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## A NOTE ON THE BEHAVIOUR OF FOUR-HORNED ANTELOPE *TETRACERUS QUADRICORNIS* DE BLAINVILLE, 1816 (MAMMALIA: CETARTIODACTYLA: BOVIDAE) IN LOWLAND NEPAL

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**Abstract:** Behavioural studies provide the reasons behind habitat preferences of animals and their fitness to survive and propagate. The Four-horned Antelope, an endangered endemic species to the Indian subcontinent was monitored at Ratamate area of Babai Valley in Bardia National Park, Nepal. We used ad libitum sampling and focal animal sampling within the rule for continuous recording of 'all-occurrences' of 'vigilance' behaviour. We found that the Four-horned Antelope remains 'alert and vigilant' during 40% of its behavioural time budget when it scans the surroundings with raised head, with or without chewing. In the event of sudden threat it 'freezes', lying down still and hiding in the ground cover. Therefore, maintenance of ground cover should form a regular practice in conservation management of the Four-horned Antelope.

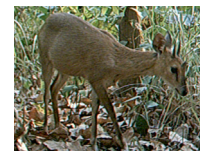
**Keywords:** Bardia National Park, behaviour, ground cover requirement, Four-horned Antelope, *Tetracerus quadricornis*.

**Abbreviations:** FHA - Four-horned Antelope; BD - Barking Deer; IUCN - International Union for Nature Conservation; DHM - Department of Hydrology and Meteorology.

Behavioural studies provide knowledge on habitat ecology of a species and help in conservation. Such studies inform us about the reasons behind the habitat preferences of an animal, their response to predators or threats, and breeding/survival success (Sutherland 1998; Caro 2007). The Four-horned Antelope *Tetracerus quadricornis* Blainville, 1816, also known as "Chausingha" or "Chauka", is endemic to the Indian subcontinent. Very limited ecological information is available for this threatened species. According to the IUCN Red List of Threatened Species, this is a 'Vulnerable' species with a decreasing population trend (Mallon 2008) and considered 'Data Deficient' in Nepal (Jnawali et al. 2011). The Four-horned Antelope (FHA) is scattered through most of India (Rahmani 2001) and some pockets of lowland Nepal such as Chitwan and Bardia National Parks (Bolton 1975, 1976; Pokharel & Storch 2012;



*Tetracerus quadricornis*  
Four-horned Antelope



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Pokharel et al. 2015) (Images 1–3). Because of limited ecological information the species has received less concern in the field of wildlife conservation in Nepal. With this background information, we conducted a field research in Babai Valley, Bardia National Park to explore the ‘alert’ or ‘vigilance behaviour’ of FHA with the aim of improving the existing knowledge on behavioural ecology and approach to conservation.

## MATERIALS AND METHODS

### Study area

The present study was conducted at Ratamate area of Babai Valley in southeastern part of Bardia National Park (28°28′26.5″N & 81°29′10.1″E). The park is located in lowland Nepal covering an area of 968km<sup>2</sup> near the Indian border, 390km west of Kathmandu. Monthly mean temperature of the area ranges from a minimum of 10°C in January to a maximum of 45°C in June. The park has a subtropical monsoonal climate with three distinct seasons; monsoon, winter and dry. The annual rainfall is 1,560–2,230 mm, most of which is recorded during the monsoon from June to September (DHM 2005–2009, unpublished data). During the dry season, from March till the end of May, air moisture level is very low and dry biomass is burnt every year to provide fresh pasture to herbivores. Fresh vegetation sprouts with the pre-monsoon rain during May indicates the end of the dry season. There is ample food for herbivores and easy access to water during the monsoon while the dry season is harsh because almost all the forest undergrowth gets burnt. Water is localised to rivers and certain gorges, and all seasonal streams dry up in summer. The Ratamate area provides a perennial water

source and mineral licks. Therefore, many animals in Babai Valley visit Ratamate.

The vegetation in Babai Valley consists of Climax Sal *Shorea robusta* and mixed deciduous forest. A mosaic of riverine forest and early successional floodplain communities are along the Babai River and its tributaries. Patches of grassland, locally known as ‘phanta’, and tall grass at early succession stage are scattered throughout the Sal forest (Upreti 1994; Pokharel 2010). Chital *Axis axis*, Wild Boar *Sus scrofa*, Barking Deer *Muntiacus vaginalis*, and Sambar *Rusa unicolor* are some of the commonly found herbivores in the park whereas Tiger *Panthera tigris*, Leopard *P. pardus*, Sloth Bear *Melursus ursinus*, Striped Hyena *Hyaena hyaena*, and Dhole *Cuon alpinus* are the main predators (Heinen & Kattel 1992).

### Study design

FHAs are sighted in most of the vegetation associations available in Babai Valley but are not easy to monitor for long durations because of their shy nature, small body size and poor visibility inside the forest. Therefore, monitoring of FHA in relatively open areas such as stream banks where they come to drink water and at the sites of mineral licking was resorted to in this study. Areas with unobstructed line of vision such as the top of a cliff or a branch of a tree were preferentially used for making observations so that the animal could be seen clearly without being disturbed.

The methods of ad libitum sampling and focal animal sampling were used in accordance with Martin & Bateson (1993) within the ambit of rules for continuous- or “all-occurrence” recording. The objective was to have data that could provide exact and reliable record



Image 1. An adult male FHA at mine licking site



Image 2. An adult male FHA in the Sal forest of Bardia NP



**Image 3.** An adult male and female, and a young FHA at the bank of Ratamate Stream

on behaviour by measuring true frequencies and durations of different activity patterns. Three different adult FHAs (two females and one male), who came to visit a mine licking site, were observed from 15–18 May 2010 for a total of approximately five hours from early morning to evening using a pair of binoculars (Pentax 10×42). Observations paused for 1–2 minutes after an observation for approximately 10mins and stopped when the focal animal was no longer visible. Sex and age group of focal animal were noted down and eight different activity patterns were identified. They include alert/vigilance (raising head above shoulder level while scanning the surrounding and includes both vigilance with and without chewing), looking at subject (looking at the researcher raising head above shoulder with constant body posture), freezing (hiding inside the bush without active body movement), walking (moving with head either below shoulder or at the level of shoulder and/or searching for food but not collecting), drinking (drinking water), licking (feeding on soil), browsing (collecting food/vegetative materials) and other activities (other activity patterns such as itching body, shaking tail while neither eating nor scanning the surrounding, and smelling).

#### Data analysis

Only three individuals (two females and one male) could be observed in the field for behavioural study. Therefore behavioural patterns are expressed separately and could not be compared statistically between sexes due to insufficient replications. Furthermore, data on freezing behaviour was excluded from data analysis because the data could be collected for only one female as a single and sudden event. The data on alertness was

transferred into frequency table to obtain the frequency of head raising per minute. Furthermore, percentage of time spent was used to compare the different activity patterns of three individuals, and was calculated as:

$$\text{time spent} = \left( \frac{x_i}{\sum_{i=1}^n X} \right) * 100$$

where  $x_i$  = duration of an activity  $i$ ; and  $X$  = total duration observed

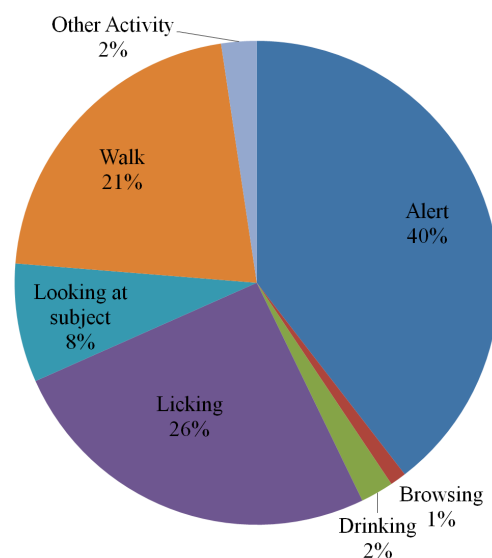
## RESULTS AND DISCUSSION

### Activity patterns

The female FHAs were observed for more time in the open area (88.10%) than the adult male (11.90%). Alert behaviour was observed to be occurring for most of the time (39.59%) followed by mineral licking (25.63%) and walking (21.28%) (Table 1; Fig. 1). Other behaviours occurred only with small durations. Females spent more time licking than the male whereas only the male was observed to browse. The dense riverine forest was within a distance of 100m. All focal individuals noticed the researcher and were quite alert at the beginning. The female FHAs seemed to be very aware of the researcher in comparison to the male FHA which did not pay much attention.

### Frequency of alertness/vigilance

The range of vigilance activity, in terms of number of head-uplift per minute, ranged from 0–6. Mean frequency of head raising among three individuals was found to be  $2.06 \pm 1.206$  (standard deviation of mean).



**Figure 1.** Average time spent by FHAs for different activity patterns in an open area of Babai Valley, Bardia National Park, Nepal.

**Table 1. Summary of activity duration (in hours) recorded for two females and one male Four-horned Antelope in Bardia National Park, Nepal from 15–18 May 2010.**

	Male (1)	Female 1 (2)	Female 2 (3)	Total duration observed females (2)+(3)=(4)	Total duration made on antelopes (1)+(4)=(5)
Hours spent in open area	1.03	2.57	3.15	5.72	6.75
Total hours observed*	0.52	1.92	1.93	3.85	4.37
Alert/vigilant behaviour	0.16	0.60	0.97	1.57	1.73
Looked towards observer	0.03	0.17	0.15	0.32	0.35
Walking	0.20	0.34	0.39	0.73	0.93
Drinking	0.02	0.04	0.04	0.08	0.10
Mineral-licking	0.01	0.73	0.37	1.11	1.12
Browsing	0.05	0.00	0.00	0.00	0.05
Other activities	0.06	0.04	0.00	0.04	0.10

\* Note: Female 2 spent 0.53 hr for freezing, which was excluded from this table.

During vigilance, the animal frequently raised its head and stopped all other activities for a while before getting back to foraging or licking activity. At the beginning, when it visited mine licking sites, it was more vigilant, but with time, it became less attentive and its head raising frequency decreased. However, when it noticed any disturbance, even the call of a bird, it became alert for a moment. Even though there was a relatively low level of inter-specific as well as intra-specific disturbance during field observation, food intake rate was limited by vigilant activity rather than by chewing and swallowing.

#### Response of FHA to disturbance

**Freezing behaviour:** The “freezing behaviour” was observed only in an adult female and a young one. While two young FHAs were following their mother along the forest edge, a troop of Hanuman Langurs *Semnopithecus entellus* arrived and disturbed them. The adult female, the mother, did not respond to them, but one of the young FHA quickly ran to its mother and remained very close to her, but the other remained still, in the tall grass. After 2–3 minutes, the monkey troop moved away, and the young FHA came out and ran to its mother. They were observed for a very short time. When the mature female noticed the presence of two of our team members at a distance of about 150m, she moved silently to a nearby bush of tall grass, entered about 5m inside and sat down. Because of the dry season, the colour of ground vegetation i.e., grass, was similar to her body colour, therefore, it was very hard to see her inside the bush camouflage. She stayed there for about 32mins without moving from her position but she moved her pinna slowly to detect the potential danger and its direction.

**Other type of response:** In addition to their regular vigilance pattern, FHAs seemed to be quite attentive to every disturbance they perceived. They spent a considerable amount of time looking at the event or in the direction of the disturbance. The researcher remained motionless when the female FHAs looked at the researcher. After a period of time the female FHAs perceiving no threat shifted their activity to another event. The longest time that the female FHAs spent continuously looking at the researcher was 3 minutes 19 seconds. Even for such a long time, both FHAs did not look around for the other probable predation risk, neither did they try to run away. Later on, the same animal did not spend such amount of time even if they saw the researcher. The male FHA did not spend a long duration of time concentrated on the researcher as compared to the females.

During the field study, FHA responded more towards Chital and Barking deer (BD) than towards Macaques (*Macaca* sp.) FHA used to spend some moments being watchful when it saw Chital and even Chitals responded similarly, but FHA was more alert than the Chital. Evidently, the Chital drew its attention to FHA first. The same behaviour occurred when FHA and BD encountered each other. FHA was alert not only in the presence of other species, but also in the presence of other FHAs. When an adult male was active at a mine licking site and an adult female arrived, both of them remained alert when they noticed each other. After a while, the male drew its attention to the female allowing her to come to the mine licking site at the same place. Then the female slowly moved towards the male, they smelled each other and accepted the presence of each other. Then they started to perform the normal

activity of licking, walking or drinking. Once, when an adult female was returning to the nearest forest, west bank of Ratamate Stream, she encountered a group of FHA with an adult male and a female (mother) with a young one. At that time, the mother FHA with her young offspring was more alert than the male. The young one did not care about the new comer. The adult female lowered her head, stretched her neck towards them (group of FHA) and smelled the air. When the group of FHAs, probably members of a family, did not react in an agonistic way, the adult FHA moved slowly towards the group lowering her head and shaking her tail frequently showing submissive behaviour. Later, all FHAs behaved in a normal way and formed a new group as if they were familiar with each other and started to forage. After a few minutes, they disappeared into the forest.

In conclusion, Four-horned Antelopes were observed to spend ca. 40% of their time being vigilant and were aware of every kind of disturbance they perceive. In response to threat they preferred to hide and freeze into the vegetation cover rather than try to escape. Therefore, conservation management in Bardia National Park and in other areas of Four-horned Antelope distribution should consider maintaining the ground cover.

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