

Habitat Preference and Social Composition of Antelopes in Arid Region of Kachchh, Gujarat, India

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ABSTRACT

The habitat preference and social composition of the two antelope namely; chinkara and blue bull were studied. Study was conducted in arid part of Kachchh district, Gujarat. Line transect method applied to assess the population and distribution of the antelopes. It was found that 15.53% of individuals of blue bull were single or in pairs 68.93% in groups, while in chinkara 6.06% of individuals were solitary, 12.12% in pair and 81.82% in groups. The overall mean group size of blue bull in the study area was 2.43 ± 1.55 , while in chinkara it was 2.55 ± 1.61 . In conclusion, the abundance and density of these antelope had decreased and the social composition including group size and age-sex ratio was different in the arid part of kachchh in relation to existing population of these antelope in other parts of their natural distribution.

Key words: antelope; blue bull; chinkara; habitat preference; arid region; Kachchh.

INTRODUCTION

The socio-ecological systems of mammals are complex, controlled by many factors (Crook *et al.*, 1976), and organized in relation to the ecological factors notably plant species diversity, food dispersion and predator diversity and density (Geist, 1974). These ecological factors influence the group size and composition of mammalian species (Geist, 1974). The differential use of food resources by the species of a community in a habitat facilitate in their co-existence (Bagchi *et al.*, 2003). Resource competition among species within a habitat due to overlapping of food resources and intense competition was found among the wild herbivores (Madhusudan, 2004).

The distribution of vegetation and abundance of food is related to the space use of gazelle (Baharav, 1980). Space used by an animal and the degree of ecosystem disturbance depends upon the population density of animals (Anastassia *et al.*, 2005). The spatial use by ungulate is affected by anthropogenic disturbances (Attum, 2007). The group size influences the number of males, female survival, mating behaviour and reproduction (Wittenberger, 1980). The adult sex-ratio varied among the mammalian species and the predation is one of the major factor affects on the sex ratio of ungulate population (Berger & Gompper, 1999).

Chinkara and blue bull are two major competitive antelope species due to similarity in their resource use (Bagchi *et al.*, 2003) and are distributed in scrubland, open woodland, dry deciduous forests and dune areas (Goyal & Rajpurohit, 2000; Rahmani, 1990; Rahmani, 2001). Both blue bull and chinkara occur near human settlements due to religious beliefs of local communities (Dookia *et al.*, 2009; Rahmani, 2001).

The aim of the present paper was to find out the habitat preference and social composition of two co-existing antelopes viz *Gazella bennetti* and *Boselaphus tragocamelus* in the arid region of Kachchh for its conservation significance as the habitat is being degraded rapidly due to increasing mining, industrialization, invasion of *Prosopis juliflora* and other developmental activities. The both antelope species are listed as a least concern category of IUCN Red list, 2010.

MATERIALS AND METHODS

Study area

Kachchh, (22°41'11" to 24°41'47" N and 68°9'46" to 71°54'47"), extending over 45,652 sq. km. area lies in the western part of Gujarat state and falls under the Desert bio-geographic zone and 3B Desert - Kachchh Province (Rodgers *et al.*, 2002). It is bestowed with major terrestrial ecosystems like, tropical thorn forest, Scrub savannah, Grasslands and interspersed with dry land forming (arid agro-ecosystem). Kachchh falls in the arid tract and has a tropical monsoon climate. It experiences extremes of weather conditions with winter starting from mid November to end February with the temperature going down to the average minimum of 4.6°C in January and Summer extends from March till June with maximum temperature varying from 39-45°C. The estimated average annual rainfall is 326mm and highly erratic leading to protracted droughts which is common phenomena. The evapo-transpiration rates are very high, with 2.25m in a year. Wind velocity is generally light to moderate.

Sampling design

The whole study area (Figure 1) were divided into 5 x 5

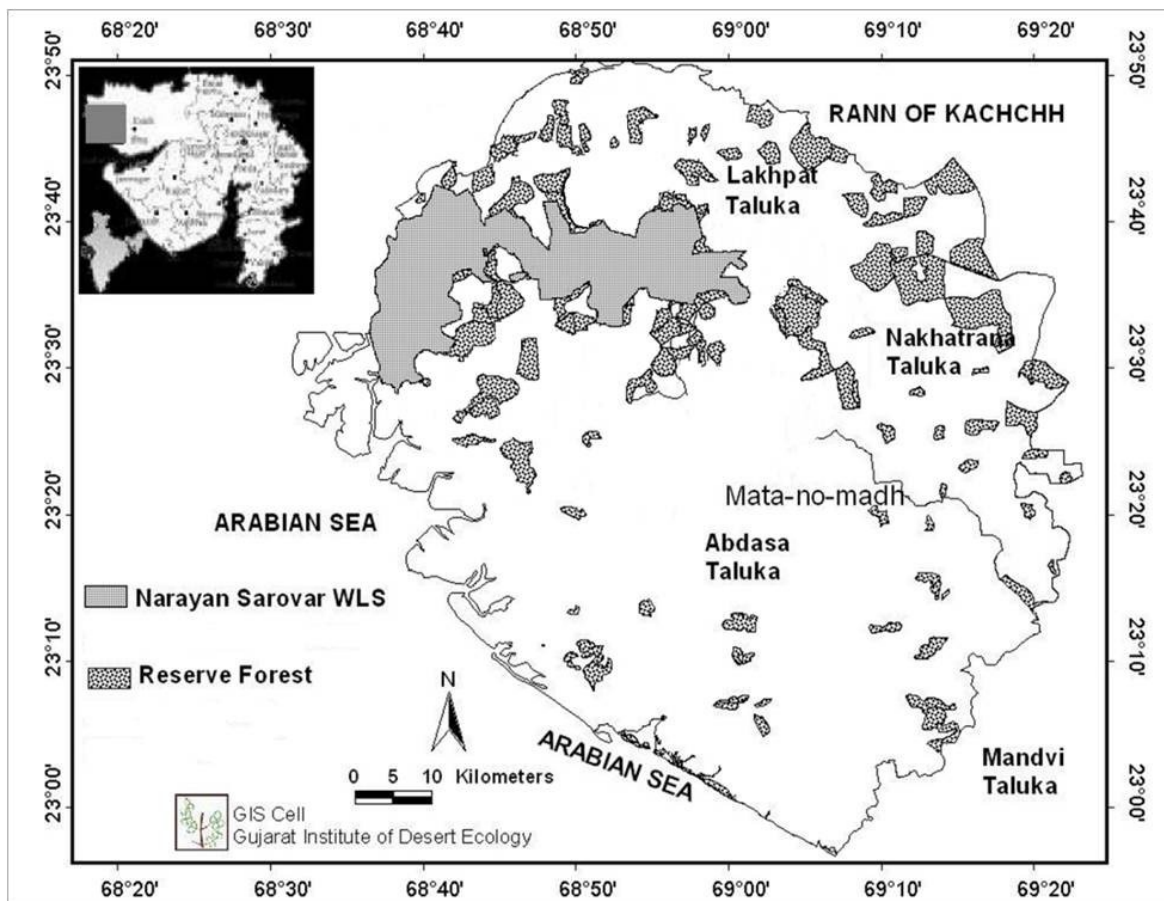


Figure 1. Map shows location of study area.

km grids and surveyed the antelope population by 1.1 km line transects within the randomly selected grids (Burnham *et al.*, 1980). A total of 180 line transects were surveyed during the study period (January 2008 to March 2009). The transect surveys were conducted during the morning and late afternoon hours in all seasons. Data were recorded on the species, no. of individuals, age-sex, group, sighting distance from transect, activities of animal and habitat features.

Indirect count

Belt transects and circular plots were also made to assess the population of antelope as an indirect evidence of the availability of antelopes. In each line transect seven circular plots of 10m radius and six belts (160m length and 3 m width) were set up to count the number of pellets as an indirect evidence (Rodgers, 1991).

Data analysis

The abundance and density/km² of the blue bull and chinkara in the study area were calculated from direct sighting data and of the pellets by indirect evidence. Mean number of individuals and pellets per transects in all types of habitat were also calculated. The number of individuals sighted from transects were analyzed by creating seven distance classes. The age-sex ratio of blue bull and chinkara in different habitat were also calculated. The frequency of occurrence of various group sizes was also analyzed.

RESULTS

A total of 104 individuals of blue bull and 132 individual of chinkara recorded during the study period, by moving through the 180 number of line transects. Out of the 180 transect, 13 transects in agriculture, 125 in forests, 36 in grasslands and 6 transects in wetlands were surveyed during the study period. Blue bulls were observed in 39 transects and chinkara in 43 transects.

Habitat preference

Out of total recorded population of blue bull, 73.07% recorded in forest, 23.07% in grassland, only 2.88% in agriculture and a single individual sighted in wetland habitat, while 54.54% of the population of chinkara was recorded from forest, 33.33% in grassland and 12.12% recorded in agricultural areas. On analysis of the population of antelope recorded by direct and indirect sighting, the mean number of individual or pellet per transect of blue bull was more in forest and less in agriculture, however the mean number of individual or pellets per transect of chinkara was found more in agriculture and less in forest (Figure 2).

The direct sighting of the population of antelope in study area, it was recorded that, the maximum density of blue bull found in grassland and minimum in wet land, while the maximum density of chinkara recorded in both agriculture and grassland habitat and minimum in forest areas. The abundance of blue bull in agriculture was less when compared to the chinkara, while the abundance of

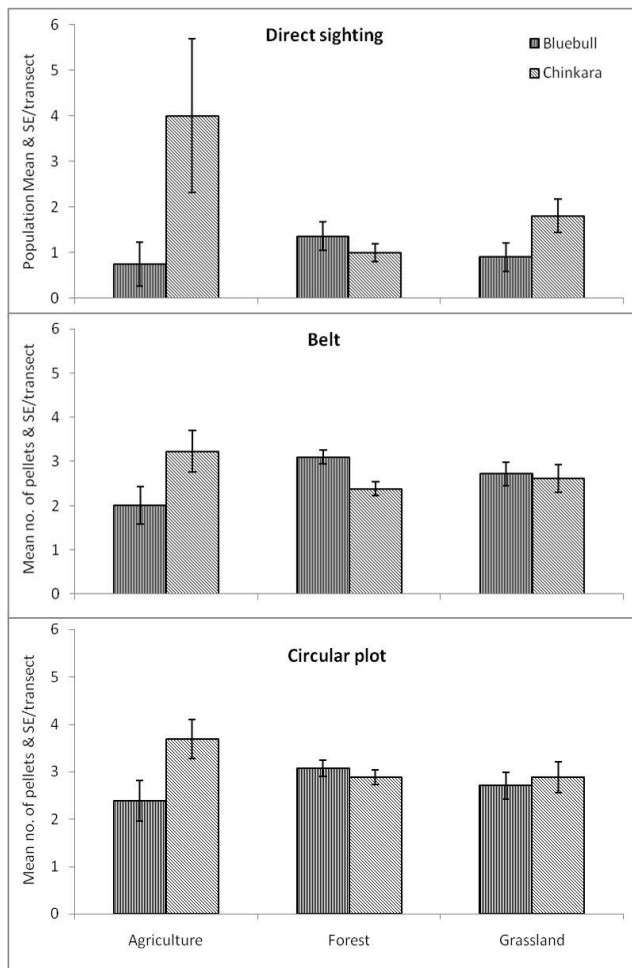


Figure 2. Mean and SE of the population and pellets of blue bull and chinkara in various types of habitat.

these two species of antelope in forest and grassland was more or less similar. It was also observed that, the density and abundance of chinkara was more in comparison to the blue bull (Table1). The analysis of the pellet groups recorded through the belt transect survey, as indirect evidence of the population of antelope showed that the abundance and density of blue bull was more compared to chinkara in the study area. The abundance of the pellet group of blue bull was recorded more in grassland and density recorded maximum in the forest. In case of chinkara, the pellet group was more abundant in wetland and less abundant in forest, while the density of pellets maximum recorded in agriculture (see Table 1). The investigation of the pellet group of antelope recorded in circular plot reveals that, blue bull was more abundant in forest while their density was more in wetland, whereas the pellets of chinkara were more abundant and dense in agriculture. It was also noted from the observation that the number of pellets of blue bull was more abundant and dense than chinkara (Table.1).

The analysis of the data on various distance classes from the designed transects indicate that, the maximum number of individuals and group of blue bull recorded within 10 to 40 m in all major categories of habitat in the study area. Similarly, the main concentration of chinkara population observed within 10-50 m distance from transects in agriculture and forest areas, and in 0-50 m in grassland areas (Figure 3).

Social composition

A total of 104 individuals (grassland=24, forest=76, agriculture=3 and wetland=1) of blue bull and 132 individuals (grassland=44, forest=72 and agriculture=16) of chinkara were observed during the study period. Out of

Table 1. Abundance and density of the blue bull and chinkara in the various habitats of the arid region of western Kachchh

Method	Habitat	Blue bull			Chinkara		
		No. of Evidences	Abundance	density/ km ²	No. of Evidences	Abundance	density/ km ²
Direct	Agriculture	3	1.5	0.0015	16	4	0.0079
	Forest	76	2.81	0.0039	72	3	0.0037
	Grassland	24	2.66	0.0043	44	2.93	0.0079
	Wetland	1	1	0.0011	0	0	0
	Total/Average	104	2.66	0.0037	132	3.06	0.0047
Belt (1080)	Agriculture	31	1.192	0.82	67	1.595	1.12
	Forest	452	1.215	1.03	311	1.087	0.79
	Grassland	144	1.469	0.94	125	1.329	0.90
	Wetland	19	1.266	0.86	10	1.666	0.34
	Total/ Average	646	1.264	0.98	513	1.198	0.82
Circular Plot (1260)	Agriculture	36	1.161	1.08	73	1.520	1.67
	Forest	621	1.696	1.33	480	1.399	1.24
	Grassland	112	1.217	1.16	135	1.377	1.23
	Wetland	21	1.166	1.36	14	1.166	0.90
	Total/Average	790	1.558	1.28	702	1.401	1.26

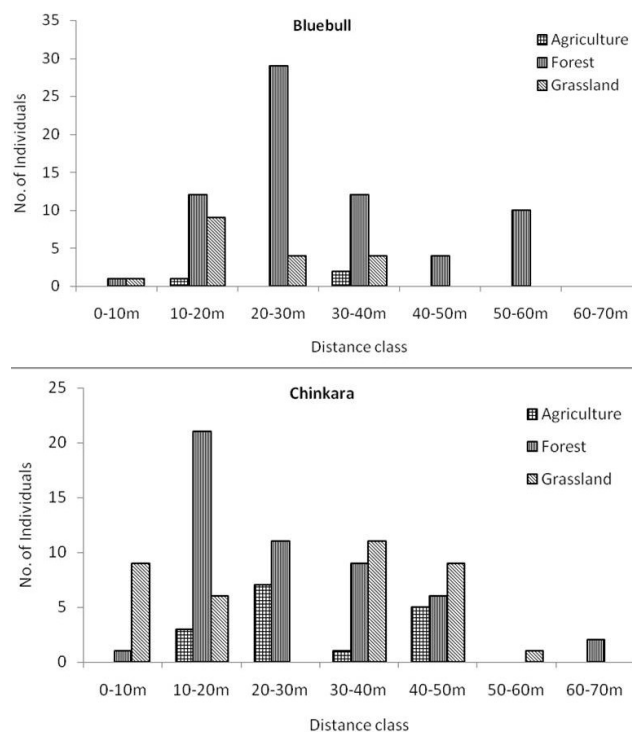


Figure 3. Number of individuals of blue bull and chinkara in different distance classes from the transects.

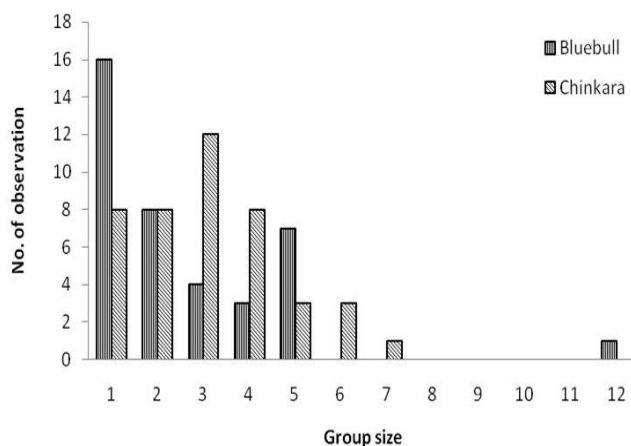


Figure 4. Frequency of group size of antelopes in the arid region of western Kachchh.

the 104 individual of blue bull, 32 adult male, 60 adult female, 9 sub-adult and 3 juvenile were recorded, while 43 adult male, 63 adult female, 22 sub-adult and 4 juvenile individuals of chinkara were observed during the survey. The results of the analysis of group size and sex ratio recorded during the study is given and described in separate headings:-

Group size: on analysis of the population of antelope in western kachchh, it was found that 15.53% of individuals of blue bull observed in single and in pair, 68.93% in groups more than two individuals. In case of chinkara, 6.06% of individuals were observed solitary, 12.12% in pair and 81.82% were observed in groups. The frequency of observation of various group size classes of blue bull and chinkara recorded in study area is shown in Figure 4.

The range of group size of blue bull were recorded in the habitat were varied between 1 to 12, however in case of chinkara the range of group size were varied between 1 to 7. The overall mean group size and standard deviation (SD) of blue bull recorded in the study area was 2.43 ± 1.55 , while in chinkara it was 2.55 ± 1.61 . The mean group size and standard deviation of the chinkara and blue bull recorded in major habitats of western Kachchh is given in Table 2.

Table 2. Mean group size and SD of the blue bull and chinkara in various types of habitat.

Habitat	Blue bull (Mean±SD)	Chinkara (Mean±SD)
Agriculture	1.5±0.7	4.75±2.51
Forest	2.72±2.54	2.17±1.33
Grassland	2±1.5	2.57±1.34
Overall	2.43±1.55	2.55±1.61

Age-sex ratio: On analysis of the population observed during the study indicate that 30.09% of individuals were adult male, 58.25% adult female, 8.73% sub-adult and 2.91% were juvenile of blue bull. Similarly in case of chinkara, 32.57% were adult male, 47.72% adult female, 16.66% sub-adult and rest 3.03% were juvenile among the total recorded population in western Kachchh. On calculation of the age-sex ratio of blue bull, per 100 population of adult female, 51.66 individuals were adult male, 15 sub-adult and 5 juvenile. The ratio between young and adult female was 20 young per 100 adult female in blue bull and 41.28 young per 100 adult female of chinkara. Among the chinkara population, the age-sex ratio in per 100 adult female, 68.25 individual adult male, 34.92 sub-adult and 6.35 juvenile were recorded. The adult sex ratio of the blue bull population were recorded 2.93 and 2.46 in chinkara.

DISCUSSION

In 1999, GEER & GUIDE (2001) sighted 61 chinkara in Narayan Sarovar Sanctuary (NSS), Kachchh, Gujarat (situated in the north-western part of the present study area) and estimated the population within this sanctuary was 1285, while in 1989 the population of chinkara in NSS was reported 956 (Chhabara, 1989). The present work recorded 132 individual of chinkara and 104 individuals of blue bull in whole study area by direct sighting; however no any record of the population and composition of blue bull available in this area. GEER & GUIDE (2001) also reported 50% of chinkara were adult female, 37.04% adult male, 5.56% sub-adult and 7.4% of individual of juvenile in NSS, while in compare the present study found less number of adult female, adult male and juvenile and more number of sub-adult population.

The information presented in this paragraph and the next (densities from other sites, group size and sex-ratio) would be easily comparable when represented in a table. The density of ungulates in dry deciduous forest of Gir, Gujarat ranged from 50.8 km^{-2} to 0.42 km^{-2} and the

density of chinkara (*Gazella bennettii*) was more than blue bull (*Boselaphus tragocamelus*) (Khan *et al.*, 1996). The similar trend like the density of chinkara (0.0047 km^{-2}) was more in relation to blue bull (0.0037 km^{-2}) in present study. The density of chinkara in NSS was found 1.25 km^{-2} (Chhabara, 1989) and 2.89 km^{-2} (GEER & GUIDE 2001) which was more in compare to present study. The density of chinkara reported from other areas by Rahmani (2001), Dookia *et al.* (2009), Arshad & Gill (2010) and are higher than present study, possibly due to the distribution of chinkara is in large part of western Kachchh. Similarly, the density of blue bull was found less in western Kachchh compare to the other areas (Singh, 1995; Khan, *et al.* 1996; Aryal, 2007).

Blue bull are partially social in their habits and large groups are found rarely (Prater, 1971), exhibit three distinct kinds of groups (Schaller, 1967). The range of group size of blue bull was found 1 to 12 and 1 to 7 in case of chinkara in the western part of Kachchh during the present study. The ranges of group size of blue bull reported by various authors time to time as 1-18 (Schaller, 1967), and the maximum size reported as 10 individual by Bagchi *et al.* (2008) and Dinerstein (1980), 24 by Sheffield *et al.* (1983), 30 by Singh (1995) and 43 reported by Sankar (1994). Only few reports available on the group size of chinkara including Arshad & Gill (2010), Prater (1971) and Schaller (1967) found a range of 1-16 individuals. In different season the group structure of antelope changes (Sankar, 1994) and sometimes assemble in good feeding ground like grasslands and crop field (Singh, 1995). The mean group size found during the present study on blue bull (2.43) and chinkara (2.55) was more or less similar as reported by earlier authors as 2.9 blue bull observed in Karnali-Bardia (Dinerstein, 1980), 4.0 in Sariska (Sankar, 1994), 2.2 in Gir (Khan *et al.*, 1995), 2.9 (winter) and 2.5 (summer) in dry tropical forest of western India (Bagchi *et al.*, 2008). Similar, the mean group size of chinkara in dry tropical forest of western India was found 2.6 in winter and 2.5 in summer (Bagchi *et al.*, 2008).

The sex ratio of antelopes (0.51:1 in blue bull and 0.68:1 in chinkara) observed in western part of Kachchh during the study found in favour of female. The various studies also found in favour of female as reported in free ranging blue bull the male-female ratio was 0.59:1 in Bharatpur (Schaller & Spillett, 1966), 0.39:1 in Vanvihar Sanctuary (Schaller, 1967), 0.81:1 in Texas (Sheffield *et al.*, 1983), 0.89:1 (Berwick & Jordan, 1971) and 0.71:1 (Khan *et al.*, 1995) in Gir, 0.4:1 in Sariska (Sankar, 1994) and 0.75:1 in Lumbini (Aryal, 2007). The sex ratio of chinkara in NSS was reported 0.74:1 female (GEER & GUIDE, 2001) and the sex ratio of 0.57:1 in Cholistan Game Reserve (Arshad & Gill, 2010). While, the sex ratio of blue bull (116.8:100) and chinkara (119.8:100) was found in favour of male in dry tropical forest of western India (Bagchi *et al.*, 2008). The result also found an adult female and young individual ratio of blue bull (1:0.20) was similar to the observation of Khan *et al.* (1995) in Gir (1:0.23) and Bagchi *et al.* (2008) in dry tropical forest of western India (1: 0.24) while less in compare to Sankar (1994) observed in Sariska Tiger Reserve (1:0.48). The adult female and

young one ratio of chinkara in NSS was reported as 1:0.15 (GEER & GUIDE, 2001) was less in relation to present study (1:0.41) and more or less equal to the ratio of chinkara (1:0.35) in dry tropical forest of western India (Bagchi *et al.*, 2008).

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