

The population size, abundance and distribution of the Critically Endangered Hirola Antelope (*Beatragus hunteri*) in Arawale National Reserve, Northeastern, Kenya.

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1.0. Abstract.

This paper outlines the spatial distribution, population size, habitat preferences and factors causing the decline of Hirola antelope in Arawale National Reserve (ANR) in Garissa and Ijara districts, north eastern Kenya. The reserve covers an area of 540Km². The objectives of the study were to gather baseline information on hirola distribution, population size habitat preferences and human activities impacting on its existence. A sampling method using line transect count was used to collect data used to estimate the distribution of biological populations (Norton-Griffiths, 1978). Community scouts collected data using Global Positioning Systems (GPS) and recorded on standard datasheets for 12 months. Transect walks were done from 6.00Am to 10.00Am every 5th day of the month. The data was entered into a geo-database and analysed using Arcmap, Ms Excel and Access. The results indicate that the population of hirola in Arawale National Reserve were 69 individuals comprising only 6% of the total population in the natural geographic range of hirola estimated to be 1,167 individuals. It also revealed that hirola prefer open bushes and grasslands. The decline of the Hirola on its natural range is due to a combination of factors, including, habitat loss and degradation, competition with livestock, poaching and drought.

Key words: Hirola Antelope *Beatragus hunteri*, GIS, Endangered Species

2.0. Introduction.

The Hirola antelope (*Beatragus hunteri*) is a "Critically Endangered" species endemic to a small area in Southeast Kenya and Southwest Somalia. The Hirola is one of the world's most endangered genera of large mammals and the only existing member of its genus (IUCN, 1996). The hirola is now either

in low numbers or extinct in Somalia. The natural population in Kenya has declined from roughly 14,000 animals in the 1970's to 1,167 today (Andanje & Goeltenboth, 1995; Butynski, 2000; Agatsiva, 1995).

The historic natural range of the Hirola in Kenya and Somalia is estimated at 38,400 Km² (Butynski, 2000). The natural range in Kenya declined from about 19,158 Km² in the 1960's to approximately 9,177 Km² in 2006. Today, only the central portion of the species historic range in Kenya is occupied (fig. 7).

Hirola stand 100 to 125 cm. at the shoulder and weigh 80 to 118 kilograms (Butynski, 2000). The coat is a light sandy brown, which turns greyer in adult males. Two white lines form a chevron between the eyes directed towards the forehead. The long, thick tail is white, as are the ears, which are tipped with black. The lyrate horns are much more like those of an impala than a topi or hartebeest, but are shorter and sturdier with heavy ridges along most of their length. Hirola are found on arid, grassy plains.

Fig. 1. An Adult Hirola



They are diurnal and spend the mornings and evenings grazing. Herds contain from two to forty females led by one territorial male but bachelor herds of five or so males are common. Herds do not move much as the males leading them are very territorial. (Kingdon, 1982; Sclater, 1889)

In 1963, a founder population of 10-20 hirola was translocated into Tsavo East National Park. This population grew to 79 individuals by 1996. In 1996, another 29 hirola were placed into this population. There were an estimated 105 hirola in the Tsavo population in 1998 (Butynski, 2000).

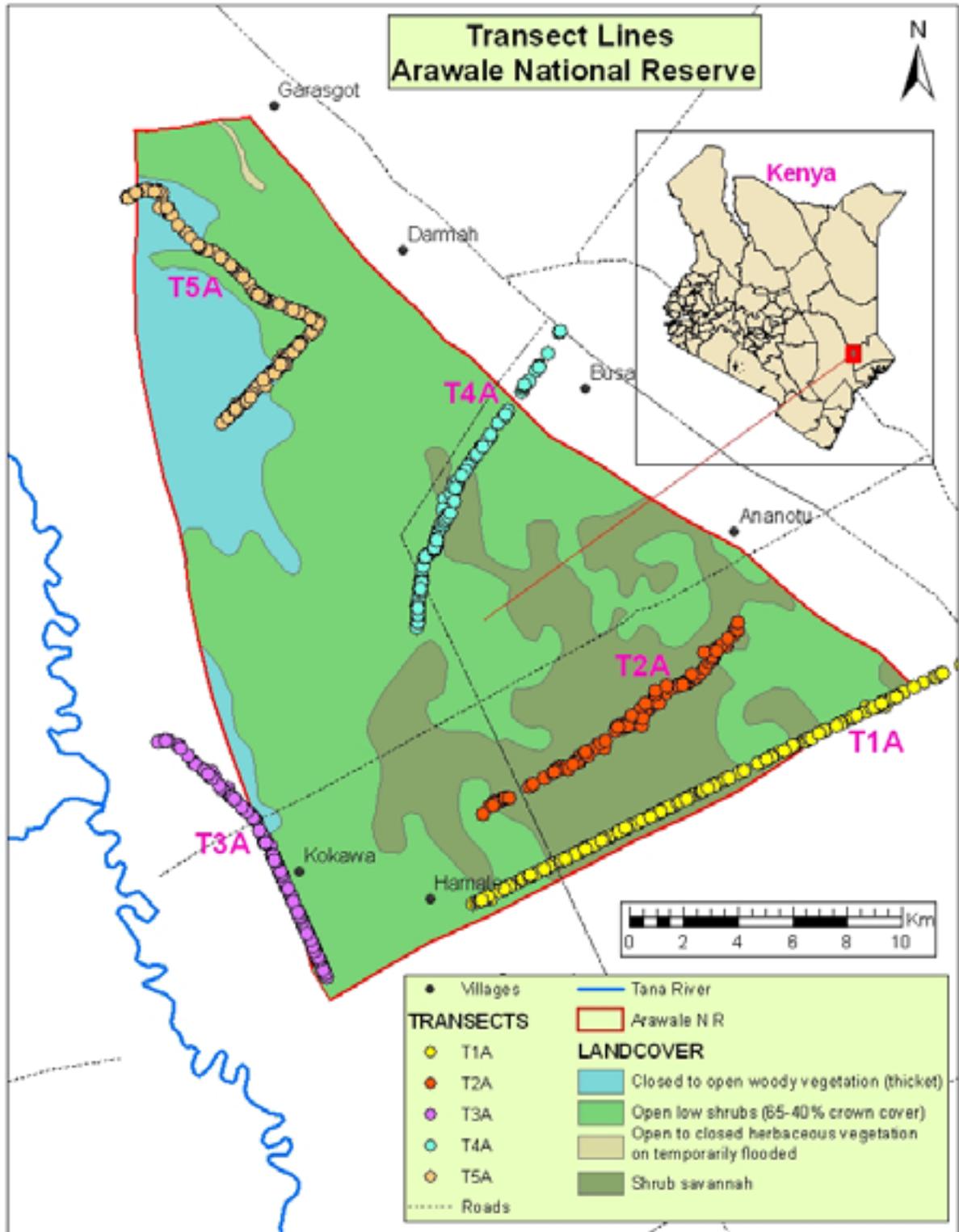
3.0 STUDY AREA

The Arawale National Reserve (ANR) is located between 1° 15' and 1° 34'S, and 40° 04' and 40° 20' in Garissa and Ijara districts, North-eastern Kenya. The reserve was gazetted in 1973, as the main in-situ measure to conserve the endemic hirola antelope, and to protect other wildlife species of conservation interest. It is listed in the category VI of the world-protected areas of IUCN (1996). In early 1980s, the reserve witnessed increased poaching activities, overgrazing by domestic livestock and human settlements.

Garissa County Council was responsible for the management of Arawale, but delegated law enforcement and security patrolling to the Kenya Wildlife Services (KWS). However, management and law enforcement has only been in place up to late 1980s, until a combination of lack of resources and insecurity problems prevented further KWS and County Council commitments. The withdrawal of security and abandonment has led to a situation of neglect and complete lack of management for three decades.

Arawale holds other species of conservation interest, including reticulated giraffe (*Giraffa camelopardalis*), cheetah (*Acinonyx jubatus*), African wild dog (*Lycaon pictus*), desert warthog (*Phacochoerus delameri*) and Somali bush baby (*Galago gallarum*). Other species, like eland, elephants (*Loxodonta Africana*) and black rhinoceros (*Diceros bicornis*) have been eliminated by poaching (Dahiye, 1999).

Fig. 2. Location of ANR and the Transect Lines.



4.0 OBJECTIVES

The general objective of the community-based ecological resource monitoring was to collect and analyse data to estimate the distribution and abundance of biological population in Arawale National Reserve.

4.1 Specific objectives

The specific objectives were to gather baseline information on:-

- i) Hirola distribution and population size
- ii) Habitat preferences of hirola
- iii) Factors causing decline of hirola population

5.0 METHODOLOGIES

Line Transects Counts (LTC's), a long term monitoring and data collection procedures was designed and used. A Line transect count is a sampling method used to estimate distribution and abundance of biological populations in selected areas.

5 line transects T1, T2, T3, T4 and T5, with length of 22, 10, 10, 13, 15 Kilometres respectively, were established in different parts of Arawale National Reserve using described procedures with the help of local communities. Eleven field Scouts were selected from the communities located near the transect areas. The Scouts were trained on the procedures of data collection, use of Global Positioning System (GPS), wildlife species identification, and data collection tools to carry out monthly transects counts on foot (except transect T1 on vehicle) along the line transects and replicated for 12 months following prescribed procedures. The data was collected between 6AM - 10AM each 5th day of the month.

The data collected was entered into ArcGIS geodatabase for analyses, interpretation and designing of distribution maps of wildlife, livestock, and human activities. Ms Access and Excel packages were also utilized in analysis.

6.0 RESULTS

6.1 Population size, abundance and density.

During the study a total of 534 hirola's, comprising 87 groups, were recorded in 4 out of 5 transects. This represents an average of 45 individuals per month. The group sizes ranged from 1 to 20 individuals with a mean of 6.1 and standard deviation of 4.7.

Using $N = nZ/TW$ Where:

n = Population size of each individual in transects (monthly average)

Z = total area of the survey zone

T = Length of the road transect

W = Width of the road transect.

N = Population size of individuals of a species in the whole survey zone.

(Norton-Griffiths, 1978) the population size of Hirola in ANR was 69 individuals. Therefore only 6% of the total natural population of Hirola in Kenya (estimated to be 1,167) are resident and use the reserve as the refuge. The population density of hirola in Arawale is 0.13/km².

Table 1. Population size of Hirola in Arawale National Reserve (ANR)

Species	Total	Average/Month	Population Size	Density
Hirola	534	45	69.0	0.13

Table 2. Statistics of recorded hirola groups

Groups	Min	Max	Sum	Mean	SD
87	1	20	534	6.1	4.7

Fig 3. Population size of Hirola (Beatragus hunteri) in ANR.

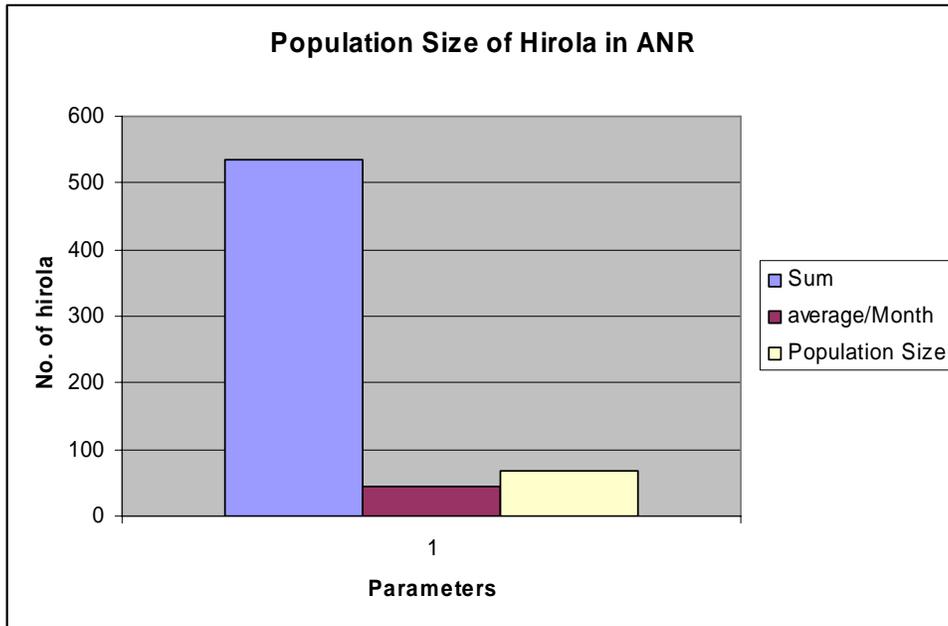
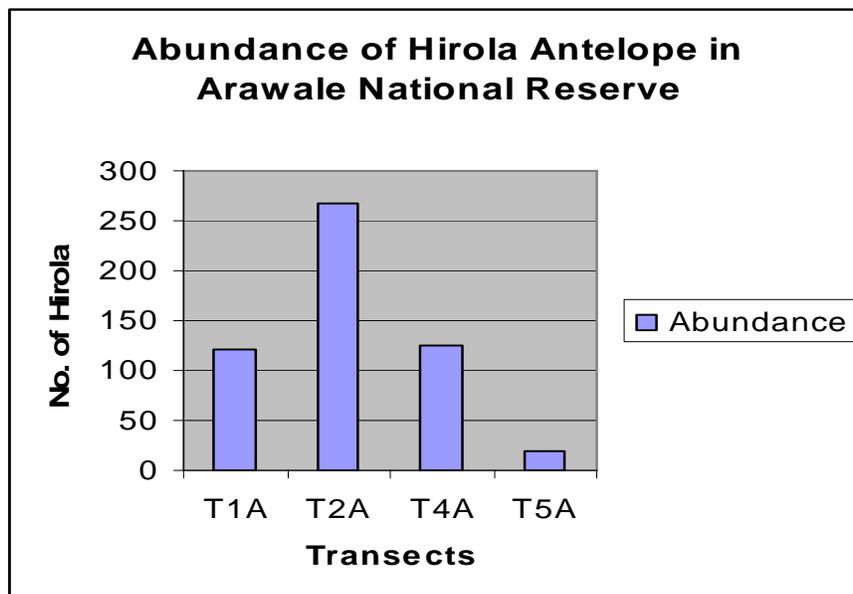


Fig. 4. Abundance of Hirola (Beatragus hunteri) in A.N.R.



Hirola were most abundant in Transect T2A as it is situated in shrub savannah vegetation (fig. 2) with closed to open grassland covering 60% polygon area (fig. 9), the ideal habitat for Hirola. Transect T5A was located in the North West part of the reserve which is dominated by dry acacia bushes, human settlements and prevalent overgrazing. No hirola was sighted in T3A as it is

located along the riverine dense forest with 65-40% crown cover which hinders regeneration of grass (fig. 2, 9).

6.2 Spatial Distribution

During dry season 59 groups of hirola totaling 313 individuals were recorded in ANR (59% of total). While in wet season only 28 groups comprising 221 individuals were recorded (41% of total). This was attributed to the fact that wildlife tend to converge in areas with strategic and scarce resources such as water and pasture in dry season while in wet season these resources are well distributed in the range therefore animals scatter over a large area reducing the chances of spotting them significantly.

Table 3. Seasonal distribution of Hirola in Arawale National Reserve.

SEASON	Frequency	% Frequency	No. Hirola	Hirola No. %
dry	59	68	313	59
wet	28	32	221	41
Total	87	100	534	100

Fig 5. Seasonal distribution of Hirola in ANR.

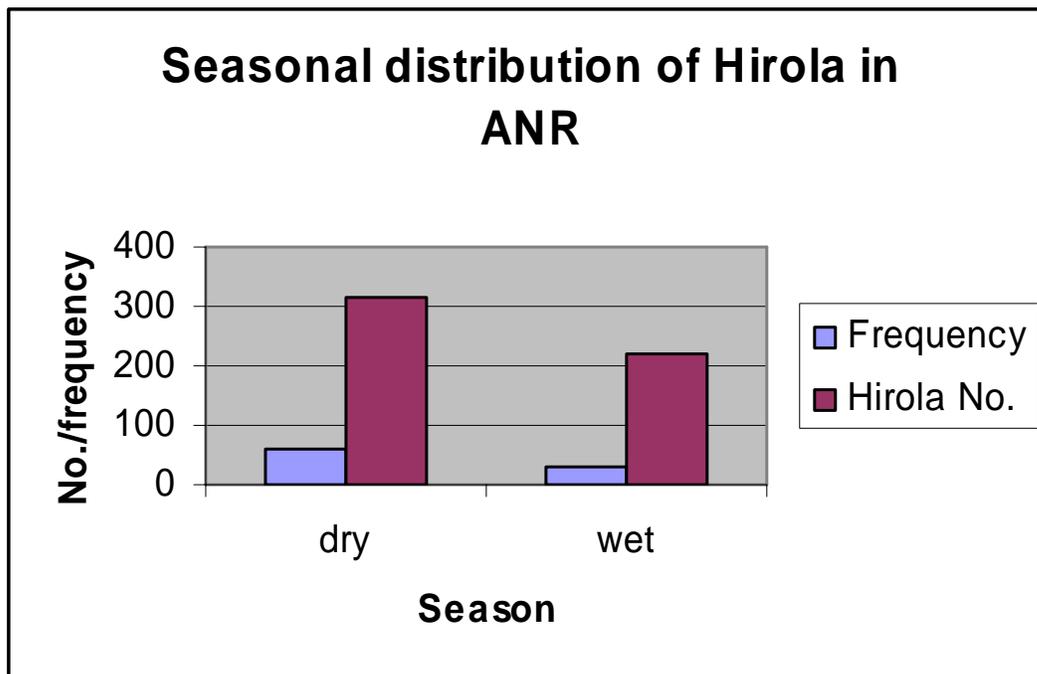


Fig. 6. Seasonal distribution of hirola in Arawale National Reserve.

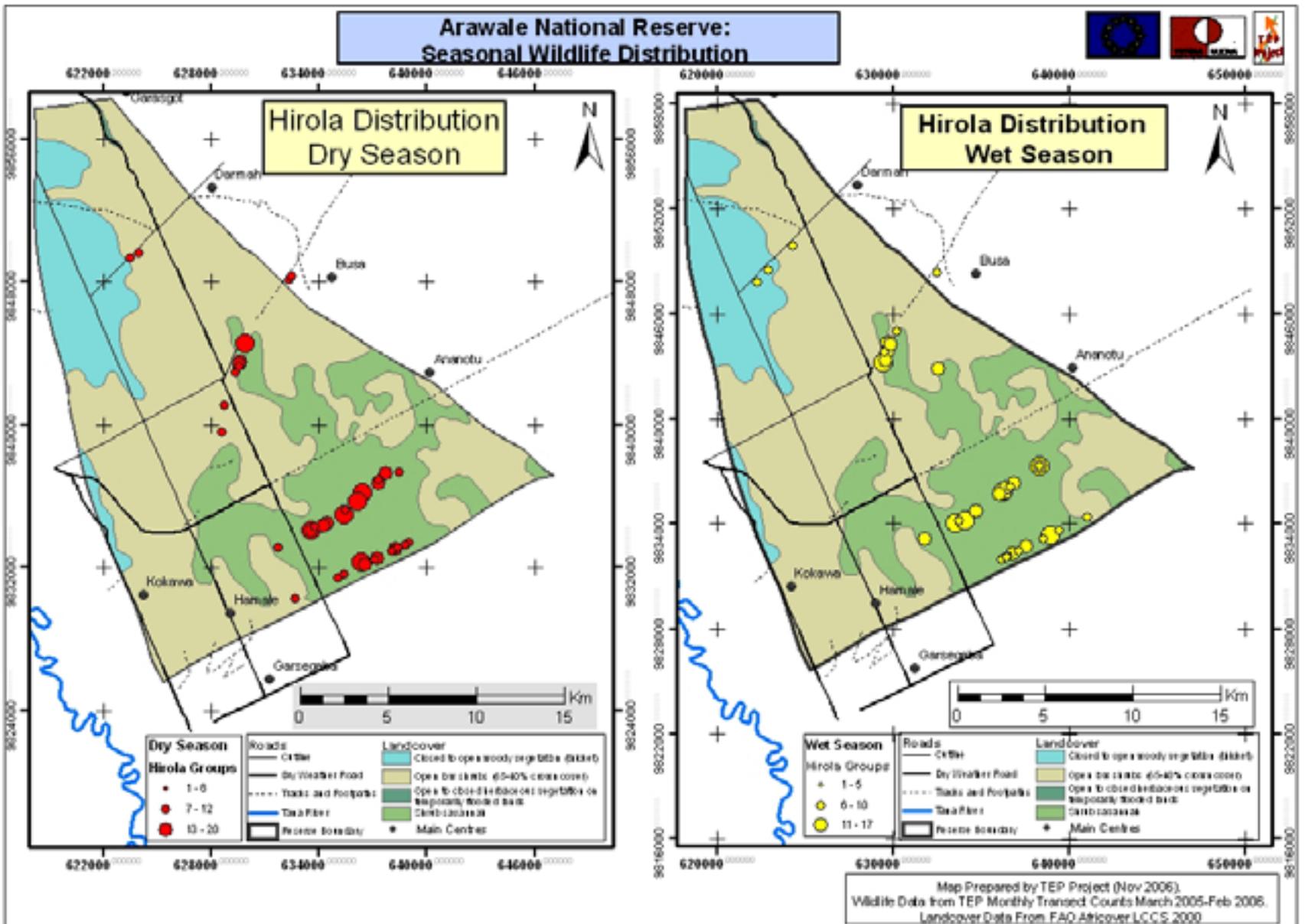
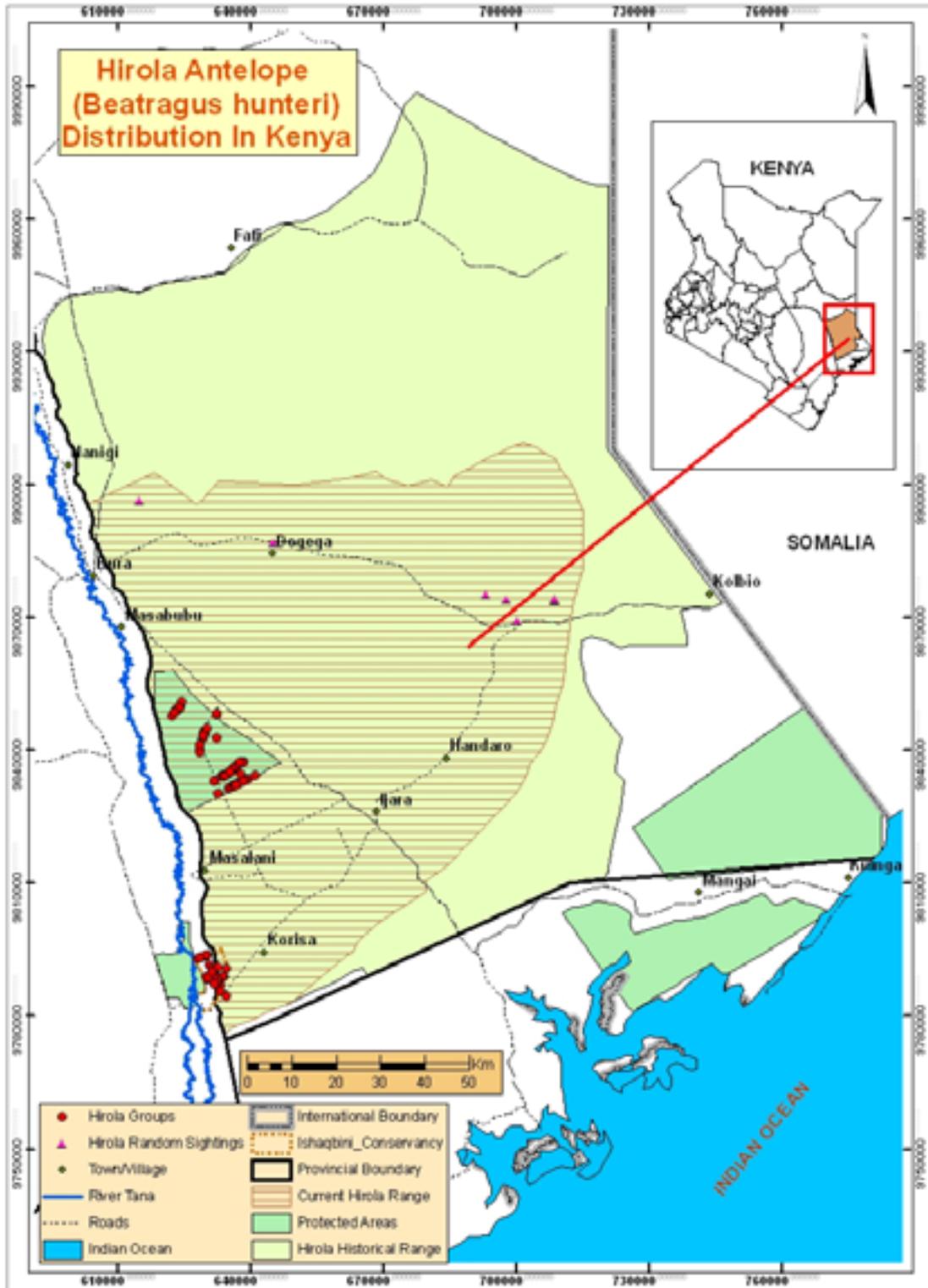


Fig. 7. Historical (19,158 km²) and Current (9,177 km²) distribution of the hirola antelope *Beatragus hunteri* in Kenya.



6.3 HABITAT PREFERENCES

No hirola was sighted in closed bush. Out of 87 groups of hirola sighted, 57 groups constituting 53% of the total were in open bush while 30 groups comprising 47% of total were in grassland. Hirola preferred open grassland and wooded grassland habitats with short grass.

Table 4. Habitat preference of Hirola in Arawale National Reserve.

Vegetation Type	Frequency	% Frequency	No. of Hirola	% Hirola
grassland	30	34	253	47
open bush	57	66	281	53
Closed Bush	0	0	0	0
Total	87	100	534	100

Fig. 8. Habitat preference of Hirola in ANR

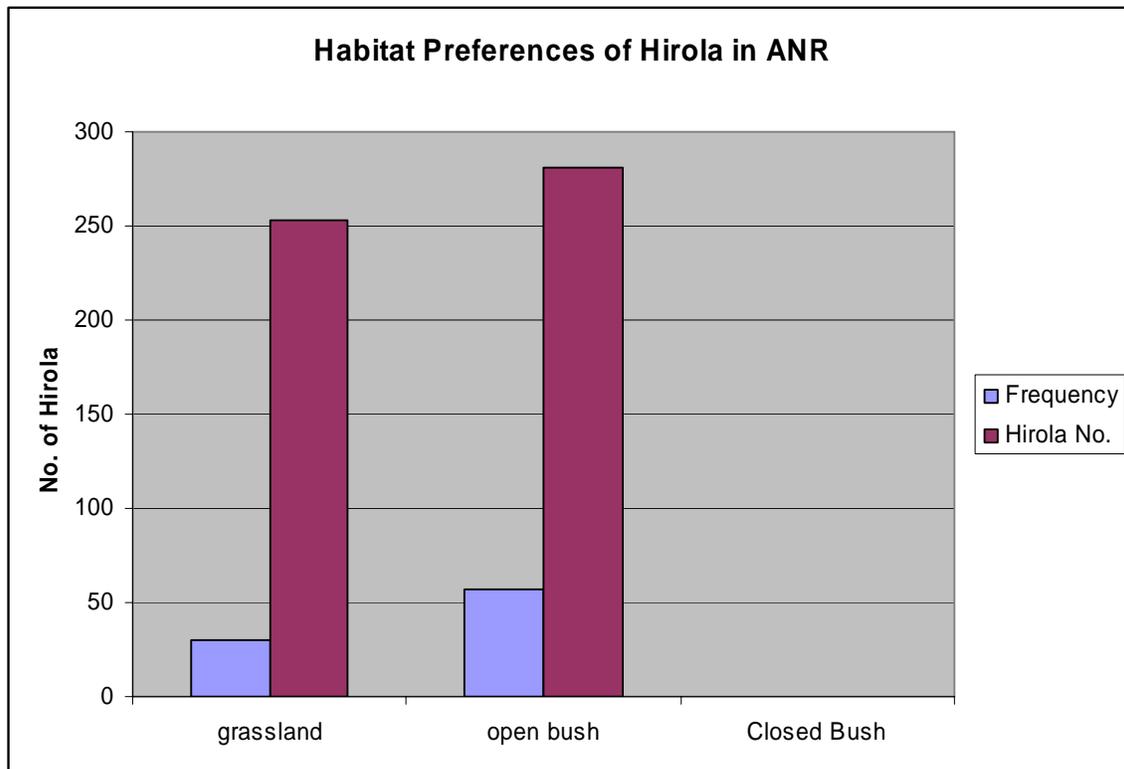
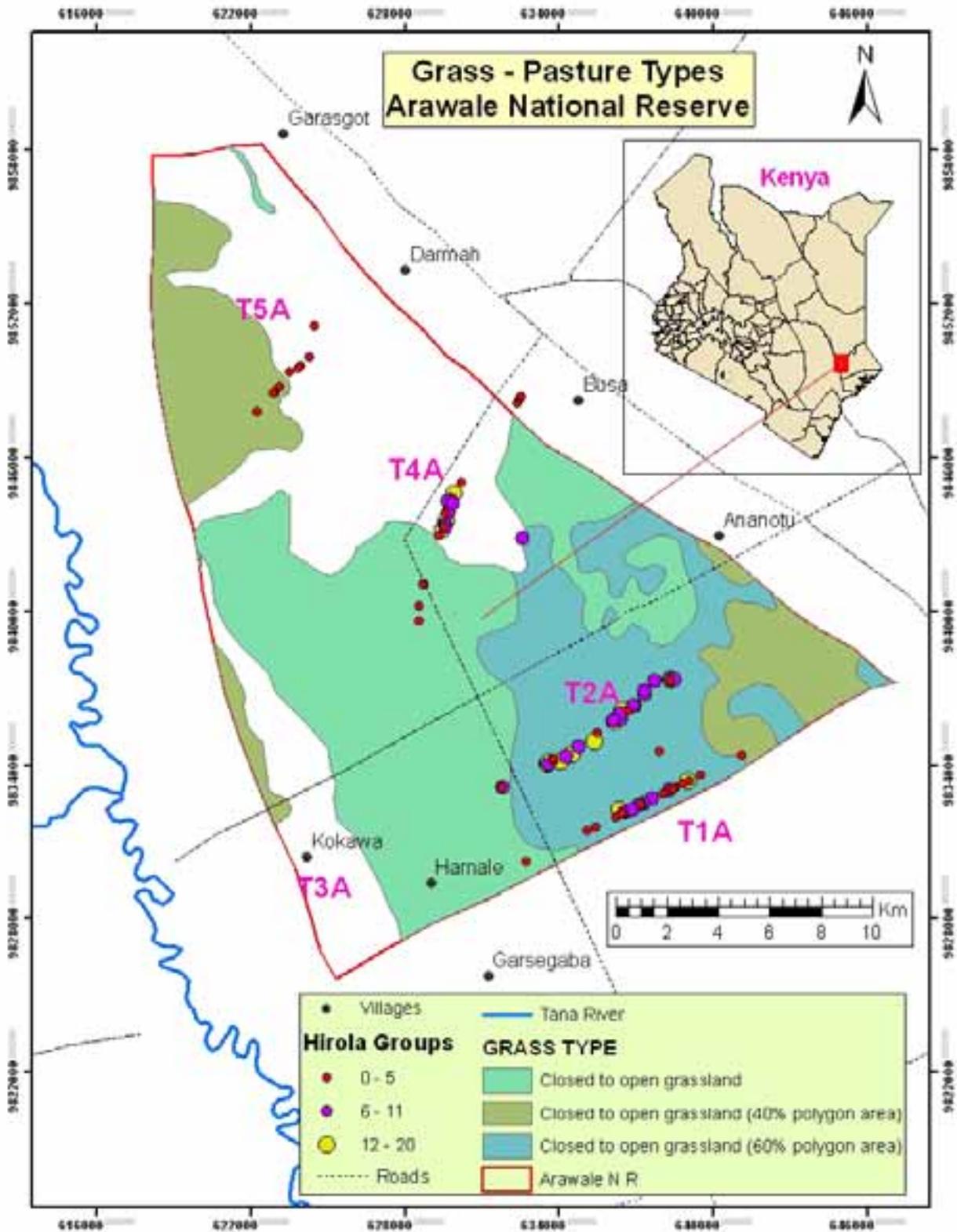


Fig. 9. Distribution of Hirola in different types of grassland.



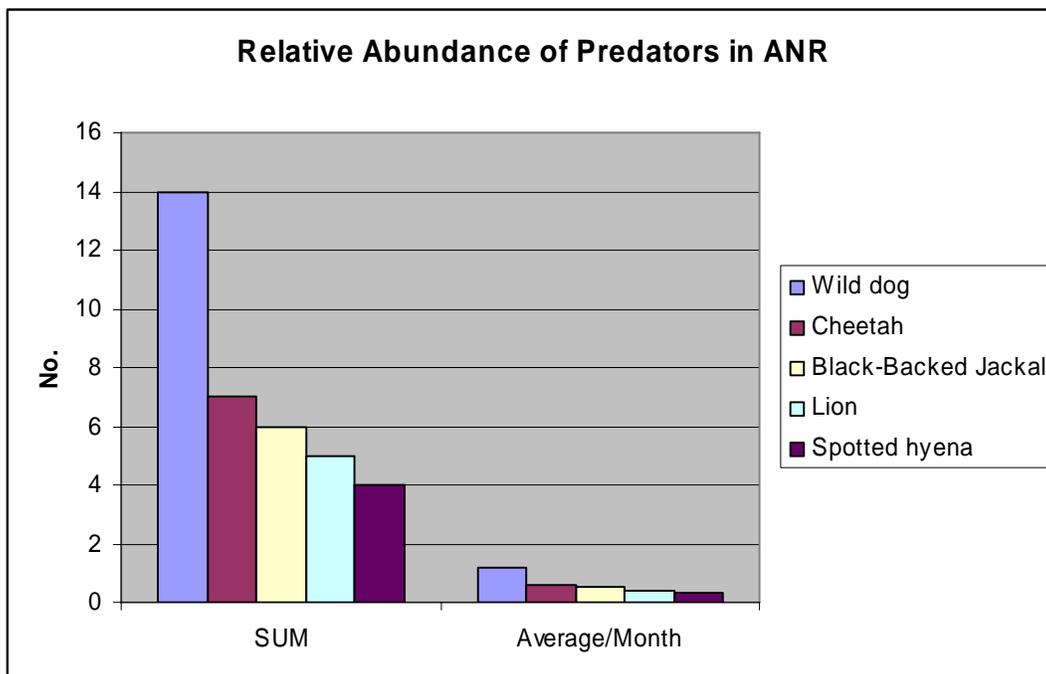
6.4 Predation.

The potential predators of hirola present in ANR are wild dog, cheetah, black-backed jackal, lion and spotted hyena. All of these predators seem to be in low numbers in the reserve. However, their numbers may be relatively higher considering most carnivores hide in the bush, therefore maybe easily missed in transect walks. The Hirola Scouts recorded seeing two groups of wild dog with 9 and 5 individuals respectively. Black-backed jackal, probably prey on hirola calves, particularly new-born calves lying-up away from their mothers. However, lions are the main predators around the reserve even for the livestock.

Table 5. The predator species population in Arawale National Reserve.

Species	SUM	Average/Month
Wild dog	14	1.2
Cheetah	7	0.6
Black-Backed Jackal	6	0.5
Lion	5	0.4
Spotted hyena	4	0.3

Fig. 10. The population of predator species in ANR.



6.5 Human Settlements and Livestock Grazing.

A total of 8,434 domestic animals were recorded to be grazing in ANR along the transect lines. Cattle were the highest followed by shoats with 4,202 and 3,720 individuals respectively. Overgrazing increases competition for pastures especially during dry seasons.

Table 6. Total Livestock Species Recorded.

Species	Total
Cattle	4,202
Shoats	3,720
Goats	486
Donkey	24
Camel	2
Total	8,434

Fig 11. Total Livestock Species Recorded in Arawale National Reserve

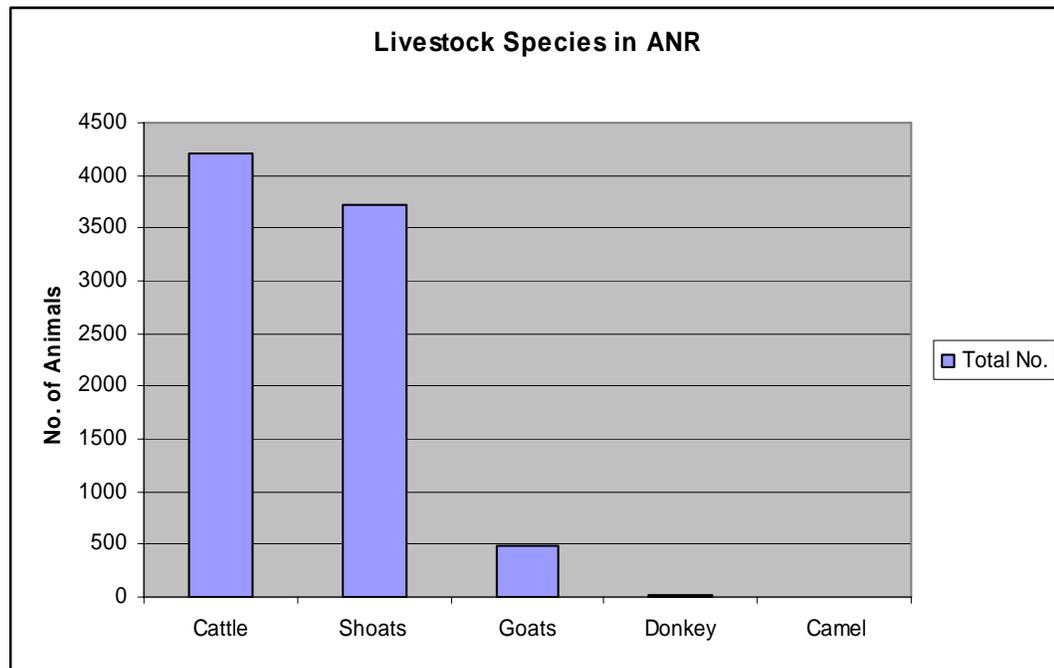


Fig. 12. Livestock Species Distribution in Arawale National Reserve

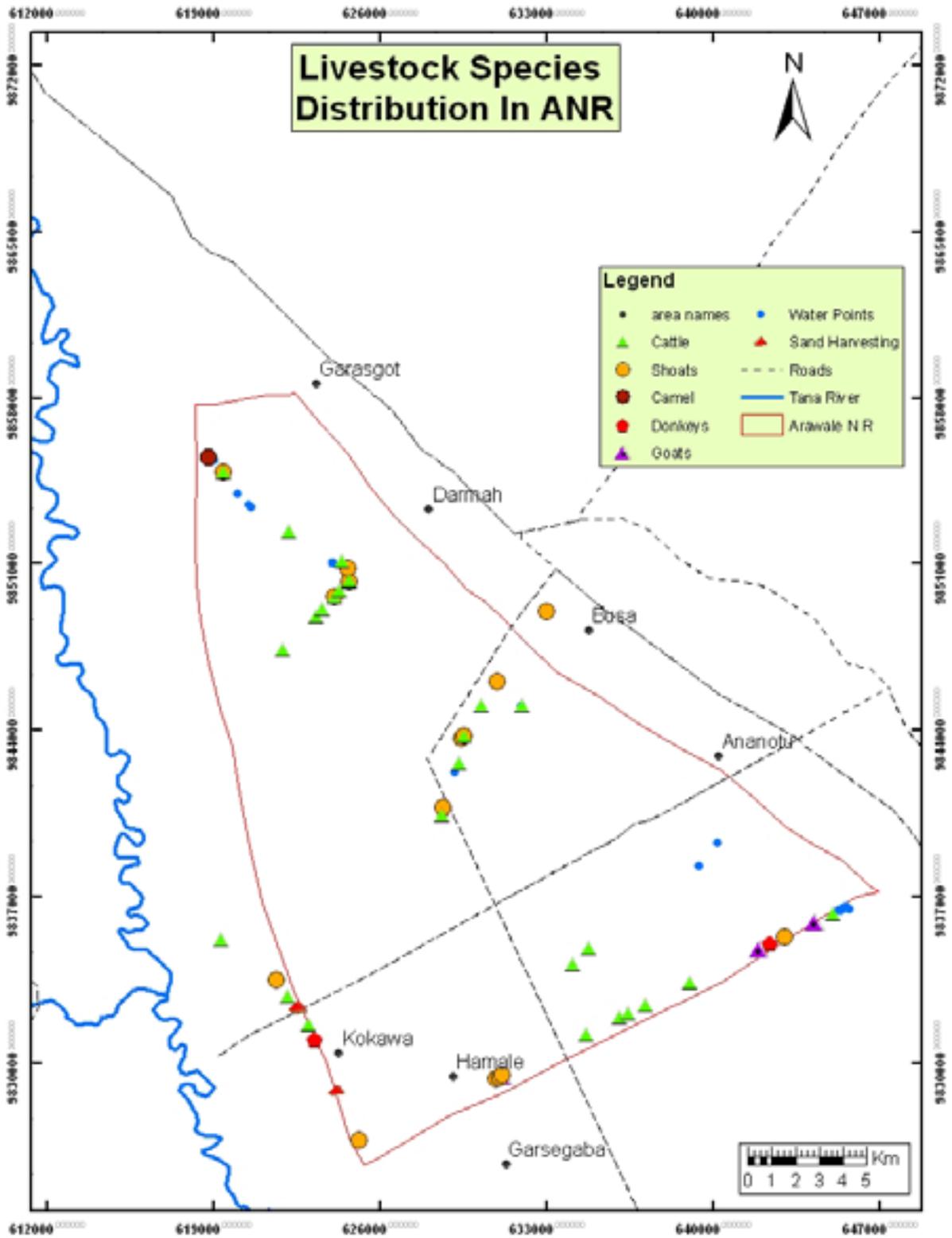


Fig. 13. Nomadic Settlements/Campsites in ANR

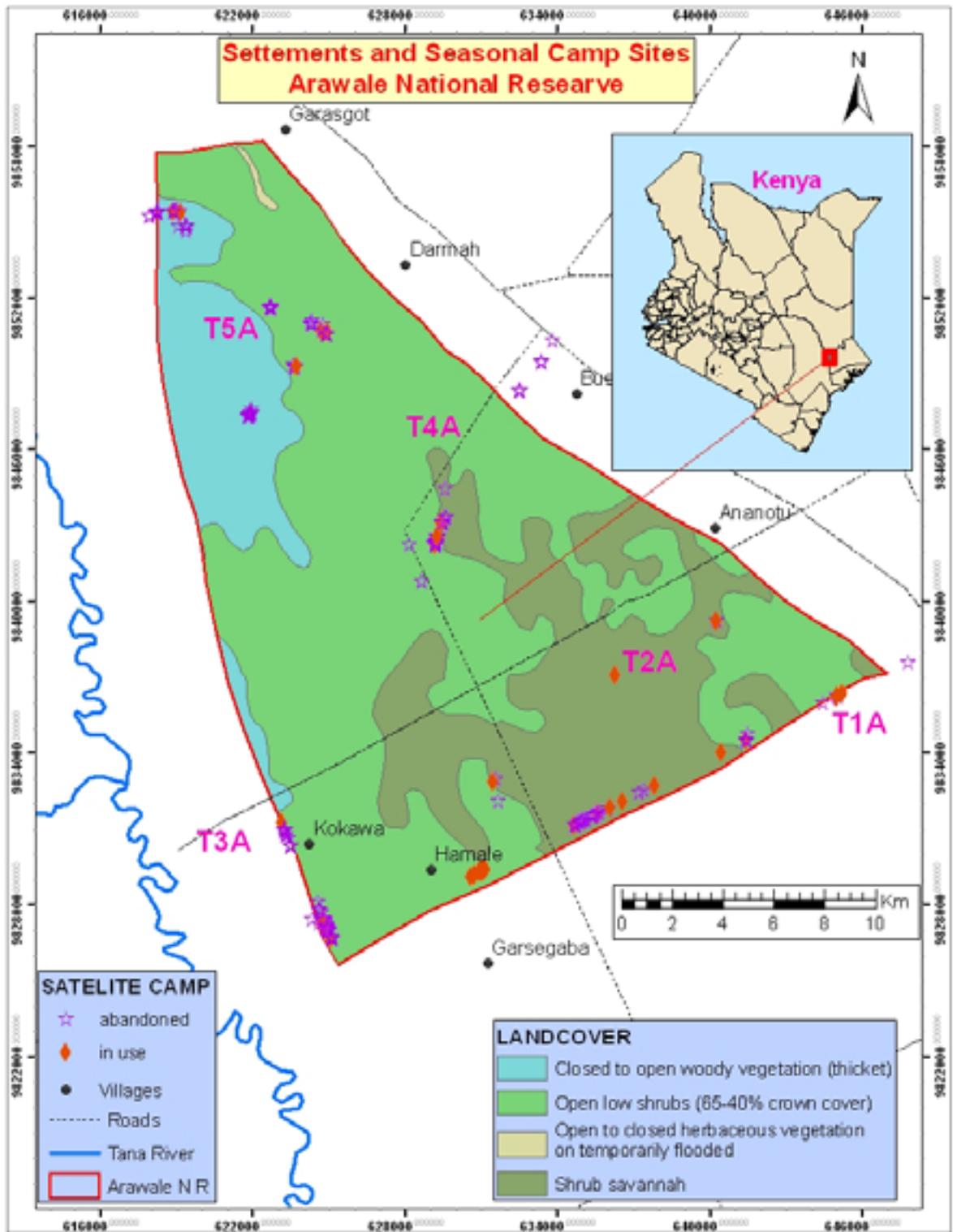
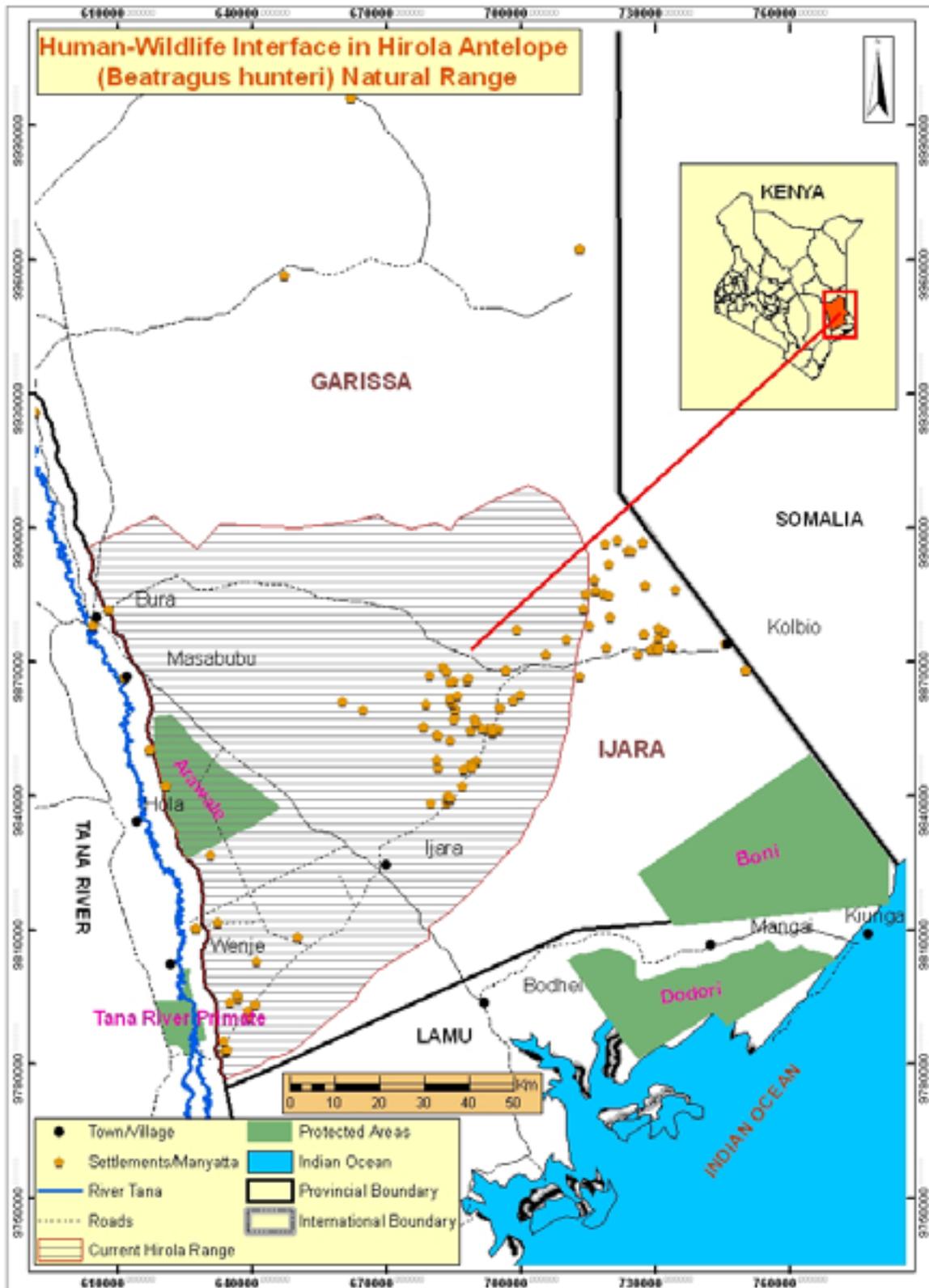


Fig. 14. Human Settlements in Hirola Range



7.0 Discussion.

Establishment of Arawale National Reserve was the main in-situ conservation initiative of the Hirola. However it currently holds only 6% of the natural population of hirola in Kenya.

Evidently therefore, the carrying capacity of the reserve has declined as a result of poor management and lack of protection by KWS and Garissa County Council (GCC). The collapse of security operations and protection by KWS resulted to increased poaching and unprecedented degradation, overgrazing and poaching thereby resulting to decline of hirola.

Despite hirola, the reserve holds 4 other known species of conservation concern i.e. the wild dog, reticulated giraffe, desert warthog and cheetah. Therefore its proper management is vital for conservation of these species.

The results conform to 1995 and 1996 censuses which found hirola in low numbers in Arawale (Ottichilo *et al.*, 1995; DRSRS, 1996). In 1999, Andanje (2000b) observed 55 hirola in Arawale National Reserve. Butinsky 2000 found that at least 10 to 20 % of the total population, estimated at 500 to 1000 individuals, are resident and use the reserve as the refuge. During the late 1970s, Bunderson (*in litt.* to J. Williamson, 1985) found that Arawale only held about 10% of Kenya's hirola on a year-round basis.

The vegetation of the ANR has changed with an increase in bush and a decline in short grass coverage. This change is attributed to over-grazing by livestock, increased human settlements and drastic removal of elephants due to poaching. Elephants are important in checking the growth of bushes and promote grass regeneration thereby creating conducive habitat for the Hirola. But it is unknown whether the present low density of hirola in ANR is due to inadequate habitat or due to the low numbers of animals as a result of the dramatic decline of this species throughout its range (Butynski 2000)

Hirola live in a mosaic of grassland, shrubland and open woodland. Hirola prefer "open bushed-grassland" (Butynski, 2000), "open grassland with scattered trees and open bushland" (Grunblatt *et al.*, 1989), "grassy plains" (Kingdon, 1982), "open shrubbed grassland" (Agatsiva, 1995), and "shrubland" (Andanje & Goeltenboth, 1995). During the 1995 census of hirola, 70% of the

animals counted were on either “dwarf shrubby grassland” or “dwarf grassy shrubland” (Ottichilo *et al.*, 1995). Bunderson (1979) states that hirola preferred “open to lightly-bushed grassland” and “wooded savannas with scattered trees and shrubs of low stature”. Grass cover here is fairly good (30-50%) and grasses are short to intermediate in height (10-50 cm). The most obvious characteristics of their preferred habitats are low woody canopy cover, low grass cover, short grass height, high grass greenness, and low density of permanent waterholes. These habitats are subject to seasonal flooding. Hirola avoid tall dense stands of grass and herbaceous vegetation, as well as thick woodland and forest.

Bunderson (1985) concluded that hirola appear to be attracted to areas which are used heavily by domestic livestock under traditional Somali herding practices, in which livestock are highly mobile and over-grazing is largely absent. Although hirola avoid livestock, their density is higher in areas heavily-used (but not over-grazed) by livestock. (*e.g.*, around seasonal watering points).

Table 7: Summary of estimates of the size of the natural geographic range of hirola antelope *Beatragus hunteri* in Kenya and Somalia based on 15 aerial surveys conducted from 1973 to 1996.

Year	Kenya	Somalia	Total	Source
1885	17,900	20,500	38,400	Sclater, 1889
1963	11,980	-		Stewart & Stewart, 1963
1974/75		3640		(Abel & Killeh, 1975)
1976	12,000	2,000-3,000	14,000-15,000	Bunderson, 1979
1977-1988	10,630	-		Agatsiva, 1995
1995	9,170	-		Ottichillo <i>et al.</i> , 1995
1996	7,560	-		DRSRS, 1996

Table 8: Summary of estimates of the size of the natural population of Hirola antelope *Beatragus hunteri* in Kenya based on 15 aerial surveys conducted from 1973 to 1996.

Year	Months	Season	Transect spacing (km)	No. hirola	Source
1973	Apr/Jun	wet	10?	13,729	Watson <i>et al</i> 1973
1973				10,000	Duncan 1974
1976	May/Jun	wet	10	14,180	Bunderson 1976, 1977, 1979
1977	Feb/Mar	wet	10	2,278	Dirschl 1978, Wargute & Aligula 1993; Grunblatt <i>et al.</i> 1995
1977	Dec	dry	10	15,950	Bunderson 1979,1985
1978	Feb/Sep	dry/wet	5	7,729	Wargute & Aligula 1993
1978	Jan	wet	10	14,835	Bunderson 1979,1985
1980	July	dry	5	13,000	Williamson 1987
1981	Nov	dry	5	13,488	Wargute & Aligula 1993; Wargute 1994
1983	Apr/May	wet	5	10,843	Wargute & Aligula 1993 Grunblatt <i>et al.</i> 1995
1985	Mar	dry	5	1,595	Wargute & Aligula 1993; Grunblatt <i>et al.</i> 1995
1988	Feb-Apr		5	1,585	Grunblatt <i>e al.</i> 1989; Wargute & Aligula 1993
1993	Mar	wet	5	1,725	Wargute & Aligula 1993
1995	July	dry	1-2	302	Ottichilo <i>et al.</i> 1995
1996	May	wet	2.5	1,504	DRSRS 1997

Cattle and hirola are both grazers that prefer areas of low woody canopy and short grass. Cattle undoubtedly consume large amounts of forage than the hirola. While competition is difficult to demonstrate, it seems logical to

suggest that there are at least intermittent periods of competition for food between livestock and the other large herbivores, including the hirola, particularly during droughts when food is scarce (Bunderson, 1985).

The combined grazing of cattle and wild ungulates helps to create and maintain areas of short, green grass. Thus, it may be that hirola benefit to some degree from the presence of at least some cattle. (Butynski, 2000)

At the present time there is extensive over-grazing with accompanying bare ground and bush encroachment especially in Northern part of the reserve near Manssa-bubu. The over-grazing may be due to the long-term over-stocking of cattle, and to the abandonment of traditional nomadic Somali and Orma cattle grazing practices. As a result of this over-grazing and loss of large areas of pasture to bush, competition between cattle and hirola has therefore increased significantly.

Over-grazing of grasslands and open savannas by livestock creates conditions conducive to the development of bush. Elephants, on-the-other-hand, can ameliorate this effect by feeding on and destroying bush (Laws *et al.*, 1975). Elephant numbers along the Tana River, once high, are now extremely low. In Garissa District, the number of elephants declined from about 7,725 in 1978, to 176 in 1988 (Grunblatt *et. al.*, 1995), to fewer than 100 today (Butynski, 2000). This 98% decline in the number of elephants has essentially removed from the landscape a major factor in the maintenance of the grasslands on which hirola, cattle and many of the other large mammals depend.

People and their livestock have greatly reduced the range of the hirola due to resultant activities such as overgrazing, poaching, charcoal burning, firewood collection and deforestation to acquire building materials. The study identified livestock herders to be causing severe degradation as they set several seasonal campsites within ANR as they practice the nomadic pastoralism.

Increased settlement in the areas of dry season pasture, especially along the Tana and at seasonal water holes, prevents hirola from using large areas of former range. Ambitious livestock development projects in Garissa District, the large irrigation scheme at Bura, the large rice growing scheme

at Garsen, and the establishment of refugee camps are prime examples of factors which destroyed hirola habitat and which drew large numbers of people and livestock onto the range of the hirola.

The study identified 89 campsites within the reserve of which 61 were in use and 28 were abandoned. As the herders move from one place to another to graze their cattle they establish a campsite where they sleep with their cattle. Areas surrounding the campsites are highly degraded as they clear bushes to fence a round "Manyatta" (temporary settlement) where they stay with their livestock. Dahiye, 1999 estimates that there are about 50 villages and settlements within the present range of the hirola in Kenya. Most of these are along the Tana River. One result is an increased degradation of critical grazing areas both for livestock and wildlife (Andanje, 1998b; Dahiye, 1999).

To institute proper conservation measures in ANR, proper inventory of all species and their ecology is a priority. TEP ecological data which is stored in a geodatabase is therefore an important milestone given that it will serve as a reference databank for future inventory and updating. Formation of GIS databank with community participation is important for documenting information and also for enhancing decision support mechanisms in conservation of species of critical importance.

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