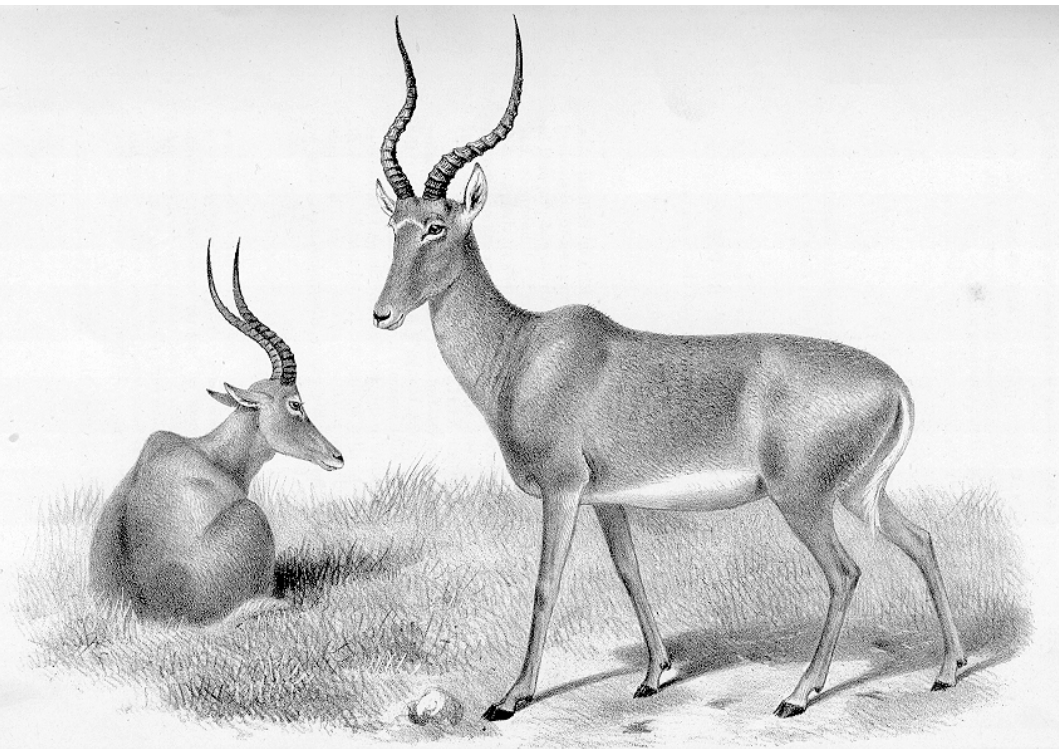
A REPORT FOR THE KENYA WILDLIFE SERVICE

AND THE HIROLA ANTELOPE MANAGEMENT COMMITTEE

*SEPTEMBER 2000*

# INDEPENDENT EVALUATION OF HIROLA ANTELOPE *BEATRAGUS HUNTERI* CONSERVATION STATUS AND CONSERVATION ACTION IN KENYA



Zoo Atlanta's Africa Biodiversity
Conservation Program
National Museums of Kenya

# INDEPENDENT EVALUATION OF
# HIROLA ANTELOPE *BEATRAGUS HUNTERI*
# CONSERVATION STATUS AND CONSERVATION ACTION IN KENYA

Two drafts of this report were provided to the Kenya Wildlife Service and to the Hirola Antelope Management Committee for review. The corrections, suggestions and comments of the reviewers have been incorporated into this final report.

The views expressed in this report are those of the author. They do not necessarily reflect the views of the Kenya Wildlife Service, Hirola Antelope Management Committee, or Zoo Atlanta.

**Cover:** Adult female hirola (Hunter's antelopes) *Beatragus hunteri.* This "Critically Endangered" species and genus is endemic to south-east Kenya and south-west Somalia. This illustration, by a "Mr Wolf", is based on a skin collected by H.C.V. Hunter in 1887 and appeared with Sclater's (1889) initial description of the hirola.

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## ACKNOWLEDGEMENTS

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# 1. EXECUTIVE SUMMARY

The hirola (or Hunter's antelope) *Beatragus hunteri* is a "Critically Endangered" genus and species endemic to south-east Kenya and south-west Somalia. This report compiles much of the information that is available on this species, and reviews and evaluates its taxonomy, abundance, distribution, and conservation status. This report also evaluates the major activities implemented on behalf of the conservation of the hirola and makes recommendations for the conservation of this species/genus both *in situ* and *ex situ.*

The hirola is one of the world's most threatened genera of large mammal. This species is now either in low numbers or extinct in Somalia. The natural population in Kenya declined from about 14,000 individuals in the l970s to somewhere between 500 and 2,000 animals today.

The historic range of the hirola in Kenya and Somalia is estimated at roughly 38,400 km2. The range of the hirola in Kenya declined from about 17,900 km2 in the 1960s to approximately 7,600 km2 in 1996. Today, only the central portion of the species' historic range in Kenya is occupied.

In 1963, a founder population of 10-20 hirola was released 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. This population now ranges over an area of ca. 600 km2.

The decline of the hirola on the species' natural range is probably due to a combination of factors, including disease, drought, poaching, competition with livestock, habitat loss and degradation. This report discusses the possible contribution of each of these factors to the decline of the hirola. The most likely scenario is that a combination of rinderpest and food shortage (due to drought, competition with livestock and habitat loss/degradation) caused the natural population of hirola to crash between 1983 and 1985, from at least 10,000 animals to fewer than 2,000 animals. Continuing disease and poaching on the natural range have probably combined to prevent this population from recovering.

The following are among the more important recommendations put forth in this report for the conservation of the hirola:

- Transfer the focus of the field research programme from the *ex situ* population in Tsavo East National Park to the *in situ* "natural population" in Garissa District and increase the number of Kenya and Somali researchers.
- Abandon attempts to determine the absolute size of the natural population of hirola and begin a monitoring program that provides information on relative population size and population trend.

- Future translocations from the natural population to new sites should only capture yearlings. This should be done by darting from a helicopter. There appears to be no good rational for capturing adults or for capturing entire groups.
- Retain at least part of the populations of newly translocated hirola in large (4-10 km2) bomas. This should significantly enhance population establishment and growth.
- Every effort needs to be made to save the hirola *in situ* while establishing several *ex situ* populations and a captive population as "insurance" against the possible failure to save the *in situ* population. To help ensure the long-term survival of the hirola, five additional populations should be established in Kenya and a viable captive population must be established outside of Kenya. The priority site for the introduction of the next population of hirola on a KWS managed area is Meru National Park, followed by Tsavo West National Park. The priority site for the establishment of a hirola population on a private game sanctuary is the Ol Jogi (Pyramid) Wildlife Sanctuary, followed by the Athi River Game Ranch. Most of the founder animals for these new populations should come from the natural population in Garissa District, after careful and full negotiation with local stakeholders. As an initial undertaking, however, consideration should be given to translocating the threatened Mackinnon Group of 15 hirola from the heavily poached Kulalu Ranch (east of Tsavo East National Park) to the Ol Jogi (Pyramid) Wildlife Sanctuary.
- KWS, with assistance from the Hirola Management Committee, should reestablish its presence within the natural range of the hirola. The priority should be to reestablish the KWS base at Ijara, followed by reestablishment of the KWS base at Massa Bubu.
- KWS, with assistance from the Hirola Management Committee, needs to renew and greatly expand its conservation education, public awareness and public relations work within the natural range of the hirola, particularly in Garissa District. This might be achieved largely by working with and through the Harroru Community Hirola Conservation Group, the Garissa Development Committee and the Garissa District Administration.

## 2. INTRODUCTION

The hirola antelope *Beatragus hunteri* is a "Critically Endangered" species endemic to a small area in south-east Kenya and south-west Somalia. As one of the world's most threatened large mammals, and the only extant member of its genus, the survival of the hirola has been of concern to conservationists since the early l960s. The hirola is now either in low numbers or extinct in Somalia. The

population in Kenya has declined from roughly 14,000 animals in the 1970s to somewhere between 500 and 2,000 today. Much of this decline seems to have occurred between 1983 and 1985.

In 1994, a multi-institutional and multi-disciplinary body known as the "Hirola Task Force" was formed with the objective of conserving the hirola in Kenya. To meet this objective, the Hirola Task Force, together with the Kenya Wildlife Service (KWS), has initiated, promoted and participated in several conservation actions on behalf of the hirola. These include (1) an aerial census in 1995 of the natural population of hirola, (2) commissioning (through the IUCN/SSC Antelope Specialist Group) the preparation in 1996 of a *Hirola Recovery Plan* (3) translocation in 1996 of 29 hirola to Tsavo East National Park, and (4) applied research on the hirola populations both on the natural range and in Tsavo East National Park.

On 8 January 1998, the "Hirola Task Force" was replaced by the "Hirola Management Committee". The Hirola Management Committee and KWS will soon prepare the *Hirola Management Plan.* Preliminary to the writing of this plan, the Hirola Management Committee wants to (1) reassess the conservation status of the hirola in light of recent conservation actions, (2) evaluate the effectiveness of these actions, and (3) make decisions on what to do next. The Hirola Management Committee has, therefore, commissioned this independent evaluation, the stated goals of which are to:

- Update information on the status and trend of the hirola in light of recent field activities.
- Assess the effectiveness of recent actions as a guide for future conservation activities on behalf of the hirola.

The stated objectives of this evaluation are as follows:

- Use the latest data from ground and aerial surveys both in Tsavo East National Park and Garissa District to see if numbers, status and trend need revision.
- Assess the 1996 translocation in terms of methods used, and in terms of numbers caught, transported, released and surviving for varying periods of time.
- Assess the impact of the 1996 removal on the natural population, and of addition to the Tsavo population, with regard to the viability of each population. The Hirola Management Committee allocated this activity to Samuel A. Andanje. He will undertake a new Population Viability Analysis of the two populations of hirola as part of his PhD research project.
- Assess, as far as possible, the cost per hirola both removed from the wild and successfully released and surviving for 6 months.

- Assess the impact of the 1996 translocation in light of the *Hirola Recovery Plan* in regard to a) observations, b) conclusions, and c) recommendations.
- Evaluate the 1996 translocation data for effectiveness of capture method under various criteria.
- Evaluate the Tsavo monitoring approach, especially with regard to the marking techniques for post-release monitoring.
- Review causation for the presumed trends in the natural population.
- Assess the role of the Arawale National Reserve for protecting the hirola *in situ.*
- Evaluate the performance of hirola translocated in 1996, in conjunction with resident groups, where possible.
- Identify factors currently limiting the increase of the natural population.
- Identify key non-biological (social, economic and political) aspects of recent hirola conservation, and assess their significance, and ways to reduce their impact and/or take advantage of opportunities presented for the future.
- Assess whether the present structure of the Hirola Management Committee is the best way of interfacing with KWS. Is another structure necessary?
- On all evidence above, suggest the most effective future conservation actions, including further research priorities.

At the beginning of this evaluation it quickly became clear that what information there was on the hirola, and on the circumstances surrounding its decline and conservation, remained widely scattered through numerous files, unpublished reports, minutes to meetings, and difficult to obtain publications. Much time and effort were spent during this evaluation compiling, analysing, and synthesizing this information. As such, a large part of this report is devoted to a summary of what we know about the hirola antelope. This work was seen as a prerequisite both to this evaluation and to making the best recommendations on how the Hirola Management Committee and KWS might proceed in their efforts to conserve the hirola.

## 3. THE NAME “HIROLA”

The hirola antelope (also known as Hunter’s antelope or Hunter’s hartebeest) was first described as a distinct taxon by Sclater (1889). This species was named by Sclater in honor of H.C.V. Hunter, who collected the type specimen in 1887.

There is some confusion concerning the origin of the common name, “hirola”. According to Hunter (Sclater, 1889) “herola” is the Galla (= Orma) name for this antelope. Others, including Dracopoli (1914), Kingdon (1982), Agatsiva (1995), Dahiye (1999), S. Mohammed (pers. comm., 1999), S. Aden Ali (pers. comm., 1999), and B. Mohamed (pers. comm., 1999) all claim that “hirola” is derived from a Somali, not Orma, word (variously spelled “arrola”, “aroli”, “arawle”, “arawla”, and “carowla”) meaning “tawny”; which is the general colour of the hirola. To add to the confusion, Dracopoli (1914) states that, “The Somali apply the word ‘arrola’ to the impalla (sic.) as well, ...” Kingdon (1982) states that the Orma (Galla) name for the hirola is “blanketta”.

## 4. TAXONOMY OF THE HIROLA

The phylogenetic/taxonomic status of the hirola was, until recently, controversial. All authorities agree that the hirola belongs to the subfamily Alcelaphinae (which includes the hartebeest *Alcelaphus* spp., wildebeest *Connochaetes* spp., and topi/tsessebe/tiang/korrigum/ bontebok/blesbok *Damaliscus* spp.) of the family Bovidae. The hirola is one of the smaller members of the Alcelaphinae. Based on its general morphology, the hirola was variously assigned as a subspecies (*D. 1. hunteri*) of the topi (Haltenorth & Diller, 1977; Walther,1990), a congener (*Damaliscus hunteri*) of the topi (Sclater, 1889; Ansell, 1972; Grubb, 1993), and as the only extant member of the genus *Beatragus (Beatragus hunteri)* (Simpson, 1945; Gentry & Gentry, 1978; Kingdon, 1982, 1997; Spinage, 1986; Gentry, 1990; Pitra *et al*., 1998; Estes, 1999).

Colin Groves (in litt., 19 March 1998) and Jonathan Kingdon (in litt., 23 March 1998), two authorities on the taxonomy of African Artiodactyla, both currently recommend the name *Beatragus hunteri.* Kingdon states, “I find it difficult to accept the lumping of *Beatragus* and *Damaliscus*. I have looked at Alcelaphine fossils in some detail (in the British Museum, Kenya National Museums, and in Pretoria), and have been impressed by the extinct species of *Beatragus,* especially the giant form. They were a very distinctive lineage in the Pleistocene, separate from *Damaliscus;* one could as well lump *Alcelaphus* and *Damaliscus”.*

Kingdon (1997) notes that the structure of the hirola’s large pre-orbital gland and muzzle differ from those of *Alcelaphus* and *Damaliscus.*

*Alcelaphus* spp. and *Damaliscus* spp. are the only bovids so far known that do not test the urine of females to determine estrus (i.e., adult males sample the urine of adult females, then curl the lip and/or open the mouth in the *flehmen* grimace) (Estes, 1991). That hirola urine-test (Andanje & Goeltenboth, 1995; Butynski pers. observ., 1999) is probably of considerable taxonomic significance as it supports the concept that they are an ancient Alcelaphine that, like wildebeest, retains the urine-

testing behaviour found in all other bovids. Estes (1999) argues that this and other findings support moving the hirola out of *Damaliscus* and into *Beatragus.*

New karyotypic (Kumamoto *et al.,* 1996) and mitochondrial DNA (Pitra *et al*., 1998) evidence also support the view that the hirola is distinct from the topi, that the hirola is more closely related to *Alcelaphus* than to *Damaliscus,* and that this species is now best referred to as *Beatragus hunteri*. In the words of a third authority on the taxonomy of African Artiodactyla, Peter Grubb (in litt., 23 May 1998), "The karyological work confirms this conclusion by showing that *Beatragus* is the sister-group of *Damaliscus* + *Alcelaphus* and branched off from the lineage before the later two genera differentiated. *Damaliscus* + *Beatragus* would be a parapatric and therefore unacceptable entity. Therefore it now seems that all parties would agree to the treatment of *Beatragus* as a distinct genus". In short, there is a growing body of evidence, and a general consensus, that the hirola is a monotypic species in the genus *Beatragus.*

The available information suggests that the hirola is the sole extant representative of a long-lasting phylogenetic lineage originating approximately 3.1 million years ago (Gentry, 1990), and that the present population represents the last relic of a once wide-spread genus. Fossils of *Beatragus* are known from the following areas: Omo River, Ethiopia (Gentry, 1985), Olduvai, Tanzania (Leakey, 1965; Gentry & Gentry, 1978), Gobaad, Djibouti (Thomas *et al*., 1984), and probably Elandsfontein, South Africa (Gentry & Gentry, 1978; Kingdon, 1982). The conservation of this highly unique animal should, therefore, be of particular concern both to those interested in questions of bovid evolution, and to those concerned with the conservation of Africa's spectacular diversity of antelopes.

## 5. PHYSICAL DESCRIPTION OF THE HIROLA

The hirola is described in detail in Sclater (1889), Dracopoli (1914), Dorst and Dandelot (1970), and Kingdon (1982, 1997). This antelope resembles a hartebeest but differs in that it is of lighter built and more graceful, with a face that is more moderate in length, withers that are much less elevated above the hindquarters, and horns that lack a basal pedicle. Hirola have a distinctive inverted white chevron between the eyes, white "spectacles" around the eyes, whitish undersides, predominantly white inner ears and tail, large pre-orbital glands, and lyrate, very sharp horns like those of an impala *Aepyceros melampus* (Fig. 1). The coat is uniform yellowish-brown or rufous-tawny. The tail is rather long, reaching the hocks. The sexes look alike, although males are larger and their coats are slightly darker, becoming slaty-grey with age.

I observed hirola both at Tsavo East and in Garissa District, and noted the following details which are not mentioned in the above cited descriptions for this species:

Forehead, back, withers and front of legs from knees to hooves darker tawny than rest of coat. Tail is mostly white but light tan at the base and on the dorsal side. Hairs at the tip of the tail are a mix of white and black. Horns, nostrils, lips, ear-tips, eyes, udder and hooves black. Sides of belly light tawny grading to whitish-tawny (not white) in centre of belly and on insides of legs. Calves paler, more sandy-brown than adults, with a less glossy coat.

Kingdon (1982) gives the following body measurements for hirola (sex and sample size not provided):

Body weight: 80-118 kg

Head + body length: 120-200 cm

Tail length: 30-45 cm

Shoulder height: 100-125 cm

Horn length: 55-72 cm

Dorst and Dandelot (1970) give the following body measurements for hirola (sex and sample size not provided)

Body weight: 73 kg

Shoulder height: 99 cm

Horn length: 61 cm

During the 1996 translocation of hirola to Tsavo, measurements were made on five adult females (Richard Kock unpubl. data). These are as follows:

Body weight: 92 kg, n = 1

Head and body length: mean = 175 cm, range = 164-180 cm, n=3

Tail length: mean = 40 cm, range = 38-41 cm, n = 4

Shoulder height: mean = 102 cm, range = 95-110 cm, n = 3

Girth: mean = 113 cm, range = 107-130 cm, n = 5

Horn length: mean = 49 cm, range = 47-50 cm, n = 3

Horn spread (greatest outside width): mean = 20 cm, range = 15-25 cm, n = 3.

Butynski (unpubl. data) obtained the following measurements from one adult female hirola (with calf) in Tsavo East National Park:

Head and body length: 173 cm

Tail length: 36 cm (excluding 10 cm of hair beyond the bony tip)

Ear length: 19 cm

Horn length: 44 cm (straight distance from base to tip)

Horn spread: 32 cm (greatest outside width)

Sclater (1889) gives the horn length of one adult male as 61 cm and of one adult female as 51 cm.

Figure 1: Adult hirola antelope *Beatragus hunteri.* Note the distinctive inverted white chevron between the eyes, the white “spectacles” around the eyes, the large pre-orbital glands, and sharp, lyrate horns. This illustration, which appeared in Sclater’s (1989) original description of the hirola, is by P. Smit and is based on a photograph forwarded by H.C.V. Hunter.

According to *Rowland Ward's Records of Big Game*, XI edition (Best *et al.*, 1962) the longest horns ever recorded for a male hirola are 72 cm in length.

Additional measurements of the horns of hirola are provided in Table 1.

Table 1: Measurements of horns of 16 skulls of adult hirola antelope *Beatragus hunteri* housed at the National Museums of Kenya in 1999 (Butynski, unpubl. data).

| | Length* (cm) | Distance between tips (cm) | Greatest outside width (cm) |
|---|---|---|---|
| Adult male | | | |
| Mean | 52.0 | 33.6 | 36.7 |
| Range | 45-60 | 26-38 | 35-40 |
| Sample size | 10 | 8 | 10 |
| Adult female | | | |
| Mean | 42.0 | 27.5 | 29.7 |
| Range | 35-49 | 22-35 | 24-33 |
| Sample size | 5 | 4 | 6 |

* Straight distance from base to tip.

# 6. DISTRIBUTION OF THE HIROLA

## 6.1 Natural Geographic Range in Kenya and Somalia

Kingdon (1982) states that the hirola "...is probably more generalized than either *Damaliscus* or *Alcelaphus* and it can be suggested with some confidence that it represents the last relic population of a formerly widely spread type". The fossil evidence indicates that *Beatragus* was once widespread in eastern Africa (Ethiopia, Djibouti, Kenya, and Tanzania) and probably ranged into South Africa (Section 4).

In this report, the population of hirola found within the species' natural geographic range will be referred to as the "natural population". The population translocated to Tsavo East National Park will be referred to as the "Tsavo population".

In this report, the term "geographic range" is used. "Geographic range" is equivalent to the "extent of occurrence" as defined by IUCN (2000). That is,

"...the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrence of a taxon, excluding cases of vagrancy. This measure may exclude discontinuities or disjunctions within the overall distributions of taxa (*e.g.*, large areas of obviously unsuitable habitat) (but see 'area of occupancy'). Extent of occurrence can often be measured by a minimum convex polygon (the smallest polygon in which no internal angle exceeds 180 degrees and which contains all the sites of occurrence)".

Since the hirola probably uses virtually all of the area within its "extent of occurrence", this species' "extent of occurrence" is probably only slightly larger than its "area of occupancy" as defined by IUCN (2000). That is,

"...the area within its "extent of occurrence" which is occupied by a taxon, excluding cases of vagrancy. The measure reflects the fact that a taxon will not usually occur throughout the area of its extent of occurrence, which may contain unsuitable or unoccupied habitats".

H.C.V. Hunter obtained the first scientific specimens of the hirola in 1887(Sclater, 1889). He states that "We first met with this antelope about 150 miles up the Tana River". Here he saw a pair of young males and shot one. He goes on to say, "We did not come across these antelopes again for some days, but then met with them in large numbers and got several specimens". Unfortunately, Hunter does not say in which direction(s) he was traveling at the time. He also states, "This species certainly does not extend down to the coast, but we saw them as far as the furthest point we reached up the river, at a place called Mussa". The Somalis informed him that the distribution of the hirola in Somalia "...extended along the coast up to Kismayu".

Hunter says that Mussa was located about 250 mi (400 km) up the Tana River, that this was the farthest point he reached during this expedition, and that hirola were present there. If Hunter's distance estimate is based on following the meanders of the Tana River, then 250 mi (400 km) up the Tana River places the former geographic range of the hirola roughly 120 km beyond the present northern range for this species. If Hunter's distance estimate is based on direct line measurements along the Tana River, then he observed hirola roughly 220 km farther along the Tana River than they are found at present.

However Hunter estimated his distances, he places the geographic range of the hirola in 1885 much farther inland than any later records suggest. This fact, together with the fact that even at that early date there was probably no suitable habitat for the hirola north or north-west of Garissa, leads me to conclude that either Hunter grossly over-estimated his distance from the Indian Ocean or that he was misquoted. Also, I have not been able to find "Mussa" on any map or in any gazetteer. There is, however, a village by the name of Massa Bubu that is located on the Tana River, south of Bura, near the Arawale National Reserve (Fig. 2). Since at least 1932 (Ritchie, 1932), Massa Bubu has been used as a reference point for the northern-most distribution of hirola along the Tana River. Bashir Sheikh Mohammed, former District Warden, lived in Massa Bubu from 1986-1991. We both are reasonably certain that this is the place that Hunter refers to as "Mussa". Bunderson (1976) apparently reached the same conclusion, although he does not address the point directly. After reviewing the information provided by Hunter (in Sclater,1889) and Dracopoli (1914), Bunderson states that the distribution he observed for the hirola in Kenya in 1976 "...coincides almost exactly with that given by Hunter in 1885 and especially by Dracopoli...".

Dracopoli (1914) wrote "...I took especial pains to discover the limits of its range. I have come to the conclusion that they are not found west of longitude 40°E. or north of latitude 0°35'S. They do not inhabit the country south of the Tana nor the district immediately adjacent to the coast. The Somali apply the word 'arrola' to the impalla (sic.) as well, and this has led to the report that Hunter's antelope is to be found in the Lorian District. This report I cannot credit, as the country near the swamp is unsuitable to their habits, and I saw no trace of any kind while I was there to lead me to believe they were to be found in that district". Note that here, Dracopoli almost certainly means 0°35'N, not 0°35'S. Lak Dere is at about 0°35'N.

Ritchie (1932) described the geographic range of the hirola as running "for about one hundred and twenty miles, first north easterly and then northward". Here lies a narrow strip of seasonally arid mixed bush and grassland bounded by waterless bushland to the north and a coastal forest-savannah mosaic to the south.

Concerning the historic range of the hirola, I conclude that the southern limit was roughly 30-50 km inland from, and parallel to, the Indian Ocean, from near Garsen on the Tana River to north of Kismayu on the Juba River (Fig. 2). The northern limit of the historic range of the hirola is less well known, but seems to have extended from about half-way between Bura and Garissa (*i.e*, at Massa Bubu) on the Tana River, north-east to about 0 35'N in the Lack Dere (=Lag Dera = Lake Dera) region, and then south-east to near the Juba River. There is apparently no evidence to support the distribution maps of Sidney (1965) and Kingdon (1997) which show the geographic range extending to the east of the Juba River. Likewise, there is no support for reports that the historic range

of the hirola extended northwards in Kenya to the Lorian Swamp (Dracopoli, 1914).

Stewart and Stewart (1963) provide the first detailed distribution map for the hirola in Kenya (Fig. 3). They state that, “What little information exists about this species suggests that its range and provided by the staff of Game Department and National Parks, as well as by professional hunters, foresters, agricultural and veterinary officers, and others. It was produced by the Fauna Research Unit of the Kenya Game Department and is apparently the first map showing the distribution of the hirola in Kenya.

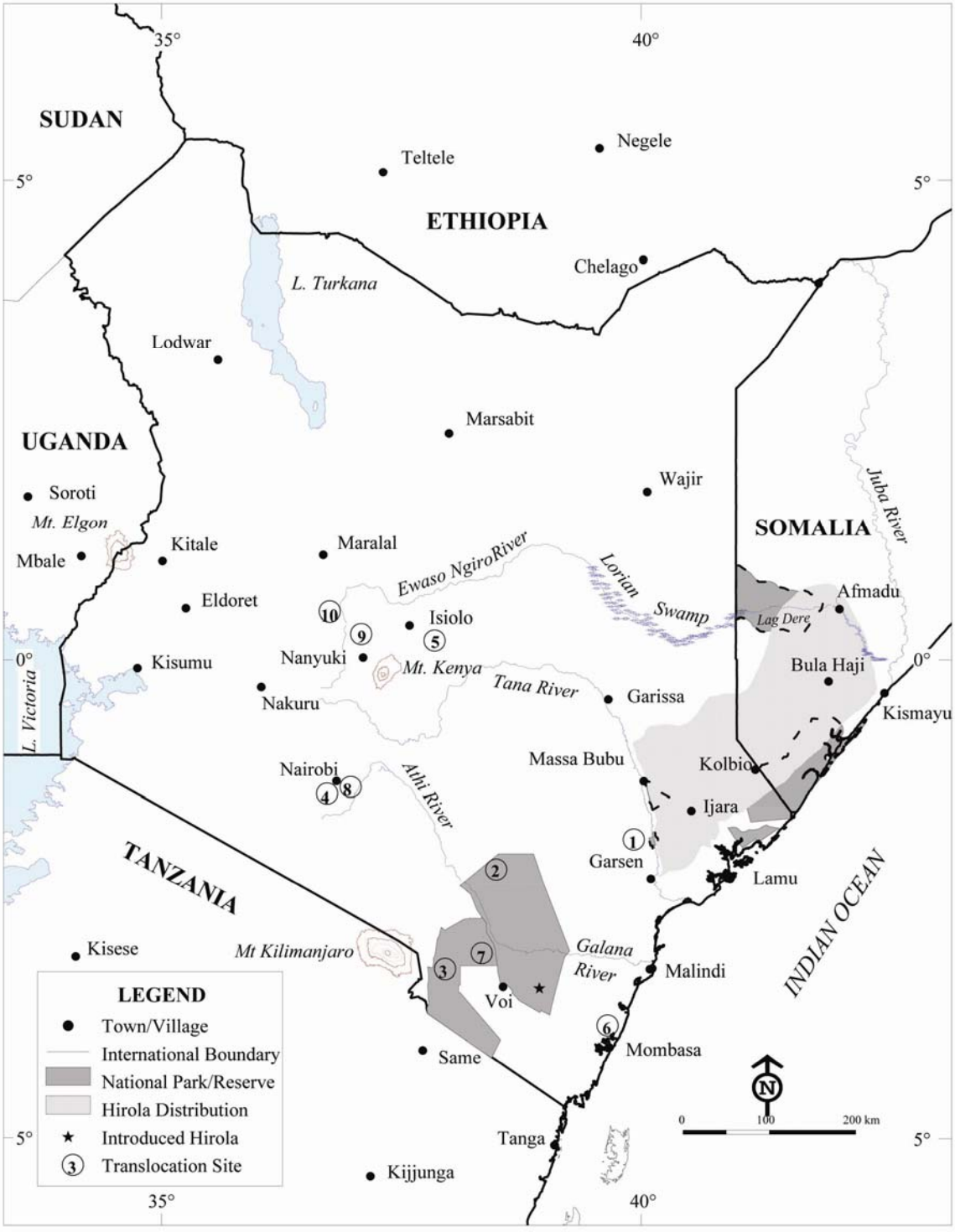
numbers in Kenya have not altered significantly during the past seventy-five years”. That is, since Hunter collected the first hirola for science in 1886.

A few years later, however, Brown (1965) made the first mention of a decline in the size of the geographic range of the hirola. Brown, however, apparently had no first hand information on the hirola. He seems to have referred to the apparently wrong information provided by Grimwood (1963, 1964) and Donaldson (1964) which indicated (based only on scant ground surveys) that the hirola population in the early 1960s was 1,500 animals or less. The first aerial surveys were to soon show that the population at the time was probably between 10,000 and 16,000 individuals.

Like Stewart and Stewart (1963), Bunderson (1976) also concluded that the natural range of the hirola in Kenya had not changed significantly during the 90 years from l887 and 1976. The only difference he noted was that hirola occurred somewhat farther south into Lamu District than stated by earlier observers. Using the computer software Map-Info (“area of polygon method”), I estimate the size of this additional range to be about 690 km2. Bunderson (1976) suggested that this region in Lamu District did not represent an extension of the range of the hirola in recent

Figure 2: Approximate historic distribution of the hirola antelope *Beatragus hunteri* in Kenya and Somalia. This map, a composite of Figures 8 and 10 of this report, incorporates all of the best documented sightings of the hirola. This map suggests that the total historic range of the hirola was about 38,400 km2, 47% of which was in Kenya (ca. 17,900 km2) and 53% (ca. 20,500 km2) in Somalia. The black star in Tsavo East National Park indicates the site of the 1963 and 1996 translocations. Also shown are the locations of the 10 sites which have been proposed for the establishment of new populations of hirola. These are as follows:

1. West Bank of Tana River Primate National Reserve
2. North-west Tsavo East National Park
3. Tsavo West National Park
4. Nairobi National Park
5. Meru National Park
6. Baobab Farm
7. Hilton Wildlife Sanctuary, Taita Hills
8. Athi River Game Ranching
9. Lewa Downs Wildlife Sanctuary
10. Ol Jogi (Pyramid) Wildlife Sanctuary


35°
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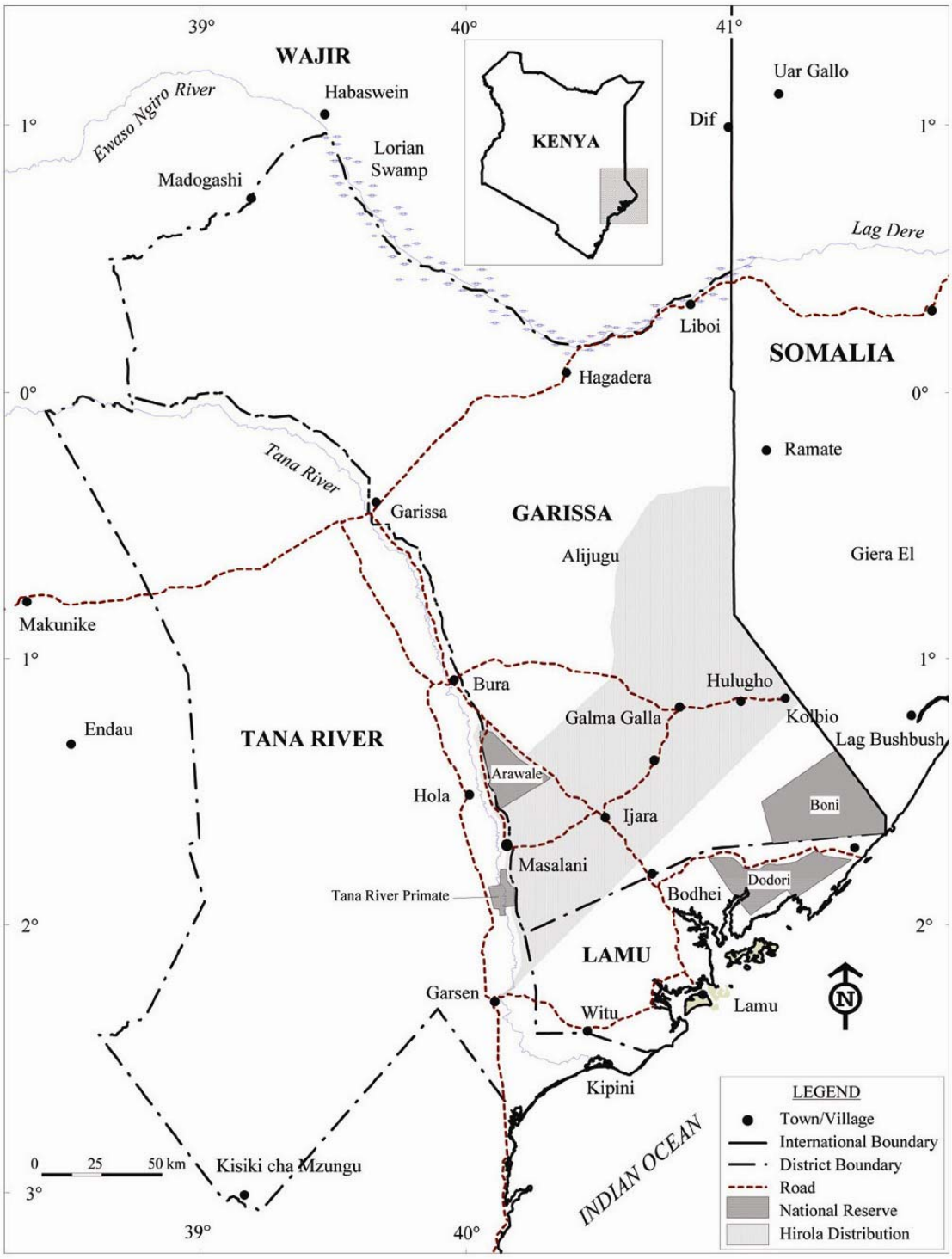
SUDAN
Teltele
Negele
5°
ETHIOPIA
Chelago
L. Turkana
Lodwar
Marsabit
UGANDA
Wajir
Soroti
Mt. Elgon
SOMALIA
Juba River
Kitale
Maralal
Mbale
Ewaso NgiroRiver
Lorian Swamp
Afmadu
Eldoret
Isiolo
Lag Dere
Kisumu
Nanyuki
Mt. Kenya
Bula Haji
0°
L. Victoria
Nakuru
Tana River
Garissa
Kismayu
Massa Bubu
Kolbio
Nairobi
Athi River
Ijara
Garsen
Lamu
TANZANIA
INDIAN OCEAN
Kisese
Mt Kilimanjaro
Galana River
Malindi
Voi
Same
Mombasa
Tanga
Kijjunga
LEGEND
Town/Village
International Boundary
National Park/Reserve
Hirola Distribution
Introduced Hirola
Translocation Site
N
0
100
200 km

Figure 3: Known distribution of the hirola antelope *Beatragus hunteri* in Kenya in 1963 (ca. 11,980 km2) (Stewart & Stewart, 1963). This map is based on information


39°
40°
41°
WAJIR
Habaswein
Ewaso Ngiro River
Lorian Swamp
Madogashi
KENYA
Uar Gallo
Dif
1°
Lag Dere
Liboi
SOMALIA
Hagadera
0°
Ramate
Tana River
Garissa
GARISSA
Alijugu
Giera El
Makunike
Bura
Hulugho
Galma Galla
Kolbio
Lag Bushbush
Endau
TANA RIVER
Arawale
Hola
Ijara
Boni
Masalani
Dodori
Tana River Primate
Bodhei
2°
LAMU
Garsen
Witu
Lamu
N
Kipini
LEGEND
Town/Village
International Boundary
District Boundary
Road
National Reserve
Hirola Distribution
0 25 50 km
Kisiki cha Mzungu
3°
INDIAN OCEAN

times, but was simply due to the fact that early observers never surveyed this region.

Although Bunderson (1976) indicated that the geographic range of the hirola in Kenya had not altered much during the 75 years prior to his research, a comparison of the maps of Stewart and Stewart (1963), and Bunderson (1976) shows that this was not the case. There is an area of about 2,550 km2 which extends approximately 40-90 km north of Galma Galla along the Kenya-Somalia border which apparently was used by hirola as of about 1963 but in which no hirola were found during the 1976 or subsequent surveys (compare Figs. 2 & 3 with Fig. 4).

Bunderson (1977) estimated the geographic range of the hirola in 1976 to cover 12,000 km2 in Kenya and another 2,000-3,000 km2 in Somalia, for a total of 14,000-15,000 km2. Applying MapInfo to Figure 4, the geographic range of the hirola in Kenya in 1976 was about 12,500 km2 [*contra* the estimate of 15,000 km2 made from this same range map by Agatsiva (1995) and Sinange (1992)].

As of 1988, hirola used the area along the Kenya-Somali border from about 45 km north of Kolbio to 15 km south of Kolbio (Fig. 5). Neither the 1995 census (Fig. 6) nor the 1996 census (Fig. 7) shows hirola within about 15 km of this border (but note that the 1996 census did not, for security reasons, cover the region within 10 km of the Kenya/ Somali border). The size of the area here that was used during the 1980s, but which was no longer used as of 1995, is approximately 900 km2.

The known historic limits of the geographic range of the hirola in Kenya, is presented in Figure 8. The information available suggests that until at least the early l960s (possibly the early 1970s), the geographic range of the hirola in Kenya was approximately 17,900 km2 (using MapInfo), and that this range was similar to that used by the species at the time of its discovery more than 75 years earlier (in 1887). The distribution map from the 1995 census (Fig. 6), and the distribution map from the 1996 census (Fig. 7) show the geographic range of the hirola in Kenya to be 9,170 km2 and 7,560 km2, respectively (using MapInfo). Thus, the geographic range of the hirola in Kenya in 1996 was only about 42% of the species' historic range (Fig. 9). All of this loss of range probably occurred since the l960s, possibly since the early l970s. The geographic range of the hirola in Kenya has been greatly reduced from all directions so that today only the central portion of the species' historic range is occupied (compare Fig. 8 with Figs. 6 & 7). These conclusions are very different from those reached by several earlier authors (*e.g.*, Wargute & Aligula, 1993; Agatsiva, 1995) who concluded that the geographic range of the hirola has changed little since 1973.

About 92% (16,530 km2) of the historic range of the hirola in Kenya was in Garissa District (North Eastern Province), while about 8% (1,370 km2) was in Lamu District (Coast Province) (Fig. 8). During the 1995 survey, more than 99% of the hirola's geographic range was in Garissa District (Fig. 6), and during the

1996 survey all of the hirola observed were in Garissa District (Fig. 7). In other words, Lamu District supported few, if any, hirola as of 1996.

The size of the geographic range of the hirola has apparently declined in historic times even more in Somalia than in Kenya. What little information there is on the geographic range of the hirola in Somalia is pieced together in Figure 10 in an attempt to reconstruct the historic range (see below). From Figure 10, the historic range in Somalia is estimated at roughly 20,500 km2 (using MapInfo). If so, the total historic range for the hirola in Kenya and Somalia was roughly 38,400 km2, with about 47% of the range in Kenya and 53% of the range in Somalia (Fig. 2).

The approximate size of the geographic range of hirola in 1974/75 in the north part of Bushbush National Park and to the north of this Park is estimated from Figure 10 to be about 3,640 km2 (using MapInfo). It should be noted that the area to the north of Lag Badana was not surveyed in 1974/75, and that these are, in fact, the only systematically collected survey data for any part of the hirola's range in Somalia.

### 6.2 Introduced Population in Tsavo East National Park, Kenya

In 1963, a population of hirola was introduced into Tsavo East National Park, about 200 km south-east of the south-eastern limit of the species' known natural range near Garsen in Tana District (Fig. 2). This exercise was popularly referred to as "Operation Hunter's" (Grimwood, 1963, 1964; Donaldson, 1964). In 1996, a second group of hirola was moved to Tsavo East during "Operation Hirola" (Kock *et al*., 1998). During both translocations the hirola were released on the Dika Plains ca. 15 km ESE of Aruba Dam (*i.e*., ca. 2 km south of the Voi River and Satao Camp) (see maps in Andanje, l997a, 1998a).

Figure 11 shows the location of the release site, and the range of the resident hirola population in Tsavo East as of 1997 (Andanje, l997a). Extrapolating from the map in Figure 11, the range of the population of resident hirola in this park is about 600 km2 (using MapInfo).

Figure 4: Known distribution of the hirola antelope *Beatraqus hunteri* in Kenya in 1976 (Ca. 12,500 km2) (Bunderson,1976). This map is based on data compiled during five aerial surveys from January-July 1976, and is the first hirola distribution map based upon systematic aerial surveys. Note that Figure 2 in Agatsiva (1995) is not from Bunderson (1976) as claimed in the caption.

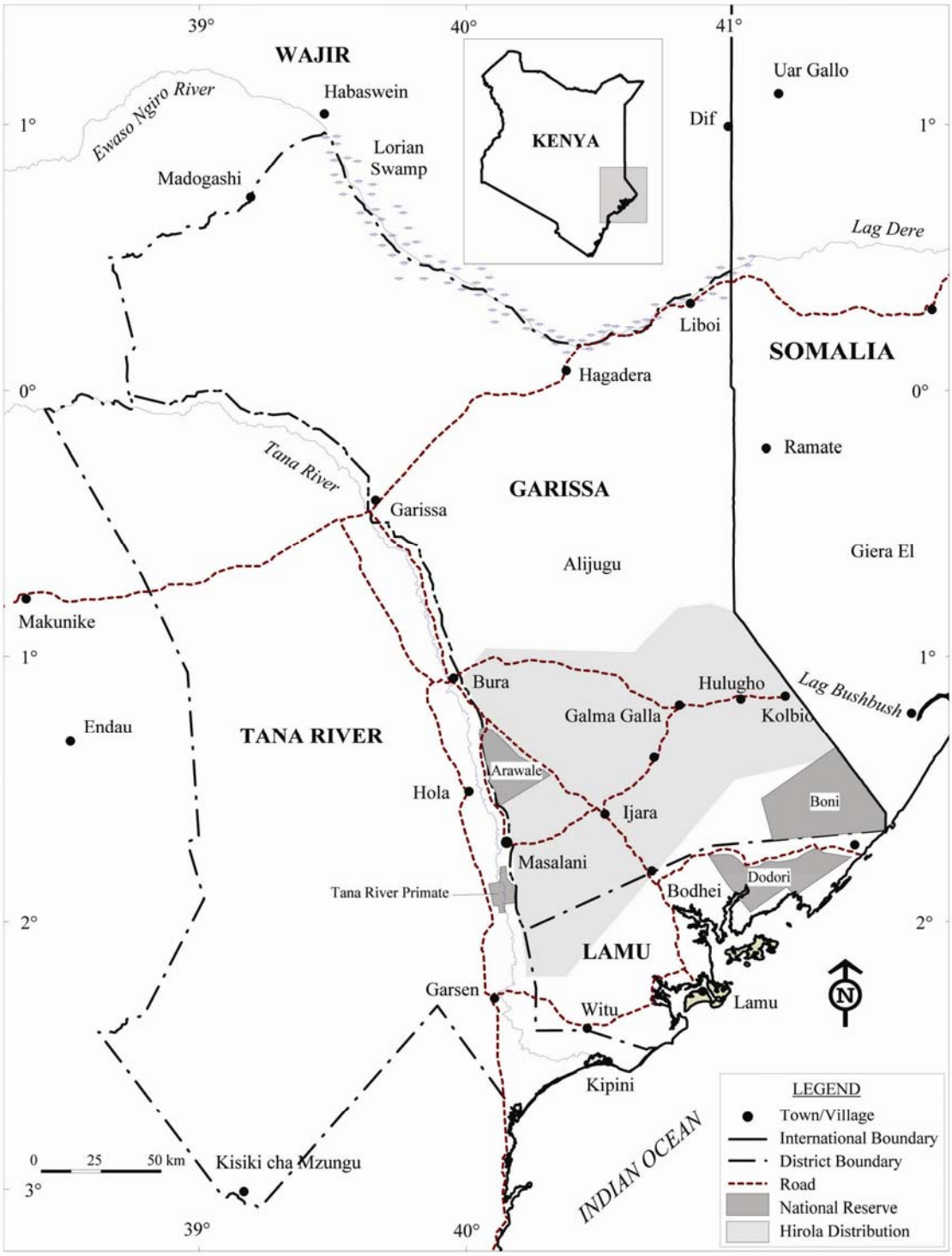

39°
40°
41°
WAJIR
Habaswein
Uar Gallo
Ewaso Ngiro River
1°
Dif
1°
KENYA
Lorian
Swamp
Madogashi
Lag Dere
Liboi
SOMALIA
Hagadera
0°
0°
Ramate
Tana River
GARISSA
Garissa
Giera El
Alijugu
Makunike
1°
1°
Bura
Hulugho
Lag Bushbush
Galma Galla
Kolbio
Endau
TANA RIVER
Arawale
Hola
Boni
Ijara
Masalani
Dodori
Tana River Primate
Bodhei
2°
2°
LAMU
Garsen
Witu
Lamu
N
Kipini
LEGEND
Town/Village
International Boundary
District Boundary
Road
National Reserve
Hirola Distribution
0
25
50 km
Kisiki cha Mzungu
INDIAN OCEAN
3°
39°
40°

Figure 5: Known distribution of the hirola antelope *Beatragus hunteri* in Kenya during 1977-1988 as determined from seven KREMU/DRSRS aerial surveys (ca. 10,630 km2) (Table 2) (adapted from Agatsiva, 1995).

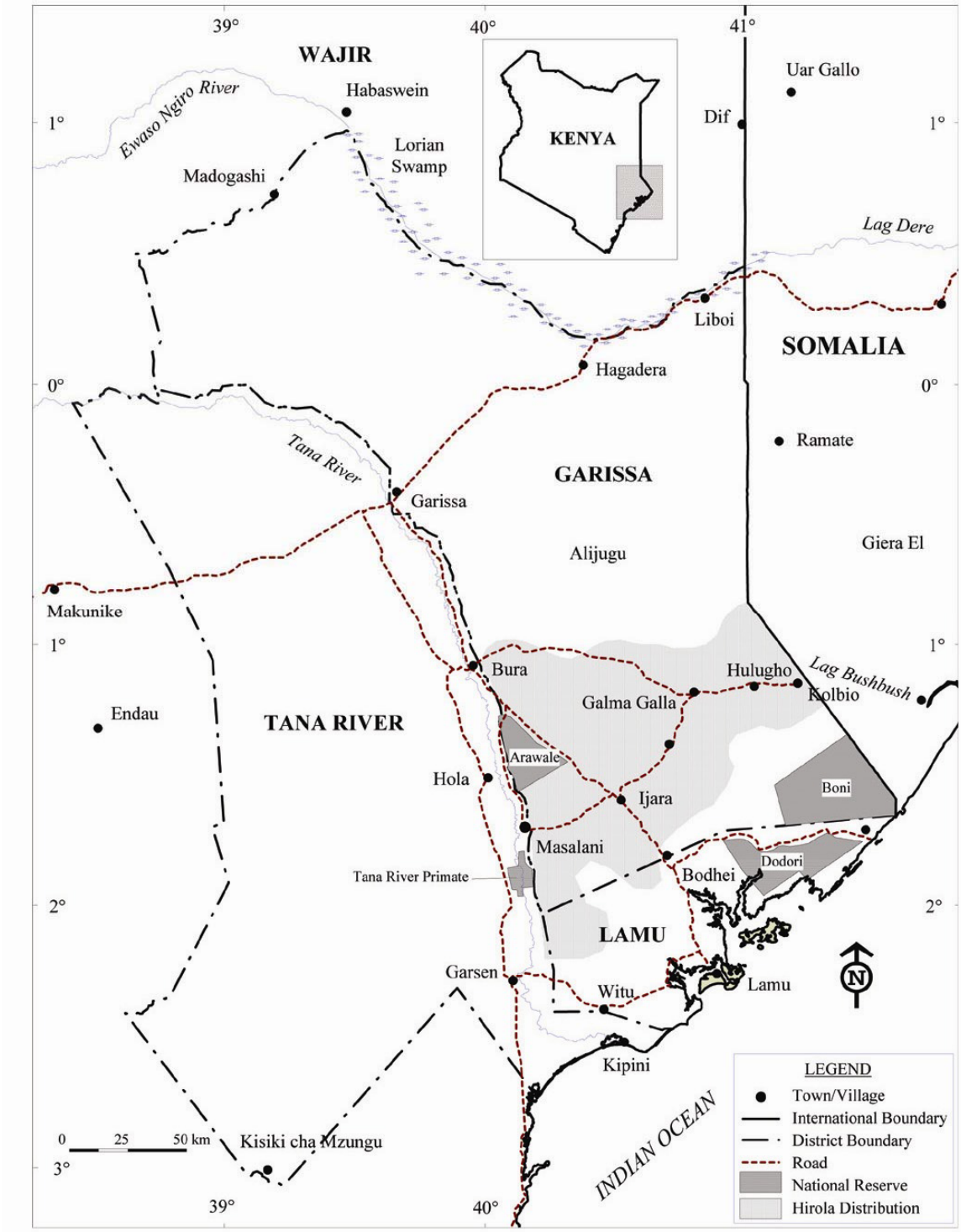

39°
40°
41°
WAJIR
Habaswein
Ewaso Ngiro River
Lorian Swamp
Madogashi
KENYA
Uar Gallo
Dif
1°
Lag Dere
Liboi
SOMALIA
Hagadera
0°
Ramate
Tana River
GARISSA
Garissa
Alijugu
Giera El
Makunike
Bura
Hulugho
Lag Bushbush
Kolbio
Galma Galla
Endau
TANA RIVER
Arawale
Hola
Ijara
Boni
Masalani
Dodori
Tana River Primate
Bodhei
2°
LAMU
Garsen
Witu
Lamu
N
Kipini
LEGEND
Town/Village
International Boundary
District Boundary
Road
National Reserve
Hirola Distribution
0 25 50 km
Kisiki cha Mzungu
3°
INDIAN OCEAN

Figure 6: Known distribution of the hirola antelope *Beatragus hunteri* in Kenya during July 1995 based upon a single aerial survey (ca. 9,170 km2) (Ottichilo *et al*., 1995). Note the considerable decline in the range of this species since the 1977-1988 period (Fig. 5) and against the historic range (Fig. 8).

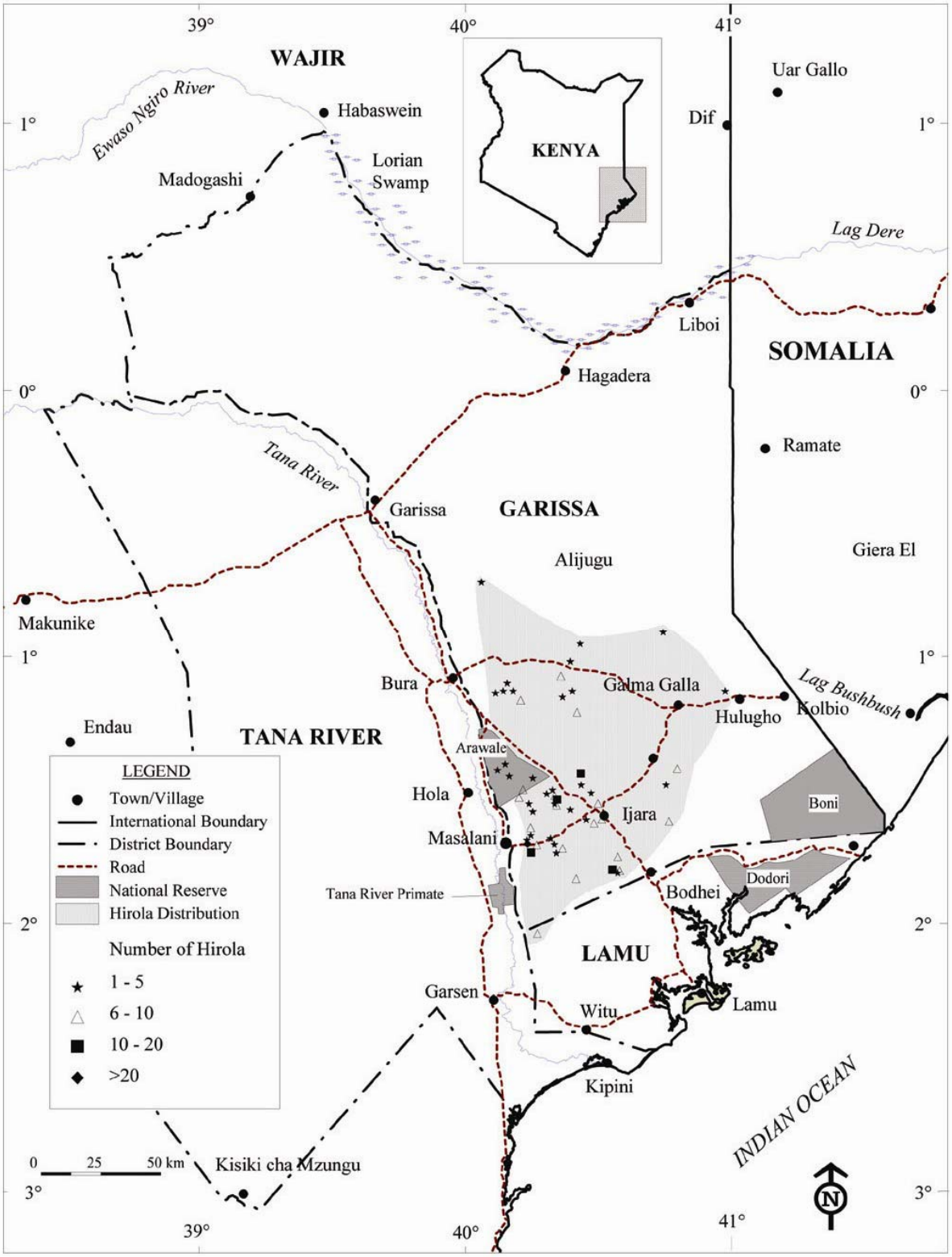

39°
40°
41°
WAJIR
Ewaso Ngiro River
Habaswein
Uar Gallo
Dif
1°
KENYA
Madogashi
Lorian
Swamp
Lag Dere
Liboi
SOMALIA
Hagadera
0°
Ramate
Tana River
Garissa
GARISSA
Alijugu
Giera El
Makunike
Bura
Galma Galla
Lag Bushbush
Hulugho
Kolbio
Endau
TANA RIVER
Arawale
Hola
Ijara
Boni
Masalani
Dodori
Tana River Primate
Bodhei
2°
LAMU
Garsen
Witu
Lamu
Kipini
INDIAN OCEAN
Kisiki cha Mzungu
3°
LEGEND
Town/Village
International Boundary
District Boundary
Road
National Reserve
Hirola Distribution
Number of Hirola
1 - 5
6 - 10
10 - 20
>20
0
25
50 km
N

Figure 7: Known distribution of the hirola antelope *Beatragus hunteri* in Kenya during May 1996 based upon a single aerial survey (ca. 7,560 km2) (DRSRS, l996a). For security reasons, this survey did not cover the region within 10 km of the Kenya/Somali border. This wet season survey shows a geographic range for the hirola similar to that found during the dry season survey conducted in 1995 (Fig. 6). Note the considerable decline in the range of this species since the 1977-1988 period (Fig. 5), and from the historic range (Fig. 8).

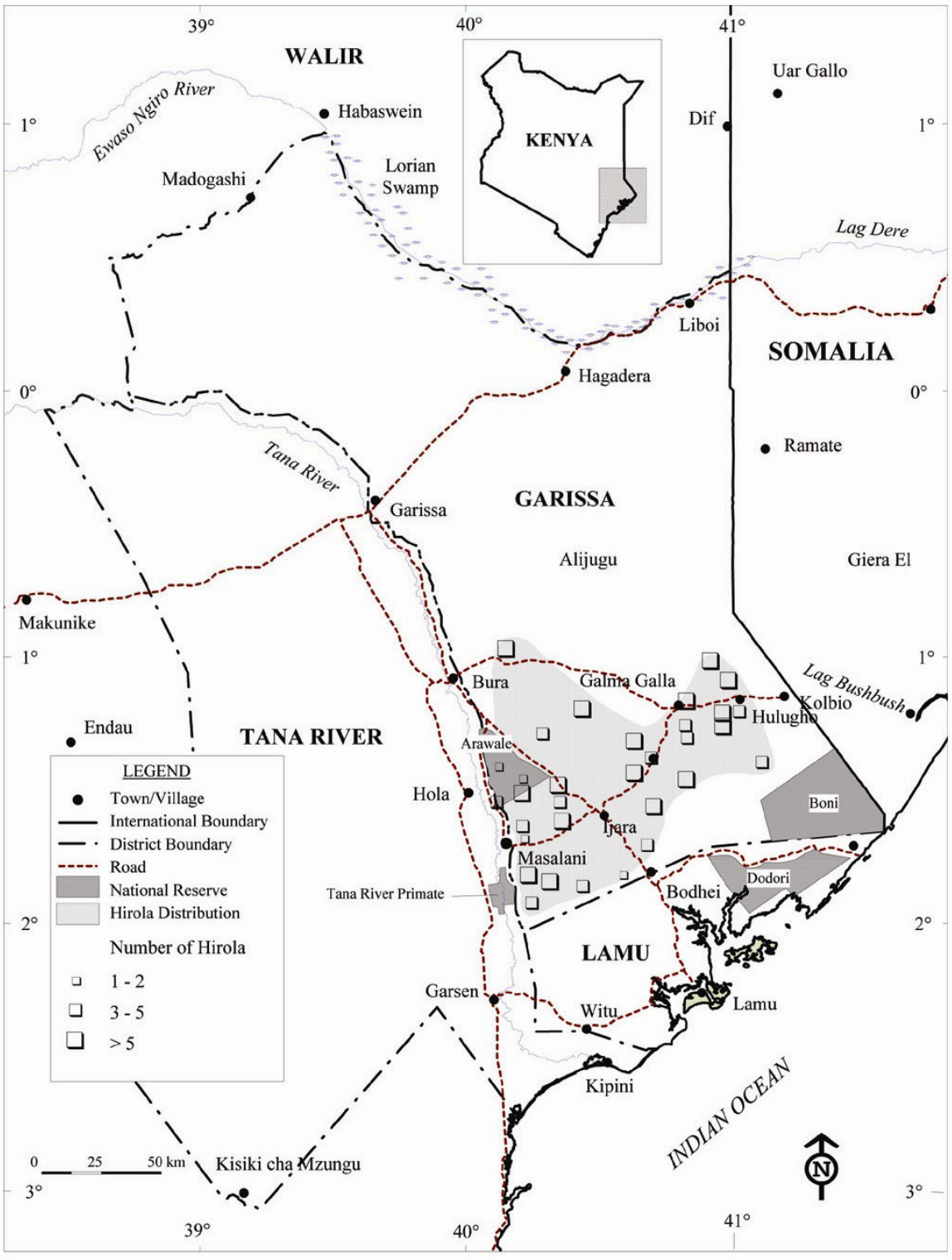

39°
40°
41°
WALIR
Ewaso Ngiro River
Habaswein
Madogashi
Lorian Swamp
KENYA
Uar Gallo
Dif
Lag Dere
Liboi
SOMALIA
Hagadera
Ramate
Tana River
GARISSA
Garissa
Alijugu
Giera El
Makunike
Bura
Galma Galla
Lag Bushbush
Kolbio
Hulugho
Endau
TANA RIVER
Arawale
Hola
Boni
Ijara
Masalani
Dodori
Tana River Primate
Bodhei
LAMU
Garsen
Witu
Lamu
Kipini
INDIAN OCEAN
LEGEND
Town/Village
International Boundary
District Boundary
Road
National Reserve
Hirola Distribution
Number of Hirola
1 - 2
3 - 5
> 5
0 25 50 km
Kisiki cha Mzungu
N

Figure 8: Known distribution of the hirola antelope *Beatragus hunteri* in Kenya during 1963-1996 (ca. 17,900 km2). This is a composite of the distribution data presented in Figures 3-7 and represents the best information available on the certain, or near certain, distribution of the hirola during this period. This can be taken to be the historic range of the hirola in Kenya. Compare this distribution with that of the hirola in 1995 (Fig. 6) and 1996 (Fig 7). Also shown here, are the proposed extension of the Arawale National Reserve, the proposed "Community Hirola Sanctuary", and the sanctuary proposed for the area south of Galma Galla.

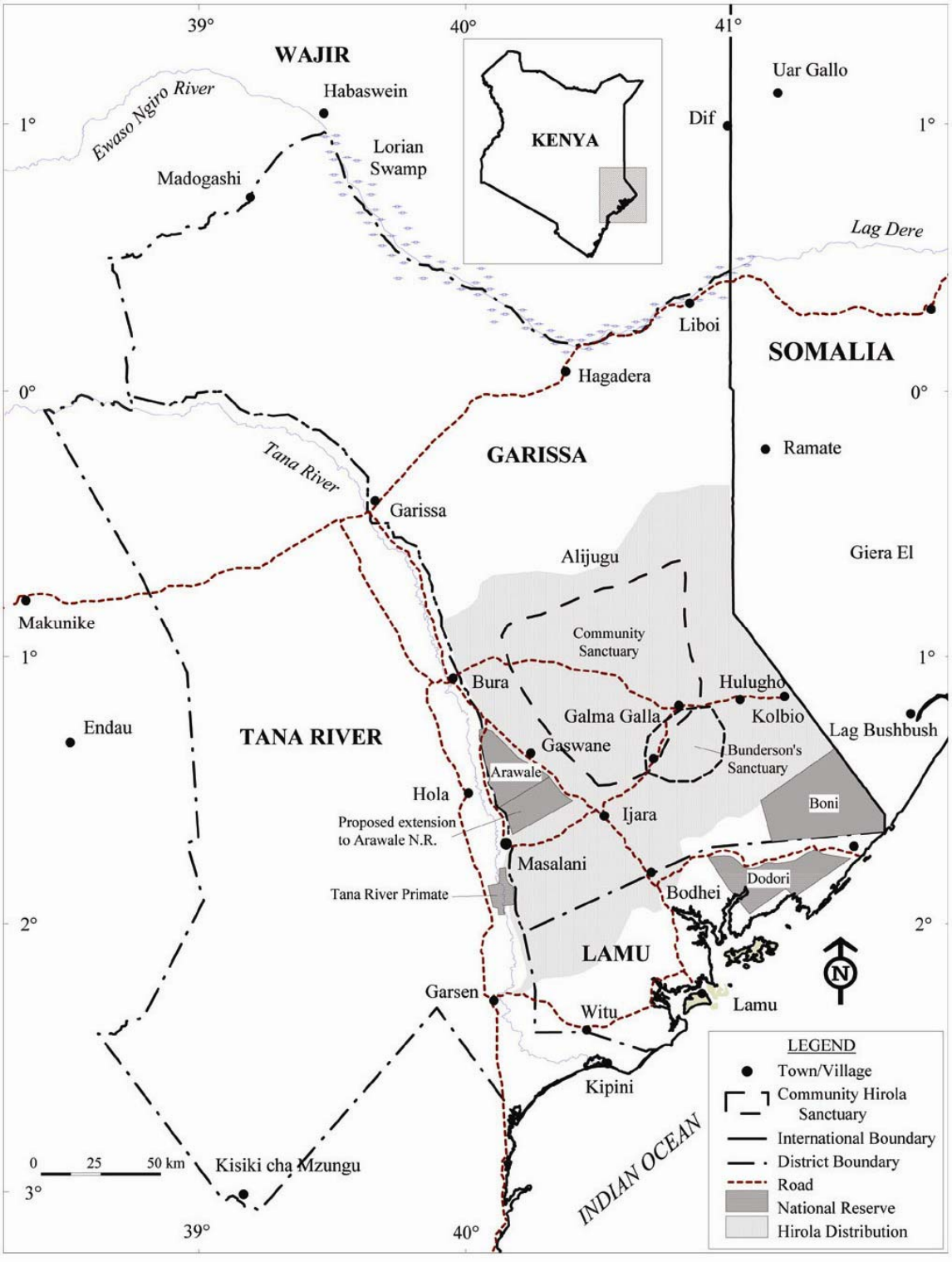

39°
40°
41°
WAJIR
Habaswein
Ewaso Ngiro River
Lorian Swamp
Madogashi
KENYA
Uar Gallo
Dif
1°
Lag Dere
Liboi
SOMALIA
Hagadera
0°
GARISSA
Ramate
Tana River
Garissa
Alijugu
Giera El
Makunike
Community Sanctuary
Bura
Hulugho
Kolbio
Lag Bushbush
Endau
TANA RIVER
Galma Galla
Gaswane
Bunderson's Sanctuary
Arawale
Hola
Boni
Proposed extension to Arawale N.R.
Ijara
Masalani
Dodori
Tana River Primate
Bodhei
2°
LAMU
Garsen
Witu
Lamu
Kipini
INDIAN OCEAN
0 25 50 km
Kisiki cha Mzungu
3°
LEGEND
Town/Village
Community Hirola Sanctuary
International Boundary
District Boundary
Road
National Reserve
Hirola Distribution

Figure 9: Changes in the size of the geographic range of the natural population of hirola antelope *Beatragus hunteri* in Kenya from 1885-1996. Sources of these data are given in Section 6.1 and in Table 2. There was no noticeable decline in the size of the range of this population from the time of its discovery in 1887 until about the late 1960s or early 1970s. Since then, the range in Kenya has declined steadily to about 42% of the species' former range.

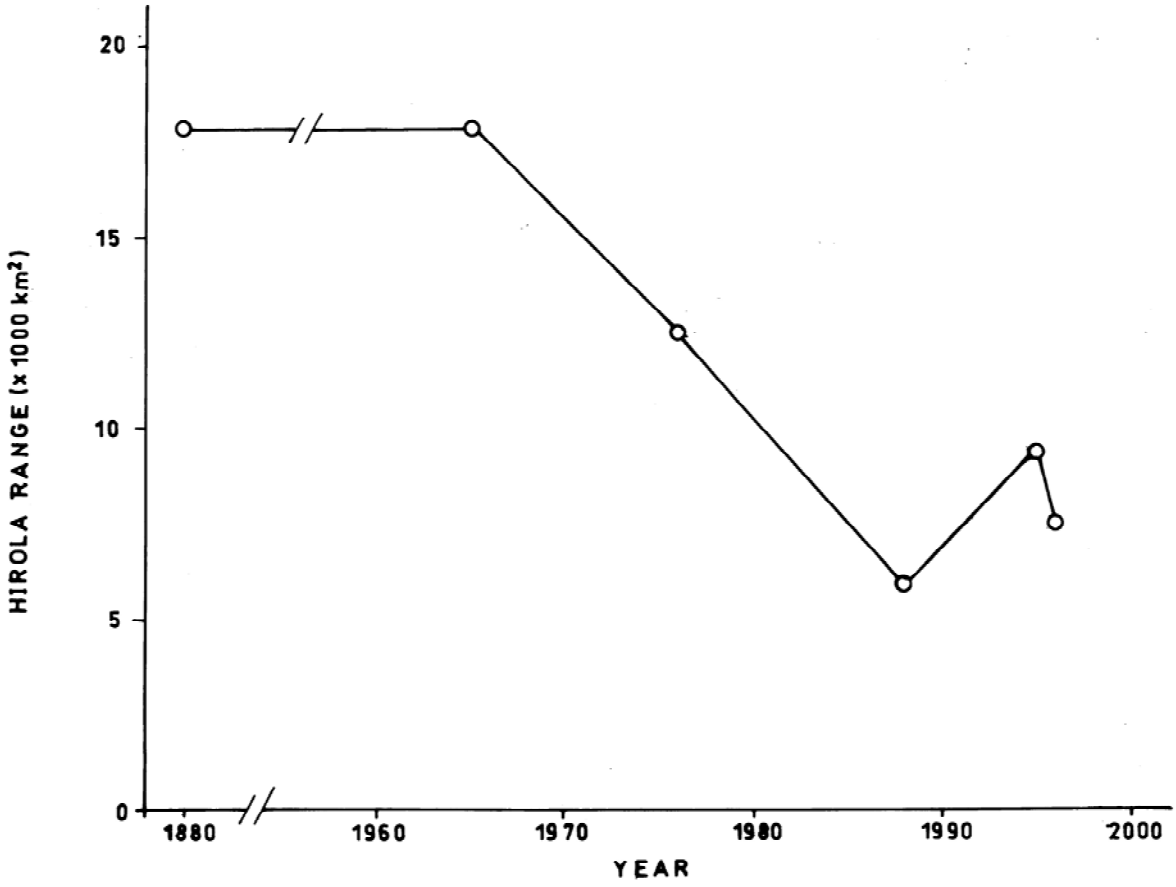

HIROLA RANGE (x 1000 km²)
20
15
10
5
0
1880
1960
1970
1980
1990
2000
YEAR

Figure 10: Approximate historic distribution of the hirola antelope *Beatragus hunteri* in Somalia based upon a review of the literature (Abel & Killeh, 1975, 1976a,b; Bunderson, 1976, 1981; Simonetta & Simonetta, 1983; Stephenson, 1988; Sale & Ighe, 1990; Stuart & Adams, 1990). The only aerial survey of the hirola in Somalia was conducted in 1974-1975. This was but a partial survey of the hirola range (from the south-west corner of Somalia from the Kenya-Somalia border to the Kismayu-Bula Haji Road at a distance of about 125 km inland from the Indian Ocean). The survey, therefore, included all of the Bushbush National Park and a large area to the north and east of the Park. Hirola were found in an area of roughly 3,640 km2 (Abel & Killeh, 1975, l976a,b). The total former range of the hirola in Somalia is estimated at 20,500 km2.

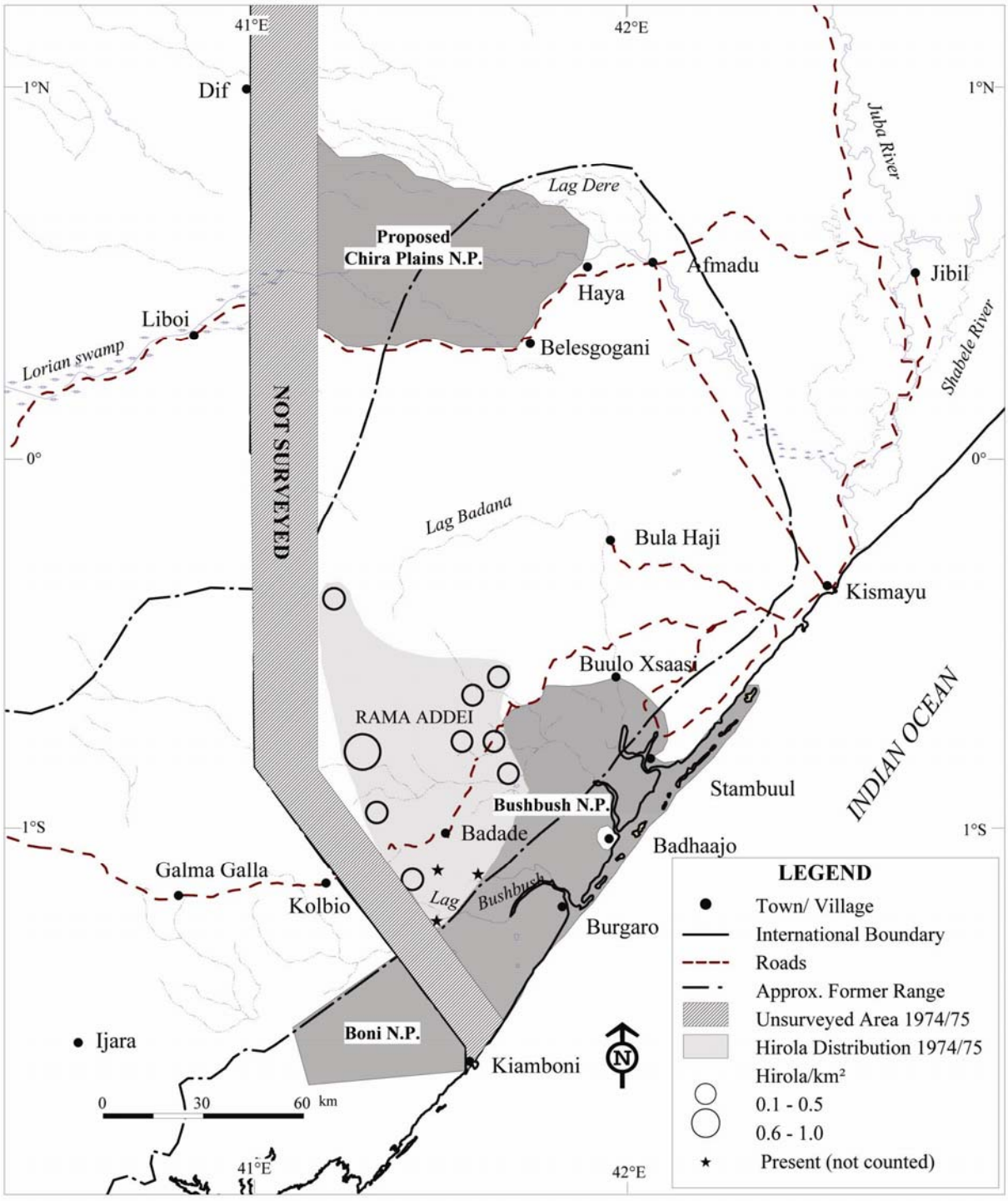
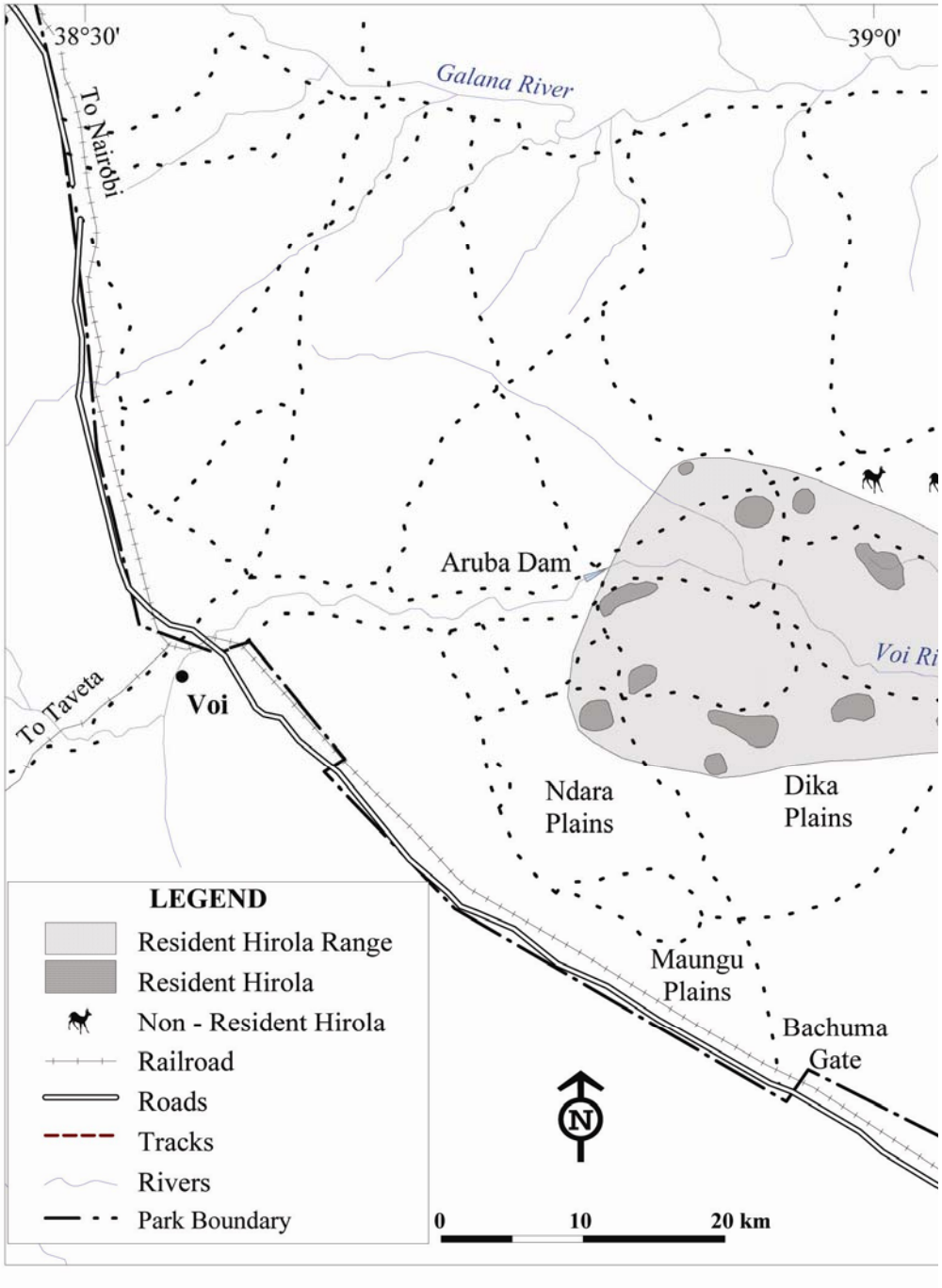

41°E
42°E
1°N
0°
1°S
Dif
Liboi
Lorian swamp
Lag Dere
Proposed
Chira Plains N.P.
Haya
Afmadu
Jibil
Juba River
Shabele River
Belesgogani
NOT SURVEYED
Lag Badana
Bula Haji
Kismayu
Buulo Xsaasi
RAMA ADDEI
INDIAN OCEAN
Stambuul
Bushbush N.P.
Badade
Badhaajo
Galma Galla
Kolbio
Lag Bushbush
Burgaro
Ijara
Boni N.P.
Kiamboni
0 30 60 km
LEGEND
Town/ Village
International Boundary
Roads
Approx. Former Range
Unsurveyed Area 1974/75
Hirola Distribution 1974/75
Hirola/km²
0.1 - 0.5
0.6 - 1.0
Present (not counted)

Figure 11: South-east corner of Tsavo East National Park showing the distribution of the hirola antelope *Beatragus hunteri* in 1995-1997. This is a composite of the range as derived from Andanje and Goeltenboth (1995, 1996) and Andanje (1997a) The shaded area on the map represents an area of about 604 km2. See more recent maps of the distribution of the hirola in Tsavo East in Andanje (1998a,b).

7.


38°30'
39°0'
Galana River
To Nairobi
Aruba Dam
Voi Ri
To Taveta
Voi
Ndara
Plains
Dika
Plains
Maungu
Plains
Bachuma
Gate
LEGEND
Resident Hirola Range
Resident Hirola
Non - Resident Hirola
Railroad
Roads
Tracks
Rivers
Park Boundary
N
0
10
20 km

# POPULATION ESTIMATES, TRENDS AND CURRENT STATUS OF THE HIROLA

## 7.1 Natural Population in Kenya

**7.1.1 Problems with the Database.** A preliminary review of the census data for the hirola indicated much confusion and a fair number of mistakes as to how many censuses were actually conducted, the years during which they were conducted, the time of year the census was undertaken, and the final estimate of hirola numbers. Because those summarizing the census results did not usually go back to the original reports or publications, mistakes made by one author were perpetuated by those who followed. By the time Magin (1996b,c) produced his summary figures of census results the database was considerably confused. For example:

- The census dated 1978 and cited "Dirschl *et al*. (1978)", was actually conducted in early 1977, and is the same census cited for 1977 by Wargute and Aligula (1993).
- The 1978 census figures given by Grunblatt *et al*. (1989) and by Wargute and Aligula (1993) are for the same census, not two different censuses.
- The data for 1989 provided by Grunblatt *et al*. (1989) are for the 1988 census. In addition, the estimated number of hirola was 1,911, not 2,500. These errors have since been reproduced (*e.g.*, Ottichilo *et al*, 1995; Andanje & Ottichilo, 1999).

Because of these kinds of problems with the census data base, I spent considerable time obtaining primary sources for the data so that at least some of the mistakes in the data set could be removed and, hopefully, not repeated.

**7.1.2 Early Population Estimates**. Early estimates of the number of hirola in Kenya were largely guesses; all based on foot or ground vehicle travel through but a tiny portion of the hirola's geographic range. These estimates varied from 350 to 2,000 animals (Bunderson, 1976; Wargute & Aligula, 1993). Grimwood (1963, 1964) stated that "it is safe to say, however, that the overall population in both Somalia and Kenya is unlikely to exceed 1,500". He implies that his best estimate for the Kenya population is 1,300 hirola. Donaldson (1964) estimated that there were about 1,500 hirola in 1964. Bunderson (1976) concluded that "these estimates can only be treated as purely subjective and speculative assessments and cannot in any way be used as indicators of the population size of the Hunter's antelope during that time".

**7.1.3 Aerial Censuses by DRSRS and Others (1973-96).** Truly useful, scientifically-based, estimates of the size of the hirola population in Kenya were not available until 1973 when the first large-scale, systematic aerial sample surveys were undertaken. These surveys indicated that there were seven- to ten-fold more hirola in Kenya than previously thought (Table 2).

Watson *et al*. (1973) provided the first population estimate for hirola based on an aerial census. They estimated that there were 13,700 hirola in Kenya in 1973. In the same year, Duncan (1974) provided an estimate of 10,000 hirola. This was followed by a similar estimate of 12,500 hirola in 1976 when Bunderson (1976) conducted five censuses of this species. It should be noted that the figure of 12,500 hirola is based on the mean of dry and wet season counts, but Bunderson suggests that "...a more accurate and precise population estimate would be obtained by using the mean of wet season estimates only...". The mean for his two wet season estimates is 14,180 hirola.

Bunderson (1979, 1985) estimated the population of hirola in Kenya to be 15,950 animals in 1977, and 14,835 in 1978. In contrast, DRSRS (formerly KREMU) provided an estimate of 2,278 hirola for 1977 (Dirschl, 1978; Dirschl *et al*, 1978; Wargute & Aligula, 1993) (Table 2).

Agatsiva (1995) suggests that the low 1977 estimate may have been affected by the low sampling intensity (10 km transect spacing; ca. 2% coverage) by DRSRS. He attributes the higher estimates obtained by DRSRS in the subsequent (1978, 1980, 1981, 1983) surveys as probably due to increased sampling intensity. For the 1978-1993 surveys, 5 km transect spacing (ca. 4-6% coverage) was used, and for the 1996 census, 2.5 km transect spacing (ca. 10-12% coverage) was used (Table 2). Agatsiva's suggestion, however, fails to take into account the fact that Bunderson (1979) obtained a mean of 13,715 (+/-1,454, ca. = 11,576-15,950) hirola from seven censuses conducted from January 1976-January 1979 using 10 km transect spacing (ca. 2% coverage). This suggests that the considerable differences observed among census takers cannot be solely attributed to transect spacing. It should also be noted that DRSRS obtained an estimate of only half this number (7,729 hirola) using 5 m spacing during 1978. In short, the low number of hirola estimated for 1977 remains unexplained, although I suspect that it had much to do with the fact that this was the first census undertaken by DRSRS, that the census

Table 2: 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 (95% c.l.) | No. cattle Garissa District (S.E) | Source |
|---|---|---|---|---|---|---|
| 1973 | Apr/Jun | wet | 10? | 13,729 | | Watson *et al* 1973 |
| 1973 | | | | 10,000 | | Duncan 1974 |
| 1976 | May/Jun | wet | 10 | 14,180* (1,730) | | Bunderson 1976, 1977, 1979 |
| 1977 | Feb/Mar | wet | 10 | 2,278 (1,089) | 424,886 (108,787) | @Dirschl 197 Dirschl *et a* 1978; @Wargu & Aligula 1993; @Grunblatt *e al*. 1995 |
| 1977 | Dec | dry | 10 | 15,950 | | Bunderson 1979,1985 |
| 1978 | Feb/Sep | dry/wet | 5 | 7,729 (1,840) | 394,339 (74,597) | @Wargute & Aligula 1993 Grunblatt *et al*. 1989, 19 |
| 1978 | Jan | wet | 10 | 14,835 | | Bunderson 1979,1985 |
| 1980 | July | dry | 5 | 13,000 | | @Williamson 1987 |
| 1981 | Nov | dry | 5 | 13,488 (2,461) | 362,591 (71,480) | @Wargute & Aligula 1993 Wargute 1994 |
| 1983 | Apr/May | wet | 5 | 10,843 (3,823) | 291,366 (38,400) | @Wargute & Aligula 1993 Grunblatt *et al*. 1995 |
| 1985 | Mar | dry | 5 | 1,595 (549) | 324,751 (67,101) | @Wargute & Aligula 1993 Grunblatt *et al*. 1995 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1988 | Feb-Apr | | 5 | 1,585$<br>SE=517 | 254,681<br>(42,165) | @Grunblatt *et al*. 1989; Wargute &<br>Aligula 1993 |
| 1993 | Mar | wet | 5 | 1,725#<br>(482) | | @Wargute &<br>Aligula 1993 |
| 1995 | July | dry | 1-2 | 302+ | | Ottichilo *et al*. 1995 |
| 1996 | May | wet | 2.5 | 1,504<br>(654)<br>SE=328 | 251,865<br>(34,084) | @DRSRS 1997 |

* Eased on two wet season censuses.

\# Based on a census which, due to security reasons, only sampled about 25% of the hirola's Kenya range. No other species counted during this survey.

\+ First and only attempt at a total count.

@ Estimate based on KREMU/DRSRS data.

$ The distribution maps presented in Grunblatt *et al* (1989) show that all "hirola" counted in Tana District (35 hirola) and in Lamu District (291 hirola) during the 1988 census were in areas where this species certainly does not occur. It is probable that topi and/or impala were mistakenly counted as hirola. I have, therefore, not included the count totals from these two districts. It seems that hirola were only really observed in Garissa District during this census. Here I use the figure of 1,585 hirola, which is the estimate for Garissa District for this census.

team was inexperienced, and that the team may not have been briefed about the differences among hirola, topi and impala. In any case, it appears that DRSRS' 1977 census data grossly misrepresent the number of hirola in the natural population at the time. I, therefore, exclude this figure from this analysis and discussion of hirola population sizes. The 1977 census results have also been excluded from further consideration by others who have examined the population trends of the hirola (*e.g*., Wargute & Aligula, 1993; Agatsiva, 1995; Ottichilo *et al.,* 1995).

Based on the data presented in Table 2, it is obvious that there is great variation in the estimates of the size of the hirola population in Kenya. For example, in 1977 and 1978 alone, the estimated size of the hirola population varied from 2,278, to 7,000-7,729, to 14,835 animals; a more than six-fold difference. These differences are probably due to a mix of factors, including time of the survey (*e.g*., wet season vs. dry season, before

calving vs. after calving), survey methods, experience of the observers, portion of the hirola range sampled, distribution of the animals, movement of hirola into Somalia, methods used to analyze the data.

Whatever the reasons for this variation, the trend in this population since 1983 has been downwards (Table 2, Fig. 12) (Wargute & Aligula, 1993; Agatsiva, 1995; Ottichilo *et al*., 1995; Magin, 1996b). The number of hirola in Kenya appears to have been between 10,000 and 15,000 from 1973 through 1983. There was then a drastic decline (85-90%) in the number of hirola between 1983 and 1985; a decline from which this population has not recovered. Referring to the DRSRS data only, the Kenya population appears to have remained fairly stable from 1985 (1,046-2,144 animals) up to the last DRSRS census in 1996 (850-2,158 animals).

Based on ground (foot) surveys conducted during each of 6 months (3 wet and 3 dry) in 1998-99, Dahiye (1999) estimated the population in Kenya to be 1,416 hirola. Each of the monthly censuses covered about 0.17% of the geographic range of the hirola in Kenya. This estimate falls well within the range of the size of this population as determined by DRSRS in 1996 and suggests that this population has remained at around 1,300- 1,600 animals since about 1985.

Not only have the size of the geographic range and of the population of the hirola declined in Kenya, so has the density of this population. In 1976 there was about 1.0 hirola/km2 over the species' geographic range, whereas by 1996 the density was only 0.2 hirola/km2. Based on his ground surveys, Dahiye (1999) estimated the density in 1999 to be roughly 0.12 hirola/km2. We can conclude that either this species is now below the carrying capacity of the range or that the carrying capacity of the range for the hirola has declined considerably...or both.

Since 1996 there has been good rainfall over Garissa District, no known disease epidemics, and probably a decrease in the poaching of hirola as

government officers and local people throughout the District have become more aware of the rarity of the hirola, of the international concern for the survival of the hirola, and of the connection between the well-being of the hirola and their own well-being...and that of their cattle. All of the people with whom I spoke to in Garissa District were of the opinion that the hirola had enjoyed three good calving seasons since 1996. Some believed that the hirola population had increased substantially since 1996 [*e.g*., John Muhanga (pers. comm., 1999); members of the Harroru Community Hirola Conservation Group (HCHCG) (pers. comm., 1999)]. The HCHCG claims that its "Hirola Guards" found 344 hirola in the Arawale National Reserve in 1998. Yakub Dahiye (pers. comm., 1999) said that during 1998 he observed a total of 97 hirola in the Hagerso area (north-east of Bura) alone.

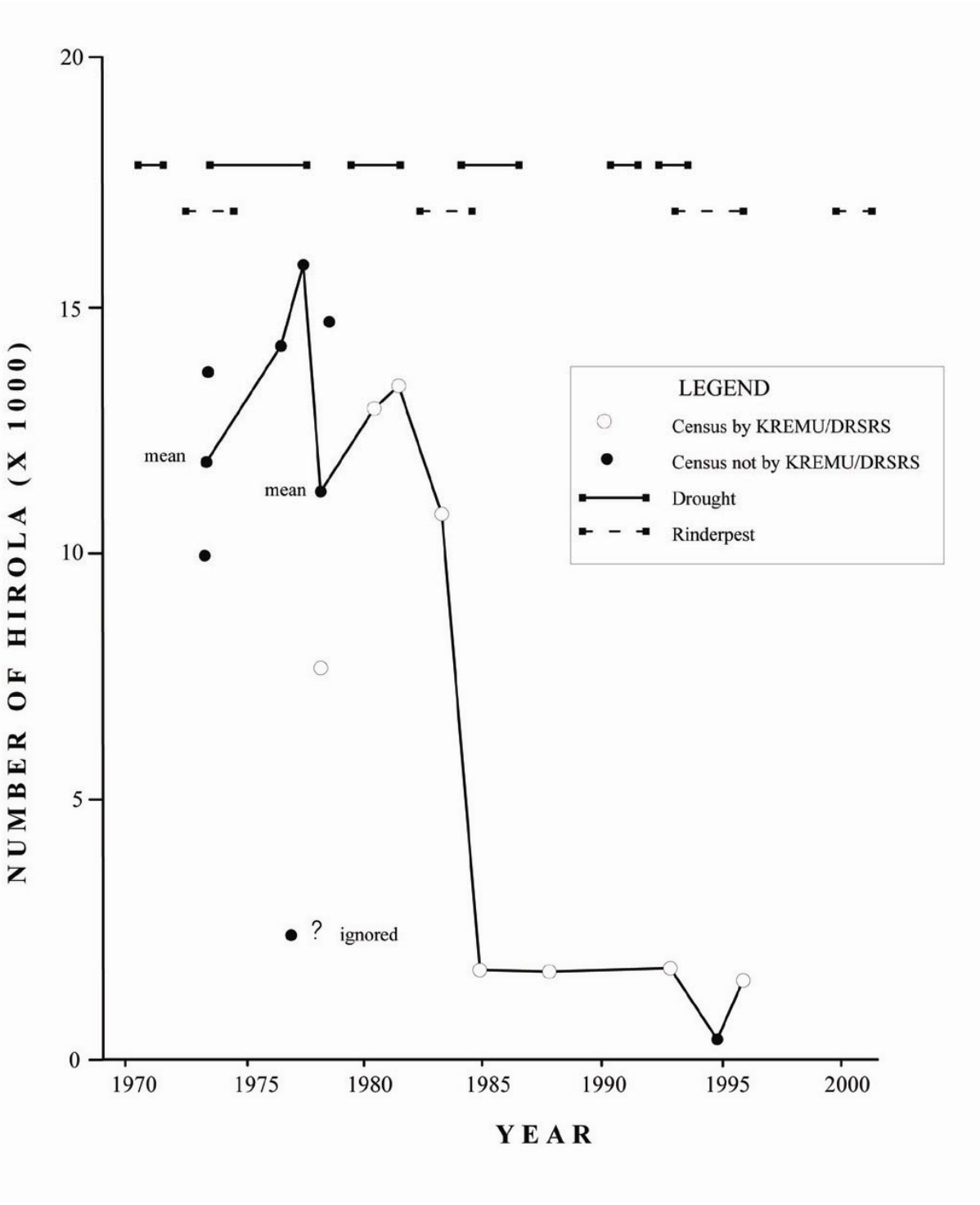
In 1998, six of the eight “Hirola Scouts” supported by the Hirola Management Committee recorded a total of 1,413 hirola in 76 groups (Andanje, 1998b). This total does not include data from a large portion of the geographic range of the hirola, including the Bura and Ijara regions. There is no way to know how many of these hirola may have been counted more than once, how many may have been missed by the Hirola Scouts, or how carefully and diligently the Hirola Scouts worked. These findings must, therefore, be viewed with extreme caution. Nonetheless, they are cause for optimism concerning the current trend in the natural population of hirola.

**7.1.4 The 1995 KWS Census**. In 1995, KWS conducted a total survey of the geographic range of the hirola in Kenya. That survey found only 302 hirola, raising widespread concern for the continued survival of the genus/species. This, in turn, resulted in a considerable increase in fund raising and conservation action on behalf of the hirola.

The following should be noted as concerns the 1995 KWS survey of the hirola:

- No photocopies of the raw data from this survey were made. The original raw data are no longer available to KWS. They are apparently with Mr. Mirangi in the USA. Mr. Mirangi no longer works for KWS. Not having these data available for this evaluation was a serious handicap.
- The final report of the results of this census (Ottichilo *et al*., 1995) is inadequate, particularly when the effort and money that went into this project are considered. For example, the report gives almost no details of the census procedures used. This makes

Figure 12: Changes in the size of the natural population of hirola antelope *Beatragus hunteri* in Kenya from 1973-1996 as determined by aerial surveys. Sources of these data are given in Table 2. Two censuses were conducted in 1973 and in 1978. Therefore, the data point used for each of these two years is the mean of the two censuses. The very low figure for 1977 is shown, but was ignored when drawing the trend line. Periods of drought and rinderpest epidemics in Garissa District are shown at the top of the figure. Note the rinderpest epidemic during 1982-1984, and that this was followed by drought in 1984-1985. These events coincide with an 85-90% decline in the number of hirola in this population from about 11,000 animals in 1983 to about 1,600 animals in 1985.


20
15
10
5
0
NUMBER OF HIROLA (X 1000)
1970
1975
1980
1985
1990
1995
2000
YEAR
mean
mean
? ignored
LEGEND
Census by KREMU/DRSRS
Census not by KREMU/DRSRS
Drought
Rinderpest

repetition of this work at a later date difficult, if not impossible. Some of the important data that should be in this report are absent. For example, there is no information on the size and composition of hirola groups (even though all hirola were photographed). These data were collected and could have been easily analysed and presented in the report.

- Information on the costs of this survey is not readily available. A total figure on the cost of this survey apparently does not exist. This makes an assessment of the cost effectiveness of this survey more difficult and less certain.

The difference between the results of the July 1995 count by KWS and the May 1996 count by DRSRS is difficult to understand, particularly in light of the fact that the DRSRS observers claim that they saw more hirola (385 on and off the transects) during their 5.8% sample survey than the KWS observers saw during their survey of the entire range of the hirola in Kenya (DRSRS, 1996). It should be noted, that for security reasons, DRSRS did not survey that part of the hirola range within 10 km of the Kenya/Somalia border during the 1996 survey, whereas KWS covered this region in 1995 (Ottichilo *et al.*,1995; George Muriuki pers. comm., 1999). This may not be an important consideration, however, as KWS did not find any hirola within about 25 km of the border in 1995.

Table 3 compares some of the procedures used during these censuses by DRSRS and KWS. The following are factors which might account for some of the difference in the numbers of hirola counted:

- It is more difficult to see hirola during the dry season than during the wet season (tawny animal on a brown background as opposed to a green background). There is more food, lower temperatures, and more cloud cover during the wet season than during the dry season. As such, hirola spend less time in the shade of trees and bushes, and more time moving and feeding in the open during the wet season than during the dry season. As a result of these, and probably other seasonal differences, aerial and ground counts of hirola both tend to yield more animals during the wet season than during the dry season (Bunderson, 1976, 1981; Dahiye, 1999; Andanje, 2000b). The KWS count was conducted during the dry season, whereas the DRSRS count was undertaken during the wet season.

- Hirola calves are born mainly in October and November. There is high calf mortality within the first 4 months after birth (Section 8.7). The DRSRS count was conducted 2 months closer to the main calving season than was the KWS count. More calves would likely have been present during the DRSRS count.

- DRSRS has experienced professionally trained, observers. The KWS observers may not have been as experienced or well trained.
- A number of the census procedures used by DRSRS and KWS were identical or similar (Table 3). They differed greatly, however, in the following respects:

    - KWS pilots and observers were in the air far longer each day. Fatigue and discomfort from the long hours and high temperatures would increase the likelihood of missing hirola.
    - KWS conducted censuses during the hottest times of the day (11:00-16:00 h). During the heat of the day hirola seek shade and lie down under trees and bushes (Dahiye, 1999; Andanje, 2000b). I have observed that during the hot hours, hirola in groups scatter with only one or two animals under a particular tree or bush. I suspect that from the air, these well camouflaged animals would be extremely difficult to detect while lying in the shade.
    - Perhaps most important, the KWS observers were required to search for hirola over a transect width of 500 m (in the three planes, each with two counters), and over a transect width of 1,000 m (in the three Huskies, each with one counter). This means that the average KWS observer was expected to count all hirola over a transect width of 667 m. This is nearly 2.3 times (667/293) the transect width covered by the DRSRS observers. Half of the KWS aircraft held observers who were expected to find hirola over a transect width which was more than 3.4 times wider than that used by the DRSRS counters. Some of this problem was overcome by the fact that the KWS aircraft flew at much slower speeds than did the DRSRS aircraft (100-120 km/h vs. 190-210 km/h). Nonetheless, I suspect that the transect widths used by counters during the KWS census were too great for an effective total count of this population.

Table 3: Comparison of procedures used by DRSRS (since 1984) in its aerial censuses of hirola antelope *Beatragus hunteri* with those used by KWS in its 1995 census of hirola.

| Variable | DRSRS* | KWS@ |
|---|---|---|
| Aircraft | Partenavia | Various# |
| Flight elevation (m) | 122 | 122 |
| Flight speed (km/h) | 190-210 | 100-120 |
| No. counters/plane | 2 | 1-2 |
| Flight time | 07:00-11:00? | 07:00-17:00? |
| Transect spacing (km) | 5 | 1 |
| Transect width/plane (m) | 282-304 | 1000 |
| Transect width/observer (m) | 141-152 | 500-1000 |
| Census coverage (%) | 5.5-6.0 | 100 |

* Source: Grunblatt *et al*. (1989). Methods described in Norton-Griffiths (1978).

@ Source: George Muriuki (pers. comm., 1999)

\# KWS used six aircraft, three of which were Huskies. Three of the aircraft held two observers and each of the Huskies held one observer.

There can be no doubt that some hirola went uncounted during the KWS census in 1995, and the proportion of hirola not counted was probably considerable greater during this census than along the 282-304 m wide strips censused by DRSRS.

DRSRS, on-the-other-hand, has “counted hirola” where hirola are known not to occur. For example, the map on page 145 of Grunblatt *et al*. (1989) indicates that DRSRS counters recorded hirola in four 5 km x 5 km grid squares in southern Lamu District in 1988. From these sightings, it was estimated that the population of hirola in Lamu District in 1988 was 291 animals. All sightings on which this estimate is based were made far south of the known range of the hirola (Fig. 8). The animals recorded as hirola were almost certainly not hirola. It is most likely that they were topi, of which there were an estimated 42,036 individuals in Lamu District at the time. Page 247 of the same report shows hirola in extreme south-east Tana District. Hirola also do not occur in that region.

There is considerable over-lap in the geographical ranges of the hirola and the topi (compare Figs. 8 & 13). To what extent DRSRS

counters recorded topi or other species as hirola (or *vice versa*) within the range of the hirola is not known.

Whatever the causes of the discrepancy between the 1995 KWS census and the 1996 DRSRS census, there is little doubt that there were fewer than 2,200 hirola in the Kenya population in 1995/96, and perhaps as few as 500, although the DRSRS data suggest that there were no fewer than 800 as of May 1996. Dahiye (1999) believes the 1995 estimate by KWS "...to be an extreme underestimation of hirola numbers". Taking all information gathered during this evaluation into consideration, my best "guess" is that the number of hirola in the Kenya population during 1995/96 was somewhere between 500 and 2,000, and that the most reasonable working figure at this time is 1,300 hirola.

Kock *et al*. (1998) state that whatever the actual number of hirola remaining in Kenya, the numbers remain critically low...and this is the critical point. While this is true, it is also true that this fact was well recognized prior to the KWS survey. This then raises the following questions: Was the 1995 KWS survey of the hirola population necessary and a good use of conservation funds, time and man-power? Did the 1995 KWS survey contribute significantly to our understanding of the status of the hirola? Could the funds have been better used on other conservation initiatives on behalf of the hirola?

The conclusion of this evaluation is that it is too early to give answers to these questions. That is, until we have some better indication of the accuracy of the 1995 census, we will not be able to answer these questions. If there were indeed 300-350 hirola in 1995, then the KWS census must be viewed as extremely important and well done. If there were 1,500-2,000 hirola in 1995, then the 1995 census must be seen as unnecessary, and as a major waste of conservation funds and energies. Whatever the final verdict, the 1995 census created awareness of the plight of the hirola and stimulated action on behalf of the conservation of the hirola...action which was needed whether there were 300 or 2,000 hirola in the natural population.

### 7.1.5 More comments on aerial surveys of savanna antelope populations.

The following important comment is taken from East (1998).

Figure 13: Historic (pre-1979; Stewart & Stewart, 1963; Bunderson, 1981) and recent (1987-1996; Grunblatt *et al*., 1995, 1996; DRSRS, 1996a,b, 1997) distribution of the topi *Damaliscus lunatus* in Kenya. The distribution of the topi in Somalia during the 1980s is taken from Sale and Ighe (1990). Note that the historic geographic ranges of the topi and hirola (Fig. 8) overlap considerably. See caption to Fig. 19.


35°
40°
SUDAN
Teltele
Negele
5°
ETHIOPIA
Chelago
L. Turkana
Lodwar
Marsabit
UGANDA
Wajir
Soroti
Mt. Elgon
Juba River
SOMALIA
Mbale
Kitale
Maralal
Ewaso NgiroRiver
Lorian Swamp
Afmadu
Eldoret
Isiolo
Lag Dere
Nanyuki
0°
Kisumu
Mt. Kenya
Bula Haji
Nakuru
Tana River
Garissa
L. Victoria
Kismayu
Massa Bubu
Nairobi
Athi River
TANZANIA
Lamu
INDIAN OCEAN
Galana River
Kisese
Mt Kilimanjaro
Malindi
Voi
LEGEND
Town/Village
International Boundary
Present Topi Distribution
Historic Topi Distribution
Same
Mombasa
N
0
100
200 km
Tanga
Kijjunga

“In addition to statistical sampling error, aerial counts underestimate the true population sizes of most species because some animals within the counting-strip are missed from the air. This can result from the coloration, size and behaviour of the species, variations in flying height and counting-strip width, and differences between observers (*e.g.*, Pennycuick & Western, 1972; Caughley, 1974; Norton-Griffiths, 1974; Graham & Bell, 1989; Mason, 1990). The level of undercounting bias in individual aerial surveys is specific to the conditions of that survey, may be highly variable and is usually unknown, but an indication of the order of magnitude of this bias is shown in the examples given in Table 4-1. These data suggest that correction factors for undercounting bias in aerial surveys may frequently be of the order 1.1-2.5 for the larger, more conspicuous savanna ungulates, *e.g.*, giraffe, buffalo, common eland, waterbuck, common hartebeest, tsessebe, wildebeest, roan, sable and oryx. Correction factors can be 4.0-10.0 for species which are smaller and/or inhabit scrubland and woodland where a relatively high proportion of the animals is likely to be obscured by vegetation, *e.g.*, lesser and greater kudu, impala and Grant’s gazelle. Hence aerial counts are generally likely to provide substantial underestimates of the true population size of most antelope species”.

The species which are probably most like the hirola in terms of the habitats in which they live are the common hartebeest, tiang/tsessebe and impala. For these three species, the percent of the population seen during aerial surveys is estimated to range from 25-80%. Thus, a correction factor of 1.2-4.0 might be expected to apply to the hirola.

## 7.2 Natural Population in Somalia

The status of the hirola population in Somalia is poorly documented. What was found during this study concerning the distribution and abundance of the hirola in Somalia is summarized in Table 4.

Published reports that the hirola has been extirpated in Somalia are all by people who have spent little or no time in the range of the hirola in Somalia (*e.g.*, Curray-Lindahl, 1975; Mbuga in litt. to J. Williamson, 1987; Agatsiva, 1995). My own interpretation of the above information is that the hirola probably does still occur in Somalia, albeit in low numbers. If so, they are most likely present in the north-west part of the Bushbush National Park, in the south-east part of the proposed Chira Plains National Park, and in the region to the south of Haya (Fig. 10).

## 7.3 Introduced Population in Tsavo East National Park, Kenya

**7.3.1 The 1963 translocation.** For a major, high profile conservation initiative, Operation Hunter’s is extremely poorly documented in the literature. A likely reason for this is that

those institutions and people involved hoped to avoid criticism from the public and conservation community for the high mortality that was experienced among those hirola which were captured...particularly since the population for this species at that time was widely believed to be fewer than 1,500 individuals (Grimwood, 1963).

The following is a summary of what is today known about the numbers of hirola captured and released during Operation Hunter's, about their survival and mortality, and about the timing of events.

There appears to be no account of the number of hirola captured during Operation Hunter's. Ottichilo *et al*. (1995) state that 100 hirola were captured during Operation Hunter's but give no source for this figure. I have found no information in the literature to support this number. Although 100 hirola may be correct, or not far off, I suspect it is both an "educated guess" and an over estimate.

Unless otherwise noted, the following information is from Grimwood (1963, 1964). Ian Grimwood was the Chief Game Warden of Kenya during Operation Hunter's. "Capture operations started early in September." Hirola were chased with vehicles and lassoed around the neck with a noose. A hood was placed over the heads of the captured hirola and they were transported (un-anaesthetized) by road for approximately 80 km to specially-constructed holding pens near Bura on the west bank of the Tana River.

The first two hirola caught were adults (sex not stated) which died shortly after capture. All subsequent captures were of immature animals aged 9-12 months (date, sex not stated). Of these, none died during the capture process. The original plan was to keep the captured hirola in holding pens at Bura (80 km from the capture site on the Walu Plains) for 2-3 weeks, transport them to holding pens on the Ndara Plains in Tsavo, and hold them there "...for a period so that they could develop a herd sense and a sense of territory...". Several hirola died in the holding pens at Bura (date, number, sex not stated) As a result of these deaths, a lorry load of six hirola was immediately dispatched on a 15 hour drive from Bura to Tsavo (date, sex not stated). Two hirola died shortly after reaching the Tsavo holding pens (date, sex not

Table 4: Summary of available information on the abundance and distribution of the hirola antelope *Beatragus hunteri* in Somalia.

| | |
|---|---|
| 1914 - | Hirola are found "...between the Tana and the Lak Dera". Not found "...north of latitude 0°35'S". "...I took especial pains to discover the limits of its range". (Dracopoli, 1914). Note that here, Dracopoli almost certainly means 0°35'N, not 0°35'S. Lak Dere is at about 0°35'N. |
| 1950 - | "This rare animal is found in the Belesgogani-Kolbio area, and there is one group on the Lakgira Plain. The writers noted two |

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|---|---|
| | males, only seven miles from Kismayu. They appear to be decreasing in numbers, and are now confined to areas difficult of access". (Ward & Sorrell, 1950). This reference is important because it places the hirola close to Kismayu and because it indicates that this species was probably already on the decline in Somalia during the l940s. |
| 1959 - | Funaioli and Simonetta (1961) state that they saw many hirola in south-central "Outre-Juba" (extreme south-west corner of Somalia = Bushbush National Park) and that the species was limited to the area between the Juba River and Tana River. They claimed that the hirola still survived because it is an extremely cautious species that is difficult to approach to within 200-300 m. Moreover, the law only allows the taking of a single animal per holder of permit type A, and a considerable part of the species' range lies in the Reserve Totale du Bubashi and in the Reserve Simple de L'Outre-Juba (*i.e.* the area south of Liboi and Afmadu, and west of Afmadu and Kismayu). The local people do not hunt hirola much because the skin is hardly of any value. (The preceeding paragraph translated from French). |
| 1963 - | Following his World Wildlife Fund mission to Somalia, P.K. Crowe told Grimwood (1963) that in Somalia the hirola "...has now disappeared from the northern part of its range and that though still fairly common in the south the total population is estimated to be no more than 200". |
| 1972 - | By 1972 the hirola was believed to have been extirpated from Somalia (Curray-Lindahl, 1975). |
| 1975 - 1978 | Bunderson (1985) visited the western part of the hirola's range in Somalia several times between 1975 and 1978 and observed "numerous" groups of hirola within a 40 km radius of Kolbio (which is located on the Kenya-Somalia border (Fig. 4). He estimated that there were 2,000 hirola in Somalia (Bunderson, 1979). |
| 1975 - | Concerning the distribution and abundance of hirola and topi in the proposed Bushbush National Park, Abel and Killeh (1975) state the following; "The proposed park area includes little of the natural habitat of these species. Both populations are centred on Kenya (Gwynne 1975, pers. comm.) from where seasonal movements occur in and out of Somalia. Most topi and Hunter's hartebeest occur north of Badade, but as maps 9 and 12 show, they are quite common within the proposed park boundaries". (Fig. 10). |
| 1976 - | Hirola "...are found mainly to the north of the proposed [Bushbush] national park area". (Abel & Killeh, 1976b). |
| 1982 - | Simonetta (1983) in 1982 saw only a few hirola near Badade/ Belesgogani/Afmadu in the Lack Dere region, but this was during a drought and he suggests that they may have dispersed from this area. He suggested, however, that the distribution of the hirola in Somalia was unaltered from former times. |
| 1982 - | Hirola "...are found as far as Rama Addei in the Somali Republic...". (Kingdon, 1982). |
| 1983 - | The Lack Dere (Afmadu-Belesgogani/Chira Plains) area "...is an area of great possibilities as far as tourist development is concerned and is the only one where Hunter's hartebeest and Grant's gazelle occur in sizable populations". (Simonetta & Simonetta, 1983). These authors also state that there is "...a reportedly important area for Hunter's hartebeest (lying mainly south of Haya)...". These authors spent a total of 20 man-months in Somalia from 1979-82. They were, however, not able to visit but |

| | |
|---|---|
| | a small part of the southern corner of Somalia and admitted that reliable information on the status of wildlife in this region was "scanty". |
| 1988 - | Concerning the Chira Plain (Lak Dere) proposed national park, Stephenson (1988) states the following; "Time did not allow for a ground visit, but the rather superficial air reconnaissance gave the impression of what is probably Somalia's finest wildlife area with its semi open plains and woody forest lands. The area is well known for its giraffe, oryx, Hunter's antelope,...". |
| 1989 - | "Numbers of hirola in Somalia are greatly reduced due to poaching and it is no longer seen in much of its former range. Extensive enquiries by the consultant failed to establish positive evidence of its current presence but this could be due to seasonal migration across the Kenya border. Some consider it may be extinct in Somalia but due to its habit of migrating from Kenya, good protection could reverse this process if it has indeed occurred. It seems probable that hirola reported on an aerial reconnaissance over the Alifootu Swamp area of the Lower Shabelle in 1987 (Parker, 1987) were in fact topi which still occur there in reasonable numbers. The hirola's range has never extended to this area". (Sale, 1989). Sale was in Somalia from 26 January - 1 April 1989 and visited both the Lag Bushbush/Lag Bagdana and Chira Plains/Lag Dere areas. |
| 1990 - | "The species is endemic to a small area of northern Kenya and southern Somalia west of the Juba river. Numbers greatly reduced due to poaching and expansion of livestock within its limited range. Replenishment by immigration from Kenya is possible if adequate protection can be given to the hirola's specific habitat requirements. Otherwise it is likely to become extinct in Somalia within a short time". (Sale & Ighe, 1990). |
| 1990 - | Stuart and Adams (1990) claim, without revealing the source of their information, that the hirola in Somalia "...has decreased severely and now occurs only in the Lack Dere region...". |
| 1992 - | It is unlikely that there are any hirola left in Somalia (Wirth, 1992). |
| 1994 - 1995 | Bashir Sheikh Mohammed (former KWS District Warden in the Boni-Dodori National Reserve and in the Arawale National Reserve until 1990), and Ahmed Haji Hussein (of HEAL, an NGO based in Kenya that is assisting resettlement in southern Somalia) together visited the area between the Kenya border and Bushbush (Lag Badana) National Park in late 1994. They report (pers. comm., 1998) that this region was largely emptied of people during the Somali conflicts, and that they witnessed hirola, elephants *Loxodonta africana,* wild dog *Lycaon pictus,* buffalo *Syncerus caffer,* lesser kudu *Tragelaphus imberbis,* and other large wild mammals. In March 1995, people at Padede Town in extreme south-west Somalia told Mr. Bashir that there were about 16 hirola just to the north-west on the Kenya/Somalia border. These two men felt that by 1998 there were probably very few hirola, if any, in Somalia. They suggested that if hirola are still in Somalia, they are in the southern extreme of their range on the edge of tsetse zone as places north have no tsetse and, therefore, now have once again many people and cattle. Also, there are few people or roads in the extreme south-west. See also Bashir (1995). |
| 1996 - | Magin (1996a) says: "It has been suggested that since the recent deterioration in the security situation many pastoralists and their livestock have moved out of southern Somalia, creating |

| | |
|---|---|
| | ecological space for wildlife. The hirola is a mobile species and it is possible that the apparent rapid decline in the Kenyan population has been brought about by the consequent mass movement of animals across the border into Somalia (Mbuga in litt. To J. Williamson, 1987; Agatsiva, 1995)". |
| 1997 - 1999 | Julian Bauer, who has worked off-and-on in the Bushbush (Lag Badana) National Park for many years, told me (pers. comm., 1997, 1999) that good numbers of hirola were still present in that park in 1997 and that at least some remained as of 1999. |
| 1999 - | H. Shikh Ali *et al.* (pers. comm.) are reasonably certain there are no hirola remaining in Somali, including the Lag Dere and Bushbush regions. They said that no large animals remain in southern Somalia. |
| 1995 - 1999 | The PARC veterinary team asked questions concerning hirola while working in south Somalia during 1995-99. The local people say that the hirola no longer exists (pers. comm. by J. Morrison to Richard Kock). |
| 1999 - | Y.M. Dahiye, a Somali student from Garissa District who undertook his MSc field research on hirola in Garissa District during 1998, says he does not know about hirola in Somalia, but that few if any survive near Kolbio near the Somalia border. He said that there are recent reports of hirola in Somalia. |

stated). Four more hirola were then flown to Tsavo but two died (date, sex not stated). Two more lorries, each carrying six hirola, were dispatched and all animals arrived alive (date, sex not stated). Three helicopters delivered the remaining 20 hirola (date, sex not stated). Donaldson (1964), but not Grimwood (1963, 1964), states that several died in the holding pens at Tsavo. On 28 October, 3 days after the last of the hirola reached Tsavo, 30 were released from the holding pens into the Park.

In the above account by Grimwood (1963, 1964), we are given only one approximate date (date capture operations began) and one exact date (the date of the release), and no information on the total number of hirola captured or dying while in the holding pens. We are also not given information on the sex composition of the captured, dead or released hirola.

The statement by Grimwood (1963) that the helicopters could have transported more hirola "had not the final collapse of the catching car and all substitutes put an end to further capture attempts" suggests that at least the last of the captured hirola were moved to Tsavo without spending much, if any, time in the holding pens at Bura.

From the information provided by Grimwood (1963, 1964) and Donaldson (1964), it seems that shipments comprised of 6, 4, 6, 6, 6, 7, and 7 hirola were made. From this, we can conclude that a total of 42 hirola, ages 9-12 months, were moved from Bura to Ndara. All 30 of the surviving hirola were released from the Ndara holding pens on 28 October, 3 days after the completion of the helicopter air lift. It can be concluded that 12 of the 42 hirola

moved from Bura died either in transit to Ndara or in the holding pens at Ndara.

If we take “several” to mean somewhere between four and 10, then these accounts indicate that 48-54 hirola were captured during Operation Hunter’s, and that 6-12 died in captivity at Bura. Twelve are said to have perished either in transit from Bura to Ndara, or in the Ndara holding pens. If a total of 18- 22 hirola died during this operation, a mortality in captivity of between 33-46% occurred.

David Sheldrick (in litt., 1963) (Table 5) provides some important additional information concerning Operation Hunter’s. David Sheldrick was the Warden of Tsavo East during Operation Hunter’s, as well as the person who opened the gates of the holding pens to release the hirola into Tsavo (Grimwood, 1963, 1964). He states the following:

- A number of hirola were captured and were ready to be moved to Ndara by mid-September.
- The first hirola were moved by road on 2 October.
- Twelve more hirola were moved to Ndara on 9 October.
- Four hirola were flown to Ndara on 10 October.
- On, or soon after 21 October, helicopters moved the remaining 20 hirola.

Table 5: Summary of how hirola antelope *Beatragus hunteri* were transported and number surviving during the 1963 translocation from Garissa District to Tsavo East National Park, Kenya. Table taken from David Sheldrick (in litt., 1963).

| **Mode of Transport** | **Total Moved from Bura to Ndara** | **No. Dying*** | **No. Released** |
|---|---|---|---|
| Truck | 18 | 7 | 11 |
| Airplane | 4 | 4 | 0 |
| Helicopter | 20 | 1 | 19 |
| Total | 42 | 12 | 30 |

* These are not the number dying “during transit”, but the number dying during transit plus the number dying during their time in the Ndara holding pens “post-transit” and prior to release..

It is important to note that Grimwood (1963, 1964) and David Sheldrick (in litt., 1963) agree that (1) hirola were moved from Bura to Ndara, and (2) that a total of 30 were released.

Piecing together the information provided by Grimwood (1963, 1964), Donaldson (1964), and David Sheldrick (in litt., 1963), the following can be deducted:

- Operation Hunter's lasted about 7 weeks (from early September when the first hirola was captured to 28 October when hirola were released in Tsavo).
- Unless they died in captivity, some hirola may have been in captivity for at least 45 days, and possibly as long as about 50 days.
- The minimum time hirola were in captivity was 9 days.
- Once the hirola left Bura, the pre-release mortality was 29% (12/42).

Although the above information is useful, there is, unfortunately, no exact chronological information of critical events (*e.g.*, what was the longest period a hirola was in captivity, or when during their captivity did the hirola die?).

It is important to note that there was probably a high initial death rate among the 30 hirola released into Tsavo and, therefore, that the overall mortality from this translocation was likely much greater than the 33-46% indicated above. Peter Jenkins (in litt., 1996), who was involved in Operation Hunter's), indicated that at least some of the 30 hirola which were released, particularly those moved by road from Bura to Ndara, were in extremely poor physical condition. He suggests that many probably died within a few days of release.

Daphne Sheldrick (in litt., 1999) states, "The survivors were released by David ahead of schedule because of their emaciated and feeble condition and the fact that many were dying in the holding pens, apparently from muscular dystrophy as a result of having been chased for capture. None of us expected any to survive because of the pathetic condition in which they were in, many hardly even able to walk, let alone run". "Incidentally, all those that were collared prior to release disappeared and were presumed killed by predators". It should be noted that this is the only reference indicating that any of the hirola were collared prior to release.

It should be remembered that these hirola were all juveniles and that they were released into an unfamiliar area. Both factors are likely to contribute to increased mortality, particular from predators. The best guesses are that the actual number of hirola in the "effective founder" population was 11 (Kock, 1996), 15 (Richard Kock pers. comm. in Magin, l996b; Soorae, 1997), and 19 (Peter Jenkins in litt., 1996). If so, and if between 48-54 hirola were captured during Operation Hunter's, the actual mortality incurred during the capture, translocation, and first week or two

after release was probably 60-72%. The sex ratio of this founder population is not known.

Agnew Mbwavi (in litt., 1996) states that there was 90% mortality of hirola during the 1963 translocation. There seems to be no basis for this figure.

Considering the potential importance of Operation Hunter’s to the survival of the hirola, it is surprising that there was no systematic study or follow-up monitoring program for this founder

Table 6: Summary of opportunistic sightings of hirola antelope *Beatragus hunteri* in Tsavo East National Park, Kenya, from 1964-1995. The first census of this populaton was conducted in 1995 (Table 7).

| Year | Place | Observations and Source |
|---|---|---|
| 1964 | ? | A single hirola and two others.<br>Source: Andanje & Goeltenboth (1995). |
| 1965 | ? | No sightings reported.<br>Source: Tsavo East Warden, D. Sheldrick, Report for 1 January - 31 December 1965. |
| 1966 | Kono ya Maharage Waterhole<br>Buchuma | Seven, four were young born in Tsavo.<br>Single male on two occasions.<br>Source: Tsavo East Warden, D. Sheldrick, Report of 1 January - 30 June 1966. |
| 1966 | Kulalu Turn-off | Eight.<br>Source: Tsavo East Warden, D. Sheldrick, Report of 1 July - 31 December 1966. |
| 1967 | Kono Maharage Waterholes | Group of eight on a number of occasions, including two young born in Tsavo. Single male also.<br>Source: Tsavo East Warden, D. Sheldrick, Report of 1 January - 31 March 1967. |
| 1967 | Kono Maharage Waterholes<br>Dika Plains | Group of eight.<br>Single animal.<br>Source: Tsavo East Warden, D. Sheldrick, Report of 1 April- 30 June 1967. |
| 1969 | Kono Maharage Waterholes<br>Sala Road 9 mi from Aruba | Hunter’s antelope again seen on several occasions. Group of nine usually found here.<br>Single adult male.<br>Source: Tsavo East Warden, D. Sheldrick, Report of 1 October - 30 June 1969. |
| 1970 | Kono Moju | Group of 10, including young obviously born in Tsavo. Hunter‘s antelope appear to be thriving.<br>Source: Tsavo East Warden, D. Sheldrick, Peport of 1 January - 30 June 1970. |
| 1976 | Mukwaju | Group of 14 established home range south of Mukwaju. They are breeding satisfactorily.<br>Source: Tsavo East Warden, D. Sheldrick, Report 25 October 1976. |
| 1976 | | Numbers do not appear to be increasing and rarely seen.<br>Source: D. Sheldrick, pers. comm. to Williams (1987). |

| | | |
|---|---|---|
| 1984 | Aruba | Group of five to seven, including young near Aruba, 20 km from Voi.<br>Source: M. Stanley-Price in litt. to Williams (1987). |
| 1991 | Aruba | Group of 16. On Bachuma Road not far from Aruba Dam.<br>Source: Jean Knocker (Box 77, Watamu) in litt. to KWS (1995). |
| 1993 | Buchuma Gate | Group of 32 (Peter Jenkins in litt., 1996). |
| 1994 | Galana Ranch | Group of two close to Galana River/Galana Ranch. |
| | Voi River | Group of two close to east boundary of Tsavo East, north of Voi River. |
| | Voi River | One close to east boundary of Tsavo East, north of Voi River. |
| | Voi River | Group of seven, central Tsavo East, north of Voi River. |
| | Aruba Dam & Bachuma Gate | Group of 11 between Aruba Dam and Bachuma Gate.<br>Source: Amar Inamdar, in litt. (1994). |
| 1994 | Mukwaju | Group of five, 1 km west of Post 144 (Mukwaju). |
| | Aruba Bridge | Group of five, 3 km east of Aruba Bridge. |
| | Ndara Plains | Group of three, 2.8 km west of Post 139 (Ndara Plains). |
| 1995 | Mukwaju | Group of five west of Post 145. |
| | Mukwaju | Group of six, 6.8 km west of Post 145. |
| | Post 178 | Group of five, 7.0 km west of Post 178. |
| | Mukwaju | Group of three, 3.8 km east of Post 144.<br>Source: Samuel Kasiski, pers. comm. to Magin (1996a). |
| | Mukwaju | Group of 9-12 seen six times during April and June at Mukwaju Airstrip, Post 145.<br>Source: Trevor Jennings, pers. comm. to Magin (l996a). |
| | Post 149 | Group of 10, 0.8 km east of Post 149.<br>Source: Jackson Kingoo & Chris Magin (Magin, 1996a). |
| | Post 178 | Group of six, 5.4 km south of Post 178 (Magin, 1996a). |

population. Table 6 provides a summary of the available information on this population from the time of the translocation in 1963 until systematic counts were made in 1995. This summary is presented here to not only demonstrate what little is known of the changes in this population from 1963 until 1995, but also to help “preserve” these data for future reference.

From Table 6, we can see that recorded sightings of hirola in Tsavo were few during the period 1963-1992. From 1966-1970, park

officials knew the locations of only 8-10 hirola. There are very few records for the period 1971-1993, although a group of 14 was reported in 1976, a group of 16 was observed in 1991, and a group of 32 was recorded in 1993. The first birth was noted in 1966 but it seems likely that some births occurred as early as 1964, given that hirola are capable of breeding and giving birth when 2 years of age.

An intensive ground survey conducted specifically to determine the number of hirola as a result of the 1963 translocation concluded that

there were at least 76 hirola in Tsavo East in December 1995, 8 months prior to the second translocation (Table 7) (Andanje & Ottichilo, 1999). Using a figure of 20 hirola as the number in the founder population, Andanje and Ottichilo (1999) calculate that the recruitment rate to this population since 1963 was 1.8 individuals per year (56 hirola/32 years = 1.8 hirola/year).

Of the 76 hirola known to be present in Tsavo in December 1995, 39% (30/76) were immatures (Table 8). The sex ratio among adults was 13 (28%) males to 33 (72%) females. There were significantly

few adult males than adult females ($\chi^2$= 10.79, df = 1, $p < 0.01$).

Overall, this population was comprised of 20 (41%) males and 45 (59%) females (11 calves were not sexed). Sixty of the hirola lived in eight stable groups (mean group size = 7.5 animals, range 5-l1), while eight subadult females, three subadult males, and five adult males each lived alone (Andanje & Ottichilo, 1999). The sizes of the home ranges of the eight groups varied from 12-40 km2 (mean 21 km2). These home ranges included the territories of one or two males (Andanje, l997a).

**7.3.2 The 1996 translocation.** Thirty-five hirola from six different groups were captured near Ijara, Garissa District, and translocated to Dika Plains, Tsavo East National Park, in August 1996.

Of the 35 hirola that were captured, 13 (37%) were males and 22 (63%) were females, while two (6%) were juveniles, nine (26%) were subadults, and 24 (69%) were adults. Ten (56%) of the adult

Table 7: Changes in the number of hirola antelope *Beatragus hunteri* sighted in Tsavo East National Park, Kenya, from 1962-1998.

| Date | No. hirola | Comments |
|---|---|---|
| 1962 | 0 | There is no record of free-living hirola west of the Tana River. |
| Aug. 1963 | 30 | First translocation of 30 hirola (all juveniles). Likely that fewer than 20 of these survived by October 1963 given the poor physical condition of at least some individuals, their young age, and the new environment. |
| 1964 | 10-20 | It is highly likely that the translocated group declined to fewer than 20 animals given that all were |

| | | |
|---|---|---|
| | | juveniles at the time of the translocation, and that no calves could be expected to be born before October 1964. |
| Dec. 1995 | 76 | First population survey conducted (Andanje & Ottichilo, 1999). |
| April 1997 | 96 | 79 “resident” hirola (including 19 calves) plus 17 hirola from the August 1996 translocation. In eight groups (Andanje, 1997a,b). |
| July 1998 | 69+ | 56 “resident” hirola plus 15 hirola from the August 1996 translocation. In nine groups. Two more groups probably present but not found and counted. Three new groups formed since 1997 (Andanje, l998a). |
| Nov. 1998 | 105 | In 12 groups (Andanje, 1998b). |

**Table 8: Size and structure of the resident population of hirola *Beatragus hunteri* in Tsavo East National Park in November-December, 1995. Source: Andanje and Ottichilo (1997a).**

| | | Total | Total | Males | | | | Females | | | | Unsexed | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Group** | **Total** | **Males** | **Females** | **A** | **S** | **Y** | **C** | **A** | **S** | **Y** | **C** | **A** | **S** | **Y** | **C** |
| **Balguda I** | 8 | 1 | 5 | 1 | - | - | - | 5 | - | - | - | - | - | - | 2 |
| **Balguda II** | 9 | 2 | 5 | 1 | - | 1 | - | 5 | - | - | - | - | - | - | 2 |
| **Mackinnon** | 9 | 1 | 5 | 1 | - | - | - | 5 | - | - | - | - | - | - | 3 |
| **DidaHarea** | 11 | 2 | 6 | 1 | 1 | - | - | 6 | - | - | - | - | - | - | 3 |
| **VoiRiver** | 6 | 2 | 4 | 1 | - | - | 1 | 2 | - | - | 2 | - | - | - | - |
| **Mukwaju I** | 5 | 1 | 4 | 1 | - | - | - | 3 | - | - | 1 | - | - | - | - |
| **Mukwaju II** | 5 | 2 | 3 | 1 | - | - | 1 | 3 | - | - | - | - | - | - | - |
| **Dakota** | 7 | 1 | 5 | 1 | - | - | - | 4 | 1 | - | - | - | - | - | - |
| **Adult males alone** | 5 | 5 | - | 1 | - | - | - | - | - | - | - | - | - | - | - |
| **Subadult alone** | 11 | 2 | 8 | - | 3 | - | - | 8 | - | - | - | - | - | - | - |
| **Total** | 76 | 20 | 45 | 13 | 4 | 1 | 2 | 33 | 9 | - | 3 | - | - | - | 33 |

**A** = adult; **S** = subadult; **Y** = young; **C** = calf

females captured were pregnant (Andanje, 1997a,b). Note that Kock (1996) states that “Over 20 pregnant females as well as adult males and immatures were translocated”. This is an error; the number of pregnant females captured was 10, not 20.

The hirola were flown from Ijara to Tsavo East National Park either on the day of capture or on the following day and kept in bomas until they recovered fully from the drugs. Release into Tsavo occurred within four days of capture.

Six (17%) of the 35 hirola that were captured died during the translocation (Table 9). No hirola died in Garissa District.

All deaths occurred in the holding pens in Tsavo (Richard Kock in litt., 1999), although three of these deaths were related to injuries received during the capture process; one adult male had an injured lower hindleg and died of pneumonia after 39 days in the holding pen, one adult female died from a neck injury, one subadult male died from a fractured humerus (euthanized), and three adult females died from capture myopathy. These

three adult females died 2, 3 and 4 days after capture (Kock *et al*., 1998). It should be noted that capture myopathy was not confirmed from histopathology. At least three of the four adult females that died were pregnant (Andanje, l997a).

**Table 9: Summary of the survival, by age/sex class, of hirola antelope *Beatragus hunteri* translocated in August 1996 from Garissa District to Tsavo East National Park, Kenya.***

| | Captured | Released | Alive 5 months post-release |
|---|---|---|---|
| **Males** | | | |
| **Adult** | 6 | 4 | 1 |
| **Subadult** | 5 | 4 | 1 |
| **Juvenile** | 2 | 2 | 2 |
| **Females** | | | |
| **Adult (pregnant)** | 10 | 7 | 4 |
| **Adult (nonpregnant)** | 8 | 8 | 5 |
| **Subadult** | 4 | 4 | 4 |
| **Total** | 35 | 29 | 17 |

* Assumes that all “missing” hirola are dead. Data source: Andanje (l997a). See this reference for more details.

Five of the six hirola that died were captured by darting from a helicopter, including the three that succumbed to capture myopathy (Richard Kock, in litt., 1999).

Of the 29 hirola that survived to be released into Tsavo, two (7%) were juvenile males, four (14%) were subadult females, four (14%) were subadult males, 15 (52%) were adult females, and four (14%) were adult males. Of the released hirola, 10 (34%) were males and 19 (66%) were females. This is a male to female ratio of 1:1.9. Among the released hirola, 10 (34%) were immature while 19 (66%) were mature. This is an immature to adult ratio of 1:1.9. Seven (47%) of the adult female were pregnant.

Ear tags were placed on all of the translocated hirola and radio collars were placed on 10 (one subadult female, two adult males, seven adult females). As of April 1997, five of these individuals were confirmed dead (two adult males, three adult females). All five deaths are suspected to have been due to predation, although in two cases the hirola lost weight before being killed by predators (lion *Panthera leo,* spotted hyena *Crocuta crocuta,* cheetah *Acinonyx jubatus*) (Andanje, l997a,b).

Four of the seven pregnant females that were released are known to have given birth, but all four calves died within 7 weeks of birth (Andanje, 1997a,b). Three other pregnant hirola were released into Tsavo but there is no information of the outcomes of their pregnancies.

In January 1997, 5 months after the capture of the 35 hirola at Ijara, the number surviving in Tsavo was 17 (49%) (assuming that the seven missing hirola are dead) (Table 9). Of the six adult males captured, one (17%) was alive. Of the 13 males captured, four (31%) were alive. Of the 18 adult females captured, nine (50%) were alive. Of the 22 females captured, 13 (59%) were alive. Of the 11 immatures (calves + subadults) captured, 7 (64%) were alive. Of the 24 adults captured, 10 (42%) were alive. Thus, survival of captured hirola was nearly twice as high among females than among males, and half again as high among immatures than among adults. Adult males experienced the highest mortality (Andanje, 1997a).

In July 1998, 23 months post-release, 16 (46%) of the 35 hirola which were translocated were still alive (Andanje, 1998a). Thus, mortality during the first 5 months post-release was far greater than during the subsequent 18 months.

Twenty-three calves were born into the Tsavo population between September 1996 and April 1997. This included four calves from females translocated while pregnant in August 1996. All four of these calves died within 1 month of birth. Of the 19 calves born to resident hirola, 12 (63%) survived to April 1997. Calf survival among resident hirola was significantly higher than among translocated hirola ($\chi^2 = 5.30$, df = 1, $p < 0.01$) (Andanje, 1997b).

During the 1997-98 calving season, 13 calves were born to that part of the Tsavo population that was being monitored (*i.e.*, 69 hirola). Of these, seven (54%) survived to July 1998. None of the 10 pregnant females that were captured produced surviving calves. Given the above information on calf survival among resident hirola in Tsavo, it seems likely that if left on their natural range, at least five (50%) of these pregnancies would have resulted in calves that survived to 5 months of age.

About 43% of the Tsavo population was comprised of adult females in 1996, approximately 64% of which gave birth during the 1996-1997 calving season (Table 10) (Andanje, l997a). From 1995-1999, approximately 16% of the hirola in the Tsavo population were adult males, 46% were adult females, and 38% were calves and yearlings (Table 10).

**Table 10: Percentages of adult male, adult female and immature hirola antelope *Beatragus hunteri* in the population in Tsavo East National Park, Kenya (1995-98).***

| Age/Sex | Dec. 1995 | Dec. 1996 | Nov. 1998 | June 1999 |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| **Adult males** | 20% | 17% | 12% | 15% |
| **Adult females** | 48% | 43% | 46% | 47% |
| **Immatures** | 32% | 39% | 41% | 38% |

*Sources: Andanje & Goeltenboth (1995); Andanje (1997a, 1998b, l999a). See these sources for detailed data on age/sex composition, by group.

### 7.4 Captive Population

In 1982, hirola were found in captivity in four facilities; Brownsville Zoo, Texas; San Diego Wild Animal Park, California; Tampa Zoo, Florida; Dvur Kralove Zoo, Czechoslovakia.

The following summary on captive hirola at the Dvur Kralove Zoo is taken from Smielowski (1987). In 1971, two male and five female hirola were moved from Garissa District to the Dvur Kralove Zoo. All seven animals were subadults. Two of the females died within 6 months of arrival. Nonetheless, during the following 11 years, 19 young were born (sex ratio 1 male:1.7 females). Juvenile mortality was 32%. One female gave birth to eight calves in 9 years and another to five calves in 5 years. One male mated with all three females. He fathered 15 calves before dying at the zoo after 10 years. The average longevity in captivity for the seven hirola brought from Garissa was 10.2 years. The five hirola surviving their first 6 months at the zoo lived a mean of 14 years. The 11 zoo-born hirola living to 3 months of age only survived an average of 2.0 years. One captive born females mated at 1.4 years and gave birth to her first calf at 1.9 years. A male and a second female born at the zoo first mated when 1.7 years of age. Gestation is approximately 227-242 days. This herd started to decline in 1979, when the animals suffered from acidosis and tympanie. Tuberculosis infected the herd twice in 1980, and in 1981 the herd was destroyed by mycobacteriosis.

As of 1998, only two hirola are known to be in captivity (International Species Inventory System, 1998). Both are at the Brownsville Zoo. One is a 22 year old female (wild born in 1977) that is now apparently behaviourally abnormal. The other is a 9 year old female (captive born in 1990 to a now deceased pair).

### 7.5 Conservation Status

The Red List categories (IUCN, 1994) have been used to evaluate the world's species of mammals. In the *1996 IUCN Red List of Threatened Animals* (IUCN, 1996), the hirola is categorized as "critically endangered", having met criterion Ala (*i.e.*, an observed reduction of at least 80% over the last 10 years or three generations, whichever is the longer, based on direct observation). As such, the hirola is now widely recognized as one of the most severely threatened species of antelope in sub-Saharan Africa. The only species of African antelope that might be more

rare in the wild than the hirola are the scimitar-horned oryx *Oryx dammah* and the Aders' duiker *Cephalophus adersi.*

*O. dammah* (Extinct in the Wild: IUCN, 1996) is believed to be extinct in the wild (Smith, 1998). There is, however, a large captive population. In 1996 there were at least 1,250 in zoos and parks around the world, and an additional 2,145 on ranches in Texas (East, 1998).

*C. adersi* (Endangered: IUCN, 1996) is only known to occur on Zanzibar Island, Tanzania, and in the Arabuko-Sokoke Forest, Kenya. The number on Zanzibar in July 1999 was estimated at 618 animals (between 479-758 animals) (Kanga & Mwinyi, 1999; Kanga, 2000b). The number in Arabuko-Sokoke Forest in October 1999 was estimated at roughly 370-400 individuals (Kanga, 2000a). There are no Aders' duiker in captivity. This species should now, undoubtedly, have "Critically Endangered" status. With only between 800-1,200 Aders' duikers remaining in two populations, this species may be more threatened than the Hirola.

It appears that the hirola is either Africa's most threatened, or second most threatened species of antelope. The conservation situation both for the hirola and Aders' duiker is made all the more serious by the fact that for both species (1) there is no *in situ* captive breeding program, (2) there is no viable captive population, (3) the natural habitat continues to be degraded and lost at a rapid rate, and (4) poaching continues to be a serious problem.

### 7.6 Legal Status

Hirola have been legally protected from hunting in Kenya since 1971 (Kenya Gazette Supplement 2 April 1971, No. 26, Legal Notes No. 65. Amendment of schedules in the Wildlife Protection Act Cap. 376), and in Somalia since 1977 when all hunting was banned (Williamson, 1987). Hirola are included in Class B of the African Convention (1969). This means that hirola may be hunted or collected only under special authorization granted by the competent authority. Due to a number of factors, including poor security within the natural range of the hirola, legal protection has rarely been enforced since about 1965. In short, the hirola is adequately protected by law, but poorly protected on the ground.

## 8. ECOLOGY AND BEHAVIOUR OF THE HIROLA

### 8.1 Scientific Studies

The hirola is one of the least studied large mammals living on the savannas of Africa. In 1962, A.D. Graham started a 3-year study of the ecology of hirola but had to abandon this effort within a few months due to political unrest in the region (Grimwood, 1963, 1964). Until recently, much of what is known of this species' ecology and behaviour was provided by Kingdon (1982) who made the

first observations over a brief period in the 1970s, and by Bunderson (1981, 1985), who studied the interactions between wildlife and domestic livestock in the hirola's range from 1975 through 1978. Andanje (1997a,b, 1998a,b, 2000b) is now undertaking the first long-term study of this species. His field research on hirola began in 1995. Kenya's Department of Remote Sensing and Resource Surveys (DRSRS), through regular aerial surveys, has provided substantial information on the distribution and numbers of hirola since 1977. The Kenya Wildlife Service (KWS) has made valuable contributions towards the conservation of the hirola through translocations to Tsavo East National Park in 1963 and 1996, and its census of the natural population in 1995. Recently, Y.M. Dahiye (1999) completed his MSc field research on the size, structure and seasonal distribution of the hirola in Garissa District.

## 8.2 Seasonal Distribution and Movements

Hirola disperse during the wet season (Fig. 14). In the dry season the distribution is more clumped due to scarcity of forage (Fig. 15). Bunderson (1976, 1977, 1985) describes two distinct regions where hirola concentrated in high numbers during the 1976 dry season. One covered an area of about 1,000 km2 near the Tana River (including the Arawale National Reserve) between Masalani and Bura. The other was farther east in the vicinity of Galma Galla and covered an area of roughly 1,500 km2. During 1976, these two regions supported 45-5O% of the Kenya population of hirola during the wet season, and 70- 75% of the population during the dry season. The Galma Galla area was the most important, particularly during the dry season when 50-55% of the population was found here. The remaining portions of the range held low numbers of hirola. During the wet season, hirola dispersed in all directions from areas of high density to exhibit a much more uniform distribution (Fig.14).

The distribution pattern of the hirola during the dry season seems to have changed considerably since 1976. During the July 1995 dry season survey almost no hirola were found in the vicinity of Galma Galla and relatively few were located in the region along the Tana River between Masalani and Bura (Fig. 6). During the 1995 survey, the only concentration of hirola was farther south along the Tana River between Wenje and Baomo in and near the Tana River Primate National Reserve (Ottichilo *et al.,* 1995). The 1996 wet season survey, however, indicated that the Galma Galla and Masalani-Bura regions were where hirola, at least sometimes, still reached their highest densities (Fig. 7) (DRSRS, 1996). Dahiye (1999) found hirola densities to be highest in the Hulugho and Sangailu in late 1989 and early 1999. During the dry season, hirola attained highest densities both at Hulugho and Ijara, while during the wet season they concentrated in the vicinity of Bura, Masalani and Sangailu.

Bunderson (1976, 1977, 1981), Andanje (1999b) and Dahiye (1999) found that the hirola to be a highly mobile species, moving over its natural range in Kenya in search of suitable forage as climatic conditions change. They found no evidence of a set pattern of mass migration in this species. There are no data to support the (often cited) contentions of M.D. Gwynne (pers. comm. in Abel & Killeh, 1976b) or Mbugua (in litt. to J. Williamson, 1987) that hirola are, or have ever been, “migratory”, moving into Kenya from Somalia during the dry season.

## 8.3 Habitat Description

Vegetation types within the natural range of the hirola vary from lush savanna grassland in the south to open bushed grassland in the centre, to dry thorn bush in the north. To the north, the range of the hirola is bounded by waterless, semi-desert acacia steppes with a sparse cover of grass. Kingdon (1982) suggests that it is insufficient grazing, rather than lack of water, that sets the northern limit of the range of hirola. To the east, in Somalia, aridity increases and over-grazing by domestic stock has been severe since at least the early l970s (Bunderson, 1979). The natural range is bounded on the south by a humid coastal forest-savanna mosaic, and on the west by a narrow band of riparian forest along the Tana River (Fig. 16). It should be noted that the region immediately to the west of the Tana River is also arid and extremely over-grazed, with the result that it is today largely an area of dense bush and little grass, and appears to be unsuitable habitat for hirola (Butynski pers. observ., 1999).

The current range of the hirola is on flat or gently undulating ground and lies between about 40 m (Garsen) and 220 m (Galma Galla) above sea level.

Rainfall is distributed bi-modally, with the long rains from April through June and the short rains from November through December. Distinct dry seasons occur between the rains, particularly during January-March. Mean annual rainfall ranges from 350 mm in the northern

extreme of the range to 700 mm on the southern edge of the range (Bunderson, 1979, 1981; Hughes, 1990) (Fig. 17). This rainfall gradient is the principle factor governing the distributions of plant and animal communities, although soil types also contribute to this (Bunderson, 1979). The preferred habitat of the hirola lies in the 400-550 mm rainfall zone (Bunderson, 1981).

Temperatures are high throughout the year. Annual daily minimum and maximum temperatures average about 2l°C and 30°C, respectively (Muchena, 1987). Mean monthly temperatures are 22°-36°C, being lowest during May-July and highest during January-February (Bunderson, 1981; Hughes, 1990).

In Tsavo East National Park, rainfall ranges from 200-700 mm per year. Mean monthly temperature minima is 20°C and mean monthly maxima is 30°C. The hirola in Tsavo live at an elevation of about 300-500 m. Thus, hirola in Tsavo are living at a slightly higher elevation where temperatures are marginally cooler than on the natural range.

Figure 14: June 1976 (late wet season) distribution and densities of the natural population of hirola antelope *Beatragus hunteri* in Kenya as determined by aerial surveys. These data taken from Bunderson (1976). Compare with the late dry season distribution (Fig. 15).

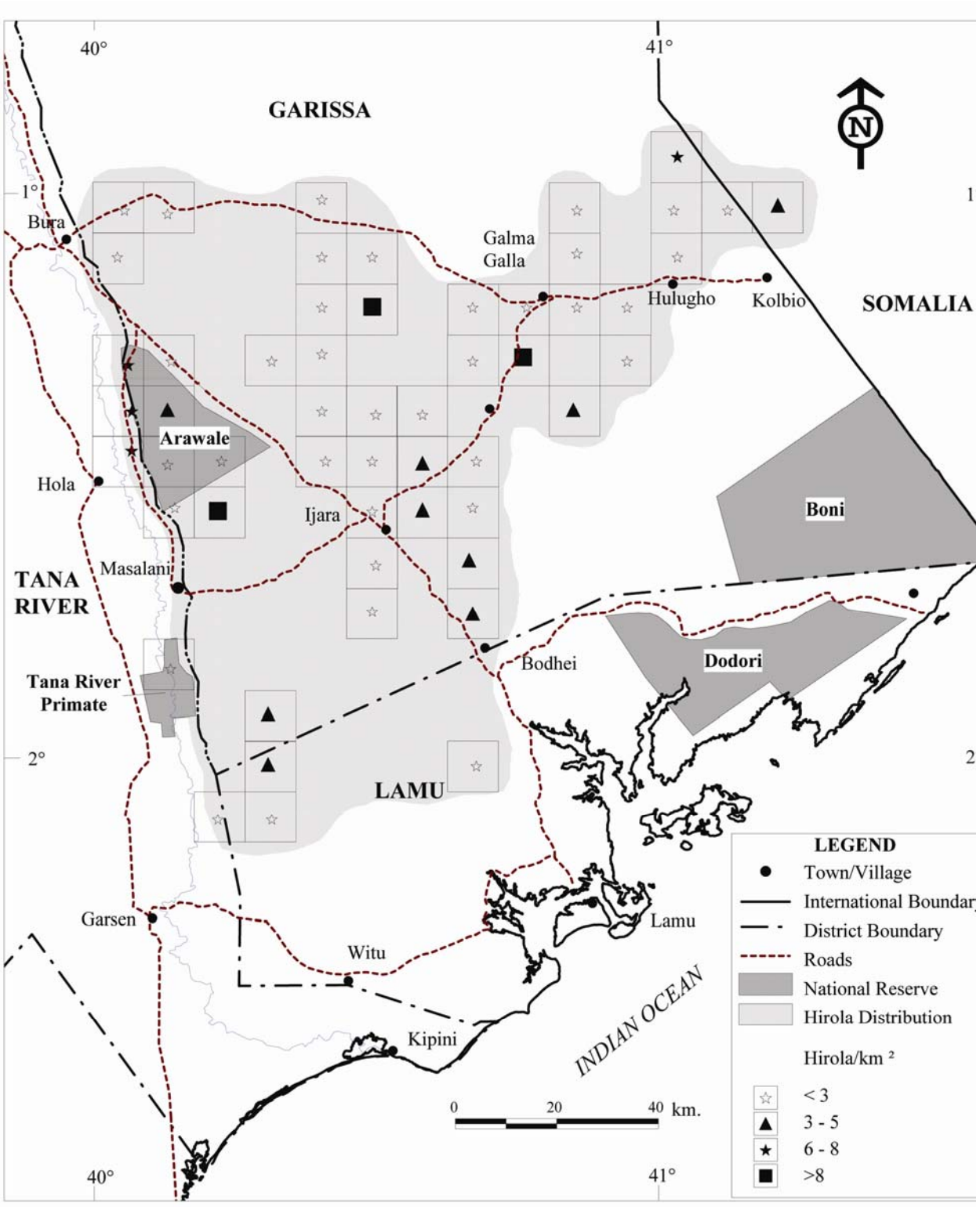



Figure 15: March 1976 (late dry season) distribution and densities of the natural population of hirola antelope *Beatragus*

*hunteri* in Kenya as determined by aerial survey. These data taken from Bunderson (1976). Compare with the late wet season distribution (Fig. 14).

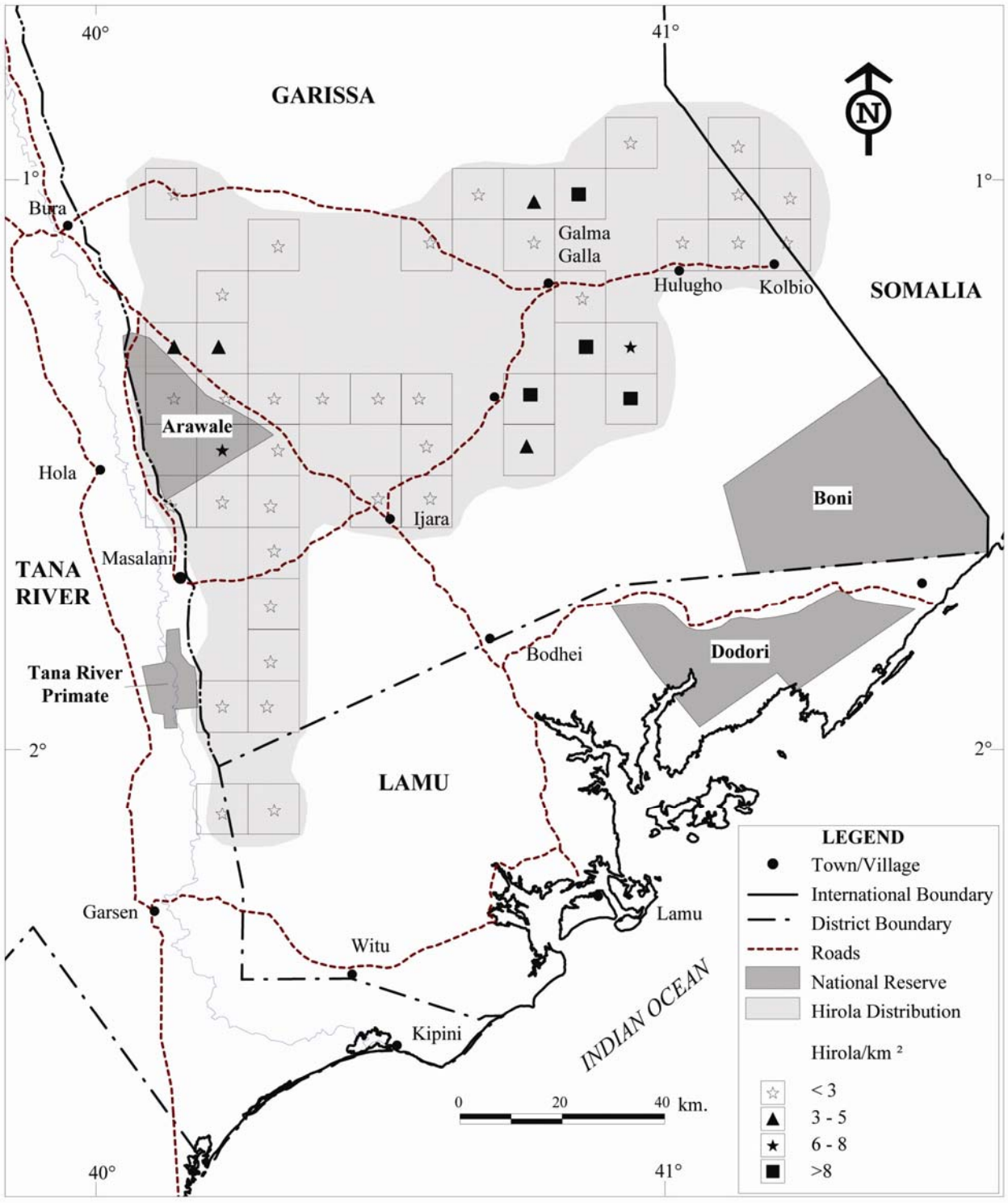

40°
41°
GARISSA
N
1°
Bura
Galma
Galla
Hulugho
Kolbio
SOMALIA
Arawale
Hola
Ijara
Boni
Masalani
TANA
RIVER
Bodhei
Dodori
Tana River
Primate
2°
LAMU
Garsen
Witu
Lamu
Kipini
INDIAN OCEAN
0
20
40 km.
LEGEND
Town/Village
International Boundary
District Boundary
Roads
National Reserve
Hirola Distribution
Hirola/km ²
< 3
3 - 5
6 - 8
>8

Figure 16: Major vegetation types over the geographic range of the hirola antelope *Beatragus hunteri* in Kenya. Based on Bunderson (1981), and Pratt and Gwynne (1977). Most of the range of the hirola is in the “Bushed Grassland” vegetation.

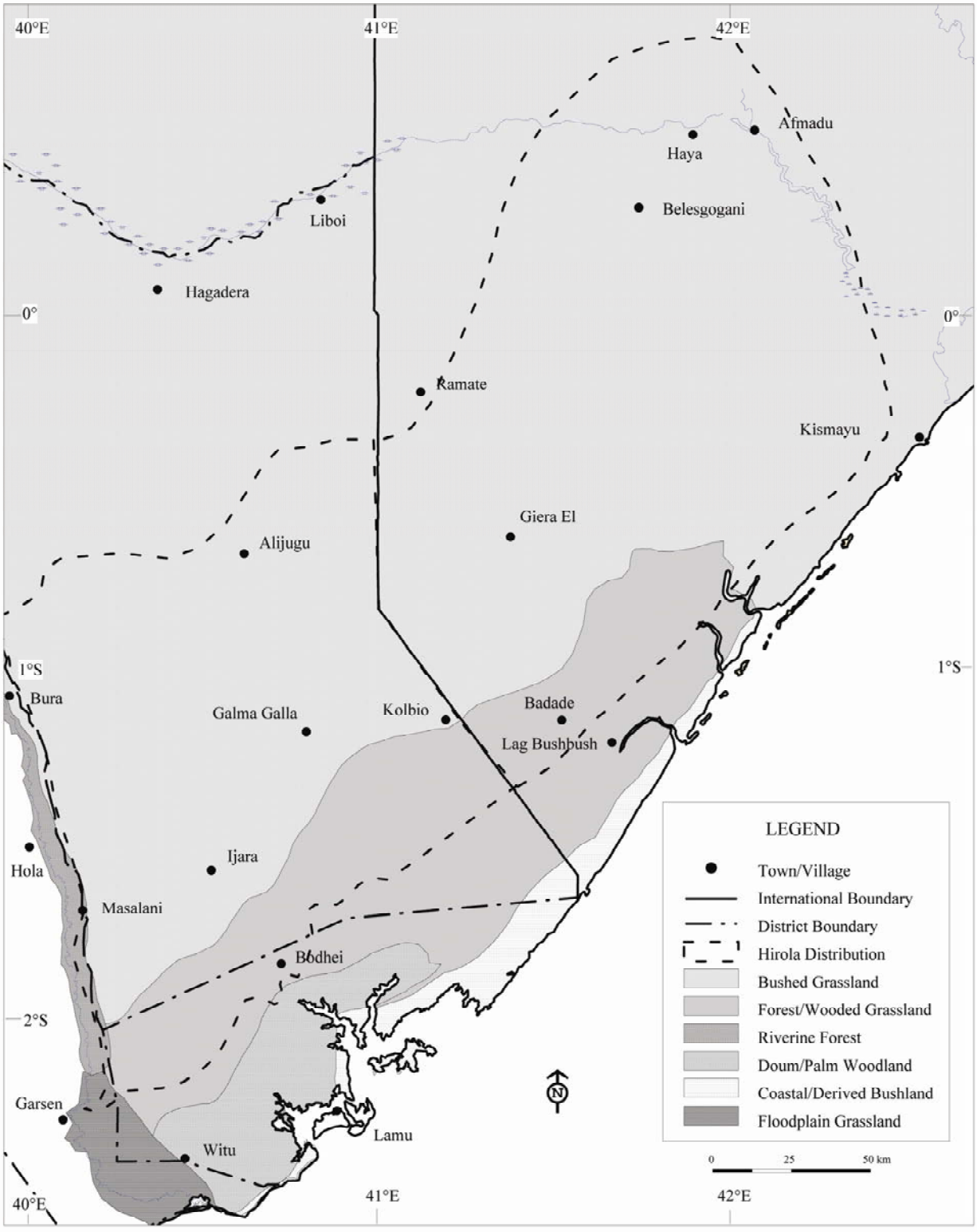
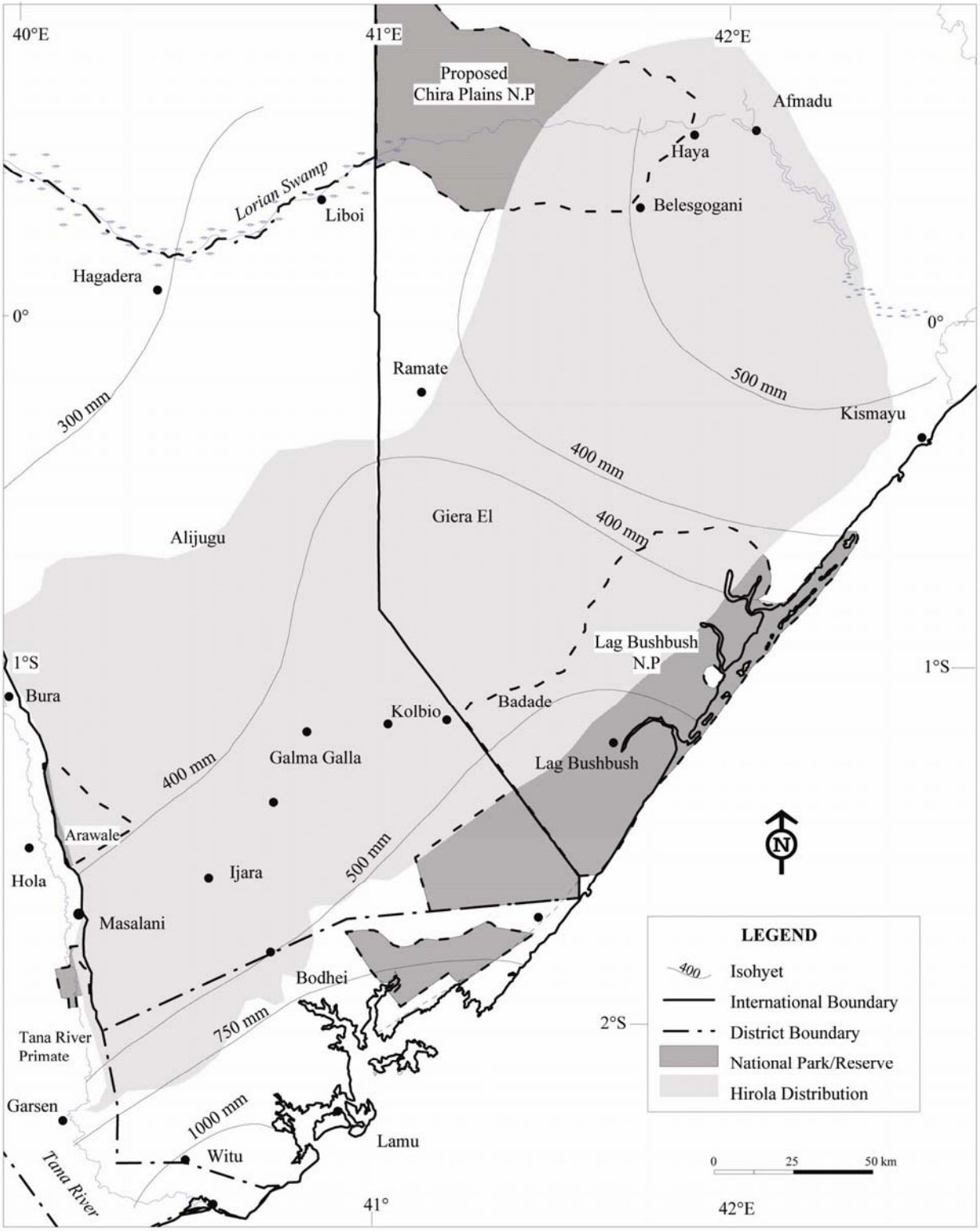

40°E
41°E
42°E
Afmadu
Haya
Belesgogani
Liboi
Hagadera
0°
Ramate
Kismayu
Giera El
Alijugu
1°S
Bura
Galma Galla
Kolbio
Badade
Lag Bushbush
Ijara
Hola
Masalani
Bodhei
2°S
Garsen
Witu
Lamu
LEGEND
Town/Village
International Boundary
District Boundary
Hirola Distribution
Bushed Grassland
Forest/Wooded Grassland
Riverine Forest
Doum/Palm Woodland
Coastal/Derived Bushland
Floodplain Grassland
0
25
50 km
N

Figure 17: Mean annual rainfall (mm) over the historic geographicrange of the hirola antelope *Beatragus hunteri.* Taken from the *National Atlas of Kenya* (Anon., 1970) and modified with data from Bunderson (1981) and Hughes (1990). The range of the hirola lies largely in the 350-500 mm rainfall zone.


40°E
41°E
42°E
Proposed
Chira Plains N.P
Afmadu
Haya
Belesgogani
Lorian Swamp
Liboi
Hagadera
0°
Ramate
300 mm
500 mm
Kismayu
400 mm
Giera El
400 mm
Alijugu
Lag Bushbush
N.P
1°S
Bura
Kolbio
Badade
Galma Galla
Lag Bushbush
400 mm
Arawale
Ijara
500 mm
Hola
Masalani
Bodhei
750 mm
2°S
Tana River
Primate
Garsen
1000 mm
Lamu
Witu
Tana River
41°
42°E
LEGEND
400 Isohyet
International Boundary
District Boundary
National Park/Reserve
Hirola Distribution
0 25 50 km

Tsetse fly are common in the coastal forest-savanna mosaic (Fig. 18). Since tsetse flies transmit trypanosomiasis to people and domestic animals, these areas are not heavily used by either people or their livestock. As most species of wildlife are immune to trypanosomiasis there are relatively high densities of wild animals in the tsetse fly zone (Bunderson, 1979; Butynski pers. observ., 1999).

Most of the range of the hirola lies north of the high risk tsetse fly/trypanosomiasis zone (Bunderson, 1985) (Fig. 18). Bunderson (in litt. to J. Williamson, 1985) suggests that the distribution of tsetse fly sets the southern limit for the hirola, implying that the southern distributions of the hirola is limited by trypanosomiasis. This seems unlikely. I strongly suspect that hirola are immune to trypanosomiasis. It seems far more likely that the habitat suitable for the tsetse fly (forest-savannah mosaic) is simply not suitable habitat for the hirola.

Agriculture in the region is limited largely to the west (right) bank of the Tana River as insecurity along the east (left) bank prevents the Pokomo farmers from living and farming there (Butynski & Mwangi, 1994). Within the habitat of the hirola, man's activities are limited primarily to the pastoral practices and domestic livestock of Somali and Orma nomads, particularly the Somalis who are the primary inhabitants of the region to the north of the tsetse fly zone. Most of the agricultural and pastoral activities in the range of the hirola continue to be at a subsistence level, although there has been an increase in commercial systems of production along the Tana River since the 1960s.

### 8.4 Habitat Preference

Hirola live in a mosaic of grassland, shrubland and open woodland. The habitat where this antelope is most often found has been described as "open bushed-grassland" (Dorst & Dandelot, 1970), "open grassland with scattered trees and open bushland" (Watson *et al*., 1973), "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 (1977, 1979, 1981) provides the most detailed information to date on the hirola in its natural range. He states that the preferred habitat lies in the 400 to 550 mm rainfall zone. He found hirola in 12 of the 19 habitat types which he recognized. Hirola showed preference for five of these habitats during the dry season, and seven during the wet season. In both seasons they preferred "open to lightly-bushed grassland" and "wooded savannas with scattered trees and shrubs of low stature". The highest densities of hirola (7.14 animals/km2) were recorded in short *Digitaria milanjiana/Chloris mossambicensis/Dobera glabra* wooded-bushed grassland on well-drained white sandy soils. This particular habitat can be considered the hirola's "optimal

habitat" and is easily recognized by the presence of widely scattered *Dobera glabra* trees in monodominant stands. 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. I suspect that a closer look at the preferred habitats of the hirola would reveal that they lie within ancient ("fossil") rivers and lakes. Hirola avoid tall dense stands of grass and herbaceous vegetation, as well as thick woodland and forest.

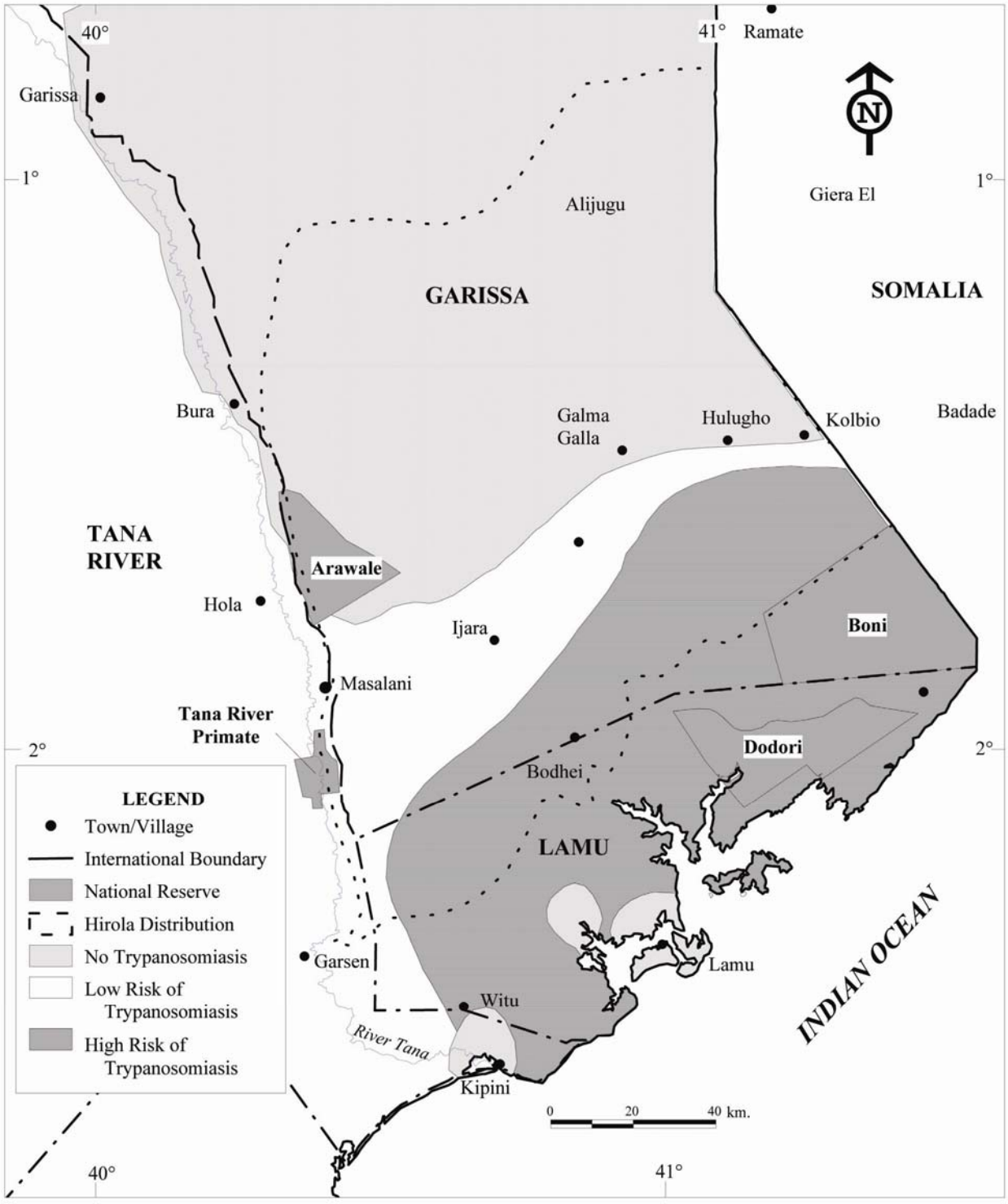
Bunderson (1985) concluded that hirola prefer short leafy swards of grass formed by fire or the combined grazing pressure of wildlife and domestic livestock. They appear to be attracted to areas which are used heavily by domestic livestock under traditional Somali herding practices, in which livestock 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).

Consistent with the findings of Bunderson (1977, 1981), Dahiye (1999) found that hirola in Garissa District prefer open grassland and wooded grassland habitats with short grass. Hirola tend to avoid woodland and particularly bushed woodland. During the wet season, hirola prefer the less diverse and more open habitats, while during the dry season they occupy more diverse and more wooded habitats where shade and some green forage can be found.

Hirola in Tsavo have habitat preferences similar to the population on its natural range (Andanje & Goeltenboth, 1996; Andanje & Ottichilo, 1999). Here, hirola use fairly open, short, green grassland habitats where grass heights averaged about 17 cm. More shrubby areas are used during the dry season and more open areas were used during the wet season. They found that hirola in Tsavo did not move far from seasonal waterholes.

Kingdon (1982) does not consider the hirola to have unusual ecological requirements, instead suggesting that it is more generalized than either *Damaliscus spp*. or *Alcelaphus* spp. He further suggests that the survival of the present relict population of the hirola is due to the absence of *Alcelaphus* spp. in the region, given that the hartebeest are the most likely

Figure 18: Distribution of tsetse fly *Glossina* spp. and trypanosomiasis over the geographic range of the hirola antelope *Beatragus hunteri* in Kenya (*National Atlas of Kenya*, 1970; Bunderson, 1981). The range of the hirola is largely outside of the tsetse free/trypanosomiasis zone.


40°
41°
Ramate
Garissa
1°
Giera El
Alijugu
GARISSA
SOMALIA
Bura
Galma
Galla
Hulugho
Kolbio
Badade
TANA
RIVER
Arawale
Hola
Ijara
Boni
Masalani
Tana River
Primate
2°
Dodori
Bodhei
LAMU
INDIAN OCEAN
Garsen
Lamu
Witu
River Tana
Kipini
0 20 40 km.
LEGEND
Town/Village
International Boundary
National Reserve
Hirola Distribution
No Trypanosomiasis
Low Risk of Trypanosomiasis
High Risk of Trypanosomiasis

ecological competitor for the hirola. *Alcelaphus* is a relatively recently evolved genus, the members of which have probably been kept out of the range of the hirola by the Indian Ocean to the south, the Tana River to the east, and the sub-desert to the north (Kingdon, 1982) (Fig. 19).

A large part of the southern range of the hirola in Kenya (and formerly also in Somalia) over-laps with Africa's largest remaining population of topi (East, 1998) (Fig. 13). Competition between these two species/genera is likely during the dry season and during droughts when good grazing is scarce. During these periods, hirola concentrate at sites in the northern and eastern parts of its range while the topi retreats southwards to forage on the relatively moist coastal grasslands (Bunderson, 1981). These movements must do much to limit competition between these two species.

It is worth pointing out that the "coastal topi" *D. l. topi* has a distribution which, like the hirola, is limited to south-western Somalia and south-eastern Kenya (Fig. 13). Unlike the hirola, however, the topi is a common species with an estimated 40,190 animals in Tana, Garissa and Lamu Districts in 1996 (DRSRS l996a,b, 1997).

### 8.5 Diet and Feeding

Upon close examination of the gastro-intestinal tract of the hirola, Hofmann (1996) concluded that this species is an extremely well adapted dry region grass and roughage eater as defined in his ruminant classification of feeding types (Hofmann & Stewart, 1972).

The hirola is primarily a grazer, although browse from forbs and woody vegetation is an important part of the diet during the dry season. Hirola are highly selective in terms of the plant species eaten, and their height and greenness. They prefer short green grass with a high ratio of leaf to stem (Bunderson, 1981; Andanje & Goeltenboth, 1995; Andanje & Ottichilo, 1999; Dahiye, 1999). Mean "bite heights" for selected food plants in Tsavo ranged from 3.7-16.0 cm (Andanje & Goeltenboth, 1995). *Chloris* spp. and *Digitaria* spp. are particularly important in the diet, both in the natural range (Kingdon, 1982) and in Tsavo (Andanje & Goeltenboth, 1995). During a 3 month study in Tsavo, hirola were observed feeding on 23 species of grasses and on three species of forbs (Andanje & Ottichilo, 1999).

Dahiye (1999) often found hirola feeding on luxuriant regrowth in and around abandoned homesteads and bomas, and at dried-up water holes, dams and floodplains. Hirola seem to select the most nutritious plants during the wet season and those with high water content during the dry season.

Kingdon (1982, 1997) states that hirola do not require drinking water; surviving drought by laying down fat, by avoiding energetic activity, and by resting in shade during the heat of the day.

Bunderson (1981) and Dahiye (1999) also found that hirola appear to be independent of surface water.

Andanje and Goeltenboth (1995) state that in Tsavo, "...hirola were always within 500 m of water holes and fresh foot prints were always found at water holes". The widespread observation that hirola are often found near watering points has suggested to many people that hirola require free-water. For example, Ottichilo *et al*. (1995) and Magin (1996b) imply that hirola need to drink water. During my time in Garissa District, several people indicated that hirola require free-water, and that they compete with livestock for water on the natural range. I, therefore, questioned a good many people as to whether they had actually observed hirola drinking. None had...even during periods of drought! These included John Muhanga (the long-time KWS Warden in Garissa), Sam Andanje, and several Hirola Scouts and members of the two hirola conservation NGOs.

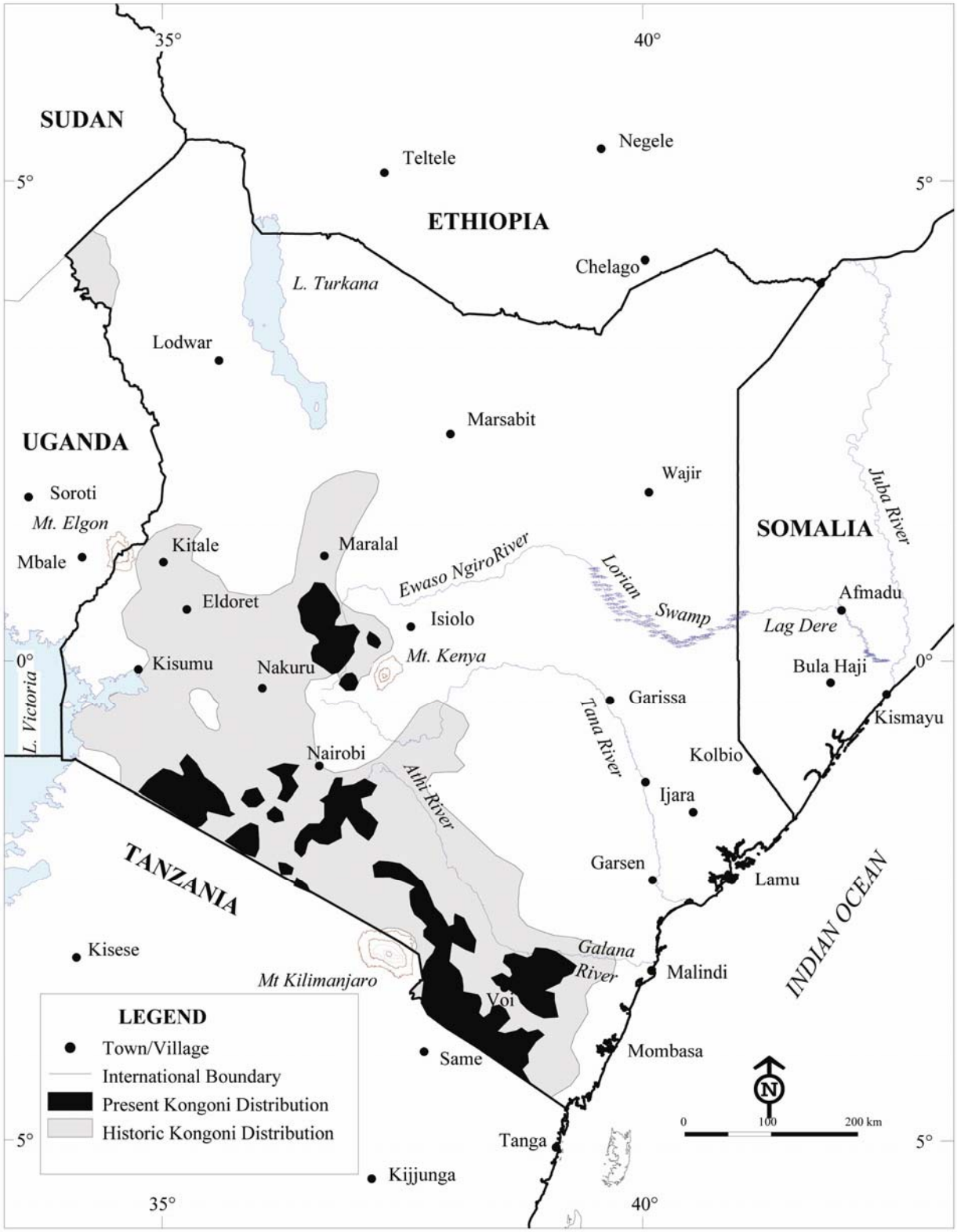
I conclude that hirola are present at these sites not for the water, but rather for the short, green grasses that these sites offer. This conclusion lends support to Kingdon's (1982) statement that the hirola "...is capable of surviving without water...", and to his suggestion that the northern range of the hirola is not limited by surface water but rather by suitable quantities of short, green grass.

In Tsavo, the main feeding periods are from 9:30-13:30 h, and from 15:30 h to early evening (Andanje & Geoltenboth, 1996). No night observations were made. Dahiye (1999) observed that hirola in the natural population are most active from 7:30- 10:30 h, during the evening and through the night. As in Tsavo, hirola on the natural range often rested in the early morning and during mid-day. Part of the reason for feeding at these times is probably to obtain moisture from the forage and to reduce water loss.

### 8.6 Social Organization and Population Structure

Adult male hirola attempt to secure and hold territories on which there is good quality pasture. The territories, which are vigorously defended, are up to 7 km2 in size (Bunderson, 1985). Territories are marked with secretions from the pre-orbital glands smeared on vegetation and soil. In addition, the males posture on stamping grounds. The soils at these sites are scraped with the

Figure 19: Historic (pre-1963, Stewart & Stewart, 1963) and recent (1987-1994, Grunblatt *et al*., 1995, 1996) distribution of the kongoni (Coke's hartebeest) *Alcelaphus buselaphus* in Kenya. This species is not found in Somalia. The topi (Fig. 13) and the kongoni are the two species in the region which are most closely related to the hirola antelope *Beatragus hunteri* and, therefore, may have at times competed with (or out-competed) the hirola for food.


35°
40°
SUDAN
Teltele
Negele
5°
ETHIOPIA
Chelago
L. Turkana
Lodwar
Marsabit
UGANDA
Wajir
Soroti
Mt. Elgon
SOMALIA
Juba River
Kitale
Maralal
Mbale
Ewaso NgiroRiver
Lorian Swamp
Afmadu
Eldoret
Isiolo
Lag Dere
0°
Kisumu
Nakuru
Mt. Kenya
Bula Haji
L. Victoria
Garissa
Kismayu
Tana River
Nairobi
Athi River
Kolbio
Ijara
TANZANIA
Garsen
Lamu
INDIAN OCEAN
Kisese
Galana River
Mt Kilimanjaro
Malindi
Voi
LEGEND
Town/Village
International Boundary
Present Kongoni Distribution
Historic Kongoni Distribution
Same
Mombasa
N
0
100
200 km
Tanga
Kijjunga

hooves and marked with dung, and the vegetation is slashed with the horns (Kingdon, 1982; Andanje & Goeltenboth, 1995; Dahiye, 1999; Butynski pers. observ., 1999). Non-territorial males live in bachelor groups of 2-38 animals (Bunderson, 1985), sometimes in the company of topi, Burchell's zebra *Eguus burchelli,* gerenuk *Litocranius walleri*, and giraffe *Giraffa camelopardalis reticulata* (Bunderson, 1981; Kingdon, 1982).

During the 1970s, Bunderson (1981) observed mixed aggregations of breeding/nursery groups and bachelor groups numbering up to 300 individuals, particularly at the end of the dry season when isolated rains produced patches of green vegetation. Females form breeding/ nursery groups of from 5-40 animals (Kingdon, 1982), with a mean group size of about eight individuals on the natural range (Bunderson, 1985). The survey reports by DRSRS and KWS do not (surprisingly) give information on either the number of groups encountered or on group size. Kock (1995) indicates that during the KWS survey in 1995 that, "The population is scattered in small groups (maximum 15) with very few young animals". A radio message by "Pilot Lamu", dated 8 August 1996, gave the sizes of 15 groups of hirola on the natural range. Mean group size was 7.0 (range 2-12). From these limited data it appears that mean group size has not changed over the past 25 years or so, although the large aggregations reported by Bunderson (1981) and Kingdon (1982) seem to no longer occur.

Working in the natural range in 1989-1999, Dahiye (1999) found that there is a dominant male in each nursery group and that these groups are fairly stable. Nursery groups ranged in size from 5-17 animals. The mean size of 10 groups selected for more detailed study was 8.7 animals (range 6-11). Of the 87 hirola in these 10 groups, 56% were adults, 28% were subadults/yearlings, and 16% were calves. Forty-nine percent of the 87 hirola were females, 34% were males and 16% were unsexed calves.

Censuses conducted on the natural range in 1998-1999 found that 72% of hirola were adults while 28% were subadults, yearlings and calves. Of the adults, 44% were males and 56% were females. There were significantly more adult females than adult males (Dahiye, 1999). This age/sex structure is similar to that found in the Tsavo population (Section 7.3).

Andanje (2000b) counted 274 hirola in 38 groups over the natural range (19 groups in June-July 1999 dry season; 19 groups in March-April 2000 wet season). While some of these groups were undoubtedly counted more than once, these data are nonetheless valuable, particularly since the counts were made nearly 1 year apart. Mean group size was 7.2 animals (range 2-16). Of the 274 hirola observed, 68% were adults, 10% were subadults, 16% were yearlings, and 6% were calves.

On the natural range, bachelor groups are mainly comprised of subadult males and females, and subordinate adult males. Bachelor groups ranged in size from 2-24 individuals in 1998-1999, but were very unstable.

At Tsavo, mean group size for eight groups was 7.5 (range 5-11) in 1995 (Andanje & Ottichilo, 1999). In 1998, the mean size of seven groups in Tsavo was 8.0 (range 2-19) (Andanje, l998b). In 1999, the mean size of eight groups was 7.6 (range 2-15) (Andanje, l999a).

In Tsavo, breeding groups are relatively sedentary. They are usually accompanied by one adult male and lead by either the adult male or the dominant female. The adult male is presumed to be the holder of the territory on which the group is present (Kingdon, 1982). It seems likely that these groups move from one adult male territory to another in search of food. In Tsavo, two breeding/nursery groups under study moved 3.5-4.5 km per day (Andanje & Goeltenboth, 1995). Here, sub-adults of both sexes leave nursery groups when about 9 months of age and live in peripheral areas where they spend most of their time alone or in association with other species of ungulate, particularly Grant's gazelle *Gazella granti.* Occasionally these subadults form temporary mixed or single sex groups of up to three subadults. Subadult females, but not subadult males, sometimes temporarily joined an adult male (Andanje, l997a; Andanje & Ottichilo, 1999).

On the natural range, groups of hirola are often associated with beisa oryx *Oryx beisa beisa*, gerenuk, and giraffe (Bunderson, 1981). Dahiye (1999) found hirola in association with at least one other species 59% of the time. They were in association with beisa oryx 19% of the time, with Burchell's zebra 13% of the time, and with Grants' gazelle 12% of the time. Andanje and Goeltenboth (1995) found that groups of hirola in Tsavo spend 33% of their time alone, but are with Grant's gazelle 67% of the time, and with warthog *Phacochoerus* spp. or beisa oryx 8% of the time.

In Tsavo, Andanje (l998a) found that calving takes place near the nursery group, but that the majority (6 of 9) of females with calves moved out of the group to stay either alone or with one other female for 1-2 months before rejoining the group.

Calves are able to follow their mothers within 30 minutes after birth (Sam Andanje in litt., March 1998).

### 8.7 Reproduction

Data on age at sexual maturity for hirola in the wild are not available. In captivity, one female mated at 1.4 years and gave birth to her first calf at 1.9 years (Smielowski, 1987). A male and a second female born in captivity first mated when 1.7 years of age.

In the wild, female common hartebeest *Alcelaphus busephalus* are sexually mature at 1.5-2 years of age and generally give birth to their first young at 2-3 years of age. Male hartebeest are adult-sized at 3 years but probably take at least 4 years to establish territories and mate (Bindernagel, 1968; Skinner & Smithers, 1990).

Female bontebok *Damaliscus dorcas dorcas* and blesbok *Damaliscus dorcas phillipsi* are sexually mature at 2-2.5 years, and have their first calf at about 3 years (Skinner & Smithers, 1990).

Female topi and tsessebe first breed at approximately 28 months and have their first calf at about 3 years. Males become sexually mature at 30 to 42 months (Child *et al*., 1972; Kingdon, 1982).

These reproductive parameters for other Alcelaphines probably also apply to the hirola in the wild. If so, female hirola in the wild probably mature at 2-2.5 years and have their first calf at about 3 years. Male hirola in the wild are probably sexually mature at 2.5-3 years, but probably do not usually establish territories and breed until about 4 years of age.

Kingdon (1982) states that hirola are seasonal breeders, and that most calves are born at the beginning of the short rains in October and November. Similarly, Andanje (l998a) found that hirola in Tsavo calve from early August to mid-February, with a peak in November. These are also the months during which other Alcelaphine give birth, even in southern Africa (Skinner & Smithers, 1990).

The timing of the birth season means that optimal grazing is available to lactating females and growing calves in November-January. The gestation period of 227-242 days (Smielowski, 1987) centres the mating season on February-March at the start of the long rains.

There are no data on calving rates or calf survival for hirola in the natural population. During the 1996-1997 calving season, approximately 64% of the adult females in Tsavo gave birth (Andanje, 1997a,b). Hirola are only known to give birth to singletons.

In Tsavo, during the 1996-1997 calving season, 12 of 19 calves (63%) survived to April 1997 (Andanje, 1997b). During the 1997-1998 calving season, seven of 13 calves (54%) survived to July 1998 (Andanje, 1998a). Mortality was particularly high among calves less than 1 month of age. In captivity, 32% of 19 calves died before they were 3 months of age (Smielowski, 1987).

### 8.8 Predators

The known predators of hirola are lion, leopard *Panthera pardus,* and wild dog (Andanje, 1997a, 1998a,b; Dahiye, 1999). As with other bovids of this size living in savannah habitats, cheetah, and spotted hyaena are probably also significant predators of hirola. All of these predators seem to be in reasonable numbers in Garissa District (Ottichilo *et al*., 1995; Butynski pers. observ., 1999). According to Kock (1995), “There are still considerable numbers of predators, mainly lion but also cheetah and wild dog contributing to the overall pressure on the species [hirola]”.

At this time there is much talk among the Hirola Scouts and herdsmen of wild dogs in the range of the hirola (Yakub Dahiye pers. comm., March 1999). It seems that packs of wild dogs are fairly often sited, and that there are at least two packs in the

Kenya portion of the natural range of the hirola. One of the packs was said to be of about 10 animals and the other of more than 20 animals. The pack of 10 was reported to be in the vicinity of Katumba and Kandelongwe (John Muhanga pers. comm., 1999). One Hirola Scout said he saw wild dogs chasing a hirola near a cattle boma and another reported seeing wild dogs killing a hirola (S. Aden Ali pers. comm., 1999).

Jackal *Canis* spp., caracal *Felis caracal,* serval *Felis serval,* baboons *Papio cynocephalus,* pythons *Python sebae,* and large eagles *Aquila* spp. probably prey on hirola calves, perhaps particularly new-born calves lying-up away from their mothers.

The picture that is emerging from current research is that lion are the main predator of the hirola, both on the natural range and in Tsavo. Andanje (1997a, 1998a) found a total of seven adult hirola and one calf killed by lions in Tsavo, and two calves killed by leopards during 1997-1998. Hirola Scouts reported 13 hirola (seven of which were sick) killed by lions in Garissa District in 1998-2000 (Andanje, 1998b, 2000a).

### 8.9 Diseases

In captivity, hirola suffer from acidosis, bloat, tuberculosis and mycobacterioses (Smielowski, 1987).

Little is known concerning disease in wild hirola. It is probable, however, that, like most African bovids, the hirola is at least somewhat susceptible to rinderpest. The closely related *Damaliscus* spp. are moderately susceptible to rinderpest (Woodford, 1984), while the wildebeest *Connochaetes taurinus,* which is a member of the same tribe (Alcelaphini) as the hirola, is particularly vulnerable to rinderpest (Watkin, 1997).

Confirmed epidemics of rinderpest occurred among cattle in the range of hirola (Garissa District) in 1962-1963 and in 1982- 1984, and rinderpest is apparently present in cattle and goats in Garissa District at this time (HMC Minutes, May 2000) (Fig. 12). There was a probable epidemic in the area in 1972-74 (SVA in litt. to J. Mirangi, October 1995). Ottichilo *et al*. (1995) suggest that each rinderpest epidemic may kill 50% of the hirola. This seems possible based upon what is known about the level of mortality experienced by other ungulates during rinderpest epidemics. In 1991, rinderpest struck the Serengeti-Mara region and within 2 years the populations of buffalo and wildebeest declined by 95% (Watkin, 1997). In 1994-1995 there was a rinderpest epidemic west of the Tana River near Garsen and in Tsavo East National Park. In Tsavo, this epidemic killed 55% of the buffalo and 85% of the individuals of some other ruminant species (Kock, 1997; Kock *et al*., 1998, 1999).

Initial seriological testing of four adult hirola in 1995, and of the 35 hirola captured during the 1996 translocation, indicated that none of these animals had been exposed to rinderpest at anytime in their lives. In 1999, however, these samples were reassessed using a more sensitive test. It was found that at least

one of the hirola was positive for rinderpest (Richard Kock pers. comm., 1999). This, the first evidence for rinderpest in the hirola, indicates that there has been rinderpest in the natural population of hirola at least once since the early 1980s.

There is concern that rinderpest may now be continuously present (endemic) in Garissa District and that each year a portion of the hirola population succumbs to this disease (Richard Kock in litt., 1999). If this is the case, this could at least partly explain why numbers of hirola have not recovered since the 1983-1984 crash.

Foot-and-mouth might cause some mortality among hirola but it is likely that hirola, like other wild ungulates are wholly or partially resistant to this disease (Pratt & Gwynne, 1977; Richard Kock in litt., 1999).

East coast fever and trypanosomiasis killed at least 24 hirola in Garissa District in late 1998 (HMC Minutes, February 1999). The southern part of the natural range of the hirola lies within the coastal tsetse fly/trypanosomiasis zone (Fig. 18) (Section 8.3). Magin (1996b) points out that the hirola in Tsavo have survived 35 years of living in a tsetse fly zone. This implies a certain level of resistance. No blood parasites, including trypanosomiasis, were found in 38 samples taken from hirola during the 1996 translocation (Kock *et al.*, 1998).

Of particular concern is the likelihood that hirola are susceptible to diseases harboured by domestic livestock, especially goats and cattle. For example, outbreaks of contagious bovine pleuro-pneumonia among cattle are frequent within the natural range of the hirola (Agatsiva, 1995). Haemorrhagic septicaemia and tuberculosis are other common livestock diseases to which hirola might be susceptible (Richard Kock pers. comm. to Magin, 1996).

During 1998, Hirola Scouts found 21 hirola infected by an unidentified disease. This disease also infected other wild ungulates and livestock. Infected animals lost weight and then were unable to walk. Infected livestock recovered when kept in the shade, injected with tetracycline, and given water and food. While some of the sick hirola recovered, at least seven were killed by lions (Andanje, 1998b). This disease seems not to have had a great impact on the number of hirola.

As with other species of wild ungulates, the hirola has probably suffered massive mortality from disease from time to time. There are, however, no reports of hirola suffering significant declines in numbers as a result of disease. Kingdon (1982), apparently referring to the 1960s and l970s, said there was no evidence of a disease epidemic killing large numbers of hirola. The strongest indirect evidence for a disease epidemic in hirola is the dramatic decline in hirola numbers during 1983-1985.

## 9. WHAT CAUSED THE DECLINE IN THE NUMBER OF HIROLA?

## 9.1 Introduction

The change in the size of the hirola population on its natural range raises two important questions. Firstly, why did this population apparently decline 85-90% during the brief period 1983-1985, and secondly, why has this population not recovered?

Previous biologists addressing the question of why this population declined all suggest the following as potential causes: (1) predation (including poaching), (2) disease, and (3) food shortages (resulting from drought, increased competition from livestock, habitat loss/degradation) (Wargute & Aligula, 1993; Wargute, 1994; Agatsiva, 1995; Magin, l996b; Dahiye, 1999). This is, of course, the “standard list” of those factors known to at least sometimes cause substantial declines of wildlife populations, perhaps particularly of ungulates.

Here I provide a review of what is known concerning the above potential causative factors as they might relate to the decline in the number of hirola on the natural range. This information is then used as a basis for “informed speculation”.

What we know about predation and disease as concerns the hirola is presented above in Sections 8.8 and 8.9, respectively.

## 9.2 Food Shortages

Shortages of food, resulting in the decline of a population of wild ungulates in a semi-arid region are most often attributable to drought, increased competition from livestock, and habitat loss/degradation. These three factors, often strongly interlinked and interdependent, will be considered here.

**9.2.1 Habitat Loss and Degradation.** Hirola have apparently had an association with pastoralist and their livestock for at least 1,000 years. What little is known of the history of the region between the Tana and Juba Rivers suggests that the first pastoralist here were Bantu. The Bantu were forced to retreat southwards to the Tana by Somali pressure from the north. In about the 16th century, the Orma (Galla), moving down the Tana, dislodged the Somalis to occupy these grazing lands for perhaps 200 years. In the 18th century the Somali moved south in a reconquest of their former land, until by the l860s the Galla were largely removed (Turton, 1975). These early pastoralists were apparently semi-nomadic, their livestock densities were probably low, and there is no evidence that there was significant over-grazing or habitat alteration. They probably also did little hunting.

People and their livestock have greatly reduced the range of the hirola during the second half of the 20th Century. The number of people in Garissa District decline considerably from 94,000 in 1962 to 65,000 in 1969. This was apparently in response to the

considerable fighting which occurred in Garissa District during this period. The human population then rose sharply over the decade between 1989 to 1999 from about 127,000 in 1989 to 390,000 in 1999. This increase is partly a result of refugees moving into the District from war-torn Somalia (Fig. 20).

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 schemes which destroyed hirola habitat and which drew large numbers of people and livestock onto the range of the hirola. 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. There is a strong trend for the nomadic Somali and Orma people of this region to become increasingly sedentary. One result is an increased degradation of critical grazing areas both for livestock and wildlife (Andanje, 1999b; Dahiye, 1999).

Based on their review of wildlife and livestock population trends in Kenya from 1977-1994, Rainy and Worden (1997) reach several conclusions concerning what will happen to Kenya's wildlife and livestock populations over the next 10 years if rangeland and wildlife conservation strategies strong enough to stop the present massive declines in the numbers of wild animals cannot be quickly found. Some of their conclusions are as follows:

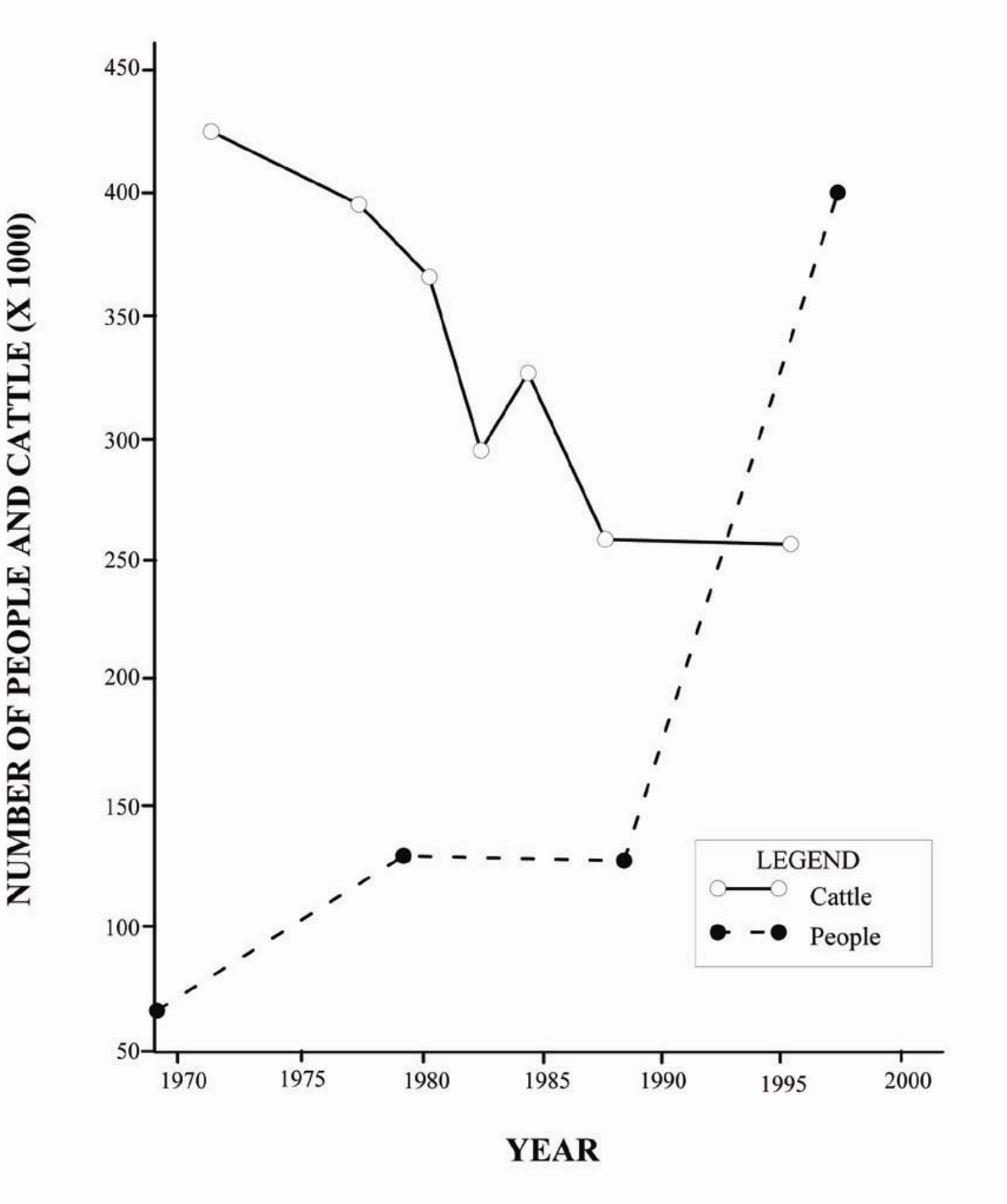
"It is often assumed that domestic animals will increase as wildlife declines but in fact national losses of domestic livestock may be nearly twice wildlife losses. Losses to cattle may be so severe that cattle may become undetectable within the decade in seven rangeland districts: Turkana, Garissa, Samburu, Isiolo, West Pokot, Tana River and Kwale". "Over vast areas of Kenya's rangelands, wildlife populations and cattle populations are in dramatic and rapid decline. Such livestock declines suggest that we may now be paying the price of more than 100 years of over-stocking beyond the carrying capacity limits set by rainfall".

"...we suggest that a common cause of these livestock and wildlife declines may be carrying capacity reduction because of rangeland degradation, particularly of the grass and herb layer. The current shift from cattle to small stock and camels for many districts may be the result of loss of grass cover. In the long term, this shift to browsers may only extend range degradation into the woody layers of vegetation".

"Finally, these declining wildlife and cattle trends raise a much larger human security problem that goes beyond the already serious implications for wildlife, tourism, range management and the livestock industry. For the past two years, Kenyan newspaper headlines have highlighted many instances of armed livestock raiding between pastoralists in Baringo, West Pokot, Turkana, Samburu, Isiolo, and Marsabit Districts. The scale of these raids

is unprecedented in Kenya, but may have parallels in the recent collapse of the Somali state and the chronic insecurity that has affected Karamoja District in Uganda for the past 25 years. These raids involve thousands of animals, automatic weapons, and the loss of life and livelihood for thousands of pastoralists. They cannot be explained simply by invoking the traditional propensity for stock raiding by pastoral people. In 1996, hundreds of Samburu

Figure 20: Changes in the total number of people (1969-1999) and cattle (1973-1996) in Garissa District, Kenya. It is interesting to note that the population in Garissa District was 93,400 people in 1962 before declining to 64,500 people in 1969. The population more than tripled over the 10 years from 1989-1999. This is apparently largely due to the mass movement of people into Garissa District from Somalia. Data for people are from the Central Bureau of Statistics, Ministry of Finance and Planning, Kenya Population Census. Data for cattle from Grunblatt *et al*. (1995) and DRSRS (1997).


NUMBER OF PEOPLE AND CATTLE (X 1000)
450
400
350
300
250
200
150
100
50
1970
1975
1980
1985
1990
1995
2000
YEAR
LEGEND
Cattle
People

families and thousands of their cattle sought refuge on northern Laikipia to escape the combined effects of drought and raids by Turkana and Somali. These conflicts may well be a modern human response to environmental degradation of the region's rangelands that is unprecedented in extent and severity".

**9.2.2 Drought and Disease.** In semi-arid areas, severe droughts are known to greatly reduce wildlife populations through thirst and starvation. For example, in the Masai Mara, in 1993-1994, 80% of an estimated 8,000 buffalo died or emigrated as a result of drought (Holly Dublin pers. comm. in Magin, 1996b).

There were droughts over the range of the hirola during 1965, 1970, 1973-1976, 1979, 1980, 1984-1985, 1990, 1992 (Dirschl, 1978; Decker, 1989; Wargute & Aligula, 1993; Wargute, 1994). These drought years are plotted at the top of Figure 12. During 13 of the 18 years from 1970-87 there was lower than average rainfall in the region (Decker, 1989). The 1973-1976 drought was probably the most severe, but there is no indication from the census data that this had an impact on hirola numbers. There was also a moderate drought during 1984-1985, at the time of the great decline in hirola numbers. Probably more importantly, however, there was also a rinderpest epidemic in Garissa District during 1982-1983. I strongly suspect that this epidemic, perhaps in conjunction with drought-related stress as a result of a shortage of food on over-grazed range, caused the rapid decline in the number of hirola.

Some other species of wild ungulate (but not all) also declined considerably in Garissa District during this period, and have since failed to fully recover (Table 11). For example, the population of Grant gazelle dropped from 5,104 in 1983 to 1,203 in 1985 (76% decline), and was 1,926 in 1996. Lesser kudu numbers fell from 2,816 in 1983 to 776 in 1985 (72% decline), and were at 1,812 in 1996. Topi numbers dropped from 18,064 in 1983 to 3,033 in 1985 (83% decline), but increased to 27,568 by 1988.

Why have topi rebounded from this population crash while the population of hirola have not?. The range of the hirola experienced a considerable increase in the number of people and livestock during the 19th Century. This has lead to severe degradation and loss of habitat for hirola, and to increased competition for food with livestock. There has also been a substantial increase in poaching. These factors have likely made it difficult, if not impossible, for numbers of hirola to recover. In contrast, most of the dry season range of the topi lies deep within the tsetse fly zone and, therefore, remains largely intact with few people or livestock, and without widespread poaching. The topi population has recovered rapidly under these conditions.

**9.2.3 Loss of Floodplain Grasslands.** Hirola live in a semi-arid region bordered by two major rivers, the Tana and the Juba. Both rivers have extensive floodplains. When these rivers discharge water over their banks and onto the floodplain, a large amount of

sediment rich in nutrients is deposited. This periodic inflow (recharge) of water and nutrients makes these floodplains far more productive than areas away from the river. These favourable hydrological conditions may have played a critical role in providing seasonal “fall-back” forage for a portion of the hirola population. This suggestion is supported by the fact that part of the hirola population tends to congregate near the Tana River during the dry season (Bunderson, 1981). With the regeneration potential of these floodplains reduced as a result of the five large hydro-electric dams up-stream, and the amount and frequency of the forage for hirola likewise reduced during critical periods, the carrying capacity of the range of the hirola has likely also been much reduced.

The floodplain of the Tana River extends from Mbalambala, which is upstream of Garissa, to Garsen, where the Tana Delta begins. This floodplain is up to 6 km wide over parts of the range of the hirola. The natural hydrological regime of this river consists of biannual floods, with peaks in May and November (Hughes, 1990). Historically, flood heights and duration have varied considerably along the Tana. These are now partly controlled by the five dams constructed between 1968 and 1988. The fourth and largest dam at Masinga was completed in 1981. A sixth, very large dam, is now being considered for construction at Mutonga/Grand Falls (Butynski, 1995).

Prior to the construction of these dams, floods in the Tana River were high enough to put water onto the grasslands of the floodplain about once every 3 years, on average (Hughes, 1990). It is predicted that the grasslands of the floodplain will now receive floodwater only once in 12 years, on average. That is, roughly one-fourth as often. This reduced frequency of flooding will likely diminish the amount of sediment deposited onto the grasslands of the floodplain and lower the water table. These events will reduce the extent of the area covered by floodplain grasses and, therefore, the amount of floodplain grass available to the hirola, as well as the frequency at which these grasses are available. The construction of additional dams will further decrease the frequency of flooding and the deposit of sediment over the floodplain. This will further reduce the productivity of the floodplain and its usefulness as a seasonal grazing area for livestock and wildlife, including hirola (Butynski, 1995; Nippon Koei, 1995). Other likely events are the replacement of the

Table 11: Changes in numbers of domestic stock and wildlife in Garissa District (1977-1996). Sources: Grunblatt, *et. al*. (1995); DRSRS, 1997.

| Species | 1977 (S.E.) | 1978 (S.E.) | 1983 (S.E.) | 1985 (S.E.) | 1988 (S.E.) | 1996 (S.E.) |
|---|---|---|---|---|---|---|
| **Livestock** | | | | | | |
| Cattle | 424886 | 394339 | 291366 | 324751 | 254681 | 251865 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | (108787) | (74597) | (38400) | (67101) | (42165) | (34084) |
| Goat & Sheep | 214932 (44873) | 393949 (49750) | 258823 (43323) | 326992 (70581) | 257070 (44430) | 468588 (61486) |
| Camel | 45561 (14273) | 45987 (10505) | 47372 (13974) | 91018 (24424) | 41901 (5534) | 60143 (13293) |
| Donkey | 905 (358) | 2119 (1083) | 1518 (584) | 4184 (1395) | 2654 (1608) | 3455 (974) |
| Livestock Subtotal | 686284 | 836394 | 599079 | 746945 | 556306 | 784051 |
| **Grazer & Browser** | | | | | | |
| Eland | 2162 (1710) | 278 (223) | 220 (215) | - - | 230 (153) | 0 (0) |
| Elephant | 5280 (1914) | 7725 (2638) | 2904 (980) | 642 (657) | 176 (170) | 0 (0) |
| Impala | 553 (395) | 446 (385) | 1012 (548) | - - | 318 (96) | 18 (18) |
| Grazer & Browser Subtotal | 7995 | 8449 | 4136 | 642 | 724 | 18 |
| **Browser** | | | | | | |
| Gerenuk | 10962 (1874) | 9983 (1167) | 6710 (991) | 7241 (4650) | 3149 (460) | 3889 (506) |
| Giraffe | 9755 (1675) | 11740 (2066) | 11947 (2131) | 10980 (2617) | 9077 (1214) | 9819 (1230) |
| Grant’s Gazelle | 18757 (6074) | 23063 (5502) | 5104 (1369) | 1203 (442) | 1645 (439) | 1926 (1039) |
| Lesser Kudu | 5582 (1340) | 4964 (1203) | 2816 (452) | 776 (457) | 619 (116) | 1812 (352) |
| Browser Subtotal | 45056 | 49750 | 26577 | 20200 | 14490 | 17446 |
| **Grazer** | | | | | | |
| Burchell’s Zebra | 3319 (2310) | 4183 (1835) | 3102 (1179) | 1633 (908) | 1238 (545) | 132 (130) |
| Grevy’s Zebra | 905 (411) | 752 (324) | 484 (176) | 1664 (1384) | 371 (145) | 283 (118) |
| Hirola | 15950 (?) | 11282 (?) | 10843 (?) | 1595 (?) | 1585 (517) | 1359 (486) |
| Oryx | 5079 (2420) | 5661 (1363) | 2442 (590) | 1969 (1077) | 1486 (361) | 3550 (783) |
| Topi | 4073 (1989) | 24095 (7540) | 18064 (5317) | 3033 (1293) | 27568 (11565) | 10914 (6986) |
| Waterbuck | - - | 697 (268) | 176 (78) | 875 (487) | 477 (219) | 717 (355) |
| Grazer | 29326 | 46670 | 35111 | 10769 | 32725 | 16955 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Subtotal | | | | | | |
| **Overall Total*** | 82377 | 104869 | 65824 | 31611 | 47939 | 34419 |

* “Overall Total” is for all large wild mammals (*i.e.*, excludes livestock).

grassland of the floodplain by bush, leading to the over grazing and degradation of other habitats over a large area.

Expanding human settlement, and both small and large farming activities on the flooplain of the Tana River, have further reduced the use of these grasslands by hirola and other wildlife.

**9.2.4 Competition with Livestock**. In theory, interspecific competition occurs when two or more species utilize a resource which is limited in supply. The result of competition is usually a decline in the numbers of one or both species.

In south-east Kenya, livestock (cattle, goats, sheep, camels, donkeys) far out-number large wild mammals (Table 11). For example, in 1996 there were about 784,000 head of livestock in Garissa District and about 34,400 head of large wild mammal. This is roughly 23 head of livestock for every one large wild mammal, and about 577 head of livestock for every hirola.

In terms of biomass, cattle account for most of the livestock biomass in this region. In 1976-1977, in areas where hirola occurred, the biomass of cattle ranged from 183-4,600 kg/km2, depending upon the habitat. In contrast, the biomass for hirola ranged from about 16-350 kg/km2 (Bunderson, 1981). The biomass of cattle at that time was, therefore, roughly 12-fold that of hirola. In 1996, after the collapse of the hirola population, the biomass of cattle was probably more than 400 times that of the hirola.

Cattle and hirola are both grazers that prefer areas of low woody canopy and short grass. Cattle undoubtedly consume large amounts of forage that otherwise would be available to large wild herbivores such as 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. In particular, competition is expected to be present during droughts when food is especially scarce (Bell, 1970; Sinclair, 1975; Bunderson, 1981).

While hirola generally avoid cattle, their numbers are highest in areas heavily used by cattle, such as around seasonal watering points. 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. Bunderson (1981) conducted the only detailed assessment of habitat preference and use in south-east Kenya in 1966-1978. He concluded that “under present conditions, the grazing of domestic livestock by semi-nomadic herdsmen has had no significant adverse effect on wildlife in the range of the hirola”. “All in all, wildlife seemed little affected by the current livestock numbers and grazing practices of pastoralists”. It should be noted, however, that at the time of Bunderson’s study there was an absence of over-grazing in this region. At the present time there is extensive over-grazing with accompanying

bare ground and bush encroachment (Section 9.2.1). This 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 is far more likely today than it was 33 years ago during Bunderson's study.

The most widely cited causes for the decline of the hirola are competition with cattle, and habitat degradation and loss as a result of over-grazing by cattle (Agatsiva, 1995; Ottichilo et *al.*, 1995; Dahiye, 1999). Two estimates were found of the number of cattle actually occurring within the range of the hirola (*i.e.*, not Garissa District totals). These are 200,000 cattle in 1973 (Duncan, 1974), and 126,730 cattle in 1995 (Ottichilo *et al.*, 1995). This is a 37% decline of cattle over the range of the hirola over 22 years. Note that Magin (1996b) states that in 1977 there were 450,000 cattle within the range of the hirola. This is incorrect as his figure is for all of the East Central Coastal area, which includes all of Garissa and Lamu Districts and, therefore, a large area not inhabited by hirola.

DRSRS provides six data points for the number of cattle in Garissa District during 1977-1996 (Table 11, Fig. 20). These data probably demonstrate relative changes in the number of cattle within the range of the hirola. Figure 20 shows that there was a steady decline in the number of cattle in Garissa District from 1977 (424,886 animals) to 1988 (254,681 animals). This is a 40% decline in just 11 years. Cattle numbers remained down as of 1996. Goat and sheep numbers, however, more than doubled during this period (Table 11).

There is a general downward trend in the total number of large wild animals in Garissa District from 1977-1988 (Table 11, Fig. 21). This trend is very clear for mixed feeders (*i.e.*, species which both graze and browse: eland *Taurotragus oryx*, elephant, and impala) and browsers (gerenuk, giraffe, Grant's gazelle, lesser kudu), than it is for grazers alone (Burchell's zebra, Grevy's zebra *Equus grevyi,* hirola, beisa oryx, topi, common waterbuck *Kobus ellipsiprymnus ellipsiprymnus*). There was a particularly large decline in numbers between 1978 (104,869 wild animals) and 1985 (31,611 wild animals). This is a 55% decline in but 7 years. It was during the latter part of this period (1983-1985) that it seems the large decline in the number of hirola also occurred (Fig. 12).

What is surprising about the above figures is that mixed feeders and browsers showed a much greater decline in numbers than did the grazers. Combined, mixed feeders and browsers declined about 74% from 58,199 animals in 1978 to 15,214 in 1988 (Table 11, Fig. 21). This is difficult to explain given the ever increasing amount of bush in Garissa District. It may be that the species of woody plants favoured by over-grazing are not suitable browse species, that preferred browse species also declined, and/or that drought and disease affected mixed feeders and browsers more than grazers.

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; Hatton *et al*., 1982). Elephant numbers along the Tana River, once high, are now extremely low. In Garissa District, for example, the number of elephants declined from about 7,725 in 1978, to 176 in 1988 (Grunblatt *et. al*., 1995), to fewer than 100 today (John Muhanga pers. comm., 1999). 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. There is a similar situation for the other two mixed-feeders; impala and eland. Eland declined from 2,162 in 1977 to 0 in 1996 (Table 11).

Kock (1995) states that, “The habitat is in an ecological tailspin... the loss of the elephant has resulted in large open pastures becoming encroached by acacia”. This author fully agrees.

Five species of large wild mammal appear to have experienced a population crash between 1983 and 1985; elephant, Grant’s gazelle, lesser kudu, hirola, and topi (Table 11). Of these five species, only the topi has recovered. There was a moderate drought during this period but that was not likely to have affected the supply of food more so than the three, more severe, droughts between 1970 and 1981. What seems most likely is that these species were greatly affected by the rinderpest epidemic in Garissa District during 1982-1983, and probably also by poaching and habitat degradation. Once reduced in size, these populations have probably had difficulties recovering as a result of poaching, particularly in the vicinity of the Kenya/Somali border. This seems to be the most likely scenario based upon the limited data available.

While the number of hirola in Kenya has declined about 90% since the early 1980s, this is, in my opinion, highly unlikely to reflect a concomitant 90% reduction in the carrying capacity of the range formerly occupied by hirola. That is, that the supply of food available today can only support 10% as many hirola as in the 1970s and early 1980s. My guess is that the former range of the hirola within Kenya can still support many more hirola than at present.

While good numbers of large predators exist in Garissa District (Section 8.8) and probably have some effect on the recovery of this population, the predators themselves are unlikely to be responsible either for the decline of this population, or for keeping this population from recovering.

### 9.3 Poaching

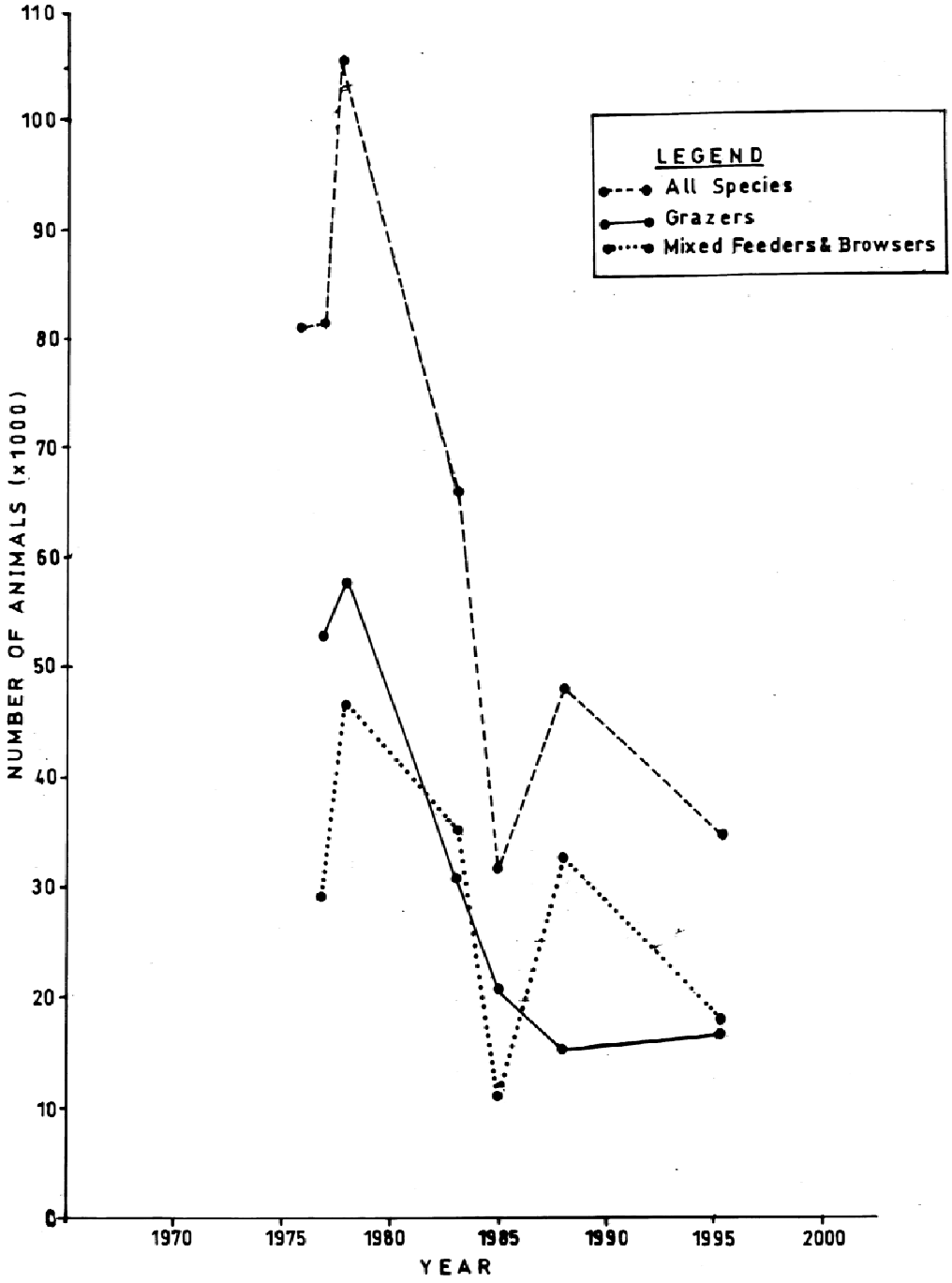
**Tsavo.** Poaching is not a problem for hirola within Tsavo East National Park. There is concern, however, for the one group (Mackinnon group) of hirola found outside of the Park to the east along the Voi River on the Kulalu Ranch. This group, which totalled nine hirola in 1996-1997 and 15 hirola in 2000 (Andanje

1997a, 1998a,b, 1999b), lives in an area where poaching is said to be common.

**Natural Range.** The following is a summary of information gathered on poaching within the natural range of the hirola. Bashir Sheikh Mohamed was born and raised in Garissa. He is a former KWS warden in the Boni-Dodori region, and the last warden for the Arawale National Reserve (1986-1991). He said (pers. comm., 1998, 1999) that while he was in Lamu and Garissa Districts, poaching by the police and security forces were the greatest problem for the hirola...and probably still are. They often hunt hirola and other large mammals. Their food rations are called “Combo 10” (feeds 10 men for 1 day or 1 man for 10 days). They call hirola “Combo 11”. The only police posts in the hirola’s range are at Ijara, Bura, Hulugho Masalani, and Sangailu (north of Boni/Dodori). At the time, the police at Bura, Masalani, Ijara and Hulugho did the most poaching of hirola. He said that Pokomo are not big hunters, that they hunt primarily on and close to the Tana River, and are not known to hunt within the range of the hirola. He suspects that Pokomo hunters seldom, if ever, kill hirola.

According to Agatsiva (1995), the poaching by Pokomo Home Guards and government security people seems relatively recent. He goes on to say that “the animals that stray to Somalia are definitely poached and this situation has led to the population being wiped out in Somalia”. He felt that poaching was probably a factor in the decline of the hirola but how important is difficult to assess.

Figure 21: Changes in the total number of large wild herbivores in Garissa District, Kenya, from 1977-1996. Data from Grunblatt *et al*. (1995) and DRSRS (1997a).


LEGEND
All Species
Grazers
Mixed Feeders& Browsers
NUMBER OF ANIMALS (x1000)
YEAR
0
10
20
30
40
50
60
70
80
90
100
110
1970
1975
1980
1985
1990
1995
2000

Ottichilo *et al*. (1995) state that “Poaching of the species was reported to have been very rampant during the recent period of intense upheavals and instability in Somalia when most Somali citizens migrated into Kenya through the study area with very sophisticated and lethal ammunition. We were informed that the species formed a major source of food for the escaping Somali citizens. The hirola range is also infested with a lot of Somali bandits whose main activity is to steal livestock and rob the people in the area. Since these bandits spend most of their time in the wilderness, their main source of food is wild game. We were informed that their preferred wildlife species is the hirola”.

The Hirola Task Force Translocation Subcommittee Minutes of 30 July 1996 state that the “District Warden noted during his recent operation that KWS was not active on the East Bank. He had identified 54 snare lines, pits and police personnel shooting wild game. It was also noted that the vehicle donated by ODA for hirola security was not being used for the intended purpose. A note to be sent to the Director KWS”.

Andanje (1998a, l999b, 2000a) reported that four hirola are known to have been poached during the first 6 months of 1998 and that eight hirola were reported poached during October 1999-March 2000. He said that the reported incidents of poaching in Garissa District by bandits and government security forces were “just the tip of the iceberg”. During the last 6 months of 1998, two hirola were killed at Galma Galla (one by Administration Police and one, on 28 October, 1999, by the Member of Parliaments’ escort team), while bandits killed three hirola at Tumtish. Kenya Army soldiers (using vehicle 44KA62) killed an adult male hirola at Galma Galla in February 2000 and another was killed at Sangailu by Kenya Police. At about the same time, bandits killed four hirola at Dekaharja. Andanje states that the main poachers are Home Guards, administration police, Kenya Army personnel and bandits, and that known Somali poachers are now being recruited as Home Guards and given guns. There are many reports of poaching from areas along the Tana River (Garsweno, Gabab, Hara areas) where poachers are said to be Pokomo (Andanje, 1998b), and from the region of the Kenya/Somali border (Tumtish, Kuranhindi, Dekaharja, Bulagolol areas) where bandits are particularly active (Andanje, l999b).

S. Aden Ali (pers. comm., 1998) said that a hirola was killed at Garasweno (at Jana, across from Hola). This animal is said to have been killed by Pokomo hunters and the meat sold in Hola.

Kock *et al.* (1998) mention that hirola were being killed to supply meat to the Administration Police and to the refugee camps.

John Muhanga (KWS Provincial Warden, Garissa, pers. comm., 1999) said that there are many guns in Garissa District, but that poaching was not a serious problem for hirola. Pokomo Home Guards from the west bank of the Tana cross at night and make pit-traps with stakes at the bottom. These catch elephants, buffalo, hirola, and other animals. He had no serious problems with poachers during all of 1998. Police may shoot hirola but he had received no confirmed reports.

H. Shikh Ali (former KWS ranger and HCHCG Coordinator, in litt., June 1998, April 1999, pers. comm., 1999) states that there are three UNHCR refugee camps (Hagadera, Ifo, Hagahle = Dagalley) in the range of the hirola, and that there are roughly 350 families (1,700-3,500 people) in these camps. The Hagadera camp is the largest and the one from which the most hunting occurs. The Boni refugees in these camps do much hunting, including hirola. The sale of wildlife meat is currently a booming business in the refugee camps. At one time, the police at Galma Galla killed hirola, but that has stopped. There is no KWS presence in hirola range now, except for single patrols every 2-3 months.

In January, 1999, in a general meeting with members of the HCHCG, I was told that banditry and insecurity in Garissa District increased considerably in 1977 and with this came a great increase in hunting, including hirola. There continues to be a problem along the Tana River of poaching by Pokomo. They hunt with torches and loud noises. The loss of hirola within Somalia and along the border was due to poaching.

Martin Muli (District Officer, Masalani, pers. comm., 1999) claims Pokomo Home Guards and bandits poach hirola. The Pokomo poach many hirola.

During my tour of the hirola range in Garissa District in January 1999, we stopped at Masalani. A giraffe had been poached the day before in the nearby village of Magengo on the Tana River. Several people went to investigate, including the KWS Security Warden (Abdi Adan) and the District Officer (Martin Muli). Seems there is a serious poaching problem here with animals being killed and sold in butcheries. Pokomo Home Guards were doing the poaching using government guns. There are 30 Home Guards in this area, seven of them in Magengo. Twenty of the 30 Home Guards have guns. The leader of the Home Guard force and the Magengo village chief both seemed knowledgeable about the poaching and disinterested in stopping it. They were given strong warnings by both the Security Warden and the District Officer.

M. Mwaro (District Officer, Ijara, pers. comm., 1999) said that poaching by bandits was occurring, but that it was not severe.

Y. Haji (Member of Parliament, Fafi Constituency, pers. comm., 1999) claimed he knew of poaching by Home Guards along Tana. He said the best way to deal with this problem was for the Director, KWS, to tell the Office of the President of these killings...since the Home Guards fall under this Office.

Y. Adan (Acting Chief, Galma Galla, pers. comm., 1999) said that there was no poaching now in the Galma Galla area, but that Somalis come across the boarder to hunt large animals close to the boarder. There are 4-5 soldiers here now...but no police.

Yakub Dahiye (pers. comm., 1999), who spent several months in the range of the hirola in 1989-1999 conducting research on this species, claimed that poaching is only a problem along the Tana, along the border with Somalia, and near refugee camps. He believes that Administration Police do much of the poaching.

District Officer, Bura (pers. comm., 1999) said he knew of no cases of hirola poaching in the 18 months he had been posted at Bura.

Ali Jama (pers. comm., 1999) was the KWS Warden for Garissa District during 1991-1992. At that time, KWS still had its system of ranger posts throughout the range of the hirola. He recalls that at the time the level of poaching of hirola was thought to be very low. In fact, he could not recall any confirmed reports of the poaching of hirola.

Patrick Hamilton (pers. comm., 1994, 1999), KWS Warden for Lamu District during the early 1990s and now with KWS Intelligence, believes poaching has been and is the biggest problem faced by the hirola in recent years. He suggests that the large bands of bandits (100-300 men) who operated throughout the range of the hirola during the 1990s were particularly damaging as they had many guns and lived off the land. Mr. Hamilton is a trained biologist. His present opinion is that the habitat for the hirola is still reasonably intact and that competition with livestock is not a factor for the hirola as livestock numbers are down. He seems to have no doubt that poaching is the primary reason why the hirola has not recovered since the 1983-1984 population crash.

Kock (1995), former Senior Veterinary Adviser to KWS who was involved in both the 1995 census of hirola and the 1996 translocation, said that, “Security remains poor and some animals are no doubt poached”.

Glenton Coombe (pers. comm., 1999) is a KWS pilot who flew over the range of the hirola both during the 1995 KWS census and the 1996 translocation. He is now based in Lamu. He thinks that poaching is the main factor now limiting the numbers of hirola at this time.

Kyalo (1998) toured the range of the hirola in Garissa District for 5 days in July 1998. He was told of poaching of hirola by bandits and of other wildlife near the Tana River by Pokomo Home Guards.

The considerable decline in the number of cattle, hirola, and other large wild mammals in Garissa District from the early l970s to the late l980s (Table 11) suggests that disease, habitat loss and habitat degradation affected both livestock and wildlife. Poaching was certainly the factor most affecting the numbers of elephant and black rhinoceros *Diceros bicornis* and was probably also a major contributor to all of those species which exhibited a decline during this period. During the 7 years from 1978 to 1985, the population of elephants in Garissa District declined by 92%, from 7,725 to 642, and the black rhinoceros was extirpated. Over the next 11 years, from 1985 to 1996, the number of elephant in Garissa District declined still further, to fewer than 100, and eland were probably extirpated from the District. Poaching of other wild animals, including hirola, can also be assumed to have been rampant during this period.

Based upon the above, and other information concerning the poaching of hirola, it is not possible to make firm conclusions concerning past and current levels of poaching, and how this has affected the hirola in the natural population. The many reports of hunting by Pokomo Home Guards suggests that this is a serious problem for wildlife along the Tana River, but that hirola are seldom among the species poached by Home Guards. This is largely because the Home Guards hunt close to the river in habitats unsuitable for hirola.

Probably the best indirect evidence for the major impact of poaching on the hirola comes from the fact that there are few, if any, hirola within 25 km of the Kenya/Somali border (Section 7.1.4) (Figs. 6 & 7) . Due to the great security problem in the vicinity of this border, this region has relatively few people and livestock. As such, hirola should find ample forage here and, thus, be present in good numbers. The absence of hirola in the vicinity of the Kenya/Somalia border, and the apparent low numbers or absence of hirola in Somalia, strongly suggest that poaching of this antelope by Somalis (especially bandits) based within Somalia has been heavy and persistent. Poaching of hirola by Kenyan police and security forces has also occurred and reported to be a common practice, both in the past and at present.

My assessment is that poaching probably contributed little to the sharp decline of hirola numbers which occurred between 1983 and 1985, but that the current combined poaching of hirola by Home Guards, Somali bandits, Kenya police and security forces, and others is likely to be the prime reason why the natural population of hirola has not recovered from the 1983-1985 decline.

### 9.4 Inbreeding/Demographic Depression

Ottichilo and Andanje (1997) express concern that the current situation of the hirola, with a dispersed population and small group sizes, may be leading to inbreeding and, thus, to some effects on reproduction and population growth.

It should be noted that there is no evidence that inbreeding is a problem in the natural population of hirola, and that a population the size of the natural population is probably still too large for inbreeding depression to be a major consideration at this time. Theoretical studies suggest that for large mammals, populations of more than 500 animals are highly unlikely to accumulate deleterious genes at a rate that should concern conservation biologists over the short term (Lande & Barrowclough, 1987; Soule 1987). The much smaller population in Tsavo East is a far more likely to experience demographic and genetic problems. I fully agree with Magin (1996b) when he states, “A founder number of 50 animals is generally thought to provide sufficient genetic diversity in a population to ensure that adverse demographic and genetic effects are minimized...”.

### 9.5 Decline of Arawale National Reserve

The gazettement in 1973 of the Arawale National Reserve (540 km2) (Fig. 14) was the main *in situ* measure enacted to conserve the hirola in Kenya. The management of Arawale is the responsibility of the Garissa District Council but security is largely the responsibility of KWS. During the late l970s, Bunderson (*in litt.* to J. Williamson, 1985) found that Arawale only held about 10% of Kenya's hirola on a year-round basis. He recommended extending the Reserve's southern boundary to include an additional 300-350 km2 (Fig. 8). He also recommended that a second reserve of 800 km2 be created in the region of Kolbio and Galma Galla where hirola were found in high numbers year-round (Fig. 8). In both of these reserves, traditional Somali livestock grazing practises were to have been permitted. Together, these two reserves would have held 35-45% of Kenya's hirola year round. Unfortunately, neither of Bunderson's recommendations was acted upon, principally because of the insecurity in the whole of Garissa District.

In the meantime, the vegetation of the Arawale National Reserve has, by all accounts, changed, with an increase in bush and a decline in the coverage of short grass. There are, however, no quantitative data by which to assess the extent of the change. This change is attributed to over-grazing by livestock. The 1995 and 1996 censuses found hirola in low numbers in Arawale (Ottichilo *et al*., 1995; DRSRS, 1996). In 1999, Andanje (2000b) observed 55 hirola in Arawale National Reserve.

By the 1980s, Arawale was no longer serving its role as a refuge for the hirola as poaching, livestock grazing and semi permanent settlements were all present (Magin, 1996b) . While the carrying capacity of Arawale for hirola has certainly declined, it is unknown whether the present low density of hirola here is due to inadequate habitat or simply to the low numbers of animals as a result of the dramatic decline of this species throughout its range.

## 10. HIROLA TASK FORCE/HIROLA MANAGEMENT COMMITTEE

### 10.1 Background

On 5 August 1994, a consultative workshop was held at the National Museums of Kenya to review what was known concerning the conservation status of the hirola, threats to the survival of this species, and measures which might be taken to help ensure the survival of the hirola. According to the minutes of this meeting, the "Participants noted with concern that the long-term viability of the species' survival is questionable".

The following "emerged as prerequisites for the long-term planning and management of the Hunter's hartebeest":

1. That a multi-sectoral task force of interested institutions be created "...to oversee the immediate and long term plans to promote conservation of the Hunter's hartebeest".

2. That “Security in the area must be improved through the involvement of Kenya Wildlife Service and the Office of the President. Kenya Wildlife Service should intensify patrols especially for the forthcoming ground surveys”.

3. The “Multi-sectoral ground surveys to supplement the aerial surveys should be undertaken as a matter of priority”.

4. That “Translocation or captive breeding of hirola populations to suitable rangelands should be considered”.

The members nominated into the “Hirola Task Force” (HTF) at this meeting were as follows:

African Wildlife Foundation (AWF)

Department of Resource Surveys and Remote Sensing (DRSRS)

East African Wild Life Society (EAWLS)

Kenya Wildlife Service (KWS)

National Museums of Kenya (NMK)

Office of the President (OP)

World Conservation Union (IUCN)

Wildlife Conservation International (WCI)

It was agreed that EAWLS would take the leading role on the Hirola Task Force and that the first meeting of the Hirola Task Force would be held on 15 August 1994 to “help map out strategies to save the species”.

The “Hirola Task Force” was replaced by the “Hirola Management Committee” on 8 January 1998. Like The Hirola Task Force, The Hirola Management Committee is a joint body of Government, NGOs and private individuals with the objective of conserving the hirola antelope in Kenya.

## 10.2 Terms of Reference

### 10.2.1 Terms of reference for the Hirola Task Force

During the 15 August 1994 meeting of the Hirola Task Force the (so called) “Terms of Reference” and the “Action Plan” were developed and agreed upon (HTF Minutes, 15 August 1994). The “Terms of Reference" of the Hirola Task Force read as follows:

“It was noted that unlike many other task forces, the Hunter’s Hartebeest Task Force was not commissioned by the government or any other institution but was born out of common interest by different organizations to save a threatened species. So it is the mandate of the Task Force to clearly define the problem and what needs to be done and map out strategies on how to do it.

After setting itself a time limit, the Task Force will come up with a set of recommendations that will form the basis for an action plan that will promote the conservation of the hirola.

The Task Force was reminded that the status and population trends of the hirola were known. The Task Force should therefore establish the unknown, for instance the flooding regimes of the Tana River and its relationship with the habitat requirements of the hirola. The Task Force should establish why the translocations of the hirola to Tsavo in 1963 were not very successful yet Tsavo had the same vegetation as Arawale in N.E. Kenya. The Task Force noted that there is a lot of related information hence the need to contact earlier researchers' works.

It was recounted that the data that is currently available is purely based on aerial surveys hence the Task Force needs to address itself to ground surveys as it is most important to get first hand information on the ground.

The Task Force acknowledged that literature on the hirola is scattered. There is the need to collect and collate all relevant literature. A fundamental task of the Task Force is therefore to do a literature survey on the hirola. But is was noted that the Task Force could not undertake any activity if there were no finances.

At this juncture, IUCN confirmed that about US$ 10,000 will be available for use by the Task Force if it prepared a good project proposal and handed it over to IUCN-East African Regional and Technical Office. The Task Force indicated that these funds could be used for preliminary surveys".

It should be noted that the above are not really, strictly speaking, "terms of reference". Nonetheless, they seem to have served the purpose.

### 10.2.2 Terms of reference for the Hirola Management Committee

"The terms of reference for the Hirola Management Committee are to:

- monitor the hirola population by setting up a monitoring programme for both *in-situ* and *ex-situ* environments;
- understand the threats to the hirola population and put in place protective and management programs to mitigate against these threats;
- identify and employ the most effective ways of involving the local communities in the natural range area in monitoring and conservation efforts for the hirola;
- advise on all possible options available for hirola translocation in the future;
- develop a long term workplan for the conservation of the hirola in the East and West bank areas together with the Tsavo East N.P population;

- prepare a budget for implementation of the hirola conservation programme for the purpose of planning and fund raising;
- co-ordinate all conservation activities;
- and be the central organ for deposition and dissemination of information on the hirola anteiope".

### 10.3 Action Plan

The "Action Plan" of the Hirola Task Force reads as follows (HTF Minutes, 15 August 1994):

"It was noted that there are some options that the Task Force can pursue in a bid to foster conservation of the hirola. Among the immediate ones is translocation of the species to alternative habitats where their survival can be guaranteed. After all capturing methods are now more advanced and practical than they were in the 1960s when the first attempts were made.

In preparing the set of recommendations for the Hunter's antelope, the Task Force acknowledged the need for institutional linkages where each interested organization may focus on a component. For instance, KWS could provide a comprehensive report on ground information through the warden in charge of Arawale Game Reserve.

At this juncture, the Task Force identified several priority issues to be addressed by individual institutions and finally by the Task Force. The issues were identified and assigned to institutions as follows:

1. Population dynamics (*i.e.*, numbers and distribution) – RSRS.
2. Habitat/ecology (*i.e.* habitat requirements, including the riverine flood plain and how they are affected by the River Tana flooding patterns/regimes) - DRSRS/EAWLS.
3. Intensive aerial surveys (*i.e.*, aerial surveys to be done at higher sampling intensity) - DRSRS.
4. Population trends in natural range among other species, mainly herbivores - DRSRS.
5. Security, alongside overall infrastructure (*i.e.*, roads and security to be improved to facilitate ground surveys) - KWS.
6. The exact range of the hirola (*i.e.*, establishing the range of movement of the hirola) - EAWLS.
7. Reproductive status (*i.e.*, number of young and infant mortality rates) - KWS.
8. Habitat requirements of the species (*i.e.*, habitat selection using satellite images) - DRSRS/AWF.
9. Information search (*i.e.*, review all available literature with a view to collecting/collating anything on the Hunter's hartebeest) - AWF.

10. Human influences on hirola numbers and distribution patterns (*i.e.*, cultural attitudes towards wildlife) - KWS.

11. Taxonomic factors and diseases - NMK/EAWLS."

It should be noted that not one of the above "assignments" to institutions present at the 15 August, 1994, meeting were effectively carried out by the assigned institution. Even to this date, many of the "priority" activities assigned to the founding member institutions of the Hirola Task Force have not been conducted. This report is the first to adequately provide the information requested under numbers 9 and 11 above.

Other activities of the Task Force which were described in the 15 August 1994 meeting are:

- Acquire more information on the approximate range of the hirola in Tsavo East National Park.
- Mount a campaign so that the public is aware of the status of the hirola and the conservation measures being taken.

# 11. 1996 TRANSLOCATION

## 11.1 Objectives

One of the first major activities of the Hirola Task Force was to promote, organize and assist in the capture, translocation and release of additional hirola from Garissa District to the population established in Tsavo East National Park in 1963. This was "...an effort to conserve the hirola in the short term whilst efforts were made *in situ* to resolve the problems causing extinction of this now endemic species in Kenya". (Kock, 1996). This translocation had four main objectives (Kock *et al*, 1998):

- To establish whether improved translocation techniques and introduction could be successfully used as a conservation tool. Mortality had been extremely high in the 1960s and no research had been done to determine if Tsavo would be suitable in the long-term for this species.
- To enable closer scientific study of the species.
- To provide an injection of genes into the Tsavo population, which was probably based on less than 22 founders.
- To raise awareness in the district, the region and abroad about the plight of the hirola.

## 11.2 Background

The Hirola Task Force established the "Translocation Subcommittee" on 17 April, 1996, after the *Hirola Recovery Plan* recommended further translocations as part of efforts to ensure the long-term conservation of the hirola (Magin l996b). This subcommittee held

its first meeting on 23 April 1996. The translocation was undertaken during August 1996. The Translocation Subcommittee was dissolved on 5 March 1997 after 10 meetings.

### 11.3 Personnel

About 57 people were based in Garissa and Tana Districts during the 1996 translocation. Additional people worked at the bomas in Tsavo. The field team comprised people from KWS, volunteers from conservation NGOs in Kenya, and two members of the National Parks Board in South Africa who supervised the first week of netting operation.

### 11.4 Capture Methods and Numbers Caught/Translocated

After consultation with specialists experienced with hartebeest translocations in South Africa and Zimbabwe, it was decided that a "fixed funnel net boma drive system" with internal chase net would be used to capture the hirola. The entrance to the U-shaped trap was 70 m wide, the funnel was (apparently) 70 m deep, and the boma at the end of the funnel was 50 m x 70 m. Cross curtains were erected for closure of the entrance once the hirola entered the trap. Hirola were driven towards the boma with a helicopter for up to 3 km (2-10 minutes). Once near the entrance to the boma, teams of people on the ground directed the hirola into the boma (Lucile Ford, pers. comm., 1999).

Based on the 1996 capture experience, Kock *et al*. (1998) give recommended dimensions for fixed funnel boma nets to be used in future capture operations. These differed in some respects from that used in the 1996 exercise.

Darting was not recommended as a method for capturing hirola due to the added stress and resultant capture myopathy associated with this method. Darting was used, however, in this exercise due to intense political pressure to complete the exercise in as short a period as possible (see below).

Once in the rectangular boma the hirola became entangled in 8 x 40 m drop nets and were immediately restrained by hand, blind-folded, hobbled, tranquillized with 10-15 mg haloperidol i/v, radio-collared (10 hirola), marked with coloured and numbered ear-tags, measured, sampled (blood and feces), and then moved by stretcher to a vehicle, transported to an airstrip, and flown by Cessna Caravan to Tsavo. The flight from Ijara to Mukwaju in Tsavo East National Park took 1 hour. During the flight the hirola were restrained in sternal recumbency. In Tsavo they were placed in family groups in bomas, with the exception that the dominant male was separated. Hirola were kept in the bomas 1-4 days prior to release. Water and food were provided. The bomas in Tsavo were as follows: two x 40 m2; two x 30 m2; four x 12 m2. It would be interesting to know whether any of the hirola were observed to drink water while in the bomas (Section 8.5). If not, water need not be provided to hirola during future translocations.

At the time of the capture, the capture site was dry and hot, with temperatures in the shade at 30°C by mid-morning and at 34°C by mid-afternoon. The terrain was flat and dominated by thick scrub. All of the main herds of hirola within the vicinity of Ijara were located by KWS Airwing prior to the setting-up of the nets. It took 2 days for the first nets to be set up.

The first attempt at capturing hirola was on 13 August, but no animals were caught. On 14 August, a complete group of 11 hirola was trapped after being driven by helicopter for 2-3 km. This group was released into Tsavo the next day (Kock, 1996). On 15 August the helicopter had mechanical problems so no complete drive was possible. Therefore, "... a drop net system without a capture boma was tried unsuccessfully on a herd of five animals".

Three hirola were caught in the nets and one darted on 20 and 21 August. They were transported to Tsavo successfully, but due to the placement of an injunction by the Garissa County Council (Section 11.6), no further captures were possible until the appeal by KWS. The court lifted the injunction and the translocation was allowed to continue on 27 August. A new site was identified and over the next 5 days, with a combination of boma capture and drop nets (9 hirola), drop nets alone (2 hirola), and darting (9 hirola), a further 20 animals were caught in three different locations within 30 km of Ijara. In a radius of 30 km from Ijara, 76 animals were located, 35 removed and remnant groups left in each location to ensure no local extinction of the species as a result of the capture (Kock, 1996). Further details of the 1996 capture and translocation are provided in Kock *et al*. (1998).

See Section 7.3.2 for survival/mortality data on the 35 hirola translocated during this exercise.

### 11.5 Sensitization of, and Approval by, People in Garissa District

The Hirola Task Force obtained approval from Garissa District representatives, the District Development Committee, and the District Administration to (1) translocate at least 30 hirola to Tsavo, and (2) to assist in the long-term conservation of hirola in Garissa District. Two Members of Parliament from Garissa District, Hon. Salat and Hon. Arte are members of the Hirola Task Force. In addition, on 27 May, 1996, the KWS Warden for Garissa District spoke to the County Councillor and local administration about the translocation.

Nonetheless, on 18 July, 1996, the MP for Arawale expressed dissatisfaction with developments. KWS representatives met with the MP on 30 July. It was learned that he wanted money for his constituency. It was pointed out to him that KShs 100,000 had already been spent in the Arawale area on casual laborers hired to construct airstrips.

A pretranslocation operation was undertaken by Hirola Task Force members, the District Warden and Warden Woodley (Kock, 1996).

The local Somalis were interested in the translocation and KWS made efforts prior to the translocation to inform the local Somali community of the planned translocation. The translocation team was made welcome at Ijara and there were initial good relations between the local community and the team (Kock *et al*., 1998).

### 11.6 The Court Injunction and its Effects

The initial, successful capture and translocation of hirola was compromised by the court injunction (Sections 11.4 & 11.11). As a result, members of the translocation team returned to Nairobi to go to court with KWS legal affairs personnel to defend the translocation. The court found that the injunction was based on political motives and ruled as baseless. Nonetheless, this temporary injunction did considerable damage to the translocation exercise. According to Kock *et al*. (1998) "...the media coverage that the case inspired led to intense pressure in the field. Sadly, the team's good relations with the local people deteriorated as politics entered the debate. The team continued its work against considerable constraints. In order to accelerate the translocation it was decided to dart animals from the helicopter (contrary to the agreed protocols) to try to keep herds together for release. No blame should be placed on the team as this decision was taken under critical circumstances and indeed was successful in bringing up the numbers of animals captured. Unfortunately, concerns over the risks of darting were borne out by a higher proportion of mortalities after translocation among these more stressed individuals. The operation was completed but the last few animals literally had to be flown out by helicopter as ground transportation had been threatened with violent intervention by certain politically motivated groups. The only positive aspect of all the publicity was that suddenly this enigmatic creature was known throughout Kenya and its story was splashed across the newspapers of the world. Even the local pastoralists for the first time realized they had something valuable, something that could benefit them instead of merely providing meat for the administration police and suppliers of the refugee camps". This viewpoint was confirmed by Kyalo (1998).

### 11.7 Post Release Monitoring and Research in Tsavo

A long-term research project to monitor the hirola population in Tsavo East National Park, and to obtain information on the ecology and behaviour of this little-know species was initiated in October 1995 (Andanje, 1997a,b, 1998a,b; Andanje & Goeltenboth, 1995, 1996; Andanje & Ottichilo, 1999; Ottichilo & Andanje, 1997). To date, this research has yielded valuable information on the hirola within the Tsavo ecosystem. I judge that the following subjects have been well covered, or at least adequately covered for the present time as concerns the Tsavo population. In most cases, however, the data have yet to be written-up in detail and made widely available.

- Population size, growth, age structure and dynamics.
- Group size and home range.
- Reproductive rates, birth season and calf survival.
- Daily activity pattern and annual movements.
- Diet, and food and habitat preferences.

Subjects in need of much additional research in Tsavo:

- Evaluation of causes of mortality, particularly of predators and disease.
- Territorial behaviour and social organization.
- Inter-specific competition, particularly with kongoni (Coke's hartebeest).
- Evaluation of the carrying capacity for hirola of the current range, and of other sectors of Tsavo East National Park.
- Genetic evaluation of this population.

The main findings as concerns the hirola in Tsavo are summarized in this report in Sections 7.3.2. and 8.

### 11.8 Fenced Sanctuary in Tsavo East National Park

Of the recommendations made in the *Hirola Recovery Plan* (Magin, 1996b) concerning the translocation of hirola from Garissa District to Tsavo East National Park, the only recommendation not implemented was the establishment of a fenced sanctuary for the hirola in Tsavo. "This was rejected by the Task Force on the basis of the potential ecological disturbance in the Tsavo East National Park and cost of maintaining a sanctuary". (Kock, 1996).

### 11.9 Translocation Costs

The total funds received to support the 1996 translocation (Operation Hirola) are summarized by Soorae (1998). A total of KShs 3,586,316 were received from 11 sources. US$ 30,000 were received from one source. Pounds Sterling 2,623 were received from four sources. The Eden Wildlife Trust contributed helicopter time, vehicle time and staff allowances during the translocation. This was evaluated at US $ 13,000 (Soorae, 1998). Converting these amounts to US Dollars, the total financial support received for the 1996 translocation was about US$ 115,000 (using KShs 53/US$).

Of the US$ 115,000 available to cover costs of the 1996 translocation, all but about US $ 3,900 (KShs 205,572) were spent (Soorae, 1998). Thus, the total spent on the translocation, according to Soorae (1998), was approximately US$ 111,100. This translates into US$ 3,175/hirola captured (35 hirola), US$ 3,830/hirola released (29 hirola) into Tsavo East National Park, and US$ 6,945/hirola surviving until July 1998 (23 months post-

release) in the Park (16 hirola). These figures are the directly incurred financial costs of the translocation. The “true costs” are considerable greater but remain unknown.

To obtain the true costs of the 1996 translocation, the costs of the following would need to be included:

- The value of the 10 radio collars (KShs 375,000 = ca. US$ 7,700) donated by WWF (Translocation Subcommittee Minutes, 25th June 1996)
- The KShs 303,000 (= ca. US$ 5,700) given by KWS for community mobilization prior to the translocation (Translocation Subcommittee Minutes, 25 June 1996).
- Costs to KWS in terms of its support in the form of equipment, materials and personnel. No cost estimate is available.
- The value of the time donated by numerous people in preparation of the translocation and during the translocation. No cost estimate is available.
- The cost of the follow-up monitoring and research project. No cost estimate is available.

Although the true costs of the 1996 translocation of hirola have not been compiled, some rough calculations indicate that they are probably not less than US$ 160,000 or more than US $200,000. Thus, it is likely that the true cost of each hirola translocated and surviving to 23 months post-release was somewhere between US$ 10,000 and US$ 12,500. This would seem to be good value for the money when the probable conservation impact of the exercise on this critically endangered genus is considered. Not only were 16 hirola successfully translocated, this project yielded a considerable amount of positive publicity, public awareness, training in the translocation process, and knowledge that will be invaluable for future translocations of this and other species of antelope.

Prior to the translocation, it was estimated that it would cost KShs 3,000,000 to translocate 30 hirola (Translocation Subcommittee Minutes, 27 May 1996). This estimate was revised to KShs 3,736,745 (Translocation Subcommittee Minutes, 9 July 1996). The actual expenses incurred by Hirola Task Force for all of the expenses it covered in relation to the 1996 translocation was about KShs 5,890,000 (KShs 53 x $111,100). Although the initial estimate of costs was low, the Hirola Task Force was able to raise adequate funds to cover the higher than expected costs. This is much to the credit of the Hirola Task Force.

### 11.10 Problems and Constraints

The 1996 translocation program was able to effectively overcome the inherent problems and constraints of undertaking a logistically complex and biologicly delicate operation in a remote

region. The other major problem faced by the translocation program was the political situation in Garissa District which led to the court injunction on the translocation process (Section 11.6).

According to Kock *et al.* (1998), “Political and legal constraints imposed on KWS in the middle of the operation proved to be the major problem. The level of community sensitization was ineffective in preventing this happening probably as a result of the objections coming from an unexpected quarter and not from the local community. A minority of Kenyans of Somalia ethnic affiliation, based in Nairobi and Garissa, not representing any official agency initiated the court action. They may have wished to use this opportunity for political ends and were able to stop the operation on false premises. No representatives of the Task Force or KWS were present at the time of placement so no defense could be given. The argument was that KWS was spraying children in the area with drugs and removing hirola from the Arawale National Reserve...both of which were untrue. This initially delayed the operation and increased expenses. After the injunction was overturned the operation was put under pressure as the publicity from the media (lacking in any facts and promoting the plaintiffs fabrications) was causing local communities to call for the operation to be halted. As a result and despite the agreed protocols it was decided that helicopter darting should be initiated to expedite capture. This led to increased mortality”.

In short, “...to ensure adequate numbers were translocated in the available time as a direct consequence of the interference by the Garissa County Council through the courts...”, the capture team was forced to abandon the successful, and less stressful, capture of hirola in nets in favour of darting from a helicopter. Of the 11 hirola darted, nine died within 38 days; three within 3 days of capture from myopathy, two within 3 days from restraint trauma, and four within 38 days from predation after release within Tsavo. Darting may have increased the susceptibility of hirola to predation as a result of chronic muscle damage. It seems that five of the six deaths which occurred during capture, transport and boma phases of this project might have been avoided if the funnel net boma technique could have been used throughout the exercise and the incidence of capture myopathy accordingly reduced (Kock *et al.,* 1998).

### 11.11 Conclusions of the Hirola Task Force

At the conclusion of the 1996 translocation, the Hirola Task Force made several statements. These are examined here.

*Statement 1.* “The mortality was low in relation to previous translocation efforts and safe translocation techniques are now established for this species as result of this initiative”. (Kock, 1996).

The data support this statement. During the 1963 translocation, an estimated 33-46% of the hirola died prior to release from the

holding pens. Mortality from the time of capture up to about 2 weeks post release is estimated to be 60- 80% (see Section 7.3.1). During the 1996 translocation, 17% of the hirola died prior to release into Tsavo. Eight months after the release, 51% of the hirola were dead. If the 1996 capture team were not forced to abandoned the funnel net capture method in favour of darting (Sections 11.6 & 11.11), then the mortality incurred during the 1996 translocation would certainly have been less, probably considerably so.

At least three different capture techniques were used during the 1996 translocation. Nobody has undertaken a detailed analysis of survival of hirola captured under the different methods. This should be done.

*Statement 2.* "This can be considered a major success for this endangered species and will effectively double the Tsavo population with a new genetic input with all the potential for improved vigour of this population". (Kock, 1996).

I judge this to be an over-statement. First, the population of hirola in Tsavo just prior to the 1996 translocation was about 79 individuals. The 29 hirola translocated in August 1996 increased this population by 27% (29/109), not 50%. Eight months after the translocation, with 17 of the 29 translocated hirola surviving, the contribution to the population is estimated to be only 18% (17/96). Second, nothing is known concerning the genetic composition of either the founder population in Tsavo or of the animals translocated in 1996. While it seems safe to assume that new genetic material was added to the Tsavo population, we do not know if this was particularly useful or important.

*Statement 3.* Kock *et al*. (1998) state that, "The recent effort proved animals of all ages and sex (including females in the last trimester of pregnancy) could be captured and translocated successfully with low mortality even under duress".

This statement has no foundation among the available data, in particular the claim that females in their last trimester of pregnancy can be translocated with low mortality. During the 1996 translocation, at least 10 of the animals were pregnant (Section 7.3.2). Three of these died prior to release into Tsavo. Eight months post-release, only four (40%) of the females translocated while pregnant were alive...and all 10 of the foetuses/calves they held were dead. Counting the 10 foetuses in their third trimester as "translocation project hirola", it must be concluded that 16 (80%) of the 20 hirola captured while either pregnant or as foetuses died within 8 months of the translocation. If there is one thing that the 1996 translocation can be criticized for it is the translocation of heavily pregnant animals and the high mortality borne by these animals, the unborn foetuses, and the calves.

# 12. POPULATION VIABILITY ANALYSIS

Magin (1996b) undertook a preliminary population viability analysis (PVA) of the hirola in order to assist in the evaluation of the relative probability of extinction of a small population, and of the likely impacts of particular management interventions. In particular, Magin was interested in questions "...concerning the number of individuals required as founders, their age-sex composition, and whether or not to provide a predator-proof sanctuary". He used VORTEX Version 7 (Lacy *et al*., 1995) for the stochastic simulation of the extinction process.

As with many PVAs, Magin (1996b) faced the serious problem of a lack of good information on the more critical biological parameters for the species. Hirola have never been the subject of detailed study. As such, most of the parameters used in his PVA were estimated from limited studies of the fairly closely-related, and ecologically-similar, hartebeest *Alcelaphus busephalus* (Gosling, 1974; Stanley-Price, 1974; Kingdon, 1982). See Magin (l996b) for details.

Some of the parameters which Magin (1996b) used, and which additional data from other alcelaphines and which more recent data for the hirola suggest may not apply to the hirola (Section 8.7), are summarized here.

- Most adult female hartebeest calve each year, so Magin assumed that 90% of adult female hirola calve each year. Preliminary research suggests that only about 64% of adult female hirola calve each year (Andanje, 1997a,b).
- Magin assumed that female hirola mature at 1.5-2 years and that age at first birth is 2 years. A review of the data for the alcelaphines (Section 8.7) suggests that maturity is more likely to be reached at 2-2.5 years and that the first birth occurs at about 3 years.
- Magin assumed that a translocated population of hirola would start with a stable age distribution since founders would be captured at random. He did not take into consideration the fact that survival during the translocation process, and during the several months following the translocation, favours immature individuals over adults, or that it favours adult females over adult males (see Section 7.3.2).
- Magin used an adult sex ratio of 1:1.5 males:females. The adult sex ratio may be much more biased than this towards females. The adult sex ratio in the Tsavo population prior to the 1996 translocation was 1:3.8 males:females (Table 8).

The PVA concentrated on variations in three key elements of the model: (1) juvenile mortality; (2) initial size of the founder population; and (3) age/sex structure of the population. This was done in order to (1) account for uncertainty over the appropriate

levels for some parameters, and (2) to provide guidance for developing the 1996 translocation strategy.

The main conclusions of the PVA undertaken by Magin (1996b) are that:

- As expected, the larger the founder population the greater the likelihood that the translocation will be a success.
- A founder population of at least 30 animals is the minimum required to guarantee an 8O% chance of persistence for 30 years, assuming a high rate of juvenile mortality. Increasing the number of founders to 50 produced a relatively small increase in the probability that the population would survive. Thus, if 60 founders were obtained, it might be better to split them into two populations of 30 animals each at two translocations sites.
- As expected, the smaller the number of founders the faster the inbreeding coefficient of the population rises.
- Biasing the age/sex ratio towards females (up to 1 male/2 females) and immature animals produced a slight increase in population persistence and growth rate. Selection of younger animals is recommended.
- The various populations modelled were most sensitive to variations in juvenile mortality rate. Magin, therefore, recommended that translocated populations of hirola be placed in a predator-free sanctuary or in sites with a low density of natural predators.

Magin summarized his findings by stating that "...if juvenile mortality can be reduced by 30% by the exclusion of predators, an initial population of 30 founders with a 1:1 male to female sex ratio and 50% of animals aged 4 years or younger would be expected to have a probability of success over 50 years of 95.5%, producing a final population of around 345 (S.E. +/-12) with an expected inbreeding coefficient of 0.085. Biasing the sex ratio towards females, selecting a higher proportion of young animals, and increasing the number of founders could all be expected to improve on this performance".

Magin's PVA provides some guiding principles for the translocation of hirola both in order to (1) establish new populations and to (2) boost existing small populations.

Unfortunately, Magin did not conduct a PVA on the present population in Tsavo. This would have been particularly useful, taking into consideration the following:

- That this population was established in 1963 by 11-19 founders.
- That all of the founders were juveniles.
- The size, sex ratio, age ratio, birth rate, calf survival, *etc*., of this population both as of 1996 and at present.

It would then have been especially useful to see what the addition of 15, 20, 25, 30 or 35 hirola to this population might be expected to accomplish in terms of its survival. The 1996 translocation resulted in the addition of 17 new hirola to the Tsavo population after 5 months, 16 of which were still alive after 23 months (Section 7.3.2).

# 13. LOCAL HIROLA CONSERVATION ORGANIZATIONS

## 13.1 Introduction

Several community based organizations (CBOs) have been established with the stated aim of conserving the hirola on its natural range in Kenya. Among these, the two main groups are the “Harroru Community Hirola Conservation Group” (HCHCG) and the “Arawale Youth Wildlife Community” (AYWC). The stated objectives and activities of these two groups are reviewed here.

## 13.2 Harroru Community Hirola Conservation Group (HCHCG)

The HCHCG was established in August 1997 and later registered with the Department of Social Services. The group’s office is at Massa Bubu (= Massabubu) Trading Centre. This group comprises those communities that graze livestock in the Harroru Area (the land between Kamuthe, Galma Galla, Gababa, Garasweine, Masa Bubu and Bura). The goal of this group is to “...address the challenges of deteriorating and declining biodiversity through a sustainable development and lifestyle”.

“The group hopes to integrate social development, economic and environmental concern through active linkage with community conservation of the environment to poverty eradication. More so, the community hopes to co-exist with endangered species of wildlife and plants and thus reap the benefits of such co-existence through sharing of resources like water, pastures, veterinary services, micro-enterprises *etc.*”.

“In achieving its stated objectives, the group hopes to closely co-operate with the stakeholders like the Provincial Administration, Kenya Wildlife Service, non-governmental organizations, private sector, research institutions, international partners and local community”. (S.A. Ali *in litt*., 1997).

In May 1998, the HCHCG presented a list of concerns and recommendations as concerns hirola conservation to the Hirola Management Committee (S.A. Ali *in litt*., 1998). Here is a selected summary of these concerns and recommendations:

Concerns:

- Since the 1996 translocation exercise there has not been any effort by the stakeholders to create a sense of community ownership and involvement.
- Forums in Garissa have no impact on hirola conservation as the audience is made up of political leaders, most of whom are not in touch with the grassroots community on the hirola range.
- KWS has yet to devise a method to ensure community participation in wildlife conservation. The presence of KWS in Garissa is more or less ceremonial as hunting in the range of the hirola goes on unabated despite the fact that community members have shared their concerns with KWS.
- Research on hirola in Tsavo is not representative of hirola on its natural range.
- The lack of KWS or other key stakeholder involvement on hirola conservation at the grassroots level is made with prejudice of the area's security situation.
- KWS raised the expectations of the community in terms of immediate benefits and these went unfulfilled. This is a hindering factor in species conservation as mistrust has been created. "A good example is the construction and equipping of Bura Secondary School laboratory and KShs 200,000 pledge to Ijara Primary School".

Recommendations:

- KWS and other key stakeholders should hold community activities "under trees in the hirola range", rather than discuss issues in Garissa.
- Key stakeholders should assess the capacity of local community-based groups which have an interest in the conservation of the hirola, and extend support to these groups. The community groups can then be delegated tasks concerned with biodiversity conservation.
- KWS should reestablish the Massa Bubu ranger camp as wildlife populations in the area are declining due to lack of armed protection. The current hunting in the area would stop if poachers knew a protection force was present.
- Want researchers in the natural range of the hirola as studies in Tsavo do not benefit the hirola or the communities on the natural range.
- Security in the southern part of Garissa District has not been as bad as imagined. In fact, it "...has been peaceful all through".
- Want "...KWS to update the community on the constraints to their previous pledges...". Inputs for community development

should focus on women's groups and income generating activities.

- Community groups should be supported in undertaking activities like community mobilization, hirola monitoring and surveillance.

In July 1998, the HCHCG presented a proposal to GEF/Small Grants Programme for a project titled "Community Based Hirola Protection and Conservation". The following is the Executive Summary of this proposal.

"Harroru Community 'Hirola' Conservation Group was formed by the settled nomadic communities living and grazing their livestock in the area lying between Nanighi and Bura Division, Gababa in Masalani Division, Ruka in Ijara Division and Galla Gama in Hulugho Division.

The organization was formed with the basic objective of protecting and conserving the area's biodiversity and in particular the threatened and endangered rare antelope 'the hirola' mainly through community empowerment and capacity building, sensitization and awareness creation campaigns.

Little is known about the status, distribution, population and location of the 'hirola'. There are currently no known studies from the area and therefore intensive surveys on the ecology, habitat range and related ethnobiology of the diminishing 'hirola' population as well as the diverse wildlife and plant species of the region is crucial. The project will therefore undertake a community based 'hirola' monitoring and surveillance activities with a view of empowering the community members to willingly adopt biodiversity protection and conservation initiatives with promising sustainable livelihood in the long run. In this regard, the project coordination team will be strengthened through training to achieve the necessary optimal capacity for provision of guidance, oversight and management services to the project activities.

The successful implementation of this project will go a long way in improving future socio-economic status of the community. In this respect, the project will study and identify viable micro-business sensitive to sustainable utilization of natural resources and based on indigenous technologies and locally available resources. Possibilities of initiating and promoting ecotourism activities in the area will also be pursued. Encouraging ecotourism activities is one way of triggering income generating micro-business in the area. However this is a long term plan.

By the end of the project, the community is expected to have developed a 'we' ownership of the entire area's biodiversity. The project expects to receive an amount totaling to KShs 2,998,050 (ca. $50,000) from the Global Environmental Facility-Small Grants Programme (GEF/SGP).

For effective project implementation, the project has already established good work relationships with related stake holders including; Kenya Wildlife Services (KWS), National Museums of

Kenya (NMK), Provincial Administration (PA) and a local Non-Governmental Organization (NGO), Women Kind Kenya (WKK). During the project period, efforts will be made to identify and involve more relevant organizations and institutions".

The following excerpts are taken from the HCHCG proposal.

"Both the 'hirola' antelope, and the community came under the international limelight during the controversial attempt by Kenya Wildlife Services (KWS) to translocate the antelopes to Tsavo. This triggered considerable resistance from the community, claiming that it was part of their natural inheritance and thus their inherent right to protect and conserve the antelope in its natural range. Culturally, the community does not promote hunting or kill wild animals for meat.

The current status of 'hirola' in the area is estimated at 350 animals as per KWS surveys. In the past, conservation efforts ignored the participation and interests of the local communities. As a result, the community members created a negative attitude towards foreigners attempting to take over the 'hirola' conservation without their involvement leading to stalemate of conservation efforts. So far no efforts whatsoever has been undertaken to do '*in situ*' conservation of the species and therefore the need to sensitize and empower the community to undertake the initiative.

Due to the prevailing misunderstanding and the urgency to save the 'hirola' and other wildlife species, the Harroru community through the Harroru Community 'Hirola' Conservation Group as facilitators came up with the community-based 'Hirola' conservation project. The key aim is to create awareness on the need and importance of protecting and conserving the existing area's biodiversity. To this effect preliminary community mobilization and 'hirola' monitoring activities in the area has already started.

The plan is to get the community to recognize and appreciate the value of their natural resources and to discourage existing destructive hunting practices among the riverine communities".

### 13.3 Arawale Youth Wildlife Community (AYWC)

The AYWC was formed in 1994. The long-term objective of the AYWC is to "conserve wildlife through supporting local pastoralists and farmers in order to safeguard the wildlife". The immediate objectives are:

- "To manage and conserve the wildlife and natural resources in Arawale in liaison with the Kenya Wildlife Service, the Government and the local community.
- To develop programmes for the community who are pastoralists for the protection of all wildlife *e.g*. construction of water dams, provision of livestock drugs.
- To make Arawale Youth Wildlife Community self supporting by educational programmes and income generating activities.

- Sensitization of the community by learning and training the stakeholders at village level more about wildlife, plant conservation and passing the mobile class to the people".

The proposed activities are:

- "Sensitization of the community by mobilizing them on the importance of conserving (focal persons - local leaders, religious leaders, opinion elders *etc*.).
- Construction of water dams for both the wildlife and the local community, this targeted due to the scarcity of close access of both water to both. Target area is Madahgesi and Dagega.
- Meetings and barazas for educating the community on the importance of conservation.
- Development of educational materials on the importance of conservation. Thus printing posters to educate the community on fire hazards in the forests, animals, schools and the community at large.
- Agroforestry nursery for the farmers who are living next to the reserve *e.g.* Neem tree production.
- Assessment of livestock diseases and contribution of the drugs to curb them to the pastrolists.
- Collection of seeds of indigenous trees *i.e* acacia *etc*.
- Training the community at the village level on the importance of wildlife and natural resources".

### 13.4 One Community Based Organization for Hirola Conservation

On a number of occasions, the Hirola Management Committee expressed concern over the number of community based organizations purporting to be interested in the conservation of the hirola, with the confusion associated with several groups operating with similar goals, and with the conflicts that existed among the groups. The following statement is taken from the HMC Minutes (April 1999).

"It was brought to the attention of the members that CBOs (community based organizations) had been formed in Garissa in the guise of hirola conservation. The activities of some of these CBOs were highly doubtful. Some had even managed to secure funding from the donors for the hirola conservation activities without the consent of the HMC. It was felt that with no machinery in place to monitor their activities, chances of these funds being diverted to other activities other than hirola conservation were very high. Therefore the HMC, which is the body officially mandated to take responsibility over the hirola conservation activities, has a right to control the activities of these community organizations. Consequently, it was agreed that the secretary should write to the two CBOs (Harroru and Arawale Groups), request for an update of

their activities and ask for the copies of the minutes of their latest meetings together with copies of the fund raising proposals sent to donors".

The HMC Minutes of June 1999 state that, "Reportedly, up to 10 community conservation groups have so far been registered. However, most of them lacked clearly defined objectives on hirola conservation and may have been formed in anticipation of the financial gains, other than interest in conservation. It was suggested that the registration of any more groups should be stopped".

These same minutes also mention that, "Mr. Ogle gave the members an insight of the communities activities at Garissa. He noted that clanism and political rivalry were greatly affecting the community's initiatives in the hirola conservation. However, a letter received at the KWS indicated that the communities from Fafi and Ijara constituencies had met in April to harmonize their hirola conservation activities. Under the patronage of their MPs (Hon. Ilyas Bare Shill - MP Fafi and Hon. Muhammed Dahir Weyrah - MP Ijara) they formed a common goal of hirola conservation. The members observed that the merging would have positive impact on the community participation. It would also be easier and more effective for the HMC to deal with this new umbrella group since it had no political inclination and was a representation of a wider community".

The mergence of the AYWC with the HCHCG to form one umbrella group (which retained the name "Harroru Community Hirola Conservation Group") on 19 April 1999 is likely a major boost for the conservation of the hirola on the natural range.

# 14. EVALUATION AND RECOMMENDATIONS: RESEARCH

## 14.1 Evaluation

Since 1994, the amount of information critical to the conservation of the hirola has increased considerably thanks to the joint efforts of KWS and the Hirola Task Force. Nonetheless, information on the hirola remains far from adequate for (1) making well informed decisions concerning the conservation and management of this species, for (2) assessing progress, and for (3) evaluating the impact and success of various conservation actions.

## 14.2 Recommendations

### 14.2.1 **Research on the Tsavo Hirola Population** (listed in order of priority)

14.2.1.1 *Conduct a total population count in Tsavo every 3 years*

The research priority for hirola in Tsavo is to determine the size and structure of this population every 3 years; unless there is reason to believe that this population is undergoing a rapid decline, in which case a census should be conducted as soon as possible. All future censuses should be undertaken at the same time of year through a complete ground count with assistance from the air (Husky with pilot and one observer). A good time of the year for this census is June. June is suggested because (1) most of the calf mortality has occurred by then, and (2) the dry season is well advanced, making conditions suitable for flying, viewing, and for movement on the ground.

14.2.1.2 *Assess the genetic health of the Tsavo population*

Research is needed to establish baseline information on the genetic composition of the current population of hirola in Tsavo. Blood samples for genetic analysis were collected from 35 hirola during the 1996 translocation. The analysis should be completed, written-up and published.

**14.2.2 Research on the Natural Hirola Population** (listed in order of priority)

*14.2.2.1 Transfer the focus of the field research programme from Tsavo to the natural population*

The current plans of S. Andanje to undertake additional research on the ecological and behaviour of hirola in Tsavo should be supported by the Hirola Management Committee. However, once S. Andanje has completed his PhD dissertation research on the hirola of Tsavo, the focus of the KWS/Hirola Management Committee's research on hirola should move to the natural population in south-eastern Kenya. While the KWS/Hirola Management Committee should encourage and facilitate the priority research listed in Section 14.2.1 for hirola in Tsavo, the KWS/Hirola Management Committee should no longer provide KWS researchers for this work, or fund this research. The exceptions being (1) the census of this population every 3 years, and (2) perhaps the genetics research.

14.2.2.2 *Closely monitor the relative size and trend of the natural population*

Priority research for the natural population is the monitoring of its relative size and trend. Expensive, difficult and controversial efforts to determine the absolute size of this population should not be attempted anytime in the next decade. Rather, it is recommended that counts be made along fixed transects using strict procedures. Below are some suggestions on the procedures which might be followed. These should be discussed in detail with those with much experience in aerial surveys and

population sampling before making final decisions on which procedures to use.

The aircraft flies 122 m above the ground at a speed of 100 km/h, and 1.5 km from, and parallel to the road. The 1.5 km distance of the aircraft from the road is defined by rods or tape mounted on the outside of the aircraft, and by marks on the windows.

Transects located 1.5 km from the road should nearly eliminate the effects of the road on the distribution of the hirola. These "effects" include the different vegetation that occurs along the road as a result of road construction and water drainage, and the disturbance of hirola caused by the people and vehicles who use the road.

In addition to flying and navigating the aircraft, the pilot is responsible for recording environmental conditions. If the pilot has time, he/she might assist the observer (counter) in locating hirola and other animals within the transect. If this is done, it needs to be done in a consistent manner, particularly in terms of the amount of time the pilot devotes to searching the transect.

The counter searches for hirola over a 282-304 m wide transect. The calibrated transect width is defined by rods mounted on the outside of the Husky and by marks on the window. Counts should always be made only on that side of the aircraft which is away from the road. For each encounter, the size of the group and the number of animals located outside of the transect should be recorded using a tape recorder. A GPS reading should be made of all hirola and a photograph taken of all hirola encountered where at least one member of the group is present within the transect. The adult:immature ratio can be assessed from these photos later, and the size of the group can be reexamined. The Husky can break from the transect line to ensure that an adequate photograph of the group is obtained.

A point for discussion is whether the observer will search for and count species other than hirola. Ideally, the observer will record all species of large mammals, including livestock, that occur within the transect. This should not be done, however, if it in anyway increases the likelihood of missing hirola along the transect, or increases the inconsistency of the procedures within or among transects and censuses. If the observer is too busy to obtain good data on all large mammals, he/she should focus only on the large wild animals (*i.e.*, excludes livestock from the census). If the observer is too busy to obtain good data on all the large wild animals, he/she should focus on those of greatest conservation interest (*e.g.*, elephant, Grevy zebra, beisa oryx, desert warthog *Phacochoerus aethiopicus*). All sightings of large predators should be recorded, regardless of whether sighted on or off the transects. Of particularly interest are sightings of cheetah and wild dog in this region. The experience of DRSRS and KWS suggests that the observer will probably have the time to record all species of large mammals and livestock. DRSRS observers do so while flying at twice the speed recommended here, and KWS

observers do so while covering a transect width more than five times wider than that recommended here.

Six transects will be censused over two consecutive days. Day 1, fly three transects along each of the three main roads that pass through the range of the hirola (Fig. 22). These transects are as follows:

- Transect 1. Bodhei/Ijara/Bura (fly along the south-east side of the road). Length of transect ca. 150 km.

  Spend the night prior to this census at Baomo KWS Station or at Mchelelo Research Station in the Tana Primate National Reserve. Fill the aircraft fuel tanks. Fly 75 km to Bodhei. Begin census at Bodhei at 6:45 h and end at Bura (at Ca. 8:45 h).

- Transect 2. Bura/Galma Galla/Kolbio (fly along the north side of the road). Length of transect ca. 170 km.

  Begin this transect at Bura immediately after completion of Transect 1. Depending on a number of factors, including the number of hirola encountered, this transect is likely to end at Kolbio at about 11:00 h. On completion of Transect 2, the aircraft should land at either Kolbio or Galma Galla so that the pilot and observer can rest and wait out the hot portion of the day, prior to undertaking Transect 3.

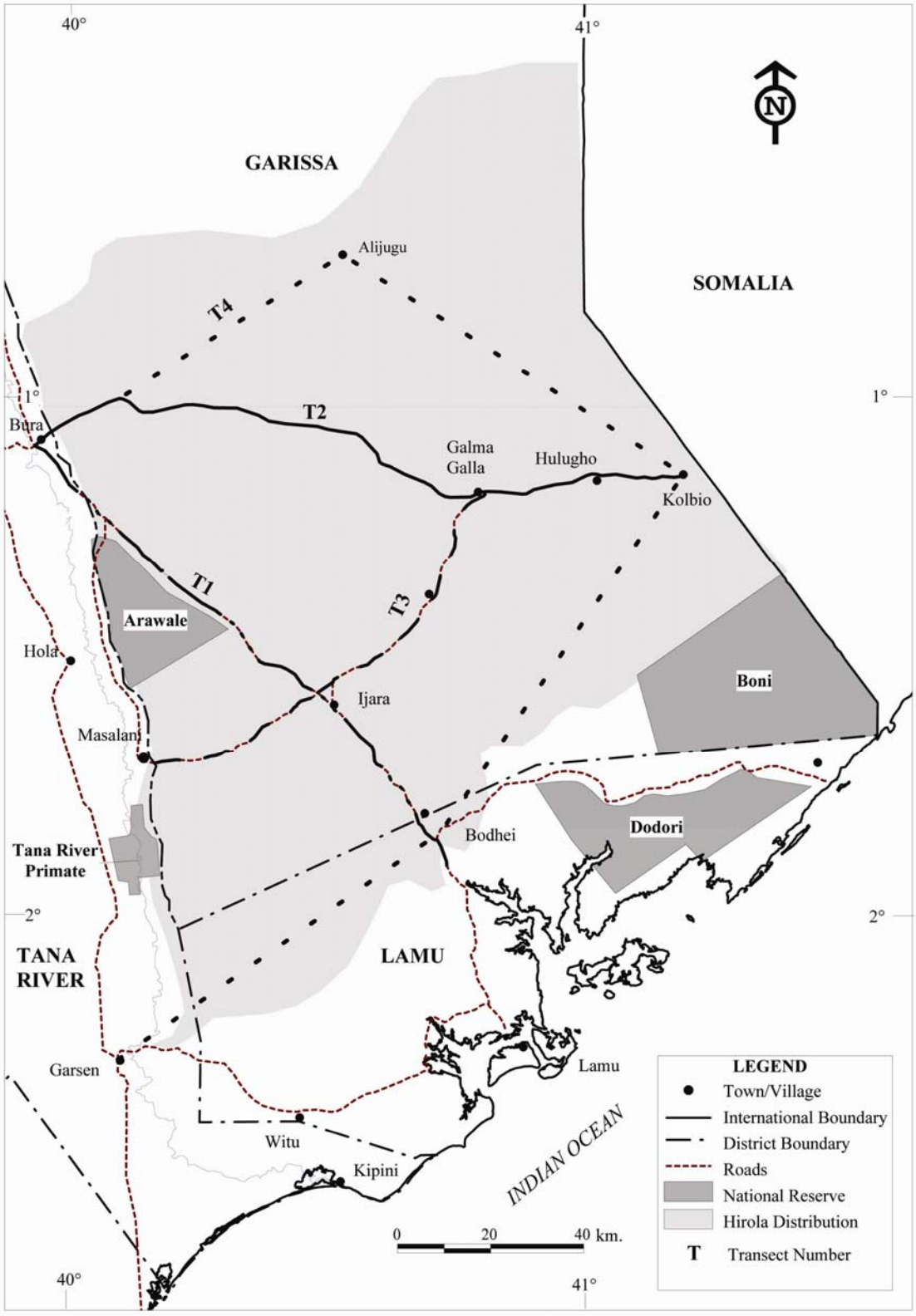
- Transect 3. Galma Galla/Ijara/Masalani (fly along the south-west side of the road). Length of transect ca. 120 km.

  Begin this transect at Galma Galla at 16:30 h. This census will end at Masalani at about 18:15 h. End of census. Continue on to the Tana Primate National Reserve (ca. 25 km) to refuel and spend the night.

- On Day 2, follow the exact same procedure but conduct the census 1.5 km on the opposite side of the road from the Day 1 census. Thus, the distance between the parallel transects will be 3 km.

The above allows for six transects totalling about 880 km and taking 2 days to complete. It is estimated that this census will involve a total of 7.5-8.0 flight hours per day (ca. 6 flight hours on transects and ca. 1.5 flight hours between transects and camp). A Husky carries fuel for roughly 8 h. This means that either a fuel stop is necessary (probably in Bura), or else additional fuel (20 L jerry can) is carried on the aircraft. Alternatively, it may be possible to safely store a drum of fuel at Galma Galla or Kolbio and refuel there during the mid-day break.

Figure 22: Proposed location of aerial transects to use for monitoring changes in the relative size and distribution of the natural population of hirola in Garissa District.


40°
41°
N
GARISSA
SOMALIA
Alijugu
T4
1°
T2
Bura
Galma
Galla
Hulugho
Kolbio
T1
T3
Arawale
Hola
Boni
Ijara
Masalani
Bodhei
Dodori
Tana River
Primate
2°
TANA
RIVER
LAMU
Garsen
Lamu
Witu
Kipini
INDIAN OCEAN
0
20
40 km.
LEGEND
Town/Village
International Boundary
District Boundary
Roads
National Reserve
Hirola Distribution
T
Transect Number

This last option is preferred but will be the most difficult from a logistic stand-point.

The hirola censuses described above should be fairly inexpensive and require no more than three full days of time on the part of one pilot and one observer (figuring a half day each to fly to and from the Tana Primate National Reserve from either Tsavo East National Park or Nairobi.

In order to establish a good set of baseline data, I suggest that the above censuses be conducted twice per year during the first 2 years and thereafter once per year. It is important that the census be undertaken within the same month each year. This will help reduce the variability present among a number of factors that might affect hirola numbers, distribution and detectability. I suggest that the census be conducted near the middle of June. Mid-June is relatively cool, the grass is still green, the rains have usually subsided, the air is relatively clear of smoke, and most of the mortality among young of the year has already occurred. During the first 2 years I suggest one census near the beginning and one near the middle of June. Thereafter, an attempt should be made to undertake the census near the middle of June.

As soon as possible after completion of each census, the data should be transcribed onto data sheets, three photocopies made of the data sheets, and these stored in safe places. At least one of the data sheets should be stored at a safe site away from KWS Headquarters (*e.g.*, WWF, WCS, IUCN). A detailed report should be written within 1 month of the completion of each census and the data entered into the KWS data base. At least 15 copies should be made of the report. The copies should be distributed to several “safe” libraries in Kenya and abroad. The libraries of the East Africa Natural History Society (Nature Kenya), WWF, AWF, IUCN and EAWLS would be good recipients.

For purposes of statistical analysis, it is recommended that each transect be subdivided into 5 km long sections (*i.e.*, 1.46 km2 sample units). The roughly 880 km of transect searched during each census will yield about 176 sample units, with a total area sampled of approximately 260 km2. The current range of the hirola in Kenya at this time is about 8,000 km2. Thus, the census described above would sample about 2.8% of this species’ range in Kenya. The six transects proposed here move through areas with the historically highest densities of hirola (*e.g.,* Masalani, Ijara, Galma Galla). If, say, there are 1,000 hirola in the natural population, this proposed census should, on average, encounter more than 28 animals. Although the area sampled is probably too small to use as a basis for estimates of absolute population size, the area sampled is expected to yield adequate data for reaching reasonable conclusions on population trend and on rates of population increase or decline. If this proves not to be the case, then consideration should be given to increasing the total length of the transects searched along each census, and/or the frequency of the censuses, and/or the width of the transects.

KWS rangers and wardens on the ground should be required to always record sightings of hirola on data form sheets. This information, if diligently collected, can be valuable in assessing changes in the distribution of the hirola.

KWS might consider conducting aerial surveys along the periphery of the range of the hirola from time to time in order to determine whether the range is expanding or contracting. This should be done as systematically as possible and in a way that minimizes the differences (variables) among these surveys. The following transect should prove highly useful in assessing hirola distribution and relative abundance along the more peripheral parts of the species' range in Kenya: Garsen to Bodhei to Kolbio to Alijugu to Bura. See transect T4 in Figure 22.

#### *14.2.2.3 Support research by Kenyan and Somali students*

The Hirola Management Committee should promote, guide and support in various ways research on the natural population of hirola, both in Kenya and in Somalia. The goal should be to have at least two Kenyan and/or Somali post-graduate students in the field within the range of this population of hirola at all times. Here are some detailed viewpoints and recommendations on this issue:

- A particular effort should be made to identify the best qualified students from the range of the hirola in south-eastern Kenya and south-western Somalia. In most cases, these will be members of the Somali and Orma ethnic groups. The vast majority of the people within the natural range of the hirola are Somali. The people of this region are particularly concerned that opportunities for educational advancement and employment be provided to members of their ethnic group. This is an especially important consideration within the range of the hirola given the distinctiveness of the Somali and Orma peoples, their languages and their cultures. Other important considerations for research and conservation in this region are (1) the numerous strong-willed, and sometime volatile political factions, (2) the poor infrastructure, and especially (3) the extreme level of insecurity. These factors, and others, combine to make it particularly difficult, expensive and risky for outsiders to undertake research and conservation work within the natural range of the hirola. Researchers and conservationists originating from this region are immune to cultural and language barriers, and best prepared to come to terms with the political and security limitations.
- Initially, the Hirola Management Committee should actively seek proposals for research on the ecology and/or behaviour of the hirola. The research should be highly applied with strong implications for hirola conservation and management. Both the quality of the researcher and of the proposal should be considered during the review process. The Hirola Management Committee should give guidance to this process by

providing a list of priority research projects, and clear guide-lines for proposal submission, financial accountability, and reporting. A grant application form should be provided and the completed form submitted to the Hirola Management Committee along with a C.V., detailed proposal and budget. Grants of from $500 to $5,000 per year should be considered.

- The Hirola Management Committee should establish a hirola research fund with the goal of providing at least $12,000 per year to Kenyan and Somali post-graduate researchers. This level of funding should be able to support two to four students. Ideally, the Hirola Management Committee will establish a Hirola Research and Conservation Trust Fund (Section 20.3), some of the money from which is dedicated to supporting Kenyan and Somali post-graduate researchers.
- Funds for well-conceived and well-written proposals concerned with applied research on hirola should not be difficult to secure for well-qualified Kenyan and Somali students. Where funds from the Hirola Management Committee are not directly available to support worthy students and their research, the Hirola Management Committee should direct such students to likely sources of funding, and provide letters of support, make telephone calls, *etc*. to potential donors on behalf of the students.
- Students, especially those originating from within and near the range of the hirola, will not only provide information vital to the conservation and management of the hirola, they will also (and perhaps more importantly) do much to stimulate additional interest in and appreciation of the hirola, and thereby, support for the conservation of this species and its environment. I judge that these students, together with well-trained and well-supervised Hirola Scouts, will be the most cost-effective ambassadors for hirola conservations both in the short- and the long-terms.
- Priority research projects to be conducted within the natural range of the hirola, either by post-graduate students or senior scientists, are listed here in order of priority:
    - *Historical Distribution and Abundance of the Hirola* We have little understanding of the historical abundance and distribution of the hirola. Knowledge of “what was” is important to species management and conservation planning. Yet the sole source of such information, the oldest people in the region, is being lost daily. Two Somali students, one working in Kenya and the other in Somalia, should conduct well conceived interviews of the oldest people of the region. The answers to such questions as, “Where did you find (or, not find) hirola when you were a young man/woman?” and “How often did you see hirola when you were a young man/woman (daily, weekly, monthly, *etc*.)?” would do much to reconstruct

the abundance and distribution of the hirola during the first half of the 20th Century. Those conducting this research might also take this opportunity to gather information on how people formerly perceived the hirola and its place within their culture...and how this perception and place have changed with time? This research need not be done by a biologist; it could be conducted by someone with an interest and background in disciplines such as anthropology, ethnography or history.

- *Current Distribution and Abundance of the Hirola in Somalia, with an Assessment of Threats.* It appears that more than half of the original natural range of the hirola was in Somalia (Section 6.1). Continued survival of the hirola in Somalia may be critical to the long-term survival of this antelope. There has never been much information on the distribution and abundance of the hirola in Somalia, and virtually no first-and information for over 20 years. This research would be done by traveling by foot and public means throughout the likely former range of the hirola in Somalia, conducting interviews, and visiting sites to confirm the presence of hirola.

- *Factors Limiting the Distribution and Abundance of the Hirola.* This is a broad and difficult topic, and one which needs to be addressed by several students and senior scientists. Separate projects might focus on the roles of competition with other grazers (particularly cattle and topi), drought, disease, predation, poaching, and habitat change/degradation/loss on the distribution and abundance of hirola.

- *Genetic Baseline for the Hirola*. Basic genetic information should be obtained on the natural population of hirola. Some insight into the genetics of this population, and of the translocated population, can be obtained from the 35 blood samples taken from hirola during the 1996 translocation, from the three samples taken by Richard Kock during research on disease in hirola in 1995, and from the several hirola found dead each year by Hirola Scouts. If additional samples are required, methods should be developed for obtaining the genetic information from fecal samples.

- *Ecology and Behaviour of the Hirola*. There is little information on the ecology and behaviour of the hirola in the natural population. While considerable information on the ecology and behaviour of the hirola will be obtained during studies focused on factors limiting hirola distribution and abundance (see above), such studies are unlikely to yield detailed data on population dynamics, social and reproductive behaviour, home range size, movement patterns, or on reproduction,

growth and mortality rates. Much of this information is vital to PVAs and population modelling, and to conservation planning.

#### 14.2.2.4 *Retrieve the missing 1995 KWS hirola census data*

Secure the missing raw data from the 1995 KWS hirola census, make three copies of all data sheets and store these in three different locations, at least one of which is not at KWS Headquarters. WWF, WCS, AWF, EAWLS or IUCN in Nairobi may be willing to store data sets in a secure place.

#### 14.2.2.5 *Rewrite the 1995 KWS hirola census report*

Once the missing raw data are obtained, the final report for the 1995 census should be rewritten and a more comprehensive and useful document produced. The final report should include, among other things, the following:

- Details on the procedures used to collect the data. In particular, what time did censuses begin and end.
- An analysis of the relationship between time of day and the number of hirola counted.
- An analysis of the relationship between transect width and the number of hirola counted.
- Details on the size of groups of hirola (mean, range, standard error). Is there a relationships between size of groups and their location within the range of the hirola (*e.g.*, periphery vs. core)? Is there a relationship between the size of groups and the density of groups?
- Present details on the other species counted during this survey (*e.g.*, population estimates, distributions, group sizes, habitat).

#### 14.2.2.6 *Establish three hirola information bases in Nairobi*

During this evaluation, much time and effort were spent compiling literature and data on the hirola. Some of this information was difficult to obtain and may soon become unavailable. Some reports and data sets seem to already be unavailable [*e.g.* Sinange (1992)]. Three complete sets of photocopies of this information-base should be placed in three different, secure, locations. One set each should go to the KWS Library and to the library of the East African Natural History Society/National Museums of Kenya. Libraries that might be a suitable depository for the third set are at WWF, IUCN, and AWF.

#### 14.2.2.7 *Conduct more PVAs*

Although PVAs have their limitations, and their value to conservation is sometimes overstated, they can help guide management and research programs. As more data become available for a species and its populations, the predictive powers of the PVA models improve, making the findings potentially more valuable. From time to time, new PVAs should be conducted on the natural and translocated populations of hirola. Already, the new data obtained on hirola since the 1996 PVA should greatly benefit the next PVA (Section 12).

Two PVAs should be conducted on the Tsavo population. The first PVA should use the data available on this population of hirola as of 1996, just prior to the 1996 translocation. The second PVA should be conducted in 2000 using the most current database for this population (Section 12). The data presented in this report suggest that the age at which females give birth to their first calf, birth rates, and adult sex ratios may be considerably different than the values used in the first PVA (Magin, 1996b). It should be both interesting and insightful to use these new values in some of the simulations in future PVAs. New PVAs should be of considerable value in monitoring the progress and needs of the Tsavo population, in planning the establishment of new populations of hirola, and in managing the natural population.

# 15. EVALUATION AND RECOMMENDATIONS: TRANSLOCATIONS

## 15.1 Evaluation

**15.1.1 The 1963 Translocation.** The 1963 translocation of hirola from Garissa District to Tsavo East National Park had a number of problems (Section 7.3.1). These are briefly reviewed here.

- The translocation was proposed and made on the belief that the number of hirola in the natural population had declined greatly and comprised fewer than 1,500 animals in 1963 (Section 7.1.2). It seems that this estimate was low by 6- to 10-fold. Ten years after this translocation, when aerial surveys were first undertaken, this population was estimated at more than 13,000 individuals. Thus, the rational for the 1963 translocation was flawed.
- Mortality of hirola during the 1963 translocation is estimated at 60-72%. This is extremely high.
- There was no systematic monitoring program for the hirola after their translocation. The first census of, and research on, this population were not undertaken until 1995.
- The 1963 translocation is extremely poorly documented. For example, there is no account of the following: number of hirola captured or the number dying prior to release; sex

composition of the captured, dead or released hirola; dates for many of the most important events of the translocation.

While one might be critical of the 1963 translocation for the reasons given above, the bottom line is that this translocation must today be judged not only as a success, but also as an extremely important achievement on behalf of hirola conservation. After all, as of 1995, this population had established itself at about 79 animals. Indeed, there have been few wildlife translocations anywhere which could be ranked as more important...and more successful.

**15.1.2 The 1996 Translocation.** The translocation of hirola in 1996 from Garissa District to Tsavo East National Park, although facing some unexpected and serious constraints, was able to overcome the problems (Sections 7.3.2 & 11). Of 35 hirola captured, six (17%) died prior to release. Of the 29 hirola release, 16 survived their first 23 months in Tsavo. Mortality from the time of capture to 23 months post-release was 54%.

It appears that a few of the decisions made, and procedures followed, prior to and during this translocations resulted in some unnecessary mortality. Nonetheless, the vast majority of the decisions made were correct and resulted in a greatly reduced level of mortality as compared to the 1963 translocation. As with the 1963 translocation, important lessons were learned and questions answered during the 1996 translocation. I conclude that the 1996 translocation was a job well done, and another successful and important step for the conservation of the hirola.

## 15.2 Comments on the 1996 Translocation

**15.2.1 Capture Methods and Choice of Age Groups**. Hirola and many other ungulates are susceptible to capture myopathy. This disease appears more likely to occur in animals that are highly stressed during the chase prior to capture (du Bothma, 1990). It is known that young animals are less prone to capture myopathy than are older individuals (Magin, 1996b).

Animal capture teams knew prior to 1963 that yearling hirola (9-12 months of age) survived capture, translocation and captivity better than adults. As such, the 1963 translocation team focused on the capture of yearlings.

During the 1963 translocation, the first two animals captured were adults and both died soon after capture. The capture team, therefore, decided to switch to capturing only yearlings. None of these died during the capture process, even though neck nooses, not darts were used. A sufficient number of yearlings survived in Tsavo to breed and establish a new population (in spite of the fact that there were no adults present).

The *Hirola Recovery Plan* (Magin, 1996b) recommends the use of net bomas for capturing hirola as the method most suitable for minimizing mortality. Peter Jenkins (in litt., 1996) states that, "Plastic bomas/nets are widely used in southern Africa for many species with a recorded mortality across the board as low as 2%". During the 1996 translocation, one goal was to translocate whole groups. It is thought that this would reduce fighting, injuries and mortality among animals in the post capture period (du Bothma, 1990). This also meant that net bomas needed to be used.

The hirola were released into Tsavo within 4 days of capture, minimizing the time they were kept in small bomas. This seems most appropriate. Prior to the 1963 translocation it was believed that maintaining hirola in small bomas prior to release would reduce overall mortality. It now appears that the longer hirola are in small bomas the greater the overall mortality.

Magin (1996b), based on his PVA simulations, recommended in the *Hirola Recovery Plan* that there be preferential selection of younger animals during translocations. He made this recommendation because his simulations suggested that biasing the age ratio towards younger animals produced a slight increase in population persistence and growth rate, and because it would probably reduce losses during capture and transport. There is no indication that this recommendation was followed during the 1996 translocation.

Of the 24 adults captured, only 10 (42%) survived to 5 months post-release. Survival drops to 10 of 34 (29%) if the survival of the foetuses and newly born calves from the 10 translocated pregnant hirola are considered (which they should be). Of the 11 yearlings captured, seven (64%) survived to 5 months post release.

This difference in survivorship is statistically significant ($\chi^2$= 4.11, df = 1, $p < 0.04$).
There is no mention in the minutes of the Translocation Subcommittee or of the Hirola Task Force of any discussion concerning which age classes to translocate, or of the rationale for translocating entire groups. The following should be considered and discussed in detail before any future translocations are undertaken.

- Yearlings appear to survive the translocation process better than adults. Adult males (1 of 6, 17% surviving), pregnant females (4 of 10, 40% surviving), and foetuses/new born calves (0 of 10, 0% surviving) all had high mortality rates during the 1996 translocation.
- The net boma was used in 1996 as this appeared to be the best method both for capturing entire groups and for minimizing mortality. It is now known, however, that hirola captured in whole groups do not regroup once translocated. The only affinity which seems to remain among hirola after their translocation is between adult females and their young of the year (Andanje, 1997a). There is, at this time, no obvious advantage to translocating whole groups, or even partial groups. In addition, most of the animals are likely to be

closely related (fathers, mothers, sons, daughters, half-sisters, half-brothers). This means that the genetic diversity of the animals removed from the natural population will likely be less than if only one or two yearlings were taken from each group.

- In 1963, yearling hirola were captured by neck-noose after presumably a long chase with a truck. Darting from a helicopter requires, on average, less of a chase. This should result in less stress overall. Given new information on the translocation of hirola and other large mammals, and new technologies, darting of yearling hirola (only) should result in considerably lower mortality than does boma net capture of entire groups with their adult males and pregnant females. Some other known or presumed advantages of translocating only yearlings, after dart capture, are as follows:
- The costs of the translocation, in terms of materials/equipment, time, man-power, planning and logistics, would all be considerably reduced. Included in this consideration is the fact that yearlings are much smaller than adults and, therefore, easier, less dangerous, and less expensive to handle and transport.
- Like many other species of antelope, particularly the alcelaphines, adult male and adult female hirola can be aggressive in small enclosures (Morris Gosling in litt., 1996). Deaths from fighting have occurred while in bomas (Donald Hunt pers. comm. to Magin, 1996b). One probable advantage to translocating yearlings, particularly if they are to be maintained for some period within an enclosure (be it small or large), is that they are unlikely to be aggressive, either towards one another or towards people.
- If the costs (money, time, man-power, equipment, materials) involved in the translocation of hirola were reduced from the 1996 level, it will not only be a savings for hirola conservation, it would mean that future translocations would have a lower profile among people in Garissa District, giving politicians less cause or time to create problems.
- At about 9 months of age, hirola of both sexes leave the group to live either alone or in association with other species of ungulate, particularly Grant’s gazelle. Sometimes these yearlings temporarily form mixed or single sex groups of up to three yearlings (Andanje, 1997a, 1998a; Andanje & Ottichilo, 1999). There is no information available on how long yearling hirola live away from the group, but it is presumably 6-12 months. Thus, if yearlings are translocated from the natural population during July and August it would be at a time when they would, in any case, be leaving the natal group to live alone or with one or a few other yearlings.
- A translocated juvenile hirola, with a full reproductive life ahead of it, should, on average, contribute more offspring

and therefore more new genetic material to the founder population than would a hirola translocated as an adult (some of which may be post-reproductive).

**15.2.2 Building Predator-Proof Sanctuaries.** In Tsavo, Andanje (1997a,b) found that about 40-50% of hirola calves die during their first 6 months of life. Mortality is especially high during the first month of life (Section 8.7). Predation seems to be the main cause. Predators may also be the main cause of adult mortality, except during disease epidemics and periods of food shortage.

It has been incorrectly suggested that 40-50% is a high rate of mortality for antelope calves (*e.g.*, Dahiye, 1999). The literature (*e.g.*, Kingdon, 1982) on mortality for wild African antelopes (including the alcelaphines) living under natural conditions in open habitats indicates that mortality during the first year is often greater than 50%. Nonetheless, one of the surest and most effective ways to increase rate of population growth is to reduce mortality, particularly calf mortality.

One of the biggest and most controversial questions surrounding the release and management of hirola in new populations is whether at least part of the population should be held within a fenced area so as to nearly eliminate predation on that portion of the population, and to allow for easier monitoring and veterinary interventions. A sanctuary of about 10 km2 could hold two or three groups of hirola (ca. 20-30 animals) in a nearly predator-free environment. Fenced sanctuaries of 4 km2 held up to 48 Lichtenstein’s hartebeest in Kruger National Park with minimum mortality (Magin, 1996b).

I estimate that where there is a natural predator community (*e.g.*, in Tsavo East National Park), a properly managed sanctuary holding 20-30 hirola would reduce calf loss to predators by about 3-5 calves/year, as well as reduce the loss of older hirola to predators by an animal or two each year. It seems likely that where natural predator communities exist, a well-managed 10 km2 predator-proof sanctuary at Tsavo could yield a net gain to the population of 4-7 hirola each year. This is not a large number...nor is it an insignificant number for a genus that is “critically endangered”. Another role for such a sanctuary would be as a temporary holding ground for newly translocated hirola. The sanctuary would let the animals fully recover from the translocation in a predator-free environment, as well as allow for health monitoring and veterinary intervention during the critical recovery period. A sanctuary would be particularly useful as a holding area for translocated pregnant hirola. Newly translocated females and their calves might be held in the sanctuary for 4-6 months.

The sanctuary might be managed in an attempt to maximize the number of young born and surviving each year. If the sanctuary is 10 km2 in area, the authorities may want to minimize the number of adult males (ca. 4) and maximize the number of adult females (ca.

24). As the yearlings reach about 9 months of age most of them should be released as this is the time that they normally leave the group (Section 8.6). A few yearlings might be kept in the sanctuary as needed to replace post-reproductive and dead individuals. Post-reproductive hirola should also be released from the sanctuary so as to minimize competition within the sanctuary.

Listed here are some of the pros and cons of establishing predator-proof (and elephant-proof) fenced sanctuaries for the hirola at future translocation sites where there are natural predator communities.

Pro Predator-Proof Fenced Sanctuary:

- Considerably reduce mortality by predators and disease, allowing for more rapid population growth. Should be particularly useful in reducing mortality among newborn calves and newly translocated hirola, especially pregnant females, while they recover from the translocation.
- Allows for closer monitoring and medical interventions. Food could be provided during periods of food shortage.
- The sanctuary could eventually be a source of hirola for establishing additional populations.
- Should reduce the need to remove hirola from the natural population (an activity which is both politically and financially expensive, and logistically difficult). For example, the 1996 translocation removed 35 hirola from the natural population at an estimated “true cost” of US$ 160,000-200,000. Of the 35 hirola captured, 16 survived to 23 months post-release. Thus, the “cost” of each of the 16 surviving hirola was probably between US$ 10,000-12,500. If we take the cost of constructing a suitable fence for the hirola to be US$ 15,000/km, then a 14 km long fence enclosing a 10 km2 area would cost US$ 210,000. If, as suggested above, this 10 km2 enclosure reduced mortality by 4-7 hirola each year, the fence would, in a sense, “pay for itself ” in 3-5 years. Against these figures, a fence that results in reduced mortality and costs might make good sense as an additional conservation tool for sites where natural predator communities occur.
- The sanctuary can also be used to protect other species from predators (*e.g.*, black rhinoceros, sable, roan), making them even more valuable as conservation tools and more cost effective.

Con Predator-Proof Fenced Sanctuary:

- A predator-proof (and elephant-proof) fence around 4-10 km2 sanctuaries would be fairly expensive to construct (roughly US$ 15,000/km of fence) and maintain, and require a good part-time manager and well-trained, dedicated staff.

- There may be problems of aggression and injury among the captive hirola. This is unlikely, however, to be a serious problem in enclosures of this size where hirola densities are not high. Particularly aggressive hirola could be removed.
- There may be negative impacts on the habitat by the hirola. The impact of the hirola on the habitat should be monitored. If found to be negative, various actions can be taken, including reducing the stocking rate and/or providing supplemental food.
- Hirola maintained in a sanctuary, particularly those born and raised there, might be "naive" to predators once released and, therefore, suffer high levels of predation. This is probably the most serious concern of placing hirola within a sanctuary. Nonetheless, since predation on this species is so great during the first 6 months after birth, the net gain in surviving hirola is likely to be considerable when maintained in a sanctuary until about 9 months of age. Certainly a naive 9 month old yearling hirola released into a predator community is far more likely to survive than is a 1-100 day old hirola calf. The other point to be made here is that the array of predators capable of killing a 1 day old hirola (*e.g.*, jackal, python, caracal, serval, baboon, eagle) is far greater than for a much larger, aware and faster 9 month old hirola.
- Fences in a national park are often not appreciated by tourists. Within national parks and national reserves, predator-proof sanctuaries should generally be located away from the tourist circuit, yet in well-protected, prime hirola habitat. This should be possible in most cases. The hirola population introduced into Tsavo East National Park is largely within the main tourist circuit. While the habitat there is suitable for hirola, and the area is easily accessible and well protected from poachers, KWS has stated that a predator-proof fence there for the hirola is unacceptable at this time. If predator-proof sanctuaries are going to be developed at new translocation sites, much consideration needs to be given prior to site selection as to where the fenced sanctuaries will be located. It should be noted that the managers of private game ranches (which are usually already fenced) are likely to be much more receptive of a predator-proof fence than are the managers of national parks and national reserves.
- Fire can be a serious problem, damaging the fence (if wooden poles are used) and killing wildlife. Much of this problem can be overcome if (1) metal posts are used (as is now KWS policy), (2) fire-breaks are made and well maintained, and (3) those workers responsible for caring for the hirola (and other workers in the area) are trained in fire fighting techniques, particularly back-burning.

**15.2.3 Placing Radio Collars on Hirola**. Concern has been expressed over the possible negative impact of placing radio collars on a limited number of adult hirola for purposes of locating groups for monitoring and research purposes (Daphne Sheldrick in litt., February 1999, June 1999, November 1999; Richard Kock in litt., April 1999; HMC Minutes, February 1999). Two analyses of survivorship of collared verses non-collared hirola following the 1996 translocation to Tsavo East National Park indicate that radio collaring had no statistically significant effect on survival ($\chi^2$= 0.47, df = 1, p > 0.3) (Andanje, 1997b; Gosling, 1999).
The following short report on this question was written by Gosling (1999).

1) The hirola population in Tsavo NP has grown slowly from the small group introduced in 1963 to around 100 in 1999. This growth rate is far too low to give any confidence that the population is viable in the medium term. Since *ex situ* conservation is part of the KWS strategy for hirola recovery it is important to identify the factors limiting the Tsavo population so that their effect can be removed or modified in future conservation management. It is therefore necessary to closely monitor the population and carry out applied research to identify the limiting factors.

2) Hirola live in groups of females with their offspring, each accompanied by an adult male. These groups move over large ranges, sometimes up to 20 km2. After spending a few days in one part of this range groups may suddenly move to another area. Because of these habits and the scrubland habitat in which they live, hirola are extremely difficult to find. This problem is compounded by the behaviour of some young animals and bachelor which live alone. Mr Andanje, the KWS biologist responsible for monitoring the population, often spends entire days in fruitless searching despite his excellent field skills. We have quantified the time lost in this way by calculating the distance covered in searches for hirola in a five month period in late 1996 in relation to the number of hirola groups located and have compared it with similar period in early 1999. Individuals were collared in most groups in the early period but all collars had failed or almost failed in 1999.

| | Distance(kms) | Groups sighted | Km/group |
|---|---|---|---|
| 1996 (5 mths) | 8,433 | 96 | 87.8 |
| 1999 (5 mths) | 13,612 | 27 | 504.1 |

3) Under these circumstances radio collaring is widely accepted technique to help locate animals. Of course it must not be used without careful thought. The risks of any intervention

must be identified and balanced against its benefits with particular care in the case of a critically endangered species. Hirola have been shown to be vulnerable to capture stress so that the procedures associated with collaring must be designed carefully. The optimum technique is probably that used in March this year when a habituated adult female was darted from a vehicle without chase. After collaring the female recovered quickly and rejoined the group. I saw this female during my recent visit, six months after it was collared. It was with its group and appeared to be in good health. I recommend that this technique be used in future.

4) It has been suggested that collared hirola may be more vulnerable to predation than non-collared animals and there are some grounds for expecting this. Predators appear to use any abnormality as a cue in prey selection and have rapidly eliminated some collared animals, such as a group of wildebeest collared in Ngorongoro by Estes. However, in this example the collars were brightly coloured to facilitate resighting by human observers. In contrast, hirola collars have been deliberately disguised as far as possible by colouring them with a dye close to the tan colour of the hirola's coat. Predator behaviour may also be different in the closed habitat of Tsavo to that of Ngorongoro with less opportunity for prey selection. Fortunately, we have objective data on the effect of collaring on the hirola in Tsavo to help resolve this issue. When the new group of hirola were released in 1996 some were collared and some marked with small inconspicuous ear tags. Mr Andanje has monitored the survival of these two groups up to the present and the data are as follows:

| | Collared | Not collared | Total |
|---|---|---|---|
| Alive | 4 | 7 | 11 |
| Dead | 6 | 12 | 18 |
| Total | 10 | 19 | 29 |

There is no significant difference in the survival of collared and non-collared animals ($\chi^2$= 0.028, df = 1, NS). We can thus conclude that there is no evidence for higher levels of predation on the collared hirola.

5) Two further points should be made about radio collaring. The first is that I have doubts about the efficacy of the current equipment and recommend that alternatives be considered before further collars are fitted. Secondly, collaring is not sufficient by itself to study a population at very low density such as the hirola in Tsavo NP. Transmitters have limited range in broken terrain and systematic air support is also vital if this population is to be monitored efficiently. This has been lacking in recent months and I would support the

recent decision to increase the level of air support for this project".

## 15.3 Recommendations

**15.3.1 The Hirola Translocation Subcommittee's Recommendations for Future Translocations.** Upon completion of the 1996 translocation of hirola, the Translocation Subcommittee made eight recommendations for future translocations of free-living hirola (Kock *et al*., 1998). The eight recommendations are quoted here exactly as they were given.

1. U net boma (100 m mouth, 70 m depth) with internal drop nets (7 x 40 m) capture is suitable method for groups sizes up to 12. Fixed funnel bomas with curtains (side and cross) and internal drop nets may work well especially if a large mouth is employed (200 m). Loose drop nets for small numbers of animals is also suitable if placed close (<200 m) to the hirola prior to a helicopter drive. Chase times by helicopter should be less than 10 minutes and with minimal panic in the animals until the final drive. Support and search light aircraft are essential aids on a daily basis. The use of three or four ground teams with radios and led by aircraft, was effective in herding the animals closer to the trap thus minimizing helicopter chase time.
2. Darting is not a good method of capture. It was not advised in the planning but under the intense pressure to finish was used as a last resort. 9/11 darted animals died; 5 within 3 days of capture; 3 from myopathy, 2 from restraint trauma, and 4 within 38 days after release, from predation. The latter may be coincidental but darting could have increased their susceptibility to predation from chronic muscle damage. The other factor might be isolation post release as a result of relatively few animals from any family group being caught by this method. Dart chase times must not exceed 1 minute and ambient temperatures should be below 30°C. Animals with body temperatures above 41°C should be released and all animals cooled before transportation with water. The drug of choice is etrophine at a maximum dose of 5 mg combined with a sedative.
3. Capture should take place in the cooler hours (7:00 a.m.-10:00 a.m.).
4. Numbers of staff in the field could be reduced to a more manageable number. For capture a maximum of 20 personnel to handle 12 animals. As many of the staff with experience in this operation should be used in the future.
5. Transport from the capture boma to the airfield requires a well prepared truck with tarpaulin covers, solid sides, non slip flooring and padding. The animals should be transported standing and with minimal restraint.

6. The Cessna caravan is a suitable transporter (maximum 10 adult animals) for long distance with animals in sternal recumbency and with horns secured by rope and 3 personnel for restraint.
7. Animals should be held in bomas at the release site for a maximum of 3 days. Boma design needs modification.
8. Animals should be released into a fenced sanctuary to allow a period of adaptation without predator pressure. This was an initial recommendation which was not followed and the results reinforce the need to do this in future attempts.

Lucile Ford (pers. comm., 1999) indicated that, during the 1996 translocation, the three to four ground teams (each with 8-11 people) took over the drive from the helicopter as the hirola approached the boma. The ground teams then funnelled the hirola into the boma. She also mentioned that the helicopter sometimes had problems keeping track of the location of the boma during the drive and that parking the vehicles behind the boma made it easier for the pilot to relocate the boma.

**15.3.2 Recommendations from this Evaluation**. All eight of the above recommendations of the Translocation Subcommittee should be taken seriously as they are based on considerable experience. Based upon this evaluation, I have the following additional recommendations for future translocations of the hirola:

15.3.2.*1 Translocation method and age group*

Give serious discussion and evaluation to the possible advantages of translocating only yearling hirola using the “helicopter darting method” as opposed to translocating adults and entire herds using the “boma net method” (Sections 7.3.2 & 11.4). While there are obviously many things to take into account when making this choice, by far the most important consideration must be the proportion of hirola captured that survive their first 6 months in the new location.

15.3.2.*2 Predator-proof sanctuaries*

Probably the most controversial question concerning the translocation of hirola is whether they should be placed within a large predator-free/predator-proof sanctuary, and whether a portion of the resident population should be maintained in a sanctuary. This topic had been discussed by the Hirola Task Force (HTF Minutes, October 1995, January 1996) and by the Translocation Subcommittee (Kock *et al*., 1998), and reviewed in the *Hirola Action Plan* (Magin, 1996b) and in this report (Sections 15.2.2 & 15.3.1). KWS and other organizations and groups in Kenya have considerable experience developing and managing fenced sanctuaries for threatened large mammals.

This evaluation supports the concept of a fenced sanctuary in Tsavo, as well as at other sites where hirola will eventually be

translocated. A fenced sanctuary at Tsavo should not, however, be considered a priority for hirola conservation at this time; particularly as the Tsavo population is apparently now over 100 animals and appears to be steadily increasing, and since there are no imminent plans for a third translocation. There are more important actions which need to be planned, funded and implemented at present. Until these other activities are in place, or unless the population of hirola in Tsavo for some reason begins to decline in numbers, the sanctuary in Tsavo should not be further considered.

#### 5.3.2.3 *Radio collars*

The available data indicate that the radio collars, as now used, have no significant impact on the survival of hirola.

Nonetheless, the following guidelines should be followed in order to further limit any negative impact, stress, or discomfort that radio collars might cause:

- No more hirola than absolutely necessary should be collared. This probably means that no more than one hirola per group should be collared. To justify collaring, researchers must make good and frequent use of radio collared hirola. They must attempt to maximize the amount of data obtained, and to make the best use possible of the radio collared individuals and of the groups in which they live.
- Darting of hirola for radio collaring must be done during the early morning (cool) hours of the day. This will minimize heat stress and allow the hirola time to recover prior to nightfall when most predators become active. Hirola should be darted from a ground vehicle and not chased. The best and safest drugs and darting equipment available should always be used.
- Only adult hirola should be collared, preferably males. If adult females must be collared, they should be either non-pregnant or in the first two trimesters of pregnancy. Females with calves younger than about 2 months of age should also not be collared. Thus, collaring of adult females is best undertaken during the months of April, May and June.
- The best available radios, collars and receivers should be used. Radios and batteries should be long-lived in order to reduce the frequency at which they need replacement. Collars should match the colour of the hirola in order to not draw the attention of predators.

#### 15.3.2.4 *Collection of data*

There are few linear measurement data on hirola, and almost no body weight (mass) data. It is a waste of an opportunity to have hirola “in hand” and to not take the basic body measurements and weight of the adults. While the period during which hirola are

being handled can be extremely busy, time should be made available for someone to gather these important data. Certainly, there was time to measure and weigh the six hirola that died during the 1996 translocation, yet this was not done (at least not for all of them). The other recommendation to make here is that there is little skeletal material for this “critically endangered” species/genus among museums, including at the National Museums of Kenya. Skulls are particularly valuable. These materials seem not to have been collected and deposited during the 1996 translocation. This recommendation also applies to dead hirola found in the field. For example, Andanje (1999a) observed 14 hirola carcasses from the Tsavo population during the period June 1998 to June 1999, while during this same period several additional hirola carcasses were located by the Hirola Scouts on the natural range. Where are these valuable specimens being stored? Are they being properly stored and made available to other researchers? Have samples been collected for the genetics research that is now being proposed?

#### 15.3.2.5 *Information on the 1996 translocation*

Some important details concerning the 1996 translocation of hirola to Tsavo East National Park are not available or easily deciphered. The following should be written down and made widely available:

- Details of size and structure of the capture nets (accompanied by clear sketches).
- A table that shows the following for each hirola captured: age/sex, drive time to capture, method of capture, and date of death (if applicable).

# 16. EVALUATION AND RECOMMENDATIONS: ESTABLISHING NEW POPULATIONS

## 16.1 The Need for More Populations of Hirola

The present two populations of hirola, both of which are in low numbers and facing a highly uncertain future, are certainly not good enough for any species, let alone a monotypic genus. Given the present low numbers of the natural population, I strongly recommend that a minimum of five additional populations be established, at least one of which is a captive population located outside of Africa. The other four additional populations might be establishing both within Kenya’s national park and national reserve system as well as on private land. The goal should be to establish the captive population before 2005 and the four free-living populations before 2010.

The IUCN/SSC Antelope Specialist Group recently reviewed and evaluated the conservation status of the hirola (East, 1998). This Specialist Group gave the following concluding statement. “The decline of this antelope’s numbers since the 1970s within its very restricted natural range suggests that it is in danger of extinction in the short to medium term. Security problems preclude the development of effective conservation measures over most of its natural range, with a few possible exceptions such as parts of Badade District in Somalia. Establishment of additional extralimital populations to the one in Tsavo National Park, in areas where high levels of protection and management can be assured, is an urgent priority to reduce the risk of extinction”. “Its survival will remain highly precarious until secure populations have been established in a greater number of areas within or outside its natural range”.

Establishing populations of hirola on KWS-managed land and on private land both have their positive and negative aspects.

### 16.2 KWS Managed Areas vs Private Game Ranches as Translocation Sites

As far as KWS is concerned, the main advantage of translocating hirola to KWS managed areas is that KWS has direct control over the protection and management of both the hirola and the habitat. There have been (are) some serious disagreements between KWS and some private game ranch owners over the management and movement of some species on private land, particularly the black rhinoceros. Since important lessons have been learned in this regard, it should be possible for clearer and more firm agreements to be made between KWS and private land owners over the management and ownership of hirola introduced to or born on private land.

There are three main disadvantages of translocating hirola to national parks and national reserves. First, KWS has limited financial and human resources for these translocations and for the follow-up management and monitoring programmes. Outside funds for these activities would need to be secured. Second, national parks and national reserves are established with the primary aim of preserving “natural ecosystems”. This makes it generally much less acceptable to introduce “exotic species” to parks and reserves than to private lands. Third, KWS is adverse to establishing additional large predator-free enclosures within protected areas or to radio collaring hirola where they might be viewed by tourists. Both of these important wildlife management and research tools are generally acceptable and widely used on private game ranches.

While it seems highly probably that hirola occurred over much of Kenya’s rangeland in the distant past, and that because of this they would not have much negative impact on the flora and fauna of Kenya’s protected areas, they are, nonetheless not a natural part of these ecosystems at this time. Their introduction to national parks and reserves should be undertaken with some caution and perhaps only when alternative options do not exist. The possible

impact of hirola on the environment is much less of a concern on private land where the flora and fauna are often already considerably impacted and altered by decades of human interventions, including grazing and browsing by exotic species such as cattle, goats and sheep.

Some prerequisites for the selection of private game ranches for the establishment of new populations of the hirola are as follows:

- Demonstrated commitment to wildlife conservation.
- Willingness and ability to cover all expenses related to the translocation, maintenance, protection and management of the hirola population. Where large predators are common, this should include provision of a 4-10 km2 predator-free sanctuary for use by a portion of the hirola population, and for temporary use by newly translocated hirola.
- Production and approval by KWS of a 10-year, hirola management plan.
- MOU with KWS for the hirola. Ownership of all hirola, including any offspring, must remain with KWS or with the Government of Kenya.
- Trust fund in place specifically to support the growth and well-being of the hirola population, and to secure its long-term future should land ownership change or political/security conditions require that the entire group (if small) or part of the group (if large) be removed.
- Habitat likely to support a population of hirola with minimal intervention or management.
- Good security and veterinary support, and willingness to fund, or at least support, research on the hirola population.
- Willingness to at least temporarily reduce the density of probable competitors (*e.g.*, kongoni) or predators (*e.g.*, lion, leopard, hyaena) if they appear to have an unacceptable negative impact on the establishment and growth of the hirola population.

## 16.3 Evaluation of Potential Sites for Hirola Translocation

**16.3.1 Background.** Magin (l996b), in the *Hirola Recovery Plan,* provides a comparison and an evaluation of seven potential translocation sites in Kenya. That Plan should be referred to for details of those seven sites. Here I review and provide comments on these seven sites and on three additional sites (Fig. 2).

Six of the 10 potential translocation sites considered here were visited by Magin (1996b). I have also visited six of these sites (*i.e.*, Tsavo East National Park, Tsavo West National Park, Meru National Park, Baobab Farm, Athi River, 01 Jogi). All 10 sites

have permanent water and airstrips, and most have large areas of habitat which is at least broadly similar in structure and grass genus/species composition to that in the natural range of the hirola. All except Baobab Farm are at higher elevation than the natural range, all are cooler and receive a higher annual rainfall than the natural range.

### 16.3.2 National Parks and National Reserves (KWS Managed Areas)

#### *16.3.2.1 West bank of the Tana River Primate National Reserve (171 km2)*

I have worked in this area since 1994. Magin judged this site as unsuitable for a hirola translocation. I agree. Although but a few kilometres to the west of the natural range of the hirola, the habitat here differs considerably, perhaps largely as a result of over-grazing by livestock over the long-term. Much of the region is covered by dense bush on sandy or gravely ground. These is little habitat here on which hirola would be expected to do well. The area is also insecure and there are logistic problems.

#### *16.3.2.2 North-west Tsavo East National Park (11,747 km2)*

Altitude: 200-1,200 m. Rainfall: 30-60 cm/year. Tsavo, of course, already has a translocated population of hirola which has reproduced and survived for more than 37 years. This population is now fairly well established at over 100 animals, and is probably increasing. The area is well protected, large and natural, and offers much potential for expansion of this population. With the most recent translocation in 1996, no further translocations to this particular population in Tsavo will likely to be needed in either the near- or medium-terms. Tsavo East is, however, a large national park of which the present introduced population of hirola uses but 600 km2 (5% of the total area). Introducing another population into Tsavo East National Park should be considered. One area that would probably support hirola lies east of the Yatta Plateau and north of the Tiva River in the northwest corner of this Park. Here is found the same bio-climatic zone (Wijngaarden, 1985) as over that part of Tsavo East National Park where hirola now occur, and the same Biogeographical Province (3.14.07, Somalian; Udvardy, 1975) as Garissa District. If this site were chosen for a future translocation of hirola, the security of the area would need to be improved as poaching might be a problem.

#### *16.3.2.3 Tsavo West National Park (9,065 km2)*

Altitude: 200-2,400 m. Rainfall: 30-50 cm/year. This large park lies within the same bio-climatic zone as does the southern part of Tsavo East National Park (Wijngaarden, 1985) and the Hilton Wildlife Sanctuary near the Taita Hills (Section 16.3.3.2), and in the same Biogeographical Province (3.14.07, Somalian; Udvardy,

1975) as Garissa District. Good protection is already in place. Hirola would probably do well here, although the exact site for the translocation would need to be determined. This would be a good choice for one of perhaps three widely-spaced populations of hirola within the Tsavo ecosystem (Section 16.3.2.2).

*16.3.2.4 Nairobi National Park (112 km2)*

Altitude: 1,550-1,750 m. Rainfall: 63-89 cm/year. About 80% of this Park is grassland with scattered scrubs and trees. This is probably Kenya's most secure protected area and the one with the fewest logistic problems for the management of a population of hirola. Although this area differs considerably from Garissa District in many ways, there are a good number of species of large mammal here which also inhabit Garissa District. Kongoni (Coke's hartebeest) is also found here. Hirola in Nairobi National Park would bring the species close to a large number of people, including politicians and donors. A population in this park could serve both as a major tourist attraction and as a means of raising public awareness over the plight of this genus/ species. The main concerns over this site are that it is relatively small and that the Mbagathi River may not be an effective barrier to keeping hirola from moving southward out of the Park and onto private land. The 81 km2 Athi River Game Ranch (Section 16.3.3.3) is contiguous with Nairobi National Park and is nearly free of predators. The possibility of jointly managing a population of hirola that ranges over both the Nairobi National Park and the Athi River Game Ranch (total = 193 km2) should be closely examined as this might be feasible while yielding some extremely interesting possibilities both for hirola management and conservation partnership.

*16.3.2.5 Meru National Park (870 km2)*

Altitude: 300-1,000 m. Rainfall: 30-36 cm/year. Meru National Park is contiguous to Kora National Reserve (1,788 km2), Rahole National Reserve (1,270 km2), North Kitui National Reserve (745 km2) and Bisanadi National Reserve (600 km2). Combined this is a conservation area that covers 5,273 km2. The only conservation area in Kenya which is larger than this is Tsavo. The Tana River forms the south boundary of Meru National Park. Meru lies only about 170 km to the north-west of the present range of the hirola and is in the same Biogeographical Province as Garissa District (3.14.07 Somalian; Udvardy, 1975). Parts of Meru are covered with wooded grassland. In addition, the large mammal fauna of Meru is nearly identical to that in the range of the hirola, with the major exception being that the kongoni (Coke's hartebeest) is present rather than topi. Given that Meru is on the same bank of the Tana River as is the current distribution of the hirola, there is an excellent chance that hirola once ranged over the Meru region. Security in Meru National Park is, once again, good. This report recommends Meru National Park as the best site for a hirola translocation among the KWS managed areas.

### 16.3.3 Private Game Ranches (Areas not Managed by KWS)

*16.3.3.1 Baobab Farm, Mombasa (1.8 km2)*

Altitude: near sea level. Rainfall: 100-120 cm/year. Small privately-owned game sanctuary. Rainfall here is at least twice that of the natural range. That could be a serious problem for hirola from the stand-point of disease. Although a small number of hirola could probably survive here, and offer viewing (education) to the public, the area is far too small and far too unnatural to otherwise have much conservation value for the hirola. This is certainly the site least suitable for a hirola translocation.

*16.3.3.2 Hilton Wildlife Sanctuary, Taita Hills (104 km2)*

Altitude: 1,300-1,500 m. Rainfall: 30-50 cm/year. Privately-owned game sanctuary located off the eastern boundary of Tsavo West National Park (Section 16.3.2.3). The ecology of this site is, therefore, similar to parts of Tsavo West National Park. This sanctuary could probably support hirola with a minimum of intervention. Security is good and logistics are manageable. There is no veterinarian present but veterinary assistance can be obtained when necessary. A predator-proof enclosure might need to be constructed for temporary use by newly translocated hirola. Hirola would be expected to do as well here as in the Tsavo East National Park. The potential should be examined for the possible joint management with Tsavo West National Park of an introduced population of hirola. A portion of the population of hirola established in the Hilton Wildlife Sanctuary might be allowed to move into the Park once numbers reach a certain level.

*16.3.3.3 Athi River Game Ranching (81 km2)*

Altitude: 1,600 m. Rainfall: 42-45 cm/year. Privately-owned game ranch/ sanctuary 81 km2 in size located off the east side of Nairobi National Park. There is a predator-proof fence around this entire area of rich grassland. A few cheetah and hyaena are the only large predators. The ranch has a long standing research program with the Center for Field Studies/Earthwatch and a good ecological data base. There is a veterinarian on site and the KWS Veterinary Unit is only about a 1 hour drive away. There are about 700 kongoni on this ranch, but the owner is willing to reduce this number if it will promote the growth of the hirola population. If desirable, it would be easy to move hirola from this site into Nairobi National Park. In fact, it may be possible to jointly manage a population of hirola that occupies both this ranch and Nairobi National Park (Section 16.3.2.4). During my few visits to this ranch I found a high level of ticks. This raises some concern for the transmission of disease to hirola. Nonetheless, this is a very secure area and the game ranch site which offers the fewest logistic problems. Hirola should do well at this site.

*16.3.3.4 Lewa Downs Wildlife Sanctuary (260 km2)*

Altitude: 1,400-1,800 m. Rainfall: 45-50 cm/year. Near Nanyuki, Laikipia District. This site is well-known for its contribution to wildlife conservation in Kenya. For example, Lewa supports populations of black rhinoceros, white rhinoceros *Ceratotherium simum,* elephant, Grevy's zebra, and Kenya hartebeest (*Alcelaphus buselaphus cokei* X *A. b. lelwel* stable hybrid). This is a fairly natural area which is part of the large Laikipia ecosystem with its large ranches and relatively abundant, and well-managed and protected, wildlife populations. Many of the large ranches in this region give high priority to wildlife conservation and several would probably be interested in securing and managing groups of hirola. Lewa Downs has a wildlife research program and research facilities. There is no veterinarian on site but veterinary assistance is available. Although there are few lions, there are a good number of leopard, and some cheetah and spotted hyena. A predator-free enclosure needs to be built for hirola. Hirola should do well here and there is considerable area over which a population might become established.

*16.3.3.5 Ol Jogi (Pyramid) Wildlife Sanctuary (52 km2)*

Altitude: 1,780-2,235 m. Rainfall: 40-45 cm/year. Privately-owned game sanctuary that is part of a much larger ranch (243 km2) on which there are cattle and good numbers of wildlife. This ranch is, in-turn, bordered by or near other large ranches (*e.g.*, Mpala, Segara, Ol Pejeta) with a demonstrated commitment to wildlife conservation. Ol Jogi has a wildlife biologist and veterinarian on site, as well as research facilities and a full clinical veterinary facility. Although the Sanctuary is completely fenced and probably predator proof, there are a good number of leopard and hyaena within the site, plus a few lion and cheetah. A 4 km2 predator-proof and predator-free enclosure already exists inside the Sanctuary. This was built several years ago in anticipation of receiving hirola. Security is excellent and logistics are manageable.

Ol Jogi should be given highest priority for the next hirola translocation. This is because (1) hirola should do well on these rangelands, particularly given the management, research and veterinary capabilities, (2) this site should tell us the most about the potential geographic range of the hirola in Kenya, (3) the infrastructure and personnel are in place to provide maximum protection and support to the hirola, to monitor their well-being, and to recapture and move them off the site if they do not do well, and (4) funds for this translocation might be available fairly quickly. That is, this translocation could be undertaken while funds for translocation to a fourth site are being sought.

Of the proposed sites, Ol Jogi is the farthest from the current natural range of the hirola and at the highest elevation. It seems likely that hirola, or other (now extinct) members of the genus

*Beatragus,* once occupied these high rangelands. If the hirola can do well at Ol Jogi, it means that there is a large area in Kenya over which this species can be potentially translocated and established.

It is recommended that about eight yearling hirola (ca. three males and five females) be translocated from Garissa District to Ol Jogi to establish a "test population". If these animals do well and reproduce, then an additional 15 yearling hirola from Garissa District should be added after about 2 years (to avoid inbreeding during the second generation).

**16.3.4 Priority Sites for Estab1ishing Hirola Populations**. Of the 10 sites thus far proposed for receiving translocated hirola (Fig. 2, Section 16.3), this evaluation ranks them as follows in terms of their potential to contribute to the conservation of the hirola:

1. Ol Jogi (Pyramid) Wildlife Sanctuary
2. Meru National Park
3. Tsavo West National Park (perhaps in partnership with Hilton Taita)
4. North-east Tsavo East National Park
5. Nairobi National Park (perhaps in partnership with Athi River)
6. Athi River Game Ranch
7. Lewa Downs Wildlife Sanctuary
8. Hilton Wildlife Sanctuary
9. Tana River Primate National Reserve
10. Baobab Farm

These sites were discussed by the Hirola Task Force on 25 October 1995 and on 11 January 1996. It was decided that Tsavo East National Park was the most suitable site for a translocation, followed by Athi River. The Tsavo East translocation was conducted in August 1996. That put Athi River as the next site for a translocation according to the Hirola Task Force. This evaluation suggests, however, that Ol Jogi Wildlife Sanctuary be the next site, followed by Meru National Park.

The above list of priority sites will certainly change with time as conditions for each site change (*e.g.*, security, availability of funds), and as circumstances surrounding the conservation status of the hirola change (*e.g.*, size of the natural population).

## 16.4 Establishing a Captive Population

**16.4.1 Evaluation.** Important security for the long-term survival of the hirola can be gained by establishing a self-sustaining captive population before 2005. Hirola have been in captivity since at least the 1950s and some individuals have survived and bred well (Smielowski, 1987). There have, however, been serious disease problems which affected groups from time to time, causing their eventual decline and elimination. At present there are only two hirola in captivity (Section 7.4).

Zoos have come a long way in the past few decades, not only in their ability to maintain and breed antelopes in large naturalistic enclosures, but also in their commitment to conservation, particular through research, public education and financial support of *in situ* conservation activities. At this stage, the world's better zoos almost certainly have the capability of maintaining a viable population of hirola. As Magin (l996b) indicates, "...the problems associated with breeding hirola in captivity are not insurmountable. With sufficient planning and international co-operation, a captive breeding programme for hirola as a conservation insurance policy should be perfectly feasible". I fully agree. Other members of the Alcelaphinae are now doing well in captivity. There seems to be no reason why the hirola would not also do well.

The hirola is Africa's only critically endangered species/genus of antelope which is not represented in captivity by a viable population. Steps should be taken to remedy this situation. Establishing a viable population of hirola in captivity would provide for new research opportunities on the species, increase public awareness of the plight of the hirola, enhance donor and zoo support for *in situ* conservation of the hirola, and most importantly, further ensure the survival of the hirola and serve as a possible source of animals for reintroductions.

Two species of large antelopes, the Arabian oryx *Oryx leucoryx* and the scimitar-horned oryx (Section 7.5) survive in the wild today only because they were brought into captivity and reintroduced to their native ranges. The addax *Addax nasomaculatus* is nearly extinct in the wild but there is a viable captive population (2,352 in 1996) which could be tapped if reintroductions are needed (East, 1998). Similarly, the mountain bongo *Tragelaphus eurycerus isaaci,* a subspecies endemic to Kenya, is in low numbers in Kenya but in 1996 there were about 370 in captivity. The number in captivity probably exceeds the number in the wild. A reintroduction of the mountain bongo to parts of its former range in Kenya is now being considered (East, 1998).

**16.4.2 Recommendations**. KWS and the Hirola Management Committee should request the American Zoo and Aquarium Association (AZA) (which is a coalition of the best zoos in North America) to advise on how a population of hirola would best be maintained in captivity, how many wild caught animals might be required to found a captive population, how they might be distributed among various captive facilities, which facilities, *etc*. Some AZA members have

breeding facilities where antelope live in large enclosures under what are semi-natural conditions (*e.g.*, Bronx Zoo's St. Catherine's Island, White Oak, San Diego). The hirola would probably be a prime candidate for such facilities as well as for some of the big ranches in Texas where large numbers of antelope are maintained. The AZA should be requested to develop a "Species Survival Plan" (SSP) for the hirola in which details for the maintenance and propagation of this species in captivity are provided.

### 16.5 Removing More Hirola from the Natural Population

From a purely conservation viewpoint, there is no doubt that additional populations of hirola should be established, and that the founder animals should come from the natural population in Garissa District. Science, technology, and methodology are not constraints to additional translocations. With some effort, funding for several more translocations can certainly be found. The biggest obstacle to another hirola translocation any time soon is the complicated political situation in Garissa District (Sections 11.5 & 11.6), and to some extent the overall security situation.

Hirola numbers in the natural population have declined greatly since 1983. This population may have stabilized, or possibly even increased in recent years, but at 500-2,000 individuals it is still highly vulnerable. Although current conservation activities should focus on the natural population, wise and prudent conservation dictates that additional populations be established. Thus, some means for over-coming the current opposition to the additional removal of hirola from Garissa District need to be examined and tried.

It is obvious that the politicians and the people of Garissa District want "something" before "their hirola" are removed. To some extent, more education, more sensitization and more negotiation with the politicians and people may help, but I suspect that ultimately, the best, easiest and least painful path will be to provide some sort of material contribution that a large portion of the people living within the range of the hirola directly benefit from. At this time this seems to be the only clear route towards obtaining additional hirola from Garissa District while establishing a win-win situation between KWS and the local people.

The Hirola Management Committee has, in the recent past, provided money to four schools in the range of the hirola for the purchase of desks, books, writing supplies and other educational materials. These funds were well received and greatly appreciated. After some negotiation, similar "contributions" to schools and clinics could be made prior to each translocation of hirola after some negotiation. This kind of exchange seems fair and proper. Although more expensive and logistically difficult, it would be best if this kind of material support to schools and clinics were directly purchased and delivered by KWS. This would help the people of

Garissa District better make (and remember) the connection between this assistance, KWS, and conservation of the hirola.

# 17. EVALUATION AND RECOMMENDATIONS: COMPOSITION AND ORGANIZATION OF THE HIROLA MANAGEMENT COMMITTEE

## 17.1 Evaluation

The Hirola Task Force/Management Committee is a multi-sectoral body established with the objective of conserving the hirola antelope in Kenya. The Hirola Task Force/Management Committee was not commissioned by Government or any other institution, but was established out of a common interest by different organizations to save the “critically endangered” hirola.

In addition to KWS, many of the larger international conservation organizations with offices in Nairobi are represented on this committee, as are several of the more active and prominent Kenyan conservation NGOs, members of parliament from the natural range of the hirola, and private individuals. The Hirola Task Force/Management Committee, therefore, has wide representation among government, and among local and international conservation bodies. The membership has an impressive range of expertise to offer this committee. This composition and expertise have served the Hirola Task Force/Management Committee well over the past 6 years.

Much of the conservation work mentioned in this report would not have been undertaken were it not for the Hirola Task Force/Management Committee, the energy and vision of its membership, and its excellent working relationship with KWS. The Hirola Task Force/Management Committee promoted, secured funding for, and participated in the 1995 census of the natural population, the 1996 translocation from Garissa District to Tsavo East National Park, the 1996 *Hirola Recovery Plan,* the research program on hirola in Tsavo, and this evaluation. The Hirola Task Force/Management Committee has served hirola conservation well.

A review of the minutes of the Hirola Task Force/Management Committee since its inception in August 1994 through August 2000

Table 12: Summary of institutional representation at the 39 meetings of the Hirola Task Force/Hirola Management Committee held between August 1994 and August 2000.

| Organization | Number of Representatives | Person Meetings |
|---|---|---|
| KWS | 37 | 183 |
| EAWLS | 11 | 57 |

| | | |
|---|---|---|
| AWF | 7 | 46 |
| Unknown | 6 | 8 |
| NMK | 5 | 12 |
| WWF | 4 | 14 |
| DRSRS | 3 | 12 |
| Private | 3 | 38 |
| Member of Parliament | 3 | 6 |
| IUCN | 2 | 8 |
| Shieldrick Trust | 2 | 6 |
| FOC | 2 | 7 |
| JICA | 2 | 6 |
| Kenyatta University | 2 | 3 |
| Zoo Atlanta | 1 | 6 |
| Eden Trust | 1 | 19 |
| NWRS | 1 | 1 |
| HCHCG | 1 | 1 |
| ZSL | 1 | 1 |
| CDC | 1 | 1 |
| Total 20 | 95 | 435 |

Table 13: List of individuals who attended eight or more meetings of the Hirola Task Force/Hirola Management Committee between August 1994 and August 2000.

| Name | Institution | No. Meetings Attended |
|---|---|---|
| Lucile Ford | Private | 32 |
| Samuel Andanje | KWS | 28 |
| Mickey P. Soorae | AWF | 25 |
| Wilberforce Ottichilo | KWS | 19 |
| Richard Kock | KWS | 19 |
| Ted Goss | Eden Trust | 19 |
| Solomon Kyalo | EAWLS | 16 |
| John Wambua | KWS | 14 |
| Dan Woodley | KWS | 12 |
| Patrick Wargute | DRSRS | 9 |
| John Waithaka | KWS | 9 |
| Joseph Musyioka | KWS | 9 |
| Reardon Olubayo | EAWLS/ICIPE | 8 |
| Mark Stanley-Price | AWF | 8 |
| Rashid Aman | NMK | 8 |
| R.M. Chira | KWS | 8 |
| Agnew Mbwavi | KWS | 8 |
| Paula Kahumbu | KWS | 8 |

indicates that the Hirola Task Force/Management Committee met 39 times and that a total of 95 people attended these meetings, 37 of them from KWS. Twenty different institutions were represented during these meetings (Table 12).

As expected, the number of meetings attended by each of the 95 participants varied considerably (Table 13). Most of the participants were not members of the Hirola Task Force/Management Committee, but rather were called to provide specific information or to take particular action.

### 17.2 Recommendations

The Hirola Management Committee should consider the following:

**17.2.1 More Scientific Expertise Needed**. The Hirola Management Committee would benefit from more scientific expertise. Some of the scientific experts on the Hirola Management Committee seldom attend meetings (Table 13) and this affects the discussions and decisions of the Committee. In the past, the Hirola Task Force/Management Committee established subcommittees to focus on and accomplish particular activities (*e.g.*, Translocation Subcommittee, Public Relations Subcommittee). This allocation of work has been effective and might be used more often. Consideration might be given to the establishment of a "Scientific Subcommittee" that could investigate and discuss scientific matters in detail, particularly research matters, and then report to the Hirola Management Committee.

**17.2.2 More Work with Local Communities Needed**. Where the Hirola Management Committee may be weakest, and perhaps least active and enthusiastic, is in matters dealing with the politicians and communities within the natural range of the hirola, and with poaching and other security problems. Herein lies the greatest and most important challenge for the Hirola Management Committee. Continued overtures of goodwill and frequent dialogue with the politicians, elders, conservation leaders and others in the natural range of the hirola would, I believe, be particularly cost effective in terms of conservation benefits for the hirola. Supporting Somali and Orma research students and Hirola Scouts, and providing material support to schools and medical clinics should be particularly effective pursuits (Kyalo, 1998). In this regard, the Hirola Management Committee may wish to establish a "Community Conservation Subcommittee" on which a few of the Somali employees of KWS sit, particularly those who come from Garissa, Tana or Lamu Districts, and who have worked there for KWS.

**17.2.3 Put More Somalis and Orma on the Hirola Management Committee**. The Hirola Management Committee would benefit from the presence of a few more Somalis and/or Orma on the Committee. Although there are a few people on the Hirola Management Committee who have worked in the Garissa, Tana and/or Lamu Districts, the Hirola Management Committee could benefit considerably from the knowledge, insights, inputs and contacts of more people originating from this region. These people might come from the ranks of the KWS staff at Headquarters.

**17.2.4 Streamline Payment Procedure.** Reassess and streamline how funds flow into and out of the Hirola Management Committee. I have not investigated this aspect of the Hirola Management Committee's operations, but gather that funds are held both by the African Wildlife Foundation and the East African Wild Life Society, and at times, by other organizations. I have requested funds from the Hirola Management Committee on two occasions; once for the initial payment of this consultancy, and once for reimbursement of personal funds provided to the Hirola Management Committee so that

a trip could be made into Garissa District to pay the Hirola Scouts and to collect data from them. In both cases there was great delay in payment and seemingly unnecessary consultation among the membership over payment of funds that had sometime earlier already been agreed upon and approved.

# 18. EVALUATION AND RECOMMENDATIONS: ARAWALE NATIONAL RESERVE

## 18.1 Evaluation

The carrying capacity for hirola of the Arawale National Reserve has declined over the past three decades and numbers of hirola using this Reserve are currently low (Section 9.5).

Arawale has been poorly managed and poorly protected by the Garissa County Council and by KWS. The value of Arawale as a refuge for the hirola is now being questioned. Nonetheless, recommendations for the degazettement of Arawale must be considered both premature and counter-productive.

At 540 km2, Arawale is a fairly large area, and one of only two protected areas in Garissa District (the other being the Boni National Reserve). In addition to supporting at least 50 hirola (Andanje, 2000b), Arawale today still holds other species of conservation concern, including reticulated giraffe, desert warthog, cheetah and wild dog. At one time, Arawale also supported elephant and black rhinocero. Properly protected and managed, Arawale could once again be an important protected area, not only for hirola, but for a number of other threatened species.

## 18.2 Recommendations

- KWS should undertake an assessment of the amount of low, medium and high quality habitat for hirola remaining in Arawale and map the locations of these habitats.
- KWS and the Hirola Management Committee should confer with the Garissa District Council, the HCHCG, and other hirola conservation groups concerning the problems, needs and management of Arawale. Together, a realistic management plan should be written and implemented jointly by KWS and the Garissa District Council.
- Local hirola conservation groups have focused their concern on Arawale. KWS and the Hirola Management Committee should encourage the HCHCG and other local conservation groups to do what they can to gain local respect and support for Arawale,

reduce poaching, and curve the present high usage of the area by people and livestock.

- KWS needs to reestablish its ranger base at Massa Bubu and greatly reduce poaching in and around Arawale. See Section 19.3 for details.
- In Section 14.2.2.3, it is recommended that the Hirola Management Committee support at least two research students in Garissa District. Ideally, one of those students would work, at least part-time, in Arawale.
- The KWS Community Conservation Officer and Community Extension Officer should make Arawale a priority area for their out-reach activities. These officers should spend at least 25% of their time in and around Arawale.
- Bunderson (1981), 20 years ago, recommended that the south boundary of Arawale National Reserve be extended ca. 300 km2 to include more of the prime year-around hirola habitat to the south. This proposed extension is shown in Figure 8. Bunderson (1981) also proposed that an 800 km2 sanctuary for the hirola be established in what he considered to be the most important area for the conservation of this species. That sanctuary would be located just south of Galma Galla (Fig. 8). These proposed sanctuaries should not be forgotten, rather they should be further investigated, assessed, and discussed with the local authorities, Garissa District Council, and HCHCG. It should be noted, however, that it makes no sense to establish new sanctuaries in this region until KWS has a solid presence, and has the financial strength and backing of the local communities to effectively protect and manage them.
- Hassan Shikh Ali, Chairman of the former Arawale Youth Wildlife Community said (pers. comm.) that the people between Galma Galla, Bura, Alijugu and Ijara agreed to establish their own protected area for conservation of the hirola (also see Kyalo, 1998). The approximate location of the “Community Hirola Sanctuary” is shown in Figure 8. Using MapInfo, the size of the sanctuary is estimated to be 5,000 km2. Here are a few points concerning this sanctuary. First, the Sanctuary would cover more critical hirola range if it were located about 25 km farther south so as to include the Ijara area and also to become contiguous with the north-east boundary of the Arawale National Reserve. At present, the northern part of this Sanctuary lies outside of the current range of the hirola (compare with the distribution shown in Figure 7). Second, KWS and the Hirola Management Committee should investigate this Community Hirola Sanctuary to determine whether it is in some way contributing to the conservation of the hirola and other wildlife in the area. If so, there may be ways that the Hirola Management Committee and KWS can encourage, assist and guide the local communities to better manage and protect this area on behalf of the hirola.

# 19. EVALUATION AND RECOMMENDATIONS: POACHING

## 19.1 Evaluation

**19.1.1 Tsavo.** Poaching is not a problem for hirola within Tsavo East National Park. There is concern, however, for the one group of hirola (Mackinnon Group) located outside of the Park to the east along the Voi River on the Kulalu Ranch (Andanje, 1997a, 1998b, 2000a). This group occupies a region where poaching is heavy. There were nine hirola in this group in 1996 and apparently only four animals in 1997. When next relocated in 2000, there were 15 hirola in the Mackinnon Group. This group probably now holds 10-15% of the hirola in the "Tsavo population". Based on the costs of translocating hirola from Garissa District to Tsavo in 1996 (Section 11.9), the monetary value of these 15 hirola is over US$ 150,000. There was a period of more than 3 years (1997-2000) during which the whereabouts and size of the Mackinnon Group of hirola was not known. This must be considered bad management of a vital resource.

**19.1.2 Natural Range.** Poaching has been, and continues to be, a serious problem for hirola on the species' natural range. Although poaching was probably not responsible for the hirola's major decline during 1983-1985, it likely contributed to that decline and is probably the most important current factor preventing this population from increasing in numbers (Section 9.3).

There has been insecurity over the natural range of the hirola in Kenya since the early 1960s. As a result of this insecurity, and the financial and logistic constraints of operating in this region, the KWS ranger posts at Ijara and Massa Bubu were abandoned in 1991. With the departure of KWS from the range of the hirola, not only were bandits and local poachers able to operate with impunity, the Kenya Police, Kenya Army, Home Guards, and other government personnel with guns were able turn to poaching without concern.

## 19.2 Recommendations

**19.2.1 Tsavo.** KWS rangers must closely monitor and guard the Mackinnon group of hirola. This group is found off the east boundary of the Tsavo East National Park on the Kulalu Ranch. Extra KWS patrols should be conducted in this region in order to reduce the chance that hirola and other wildlife in this area will be poached. These are extremely valuable animals. An evaluation of the security of this group should be made with consideration of translocating it to the Ol Jogi (Pyramid) Wildlife Sanctuary if the security problems cannot be overcome.

**19.2.2 Natural Range - Ijara.** KWS, with support from the Hirola Management Committee, should reestablish its presence at Ijara. Plans for this action are already being made and some funding is now available from Terra Nouva. Ijara, and Galma Galla to the north, are today the two most important regions for the conservation of the hirola. A strong KWS presence at Ijara is, therefore, of highest priority for hirola conservation. The KWS force at Ijara must have the capacity to work effectively throughout the natural range of the hirola. Dedicated rangers with excellent leadership and support are required. In terms of anti-poaching, the focus should be the region to the east of Galma Galla and Kolbio near the Kenya/Somali border.

There is at present no KWS Community Conservation Officer in Garissa District. A good Community Conservation Officer is badly needed. This person should be based at Ijara and work throughout the range of the hirola, particularly in the Arawale, Masalani, Ijara, Galma Galla and Kolbio areas.

The Wildlife Protection Unit at Garissa currently claims that it lacks the transportation and financial support to work in the range of the hirola more than 5 days every 3-4 months. This is wholly inadequate and, perhaps, inexcusable. Consideration should be made to transferring this unit to Ijara. If this cannot be done, then support should be found so that this unit can spend at least 12 days per month patrolling the natural range of the hirola. Patrols should be on foot, with minimal use of, or reliance on, vehicle transport. Foot patrols are far more effective and reliable than are “vehicle patrols”, are far less expensive, and help reduce the “barriers” that arise between rangers and local people when they do not have the opportunity to mingle and communicate. KWS and the Hirola Management Committee should do what they can to (1) “encourage” foot patrols, (2) increase the amount of time wardens and rangers are active on-the-ground, and (3) eliminate the reliance on vehicles and roads.

The KWS force at Ijara should, from time to time, be bolstered for 1-2 weeks at a time by additional wardens and rangers from the Wildlife Protection Unit in Garissa Town, from the nearby Tana River Primate National Reserve, and from Massa Bubu.

KWS needs to “reclaim” its buildings at Ijara, now occupied by the District Officer, other administrative personnel, and the police. If this cannot be done, then new office and living quarters must be constructed. To operate most effectively, the Ijara post should have a good radio system (including at least five hand-held radios and two vehicle radios), a Land Rover/Toyota pick-up, and a 5 tonne truck. The 5 tonne truck will be needed to move rangers to distant sites for 4-8 day foot patrols, and to bring in food, petrol, fuelwood and water. Support funding for some of this security work might come through the Hirola Management Committee.

To encourage the long foot-patrols throughout the range of the hirola, the Hirola Management Committee should give priority to funding per diems during patrols. KWS and the Hirola Management

Committee should also consider implementing a bonus system where a fixed bonus is paid to wardens and rangers for every: poacher/bandit captured, poacher/bandit convicted in court, gun confiscated, trap collected, *etc*. This system has worked extremely well in other places (Butynski pers. observ., 1999).

Trained bloodhounds are now being used effectively on some Laikipia ranches to track poachers and bandits. These dogs could probably be used to good effect as well within the range of the hirola. Consideration should be given to their at least part-time use.

**19.2.3 Natural Range - Massa Bubu**. Once the KWS post at Ijara has been reestablished, the Hirola Management Committee should assist KWS with reestablishing its presence at Massa Bubu. The headquarters here for the Arawale National Reserve was abandoned by KWS in 1990. A well supervised, but small force of about 5-7 rangers here could conduct effective 4-8 day foot patrols throughout Arawale, and between Arawale and the Tana River. Food and some other supplies could be obtained from Hola and from the smaller villages in the area. During my time in Massa Bubu it was made clear that this community would welcome back KWS as this would improve security. It may well be that in exchange for this increased security, the local people are willing to do more to protect Arawale. The KWS force at Massa Bubu could, from time to time, be bolstered for 1-2 weeks at a time by additional wardens and rangers from the Wildlife Protection Unit in Garissa Town, from the nearby Tana River Primate National Reserve, and from Ijara.

KWS will need to “regain” its buildings at Massa Bubu, which are now being used to house a medical clinic and its personnel. The Massa Bubu unit will need a good radio system, including at least three hand-held radios. Vehicle support, when needed, can be provided out of Garissa or Ijara. Support funding for some of this security work might come from the Hirola Management Committee.

**19.2.4 More Involvement by the Director, KWS.** At the request of the Hirola Management Committee, the Director of KWS wrote a letter on 22 November 1999 to the Permanent Secretary, Provincial Administration, and Office of the President concerning the poaching of hirola by Administration Police and Home Guards, and requesting their assistance in stopping this poaching by government security personnel. The letter does mention the poaching of hirola by Kenya Army personnel or by the Member of Parliament’s escort team. In any case, the letter has not had the desired impact as poaching of hirola by Kenya Government security personnel continues (Andanje, l999b, 2000a). A much stronger, more detailed and more widely circulated letter concerning this problem should be written by the Director, KWS, and given thorough follow-up by high level KWS security personnel.

**19.2.5 Bring the Poaching Problem to Wider National and International Attention.** It will require a strong KWS presence and local support to stop the poaching of hirola by bandits and other none Kenya Government personnel. However, the poaching of hirola and other wildlife in Garissa District by Kenya Government personnel should be a relatively easy and inexpensive problem to resolve, mainly because it is both outrageous and an embarrassment to the Government of Kenya. If KWS cannot stop this problem by November 2000, then the problem should be exposed to national and international audiences and pressures brought to bear by people and institutions beyond KWS. This could begin with a few articles in Kenya's national newspapers. These articles, and excerpts from this and other reports, should then be sent to the larger international institutions concerned with the conservation of biodiversity (*e.g.*, IUCN, Species Survival Commission, World Bank, WWF-International, Conservation International, The Wildlife Conservation Society, and World Society for the Protection of Animals). These institutions should be asked to express their concern over this situation to the Permanent Secretary and Office of the President.

**19.2.6 Refugee Camps.** During interviews, it was claimed that people providing food to refugees in camps located within or near the range of the hirola poached large numbers of antelope, including hirola. KWS needs to investigate this allegation in cooperation with those Kenyan and international authorities (*e.g.*, UNHCR) who set-up and maintain these camps.

**19.2.7 Hirola Scouts**. Since 1997 there has been a team of about eight Hirola Scouts scattered over part of the natural range of the hirola in Garissa District. Their work appears to have been cost-effective as they monitor groups of hirola, collect information on group size and movement, and serve as a deterrent to poachers and as intermediaries between KWS and local communities (Kyalo, 1998). The system of Hirola Scouts should be retained and probably expanded. Their continued good work will depend, however, on the close supervision, monitoring and support of their activities by KWS and the Hirola Management Committee. With the completion of Sam Andanje's PhD research on hirola in this region, someone else will not need to take on the job of supporting and supervising the work of the Hirola Scouts. This job might best be the responsibility of the to be appointed Community Extension Officer. Until that person is in place, however, the Hirola Management Committee's Liaison Officer is probably in the best position to work closest with the Hirola Scouts. All future post-graduate researchers working on hirola in the region should also work closely with, assist, encourage and report on the Hirola Scouts. To avoid confusion and conflict, however, the use of Hirola Scouts by post-graduate researchers will need to be approved, guided and coordinated by either the Community Extension Officer or by the Liaison Officer.

# 20. OTHER RECOMMENDATIONS

## 20.1 ODA Land Rover

“One vehicle which had been donated to KWS by the British Government (ODA) specifically for hirola conservation and security was found in need of urgent and extensive repair despite a low mileage (50,000 km). This cost was agreed by the Task Force but in fact the vehicle never took part in the operation due to various delays”. (Kock *et.al*., 1998). Repairs cost KShs 252,650 (Soorae, 1998)...but vehicle never used.

The conservation of the hirola would obvious benefit from the quick availability of a vehicle on the natural range. Such a vehicle was donated by ODA specifically for the purpose of assisting in the conservation of the hirola. The vehicle was, however, never used for this purpose. The Hirola Management Committee should ask KWS to (1) investigate in detail the circumstances surrounding this vehicle and its use, (2) provide a detailed report on this matter, and (3) make a suitable, reliable, alternative vehicle available for full-time use for hirola conservation activities in Garissa District.

## 20.2 Conservation Education/Public Relations

An area in obvious need of expansion throughout the natural range of the hirola is conservation education/public relations. This initiative is probably best led by the Community Extension Officer with support from the Liaison Officer, staff of KWS in Garissa District, and the Hirola Scouts. I think there is tremendous opportunity here for material and financial input from the member institutions of the American Zoo and Aquarium Association (AZA). A number of AZA institutions have a high level of interest and expertise in conservation education/public relations and seem anxious to participate in and support *in situ* projects in Africa.

## 20.3 Hirola Conservation Trust Fund

There will probably always be a need for considerable financial support for hirola conservation activities. The most obvious approach for guaranteeing long-term financing for the conservation of the hirola is to establish a “Hirola Conservation Trust Fund”. A trust fund that generates US$ 100,000 per year would probably be adequate to cover the needed hirola conservation activities. To safely generate US$ 100,000, the principle of the fund needs to be ca. US$ 1,700,000.

Trust funds for financing conservation activities are becoming increasingly common and popular. Major international donors now appear interested in contributing to conservation trust funds. For

example, in Uganda, the “Mgahinga and Bwindi-Impenetrable Forests Conservation Trust” was established in 1994 and now has a principle of US$ 6,200,000 (Butynski & Kalina, 1998). That trust fund was set-up with assistance and financial support from the World Bank GEF, USAID, and other donors. In Kenya, a US$ 5,000,000 trust fund to support the maintenance of the wildlife fence around the Aberdares Conservation Area, the “Aberdares Wildlife Fence Trust Fund”, has recently been proposed (Butynski, 1999).

While money for the principle of trust funds can no doubt be found, this takes considerable work. The question is not, “Can the funds be found?”, rather the relevant question here is, “Who has the time and energy to go after and acquire the funds”. A few institutions that now have considerable expertise in the setting-up of conservation trusts are the World Bank and World Wildlife Fund. One or both of these institutions would probably be happy to assist KWS and the Hirola Management Committee in establishing the “Hirola Conservation Trust Fund”.

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# ADDENDUM

## SUPPLEMENTARY INFORMATION AND OPINIONS SHEET

The report, *Independent Evaluation of Hirola Antelope (Beatragus hunteri) Conseriaticn Status and Conservation Action in Kenya* by Dr. Thomas Butynski. was reviewed by the members of the Hirola Management Committee prior to its release. Some of the supplementary information and opinions arising from the review are presented here as an addendum to the report.

The Hirola Management Committee (HMC) recommends that this addendum be read together with the report in order to better understand the past and present circumstances and challenges facing the conservation of the hirola.

Recommendations made in the evaluation report should not be seen as conclusive. The readers of the evaluation report are encouraged to share with the HMC their opinions on what actions might be taken to assist in the recovery of the hirola.

### SUPPLEMENTARY INFORMATION

**Addendum #1. Net capture of hirola.** (Report page 117)

It should be understood that hirola never need to be run to the capture site. Instead they can be walked close to the net and the chopper pushes them into the net at the last minute.

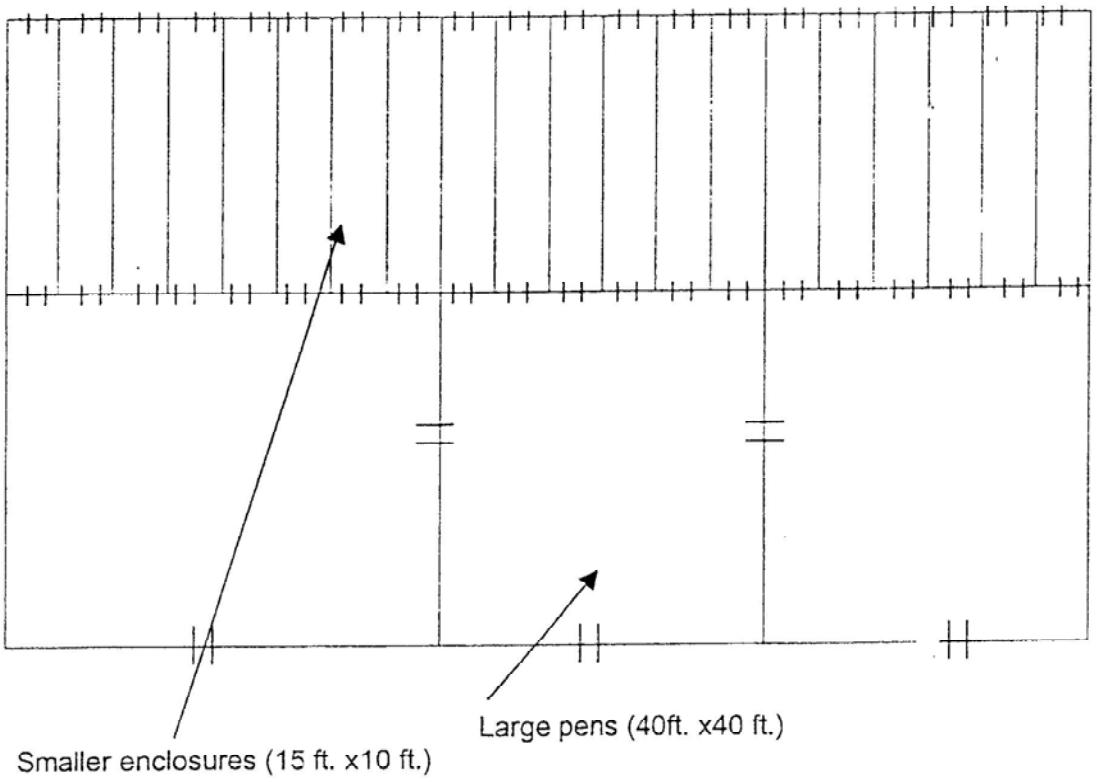
After the net is set up in a U-shaped formation and aerial support identifies a group of the animals near the capture site, a team of rangers is deployed to that group. The rangers on foot form a crescent shape behind the group of hirola and slowly walk the animals towards the opening of the U shaped nets. During the translocation, the hirola trotted a few yards then stopped, looked at the rangers then repeated this pattern for the 2-3 km to the opening of the capture nets (this took approximately 1 hour). At no time were the hirola panicked or run while getting them to the capture site (Dan Woodley). Only when they were directly at the opening of the U-shaped nets did the helicopter swoop in charging them through the opening and into the capture nets. The curtains closing the opening were then quickly drawn. If there are not enough rangers to walk the hirola to the capture site, the helicopter can be used in the same fashion just getting them to trot towards the site rather than running them. If the chopper gets too close in the early stages of the push the animals will panic and all chance of capture will be lost. From experience, pushing with the helicopter from about 50-100 m away initially and for not more than 3 minutes is the best. Once the animals are about 50-l00 m from the nets, a hard push resulting in panic and capture in the nets seems to work (Phil Matthews). It is never necessary, in fact it is detrimental, to run or panic hirola while moving them towards the capture site; only at the last minute should they be panicked into the opening of the nets.

The experience of the capture team suggests the optimal method is group capture, using a fixed U net with internal drop nets. Animals should be walked (definitely not run) from approximately 3 km into the entrance zone by foot, vehicle or helicopter and the final "chase" by helicopter approximately 100 meters from the entrance. The helicopter is needed to distract the animals from the artificial nets

and human presence and ensure entry into the system and drop nets (Richard Kock).

**Addendum #2. Holding pens designed for hirola relocation into Tsavo East National Park in 1963.** (Report page 52)
The pens were erected on the edge of the Ndara Plains. They comprised three large pens 40 ft. x 40 ft. and 20 smaller enclosures of 15 ft. x 10 ft. The support posts were blue gum poles and the walls built of split sisal poles 12 ft. high. Each pen had a shelter for shade, shallow concrete watering troughs that could be easily cleaned and filled by a hose, a heavy split log trough for supplement feeding purposes, and a mineral block. Hay and fresh grasses were provided for the antelopes every day. An 800-yard airstrip was cleared nearby.
NB. The surrounding of the pens should be designed to cause zero stress to the animals.

Holding pen structure design. (Not drawn to scale)




**Addendum #3.** An **analysis of the techniques used in the August 1996 hirola translocation with recommendations for the future.** (Report pages 2, 61-66, 117-118, 146-148)

This report aims to highlight the methods used during the 1996 translocation and relate these to the survival of individual hirolas. It also attempts to determine reasons for any problems that the translocated animals may have faced while establishing themselves in the new environment. These findings can be incorporated into future management plans in order to promote the survival of translocated hirola.

## METHODS

### Capture methods

Two weeks prior to capture, extensive aerial surveys were carried out around Bura, Masalani, Kotile and Ijara to locate areas where hirola occurred in good numbers. Eventually, Ijara was identified as suitable with a relatively good concentration of hirola and an airstrip.

*Netting*

It was believed that the success of the operation would be enhanced by the capture and release of intact social groups and this was the initial aim. After a target capture group was identified, a suitable netting site was selected, being far enough to avoid disturbing the group and close enough to avoid long bush drives to the airstrip. It took 2 days to set up the nets. Each net unit measured 10 m high and 30 m long. The nets were carefully secured and concealed in bushes and in some places were supported by poles. The nets were green in colour for camouflage. Up to 30 net units were set at a time in a U-shaped formation. Before animals were driven towards the nets, veterinary staff and handlers were put in concealed strategic sites close to the nets. No one was allowed to create scents that might alarm the hirola including smoking or urinating. Once everything was in place, information was relayed to the ground team who then started herding the animals towards the net slowly on foot. When the animals were close to the nets, information was relayed to the helicopter crew who then completed a final quick drive into the net. Once in the net, the ground crew moved in quickly and restrained the hirola. The animals were then hooded and hobbled while veterinarians, scientist and technicians injected haliperidol (~ 15mg intravenously) a long acting tranquilliser, took samples and measurements, and readied the animals for the journey. Depending on the location of the capture site, captured animals were moved by four wheel drive lorries, or helicopter to the airfield where they were loaded in a Cessna Caravan and flown to Tsavo. In the aircraft additional sedatives were administered as required by the attending vet and the hirola were restrained using straps in case they attempted to move.

*Darting*

This technique was adopted when it became necessary to speed up the capture operations. Since the animals were being captured in a pastoral area, the local politicians claimed that the aircraft were spraying noxious chemicals as they persecuted their wildlife. This led to a court injunction stopping the capture. Fortunately, the political motives of the injunction were uncovered, and the move denounced as baseless by the court. But the damage had already been done, and media coverage that the case inspired led to intense pressure in the field. Sadly the teams good relations with the local people deteriorated as politics entered the debate.

The situation was thus tense and free movement in the field was dangerous. It was thus decided that some animals should be darted from the helicopter to try to achieve the planned capture

number. The animals were sighted, chased to close range and then darted with either green or yellow power loads and Palmer darts.

*Holding pens*
After the animals were moved to Tsavo, they were placed in specially constructed holding pens made of high strong wood beams, sealed with sisal poles and linings covered with dome palm leaves for softness. Family groups were kept together in a pen with only the male separated to avoid severe fighting. After the animals were unloaded and taken to the pens, they were immediately given sedative reversal drugs (only if they had received a dose of sedative (etorphine) in the plane), antibiotics if they had wounds, and an acaricide (Pour-On) if they were severely infested with ticks. Animals that appeared to have higher than normal temperatures were cooled by applying water while those that appeared stiff due to the capture procedure and flight were massaged. Individuals were photographed and weighed at this point. A total of 10 animals were radio-collared and ear-tagged while 19 were just ear-tagged for identification and monitoring. Females were given red tags and males blue tags.

Field monitoring

Collared animals were radio tracked using aircraft and vehicle. The aircraft was used for faster determination of locations of hirola. Thereafter, a vehicle was used to get closer to the animals.

For non-collared animals, systematic transects using a Land Rover were run across field blocks. For each herd or individual hirola seen, records were made of sex, age, location using GPS co-ordinates, inter-specific association, relationship with resident hirola herds, activity, new calves born, members missing, any record of deaths etc.

RESULTS

*Translocated population*
A total of 35 hirola from 6 different groups were translocated to Tsavo during August 1996. The age and sex compositions of these animals are shown in Tablel 1.

Table 1: Groups, numbers and sexes of translocated hirola (August 1996).

| Groups | Totals | Total Males | Total Females | Males | | Females | |
|---|---|---|---|---|---|---|---|
| | | | | Adults | Yearlings | Adults | Yearlings |
| Aa | 11 | 4 | 7 | 1 | 3 | 5 | 2 |
| Bb | 3 | - | 3 | - | - | 3 | - |
| Cc | 3 | 2 | 1 | 1 | 1 | 1 | - |
| Dd | 6 | 3 | 3 | 2 | 1 | 3 | - |
| Ee | 9 | 3 | 6 | 2 | 1 | 4 | 2 |
| Ff | 3 | 1 | 2 | - | 1 | 2 | - |
| Totals | 35 | 13 | 22 | 6 | 7 | 18 | 4 |

*Mortality and injuries at capture*
General injuries sustained at capture involved fractures (1 from a dart) and muscular strain (3 cases of probable capture myopathy). Results show that there was no significant effects of capture techniques (Table 2) or age and sex of an individual (Table 3) on mortality.

Table *2*: Mortality after translocation in relation to capture technique (August 1996)

| Age Class | Capture Technique | Number of animals | | $\chi^2$ | P |
|---|---|---|---|---|---|
| | | Died | Survived | | |
| Total Capture | Netted | 2 | 21 | 3.370 | >0.05 |
| | Darted | 4 | 8 | | |
| Adults only | Netted | 2 | 12 | 2.057 | >0.05 |
| | Darted | 4 | 6 | | |
| Yearlings only | Netted | 0 | 9 | 4.950 | <0.05* |
| | Darted | 1 | 1 | | |

Table 3: Mortality after translocation in relation to age and sex of individuals (August 1996)

| Category | Classes | Number of animals | | $\chi^2$ | P |
|---|---|---|---|---|---|
| | | Died | Survived | | |
| Age | Adults | 5 | 19 | 0.732 | >0.05 |
| | Yearlings | 1 | 10 | | |
| Sex | Males | 3 | 10 | 0.513 | >0.05 |
| | Females | 3 | 19 | | |

*Mortality of released animals*
A total of 29 out of 35 captured hirola were released into the wild. These comprised 10 radio-collared and ear-tagged individuals (2 adult males, 7 adult females and 1 female yearling) and 19 ear-tagged (3 adult males, 6 male yearlings, 7 female adults and 3 female yearling). In total, the released population included 5 adult males, 6 sub-adult males, 14 adult females and 4 sub-adult females. Among these, were 21 animals that had been netted (2 adult male, 5 sub-adult males, 10 adult females and 4 sub-adult females), and 8 (3 adult males, 1 sub-adult male, 4 adult females) that had been darted. Three months after release, a total of 13 (44.8%) out of 29 released had died. Results indicate that collars had no significant effects on mortality (Table 4). However, the method of capture had a significant effect on overall survival as the majority of the animals that died had been darted (Table 5). Adults were the most affected. The sex and age of individuals did not contribute to the observed mortality (Table 6).

Table 4: Mortality in relation to collaring and ear tagging up to 3 months after release (December 1996).

| Class | Died | Survived | $\chi^2$ | P |
|---|---|---|---|---|
| Collared and ear-tagged | 5 | 5 | 0.165 | >0.05 |
| Ear-tagged | 8 | 11 | | |
| Total | 13 | 16 | | |
| | | | | |

Table 5: Mortality in relation to capture technique up to 3 months after release (December 1 99c).
(Note: data analysis excludes mortality on foeti and new-borns resulting from translocated pregnant females).

| Age Class | Capture Technique | Number of animals | | $\chi^2$ | P |
|---|---|---|---|---|---|
| | | Died | Survived | | |
| Total Capture | Netted | 6 | 15 | 8.134 | <0.05* |
| | Darted | 7 | 1 | | |
| Adults only | Netted | 4 | 8 | 4.866 | <0.05* |
| | Darted | 6 | 1 | | |
| Yearlings only | Netted | 2 | 7 | 2.593 | >0.05 |
| | Darted | 1 | 0 | | |

Table 6: Mortality in relation to sex and age group up to 3 months after release (December 1996).
(Note: data analysis excludes mortality on foeti and new-borns resulting from translocated pregnant females).

| Category | Classes | Number of animals | | $\chi^2$ | P |
|---|---|---|---|---|---|
| | | Died | Survived | | |
| Age | Adults | 10 | 9 | 1.357 | >0.05 |
| | Yearlings | 3 | 7 | | |
| Sex | Males | 6 | 4 | 1.420 | >0.05 |
| | Females | 12 | 7 | | |

*Dispersal of the released animals*

All released hirola dispersed individually into different directions. This was contrary to our expectation that they would leave together in existing social groups. Figure 1 shows the furthest distances that identified individuals moved before settling. Three females wandered most. These were individual number 386, an adult female that went outside the park to Taita Ranch, 396, an

adult female with a young male calf that moved to Galana River, and 382, a young female that moved to Kulalu Ranch (Figure 1). These movements all occurred within the first 2 weeks after release.

T-test results indicate that there were no significant differences in settling duration and distance in relation to sex age and capture technique (Table 7). However, darting seems to have had some impact as darted individuals took longer to settle than netted ones and also wandered furthest (Table 7, Figure 2). Despite the three long female movements mentioned above, graphical analyses of data indicate that males moved further than females and they joined bachelor or lone males earlier than females. In general adults took longer to settle than yearlings, although yearlings moved much longer distances before settling (Figure 2).

Figure 1: Map of Tsavo south of the Galana River showing 1996 hirola release boma (b) and the extent of dispersal of known hirola individuals (Numbers).

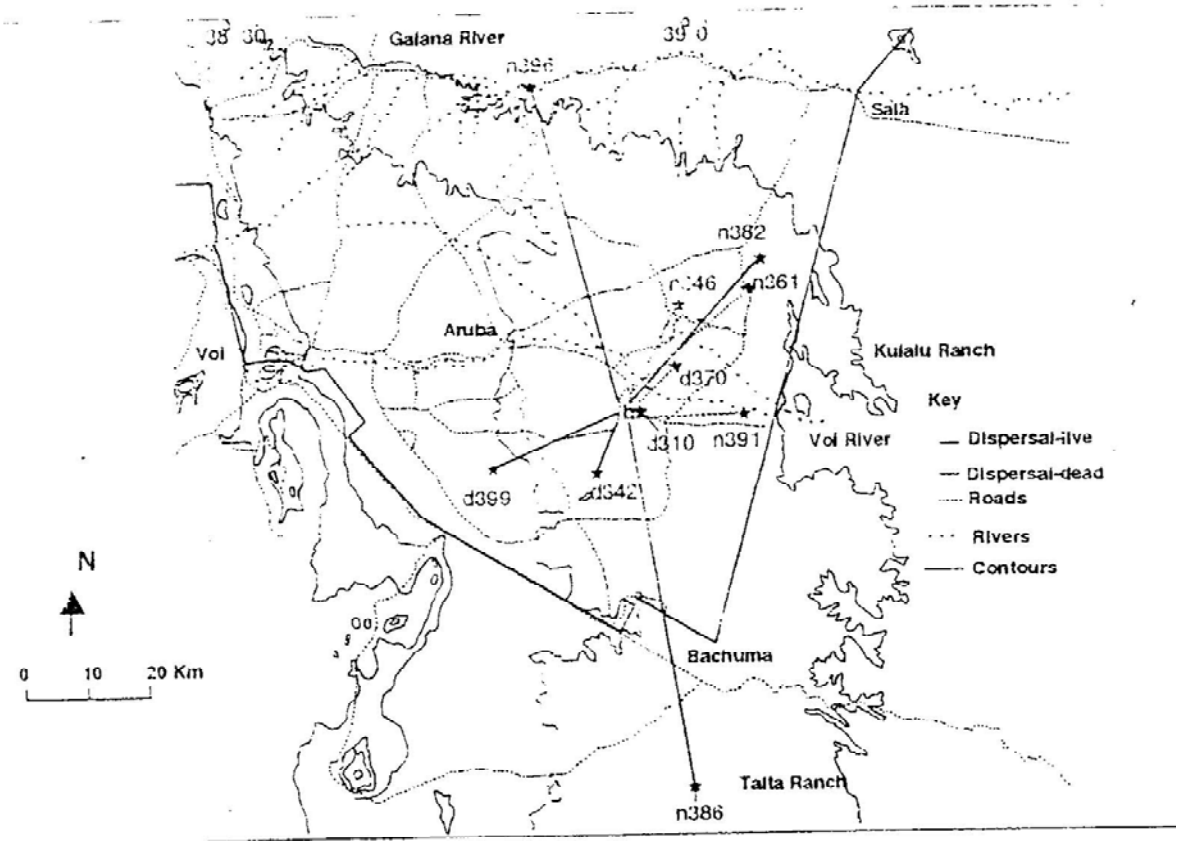
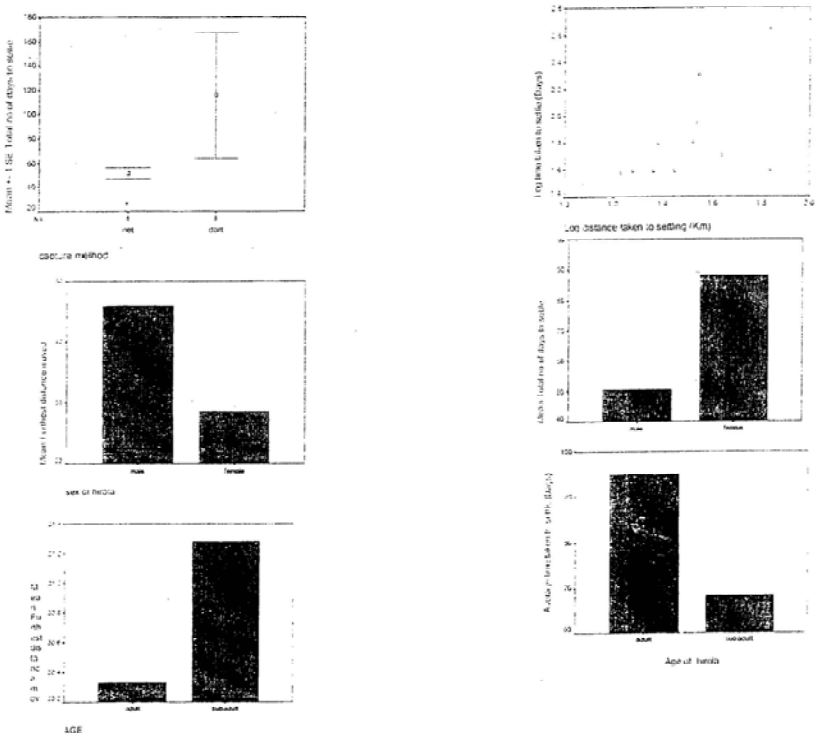


Table 7: Mean differences among age, sex and capture technique in relation to settling time and the furthest distance moved from boma. Data was log transformed for analysis.

| Category | Sub-category | Mean No. of Days to Settling | n | Mean distance moved before settling (Km) | n |
|---|---|---|---|---|---|
| Age | Adult | 95±134 | 9 | 30±18 | 9 |
| | Sub-adult | 68±59 | 7 | 31 ± 17 | 7 |
| Sex | Male | 51±16 | 2 | 46±31 | 2 |
| | Female | 88± 112 | 14 | 29 ±15 | 14 |
| Capture Method | Net | 86± 108 | 15 | 31±17 | 15 |
| | Dart | 39 | 1 | 28 | 1 |

Figure 2: Relationships of settling distance and time compared to age, sex and capture technique of hirola released in Tsavo during 1 996.



*Contributions of translocation*

A total of 11 animals (10 females and one male) were closely monitored after release (Table 8). These included 10 that were netted and 1 that was darted. Overall 15 calves were born to the females (3 by female yearlings and 12 by adult females) indicating that yearling female contribution was similar to that of adult females ($X2 = 0.006$, $DF=1$, $P > 0.05$). Among the netted animals, one yearling male matured and formed a group in 1998. The group had one male calf in 1999 and 3 calves (1 male and 2 females) in 2000. The group still appeared stable when last seen (December 2000).

Table 8: Closely monitored translocated female hirola showing their subsequent annual reproduction in Tsavo. 1** = predation of mother and calf, 1* = loss of calf, * = disappearance of an individual.

| Ind. ID | Description | Contribution (calving) | | | | |
|---|---|---|---|---|---|---|
| | | 1996 | 1997 | 1998 | 1999 | 2000 |
| Rbh | Female yearling netted | - | - | * | | |
| Let | Female yearling netted | - | - | 1 | - | 1 |
| 391 | Female adult netted | 1** | | | | |
| 399 | Female adult darted | - | 1 | 1 | 1 | * |
| 396 | Female adult netted | - | 1 | 1** | | |
| 386 | Female adult netted | - | - | 1 | 1 | 1 |
| 382 | Female yealing netted | - | - | - | - | - |
| 342 | Female adult netted | 1* | 1 | - | 1 | - |
| Fot | Female yearling netted | - | - | - | | 1 |
| Fyr | Female adult netted | 1* | | | | |
| | Total calves surviving in year of birth | 0 | 3 | 3 | 3 | 3 |

*Other Immobilisation*

In February and March 1999, after the previous radio-collars had become inactive, an attempt was made to recollar some individuals. By this time, the Tsavo hirola had become relatively tame as a result of continuous monitoring. The first approach was by netting, which led to the capture of two yearlings after two attempts on different groups. The second involved darting a habituated adult female from a vehicle. A new collar was fitted to this female while her social group watched from a distance. After release and recovery the female rejoined the group and she has since calved.

DISCUSSION AND CONCLUSIONS

These results suggest that netting favoured survival of captured yearlings although the number is small for firm conclusions.

Based on statistical analysis of deaths observed at capture, overall mortalities at capture were not caused by capture methods, age of individuals or their sex. The observed deaths may have been caused by a combination of factors among them the health of an individual, accidents, handling during capture, pregnancy stage of females and transport.

Data on the survival of hirola after release suggest that the capture method had a severe effect on adult survival. In contrast, age or sex, were not contributing factors. Adult animals may have suffered shock during capture using darting techniques from the helicopter. The chase by helicopter on this relatively delicate and slow timid animal may have caused serious muscular and internal strain. The effects of drugs on varying metabolic stages of an animal may have had an effect. The dart itself left skin and muscular injuries that may have resulted in some form of infection to the animals although usually this is not a problem. A few deep wounds sustained during boma fights could have had an effect on survival of some individuals. Capture myopathy can have an acute effect within minutes to hours and a more chronic effect that can be for several days or even months. It is presumed that the darted animals developed forms of capture myopathy and died at various times after translocation.

Post release monitoring showed that darted animals did not wander far from the release site compared to netted individuals. All except one survivor died within 25 Km range from release site (Figure 1). This may have been due to the traumatising effects of helicopter darting through myopathy capture, which causes severe stiffness and pain on movement. Their poor condition could have made the darted animals more vulnerable to predation after release.

On average, adult females wandered less from the release site, although there were three notable exceptions. While females settled a bit later than males, they were readily accepted and joined stable groups.. This probably conferred immediate benefit from group membership such as improved vigilance and group knowledge of the location of forage and water. Sub-adult females on the other hand stayed alone or joined groups of Grant's gazelle. Though this may be normal behaviour at this stage in life, under disturbed conditions and in a new environment, this might predispose them to a higher risk of predation than adult females. Adult pregnant females were ready to calf immediately (Table 3). They readily joined family groups where they could be mated quickly and continue reproducing.

## MANAGEMENT RECOMMENDATIONS

1. Capture by darting appears to have affected the survival of individuals. Future capture should be by netting. lf darting is used, it should be restricted to habituated individuals where darting can be effected using low charge darts from a vehicle. The darting of a habituated female hirola to replace its radio collar (reported above) was undoubtedly the most efficient and least traumatic capture that has been effected on this species. Unfortunately, the application of this technique is limited to circumstances where habituated animals are available.

2. Future captures, if carried using netting method or darting from close range should include all ages and sexes of hirola as these did not affect survival. Heavily pregnant females should not be translocated on welfare grounds and due to the likely loss of the foeti and new-borns. However, adult females may have particularly added advantages if released in an area where other hirola are occurring because of better social acclimatisation (joining groups). If captured as part of a group, pregnant females should be translocated as they have as good a chance of survival as any other age or sex. Their foeti and newborn, however, have little or no chance of surviving the translocation.

3. If adult females are captured, it should be done when they are in their early stages of pregnancy (i.e., just before long rains). At this stage young animals that were born late in the previous year will still be attached to their mothers and will not wander alone. Since females join resident groups readily, they will share vigilance advantage and knowledge of the new area with young before the young disperse.

4. Attempts should be made to release hirola immediately after they are moved. This would thus require the use of drugs whose effects disappear quickly. There appear to be no benefit from keeping hirola in pens for the purpose of retaining social groups during the 1996 translocation. The male with a fractured tarsus, that was confined to the boma to heal, died during the same period due to an infection of the lungs, when the wound had already healed.

5. If holding pens are used (for the purpose of recovery from drugs), the bomas should have the facility to isolate single animal so that they can see and smell one another, but not fight. The exit from each pen should be simple and direct so that hirola can exit immediately and freely. There should be no funnel at the exit since hirola seem to take any direction, irrespective of any funnel fence. Any fence should be designed only to protect working people from being attacked by exiting hirola (one person was injured in this way during the 1996 operation).

SYNERGIES: CAPTURE METHOD, ANIMALS SELECTED FOR TRANSLOCATION, AND PREGNANT FEMALES.

One of the stated objectives of the translocation was that we should learn the best methods of capture and for this reason the results as stated in the evaluation of the results of capture in 1963 and 1996 must not be misconstrued. The above report on “Analysis of the Techniques Used with Recommendations for Future” by Samuel Andanje (Hirola Researcher) and the experience of the translocation team are in harmony and contradict the recommendation of the Evaluator that “Future translocations from the natural population to new sites should only capture yearlings. This should be done by darting from a helicopter. There appears to be no good rationale for capturing adults or for capturing entire groups”.

Two reasons for this discrepancy are (1) that the information contained in the researcher’s analysis report was not available at the time of writing the evaluation report and (2) the evaluator took into consideration mortality of foeti and of new-borns of translocated hirola. In its meeting of March 2001, following peer review of the evaluation report, the Hirola Management Committee agreed to strike this particular recommendation of darting juveniles from a helicopter from the evaluation and refer to the Researcher’s analysis report; an addendum to the Evaluation Report.

In addition, future translocations should if at all possible adopt the best available method, which in the opinion of the HMC is mass net capture using ground teams to gently drive on foot animals to the capture site followed by helicopter drive techniques. Attempts should be made to identify sub-adult groups for capture and translocation and where possible avoid calving periods. If this is not possible, and as long as strict protocols are adhered to, the movement of adult and even pregnant animals can be opted as long as helicopter darting techniques are avoided.

Further capture and translocation of the hirola is a strong recommendation of the evaluation report. Therefore, information relating to the best available method and age/sex etc of the animal as presented in the above analysis needs to be more thoroughly scrutinised. The same should be used as the basis for selecting the best conservation management strategy for the hirola. The experience of the 1996 capture team was that net capture was the most humane, effective and safe method of restraint of the hirola. As a result of experience prior to the translocation and during the operation, it was concluded that darting hirola was a high-risk strategy and most likely would lead to mortality as suggested in the analysis above. The report's recommendation for darting as the preferred method has been dropped on the basis of the results of this analysis, and on the bases of the experience and opinion of the capture team. Use of ground teams to drive hirola into nets and with capture of whole herds that hold hirola of all ages and both sexes appears to be the most practical way to go at this time.

It should be noted that the hirola antelope has a predisposition to problems with the darting method. This is probably due to its unusual running pattern that makes the helicopter darting difficult to execute. In addition, it is a relatively delicate animal compared to other Bovids and as a consequence susceptible to damage from darting and capture stress. The capture of hirola is a poorly understood science. With inadequate and conclusive data on the survival, costs, etc of the different possible capture methods, a close look at what this independent evaluation and much weight to what highly experienced personnel say on this subject need to be taken into consideration.

The data sets presented in the report and results of this analysis should not be taken as the end of the affair. Instead there is need to learn lessons. It is important to recognise that in an ideal situation, pregnant females should be avoided at capture because their foeti and new-borns have little chance of surviving the translocation. In practice, however, this is usually not practical. There is as good a chance of survival of pregnant females as of any other age or sex, and having experienced females in the released population may have benefits. So release of adult females at the capture site is not recommended. There were at least 10 pregnant females translocated in 1996 and not a single one raised a calf that year. The Hirola Management Committee feels that mortalities arising from translocation of pregnant females should be considered in the light of the overall success of translocation of a group of hirola and not in terms of the loss to the population as a whole.

From the data analysis presented, it appears that there is no influence of age and sex on mortality in the translocated population. However, it should be recognised that the data are limited and that no analyses have been undertaken on the rates of mortality among translocated yearlings, sub-adults and pregnant females or their foeti or new-born young. It should also be noted that mortality is only one of the variables that needs to be considered when choosing among possible

capture/translocation methods. Costs, public perceptions, risks to workers, and other factors must also be considered. The experience gained with many hundreds of animals will serve us well in improving the methods for capturing and translocating hirola.

**Addendum # 4. Rinderpest Virus (RPV) (Pages** 44, 91, 97)

A great deal of emphasis has been placed on this disease in the evaluation report. The following is worth noting. The rinderpest outbreak so called in 1983-5 was never officially confirmed in Garissa District. Therefore, the data presented in the report are based on verbal history. However, there is no doubt that there was rinderpest but whether an epidemic or part of an ongoing endemic situation cannot be determined from available data. Disease surveillance has been carried out since 1994 and it has been established through antibody prevalence that the disease was present in Garissa, Tana and Lamu districts in 1995-6. It has also been confirmed that rinderpest has been circulating sporadically up until 1999. It is now impossible to confirm if RPV was present and caused an epidemic disease in 1983-5. The presence of antibody in hirola has been confirmed as stated in the report in 1/11 tested by virus neutralisation, which is gold standard test. Forty samples were tested by c ELISA, a test developed for sero monitoring vaccine antibody in cattle and with poor sensitivity in wildlife sera so, further tests are pending.