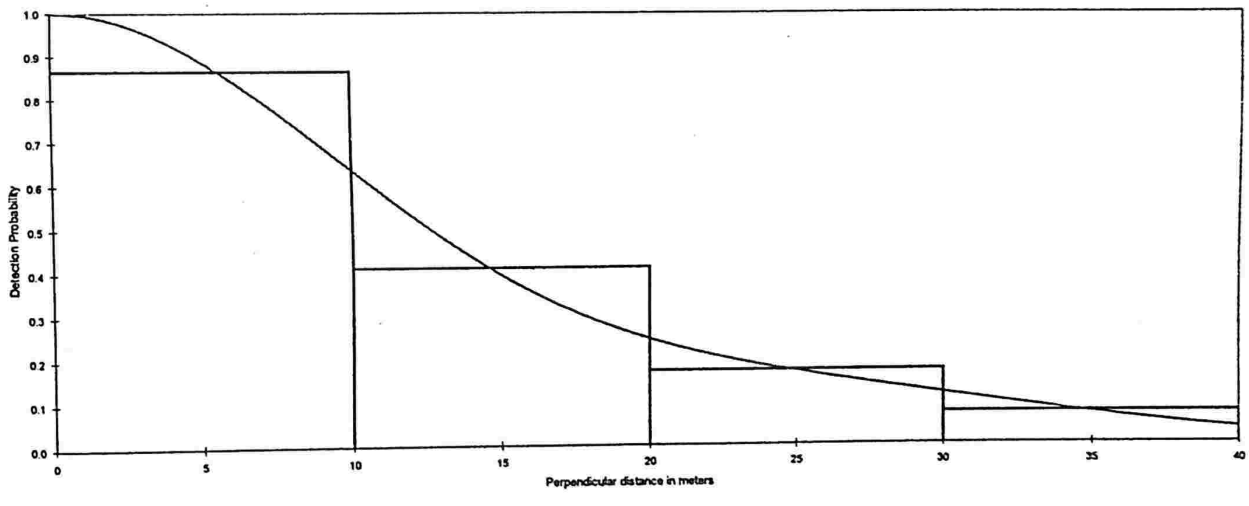

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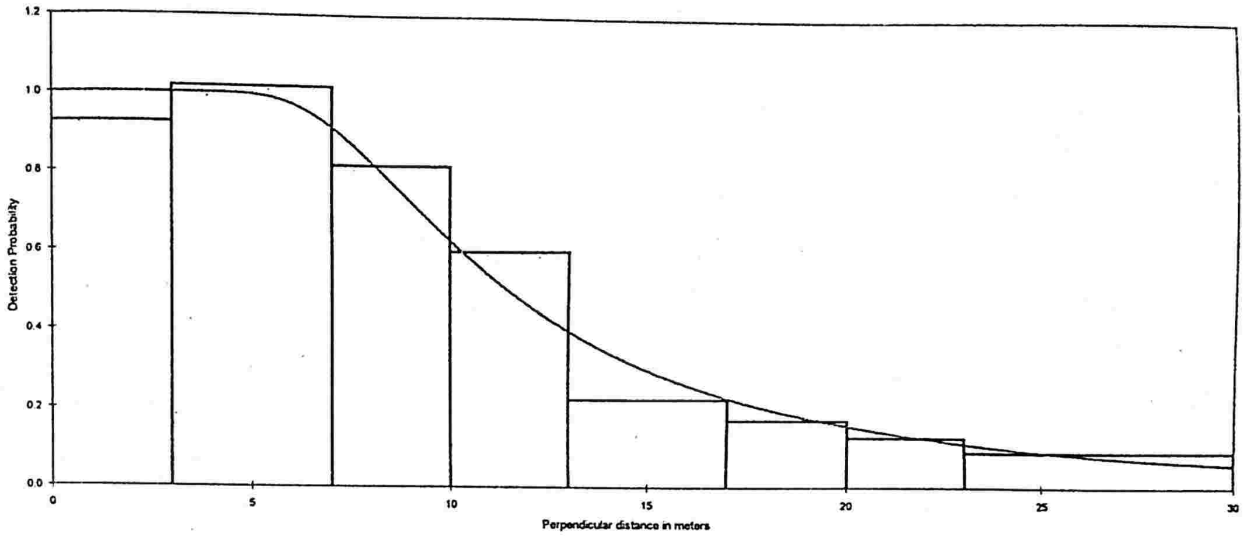

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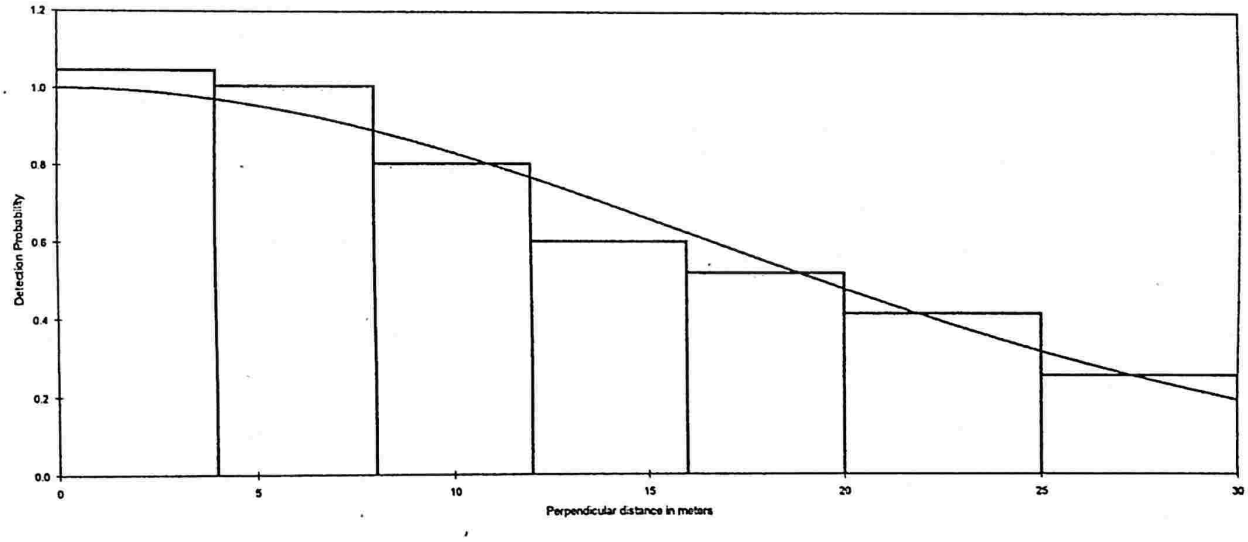
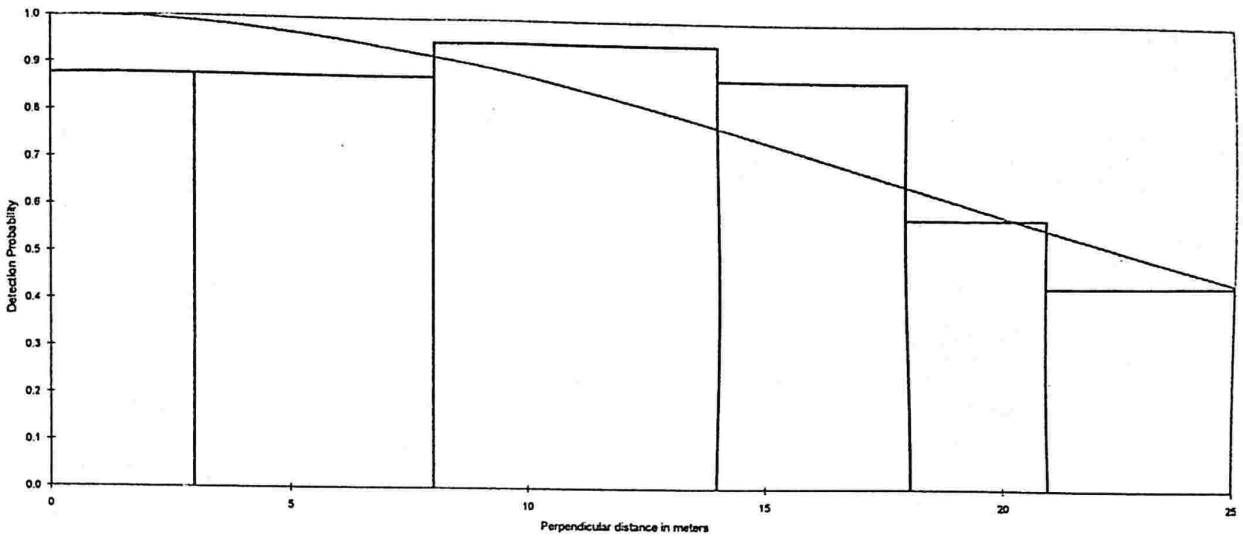
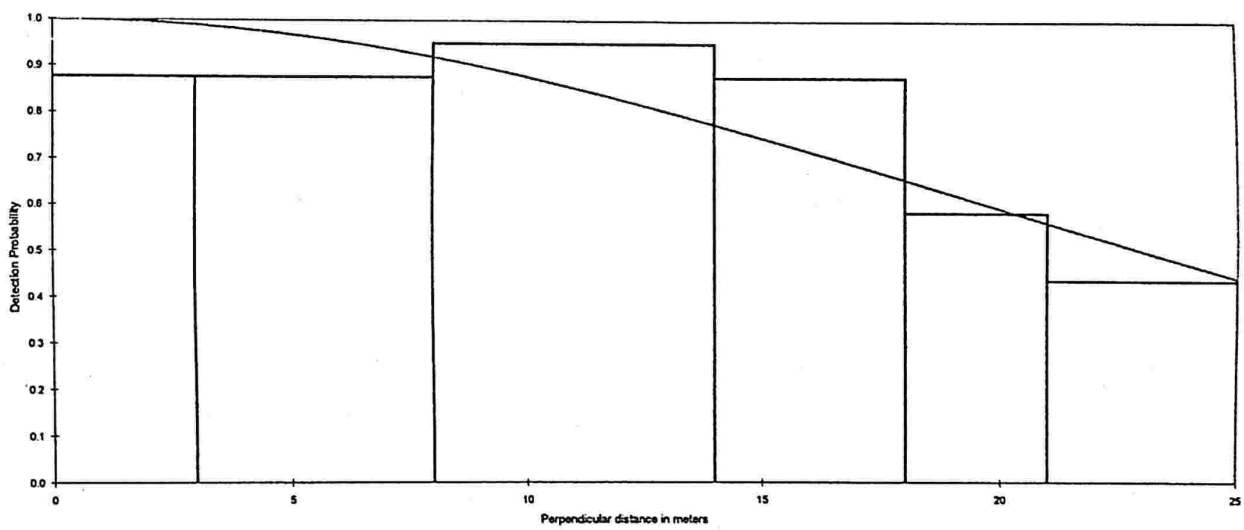


Detection probability Curve for medium birds with perpendicular distance truncated at 30m and the fitted detection function for the best fit modelling, CDS half normal (cosine adjustment).



Detection probability Curve for big birds with perpendicular distance truncatedat 25m and the fitted detection function for the best fit modelling, CDS



Detection probability Curve for ground birds with perpendicular distance truncated at 25m and the fitted detection function for the best fit modelling, CDS half normal (simple polynomial)

APPENDIX II

Folklores

STORY OF LONGKHONGLA

Longkhongla is considered as a mother and creator of all wild animals in most of the Naga folklores, it is folk tale from Sangtam tribes, also Ao tribe has a different version of this story and has related to the origin of clan as well as creation of wild animals, however in both the tribes she was considered as a mythical figure of Mother Nature. This story is a version from Sangtam community. (Reference: Govt. of Nagaland, dept. of art and culture, Kohima, Nagaland, 2009)

Longkhongla, a widow of a village from Nagaland yearned for a child but she wasn't fertile enough to have one. She prayed to the spirit in the hope of bearing a baby but nothing happened to her until a Hornbill took pity on her and dropped one of its tail feather as she was weaving cloth, but the moment she touched the feather it turns into a stone. Disappointed, she threw the stone away. It landed on a soft patch of vegetation and turns into a male baby. All the mothers from that village tried to feed the baby with their milk but it turned everyone down. Finally when it was Longkhongla's turn, to every one's surprise, the baby suckled her breast.

Longkhongla than raised the baby as her own and the boy grew up to be a handsome young man, and his look has won the admiration of all the young girls from that village and also from the neighboring villages, which has caused jealousy from the men of his age group in the village. Which result in a murderous plot to kill Longkhongla's son. So one day the villagers poisoned Longkhongla's son.

When Longkhongla found her son's dead body, she was so upset and enraged, she cut her son's dead body into several piece. These pieces, she dipped into a magical pool where each pieces turned into a feral animal. Filling the whole village with wolves, tigers, wild boars, bears and

other wild animals. Longkhongla has finally avenged her son's dead by setting all the wild animals upon the village.

Longkhongla too turned into a hornbill leading all the animals into the forest. To these days wild animals are also called as Longkhongla's animals.

Spirit, Tiger and Man

These tales is a common folklore widespread among the Naga tribes, with each village and their own ways of interpreting the tale has made these fable a favorite among all ages across the generation. Most of folklore from Nagaland has association with the animate objects and indeed there are myths about the spirits of tiger in man in Naga tribes like Ao, Sema, Zeliang, which has fascinates ethnographers worldwide.

There once lived an old woman with three sons- Spirit, Tiger and Man. Of all the sons, she loved her youngest son- man most, because he cared for her and attend to her needs unlike his other elder brothers, the spirit and the tiger, which was ferocious of them all, and even craved for his mother's flesh and often longed for her death, which both the other brothers knew about it. Over the years the woman wasn't not in her best of health and few years later she sensed she was nearing her end.

One day her condition became critical and sensing her end, the two brother send the tiger to the field, where the mother breathe her last. The man and the spirit buried her near the fireplace in order not to let the tiger locate her body. The tiger returned in the evening and ask about her mother where about which the two brother disclosed anything.

As time passes by, they decided to part ways, and when it came to question of dividing the ancestral properties, they decided that the man should keep the home since he is the youngest. The other two decided to leave far off from the man. However the tiger wanting to fulfill the desire of eating his mother's flesh keep asking his brother where they buried her, and when he denied he threatened to devour him. The spirit knowing that the tiger will kill the man, devised a

plan to save his youngest brother. So he arranged a contest between the man and the tiger with a condition that whoever touch the target would be the winner and would remain at home. The spirit knowing the tiger's agility and strength gave the man a bow and arrow. The competition began and the man instead of running shoot the arrow straight into the target and pronounce himself as the winner. The tiger sensing the trick played upon him by his two brother left into the deep forest with a warning to the man not to wander deep into the forest.

The spirit also bade its adieu to the man, saying that he need to keep an eye on both his brothers and promised to be around and then vanish into the thin air. And from that day, it is said that the tiger began to live deep in the forest and men in the villages.

Why the owl has a flat face

This is a famous fable often told to children by the elders in most Naga society, this fable dates back to the creation time, or the newly created earth by Lijaba (god of creation from Ao tribe). Written version of this fable can be found from Konyak community. This story version is from Ao community.

Once upon a time when the world was newly created by Lijaba, the god of creation, he did not fixed the duration of life cycle and there was no division between the darkness and the light.

This has caused many problem amongst the creature of the world. Henceforth the animals of the world decided to assemble together to bring a solution to the problem.

There in the assembly, many suggestion and ideas were put up by the animals and a huge debate broke out amongst them. The owl among those assembled in the gathering got bored with the proceeding blurted out "if there is darkness let it remain and if there is light let it remain all the time". The assembled animals were so outrageous by the remark made by the owl that they gave him a thorough beating. In that process, it had flattened the owl's head forever and also they banished him from the bird community.

While the owl created a controversy with its remarks, the warbler who had the size of a jungle fowl than, chipped in saying that "let there be light than dark, alternatively in the nature cycle, so that we can work while we can see in the light and sleep when it is dark". These idea appealed to all the creature of the world that they started patting him out of appreciation, finally reducing him to the smallest size of all the birds.

And hence the Aos says that the owl has a flat face and comes out only at night unlike other birds and the warbler is supposedly to be the smallest of all birds because of the heavy patting he received.

Herielung who turned into a hornbill

This story is from Benreu village in Peren district, from Zeliang community. This story is an extraction from the book "folk tales from Nagaland"

Long time ago in Benreu village there was a young man by the name Herielung who was raised by his father. His mother died at his birth so his father remarried another woman. Though Herielung's step mother mistreated him, he however turned out to be a handsome young man. He had two girl-friends, and every working day they work turn by turn together in each other's field.

Since his stepmother was a wicked lady she always add rat stool with rice on Herielung's lunch. For that reason he never took lunch with his two friends, instead he take the lunch alone on the outskirt of the field. He keeps a quill on his hair so as to sort out the rat stool from his rice.

Even though he was requested several time by his two girl friends to join him for lunch he always refuses so as not to disclose his stepmother's cruelty towards him.

One day these two girls secretly opened the lunch packet of their friend Herielung while he was working in the field and found to their horror that his rice was mixed with rat stools. The girls sympathize him and removed his lunch and add some of their lunch into his. When Herielung

found out their action he felt ashamed about the cruel treatment that he received from his stepmother.

In the evening as they were returning from the field he requested them to give their colorful attire so that he may be able to imitate the hornbill. They willingly gave them the attire to him and he put them on and climb the tallest tree and he sat on a branch and start hopping from branch to branch making the screeching hornbill sound. He asked the girls whether he look like a hornbill which the girls replied that he look like one. However, they were getting late and the girls requested him to come down from the tree, which he told them that he will come down again as he would turn into a hornbill. With that he told the girls to look at the sky when the flock of hornbills fly across their village and to see the difference among the birds. The largest among the birds would be him as he was once a man. He then told the girls to weave a cloth for themselves with one long cloth and the other a short one and watch for his arrival so that he may be able to drop the best two of his feather to them. With that words he sang a song and then flew away, leaving his two friends to return home broken hearted.

As the days passes by, a flock of hornbill flew by their village on one fine day. The two girls did as their friend Herielung has asked them to do, he then dropped two of his finest tail feather to his two friend. Seeing the act by the hornbill towards the girls Herielung's stepmother looks up the sky and opened her mouth to ask Herielung to drop one of his feather for her and her son, while she was saying the hornbill dropped its stool on her mouth.

Enraged she cursed the hornbill that it was forbidden to fly across her village in future. Henceforth flock of hornbill flying over Benreu village is a rare sightings, that is why whenever a hornbill fly across Benreu village the headman would usually declare genna* for that day.

**genna*-holiday.

A Hollo tale

Hollo is referred to Hoolock gibbon by the Phom Naga, from eastern part of Nagaland. However "hollo" is a common name across Nagaland for Hoolock gibbon which they also called as the kala bandor or the black monkey. This story is an extraction of the story-"why hollo does not drink water" from the book "folk tales from Nagaland".

Once all the rivers, streams and wells got dried due to extreme heat from the scorching sun. Hence finding water holes were a huge problem amongst the animals and that they decided to have a meeting to discuss about the fate of the issues of their water problem. One day, all the animal were ordered to assemble in a given location by the leader. The leader of the animal than said to them "there is only one well for us to drink water but there is no way to go and collect the water, so shall we construct a path so as to make our work easier and quench our thirst?". All the animals agreed to the suggestion and thus a day was suggested for the animal to build a path.

All the animals of the world turned that day except for Hollo, the animals knew that Hollo was a lazy animal and were displease that he did not turn up on that very important day. They decided to have a meeting after their work and decided not to let Hollo drink water at all. Therefore whenever Hollo goes to drink water both the water and the earth shakes so as to frighten her. Thus from that day onward, Hollo does not drink water. Also tales from the people says that the light reflection on the water and movement of the water gives the animal headache making the animal to avoid the water.

APPENDIX III

MAMMALS CHECKLIST

A total number of 42 species of mammals from 17 family and 7 order were collected from the camera traps, animal transect, pellet count, track plots, and questionnaire surveys from both the hunters and household surveys. The animals recorded are listed below.

Order Primates

Family Loridae

- Slow loris (*Nycticebus bengalensis*)

Family Ceropithecidae

- Rhesus macaque (*Macca mulata)*
- Stump-tailed macaque (*Macca artoides)*
- Capped langur (*Trachypithecus piletus)* *

Family Hylobatidae

- Hoolock gibbon (*Bunopithecus hoolock*) (*Hoolock hoolock*)

Order Artiodactyla

Family Cervidae

- *Rusa unicolor* (Sambar)
- *Muntiacus muntjac* (Indian muntjac)

Family Bovidae

- *Naemorhedus sumatraensis rubidus* (Burmese serow)
- *Naemorhedus griseus*(Chinese Goral)*
- *Bos gaurus* (Gaur)

- *Bos frontalis* (Feral Mithun)

Family Suidae

- *Sus scrofa*

Order Proboscidea

- *Elephas maximus*

Order Carnivora

Family Ursidae

- *Ursus thibetanus**

Family Canidae

- *Cuon alpinus*
- *Canis aureus*

Family Felidae

- *Panthera tigris* *
- *Panthera pardus*
- *Neofelis nebulosa*
- *Pardofelis marmorata*
- *Prionailurus bengalensis*
- *Prionailurus viverrinus*

Family Mustelidae

- *Arctonyx collaris* (hog badger)
- *Lutra lutra*
- *Martes flavigula*

Family Viverridae

- *Viverricula indica*
- *Viverra zibetha*
- *Paradoxurus hermaphrodites (*common palm civet)
- *Paguma larvata (*Himalayan palm civet)
- *Arctictis binturong*

Family Herpesidae

- *Herpestes edwardsii*

Order Pholidota

Family Manidae

- *Manis crassicaudata* (Indian pangolin)*
- *Manis pentadactyla* (Chinese pangolin)

Order: Insectivore

Family Soricidae (shrews)

Family Talpidae (moles)

Order Rodentia

Family Sciuridae

- *Funambulus palmarum* (three striped palm squirrel)
- *Dremomys lokriah* (orange bellied Himalayan squirrel)
- *Calloscirus pygerythrus* (Hoary bellied Himalayan squirrel)
- *Callosciurus erythraeus* (Pallas's squirrel)
- Small flying squirrel (unidentified)

Family Hystricidae

- *Hystrix indica* (Indian porcupine)
- *Hystrix brachyuran (*Himalayan crestless porcupine)*
- *Atherurus macrourus* (Asiatic brush tailed porcupine)

*indicates data through secondary data- questionnaires

APPENDIX IV

a. List of animal from animal transect (60 transects)

Arboreal	**Primate**	**Ungulate**
Orange Bellied Himalayan Squirrel	Stump Tail Macaque	Wild Pig
Squirrel	Rhesus Macaques	Sambar
Yellow Throated Marten		Barking Deer
3 Striped Squirrel		
Flying Squirrel		
Hoary Bellied Himalayan Squirrel		
Common Palm Civet		

b. Bird list from the bird transect from 6 sites (60 transects)

Small sized birds	**Medium sized birds**	**Large sized birds**	**Ground Dwelling birds**
Fantail	Woodpecker	Oriental Pied Hornbill	Jungle Fowl
Black Crested Bulbul	Barbet	Crested Serpent Eagle	Grey Peacock Pheasant
Wagtail	Black Drongo	Eagle (un identified)	Khaleej
Warbler	Owl	Egret	Quails
Tits	Racket Tail Drongo	Large Billed Crow	Partridge
Fantail	Jungle Babbler		
Black Bird	Lineated Barbet		
Minivets	Indian Roller		
Green Bee Eater	Accipiter		
Bushchat	Pigeon		
Flycatcher	Woodpecker		
Sunbird	Shrike		
Leaf Warbler	Spotted Dove		

Green Bird	Brown Birds
Beeeater	Dove
Oriental White Eyed	Kingfisher
Robin	Flameback Woodpecker
Crimson Sunbird	Myna
Thrush	Oriole
Ruby Cheek Sunbird	Red Footed Green Pigeon
Asian Paradise Flycatcher	Broadbill
Leaf Bird	Woodpecker Small
Wren Babbler	Green Malkohas
Red Vented Bulbul	Scimitar Babbler
	Malkohas
	Green Pigeon
	Himalayan Flameback Woodpecker

APPENDIX V

Questions data for the questionnaire survey

For hunters:

1. Name of the person:
2. Village: Khel:
3. Age:
4. Educational background:

   Illiterate: School level: 10th pass: College:

5. Occupation:

   Govt. employee Agriculture: Pastoralist:

   Labor: Agro-pastoralist: Other:

6. What is your family size :
7. Economic status:

   Poor: Average: Well off:

   Indicators; Housing, dressings, ornaments, vehicles, cattle, land, gadgets,.

8. Any relations living with your family (yes-how many, relation with whom, why OR no-no further questions).
9. Camp hunter or drive in hunters??
10. Do you hunt in any particular season or the time when the animal is active or inactive? Or when you feel the population is higher during a season or particular time?
11. How often do you hunt?

    Daily: once a week: month: years:

12. When did you start hunting?

    5-15: 16-25: 25-35: 35-

13. How did they learn the art of hunting/techniques and from whom did he learn?
14. What is he best at hunting?
15. How do they pass time during non-hunting period
16. What is your motivation in hunting initially?

For food: cultural practices: sports:

Market demand: agricultural pest:

17. What species do you preferred? (Why? Easy to catch? Or high price in the market? Or high demand? Herbivores or carnivore?

    Herbivores: carnivores:

18. What percentage of time is spent on hunting? (Does species varies with the time spent on hunting?
19. How often do they hunt?
20. What do you get from these animals (and what are the values)?

    Meat: skin: fur: claws: teeth:

    Other body parts:

21. And what is the cost of the item (species wise)?
22. Any particular preferred species and why?
23. How many kilos of meat do you get on average from any wild meat that you have hunted?
24. What is the usual price of selling the meat (per kilo)? And what is their percentage in keeping the meat? And the percentage of selling the meat.
25. How many animals they can hunt in a year (magnitude of hunt)?
26. What are the weapons (guns or local techniques) used? How much do you pay? Or do you make yourself?
27. Are weapons designed to capture specific species?
28. What is the cost per trip?

    Petrol: diesel: kerosene: ammunition:

    Others:

29. Which are areas most preferred for hunting and how long does it take from there? How much time do they take to set the area for hunting?
30. Do you use dogs to hunt wildlife? How, when and where do u train dogs?
31. What is the best time for hunting (time)? What is your movement pattern?

    Early Morning: morning: noon: afternoon:

    Evening: Late evening: night:

32. What forest vegetations do you prefer for hunting? What is the success rate in those vegetations?

    Dense forest: less dense forest: bamboo dominant:

    Sparse forest:

33. What is the success rate of hunting of animal (species wise):

    0-25: 25-50: 50-75: 75-100:

34. How much time does it take to hunt down an animal (species wise)
35. Strategy for different animal? Does it differ with species?
36. Any changes of animal sightings over time? How much time they took earlier in regards to the present scenario
37. Do you have a license for keeping a gun? Is it traditional pass down from father to son? Or some other else(his explanation)
38. Does village council have any authority in controlling your hunting expedition? Any rules and regulation set by the village council?
39. Any designated area within the villages where they could hunt? Or all the forest around is used by the villagers?
40. What are the demands of the bush meat hunting by the society?
41. Who are the regular costumers? How often do they place order for bushmeat? How much are they willing to pay for the bushmeat?
42. Any middle man initiating in supplying the hunted meat/skin/etc? What is his profit?
43. What is the magnitude of demand from the nearby town (Dimapur, Kohima, Mokokchung)
44. How often does they bring home any big catch (large ungulates)
45. When was the last time that you went for hunting?
46. How many unsuccessful hunting occurs within this month/week/year?
47. Do they like to take company while hunting (if yes, how many) or they prefer alone?
48. While hunting in group does the entire group member get to shot down at least an animal? Sharing of the catch? How much do they get? Who gets the largest share?
49. Has anybody (person, organization, government) opposed to your hunting practice? If hunting is stopped then would they be happy with this decision?

50. Are you aware of the fact that hunting has depleted the population of animals? If you are dependent on bush meat then would you accept alternative ways for acquiring bush meat like (captive breeding)? or would u still prefer traditional hunting practices?
51. Would you be interested in conserving wild flora and fauna? What and how do u think you can help?
52. If wildlife trade is the primary solution to battle poverty then would they be willing to accept alternative livelihood options (handicrafts, nature guides, become forest guards etc)?
53. Do you feel threatened by any wild animal?
54. Any favorite wild animals and why??
55. Hunting experience?
56. What is the importance of hunting to them

For households:

1. Name of the village:
2. Father's name:
3. Community name (Tribal community, etc)
4. Family size:
5. What's their family income annually?
6. Do they cook on gas or firewood
7. Any relatives living with them and their Relationship with them
8. Wealth (just observation)
9. How many kids? Age of all their family members
10. What is the occupation of the father?

    Farmer: laborer: govt. employee: business:
11. Education of the kids (parents as well)
12. Agricultures? What types of crops? How much do they yield? How much do they sell, and how much do they consume? What types of agricultural practices? How much acres of land do they use for the agriculture? Which crops gives the best yield? Who participates in the agriculture? Any hired people to work for them?

13. Any employed kids? What are they doing? Where are they working? Which company? Etc? Do they support the family?
14. What do they usual do during free time? How do they pass their time?
15. Any purchase of wild meat during their lifetime? If yes) how much do they spent in buying? How often do they buy?

16. What is their staple diet? And if this diet is sufficient for the entire family then why do they still go for wild meat? any specific reason like is it traditional or is it to meet your protein demands
17. How often do they buy meat? How much meat they consume in a daily basis? How much meat they in a month?
18. Hunted any wildlife by them?
19. Any special occasion or some traditional practices where they actually spent money in buying or spent time to go to the jungle and hunt?
20. How far do you have to go into the forest to hunt (km)? Or do you buy wild meat from the local market?
21. How far is your village from the forest?
22. What kind of support do you receive from the government?
23. How far do u have to travel to receive medical attention (hospital, clinic)?
24. How often do they utilize the products of forest? (Besides observation of the household decorations etc).
25. Any hunters in the family?
26. NTFP used?
27. What is the value of hunted meat- taste, value, symbols of status, etc?
28. Any practices of hunting wild animals (skin/fur/feather) related to ceremonial or any cultural practices?

For market:

1. what are the animals on sell
2. How much is per kilo?
3. Where did you get the meat?

4. How far is it from here? (the village or the forest, from where they get the meat)
5. Which village supplies most of the village? Most active supplier?
6. How many villages (hunter) supply this wild meat?
7. How many regular costumers do they get? How often do they buy? Which are the most preferred animals?
8. Are there any demands for traditional functions? How many festivals do they have per year?
9. What is the buying price and how much do they sell with? Or do they hunt than sell themselves?
10. How often do they get profit in selling the wildlife?
11. Is it more beneficial than selling agricultural product?
12. What is the most preferred ways of selling-smoked meat or red meat? Which has more demand?