Article

Illegal Hunting of Prey Species in the Northern Section of Bardia National Park, Nepal: Implications for Carnivore Conservation

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Abstract: We interviewed 48 people including local communities, ex hunters and protected area management professionals. The purpose of the interviews was to understand the motivations for, and the nature of, illegal hunting of prey species of iconic predators - tigers and leopards - in the northern section of Bardia National Park. Participants reported that hunting of prey species occurs mostly in spring and autumn and is less common during the summer. In the past, hunting was primarily for the purposes of obtaining meat for household consumption. Since the introduction of a road network in the region, opportunities to sell wild meat at ad-hoc 'highway markets' have developed. The purported medicinal properties of wild meat was also cited as a driver for illegal hunting. Mostly, locally hand-made guns are used for hunting and the use of dogs in hunting was often reported. Protected area managers informed that illegal hunting problems in the study area are associated with a lack of presence of park authorities, remoteness and underdevelopment and poverty of the community. Our study suggested that skills development training for local community members might reduce dependency on wild meat for household consumption and earning thereby reducing illegal hunting.

Keywords: Bardia; carnivore; illegal hunting; prey; wild meat

1. Introduction

Hunting of wildlife by humans (hereafter referred to as hunting) has long been a practice in many communities and still continues in many forms throughout the world [1,2,3,4]. At a time when human populations were small and wildlife were abundant, hunting was not a threat to the survival of animal populations. However, human population has increased drastically after 20th century, and the pressures of reduced habitat availability are threatening many species worldwide [1,5,6,7]. Unsustainable hunting for wild meat and highly valued wildlife parts used in traditional and alternative medicines further threaten the survival of many species and lead towards local, regional and global extinction – of the hunted species as well as of their natural predators [8,9,10,11] Where hunting is a threat to wildlife some wildlife conservation programs are actively working towards reducing it.

In South Asian countries including Nepal, traditional hunting of wildlife to meet cultural and household needs has been a practice since ancient times [12,13] wild meat was an important traditional source of protein for humans [10,3]. In recent times, despite laws forbidding hunting, wild meat continues to fulfill the subsistence needs of many local communities as well as a 'luxury

demand' from wealthier people residing in urban areas. Hunting of wildlife was common throughout Nepal until the National Parks and Wildlife Conservation Act (NPWCA) was promulgated in 1973. This act banned the hunting of wildlife in protected areas. Later, the Forest Act 1993 banned hunting in forests outside of the protected areas [14,15]. Section 26 (6) of the NPWCA has provisions for fines of up to NRs 10,000 (~US$ 100) or 24 months jail; or both, in cases where species other than protected species, as listed under schedule I of the Act, are killed. In cases where convictions relate to the killing of protected species, fines can be up to NRs100000 (~US$ 1000) and the penalty may also include imprisonment up to 15 years (Section 26 (1) of NPWCA). Tigers, and several of the tiger's prey species in Bardia National Park are protected species (Table 1).

After the introduction of these two key pieces of legislation, hunting reduced sharply inside protected areas in Nepal [16]. Outside of protected areas, the practice continued, resulting in most of the forests outside of the protected area system becoming almost entirely depleted of populations of large herbivores. Some instances of hunting have also been documented inside protected areas [12] especially in the fringe areas and where vigilance of protection staff is minimal.

Hunting of wildlife directly affects the population of hunted species and indirectly affects the population of dependent species. Illegal hunting of prey species has already affected populations of endangered carnivores such as tiger in Asia [17] and jaguar in America [18]. In these cases, hunting by humans is the sole reason for the absence of prey species. In recent years leopards have become a problematic species throughout the middle hills of Nepal. There are many anecdotal evidences of leopard intruding into densely human populated cities some time attacking people. It is believed that a lack of prey species has forced leopards to depend on pets and livestock, with occasional instances of human casualties [19]. This paper highlights the scenario of local hunting [as defined by 20] of prey species in Northern parts of Bardia National Park and the implications of this for carnivore conservation. Prey species in this study refers to prey of tiger and leopard, and includes ungulate species (chital, sambar and barking deer, goral, wild boar) and primates (rhesus monkey, grey langur). It explores questions around why people hunt, which species are commonly hunted, which animal parts are used for what purposes, where markets exist for the sale of animal products and what methods are employed for hunting of wildlife.

2. Materials and Methods

Study area: Bardia National Park (figure 1) is rich in biodiversity, supporting populations of a variety of mammals. These include five species of deer (Spotted, Barking, Sambar, Swamp and Hog deer), two species of antelope (blue Bull and four-horned antelope), other ungulates (wild boar, goral) and primates (grey langur and rhesus monkey). Carnivorous mammals include large carnivores (tiger and leopard), meso carnivores (grey wolf, stripped hyena, golden jackal, fox), and in the aquatic environment, the Gangetic river dolphin. Several species of reptiles are also present, including Burmese python, gharial and mugger crocodiles (see table 1 for scientific names of species mentioned in the text). More than four hundred species of birds can be found in the park, including some globally threatened species such as great hornbill and bengal florican [21]. Two major rivers: Karnali in the west and Babai in the east have created alluvial flood plain grasslands [22] which are highly productive and rich in biodiversity. The northern part of the park includes the Siwalik Range (also called the Siwalik Hills or Outer Himalayas). This includes areas (Bhavar) where pebbles and boulders brought by the Himalayan rivers accumulate. Here, the water table is very low and the area is less productive and less biodiverse. The southern plains areas of the park are characterized by highly fertile land [23]. Along the rivers, riverine forest of Sindure, Gutel, Sisau, and Khayar (see table

1 for English and scientific names in Appendix) are dominant whereas the inner forests, further away from the rivers, are dominated by Sal [24]. In the Siwalik region, forests of Khasru and Sallo dominate.

The National Park is 968 sq km in area and a buffer zone surrounding the park adds another 507 sq km (see figure 1). There are no human settlements or agricultural land inside the boundaries of the national park (during the establishment phase of the park settlements were relocated, see Brown 1997). However, a mixed heterogeneous society, including indigenous Tharu people and migrants from the hill areas (Pahade) live within the buffer zone areas. Settlements, agricultural land and community forests are all embedded within the buffer zone areas. Around 120,000 people utilize the park and its buffer zone forests for various resources to support their livelihoods (Thapa & Chapman, 2010). The buffer zone area comprises fragile Siwalik where landslides commonly occur. During 2014 the landslides in the Siwalik caused flooding in the Bheri River, which claimed the lives of nearly 50 people and destroyed 321 houses in four village development committees within the study area (unpublished data of District Administration Office, Surkhet). The settlements adjacent to the northern part of the park (the study area) were established relatively recently. Migrants from the adjacent hills moved into this location about two hundred years ago. At the time of arrival, migrant people chose to settle in locations where land was either freely available, or available at a very low cost; and where forest resources were available to support livelihoods which were resourced via subsistence agriculture and animal husbandry. Often, people migrate to lower, more fertile land after they have earned some money to purchase land in more productive locations. Therefore, the study area is somewhat of a transit settlement for economic migrants from the hill areas. This study was conducted in the Northern part of the buffer zone surrounding Bardia National Park. Four village development committees (VDC) (the VDC is the smallest local government unit) comprised our study area. These were the Taranga, Chhinchu, Hariharpur and Lekhparajul VDCs, all located within the Surkhet district. Taranga is the most remote VDC within our study site. Local people from Taranga would need to walk for three to four hours in order to reach the nearest road. The other three VDCs are not quite so remote, but none, except Chhinchhu, are serviced directly by roads. The Kohalpur-Surkhet highway, constructed in late 1980s, passes through Chhinchhu and is approximately 30 km away from the most remote part of the study area.

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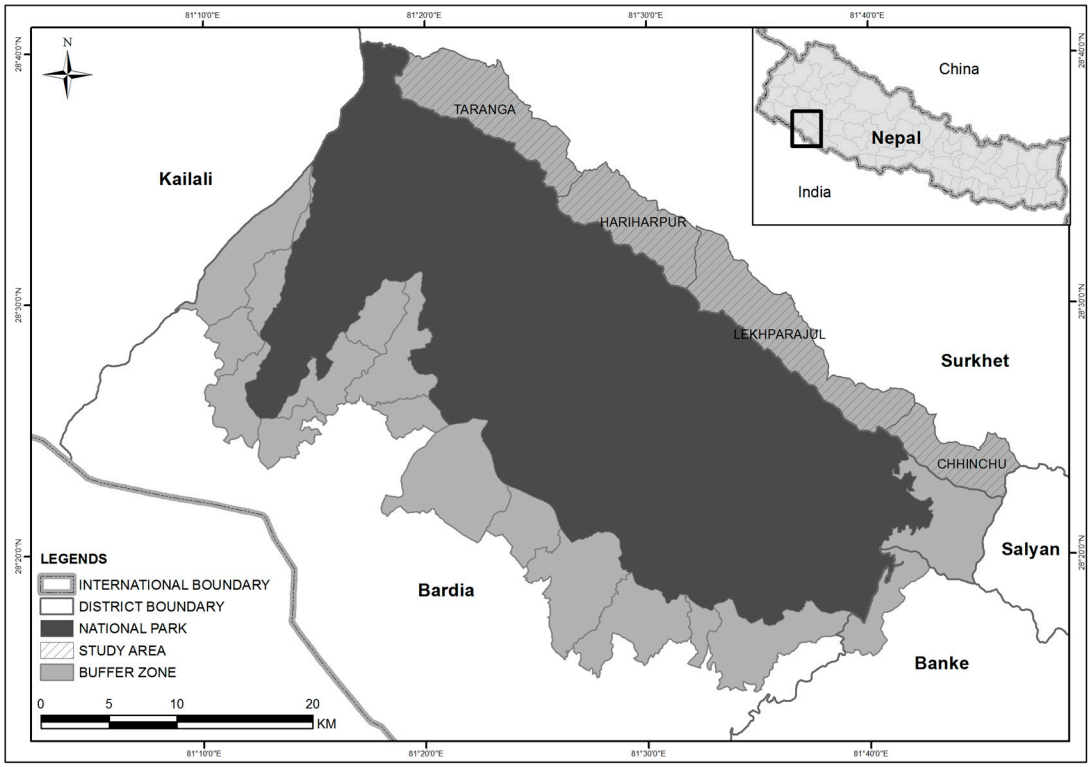

Figure 1 Bardia National Park and the surrounding buffer zone. Our study area comprised the communities of Taranga, Hariharpur, Lekhparajul and Chhinchu, located within the northern buffer zone area.

Methods: Seventeen Village Development Committees (VDCs) are embedded in the buffer zone of Bardia National Park (BNP). From among these we selected four (Chhinchu, Taranga, Lekhparajul and Hariharpur). These had only recently come under buffer zone jurisdiction (in 2010), though BNP was established in 1976 and buffer zones in other areas were declared in 1996.

We completed face-to-face interviews [26] with local people (n=43) during May and June 2015. Participants included ex-hunters and other community members. Five professional protected area managers were also interviewed. As hunting within the park and within the buffer zone is now illegal, due to fear of non-response or less response [27] and we did not wish to compromise our interviewees, no questions about the participants' own current hunting practices were asked. Rather, all questions were general and directed towards obtaining information about the nature of hunting activities rather than who was carrying out these activities. Participants were recruited by placing notices about the project in public places and requesting volunteers. 'Snowball sampling' was also applied, where volunteers recommended participation to several others in their community, some of whom subsequently volunteered. Several participants self-disclosed their own (historical) participation in hunting activities.

Interviews were conducted at locations of the participants' own choosing, which included their own dwelling or at market places or community meeting places. Before we began each interview, we provided an explanatory statement about the research and asked for informed consent to conduct the interview. Most people agreed to participate; only very few people did not give consent and did not participate further. The interviews took approximately 20 to 30 minutes each. Due to the sensitive nature of survey, we did not ask for the name of respondents, however many respondents introduced themselves during the interviews. Names volunteered in this way were not recorded. Some

demographic information about participants, such as their age, settlement history, nature and amount of land owned, livestock owned etc., was sought. Questions about the hunting or poaching of protected species were not discussed. These species are protected and penalties for hunting them are very high; we feared a reduced response rate if we discussed these species explicitly. Also, our objective was to explore the hunting of prey species of carnivores. The main part of the interview was comprised of questions about:

1. which species of wildlife participants had seen locally,
2. how many animals hunters are likely to take in a year,
3. whether hunting is more common in any particular season,
4. what methods of hunting are used,
5. which species are hunted,
6. why wildlife are hunted,
7. where wildlife products are sold and at what price, whether it is generally known that hunting is an illegal act,
8. whether access to some skills development training, may stop or reduce hunting activity,
9. what sorts of skills development training might help communities to reduce or stop hunting, etc?

We also interviewed five protected area management professionals (park rangers, warden and representatives from non-government conservation agencies) to find out:

1. whether they are aware of hunting occurring in BNP,
2. whether hunting is a past or a current practice,
3. whether hunting is more common in the northern section of the park and buffer zones,
4. whether there is a particular subgroup in the community which is considered to be more involved in hunting than others
5. how hunting can be reduced
6. whether the provision of small scale skills development training for local people may be helpful in reducing their dependence on hunting.

We also conducted several transect surveys in the forest areas nearest to settlements, seeking evidence of current hunting activities. Several transects, each approximately one km long, were established in each forest area and traversed by two observers, during daylight in December 2015. There were a total of 18 transects; seven were located near Taranga, five near Lekhparajul and six near Hariharpur. Since Chhinchu has only a very small area of forest, lying mostly along the highway, we did not conduct transect surveys in Chhinchu. A total of 38 hours and 35 minutes was spent walking the transects and observing. Our objectives were to document any evidence of hunting activity, such as the remains of animal carcasses, the presence of meat drying huts and snares left by hunters. We also listened for the sound of gunshot, which may have indicated current hunting activity.

Our project conducted a trial skills-training program, hosted by the non-government conservation agency: National Trust for Conservation of Nature (NTNC). The program focused on solar panel and household electricity maintenance. Training was provided to 13 local youths with the aim of reducing the participants' dependency on hunting by increasing their skill sets and employability. One woman and 12 men participated in the program. They were aged approximately between 20 and 35, and were drawn from the four village development communities. The NTNC also hosted three conservation education sessions with local people focusing on the significance of conserving prey species in carnivore conservation.

3. Results

3.1. Demography of the interview respondents

We interviewed 43 local community respondents including ex-hunters. The average age of the respondents was 32 (sd=10.33, n=42); the youngest was 19 while the oldest was 60 years old. Not all participants answered all questions, where this is the case, the number of respondents is indicated. The majority of those interviewed were male (67%) and respondents' professions were: farmers (66%), businessman (12%), school-teachers (10%), others (10% include students, social workers and activists) and public servants (2%). The average landholding of the respondents was 7.14 ropani (sd=3.75, the highest landholding was 16 ropani, 1 ropani of land is equivalent to 3561 sq meters) and, on average each person possessed one cow (range 4), 0.5 buffalo (range 2) and 12 goats (range 40). Respondents had been living in this location between 5 to 50 years. We also interviewed five protected area professionals. Three were from non-governmental organizations and two were from a government organization. Only one was female. These professionals were all university educated and originated from other areas of Nepal. They had been working in the area for between two and 15years.This section may be divided by subheadings. It should provide a concise and precise description of the experimental results, their interpretation as well as the experimental conclusions that can be drawn.

3.2. Seasons and reasons for prey hunting

Most of the local community interviewees (74%) had sighted wildlife (defined as large vertebrates) which included tiger, leopard, Asian elephant, greater one-horned rhinoceros, sloth bear, golden jackal, Himalayan goral, sambar deer, barking deer, wild boar, spotted deer, porcupine, grey langur monkey and rhesus monkey. We asked participants to name animal species that were hunted in the area. Nine different prey species of tiger and leopard were listed as hunted in the northern part of Bardia National Park: sambar deer, wild boar, spotted deer, barking deer, grey langur, rhesus monkey, porcupine, kalij pheasant and goral. Interviewees noted that sambar deer is the most preferred species for meat because it is a large animal and can provide more than 100 kg of wild meat; with less fat than Wild Boar. Wild Boar was also reported to taste good, and the animal is also relatively large. Interviewees noted that spotted deer (chital) are gregarious and easy to capture in Khabar (a snare made from ropes). Unlike in other areas, the Siwalik region has a low abundance of chital, therefore they are not so frequently hunted like in the plains. Himalayan goral, which inhabits the Siwalik Mountains, is often hunted in this location. Although questions were not asked regarding protected species, a few respondents mentioned hunting of tiger, and rhinoceros.

We attempted to explore the hunting frequency (total number of hunted animals in a particular year) but answers were vague and we failed to acquire this information. However, it was clear that hunting is a reasonably common activity. Interview participants reported that, prior to the establishment of buffer zones, hunting typically occurred at least twice a year; and the adult males of almost all households participated in hunting.

In response to questions about the seasonality of hunting, 41% participants indicated that spring was the season in which most hunting traditionally occurred. Autumn was named by 37% of the participants, winter by 10% of participants, and summer by 5% of participants. Seven percent of participants indicated that hunting occurred in all seasons (n=41 for this question).

Regarding the hunting methods employed, most interviewees (55%) reported the combined use of dogs and handmade guns. Seventeen percent of respondents reported the use of guns only (no dogs, snares or baits). Fifteen percent reported the combined use of dogs, snares and guns (n=41 for

this question). Interviewees reported that dogs were used most effectively to chase grey langur monkeys and chital (spotted deer), these animals were then ambushed using either snares or guns.

In response to questions about the current motivations for hunting in the area, 62% of interviewees reported that hunting is for consumption of wild meat at a local level and 36% reported that hunting is for the purposes of obtaining wild meat for sale elsewhere. Only two percent of the interviewees reported that hunting is for recreation (n=42 for this question). Interviewees reported various prices for wild meat, which averaged to NRs 613 (~US $ 6) per kilogram. Participants reported that the sale of wild meat occurs locally in small markets along the highway. Chhinchu, Surkhet, Babai (Chepang), and Karnali Chisapani, are major local market places in the area. A few respondents indicated that meats were also supplied to the capital city, Kathmandu, (~550 km from the study area; more than 13 hours by car, on difficult roads) as well. Occasionally, wild meat is supplied to nearer regional cities such as Kohalpur and Nepalgunj. These cities are nearly 60 km and 76 km away respectively from our study area. Some respondents (n=4) reported that army officials come to buy the wild meat directly from local people. Such buyers are often in official vehicles which pass easily through the security checks of the National Park. These products were reported to be destined for Kathmandu for consumption by high-level officials. In return, the locals who provide the wild meat were purported to be rewarded with jobs as soldiers in the national army (Nepalese army).

Surprisingly, 48% of interviewees indicated that they preferred wild meat in their diet due to its unique taste; and 17% reported that they liked to eat wild meat for its medicinal value. Participants reported that the meat and fresh, raw (uncooked) blood of the grey langur monkey is thought to be able to heal asthma. There is also a prominent belief that wild meat has general medicinal properties and participants explained that this was related to the fact that the animals are known to eat many wild herbs. Thirty-five percent of interviewees thought that wild meat was used for subsistence. Almost all respondents (98%) were aware that hunting of wildlife is illegal and culprits can be apprehended. Nearly all respondents (97.5%) believed that people who are involved in hunting might abandon hunting if provided with the opportunity of some type of skill development training which would lead to another source of income (n=42). Further the respondents noted awareness activities, strict enforcement of hunting restriction by better patrolling and erecting park guard post in the region, livelihood support programs focusing on skill development activities which can generate income and wildlife damage prevention programs could be beneficial in reducing the hunting for wild meat in this location.

Interviews with protected area managers (n=5) also provided evidence that selling and trading wild meat has become a means of livelihood for local people. They considered that hunting for wild meat is more common in the northern section than in other parts of the park. Regarding the involvement of particular groups of people in hunting, there was some debate. The park warden expressed a view that the Darai Magar ethnic community and other members of the mixed community, who settled in the buffer zone area after encroaching the forestland are the major groups involved in hunting. A conservation officer at a non-government conservation agency (National Trust for Nature Conservation) held a different view. He felt that there was not any particular community or group of people involved in hunting, rather almost all villagers were involved in hunting. This viewpoint corresponded more closely with that of the local people interviewed. An official of Bardia National Park believed that only males aged roughly between 25 to 40 are involved in illegal hunting. All protected area managers agreed that hunters are usually local residents, however hunters from distant locations were known to have operated occasionally in the area.

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4. Discussion

In Section 2 of Nepal's National Parks and Wildlife Conservation Act, 1973 hunting is defined as the act of chasing, capturing, harassing and killing of, or attempting to kill, wildlife. According to Section 5 of the same Act, hunting inside parks and reserve without permission is banned. Similarly, in Section 49 (n) of the Forest Act 1993, hunting is banned in any national forests without prior permission. National forests may be considered as forests outside of the national parks and wildlife reserves which are managed and governed under the Forest Act 1993. These national forests have experienced extensive hunting pressure and the majorities are devoid of large vertebrates. Before coming under the conservation jurisdiction of the buffer zone in 2010, the areas surrounding the northern section of Bardia National Park were extensively hunted [28.29]. After the buffer zone was declared, illegal hunting reduced remarkably, largely due to the continuous and vigorous efforts of Bardia National Park staff and partner conservation agencies. In our study, respondents told us that hunting still occurs. Records held by Bardia National Park also show that hunting is currently occurring in the area. According to these records, nine different cases of prey hunting in the northern part of Bardia National Park, involving 32 people, have been documented since the area was incorporated into the buffer zone. While our transect searches did not uncover any physical evidence of hunting, a fresh meat-drying hut and remnants of Sambar carcass found near the Babai (Chepang) during a routine patrol by national park staff in May 2015, is also documented in the park records. A more intensive search which extended further into forested areas may have resulted in some physical evidence of hunting.

A Conservation Officer of the National Trust for Nature Conservation, Bardia Conservation Program observed that although hunting has continued in the area after 2010, the mode of hunting has changed. Previously people hunted openly; but now they hunt covertly. Before the establishment of the National Park and the buffer zone, small groups of people (8-12) used to go hunting however this tradition no longer occurs, and now people hunt alone or in groups of two, sometimes accompanied by a dog. The smaller parties are thought to be less likely to be detected by the National Park authority and the more covert nature of present-day hunting leave less evidence.

The reasons for hunting also seem to have changed. Reports from local people interviewed during our study indicate that hunting of prey species in the northern part of the park was previously for traditional/subsistence reasons, with meat products consumed locally. However, after the highway was built, meat and animal parts are sold by local hunters at local markets along the highway. This involves considerable effort by the hunters, since the highway is some distance away from the villages, and the villages can only be reached by foot. Occasionally, purchasers are located in regional centers (Kohalpur, Nepalgunj or Surkhet) or even as far away as Kathmandu. The price of wild meat increases up to NRs 2000 (~ US$ 20) per kg if it is sold in Surkhet or Nepalgunj or Kathmandu; but there is a higher risk of being apprehended by authorities. Occasionally, respondents mentioned the sale of skins and antlers of deer. Skins of these ungulates are used in making local musical instruments such as madal and damaha. One respondent informed us that some skins were sold to a processing factory located in Nepalgunj however he /she was unaware of the price of the skins.

Not all of the products of hunting are sold outside of the area. Interviews with protected area managers (including Park Rangers and officers of conservation agencies) revealed that due to the

high unemployment rate and associated poverty in the study area, some people hunt wildlife to fulfill the protein requirements of their diet. Malla [29] reported that this area suffers from poverty; agriculture production is hardly enough for three to five months and many youths seasonally migrate to India for seasonal jobs for around two to three months to earn household needs. Some respondents reported that crop raiding by Wild Boar and Monkeys is also a driver for hunting of these animals, where the primary objective is to reduce the incidence of crop raiding rather than to acquire wild meat. Similar motivations were reported in a study by Mittermeier [30] and Paudel [31].

The traditional beliefs around the medicinal values of wild meat, including taking fresh blood of the grey langur monkey to heal asthma, is a key driver for hunting of this particular species. Similar results were reported in a study by Paudel [28] in adjacent localities of our study site. Poverty, lower levels of education and the remoteness of the area (no motorable road), all of which reduce access to health service facilities, are likely influences in the killing of wildlife for medicinal purposes.

In our study, respondents reported that hunting mostly occurred during festive seasons. Dashain, which falls in the month of October, is an important Hindu festival and meat is a major food item in each household at this time. Therefore, hunting events are frequent around the time of this festival. In addition, during the Dashain period, National Park staff vigilance is very much reduced as this is a holiday period. Hunters therefore have easy access into the forests. Protected area managers also noticed that other illegal activities such as timber smuggling also increase during the Dashain period.

As hand-made guns are made in the community, it is not difficult for local people to make or obtain a weapon and use it for hunting. A self-identified ex-hunter who is now the chairman of a community based anti-poaching unit explained the hunting practice as follows.

> "In our village (Taranga) every household possesses at least one locally hand-made gun. During the festive season (Dashain and maghee), we fire the guns in the air. For instance, in the past before starting Tika, the village leader used to fire the gun and only after that, all other villagers officially begin the Tika. Therefore, the gun is a part of the culture. Guns are also used for hunting wild meat. We used to hunt game in small groups of people. After killing the wildlife we used to play music and dance. This was our ethnic tradition (of the Magar community) in the past, which nowadays has been stopped due to the establishment of the National Park. Wild yam and wild meats are important parts of these festivals."

Occasional prey poaching is present in other parts of the Bardia National Park but the northern section (our study site) has more incidents of prey hunting (Personal communication R. C. Kandel, Chief Warden, Bardia National Park). Four reasons for the high incidence of hunting in this part of the park and buffer zone area were provided by the Chief Warden of the Park during interviews:

1) no park staff in the area,
2) poverty and a lack of job opportunities
3) remoteness
4) lack of awareness, about negative impacts of hunting on conservation

A Conservation Officer at Bardia National Park had similar thoughts regarding the reasons behind continued illegal game hunting for wild meat in the National Park. He added that the poor intelligence network compared with other areas of the park, might be an additional reason for continuation of hunting in the northern section of the park.

Our study has low number of sample interview which can be a common problem in such a sensitive type of interview seeking information on illegal activities. As the numbers of samples are low, the results can't be generalized to the whole area of our four study VDCs, however, the research result have provided preliminary information on such illegal activities which might be useful to park

managers to plan conservation activities and to the researchers for further study. The robustness of our results has been further added by secondary information from the national park authority. Though there might exist sampling bias while using snow balling technique, however, it is hard to find the people who agree to answer such illegal activities; therefore, snowballing technique makes easier to select the sample.

5. Conclusions

Our study area is home to carnivores including Tiger, Leopard, Striped hyena, red fox, golden jackal and sloth bear. The tiger is listed as an Endangered Species [31] and prey population depletion is considered a major threat to tiger populations [17, 32,33,34] and to other carnivores [35,36]. Prey population depletion reduces juvenile survival and carnivore density depends directly on prey species richness and abundance [37]. During the interviews, one respondent (a self-identified ex-hunter) mentioned that dholes (Asiatic wild dogs) were seen during the 1970s. This species has not been seen in our study area. A conservation officer at NTNC Bardia reported that dhole had not been captured by remote cameras trapping established in the park for a tiger census. Similarly, several respondents told us that the number of leopard sightings, tiger signs (e.g. footprints, also known as pugmarks) and vocalizations of fox and jackal had decreased, and attributed this to prey hunting. They reported that these signs of carnivores have recently begun to increase again after a recent call for guns to be handed over to the park authority.

The removal of herbivores may also affect the vegetation pattern since large herbivores play roles in seed dispersal which in turn affect the carnivore-herbivore assemblage [38]. In our study area grey langur monkey is one of the major seed dispersal agents for tree species and this species is a target hunted species for healing purpose of asthma.

Protection of prey species is clearly important in conservation of carnivores [33]. When prey levels are depleted, even small scale poaching might accelerate the rate of extinction. Therefore, control of hunting of prey species be a conservation priority alongside efforts to curb the poaching of endangered carnivore species. Damania et al. [32] point out that the control of hunting is vital in prey-depleted landscapes. Communities involved in hunting prey species for meat and trade could be provided with skills development training to facilitate alternative sources of income. Examples could include training in solar panel maintenance, household electricity wiring, modern farming technologies, plumbing etc. Development of skills such as these would allow community members to earn a livelihood that does not rely on hunting and alternative sources of employment would increase the opportunity costs of poaching. Our project conducted a trial skills training program focused on solar panel and household electricity maintenance. There is considerable scope to extend such programs, promulgating the message that wildlife conservation brings economic and ecological benefits to the region. Education of local people with regard to appropriate treatment of diseases such as asthma, and access to appropriate health information, facilities and medication will also help to address the hunting of wild animals for medicinal purposes.

Supplementary Materials: The following are available online at www.mdpi.com/link, Figure S1: title, Table S1: title, Video S1: title.

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Author Contributions: Babu and Wendy designed the research and prepared the manuscript. **Babu** collected primary data (interview) and analysed the data. **Ambika** collected secondary data and contributed in preparing manuscript.

Conflicts of Interest: The authors declare no conflict of interests.

Appendix

Table 1 List of plants and animals named in the text

Common name/English	Common name/Nepali	Scientific name	International Conservation status *	Protected by law in Nepal**
Mammals				
Asian elephant	Hatti	*Elephas maximus*	Endangered	Yes
Barking deer or Southern Red Muntjak	Ratuwa	*Muntiacus muntjak*	Least concern	
Bluebuck or Nilgai	Nilgai	*Boselaphus tragocamelus*	Least concern	
Dhole or Asiatic wild dog	Ban kukur	*Cuon alpinus*	Endangered	
Four-horned antelope	Chauka	*Tetraceros quadricornis*	Vulnerable	Yes
Ganges River dolphin	Dalfin	*Platanista gangetica*	Endangered	Yes
Golden jackal	Syal	*Canis aureus*	Least concern	
Greater one-horned rhinoceros	Gaida	*Rhinoceros unicornis*	Vulnerable	Yes
Himalayan Goral	Ghoral	*Naemorhedus goral*	Near threatened	
Hog deer		*Axis porcinus*	Endangered	
Indian crested porcupine	Dumsi	*Hystrix indica*	Least concern	
Leopard	Chituwa	*Panthera pardus*	Near threatened	
Northern Plains grey langur or grey langur	Dhedu bandar/guna	*Semnopithecus entellus*	Least concern	
Red fox	Fyauro	*Vulpes vulpes*	Least concern	
Rhesus monkey	Rato bandar	*Macaca mulata*	Least concern	
Sambar deer	Jarayo	*Rusa unicolor*	Vulnerable	
Sloth bear	Kathe bhalu	*Melursus ursinus*	Vulnerable	
Spotted deer	Chital	*Axis axis*	Least concern	
Striped Hyaena	Hudar	*Hyaena hyaena*	Near threatened	Yes
Swamp deer	Barahsingha	*Rucervus duvaucelii*	Vulnerable	Yes
Tiger	Bagh	*Panthera tigris*	Endangered	Yes
Wild boar	Bandel	*Sus scrofa*	Least concern	
Wolf (Gray wolf)	Bwanso	*Canis lupus*	Least concern	Yes
Reptiles				
Burmese python or python	Ajingar	*Python bivittatus*	Vulnerable	

Gharial	Ghadial gohi	*Gavialis gangeticus*	Critically endangered	Yes
Mugger or Muggar crocodile	Gohi	*Crocodylus palustris*	Vulnerable	
Birds				
Bengal florican		*Houbaropsis bengalensis*	Critically endangered	Yes
Great hornbill	Dhanesh	*Buceros bicornis*	Near threatened	Yes
Khalij pheasant	Kalij	*Lophura leucomelanos*	Least concern	
Trees				
Betel-nut palm or Black cutch	Khayar	*Senegalia catechu*	Not assessed	
Chir pine	Sallo	*Pinus roxburghii*	Least concern	
False white teak	Gutel	*Mallotus nudiflorus*	Not assessed	
Kamala tree or Red kamala	Sindure	*Mallotus philippensis*	Not assessed	
North Indian rosewood	Sisau	*Dalbergia sissoo*	Not assessed	
Kharsu oak or Brown oak	Khasru	*Quercus semecarpifolia*	Not assessed	
Sal tree	Sal	*Shorea robusta*	Least concern	

*IUCN The IUCN Red List of Threatened Species. Version 2015-4. <www.iucnredlist.org>. [accessed **03 April 2016]**.

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