ECOLOGY OF A POPULATION OF ORIBI *OUREBIA OUREBI OUREBI* (ZIMMERMAN, 1783) IN THE GOLDEN GATE HIGHLANDS NATIONAL PARK.

BY

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ABSTRACT

In the Golden Gate Highlands National Park oribi are found in the grasslands and old lands of the eastern portion of the Park. These areas are characterized by grass species such as *Eragrostis curvula*, *Heteropogon contortus*, *Themeda triandra*, *Monocymbium ceresiiforme* and *Elionurus muticus*

These oribi spend between 35 and 44 percent of their daylight hours feeding and between 50 and 59 percent resting (inactive), depending on the season. In the Golden Gate Highlands National Park oribi have an aversion for steep slopes and strong winds.

Oribi shares its habitat with other large ungulates and show a negative interaction with the zebra *Equus burchelli* and a positive association with the springbok *Antidorcas marsupialis*.

Oribi are grazers and have a preference for *Sporobolus centrifugus*. Oribi occurred in pairs or small family groups with a mean ratio of 0,47 females per male. The mean territory size of oribi in the study area was 23,1 ha.

UITTREKSEL

Die oorbietjies in die Golden Gate Hoogland Nasionale Park word op die grasvlaktes en ou lande van die oostelike gedeeltes van die Park gevind. Dié areas word gekenmerk deur grasspesies soos *Eragrostis curvula*, *Heteropogon contortus*, *Themeda triandra*, *Monocymbium ceresiiforme* en *Elionurus muticus*.

Die oorbietjie is tussen 35 en 44 persent van die dagligure aan die wei en hulle rus vir tussen 50 en 59 persent van die dagligure.

In die Golden Gate Hoogland Nasionale Park het oorbietjies 'n afkeur vir steil glooiings en sterk winde.

Die oorbietjies deel hulle habitat met ander hoefdiere en toon 'n negatiewe interaksie met bontkwaggas Equus burchelli en 'n positiewe assosiasie met springbokke Antidorcas marsupialis.

Oorbietjies is grasvreters en toon 'n voorkeur vir Sporobolus centrifugus in die Golden Gate Hoogland Nasionale Park. Die oorbietjies kom in die meeste gevalle as pare of as klein familie groepe voor teen 'n gemiddelde verhouding van 0,47 ooie per ram. Die oorbietjie se gemiddelde territoriumgrootte was 23,1 ha in die studiegebied.

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CONTENTS

Page

L I S T O F T A B L E S

Page

LIST OF FIGURES

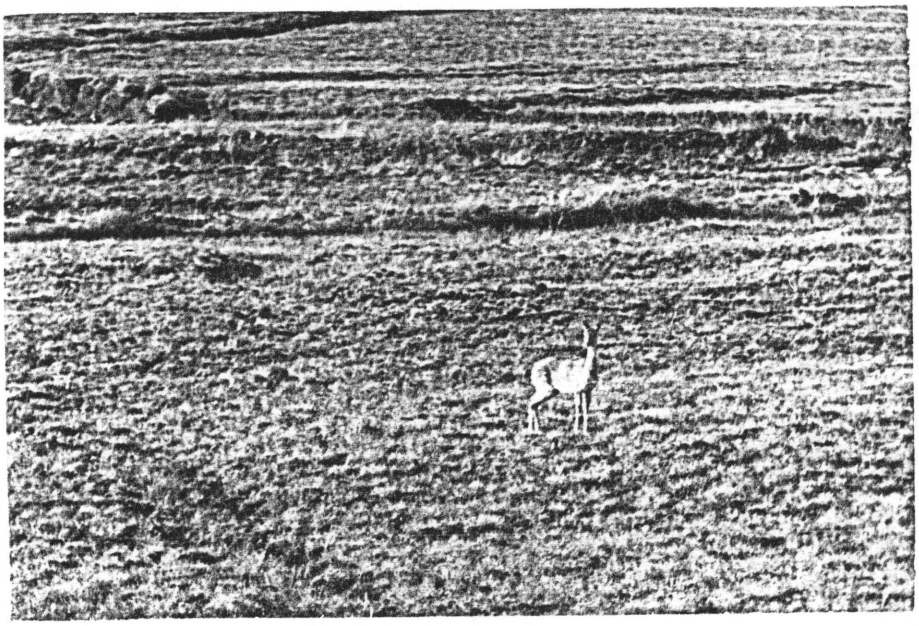

Figure 1: An oribi Ourebia ourebi in the Golden Gate Highlands National Park, Orange Free State

CHAPTER 1

INTRODUCTION

This study of oribi in the Golden Gate Highlands National Park (also referred to as Golden Gate or the Park) parallels the study of the behavioural ecology of oribi in the south eastern Transvaal by Viljoen (1982) in certain aspects. Design and general layout are similar and reference is often made to the same authors during discussions.

Oribi are physically the largest members of the tribe Neotragini, the rest of the tribe comprising up of the klipspringer *Oreotragus oreotragus*, the steenbok *Rhaphicerus campestris* and the dikdik *Madoqua kirkii*.

The status of oribi in the Republic of South Africa is described as endangered (Anon 1952, Knobel 1958, Bigalke and Bateman 1962, Vincent 1962, Ansell 1971, Von Richter, Lynch and Wessels 1972 and Von Richter 1974) or vulnerable according to some authors Skinner, Fairall and Bothma 1977 and Smithers 1986 In: South African Red Data Book : Terrestrial Mammals). Oribi have shown a decline in numbers in the Cape Province (Millar 1970 and Bezuidenhout and Long 1984), in Natal (Howard and Marshant 1984) and particularly in the Orange Free State (Von Richter, Lynch and Wessels 1972 and Lynch 1983).

In the Transvaal, Rautenbach (1982) maintains that oribi numbers have decreased dramatically and the animals have been locally exterminated in many areas.

Although relatively scarce, articles pertaining to certain aspects of the ecology of oribi have appeared from various authors (Hediger 1951, Edwards 1968, 1969a, 1969b and Tait 1969). More recently aspects such as limiting factors, population ecology, habitat preferences and carrying capacity in the Natal Drakensberg are covered in some detail by Mentis (1978), Oliver, Short and Hanks (1978), Rowe-Rowe (1982b), Rowe-Rowe (1983) and Rowe-Rowe and Scotcher (1986). Viljoen (1982) produced a comprehensive study on the behavioural ecology of oribi in the south eastern Transvaal.

During 1971, an unspecified number oribi were captured in the Greytown District, Natal and were released in the Golden Gate Highlands National Park (Penzhorn 1971 and Van Wyk pers.comm.*). In 1982 the Director of Research and Development of the National Parks Board of Trustees decided to instigate a research project into the status of the oribi in the Golden Gate Highlands National Park because the oribi were believed not to have shown any substantial increase in numbers since re-establishment in 1971. It was further speculated that the other large ungulates were having a detrimental effect on the status of the oribi. The current study was therefore entered into to provide data pertaining to the oribi in general, their status and their future at Golden Gate.

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* Mr. P. van Wyk, Director of Research and Developement, National Parks Board of Trustees, P.O. Box 787, Pretoria, 0001

This study went into detail with regard to the habitat requirements of the oribi to determine if the Park was suitable for oribi and the effect of this on the population. The aims of this study were to determine if the status of the oribi in the Golden Gate Highlands National Park was being limited by the available suitable habitat or detrimentally affected by other large ungulates in the Park. Information was gathered on the characteristics of their chosen habitat in the Park and the availability of these habitats in the Golden Gate Highlands National Park (Fig. 1). Secondary to the habitat utilization data, data pertaining to inter and intra-specific associations, social activities and feeding preferences were evaluated. The field observations for the study started in March 1982 and were terminated in November 1983.

CHAPTER 2

TAXONOMY, MORPHOLOGY AND DISTRIBUTION OF ORIBI

Taxonomy and Morphology

The type, Antilope ourebi was first described by Zimmerman in 1783 from a specimen from the Uitenhage District of the Cape Province (Roberts 1954). The earliest possible sighting of an oribi was by Thunberg (1795, In: Millar 1970) who saw an oribi near Humansdorp in 1773.

Due to the status of oribi in Southern Africa from rare to endangered depending on the author (Chapter 1) and the confusion of oribi with steenbok by particularly the public (Lynch 1983) it is necessary to review both their taxonomy, morphology and current distribution in southern africa. This chapter updates status and distribution of oribi as described by Viljoen (1982).

According to Ansell (1971) and Smithers (1983) the current classification of the oribi is:

Order : Artiodactyla
Family : Bovidae
Sub-family : Antilopinae
Tribe : Neotragini
Genus : Ourebia Laurillard, 1841
Species : Ourebia ourebi (Zimmerman, 1783).

Only the one species Ourebia ourebi (Fig. 2) is recognized with 13 subspecies limited to the African continent (Ansell 1971). The distributional boundaries and references to different subspecies are not always clear.

Three subspecies are listed by Meester, Rautenbach, Dippenaar and Baker (1986) as occurring in Southern and Central Africa: Ourebia ourebi ourebi (Zimmerman 1783) from the eastern Cape Province, southern and north-western Natal, south-eastern Orange Free State, southern and eastern Transvaal and central and southern Mozambique; Ourebia ourebi hastata Peters, 1852 from eastern and south-eastern Zimbabwe, northern Mozambique, Malawi, eastern Zambia and south-eastern Tanzania and Ourebia ourebi rutila Blaine, 1922 from north-eastern Botswana, north-western Zimbabwe, north-eastern SWA/Namibia, western Zambia, Angola and possibly south-eastern Zaire.

Ourebia ourebi is the largest of the Neotragini and has a mean mass of 14 kg and a mean shoulder height of 580 mm (Viljoen 1982) (n and SD unspecified). The full-grown ewes are larger than the rams (Smithers 1983). Horns are present only in the rams, with a mean horn length of 113 mm (Viljoen op. cit.) but reaches a record length of 184 mm according to Best (1962).

The colour of the coat varies from russet to fawn on the upper parts contrasting with the pure white underparts. The short, black tail contrasts with the white inside of the hind legs. The coat appears longer along the back with a distinct wavy appearance.

Figure 2: Distribution (shaded areas) of oribi Ourebia ourebi in the world (Smithers 1983) to show the coincidence with the savannas and grasslands of Africa.

Pre-orbital glands are found in both sexes, but are larger in the males (Viljoen _op. cit._). A hairless patch of skin is visible below the ears and small hair tufts are visible on the knees.

Distribution

The oribi is primarily a grassland dweller present in temperate, montane and tropical Africa (Tinley 1969 and Pienaar 1974) (Fig. 2). Although not found in the southern Savanna Region bordering the south-west Arid Zone, the oribi is found in the northern Savanna Region from Uganda and westwards to Senegal (Ansell 1971). Ansell (_op. cit._) further maintains that oribi are also found in the Sudanese Arid Zone from Kenya to central and western Ethiopia (Fig. 2). Oribi may be found from as low as sea level in the Cape Province (Ansell _op. cit._) to an altitude of 2 500 m above sea level in Kenya (Stewart & Stewart 1963) (Fig. 2).

EARLY DISTRIBUTION AND STATUS

The original habitat of oribi has undergone changes through human occupation and associated agricultural practices and this has reduced the habitat available to oribi (Von Richter 1971). Von Richter (1971) further notes a decline in oribi numbers due to hunting pressure. According to Du Plessis (1969) the traditional areas of oribi occurrence themselves have shown less deterioration than the decline in oribi numbers indicates.

In contrast to a previous wide distribution over the grasslands of the Cape Province, Natal, Orange Free State, Transvaal, Mozambique and Zimbabwe (Du Plessis 1969 ; Millar 1970 and Ansell 1971) oribi have now dissappeared from many areas, making their current distribution more localized (Anon 1952, Ansell 1971, Rautenbach 1982 and Lynch 1983) (Fig. 2).

Little information exists as to the status changes of the oribi. However, Stewart and Stewart (1963) maintain that the oribi has dissappeared from large areas of Kenya. A decline in oribi population is also reported from Nigeria (Petrides 1965, In: Ansell 1971).

CURRENT DISTRIBUTION IN SOUTHERN AFRICA

Cape Province and Ciskei

A detailed survey revealed only 370 surviving oribi on farmland in the south-eastern Cape Province (Millar 1970).

Von Richter (1974) states that the highest concentrations of oribi in the Cape Province are found in the Bathurst and Humansdorp districts. Edwards (1969a) reports populations of oribi on farms in the Bathurst district. Oribi also still occur in the Umzumkulu area with the largest concentrations in the Umzumkulu division of the Cape Department of Environmental and Nature Conservation (Von Richter 1974) (Fig. 3).

Transkei

Reliable information regarding oribi in the Transkei is scarce.

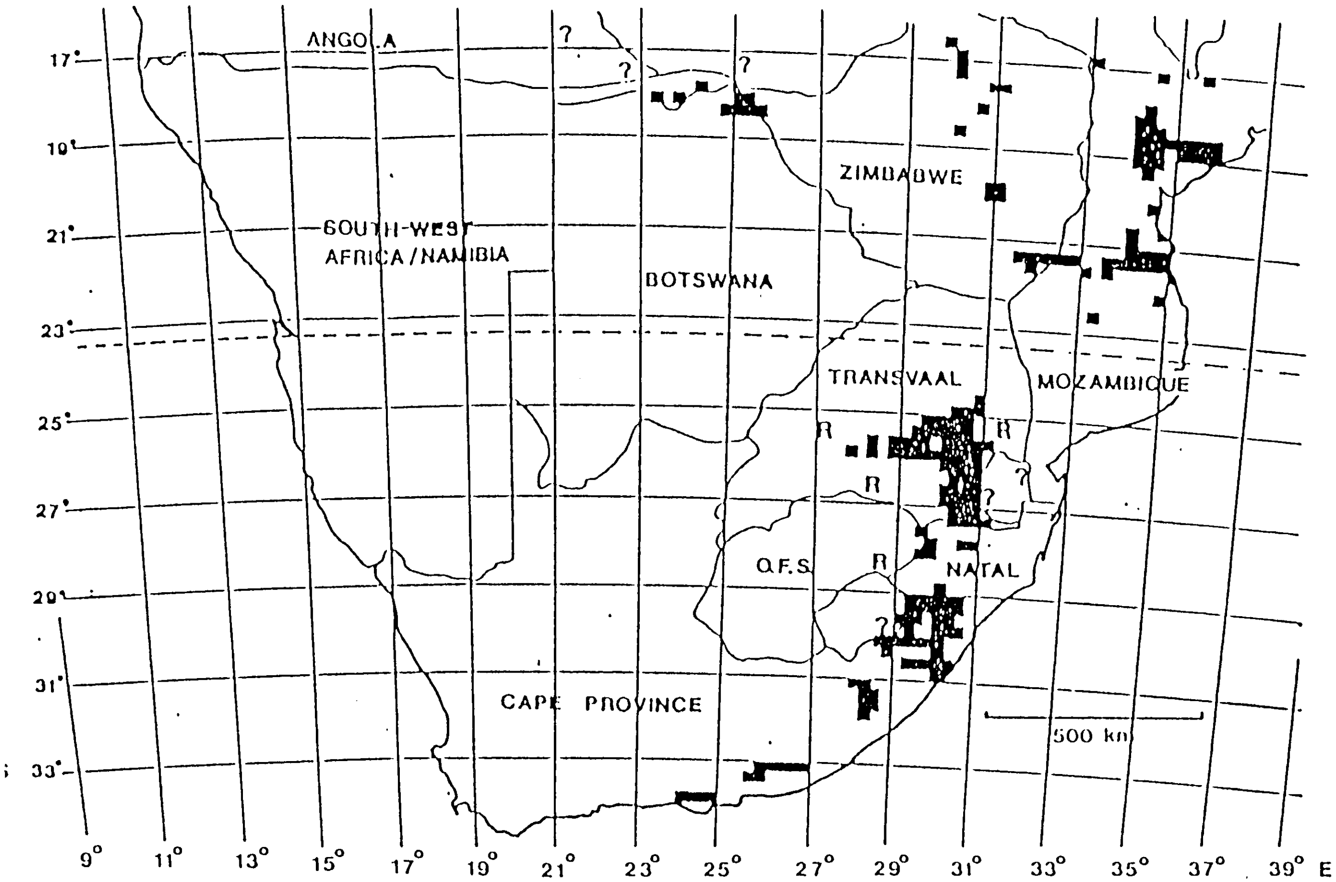

Figure 3: Distribution of oribi in Southern Africa (Viljoen 1982)

However, Millar (1970) maintains that oribi are limited to localized populations in the south-western areas.

Natal

Oribi in Natal are restricted in their distribution to the foothills of the Drakensberg and the midlands of that province (Von Richter op. cit.). According to Mentis (1974) oribi in Natal occur mainly on the plains and intermediate areas between the plains and the foothills of the Drakensberg Mountain Range. A sizeable population has existed in the Giants Castle Game Reserve since its proclamation in 1906 (Bourquin 1966 and Rowe-Rowe 1983). Oliver, Short and Hanks (1978) recorded a well-established population in Highmoor State Forest land.

A survey conducted by Howard and Marchant (1984) indicates that oribi have disappeared from a quarter of the farms where they were previously seen.

Lesotho

Although oribi were probably widespread in the past in Lesotho (Sclater 1900), data on current distribution and status are lacking. Isolated oribi are reported from the Sehlabathebe National Park (Anon 1977).

Orange Free State

Oribi were previously widespread in the eastern parts of the Orange Free State (Edwards 1968). A census conducted by Von Richter, Lynch and Wessels (1972) indicated that oribi were still released into the Suikerbosrand and Rustenburg Nature Reserves (Viljoen 1982) (Fig. 3).

Swaziland

A viable population of oribi occur in the Malalotja National Park on the Swaziland Highveld (Ballance, Culverwell and Reilly *pers. comm.**). A population of approximately 10 animals is found in the Ndzindza Nature Reserve south of the Umbuluzi Gorge in the Lubambo Mountains (Culverwell and Reilly *pers. comm.*). A population of oribi occurs in the Mlawula Nature Reserve also in the Lubambo Mountains (Culverwell *pers. comm.*). Bothma (1975) considers the oribi as endangered in Swaziland.

Mozambique

Oribi are found in the northern districts of Vila Pery and Beira as well as the south-western areas of the Tete and Zambezia Districts (Smithers and Labâo Tello 1976). Oribi are also abundant on the savannas and grasslands of the Gorongosa and Bawhine National Parks (Tinley 1977 ; Smithers *pers. comm.*°).

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Mr. J. Culverwell, Mbuluzi Nature Reserve, Tambankulu Estates, P/Bag Mhlume Swaziland

Mr. T.C. Ballance, P.O. Box 1797, Mbabane Swaziland

° The late Dr. R.H.N. Smithers, Transvaal Museum, P.O. Box 413, Pretoria, 0001 (1984) and (1987).

Zimbabwe

In Zimbabwe oribi are found in the Gazumapan National Park in the north-west, and from northern Mashonaland in a narrow strip south-east to the Mozambique border (Smithers and Wilson 1979 ; Smithers 1983). The highest concentrations, however, are found in the northern and north-eastern agricultural areas (Thomson 1973).

South West Africa / Namibia

Shortridge (1934) and Smithers (1971) maintain that oribi occur in the eastern Caprivi Strip. Von Wilhelm (1933) also mentioned a previous occurrence of oribi in the Ovamboland area of South West Africa. However, Joubert and Mostert (1975) could find no evidence of oribi in that territory.

Zambia

Oribi were formerly widespread in western Zambia and have also been reported from scattered localities in the east of that country (Ansell 1960). Ansell (1960) further states that oribi are absent from the central section of the Zambezi Valley. No more recent data are available.

Angola

According to Shortridge (1934) oribi were plentiful in Angola particularly in the south-eastern areas along the Okavango River. Smithers (1983) reported oribi as occurring in the central, southern and south-eastern areas of Angola.

CHAPTER 3

THE GOLDEN GATE HIGHLANDS NATIONAL PARK

Introduction

The Golden Gate Highlands National Park was proclaimed in 1963. Oribi originally populated the area incorporated into the Park (Edwards 1968, Von Richter et al. 1972). Oribi have, however, dissappeared from almost all of the Orange Free State (Von Richter et al. 1972) and the re-introduction of oribi into the Golden Gate Highlands National Park in 1971 and 1974 (Penzhorn 1971 and Strybis 1974) has established a population that may ensure their survival in that province.

At the onset of the study in the Golden Gate Highlands National Park, 10 years had elapsed since the re-introduction of oribi into the Park. The cryptic nature of the oribi has also contributed to a lack of detailed data regarding population statistics and habitat utilization. The lack of sightings of oribi led to the surmise that other populations of large ungulates were having a detrimental effect on the oribi (Van Wyk pers. comm.*).

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Location and Size

The Golden Gate Highlands National Park is situated in the Rooiberge of the eastern Orange Free State, 25 km east of Clarens and 70 km south-east of Bethlehem. At the time of this study the Golden Gate Highlands National Park covered the area between 28° 34' E and 28° 39' E longitude and 28° 29' S and 28° 34' S latitude (Fig. 4). The Park is bordered by privately owned farms, the southern boundary being only 3 km away from the Lesotho border. The Park was 6 229 ha in size at the time of this study, however, approximately 6 000 ha has been added, adjacent to the eastern boundary, and is due to be proclaimed part of the National Park before the end of 1988.

Topography

The Golden Gate Highlands National Park borders on the highlands of Lesotho and is connected to those highlands by a spur forming the divide between the Caledon and Little Caledon Rivers.This spur forms the southern boundary of the Golden Gate Highlands National Park. The northern boundary of the Park is formed by the Roodeberg Range, the watershed between the Caledon and Orange River System and the Vaal River System. The Park is bisected from west to east by a valley exhibiting the sandstone formations for which the area is famous. The valley rises from 1 700 m above sea level in the west to 1 900 m above sea level in the east (2828 DA Golden Gate 1:50 000 Topocadastral map).

The northern section of the Park has a ridge reaching to 2 500 m above sea level at its highest peak. The southern area of the

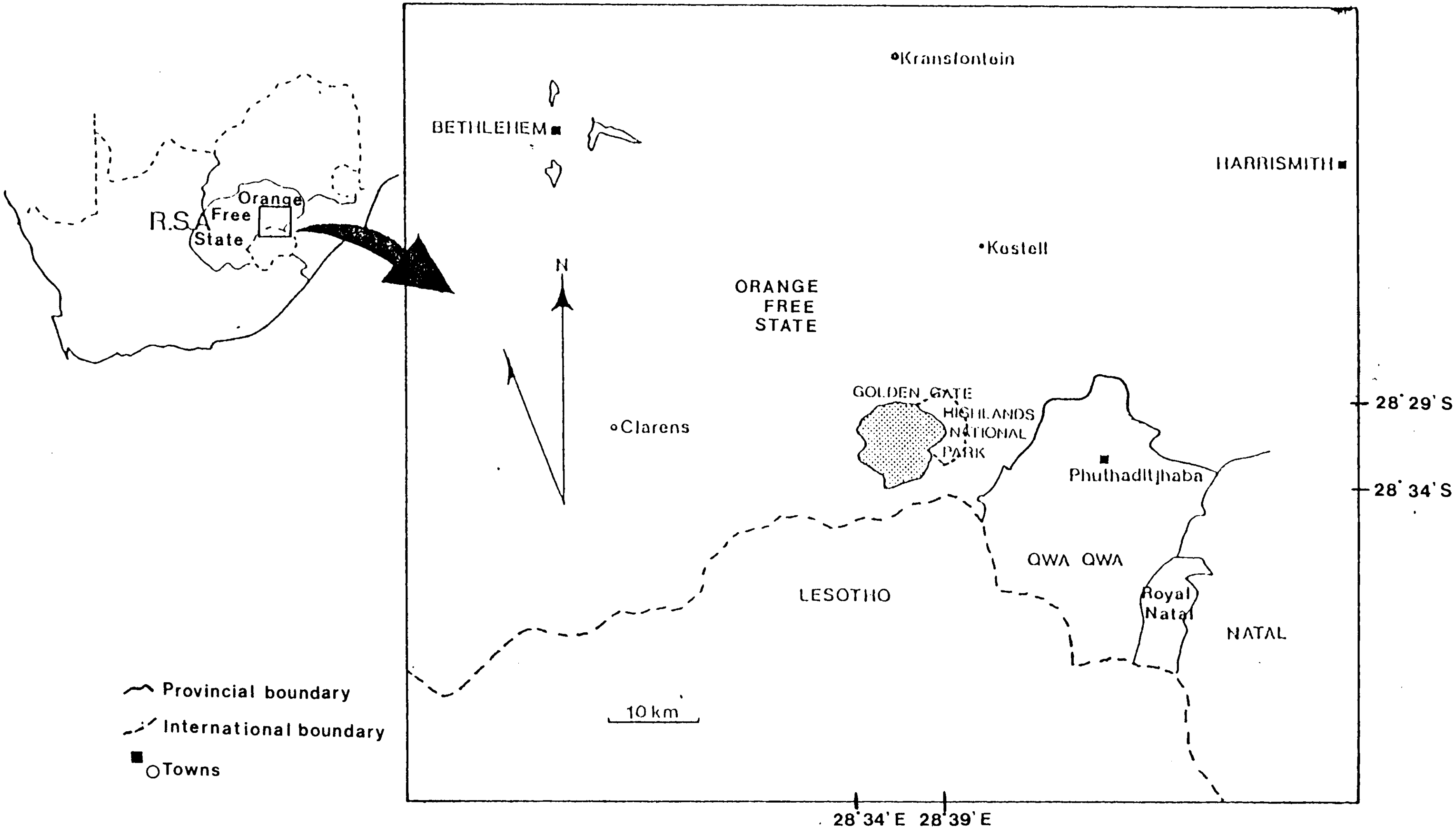

Figure 4: The location of the Golden Gate Highlands National Park in the Orange Free State in the Republic of South Africa.

Park has three rocky spurs running north-westerly, with their highest peak being Ribbokkop at 2 840 m above sea level. Ribbokkop is also the highest peak in the Orange Free State.

Geology

The geology of the Golden Gate Highlands National Park is famous and the very name derives from its spectacular geological formations. No up-to-date summary of the geology of the Park could be found due to the re-structuring of the classification system by the South African Committee for Stratigraphy (1980). Potgieter (1982) refers to the geology of the Golden Gate Highlands in some datail.

According to the South African Committee for Stratigraphy (1980) the Golden Gate Highlands National Park's geology falls into the Karoo Sequence. The Karoo Sequence can be subdivided further into the Ecca Group, the Beaufort Group and the Drakensberg Basalt Group with the Park falling into the Beaufort Group and the Drakensberg Basalt Group (Fig. 5). The Beaufort Group is further divided into the Adelaide Subgroup and the Tarkastad Subgroup. The underlying formations in the Park belong to the Tarkastad Subgroup. The Tarkastad Subgroup is divided into the Molteno Formation, the Elliot Formation and the Clarens Formation. The Molteno Formation has no exposures in the Park but it is the Formation directly underlying the Elliot and Clarens Formations. In the Golden Gate Highlands National Park the Drakensberg Basalt Group is represented by the Drakensberg Basalt Formation.

The various Formations involved have the following characteristics:

MOLTENO FORMATION

This Formation consists of whitish to cream-coloured glistening coarse-grained sandstone interbedded with blue and grey shale and mudstone. This Formation is the underlying formation in the whole of the Golden Gate Highlands National Park (Fig. 5).

ELLIOT FORMATION

The Elliot Formation consists largely of brick-red, reddish-brown mudstone and siltstone, with interbedded sandstone. Exposures occur in weathered gullies and low-lying parts of the Little Caledon River Valley (Fig. 5).

CLARENS FORMATION

The Clarens Formation is subdivided into the Basal, Middle and Upper layers referred to as Zones 1, 2 and 3 respectively. These are the sandstone cliffs for which the Golden Gate area is famous.

DRAKENSBERG BASALT FORMATION

This Formation consists of pillow lavas and pyroclastics that form the dark-coloured, amygdaloidal basaltic caps of the mountain ranges. These are evident on the watershed ranges to the north and south of the Little Caledon River Valley and the mountain spurs that form the divides between tributary valleys (Fig. 5).

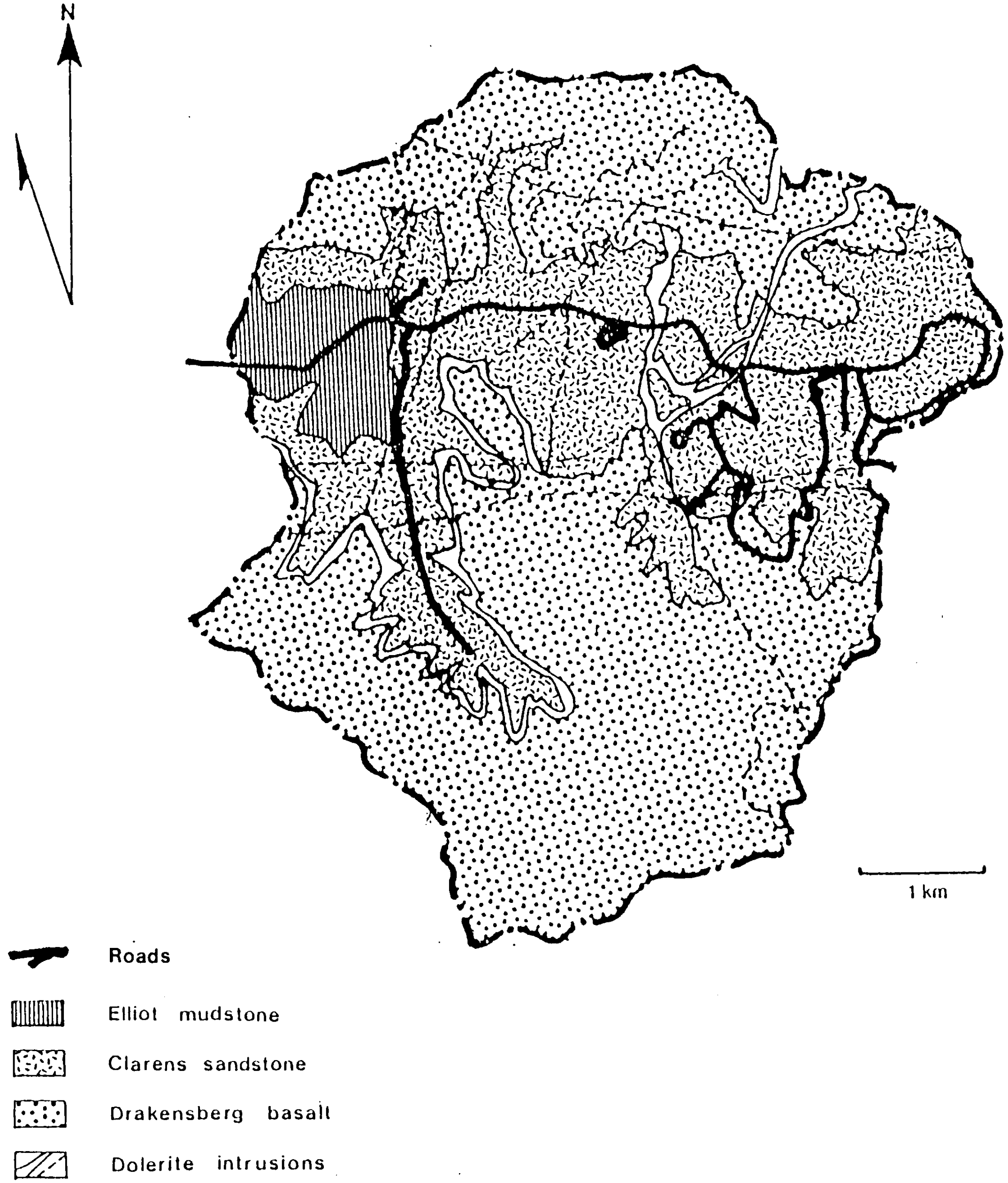

Figure 5: Size and geology of the Golden Gate Highlands National Park in the Orange Free State of the Republic of South Africa as in 1982 - 1983

Climate

INTRODUCTION

The study area is situated in a summer rainfall region characterized by temperate summers and cold winters and classified by Köppen as a Cwb climate (Trewartha 1968). According to Schulze (1965) the area falls into the "H-zone" (Highveld) of the climatic zones of Southern Africa. These climatic zones of southern Africa are derived from Köppen's classification of climates with due consideration of conventional geographical, other climatic and agricultural boundaries (Weather Bureau 1982) (Fig. 6).

A second order Weather Station was established by the Weather Bureau in the Golden Gate Highlands National Park in June 1983 at 28° 30' S latitude, 28° 35' E longitude and 1 830 m above sea level. However, rainfall data have been collected at the Golden Gate Highlands National Park since 1964.

Bearing in mind that certain statistics are not available from second order Weather Stations (sunshine hours, percentage relative air humidity and wind data) it was decided to include data from the well established Bethlehem Weather Office and the Kestell Weather Station in this chapter. This choice was made due to the differences that can occur in climate over relatively short distances and both the Bethlehem Weather Office and the Kestell Weather Station are situated close to the Golden Gate Highlands National Park. Due to the lack of long-term rainfall data for Golden Gate, rainfall data from the Bethlehem Weather Office and the Kestell Weather Station were included as a guideline of possible ranges of conditions at Golden Gate.

The closest weather office to the Golden Gate Highlands National Park is the Bethlehem Weather Office situated 60 km to the north-west of the Park at 28° 15' S latitude and 28° 20' E longitude and 1 680 m above sea level. Data pertaining to rainfall have also been used from the Kestell Weather Station (28° 19' S latitude, 28° 42' E longitude and situated at 1 707 m above sea level and 35 km to the north-east of the Park) (Weather Bureau 1983).

SUNSHINE

Data for the Bethlehem Weather Office show that December has the highest mean number of sunshine hours (293,3 hours) and April has the lowest (227,7 hours) (Weather Bureau 1983) (Table 3). Only March, April, May, November and December have a mean of one day without sunshine and the rest of the months of the year have no days without at least some sunshine (Weather Bureau 1983).

TEMPERATURE

Temperature statistics (Table 1) are from the Bethlehem Weather Office and the Golden Gate Weather Station because only approximately 5 years of data were available from the Golden Gate Weather Station. The highest mean maximum daily temperature (27,7°C) for both the Bethlehem Weather Office and the Golden Gate Weather Station occurred in January (Table 1). The lowest mean minimum daily temperature for the Bethlehem Weather Office occurred in July (-1,5°C) and the lowest mean minimum daily temperature for the Golden Gate Weather Station in August (-0,2°C) (Table 1) (Weather Bureau 1983). The absolute maximum and absolute minimum temperatures as recorded for the Golden Gate Weather Station are 33,5°C (February) and -6,5°C (August)

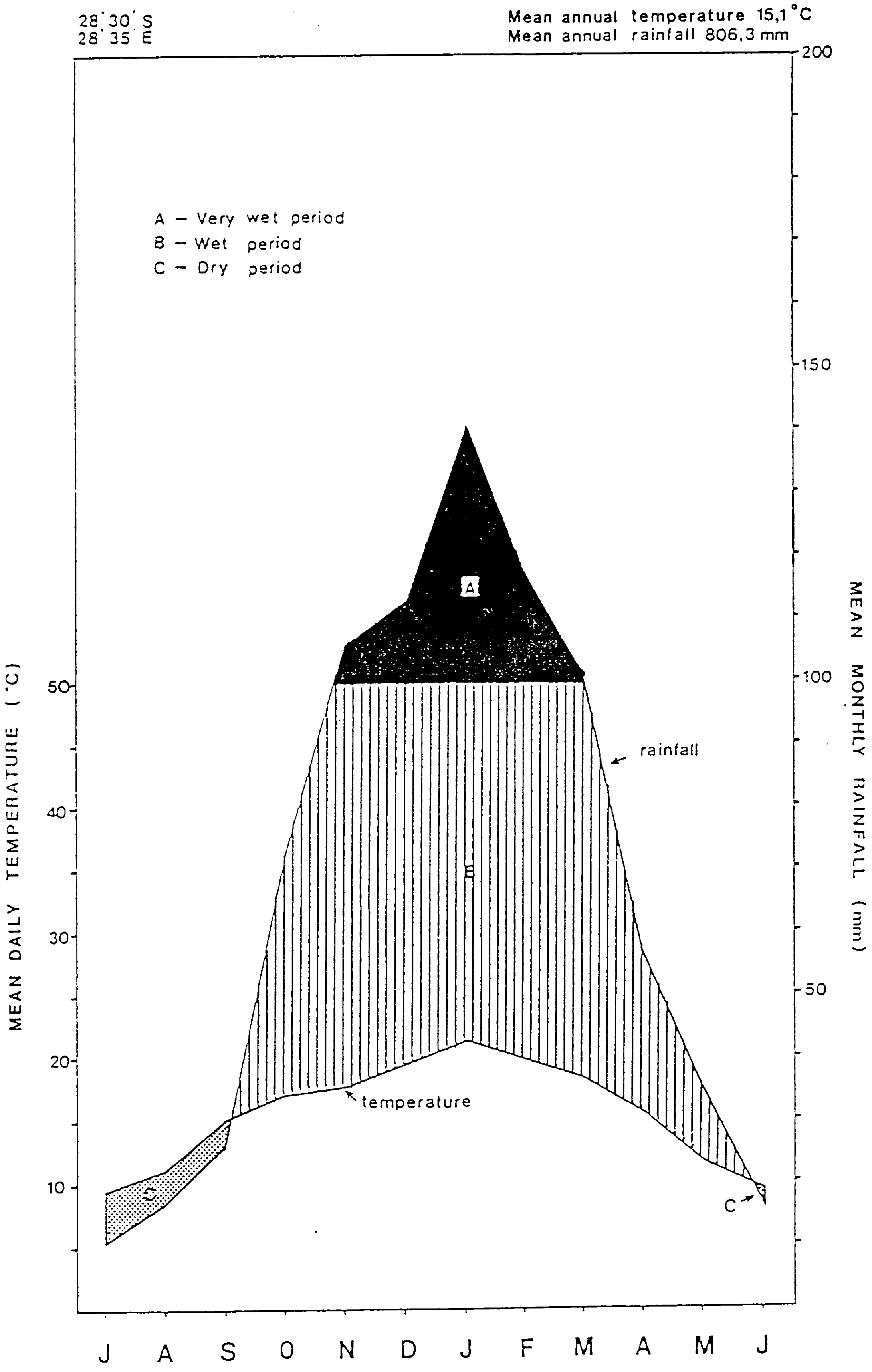

Figure 6: Walther Climate Diagram for the Golden Gate Highlands National Park, Orange Free State

(Weather Bureau 1983). The mean number of days above 30°C recorded at the Golden Gate Weather Station is only one with five days below 5°C (Weather Bureau 1983).

PERCENTAGE RELATIVE AIR HUMIDITY

The highest mean daily relative air humidity (84,5%) and the lowest mean daily relative humidity of the air (69,0%) determined at 08h00 occur during the months of April and November respectively (Table 1) (Weather Bureau 1983). The highest mean daily relative air humidity (49,0%) and lowest mean daily relative air humidity (26,9%) determined at 14h00 also occur in the months of November and July respectively (Weather Bureau 1983). These data are from the Bethlehem Weather Office, as the data from the Golden Gate weather station have not yet been analysed by the Weather Bureau.

RAINFALL

According to the records of the Golden Gate Weather Station the mean annual rainfall there is 806,3 mm (Table 2) (Weather Bureau 1983). The mean annual rainfall at the Kestell Weather Station is 736,9 mm and at the Bethlehem Weather Office it is 663,8 mm (Weather Bureau 1983). According to the Weather Bureau (1983) the months with the maximum number of rain days are February (16 rain days) at the Bethlehem Weather Office and January at the Golden Gate (12 rain days) and the Kestell (9 raindays) Weather Stations (Table 2).

Table 1: Air temperature statistics (°C) and percent relative humidity of the air based on data from the Bethlehem Weather Office and the Golden Gate Weather Station in the Orange Free State (Weather Bureau 1983 and Lawson <u>pers. comm.</u>+)

MONTH	WEATHER STATION/OFFICE	MEAN MONTHLY MINIMUM TEMPERATURE	MEAN MONTHLY MINIMUM TEMPERATURE	(MEAN MAXIMUM + MEAN MINIMUM) / 2	ABSOLUTE MAXIMUM TEMPERATURE	ABSOLUTE MINIMUM TEMPERATURE	MEAN DAILY RELATIVE HUMIDITY AT 08H00
January	Bethlehem	27,7	13,5	20,6			
	Golden Gate	27,7	14,8	21,3	33,0	12,5	73,0
February	Bethlehem	26,7	12,8	19,8			
	Golden Gate	26,2	13,1	19,7	33,5	10,0	74,5
March	Bethlehem	24,5	10,3	17,4			
	Golden Gate	25,0	11,2	18,1	29,0	8,0	79,0
April	Bethlehem	21,2	6,9	14,1			
	Golden Gate	25,8	8,6	15,7	28,6	4,0	84,5
May	Bethlehem	18,9	2,6	10,8			
	Golden Gate	18,3	3,8	11,2	27,0	-1,5	82,0
June	Bethlehem	15,9	-1,3	7,3			
	Golden Gate	15,9	1,4	8,7	21,0	-3,8	82,0
July	Bethlehem	16,4	-1,5	7,5			
	Golden Gate	14,5	3,8	9,2	20,0	-6,5	83,0
August	Bethlehem	17,2	0,8	9,0			
	Golden Gate	17,3	-0,2	8,5	22,0	-5,0	76,0
September	Bethlehem	21,3	4,3	12,8			
	Golden Gate	24,5	7,6	17,0	27,0	7,5	73,5
October	Bethlehem	22,0	6,9	14,5			
	Golden Gate	22,0	7,7	15,9	27,0	6,0	69,5
November	Bethlehem	25,8	10,2	18,0			
	Golden Gate	22,7	10,9	16,8	27,5	6,0	69,0
December	Bethlehem	26,4	11,6	19,0			
	Golden Gate	26,1	12,8	19,5	31,0	7,5	70,0

Table 2: The mean monthly, mean annual rainfall (mm) and the mean number of days of rain for the Golden Gate Weather Station in the study area and for the Bethlehem Weather Office and the Kestell Weather Station in close proximity to the Golden Gate Highlands National Park in the Orange Free State for the period March 1982 to December 1983 (Weather Bureau 1983).

WEATHER OFFICE/STATION		MONTH												YEAR
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	
Bethlehem	Rain	104,0	80,5	85,4	26,2	1,2	0,2	27,9	59,1	51,3	57,1	80,0	90,1	663,8
	Days	14	16	11	7	1	2	4	5	8	10	10	10	101
Golden Gate	Rain	141,3	119,1	102,7	57,0	35,0	7,1	5,2	17,8	25,5	77,5	108,1	109,9	806,3
	Days	12	9	8	6	3	1	1	2	3	7	10	10	72
Kestell	Rain	134,2	107,3	63,5	32,0	14,3	6,8	6,2	30,8	77,6	76,1	98,0	90,1	736,9
	Days	9	6	4	3	2	1	1	2	4	5	7	7	51

Table 3: The mean monthly hours of sunshine and the mean number of sunless days for the Bethlehem Weather Office in the Orange Free State for the period March 1982 to December 1983 (Weather Bureau 1983).

WEATHER TYPE	MEAN SUNSHINE HOURS AND MEAN SUNLESS DAYS												YEAR
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	
Mean monthly hours of sun	269,3	250,1	245,8	227,7	249,8	232,7	254,2	280,3	272,4	276,8	262,1	293,3	3113,5
Mean number of sunless days	0	0	1	1	1	0	0	0	0	0	1	1	5

SNOW AND HAIL

Only one year's data were available and were as yet not analysed. The Weather Bureau (1987) recorded 2 days of snow in June and 2 days of snow in October 1986. Only one day's hail was recorded in January 1987 (Weather Bureau 1987).

WIND

Wind speed and direction is measured by the Weather Bureau using Dines anemometers. However, the closest Weather Office possessing this facility is in Bloemfontein (Weather Bureau 1983), 300 km to the south-west of the study area.

Vegetation of the Golden Gate Highlands National Park

According to Roberts (1969) the first full-scale plant sampling was done in 1965 by L.C.C. Liebenberg. However, many of these specimens were misplaced and only 77 species were identified by the Botanical Research Institute*. Roberts (1969) collected 308 different species and a duplicate set of this collection was retained by the Botanical Research Institute. Potgieter (1982) distinguished two main vegetation types viz. those where *Themeda triandra* is dominant and those where *Themeda triandra* is either poorly represented or entirely absent. Within this framework Potgieter (1982) further differentiated the vegetation of the Golden Gate Highlands National Park into 19 plant communities. Two of Acock's (1975) veldtypes are found in the Park viz. Highland sourveld (no. 44) and the *Themeda-Festuca* veld (no. 58).

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* Botanical Research Institute, Private Bag X101, Pretoria, 0001

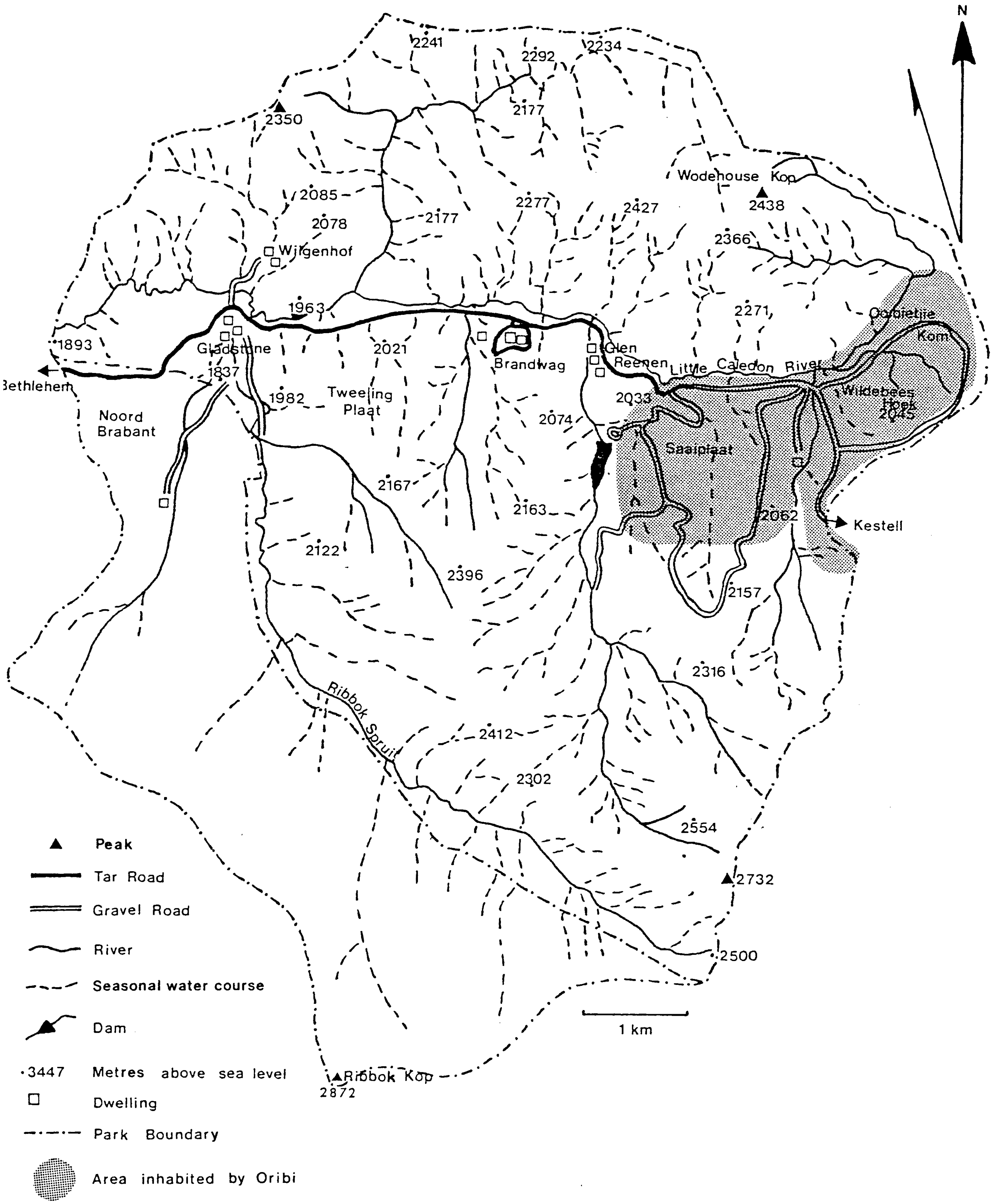

Figure 7: The Golden Gate Highlands National Park, Orange Free State illustrating the area inhabited by oribi in the period March 1982 to December 1983.

At the time of this study it was a management practice to implement a biennial burning programme during which the western and eastern half of the Park was burnt alternately so the oribi habitat was burnt every second year.

CHAPTER 4

DISTRIBUTION AND NUMBERS OF ORIBI IN THE STUDY AREA AND THE VEGETATION OF ORIBI HABITAT

Distribution

Observations on oribi in the Golden Gate Highlands National Park during the course of the study indicated that oribi are found on the open plateau and plateau spurs in the eastern section of the Park. These areas are divided into two sections by the Witsies Hoek-Clarens provincial road: known as Saaiplaat (south of the provincial road) and Oorbietjie Kom and Wildebees Hoek (north-east of that road) (Fig. 7, 8 and 9).

Status

An unspecified number of oribi was captured in the Greytown district of Natal and introduced to the Golden Gate Highlands National Park in 1971 (Penzhorn 1971, Strybis 1974). An additional 21 oribi were released in the Golden Gate Highlands National Park in 1974. These animals were captured on private land in the vicinity of Amsterdam in the eastern Transvaal (Strybis 1974).

The territorial nature of oribi and the localized nature of their distribution in the Park made it possible to do a total count from certain vantage points in the Park. The total number of oribi in the Park, determined by total count, consisted of 25 animals in September 1983.

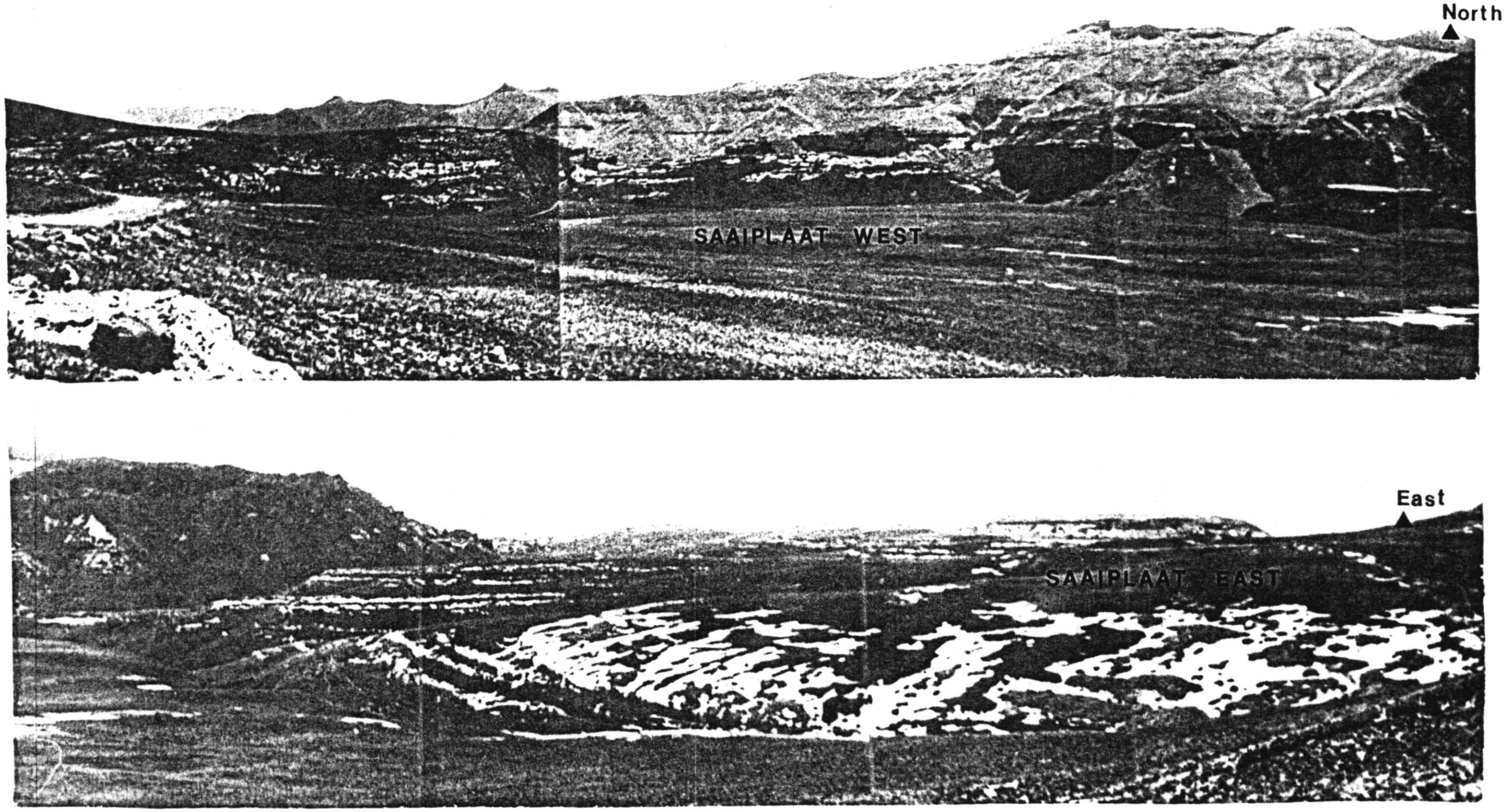

Figure 8: North-facing 180° panoramic view of the area inhabited by oribi in the Golden Gate Highlands National Park, Orange Free State.

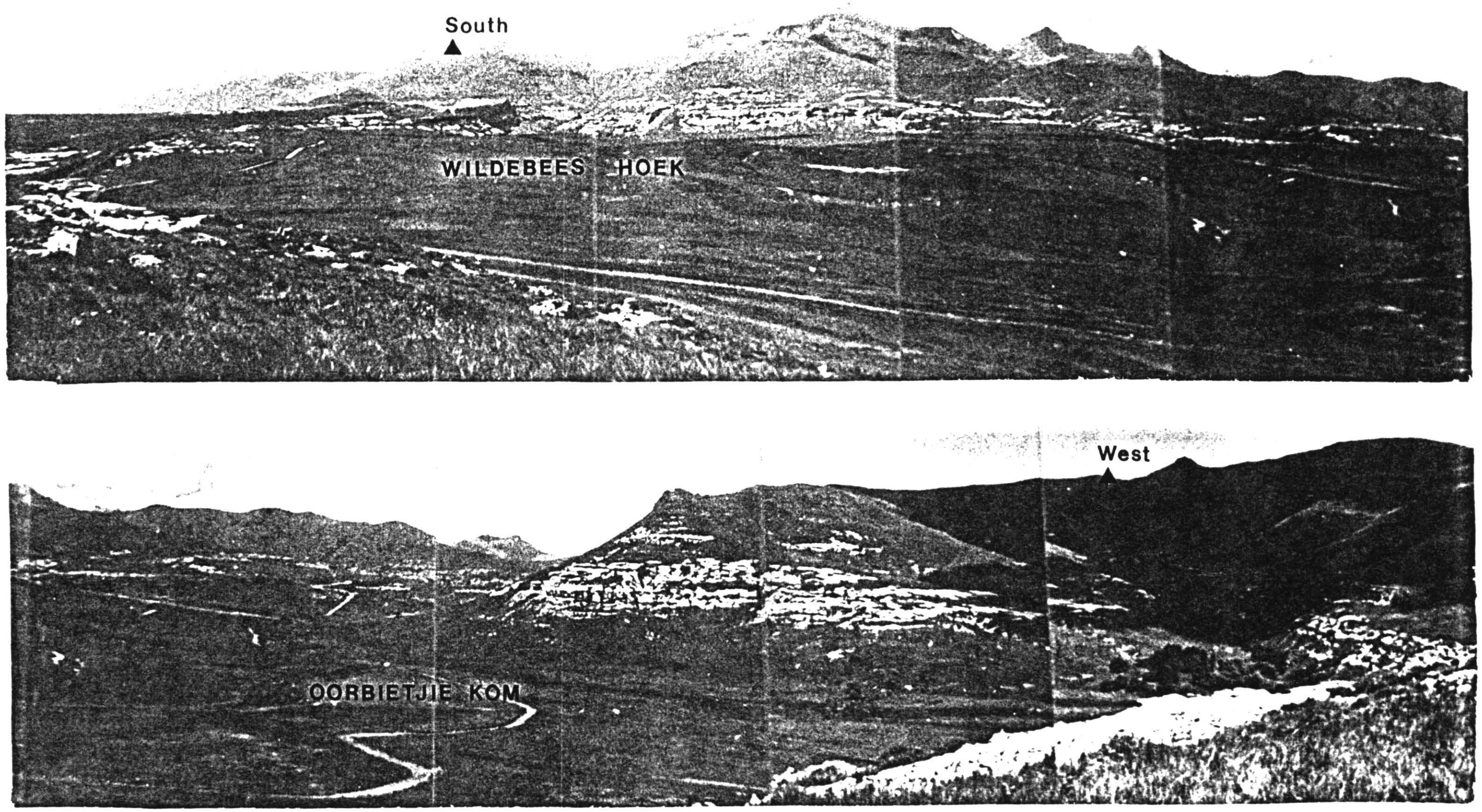

Figure 9: South-facing 180° panoramic view of the area inhabited by oribi in the Golden Gate Highlands National Park, Orange Free State.

The vegetation of the known oribi habitat

WHEELPOINT SURVEY

Introduction

Because of limited information on the vegetation of the Golden Gate Highlands National Park it was decided that a survey of vegetation of the areas specifically inhabited by oribi should be undertaken. A survey of the vegetation of these areas could then be used to determine if the oribi selected habitats characterized by certain plant species or vegetation structure.

Method

The wheelpoint method (Tidmarsh and Havenga, 1955) was used as this method provides information on plant species composition and the basal cover of the herbaceous stratum. For the sake of convenience the areas inhabited by oribi were divided into three units known as Saaiplaat west, Saaiplaat east and Oorbietjie Kom/ Wildebees Hoek (Fig. 10). Sample lines (Fig. 10) were selected in such a way that all areas frequented by oribi were included in such samples and 4 956 points were recorded. At each sample point the plant closest to the spoke was noted. Hits were noted and hits and misses were identified according to the procedure advocated by Tidmarsh and Havenga (op. cit.). If a plant could not be identified it was given a code. The plant specimen was then collected, marked and taken to the H.G.W.J. Schweicherdt Herbarium at the University of Pretoria for later identification.

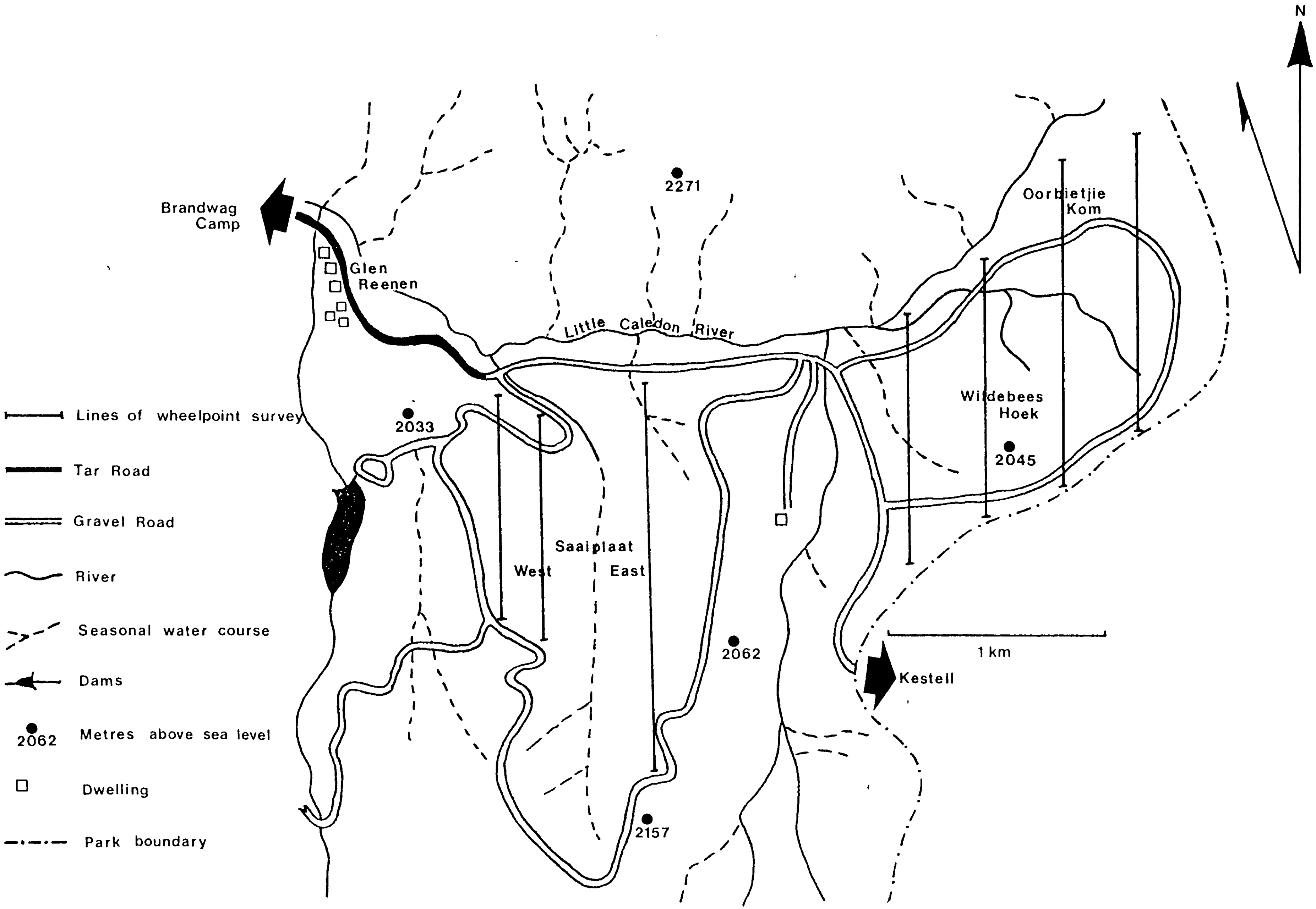

Figure 10: The lines followed during the 1983 (March) wheelpoint survey of oribi habitat in the Golden Gate Highlands National Park, Orange Free State.

Results and Discussion

SAAIPLAAT WEST

Before being declared a National Park a large portion of Saaiplaat west consisted of ploughed lands. These lands were sown with Eragrostis curvula to provide a cultivated pasture. It is evident from the results of the wheelpoint survey that Eragrostis curvula is still the most abundant plant species in the area (Table 4) with a basal cover of 13,0 percent and a percentage frequency of 72,3. The basal cover of the herbaceous species is 17,5 percent and this illustrates the density of the plant growth in the area. This high density is caused in part by the presence of sown grasses. Eragrostis curvula contributes 74 percent to the total basal cover. The other most abundant grass species in the area were Heteropogon contortus, Diheteropogon filifolius and Sporobolus centrifugus. Cyperus obtusiflorus proved to be the most abundant species of the Cyperaceae in the area. Cyperus obtusiflorus formed mats and was particularly prevalent in the centres of the territories of black wildebeest Connochaetes taurinus bulls.

The most abundant annual forb in the area was Senecio harveianus which was particularly prevalent in disturbed areas such as banks of roads and erosion ditches. Cyperus obtusiflorus and Senecio harveianus had a basal cover of 0,3 percent and 0,2 percent respectively. The geophyte that showed the highest frequency was Watsonia densiflora but it made no contribution to the basal cover.

Table 4: Results of a wheelpoint survey of the Saaiplaat west area of the Golden Gate Highlands National Park in the Orange Free State in March 1983 (1 008 points)

SPECIES	HITS	PERCENT BASAL COVER	PERCENT FREQUENCY
Eragrostis curvula	131	13,0	72,3
Heteropogon contortus	10	1,0	6,7
Diheteropogon filifolius	10	1,0	3,8
Sporobolus centrifugus	9	0,9	5,2
Elionurus muticus	5	0,5	2,2
Aristida junciformis	3	0,3	1,2
Cyperus obtusiflorus	3	0,3	3,1
Tristachya leucothrix	2	0,2	1,1
Senecio harveianus	2	0,2	1,5
Themeda triandra	1	0,1	1,0
Watsonia densiflora	0	0	0,7
Helichrysum callicomum	0	0	0,3
Moraea modesta	0	0	0,3
Eragrostis racemosa	0	0	0,2
Monocymbium ceresiiforme	0	0	0,2
Helichrysum pilosellum	0	0	0,3
Harpechloa falx	0	0	0,1
Eragrostis capensis	0	0	0,3
Paspalum dilatatum	0	0	0,1
Koeleria capensis	0	0	0,1
Hypochoeris radicata	0	0	0,1
Total hits	176	17,5	100,0
Total misses	832	82,5	-
Grand total	1 008	100,0	-

SAAIPLAAT EAST

This area is separated from Saaiplaat west by Wildebees Kloof (Fig. 7) and unlike Saaiplaat west it did not have any areas under the plough before the advent of the National Park. The vegetation of the area has a basal cover of 13,1 percent with Heteropogon contortus having a 4,3 percent basal cover and a percent frequency of 28 (Table 5). Other grasses are Elionurus muticus, Themeda triandra and Tristachya leucothrix having 2,3; 2,1 and 1,2 percent basal cover respectively. Eragrostis curvula has a 0,4 percent basal cover and a frequency of 4,7 percent, a clear difference from the Saaiplaat west area which previously had been sown with Eragrostis curvula. The Cyperaceae are represented by Cyperus rigidifolius with a frequency of 1,1 percent and it is noticeable that Cyperus obtusiflorus was not represented in the survey. The most abundant forbs in the area were Hypochoeris radicata and Senecio coronatus.

OORBIETJIE KOM / WILDEBEES HOEK

This section of the Golden Gate Highlands National Park is the largest subdivision of what can be classified as oribi habitat.

The Oorbietjie Kom/Wildebees Hoek area has a basal cover of 11,4 percent and although the area does have old lands which make up 40 percent of the surface area of Oorbietjie Kom/Wildebees Hoek, these old lands were not sown with pasture grasses i.e. Eragrostis curvula and therefore exhibit a species composition different from that of the Saaiplaat west area (Table 6).

The grass species with the highest basal cover is Heteropogon contortus with a 2,1 percent basal cover and a frequency of 17,5 percent. Stiburus alopecuroides has a 1,6 percent basal cover and a percent frequency of 14,6 percent. Other abundant grass species in the area are Themeda triandra, Monocymbium ceresiiforme and Elionurus muticus. Miscanthidium capensis has a frequency of 1,7 percent due to the low-lying areas along the drainage lines that are so prevalent in the Oorbietjie Kom. The contribution of Eragrostis caesia can be attributed to the trampled areas of Oorbietjie Kom/Wildebees Hoek as this species was only evident on these trampled areas. The most abundant forb in the area is Gnaphalium undulatum which forms mats in places. Two species of Cyperaceae are found in the area, however, Cyperus rigidifolius has a 0,1 percent basal cover but has a frequency of only 0,2 percent while Cyperus obtusiflorus has only 0,1 percent basal cover but has a frequency of 2,0 percent.

Finally in an attempt to determine the qualitative similarity or dissimilarity between the Saaiplaat west, Saaiplaat east and Oorbietjie Kom/Wildebees Hoek the equation for Jaccards qualitative similarity index (Mueller-Dombois and Ellenberg 1974) was applied. The index of similarity between Saaiplaat west and Saaiplaat east is 48 percent, that between Saaiplaat east and Oorbietjie Kom/Wildebees Hoek was 53 percent and between Saaiplaat west and Oorbietjie Kom/Wildebees Hoek it was 45 percent. As can be seen from these results it is evident that while the three above-mentioned areas are not totally dissimilar they are not similar either, however, Mueller-Dombois and Ellenberg (1974) would consider the communities as the same.

Table 5: Results of a wheelpoint survey of the Saaiplaat east area of the Golden Gate Highlands National Park in the Orange Free State in March 1983 (1 140 points).

SPECIES	HITS	PERCENT BASAL COVER	PERCENT FREQUENCY
Heteropogon contortus	49	4,3	27,6
Elionurus muticus	26	2,3	19,6
Themeda triandra	24	2,1	16,9
Tristachya leucothrix	14	1,2	8,1
Aristida junciformis	5	0,4	4,9
Eragrostis curvula	4	0,4	4,7
Monocymbium ceresiiforme	4	0,4	3,2
Sporobolus centrifugus	3	0,3	2,5
Stiburus alopecuroides	3	0,3	2,4
Diheteropogon filifolius	2	0,2	1,2
Cyperus rigidifolius	2	0,2	1,1
Pentaschistis jugorum	2	0,2	0,9
Hypochoeris radicata	2	0,2	1,6
Senecio coronatus	1	0,1	1,1
Eragrostis racemosa	1	0,1	1,6
Gnaphalium undulatum	1	0,1	0,4
Watsonia densiflora	1	0,1	0,5
Paspalum dilatatum	1	0,1	0,5
Hypoxis argentea	1	0,1	0,5
Helichrysum pilosellum	0	0,0	0,5
Gazania krebsiana	0	0,0	0,2
Eragrostis caesia	0	0,0	0,1
Total hits	146	13,1	100,0
Total misses	994	86,9	-
Grand total	1 140	100,0	-

Table 6: Results of a wheelpoint survey of the Oorbietjie Kom/ Wildebees Hoek area of the Golden Gate Highlands National Park in the Orange Free State in March 1983 (2 808 points).

SPECIES	HITS	PERCENT BASAL COVER	PERCENT FREQUENCY
Heteropogon contortus	60	2,1	17,5
Stiburus alopecuroides	46	1,6	14,6
Themeda triandra	37	1,3	9,8
Monocymbium ceresiiforme	31	1,1	10,8
Elionurus muticus	26	0,9	9,3
Tristachya leucothrix	25	0,9	9,7
Harpechloa falx	17	0,6	0,1
Eragrostis caesia	14	0,5	5,1
Eragrostis curvula	13	0,5	6,5
Sporobolus centrifugus	12	0,4	7,0
Aristida junciformis	10	0,4	2,2
Miscanthidium capensis	10	0,4	1,7
Gnaphalium undulatum	7	0,3	1,3
Cyperus rigidifolus	4	0,1	0,2
Cyperus obtusiflorus	2	0,1	2,0
Watsonia densiflora	2	0,1	0,3
Senecio coronatus	1	0,04	0,5
Diheteropogon filifolius	1	0,04	0,3
Paspalum dilatatum	1	0,04	0,5
Eragrostis capensis	0	0	0,2
Digitaria eriantha	0	0	0,04
Polygala hottentotta	0	0	0,04
Gazania krebsiana	0	0	0,1
Erica alopecurus	0	0	0,2
Total hits	319	11,4	100,0
Total misses	2 489	88,6	-
Total total	2 808	100,0	-

Conclusion

The presence of lands that have been sown in the past in the Saaiplaat west area creates such an abundance of Eragrostis curvula that the area can be classified as an Eragrostis curvula Grassveld with the surrounds classified as a mixed Heteropogon contortus - Diheteropogon filifolius - Sporobolus centrifugus Grassveld. The Saaiplaat east area can be classified as a mixed Heteropogon contortus - Elionurus muticus - Themeda triandra Grassveld. The Oorbietjie Kom/Wildebees Hoek area also has old lands although not cultivated as pastures and shows a high incidence of Stiburus alopecuroides and Monocymbium ceresiiforme in the old lands. The fact that the old lands only make up 40 percent of the area accounts for the abundance of grass species such as Heteropogon contortus, Themeda triandra and Elionurus muticus amongst the most abundant species in the area. According to Tainton (1981) the presence of Themeda triandra is an indication of optimum condition in sourveld. Due to the sketchy history of the utilization of pastures at Golden Gate, the presence of old lands and planted pastures and differing survey design, species composition is not compared to benchmark sites proposed by Tainton (1981) for Natal highland sourveld.

Looking at the floristic component and the basal cover of the respective areas, the areas are different in respect of their vegetation. However, these areas do have certain similarities such as the past man-made influences on these areas.

The effects of the dissimilarities on the general habitat utilization and feeding prefences of oribi will be discussed in Chap-

DRY MASS RANKING

Introduction

It was necessary to apply a technique to the present and possible future oribi distribution areas to provide some index of plant species availability as food to oribi. These data could then be correlated with the observations of feeding oribi to provide an index of oribi feeding preferences and food selection. These data were collected during January 1983.

Methods

In each of the areas in question 50 circular plots of 750 mm radius (area 1,75 m^2) were distributed. The ranking method of t'Mannetjie and Haydock (1963) was used for estimating the dry mass ranking of plant species of the herbaceous layer available as food to the oribi. This method involves the judgement of the observer in ranking what he considers to be the three most abundant species within each quadrat in terms of their available dry mass ranking them either "1", "2" or "3" according to their abundance. If only two species occur within the quadrat, the ranks "1" and "2" are assigned and if there is only one species it is given rank "1". On completion of the sampling, the number of times that each species was assigned to one of the three rank categories is multiplied by one of three different constants.

t'Mannetjie and Haydock (1963) in their work on Australian pastures used the constants "8", "2,4" and "1". These constants are chosen to conform to the exponential distribution to highlight the most abundant species in terms of dry mass ranking.

This same technique was applied by Zimmerman (1978) in his study of Africander steers on the Nylsvley Nature Reserve.

Results and Discussion

In the Saaiplaat west area Eragrostis curvula contributes 37,0 percent of the total plant dry mass available to oribi. It is interesting to note that Sporobolus centrifugus contributes 24,0 percent to the total dry mass ranking while exibiting a frequency of only 5,1 percent in the wheelpoint survey. Other contributors to the ranked dry mass are Heteropogon contortus (9 percent dry mass) Elionurus muticus (8,0 percent dry mass), Senecio harveianus (6 percent dry mass), Tristachya hispida (5,0 percent dry mass) and Cyperus obtusiflorus (4 percent dry mass) (Table 7). On the small areas that have been overgrazed and trampled by black wildebeest bulls in their territorial activities Cyperus obtusiflorus is particularly prevalent (Table 7).

In the Saaiplaat east area of the Park Elionurus muticus contributed 32,5 percent to the total plant dry mass availability. Aristida junciformis and Heteropogon contortus contributed 20,0 percent and 18,8 percent respectively to the total dry mass available to oribi in the area. The fourth largest contributor is Themeda triandra which contributed 12,0 percent to the total dry mass ranking.

Table 7: The results of dry mass ranking studies of the herbaceous layer of the areas inhabited by oribi in the Golden Gate Highlands National Park in the Orange Free State during 1983, given as percent contribution to total dry mass ranking for the particular area. Also given are figures for the Tweeling Plaat and Noord Brabant areas of the Park in the event of oribi possibly colonizing these areas.

PLANT SPECIES	SAAIPLAAT WEST	SAAIPLAAT EAST	OORBIETJIE KOM/WILDE-BEES HOEK	TWEELING PLAAT	NOORD BRABANT
Aristida congesta	-	-	-	-	2,9
Aristida diffusa	-	-	-	-	0,2
Aristida junciformis	0,2	20,0	2,7	3,3	7,5
Cynodon dactylon	-	-	-	-	0,2
Cyperus obtusiflorus	4,3	0,2	1,4	-	-
Cyperus rigidifolius	-	2,4	0,6	2,0	-
Diheteropogon filifolius	2,0	0,9	0,2	2,8	1,4
Elionurus muticus	7,6	32,5	18,9	9,5	3,3
Eragrostis capensis	-	-	5,2	-	-
Eragrostis curvula	36,5	2,4	11,3	5,7	28,5
Eragrostis racemosa	-	-	1,6	1,2	1,0
Erica alopecurus	0,6	-	0,4	-	-
Gnaphalium undulatum	1,0	-	3,2	0,2	3,5
Harpechloa falx	-	-	-	34,8	2,1
Helichrysum callicomum	-	-	-	-	0,6

Table 7: continued

PLANT SPECIES	SAAIPLAAT WEST	SAAIPLAAT EAST	OORBIETJIE KOM/WILDE-BEES HOEK	TWEELING PLAAT	NOORD BRABANT
Heteromma decurrens	-	-	-	-	0,8
Heteropogon contortus	9,0	18,8	10,4	19,4	15,6
Miscanthidium capensis	-	-	-	1,4	1,4
Monocymbium ceresiiforme	-	2,9	9,6	-	-
Paspalum dilatatum	-	-	-	-	0,2
Pentaschistis jugorum	0,2	1,6	-	-	10,1
Polygala hottentotta	1,2	-	-	-	-
Senecio harveianus	6,1	-	-	0,4	0,8
Sporobolus centrifugus	24,3	1,0	3,1	4,3	5,4
Stiburus alopecuroides	0,7	2,7	24,4	-	0,2
Themeda triandra	1,9	12,0	5,6	5,3	12,0
Tristachya leucothrix	4,5	4,0	4,3	8,1	0,6
Watsonia densiflora	0,2	-	0,6	0,2	-

The plant dry mass ranking for the Oorbietjie Kom/Wildebees Hoek area is made up of the following species: Stiburus alopecuroides (24,4 percent dry mass), Elionurus muticus (18,9 percent dry mass), Eragrostis curvula (11,3 percent dry mass), Heteropogon contortus (10,4 percent dry mass), Monocymbium ceresiiforme (9,6 percent dry mass) and Themeda triandra (5,6 percent dry mass). The most abundant grasses according to the wheelpoint survey are also the grasses responsible for the greater percentage of dry mass. It is also evident from the sample that the sedges and forbs contribute 6,2 percent dry mass to the total dry mass of vegetation available.

The Tweeling Plaat area of the Golden Gate Highlands National Park (Fig. 7) exhibits a similar dry mass ranking to each of the current oribi habitats in the Park (Saaiplaat west, Saaiplaat east and Oorbietjie Kom/Wildebees Hoek) except that a relatively high percentage (34,8 percent dry mass) of the ranked plant dry mass is made up of Harpechloa falx. The Noord Brabant area has only recently (1983) been incorporated into the Park and compared to Tweeling Plaat exhibits the greatest similarity according to Jaccards qualitative similarity index (46 percent) in terms of ranked plant dry mass to the areas currently inhabited by oribi. In sampling the Noord Brabant area, lands that were cultivated just prior to incorporation of the area into the Park were excluded. The old lands in the Noord Brabant area were covered with Tagetes minuta and their contribution to the maintenance of an oribi population was deemed to be minimal. The Noord Brabant area had a dry mass ranking consisting of Eragrostis curvula

(28,5 percent dry mass), Heteropogon contortus (15,6 percent dry mass) and Themeda triandra (12,0 percent dry mass). The Noord Brabant and Tweeling Plaat areas were sampled because physiognomically and physiographically these areas were similar to the areas inhabited by oribi although no oribi were evident on either Tweeling Plaat or Noord Brabant during this study. These areas are difficult for oribi to reach because of intervening mountain spurs and the presence of human activity in the Little Caledon River Valley. However, during 1984 a pair of oribi was seen in the Noord Brabant area (Lawson pers. comm.*). These animals are from the areas known to be inhabited by oribi and it is possible that colonization of these areas will take place naturally given enough time.

The plant dry mass ranking data will be compared to oribi feeding preferences and food selection in Chapter 6.

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* A.B. Lawson, P.O. Box 35, Wilderness, 6560 (1984).

CHAPTER 5

ACTIVITY PATTERNS

Introduction

Many references to the daily activity patterns of African antelope are given but are seldom expressed quantitatively. In the current study where the oribi population is relatively newly introducted a study of activity patterns can be seen as a departure point in attempting to determine possible negative influences on the population. Negative influences are important in view of the suspicions of negative influence of other ungulates on oribi in the Golden Gate Highlands National Park. Leuthold (1977) describes an activity pattern as the pattern with which definite phases of animal activities change over time.

Activity patterns of spp. comprising the Tribe Neotragini are well documented, Norton (1980) the klipspringer *Oreotragus oreotragus*, Viljoen (1982) the oribi *Ourebia ourebi* and Cohen (1988) the steenbok *Raphicerus campestris*. The study of activity patterns of African ungulates has not only been confined to the Neotragini e.g. the defassa waterbuck *Kobus ellipsiprymnus defassa* (Spinage 1968), the warthog *Phacochoerus aethiopicus* (Clough and Hassam 1970), the Hartmann's zebra *Equus zebra hartmannae* (Joubert 1972), the impala *Aepyceros melampus* (Jarman and Jarman 1973) and the elephant *Loxodonta africana* (Guy 1976).

Methods

The accepted methodology studying the activity patterns of African ungulates has been to use very short intervals between observations usually 4 or 5 minutes (Rollinson, Harker and Taylor 1956, Spinage 1968, Jarman and Jarman 1973, Novellie 1975, Waser 1975 and Viljoen 1982). Cohen (1988) used 10 minute intervals while observing the feeding patterns of steenbok. For purposes of this study feeding was construed as the primie activity as it occupied most of active periods.

After preliminary observations of oribi in the Golden Gate Highlands National Park for several months it became evident that the oribi were constant and predictable in their activities. The determination of their activity patterns and social organization was only secondary to the study of their habitat utilization. Because groups of oribi would be under observation for the greater part of the daylight hours for a period of eighteen months, it was decided that activities would be noted every hour unless the activity changed within that period. The activities were divided into four main categories, viz. feeding, resting, moving and disturbed. The last category was included to determine the possible negative influences on oribi by either man or the large ungulates in the Park, e.g. black wildebeest, blesbok and Burchell's zebra. This will be discussed in greater detail in Chapter 7.

Daylight observations extended from as early as 05h00 to as late as 19h00 in December. However, it was sometimes impossible to find oribi before 07h00.

To eliminate observing only a single group of oribi within a specific microhabitat, several vantage points were chosen from where it was possible to observe several family groups of oribi. Initially, a Tasco 16 x 60 spotting telescope was used for observing the animals, but the almost continuous wind made these observations difficult by disturbing the telescope. Thereafter all observations were made with a Pentax 10 x 50 binoculars. Observation distances varied from 100 to 500 m and observations were done from a vehicle or on foot. It was often necessary to move from one vantage point to another to keep specific animals in sight.

For the seasonal observations three seasons were distinguished on the basis of temperature and rainfall, viz. summer (October to March), early winter (April to June) and late winter (July to September). The seasonal observations started in May 1982 and were terminated in October 1983.

Simultaneous with the hourly activity observations, data were also recorded regarding climatic conditions, group sizes and structures, social organization and intraspecific interactions. The air temperature was measured and recorded with a maximum/minimum thermometer for every set of observations. The prevailing cloud cover was estimated by defining five categories viz,:

0 : clear sky

1 : 1 - 25 % cloud cover

2 : 26 - 50 % cloud cover

3 : 51 - 75 % cloud cover

The wind speed was measured with a hand-held cup anemometer and the wind speed was noted in 5 km/h intervals viz,:

0 : no wind

1 : 1 - 5 km h^{-1}

2 : 6 - 10 km h^{-1}

3 : 11 - 15 km h^{-1}

6 : 26 - 30 km h^{-1}

7 : 31 - 35 km h^{-1}

8 : 36 - 40 km h^{-1}

9 : 41 - 45 km h^{-1}

10 : 46 - 50 km h^{-1}

The wind direction was also recorded for each observation after the necessary compass points were established at the commencement of the study.

Several attempts were made to determine the nocturnal activities of oribi with a 12-Volt, 300 000 candle power hand-held spot-lamp. However, oribi were disturbed severely by the light and/ or the vehicle, and these attemps were thus abandoned.

Results and Discussion

BASIC ACTIVITY PATTERNS

Although activity patterns vary from day to day and from season to season, a basic activity pattern can be defined that is applicable to all seasons (Fig. 11). The oribi in the Golden Gate

Highlands National Park are inactive during the early morning (05h00 - 06h00) and early afternoon (12h00 - 13h00) (Fig. 11). The active (feeding) periods are alternated by periods of inactivity. For example, between 06h00 and 07h00 an annual mean of 46 percent of the oribi were inactive and between 12h00 and 13h00 an annual mean of 76 percent of oribi were inactive (S.D. = 2,8 percent mean = 47,C.V. = 5,9 and n = 658).

During the summer months (October - March) (Fig. 13) oribi activity (feeding) was from 07h00 to 08h00 with 52 percent of oribi active, 13h00 to 14h00 with 60 percent of oribi active and from 17h00 to 18h00 (56 percent of oribi active) (S.D. = 3,1 percent, mean = 11, C.V. = 27,4 and n = 154). Conversely,peak inactivity occurs from 05h00 to 06h00 with 80 percent of oribi inactive and from 15h00 to 16h00 with 70 percent of oribi inactive (S.D. = 4,9 percent, mean = 14, C.V. = 35,6 and n = 196). It appears from the results (Fig. 13) that disturbances are more prevalent during peak activity periods and it can be stated that a resting oribi, well concealed, is less inclined to flee at the approach of humans or other ungulates than an active oribi. It was also noted that oribi activities were well co-ordinated within the family group i.e. if one individual commenced an activity then the other oribi in the group followed suit.

In the early winter (April - June) the activity (feeding) peaks were not as pronounced as during the summer months. Active periods peaked from 06h00 to 09h00 (mean 44,5 percent of oribi active) and from 14h00 to 16h00 (48,8 percent of oribi active) (S.D. = 6,2 percent, mean = 6,6, C.V. = 94 and n = 92). The

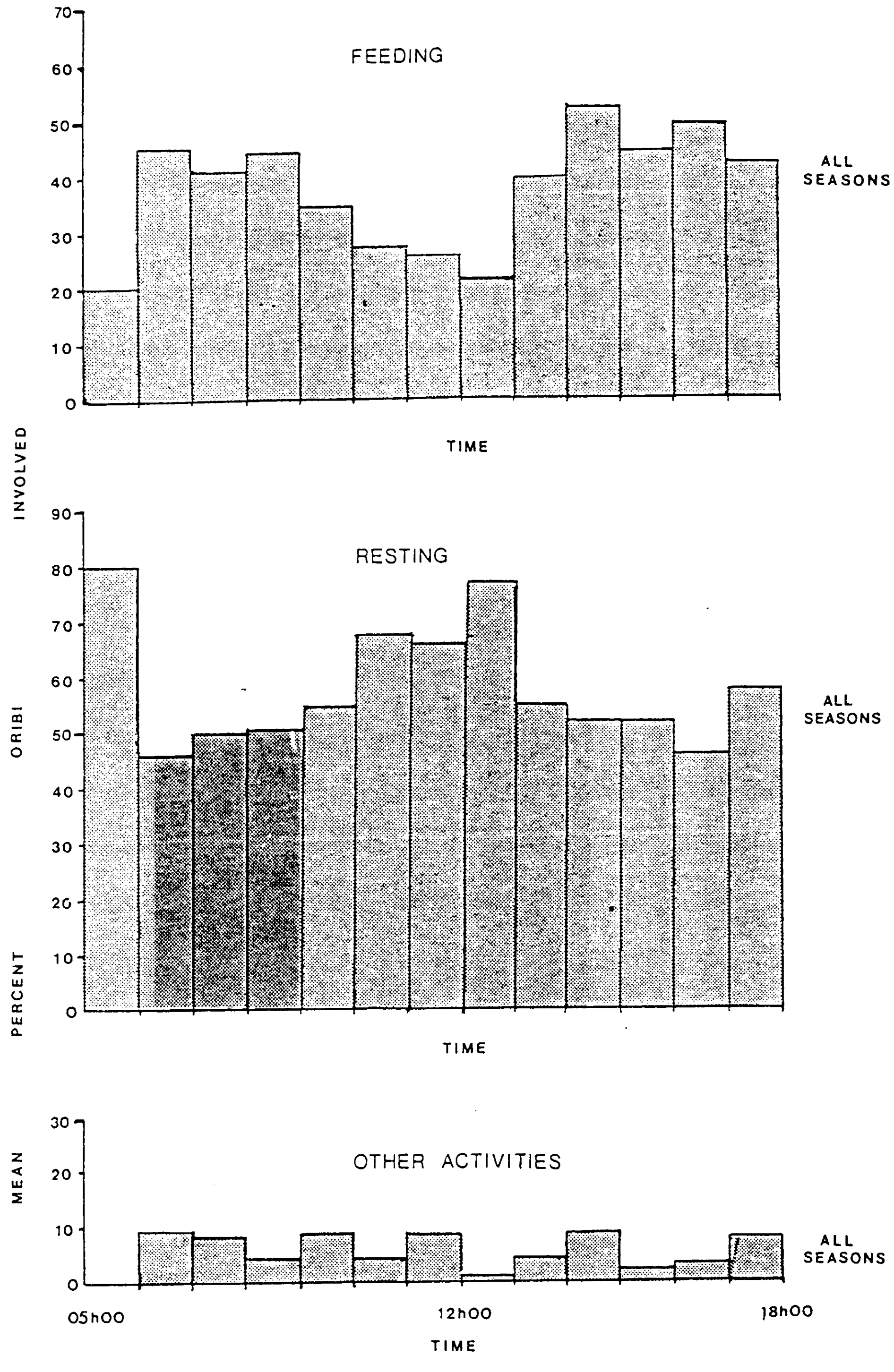

Figure 11: The daylight activity patterns (all seasons) of oribi in the Golden Gate Highlands National Park, Orange Free State from March 1982 to November 1983.

to 16h00 periods were so close that it was impossible to identify a specific peak for anyparticular hour of the day. Peak inactivity (primarily resting) occurred from 13h00 to 14h00 with 80 percent of the oribi inactive) (S.D. = 32,7 percent, mean = 47, C.V. = 69 and n = 658) (Fig. 13).

During the late winter (July - September) peak oribi activity occurred from 06h00 to 07h00 (60 percent of oribi active) and from 16h00 to 17h00 (65 percent of the oribi active) (S.D. = 16,7 percent, mean = 20,4, C.V. = 81,9 and n = 285). The peak inactivity was from 17h00 to 18h00 (65 percent of oribi inactive) (S.D. = 12,5 percent, mean = 16,3, C.V. = 77,2 and n = 228).

From all the results obtained it was determined that oribi are highly sedentary and deliberate movement not associated with feeding was kept to a minimum. More movement occurred during the late winter but most not associated with feeding movement was associated with a disturbance of some kind.

According to Viljoen (1982) oribi in the south eastern Transvaal are active during the early morning, the middle of the day and the late afternoon. The better defined peaks of active versus inactive periods of oribi in the south eastern Transvaal (Viljoen 1982) could have to do with more available habitat as results from the Golden Gate Highlands National Park clearly show peak activity during the middle of the morning and the middle of the afternoon (Figure 11). Dorst and Dandelot (1970) state that oribi spend the heat of the day concealed in tall grass but may occasionally be seen on open plains during the middle of the day.

Basic activity patterns are also reported for the dik-dik Madoqua kirkii (Tinley 1969), the klipspringer Oreotragus oreotragus (Norton 1980).

All the activity data were programmed into the National Parks Board computer at Skukuza. A chi-square test with $\chi^2 = \frac{(O - E)^2}{E}$ was applied with the null-hypothesis that oribi did not exhibit any preference for any time of the day from season to season for their activities (Welkowitz, Ewen and Cohen 1971). The results are given under the results of each activity.

FEEDING ACTIVITY

The oribi in the Golden Gate Highlands National Park spend a mean of 40 percent of the daylight hours feeding (S.D. = 6,4 percent, observations (n) = 496). Viljoen (1982) found that oribi spent 84 pecent of their active periods feeding. Accepting Viljoen's (1982) feeding frequency and since oribi in the Golden Gate Highlands National Park were active for 40 percent of the daylight hours, then they actively feed for 33,6 percent of the daylight hours (Viljoen 1982). This difference when compared with the 28,6 percent of daylight hours spent feeding by oribi in the south-eastern Transvaal (Viljoen 1982) is not statistically significant (Chi-square = 0,402; $p > 0,05$; df = 1)

Figure 12: A feeding oribi in natural grassland habitat in the Golden Gate Highlands National Park, Orange Free State.

Table 8: The seasonal mean, standard deviation and range of the percentage of total activity devoted to feeding, resting, moving and disturbances by oribi in the Golden Gate Highlands National Park, Orange Free State from March 1982 to December 1983.

ACTIVITY	SUMMER			EARLY WINTER			LATE WINTER		
	MEAN	S.D	MIN-MAX	MEAN	S.D	MIN-MAX	MEAN	S.D	MIN-MAX
Feeding	40,1	6,5	12,5 - 60	35,2	6,1	16,7 - 50	43,8	6,7	29,2 - 64,7
Resting	56,0	7,8	35 - 100	60,0	7,8	36,4 - 80	50,4	7,4	30 - 66,7
Moving	1,9	2,0	2,2 - 6,3	1,7	3,0	4,1 - 10,8	1,7	2,7	3,3 - 10
Disturbed	2,0	2,0	1,7 - 6,7	3,1	3,0	3,3 - 16,7	4,1	2,7	2 - 10
TOTAL	100,0			100,0			100,0		

As both of the study areas are sour grassveld (Acocks Veld Type 63 for south-eastern Transvaal and Veld Type 44 for Golden Gate Highlands National Park), a possible reason for the increase in feeding activity among the oribi at Golden Gate compared with oribi in the south-eastern Transvaal could be the nutritional value of the available grazing. Compared to some large ungulates oribi spend less time feeding: 33 percent of daylight hours as opposed to 42 percent of the daylight hours for waterbuck when feeding (Spinage 1968), 40 percent for impala (Jarman and Jarman 1973) and 38 percent for bushbuck *Tragelaphus scriptus* (Waser 1975).

Oribi exhibit a statistically insignificant (Chi-square = 0,4; $p > 0,05$, $df = 1$) increase in feeding activity during the late winter (Fig. 13). The time spent feeding first decreases from 40 percent in summer to 35 percent in the early winter and then increases to 44 percent in the late winter for oribi in the Golden Gate Highlands National Park. Norton (1980) reports no increase in feeding activity of klipspringer during the winter.

Although the findings indicate no increase in feeding activity during the late winter more animals fed throughout the day. This phenomenon may be related to the drop in the crude protein content of the vegetation at this time of year. Mentis (1978) in discussing limiting factors of grey rhebuck *Pelea capreolus* and oribi in the Natal Drakensberg discovered an increase in crude fibre (decrease in digestibility) and low nutrient concentrations (particularly crude protein) during the winter. Oliver, Short and Hanks (1978) also consider the decline in crude protein content of herbage as a possible oribi population limiting factor in the Natal Drakensbeg. Rowe-Rowe and Scotcher (1986) also record a crude protein drop in grazing during the winter in the Natal Drakensberg.

It is also possible that due to the selective feeding of oribi in the Park (See Chapter 8) the animals have to spend more time feeding as many of the selected plants are not available during the late winter. Pairs and family groups of oribi always fed together and for the same length of time in the Golden Gate Highlands National Park. Viljoen (1982) also noted this in his study of oribi behaviour in the south-eastern Transvaal.

Other activities of oribi while feeding, such as grooming, defecation, urination and marking are well documented by Viljoen (1982) and will not be repeated here.

RESTING

The feeding, moving and disturbance (active) periods of oribi in the Golden Gate Highlands National Park are alternated by periods of resting (inactivity). The oribi spend a mean of 56 percent of the daylight resting (Fig. 13). There is no significant difference in time spent resting in the summer compared with the early winter (56 percent resting and 60 percent resting respectively) (Chi-square = 0,02; $p > 0{,}05$; df = 1) and no statistically significant difference occurs in time spent resting in the late winter (50 percent) than in summer (56 percent) (Chi-square = 0,6; $p > 0{,}05$; df = 1).

According to Viljoen (1982) oribi rams spend less time resting than do ewes although the difference is not significant. Water buck (Spinage 1968) and impala (Jarman and Jarman 1973) spend long periods standing and ruminating. However, oribi ruminate only while lying down. This observation is corroborated by Viljoen (1982).

MOVING

This category was included in the current study because it was speculated by the Head: Information and Research for the National Parks Board that there was some negative influence affecting the survival of oribi in the Golden Gate Highlands National Park.

If oribi in Golden Gate exibited pronounced movement it would indicate an inherent instability in the behaviour of the population as it is known from the work of Viljoen (1982) that oribi are normally highly sedentary. During the summer in the Golden Gate Highlands National Park the percentage of oribi involved in movement at any hour of the day was only 2 percent of the oribi population (Fig. 13). The peak of this movement was from 11h00 to 12h00 and from 16h00 to 18h00 (Fig. 13). The mean percentage of oribi movement at Golden Gate is still 2 percent during the early winter with a marked peak from 07h00 to 08h00 (Fig. 13). The mean percentage of oribi involved in moving is also 2 for the late winter season but the peak of movement moves to between 11h00 and 12h00. This shifting of the peak of movement is possibly caused by the drop in temperature during the cold seasons (see Chapter 2).

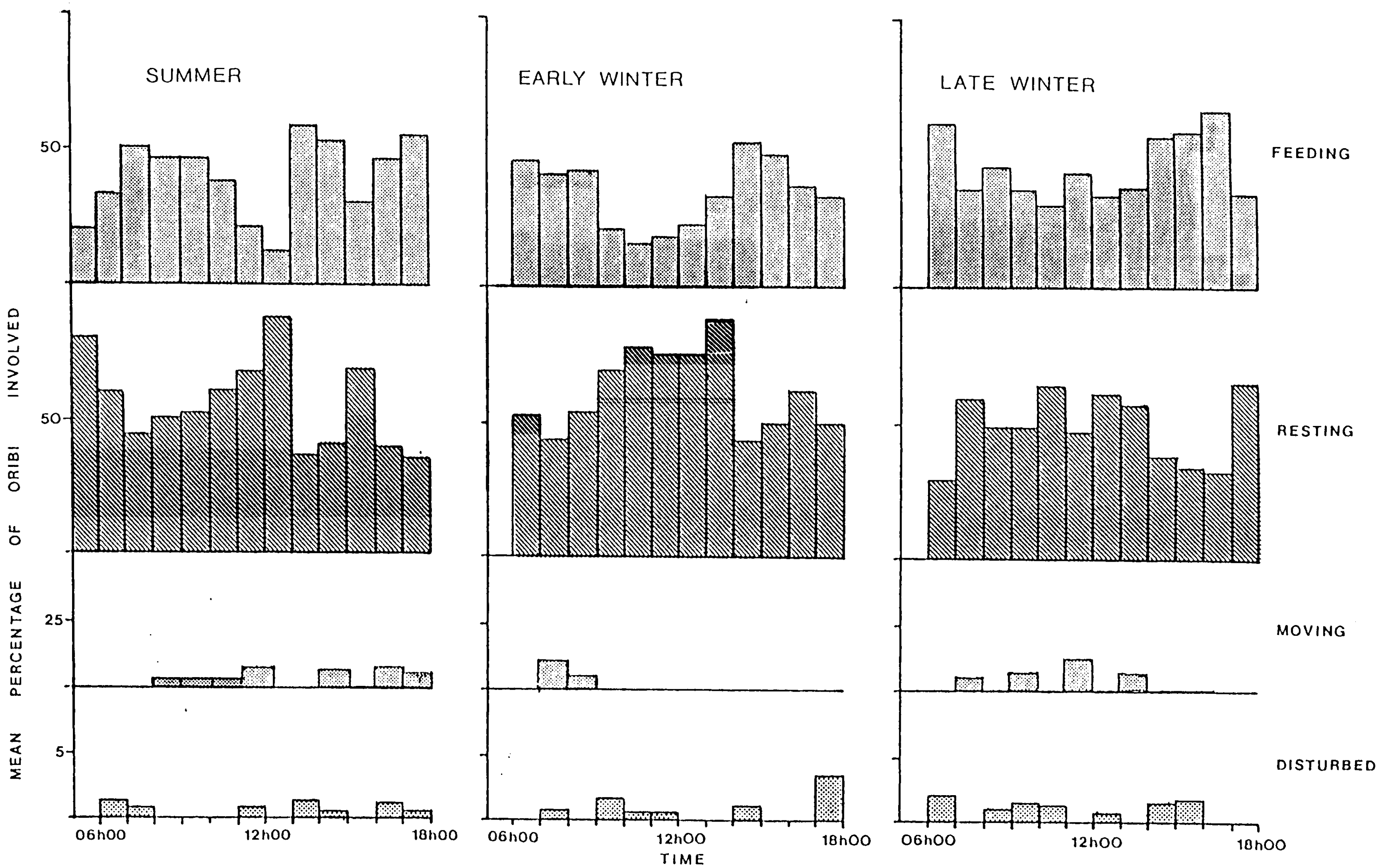

Figure 13: Seasonal activity of oribi in the Golden Gate Highlands National Park, Orange Free State from March 1982 to November 1983, summer (October to March), early winter (April to June) and late winter (July to September).

DISTURBANCE

This category was also included on the premise that other ungulates were disturbing oribi during their routine activities. Of all the observed disturbances (n = 30) during the study period only two were caused by other ungulates. In both instances the instigator was a black wildebeest. The rest of the 30 recorded disturbances were all the result of human activities, particulary people walking through the veld and cars disturbing animals feeding close to the road.

In the summer season the mean percentage of oribi disturbed for any hour of the day was 2 percent. The peaks in disturbance were from 06h00 to 08h00, from 13h00 to 14h00 and from 16h00 to 18h00. For the early winter season the percentage of oribi disturbed for any hour of the day is 3 percent. Besides a major peak in disturbances from 09h00 to 12h00 a minor peak in disturbance also occurs form 17h00 to 18h00. The first-mentioned major peak in disturbance occurs as a result of there being pronounced human activity during that period, particularly due to field hikes by visiting school groups.

For the late winter season the mean percentage of oribi disturbed during any hour of the day was 4 percent (Fig. 13). The peaks occurred from 06h00 to 07h00, from 08h00 to 11h00 and from 14h00 to 16h00. The periods from 06h00 to 07h00 and from 14h00 to 16h00 coincide with feeding (active) peaks and the period from 08h00 to 11h00 coincides with peak periods of human activity during the early and late winter. The peak from 08h00 to 11h00

Table 9: Temperature ranges (°C) at which oribi activities peaked during different seasons in the Golden Gate Highlands National Park, Orange Free State from March 1982 to December 1983.

Summer

ACTIVITY	TEMPERATURE RANGES AT WHICH ACTIVITIES PEAK (°C)					
	October	November	December	January	February	March
Feeding	16 - 20	21 - 25	26 - 30	-	21 - 25	21 - 25
Resting	21 - 25	16 - 20	16 - 20	-	21 - 25	21 - 25

Early Winter

ACTIVITY	TEMPERATURE RANGES AT WHICH ACTIVITIES PEAK		
	April	May	June
Feeding	16 - 20	11 - 15	16 - 20
Resting	16 - 20	11 - 15	11 - 15

Late Winter

ACTIVITY	TEMPERATURE RANGES AT WHICH ACTIVITIES PEAK		
	July	August	September
Feeding	16 - 20	11 - 15	16 - 20
Resting	11 - 15	11 - 15	11 - 15

is absent from the summer season probably because human activities are more concentrated during the early morning and late afternoon then. According to Viljoen (1982) humans in immediate vicinity of oribi greatly increase oribi activity.

EFFECTS OF CLIMATE ON ORIBI ACTIVITY

Temperature

The air temperature ranges were recorded together with oribi activities. These temperatures were then compared with oribi activities for all three seasons and the results are given in Table 9.

When contingency tables of oribi activity versus temperature ranges are compared for each month of the year the only significant differences were those for May, July, November and August (Chi-square = 19,2; $p < 0{,}05$; df = 9 : Chi-square = 18,4; $p < 0{,}05$; df = 9 and Chi-square = 20,1; $p < 0{,}05$; df = 9: Chi-square = 22; $p < 0{,}05$; df = 9 respectively). If the means of those temperatures for months other than May, July and November are tested with the null hypothesis that no significant differences exist between the mean temperature at which feeding and resting activity peaks, then in all cases the null hypothesis must be accepted at the 5 percent level. (January, no observations: February, Chi-square = 3,0; $p > 0{,}05$; df = 9: March, Chi-square = 7,6; $p > 0{,}05$; df = 9: April, Chi-square = 12,6; $p > 0{,}05$; df = 9: June, Chi-square = 15,9; $p > 0{,}05$; df = 9). It is therefore concluded that the direct effect of temperature on oribi activity is of no significance, however the decrease in temperature does bring about a decrease in the quality and quantity of food available (Mentis 1978, Rowe-Rowe and Scotcher 1986).

According to Jarman and Jarman (1973) low temperatures result in impala lying down early in the morning, and Hartmanns's zebra spend less time grazing under such conditions (Joubert 1971). Viljoen (1982) found that temperatures as low as -6°C did not affect oribi activities. He further found that in summer oribi had an inactive period during the heat of the day (13h00 - 15h00).

Wind and aspect

When oribi activity was compared with wind speed for each season, there was a significant change in activity only during the late winter season (July to September) (Chi-square = 52,6; $p<0,01$, df = 30). A regression analysis of oribi activity and inactivity versus wind speed indicates that both are negative regressions (active: $r = -0,73$ and inactive $r = -0,66$) (Fig. 14). A t-test applied to the correlation coefficients (r) mentioned is insignificant ($t = 0,0075$; $p > 0,05$; df = 16). If however oribi are affected by windspeed inactivity should show a positive regression. The insignificant difference in regressions of activity and inactivity proves conclusively that oribi are unaffected by windspeed.

The comparison of aspect of slope on which oribi were observed versus wind direction proved statistically significant (Chi-square 136,7; $p < 0,05$: df = 28). Of the 1 047 observations of

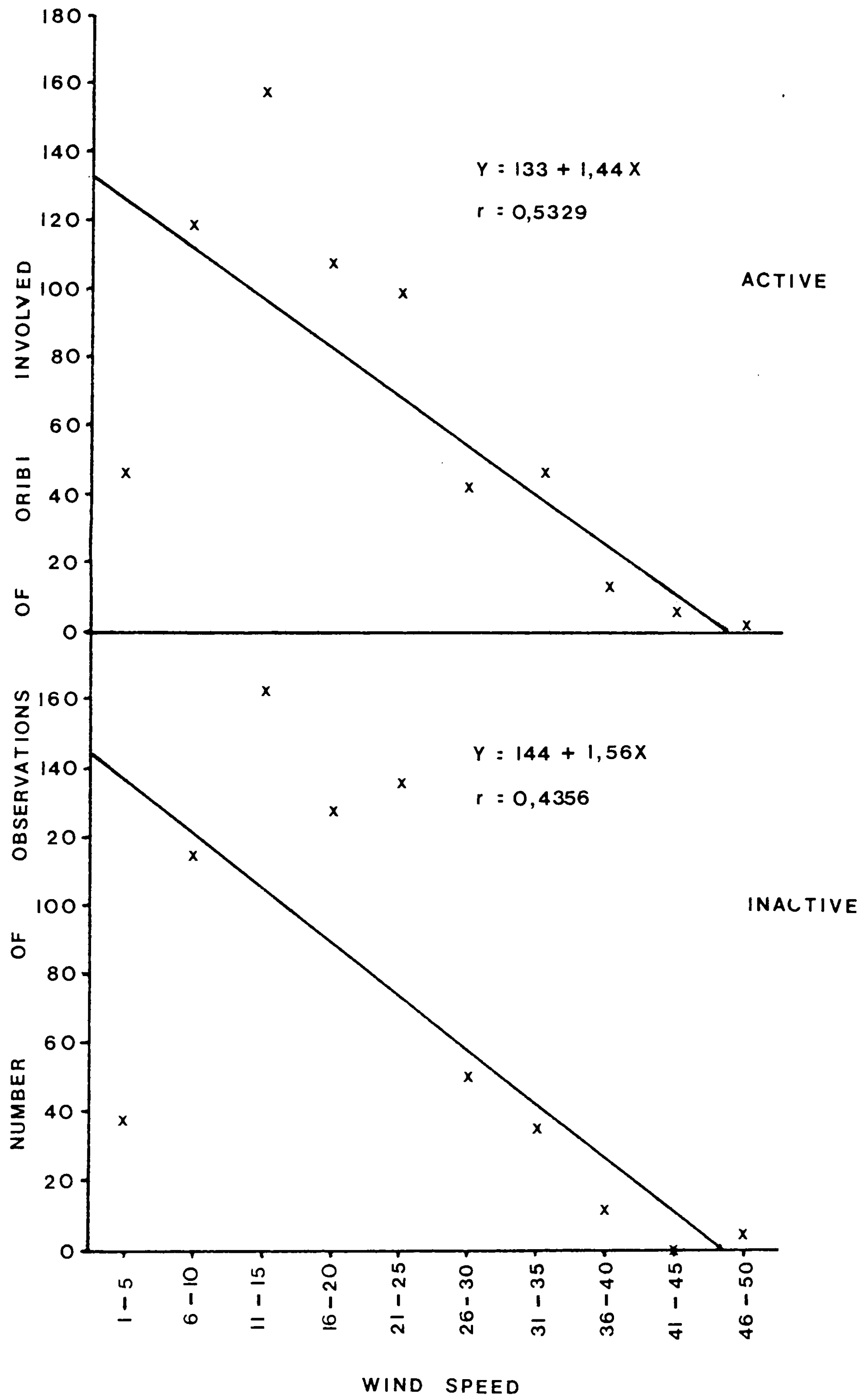

Figure 14: The negative relationship between wind speed (km/h) and oribi activity in the Golden Gate Highlands National Park, Orange Free State as measured from March 1982 to November 1983.

Table 10: Comparison of percentage cloud cover and the percentage of oribi involved in feeding and resting activities in the Golden Gate Highlands National Park, Orange Free State, from March 1982 to December 1983.

CLOUD COVER	PERCENTAGE OF ORIBI FEEDING	PERCENTAGE OF ORIBI RESTING	OTHER ACTIVITIES
No Cover	43,4	49,0	7,6
1 - 25	44,8	53,8	1,4
26 - 50	27,7	66,0	6,3
51 - 75	31,3	58,3	10,4
76 - 100	42,9	41,3	15,8

oribi in the field in which wind direction was noted, the wind direction was westerly in 86 percent of cases and in 11 percent of cases an easterly wind was blowing. Of all the observations of aspect of slope on which oribi were observed, 52 percent of observations were on northerly aspects and 27 percent on north-easterly aspects. From these results it is clear that the oribi are not affected by wind direction if they have northern aspects available. Viljoen (1982) maintains that strong or cold winds have no noticeable effect on oribi activities except that the animals became more easily disturbed while active. He, however, maintains that a strong cold wind results in less time spent being active by oribi. In the light of the findings of both this study and that of Viljoen (1982) and the fact that several ungulate species are affected by wind or cold or a combination of the two (Joubert 1971 and Jarman and Jarman 1973) it appears that oribi are negatively affected by very strong winds. Mentis (1978) also found that the number of oribi seen per vehicle count declined as the wind speed increased. This probably explains the selection of north and north easterly aspects as particularly during winter the chill factor will be less on such aspects. Norton (1980) found that weather conditions have little effect on klipspringers activity.

When the percentage of oribi feeding and the percentage of oribi resting were compared with the percentage cloud cover it was found that where clear skies prevailed (no cloud cover) resting and feeding occupied similar percentages (Chi-square = 0,14; df = 12; $p > 0{,}05$). A similar situation was found with completely overcast skies (cloud cover = 4) (Chi-square = 5,6; df = 12;

$p > 0,05$). However an increase in time spent resting by the oribi occurred from 1 percent to 75 percent cloud cover (Table 10). Both times that oribi were observed during snowstorms they were sheltering in the lee of rocks or tall grass.

Viljoen (1982) found rain to be the single most important climatic factor influencing oribi activity. It was impossible to observe the oribi at Golden Gate Highlands National Park during thunder showers owing to poor visibility. Impala stop feeding and face away from rain (Jarman and Jarman 1973). Viljoen (1982) maintains that oribi lie down when a shower passes over them. From the results of this study it can be concluded that an increase in cloud cover up to 75 percent brings about a reduction in the percentage of oribi active in the Golden Gate Highlands National Park.

CHAPTER 6

HABITAT UTILIZATION BY ORIBI

Introduction

The oribi that were re-introduced to the Golden Gate Highlands National Park were free to roam over the whole area, however they only established themselves in a small area in the east of the Park. It is assumed that oribi will select optimal habitat where present in the Park and of oribi in similar veld types and climatic influences elsewhere. I will endeavour to categorize optimal habitals, and elucidate the prime factors affecting the daily existence of oribi and ultimately contributing to their well-being.

In the current study the oribi population was introduced into an area with several different habitats enabling establishment and habitat orientation to be defined. The area inhabited is subjected to extremes of climate and varying degrees of human interference. Besides the above factors the area was subjected to intensive agricultural practices for several decades before being proclaimed a National Park. The area, situated as it is in the foothills of the Maluti Mountains, provides extremes of soils, topography and vegetation. These factors contribute to the area's sensitivity to the slightest ecological imbalance.

Most of the ungulates introduced to the Golden Gate Highlands National Park were introduced because of historical evidence of their occurrence in the area (Penzhorn 1971 and Strÿbis 1974).

Change of habitat could have placed these ungulates in habitat that is marginal in the case of sedentary species or seasonally marginal in the case of non-sedentary species placing greater stress on the animals and thus affecting their survival (Eltringham 1979).

The initial hypothesis that oribi were being adversely affected by other ungulates in the Golden Gate Highlands National Park was used as a basis for the investigation.

Methods

From January to March 1982 the whole of the Golden Gate Highlands National Park was traversed systematically on foot to obtain data pertaining to distribution and numbers of oribi in the study area. The area inhabited by oribi was thus confined to the Saaiplaat west, Saaiplaat east, Oorbietjie Kom and Wildebees Hoek (Fig. 7).

With the general distribution of oribi and factors affecting their ecology in mind a data sheet was designed to record data contributing to the general well-being of oribi in the Golden Gate Highlands National Park. To fulfil the objectives of this part of the study it was necessary to determine the extent of covariance between the occurrence of those animal species, their relationships and each of the habitat factors considered to have a possible influence on a specific animal's location. Of the various possible approaches to the collection of data, the one selected was that of the systematic sampling of relevant habitats and the recording of site attributes and climatic influences were recorded wherever oribi were located. This approach provides a direct insight into an animal's selection of that habitat which is directly available. A systematic search pattern soon revealed areas frequented by oribi and observations were made over large areas from certain vantage points.

At the time of the study, the total area inhabited by oribi in the Golden Gate Highlands National Park was 472 ha in extent, as determined with a polar compensating planimeter (Fig. 7).

ASPECT OF SLOPE

The aspect of slope was noted with each observation and eight points of the compass were used viz. N, NE, E, SE, S, SW, W and NW.

DISTANCE FROM ROADS

The area in the Golden Gate Highlands National Park inhabited by oribi is also the area in the Park that is traversed by roads. These roads are the only ones in the Park that tourists can use. Most visitors to the Park use these roads either by vehicle or on foot at some time during their stay. To establish whether or not oribi displayed any reaction, positive or negative, to the roads and their associated traffic, the following road-linked use-categories were subjectively distinguished for oribi:-

1 : 0 - 50 m from the road

2 : 51 - 100 m from the road

3 : 101 - 150 m from the road

DISTANCE FROM WATER

All available surface water within the oribi distribution area was mapped (Fig. 18 pg. 120) and the distance from nearest water was recorded for each observation of oribi, active or inactive. These data were used to establish whether oribi were dependent on surface water. Thus the possible role played by water in oribi habitat selection was studied. These data were also used to determine the water requirements of oribi in the Golden Gate Highlands National Park. The water-related categories recorded were:-

1 : 0 - 30 m from surface water

2 : 31 - 60 m from surface water

3 : >60 m from surface water

MORPHOLOGICAL UNITS

This variable was incorporated into the habitat preference data to determine if oribi in the Golden Gate Highlands National Park had a preference for a specific spatial position in their immediate environment. The study area has several erosion ditches along the drainage lines, the depth of these being as much as 5 m in places. The ditches were included in the landscape position categories to determine whether they were utilized by oribi. The following landscape categories were distinguished:-

E : Erosion ditch

B : Bank of erosion ditch to a distance of 5 m away from bank

L : Lower slope

U : Upper slope

F : Flat plain

GRADIENT OF SLOPE

The gradient of the locality occupied by a given oribi was noted for each observation. The gradients were measured in the field by the use of a simple instrument made from a protractor, a ruler and a plumbline. The following gradient categories were used:-

A : 0° to 15°

B : 16° to 30°

C : 31° to 45°

D : 46° to 60°

E : > 60°

MICROHABITAT

The area of the Golden Gate Highlands National Park inhabited by oribi includes several old lands. Some of these old lands were sown with pasture grasses such as Eragrostis curvula and other species and had been left since the area became a National Park in 1963. The varying stages of plant succession have resulted in distinct vegetational differences between the old lands and natural grassland (Chapter 4). The verges of the old lands, water courses and the interfaces of the various microhabitat types were classified as follows:

O : Old land

V : Old land verge

G : Natural grassland

B : Banks of water courses

E : Erosion ditches

H : Hollows, sources of erosion ditches and water courses (stream beds)

TRAMPLING

The following categories were used to measure different degrees of trampling in the areas inhabited by the oribi.

0 : No trampling; uniform open patches up to 50 mm in diameter

1 : Uniform open patches 51 to 100 mm in diameter

2 : Uniform open patches 101 to 200 mm in diameter

3 : Uniform open patches > 200 mm or no plant cover at all

STRUCTURE OF THE GRASS LAYER

This variable referred to the height of the grass found in the vicinity of oribi (Fig. 15).

The results of the habitat preference study were drawn from a relatively small area of the Golden Gate Highlands National Park and only a single animal species is involved. It is this fact that made it unnecessary to use advanced multivariate analysis to evaluate the available data. The area inhabited by oribi was divided in 472 grid squares of 100 m x 100 m = 1 ha each.

Of these grid squares each was categorized according to its aspect, distance from the nearest road, distance from water, landscape position and gradient. The percentage of the total grid squares for each category in each habitat factor (aspect, distance from nearest road, distance from water, landscape position, gradient) was used to determine an expected value with the null hypothesis that the oribi exhibit no selection for any categories of the various habitat factors e.g. 47 grids (10 percent) of the total 472 grids can be classified as flat plains. If oribi in the Golden Gate Highlands National Park exhibit no selection (either positive or negative) for flat plains than one would expect that 10 percent of all 1 223 observations would be of oribi occurring on flat plains. If oribi show a positive selection for flat plains significantly more than 10 percent of observations would be on flat plains. Conversely less than 10 percent of observations would imply negative selection for flat plains here evident as a negative O - E (Observed-Expected) value (Sokal and Rohlf 1969).

Results and Discussion

ASPECT OF SLOPE

The results of the observations of the actual number of observations of oribi on different slopes when compared with the expected number based on a random distribution are given in Table 11.

It can be seen from the Observed-Expected (O - E) values that the oribi have a positive selection for flat areas, north and north-eastern facing slopes. A negative selection exists for all other available slopes in the area. All the Chi-square statistics for each aspect were significant ($p < 0,05$) except for that for the

Table 11: Chi-square tests (χ^2) for significance of the observations of oribi on different slopes when compared with the expected number (random distribution) of observations based on the relative areas of each slope in the Golden Gate Highlands National Park, Orange Free State from March 1982 to December 1983.

ASPECT	NUMBER OF GRIDS	PERCENTAGE OF TOTAL GRIDS	NUMBER OF OBSERVATIONS OF ORIBI IN GRIDS (O)	EXPECTED NUMBER OF OBSERVATIONS (E)	O - E OBSERVED-EXPECTED	CHI-SQUARE VALUE	p - VALUE	df
Flat Plain	20	4,0	132	49	83	11,86	$< 0,05$	1
N	165	34,8	568	426	142	6,88	$< 0,05$	1
NE	63	13,1	297	160	137	10,83	$< 0,05$	1
E	33	6,8	27	83	- 56	6,15	$< 0,05$	1
SE	23	4,9	24	60	- 36	4,65	$< 0,05$	1
S	13	2,8	3	34	- 31	5,32	$< 0,05$	1
SW	22	4,7	35	58	- 23	3,02	$> 0,05$	1
W	45	9,5	57	117	- 60	5,55	$< 0,05$	1
NW	88	18,4	80	225	-145	9,67	$< 0,05$	1
Total	472	-	1223	-	-	62,93	-	-

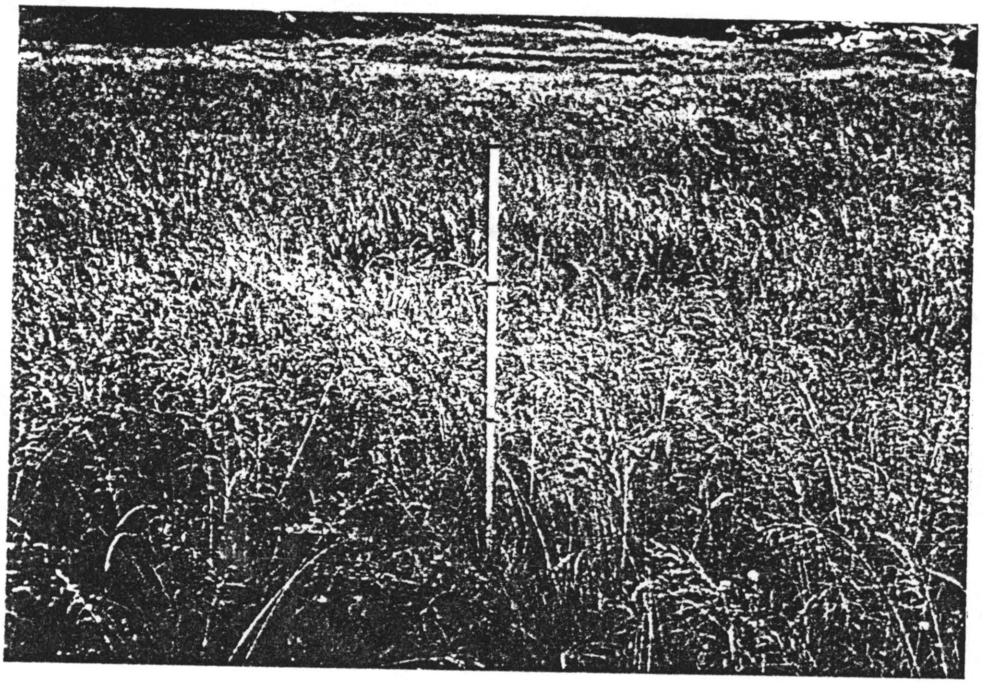

Figure 15: Technique used to measure the structure of the grass stratum of oribi habitat in the Golden Gate Highlands National Park, Orange Free State from March 1982 to December 1983.

DISTANCE FROM ROADS

A negative selection of oribi for grid squares closer than 200 m (Classes 1,2 & 3) to the roads is noticeable as is evident from the negative signs of the differences between observed and expected values. The Chi-square values for each row are significant and are larger than the critical value of 3,84 where $p < 0,05$; df = 1. A significant Chi-square value of 36,02, larger than the critical value of 3,84 ($p < 0,05$; df = 1) and the positive difference between observed and expected values indicate the high selection of oribi for areas further than 150 m away from roads (Table 12).

DISTANCE FROM WATER

The water requirements of oribi in the Golden Gate Highlands National Park are discussed in detail in Chapter 8. The distance of oribi from water was included in all observations to determine if permanent or semi-permanent surface water played any role in the oribi's selection of habitat. The results are as follows:

It appears that oribi avoid areas within 60 m of surface water. Table 13 shows the negative selection for areas less than 60 m from surface water (Classes 1 & 2) by the negative difference of the difference between the observed and expected values and the significant Chi-square values (Chi-square = 14,8; $p < 0,05$; df = 1 and Chi-square = 12,9; $p < 0,05$; df = 1) respectively.

Table 12: Chi-square tests of significance on observations of oribi at varying distances (metres) away from the roads in the Golden Gate Highlands National Park, Orange Free State from March 1982 to December 1983 to show oribi avoidance of roads.

DISTANCE AWAY FROM ROAD	NUMBER OF GRIDS	PERCENTAGE OF TOTAL NUMBER OF GRIDS	NUMBER OF OBSERVATIONS OF ORIBI IN GRID (O)	EXPECTED NUMBER OF OBSERVATIONS (E)	O - E: OBSERVED-EXPECTED VALUE	CHI-SQUARE VALUE	p - VALUE	df
0 - 50 m	136	28,4	29	347	-318	17,07	$< 0,05$	1
51 - 100 m	100	20,8	36	254	-218	13,68	$< 0,05$	1
101 - 150 m	92	18,7	51	229	-178	11,76	$< 0,05$	1
$>$ 150 m	154	32,1	1107	393	714	36,02	$< 0,05$	1
Total	472	-	1223	-	-	78,53	-	-

The positive difference between observed and expected value for observations of oribi on areas more than 60 m from surface water indicates a positive selection for these areas. The Chi-square value of 15,8 is also significant in this regard ($p < 0,05$; df = 1) (Table 13).

MORPHOLOGICAL UNITS

The results of the observations of oribi in either upper, lower or flat areas of the landscape are given in Table 14.

A positive selection is shown by the oribi for flat areas and upper landscapes (Table 14) i.e. the difference between the observed and expected values is positive. The Chi-square values are also significant for flat areas and upper landscapes (Chi-square = 18,7; $p < 0,05$; df = 1 and Chi-square = 14,1; $p < 0,05$; df = 1 respectively). The oribi show a negative selection for lower landscapes (lower slopes) and the Chi-square value of 19,4 is significant ($p < 0,05$; df = 1).

GRADIENT OF SLOPE

The gradient of each of the 472 grid squares covering the oribi habitat was determined using the known height difference between two contour lines on the topographical map of Golden Gate. The tangent of the gradient (angle of slope) is equal to the height difference between adjacent contour lines divided by the horizontal distance between the lines. The observed values are compared with the expected values statisticaly in Table 15.

Table 13: Chi-square tests (χ^2) of significance of the observations of oribi at varying distances from surface water in the Golden Gate Highlands National Park, Orange Free State from March 1982 to December 1983.

DISTANCE (m) AWAY FROM SURFACE WATER	NUMBER OF GRIDS	PERCENTAGE OF TOTAL NUMBER OF GRIDS	NUMBER OF OBSERVATIONS OF ORIBI IN GRID (O)	EXPECTED NUMBER OF OBSERVATIONS (E)	O - E OBSERVED-EXPECTED VALUE	CHI-SQUARE VALUE	p - VALUE	df
0 - 30 m	100	21,0	19	257	-238	14,8	$< 0,05$	1
31 - 60 m	82	17,9	28	219	-191	12,9	$< 0,05$	1
$>$ 60 m	290	61,0	1176	746	430	15,78	$< 0,05$	1
Total	472	-	1223	-	-	43,4	-	-

Table 14: Chi-square tests (χ^2) for significance of observations of oribi in different morphological units in the Golden Gate Highlands National Park, Orange Free State from March 1982 or December 1983.

MORPHOLOGICAL UNIT	NUMBER OF GRIDS	PERCENTAGE OF TOTAL NUMBER OF GRIDS	NUMBER OF OBSERVATIONS OF ORIBI IN GRID (O)	EXPECTED NUMBER OF OBSERVATIONS (E)	O - E OBSERVED-EXPECTED	CHI-SQUARE VALUE	p - VALUE	df
Flat	14	3,3	158	40	118	18,7	$<$ 0,05	1
Lower slopes	222	46,9	109	574	-465	19,4	$<$ 0,05	1
Upper slopes	236	49,8	956	609	347	14,1	$<$ 0,05	1
Total	472	-	1223	-	-	52,2	-	-

From the observations it is evident that there is no significant positive selection for gradients of less than 15° (Chi-square = 3,74; $p > 0,05$; df = 1) but that negative selection exist for gradients of more than 15° (B and C) as the difference between the observed minus expected values is negative. This negative selection of gradients of more than 15° is also significant (Chi-square = 6,02; $p < 0,05$; df = 1 and Chi-square = 5,03; $p < 0,05$; df = 1 respectively).

MICROHABITAT

The results of the selection of available microhabitats by the oribi are presented in Table 16.

The oribi in the Golden Gate Highlands National Park show a significant positive selection for old lands (Chi-square = 22,3; $p < 0,05$; df = 1). Significant avoidance exists with regard to grasslands and hollows as difference between the observed minus expected value is negative (Chi-square = 12,2; $p > 0,05$; df = 1 and Chi-square = 3,9; $p > 0,05$; df = 1 respectively). This is interesting to note particularly as oribi are primarily a grassland species (Fig. 12). No significant selection was evident for erosion ditches and the banks of those ditches (Chi-square = 1,7; $p > 0,05$; df = 1 and Chi-square = 2,2; $p > 0,05$; df = 1 respectively). The Chi-square value testing for the positive selection of oribi for the verges of old lands is significant (Chi-square = 20,5; $p < 0,05$; df = 1).

Table 15: Chi-square tests (χ^2) for significance on observations of oribi in different gradient categories in the Golden Gate Highlands National Park, Orange Free State from March 1982 to December 1983.

GRADIENT CATEGORY	NUMBER OF GRIDS	PERCENTAGE OF TOTAL NUMBER OF GRIDS	NUMBER OF OBSERVATIONS OF ORIBI IN GRID (O)	EXPECTED NUMBER OF OBSERVATIONS (E)	O - E OBSERVED-EXPECTED	CHI-SQUARE VALUE	p - VALUE	df
0 - 15°	381	80,2	1098	981	117	3,74	$> 0,05$	1
16° - 30°	77	16,7	118	204	- 86	6,02	$< 0,05$	1
31° - 45°	14	3,1	7	38	- 31	5,03	$< 0,05$	1
Total	472	-	1223	-	-	14,79	-	-

TRAMPLING

The results of the microhabitat studies with regard to trampling are given in Table 17. From Table 17 it is evident that oribi in the Golden Gate Highlands National Park show no significant selection for areas where trampling consists of open areas of less than 50 mm (category 0) (Chi-square = 2,4; $p > 0,05$; df = 1). Based on the positive value of the difference between observed minus expected values and the Chi-square value (Chi-square = 20,2; $p < 0,05$, df = 1), oribi in the Golden Gate Highlands National Park show a significant positive selection for areas where category 1 trampling occurs (51 - 100 mm open areas).

Where category 2 and 3 trampling occurs (101 - 200 mm open areas and > 200 mm open areas respectively) in the area inhabited by oribi the oribi show a significant negative selection (negative observed and expected difference between values) and Chi-square value 5,5; $p < 0,05$; df = 1 and Chi-square value 4,2; $p < 0,05$; df = 1 respectively).

STRUCTURE OF THE GRASS LAYER

The structure of the vegetation of the Golden Gate Highlands National Park was the only habitat factor that was subject to short-term change. Two periods in the year, viz. October to June and July to September were distinguished as having noticeable height variation of the grass layer from season to season.

Table 16: Selection of available microhabitats in the Golden Gate Highlands National Park, Orange Free State from March 1982 to December 1982 by oribi and the Chi-square tests for significance of observations.

MICROHABITAT CATEGORY	NUMBER OF GRIDS	PERCENTAGE OF TOTAL NUMBER OF GRIDS	NUMBER OF OBSERVATIONS OF ORIBI IN GRID (O)	EXPECTED NUMBER OF OBSERVATIONS (E)	O - E OBSERVED-EXPECTED	CHI-SQUARE VALUE	p - VALUE	df
O : Old land	70	14,9	483	182	301	22,3	< 0,05	1
V : Old land verge	9	1,8	118	22	96	20,5	< 0,05	1
G : Natural grassland	369	78,1	577	955	-378	12,2	< 0,05	1
B : Banks of water courses	10	2,2	36	27	9	1,7	> 0,05	1
E : Erosion ditches	5	1,0	5	13	- 8	2,2	> 0,05	1
H : Hollows sources of erosion ditches and water courses	9	1,8	4	23	- 19	3,9	< 0,05	1
Total	472	-	1223	-	-	62,9	-	-

From October to June oribi show a significant negative selection (negative difference between observed and expected values) for vegetation of both short ($< 0,5$ m) and tall (> 1m) grass height (Chi-square = 12,9; $p < 0,05$; df = 1 and Chi-square = 9,2; $p < 0,05$; df = 1 respectively). Oribi show a significant positive selection for vegetation of medium height (0,5 - 1 m) for the same period (Chi-square = 15,9; $p < 0,05$; df = 1). From July to September, however, when oribi utilize more available short vegetation though they still show some negative selection to short vegetation but the phenomenon is not significant (Chi-square = 0,7; $p > 0,05$; df = 1). The negative selection for tall vegetation and positive selection for vegetation of medium height are retained and are both significant for $p < 0,05$; df = 1 (Chi-square = 3,8 and Chi-square = 4,7 respectively) (Table 18).

The preferred habitat of oribi in the Golden Gate Highlands National Park can be summed up briefly as an area which is flat or which has a gradient of less than 15° and having a northerly or north-easterly aspect. Oribi prefer upper slopes and avoid lower slopes. There is also an independence of surface water (during daylight hours) as oribi were never observed drinking in the Golden Gate Highlands National Park. Oribi avoid roads and will select old lands or verges of old lands as a microhabitat if avaliable. The selection of the latter microhabitat could, however, be coincidental in that old lands usually have gradients less than 15° and at Golden Gate happen to occur in places that

Table 17: The occurrence of oribi in areas of varying degrees of trampling and the relevant statistical tests for significant selection of those occurrences in the Golden Gate Highlands National Park, Orange Free State from March 1982 to December 1983.

TRAMPLING CATEGORY	NUMBER OF GRIDS	PERCENTAGE OF TOTAL NUMBER OF GRIDS	NUMBER OF OBSERVATIONS OF ORIBI IN GRID (O)	EXPECTED NUMBER OF OBSERVATIONS (E)	O - E OBSERVED-EXPECTED	CHI-SQUARE VALUE	p - VALUE	df
0 : 0 - 50 mm	432	91,4	1038	1118	- 80	2,4	> 0,05	1
1 : 51 - 100 mm	17	3,6	178	44	134	20,2	< 0,05	1
2 : 101 - 200 mm	15	3,3	5	40	- 35	5,5	< 0,05	1
3 : > 200 mm	8	1,7	2	21	- 19	4,2	< 0,05	1
Total	472	-	1223	-	-	32,3	-	-

would also suit oribi topographically. The slightly trampled areas selected by oribi could reflect their selectivity for the areas when feeding. It is also clear that oribi prefer a medium grass height i.e. 0,5 m - 1 m in the Golden Gate Highlands National Park. At the time of this study the Golden Gate Highlands National Park was subjected to a biennial burning program. The area inhabited by oribi was included in its entirety in one half of the Park so the oribi habitat was subjected to a burn every two years.

Due to the above mentioned management practice it was impossible to establish a preference for burnt areas as the break between burnt and unburnt areas was remote from the nearest oribi home range over inaccessible terrain.

The findings of this chapter corroborate the classification of oribi as grassland species (Jarman 1974) and it is important to note that both Oliver, Short and Hanks (1978) and Rowe-Rowe (1983) found that oribi on the Highmoor State Forest Land and the Giants Castle Nature Reserve were similarly selective particularly with regard to gradient of slope. Viljoen (1973) also recognizes oribi as a grassland species and Viljoen (1982) reports oribi presence confined to slopes of between 1° and 20°. Several authors report the selectivity of oribi for burnt veld and it is unfortunate that the fire management practice as it was in 1982 and 1983 did not lend itself to produce supportive evidence of this observation.

Table 18: The selection of various height variations in grass by oribi in the Golden Gate Highlands National Park, Orange Free State and the Chi-square tests for significance of those selections.

VEGETATION STRUCTURE	NUMBER OF GRIDS	PERCENTAGE OF TOTAL NUMBER OF GRIDS	NUMBER OF OBSERVATIONS OF ORIBI IN GRID (O)	EXPECTED NUMBER OF OBSERVATIONS (E)	O - E OBSERVED-EXPECTED	CHI-SQUARE VALVE	p - VALUE	df
October to June								
Short grass (< 0,5m)	341	72,3	420	485	- 65	12,9	< 0,05	1
Medium grass (0,5 - 1,0m)	66	14,0	247	94	153	15,88	< 0,05	1
Tall grass (>1,0m)	65	13,7	4	92	- 88	9,17	< 0,05	1
Total	472	-	671	-	-	27,95	-	-

VEGETATION STRUCTURE	NUMBER OF GRIDS	PERCENTAGE OF TOTAL NUMBER OF GRIDS	NUMBER OF OBSERVATIONS OF ORIBI IN GRID (O)	EXPECTED NUMBER OF OBSERVATIONS (E)	O - E OBSERVED-EXPECTED	CHI-SQUARE VALVE	p - VALUE	df
July to September								
Short grass (< 0,5m)	374	79,2	422	437	- 15	0,7	> 0,05	1
Medium grass (0,5 - 1,0m)	80	16,9	130	93	37	3,8	< 0,05	1
Tall grass (>1,0m)	18	3,8	0	22	- 22	4,7	< 0,05	1
Total	472	-	552	-	-	9,2	-	-

CHAPTER 7

INTERSPECIFIC RELATIONSHIPS

Introduction

Oribi in the Golden Gate Highlands National Park share their habitat with blesbok *Damaliscus dorcas phillipsi*, springbok *Antidorcas marsupialis*, mountain reedbuck *Redunca fulvorufula*, grey rhebuck *Pelea capreolus*, black wildebeest *Connochaetes taurinus*, eland *Taurotragus oryx* and Burchell's zebra *Equus burchelli*. Generally interactions between herbivores are limited (Estes 1967) but interactions between species can be viewed as either positive, neutral (Estes 1967) or negative (Leuthold 1977).

The mountain reedbuck, grey rhebuck and to a large extent the black wildebeest bulls at Golden Gate Highlands National Park are sedentary. The mountain reedbuck restrict themselves to mountainous terrain but the grey rhebuck and black wildebeest bulls share their habitat with oribi. The grey rhebuck, black wildebeest bulls and blesbok are often found in the proximity of oribi. The Research and Information Division of National Parks Board staff at Golden Gate suspected that particularly the blesbok and black wildebeest may have a detrimental effect on oribi owing to the aggressive behaviour of both blesbok and black wildebeest (Van Wyk *pers comm*)*.

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Methods

During periods in which oribi were under observation in the current study it was noted on a data sheet if any individual or group of animals (other ungulates) approached within a specific distance of a given oribi. A set of hypothetical concentric circles with the following radii : 25 m (code 1), 50 m (code 2), 100 m (code 3) and 200 m (code 4) were created around a given oribi. The maximum distance of 200 m was selected as it became difficult to judge distances greater than 200 m. It was noted which species were involved, the number of animals in a group involved, the distance circle (area) in which the animals were (codes 1, 2, 3 or 4) and the reaction of oribi to the "intruders" and of the other oribi to one another. Reactions recorded were active aggression (A), indifference (B) or avoidance behaviour (C). The observations were repeated every 10 minutes as long as the animals concerned were within 200 m of one another.

All other data regarding oribi reaction to humans, horses and predators were recorded with the aid of rangers. The rarity of predators made oribi reactions to them difficult to observe. Visual data concerning predators and oribi were thus collected from rangers involved in activities in areas where oribi occurred.

Results and Discussion

Reaction To Other Ungulates

Direct comparison of the number of observations of each ungulate species within each concentric circle is impossible because of the varying area of each circle. Contingency tables were drawn up to determine if any significant differences occurred between the observations and expected observations of each species within each circle (Retief pers. comm.)*

The null-hypothesis that no difference occurs between circles 1 (0-25 m) and 2 (26-50 m) can be rejected (Chi-square = 13,28; $p < 0,05$; df = 4) (Table 19). Looking at the column totals, however, only the springbok and Burchells zebra exhibit a difference from circle 1 to circle 2 (blesbok: Chi-square value = 0,59; $p > 0,05$; df = 1; grey rhebuck: Chi-square value = 2,35; $p > 0,05$; df = 1; springbok: Chi-square value = 3,93; $p < 0,05$; df = 1; Burchells zebra: Chi-square value = 4,29; $p < 0,05$; df = 1) and black wildebeest: Chi-square valve = 2,12; $p > 0,05$; df = 1.

The Chi-square total for the contingency (Table 20) indicates a significant difference between observed data from circles 1 (0-25 m) and 3 (51-100 m) (Chi-square = 29,24; $p < 0,05$; df = 6). The only individuals to show a significant interaction with oribi is the springbok (Chi-square = 19,91; $p < 0,05$; df = 1). The difference between observed and expected values is positive indicating a positive interaction between oribi and springbok (Table 20).

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Table 19: Contingency table testing the observed versus expected number of observations of individuals of several other ungulates found in hypothetical concentric circles, circle 1 (0-25 m) and circle 2 (26-50 m) away from oribi in the Golden Gate Highlands National Park, Orange Free State (March 1982 to December 1983) to show possible positive or negative interactions.

	CIRCLE	BLESBOK	GREY RHEBUCK	SPRINGBOK	BLACK WILDEBEEST	BURCHELLS ZEBRA	ROW TOTAL
Observed value	1	23	13	36	35	5	112
	2	40	31	31	35	19	156
	Total	63	44	67	70	24	268
Expected value	1	26	18	28	29	10	112
	2	37	26	39	41	14	156
	Total	63	44	67	70	24	268
Chi-square value $\frac{(O - E)^2}{E}$	1	0,35	1,39	2,29	1,24	2,50	7,77
	2	0,24	0,96	1,64	0,88	1,79	5,51
Column total		0,59	2,35	3,93	2,12	4,29	13,28

(Chi-square critical value = 9,49; $p < 0,05$; df = 4 and Chi-square critical value = 3,84; $p < 0,05$; df = 1)

Table 20: The results and statistical tests (Chi-square) of observed and expected observations of individuals of several other ungulates from hypothetical concentric circle 1 (0 - 25 m) and circle 3 (51 - 100 m) away from oribi in the Golden Gate Highlands National Park, Orange Free State (March 1982 to December 1983) to show possible positive or negative interactions.

	CIRCLE	BLESBOK	GREY RHEBUCK	SPRINGBOK	BLACK WILDEBEEST	BURCHELLS ZEBRA	ELAND	OTHER ORIBI	ROW TOTAL
Observed value	1	23	13	36	35	5	0	0	112
	3	44	42	20	81	17	2	3	209
	Total	67	55	56	116	22	2	3	321
Expected value	1	23	19	20	41	8	1	1	112
	3	44	36	36	76	14	1	2	209
	Total	67	55	56	116	22	2	3	321
Chi-square value $\frac{(O - E)^2}{E}$	1	0	1,89	12,80	0,87	1,13	1,00	1,00	18,69
	3	0	1,00	7,11	0,47	0,64	1,00	0,33	10,55
Column total		0	2,89	19,91	1,34	1,87	2,00	1,33	29,24

(Chi-square critical value = 12,59; $p < 0,05$; df = 6 and Chi-square critical value = 3,84; $p < 0,05$; df = 1)

The total Chi-square for the contingency table (Table 21) is significant from circle 1 (0-25 m) to circle 4 (101-200 m) (Chi-square = 25,78; $p < 0,05$; df = 6). A further investigation of the column totals indicates that the only significant statistics are those of springbok and zebra (Chi-square = 13,92; $p < 0,05$; df = 1 and Chi-square = 7,82; $p < 0,05$; df = 1). The difference of observed and expected values indicates a positive association between oribi and springbok and a negative association between oribi and zebra (Sokal and Rohlf 1969).

According to the total Chi-square of the contingency table (Table 22) significant difference in number of observations does exist from circle 2 (26-50 m) to circle 3 (51-100 m) (Chi-square = 20,47; $p < 0,05$; df = 6). The column totals for all ungulates involved indicate that a significant negative interaction exists between oribi and black wildebeest from circle 2 and 3 (Chi-square = 7,91; $p < 0,05$; df = 1) (Table 22) and a significant positive interaction exists between oribi and springbok (Chi-square = 6,47; $p < 0,05$; df = 1).

From the contingency table (Table 23) it is evident that the difference between observed values and expected values of data from circle 2 (26-50 m) and circle 4 (101-200 m) away from oribi in the Golden Gate Highlands National Park is insignificant (Chi-square = 10,95; df = 6; $p > 0,05$). The result of the statistical test is also insignificant for every cell in the contingency table (Table 23).

Table 21: Statistical tests (Chi-square) of the results of observations of individuals of several other ungulates in hypothetical concentric circle 1 (0 - 25 m) and circle 4 (101 - 200 m) away from oribi in the Golden Gate Highlands National Park, Orange Free State (March 1982 to December 1983) to show possible positive or negative interactions.

	CIRCLE	BLESBOK	GREY RHEBUCK	SPRINGBOK	BLACK WILDEBEEST	BURCHELLS ZEBRA	ELAND	OTHER ORIBI	ROW TOTAL
Observed value	1	23	13	36	35	5	0	0	112
	4	47	25	25	64	30	2	3	196
	Total	70	38	61	99	35	2	3	308
Expected value	1	26	14	22	36	13	1	1	112
	4	44	26	39	63	22	1	2	196
	Total	70	38	61	99	35	2	3	308
Chi-square value $\frac{(O - E)^2}{E}$	1	0,35	0,07	8,90	0,03	4,92	1,00	1,00	16,27
	4	0,20	0,04	5,02	0,02	2,90	1,00	0,33	9,51
Column total		0,55	0,11	13,92	0,05	7,82	2,00	1,33	25,78

(Chi-square critical value = 12,59; $p < 0,05$; df = 6 and Chi-square critical value = 3,83; $p < 0,05$; df = 1).

Table 22: Contingency table and statistical tests (Chi-square) of the results of observations of individuals of several other ungulates in hypothetical circle 2 (26 - 50 m) and circle 3 (51 - 100 m) away from oribi in the Golden Gate Highlands National Park, Orange Free State (March 1982 to December 1983) to show possible positive or negative interactions.

	CIRCLE	BLESBOK	GREY RHEBUCK	SPRINGBOK	BLACK WILDEBEEST	BURCHELLS ZEBRA	ELAND	OTHER ORIBI	TOTAL
Observed value	2	40	31	31	35	19	0	0	156
	3	44	42	20	81	17	2	3	209
	Total	84	73	51	116	36	2	3	365
Expected value	2	36	31	22	50	15	1	1	156
	3	48	42	29	66	21	1	2	209
	Total	84	73	51	116	36	2	3	365
Chi-square	2	0,44	0	3,68	4,50	1,06	1,00	1,00	11,68
value $\frac{(O-E)^2}{E}$	3	0,33	0	2,79	3,41	0,76	1,00	0,50	8,79
Column total		0,77	0	6,47	7,91	1,82	2,00	1,50	20,47

(Chi-square critical value = 12,59; $p < 0,05$; df = 6 and Chi-square critical value = 3,84; $p < 0,05$; df = 1).

Table 23: Contingency table and statistical tests (Chi-square) for significance of the difference between observed and expected values of individuals of several other ungulates in hypothetical circle 2 (26 - 50 m) and circle 4 (101 - 200 m) away from oribi in the Golden Gate Highlands National Park, Orange Free State (March 1982 to December 1983).

	CIRCLE	BLESBOK	GREY RHEBUCK	SPRINGBOK	BLACK WILDEBEEST	BURCHELLS ZEBRA	ELAND	OTHER ORIBI	ROW TOTAL
Observed value	2	40	31	31	35	19	0	0	156
	4	47	25	25	64	30	2	3	196
	Total	87	56	56	99	49	2	3	352
Expected value	2	39	25	25	39	22	1	1	152
	4	48	31	31	60	27	1	2	200
	Total	87	56	56	99	49	2	3	352
Chi-square value $\frac{(O - E)^2}{E}$	2	0,03	1,44	1,44	0,41	0,41	1,00	1,00	5,73
	4	0,02	1,16	1,16	0,27	0,33	1,00	0,50	4,44
Column total		0,05	2,60	2,60	0,68	0,74	2,00	1,50	10,17

(Chi-square critical value = 12,59; $p < 0,05$; df = 6 and Chi-square critical value = 3,84; $p < 0,05$; df = 1).

The Chi-square total for the contingency table (Table 24) indicates no significant difference between observed and expected values from hypothetical concentric circle 3 (51-100 m) to circle 4 (101-200 m) (Chi-square = 8,88; df = 6; $p > 0,05$). Only one of the column totals involved in the contingency table (Table 24) shows any significant statistical difference in observations from hypothetical concentric circle 3 to circle 4 away from oribi in the Golden Gate Highlands National Park, that being the Burchells zebra (Chi-square = 4,17; $p < 0,05$; df = 1).

As mentioned under methods in this chapter (see: Methods) the reaction of oribi to other ungulates in their proximity were noted.The results are given in Table 25.

The total number of observations for reaction A (Aggression) is only one while that for B (Indifference) is 614 and that for C (Avoidance) only 6 (Table 26). In the Golden Gate Highlands National Park it appears that oribi are not affected by other ungulates in proximity to themselves.

The one observation of oribi showing active aggression towards an individual of another species was the only observation out of 621 observations of such behaviour noted and the aggression was exhibited by an oribi ram towards a juvenile grey rhebuck. The observations of oribi showing avoidance behaviour were all owing to resting oribi disturbed by black wildebeest bulls (Table 27).

Table 24: Contingency table and statistical tests (Chi-square) of the difference between observed and expected values for observations of individuals of several other ungulates in hypothetical concentric circle 3 (51 - 100 m) and circle 4 (101 - 200 m) away from oribi in the Golden Gate Highlands National Park, Orange Free State (March 1982 to December 1983).

	CIRCLE	BLESBOK	GREY RHEBUCK	SPRINGBOK	BLACK WILDEBEEST	BURCHELLS ZEBRA	ELAND	OTHER ORIBI	ROW TOTAL
Observed value	3	44	42	20	81	17	2	3	209
	4	47	25	25	64	30	2	3	196
	Total	91	67	45	145	47	4	6	405
Expected value	3	47	35	23	75	24	2	3	209
	4	44	32	22	70	23	2	3	196
	Total	91	67	45	145	47	4	6	405
Chi-square value $\frac{(O - E)^2}{E}$	3	0,91	1,40	0,39	0,48	2,04	0	0	4,50
	4	0,20	1,53	0,41	0,51	2,13	0	0	4,78
Column total		0,39	2,93	0,80	0,99	4,17	0	0	9,28

(Chi-square critical value = 12,59; $p < 0,05$; df = 6 and Chi-square critical value = 3,84; $p < 0,05$; df = 1)

No observations were made of members of any species showing any aggression whatsoever towards oribi. Six hundred and twenty of the observations showed indifference of other species towards oribi and only one observation was made of a member of another species actively avoiding oribi. This avoidance was a case of a juvenile grey rhebuck avoiding an oribi ram.

From these results it seems that the only negative interactions that exist between oribi and other ungulates in the Golden Gate Highlands National Park are those between oribi and zebra, and in a single instance between oribi and black wildebeest. Viljoen (1982) noted that oribi exhibit no positive associations with any other ungulates. The oribi in his study areas were coexisted with zebra, blesbok, grey rhebuck and mountain reedbuck. Oribi in the Golden Gate Highlands National Park show a positive association with springbok (Tables 23 and 24). The attitudes of oribi to other ungulates showed indifference in 99 percent of all observations. Similary reactions of other ungulates to the oribi show virtual total indifference of other ungulates towards oribi(99 percent). The above results also demonstrate that no statistically significant negative interactions exist between oribi and other ungulates in the Golden Gate Highlands National Park.

Rowe-Rowe (1983) records an 87 percent overlap in habitats between blesbok and oribi in the Giants Castle Game Reserve, in this case the blesbok having been "re-introduced" but records no interactions between the two species.

Table 25: The number of observations of three behaviour types of oribi to several other ungulates and behaviour of those other ungulates to oribi, in concentric circles of varying radii away from oribi in the Golden Gate Highlands National Park, Orange Free State (March 1982 to December 1983).

CIRCLE AND RADIUS AROUND ORIBI												
1 (25 m)			2 (50 m)			3 (100 m)			4 (200 m)			TOTAL
REACTION TYPE												
Aggression	Indifference	Avoidance	Aggression	Indifference	Avoidance	Aggression	Indifference	Avoidance	Aggression	Indifference	Avoidance	
1	104	4	0	141	2	0	189	0	0	180	0	621

CIRCLE AND RADIUS AROUND ORIBI												
1 (25 m)			2 (50 m)			3 (100 m)			4 (200 m)			TOTAL
REACTION TYPE												
Aggression	Indifference	Avoidance	Aggression	Indifference	Avoidance	Aggression	Indifference	Avoidance	Aggression	Indifference	Avoidance	
1	108	1	0	143	0	0	189	0	0	180	0	621

Table 26: Observations on oribi behaviour to some other ungulate species as percentages of the total observations in the Golden Gate Highlands National Park, Orange Free State (March 1982 to December 1983).

BEHAVIOUR		TOTAL OBSERVATIONS	PERCENTAGE OF TOTAL OBSERVATIONS
Aggression	(A)	1	0,2
Indifference	(B)	614	98,9
Avoidance	(C)	6	0,9
		621	100,00

Table 27: Observations on behaviour of individuals of other ungulate species towards oribi given as percentages of the total observations of their behaviour in the Golden Gate Highlands National Park, Orange Free State (March 1982 to December 1983).

BEHAVIOUR		TOTAL OBSERVATIONS	PERCENTAGE OF TOTAL OBSERVATIONS
Aggression	(A)	0	0,0
Indifference	(B)	620	99,8
Avoidance	(C)	1	0,2
		621	100,00

Viljoen (1982) recorded that oribi move away when sheep approach closer than an average of 13,6 m to them and when cattle approach closer than 9,7 m to the oribi. He further states that the only negative interaction other than that caused by humans and dogs was one occasion when a group of oribi were disturbed by a secretary bird Sagittarius serpentarius.

One of the most important environmental factors influencing the behaviour of ungulates in the course of evolution, is predation (Leuthold 1977), and the constant risk of falling prey to a predator has had a pronounced influence on the activity patterns, group size, group structure and even habitat preference of ungulates (Leuthold 1977).

Animals in a group do not have to be constantly on the look-out for danger because, chances are, that one of the group will spot the predator while the others are engaged in other activities (Walther 1969 and Jarman 1974). Viljoen (1982) demonstrated beyond doubt that a single oribi spent more in vigilence (84 percent) than a pair (61 percent) or a group of four oribi (percentage not given). The oribi in the Golden Gate Highlands National Park shared their habitat with several predators that could constitute a threat, particularly to the young viz,: the black-backed jackal Canis mesomelas, the caracal Felis caracal, the black eagle Aquila verreauxii and feral dogs Canis familiaris.

It is difficult in the case of small antelope such as oribi to determine the cause of predation, as particularly with young animals, the predator will leave little if any evidence of the kill. However, in the case of oribi at Golden Gate Highlands National Park the absence of an adult would be more easily missed as they only occupy a small area and they were under constant observation. This is not the case with young oribi which remain hidden for three to four months after birth (Viljoen 1982).

Oliver, Short and Hanks (1978) record no direct observations of jackal predation and only one suspected jackal kill out of 21 antelope deaths during their studies of population ecology of oribi, grey rhebuck and mountain reedbuck in the Highmoor State Forest Land.

For almost a year constant evidence was found of the presence of a feral dog during the present study in the area inhabited by oribi. This feral dog was eventually shot but there was no evidence of any oribi being preyed upon by this dog. No other evidence of predation was found and any oribi that went missing for a period was always re-located. On one occasion the Park game ranger was witness to an attempt by a black eagle to take a full-grown oribi ram (Lawson pers. comm.)*. The attempt was unsuccessful and the oribi exhibited aggressive behaviour towards the predator. From this it is evident that oribi do attempt to defend themselves against predators and that all attempts of predators are not always successful.

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CHAPTER 8

FEEDING PREFERENCES AND WATER REQUIREMENTS OF ORIBI

Introduction

Difference in feeding preference play a role in the ecological separation of ungulates (Leuthold 1977) and in view of the premise that competition from other ungulates is the prime limiting factor of oribi in the Golden Gate Highlands National Park it was decided to investigate the feeding preferences of oribi where and when the opportunity arose. The dependence of ungulates on free water also affects their selection of habitat.

Methods

The data pertaining to feeding preference were collected complementary to the habitat utilization data. Leuthold (1977) using direct observations in studying gerenuk Litocranius walleri in Kenya lists bias against inconspicuous plants as a failing of direct observations of feeding habits. In the present study fresh oribi spoor was followed wherever possible and grasses and forbs that had just been eaten were noted (Fig. 17). These data were noted to determine only the utilization of certain plants and parts, and no attempt was made to determine the bulk intake of plant material.

Results and Discussion

FEEDING PREFERENCES

It proved difficult to follow oribi spoor in grassveld (Fig. 16). However, with the help of the game ranger, his assistants, and practice it soon proved feasible to collect data in such a manner. The distance covered by oribi was noted on each occasion in an effort to illustrate the high degree of selection with regard to food plants exhibited by oribi in the Golden Gate Highlands National Park.

The oribi, being a small grassland ruminant and having no browse as component in the diet, supplement the grass's relative nutritional homogeneity by feeding selectively on certain parts of grasses and selecting certain organs of annual forbs. The sedentary nature of oribi enhances familiarity with the available food resource. Should oribi not exhibit any preference with regard to the food plants available in their habitat then the frequency (percent) that those plants make up in their diet would be closely correlated with the frequency (percent) that those plants make up in the plant species composition of the habitat.

Viljoen (1982) determined preference by oribi for a plant species as either category (a) (> 11 percent utilization), (b) (5 - 11 percent utilization) or (c) (< 5 percent utilization) in the south-eastern Transvaal. The percent utilization is determined as the' percentage of the total number of observations that a specific plant is fed upon.

In contrast to large grazers like the black wildebeest and zebra which have broad undifferentiated muzzles, oribi have a sharp, narrow head and muzzle, with prehensile lips. These characteri-

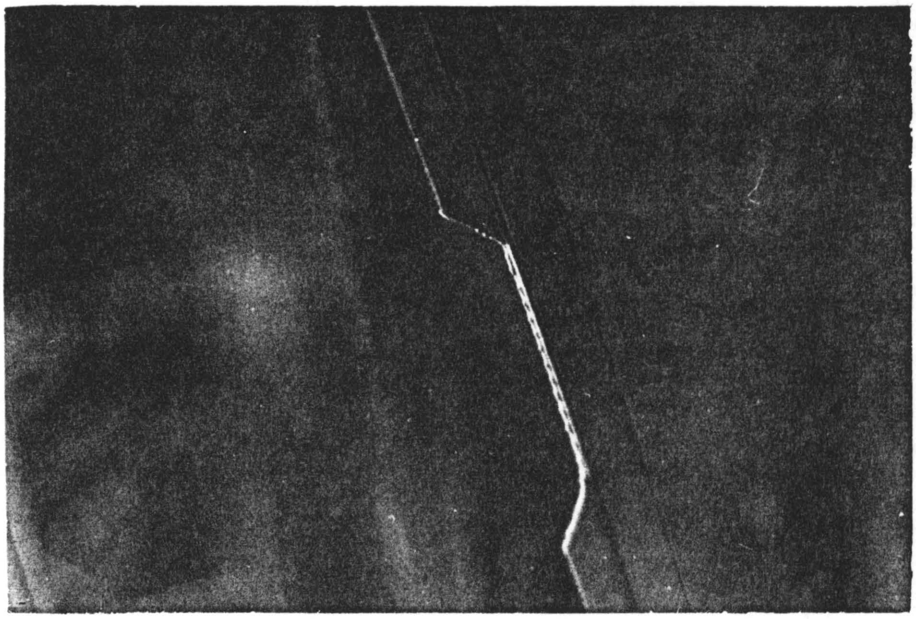


Figure 16: A *Watsonia densiflora* leaf bitten off by an oribi in the Golden Gate Highlands National Park.

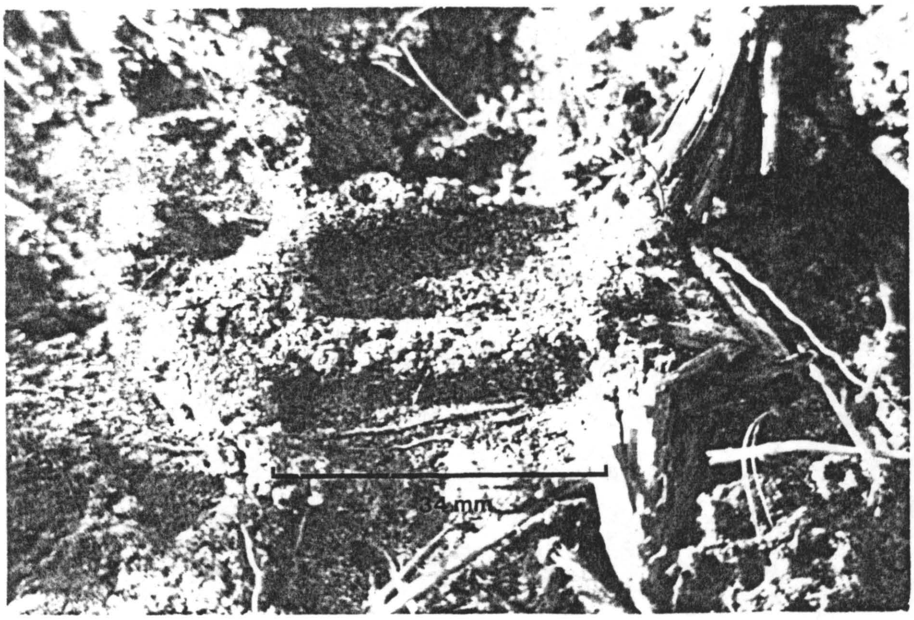


Figure 17: An oribi spoor in the Golden Gate Highlands National Park.

stics are typical of selective feeders enabling them to reach selected plants or plant structures. Although oribi in the Golden Gate Highlands National Park feed chiefly on grasses they can be classified as mixed feeders, taking both grasses and forbs (Table 28 and 29). The shortcoming of the method used to determine feeding preference was that owing to the occurrence of other antelope in the area, oribi spoor could only be found, or feeding observations made, a short time after oribi were witnessed in the area. Oribi in the Golden Gate Highlands National Park fed on 22 plant species. In Table 29 the number of obervations of oribi feeding on various plant species, the parts of the plants eaten and the months of the year in which the observations were made, are noted. Oribi feed on a wide spectrum of species and feeding preferences are categorized as follows (after Viljoen 1982).

Preference a: more than 11 percent utilization of particular plant species

Preference b: 5 - 11 percent utilization of particular plant species

Preference c: less than 5 percent utilization of particular plant species

The results of the feeding preferences for the various plant species eaten are given in Table 28.

According to the results in Table 28 the oribi have a particularly high preference for Sporobolus centrifugus followed by Themeda

Table 28: Plant species fed on by oribi in the Golden Gate Highlands National Park, Orange Free State and oribi preference for each species, a = > 11 percent utilization, b = 5 - 11 percent utilization and c = < 5 percent utilization (March 1982 - December 1983).

SPECIES	TYPE OF PREFERENCE
Grasses	
Andropogon schirensis	b
Aristida junciformis	c
Elionurus muticus	c
Eragrostis curvula	b
Eragrostis caesia	c
Heteropogon contortus	b
Monocymbium ceresiiforme	b
Pennisetum clandestinum	c
Sporobolus centrifugus	a
Stiburus alopecuroides	c
Themeda triandra	b
Tristachya leucothrix	b
Forbs	
Eulophia clavicornis	c
Gazania krebsiana	c
Gnaphalium indulatum	c
Helichrysum appendiculatum	c
Helichrysum callicomum	c
Hypoxis argentea	c
Polygala hottentotta	c
Watsonia densiflora	b
Sedges	
Cyperus obtusiflorus	b
Cyperus rigidifolius	c

triandra, Tristachya leucothrix, Watsonia densiflora, Monocymbium ceresiiforme, Heteropogon contortus, Eragrostis curvula, Cyperus obtusiflorus and Andropogon schirensis (categories a and b utilization) (Table 29). During the study it was also noted that oribi were selective with regard to parts of plants (inflorescences) fed on and particularly so with the geophytes and annuals. The oribi in the Golden Gate Highlands National Park show a preference for the influorescences of Sporobolus centrifugus. The flowers of several forbs were selected and in the case of Hypoxis argentea, Helichrysum appendiculatum and Helichrysum callicomum only the flowers were eaten.

The oribi in the Golden Gate Highlands National Park also showed a selective variation in plant use from season to season (Table 29). Selection of certain plant parts of the same plant species during different seasons was evident and for example oribi ate the leaves of Watsonia densiflora (Fig. 16) during the summer and the corms during the early and late winter.On two separate occasions oribi were observed digging to reach these corms. Eragrostis curvula was utilized throughout the year and a species such as Sporobolus centrifugus was utilized during the summer (October to March) only while, Andropogon schirensis was utilized during the early winter (April to June).

If the utilization of grass by oribi is compared in order of preference to the results of the wheelpoint survey then it can be seen that the category a and category b species eaten (Sporobolus centrifugus (a), Andropogon schirensis, Eragrostis curvula, Heteropogon contortus, Monocymbium ceresiiforme, Themeda triandra and Tristachya leucothrix) do not mimic the order of species contribution to the basal cover for the Saaiplaat west area (Fig. 4). With regard to the Saaiplaat east area a greater similarity between preference and order of contribution to basal cover exists (Fig. 5) as is the case with the Oorbietjie Kom/Wildebees Hoek area. It is also evident that Andropogon schirensis selected by oribi (category b selection) does not appear in the wheel-point survey of the above three areas. In the case of the forb and sedge most utilized (Watsonia densiflora and Cyperus obtusiflorus), Watsonia densiflora is the most important forb in the Saaiplaat west area but not in either of the other two areas (Saaiplaat east and Oorbietjie Kom/Wildebees Hoek). Cyperus obtusiflorus is the major contributor of the sedges to the basal cover only in the Saaiplaat west area.

Comparison of category a and category b selection of grasses, forbs and sedges by oribi to the dry mass ranking of the Saaiplaat west, Saaiplaat east and Oorbietjie Kom/Wildebees Hoek areas is interesting. The three prime contributors to the dry mass ranking of Saaiplaat west (Eragrostis curvula, Sporobolus centrifugus and Heteropogon contortus) are utilized proportionately by oribi. This is not the case with Saaiplaat east where only Heteropogon contortus (third largest in dry mass ranking) appears in the oribi food selection as category b utilization. Similarly for the Oorbietjie Kom/Wildebees Hoek area Eragrostis curvula is the third largest contributor to the dry mass ranking and appears as a category b utilization by oribi. Again Andropogon schirensis does not appear in the dry mass ranking data.

The grasses, forbs and sedges could also be divided into two groups: those utilized in the summer season and those utilized during the winter seasons. Among the former are the species Hypoxis argentea, Helichrysum appendiculatum, Helichrysum callicomum and Polygala hottentotta. The latter group includes species Eulophia clavicornis, Gazania krebsianna and Gnaphalium indulatum. Two species of sedges are utilized by oribi in the Golden Gate Highlands National Park, Cyperus obtusiflorus is utilized for five months (January, May, June, October and November) of the year and Cyperus rigidifolius had a low percentage utilization in December.

The Brody-Kleiber relationship between body mass and metabolic rate in mammals implies that it can be expected that oribi have a higher metabolic rate than larger antelope (Kleiber 1961). This causes a higher energy requirement per unit body mass and compensation for this follows one of two courses, either oribi increase their food intake or feed on high quality food. Since roughage feeders need a large rumen to allow slow breakdown of roughage (Hofmann and Stewart 1972), the small size of oribi obliges them to feed on high-quality food plants or to take parts of plants selectively. According to Jarman (1974) grasses are more homogeneous in food value than browse because the latter vary from nutritious growing shoots to lignified stems.

Hofmann and Stewart (1972) maintain that oribi is a "bulk and roughage" feeder and further classify oribi under the subgroup dependent on drinking water. According to Ansell (1960) oribi are exclusive grazers, but Tinley (1969) suspects that further studies would classify oribi as a mixed feeder utilizing both grasses and forbs. Jarman (1974) describes oribi as a selective feeder that is almost entirely a grazer.

Viljoen (1982) used direct observations on 2 groups of wild oribi that were habituated to determine their feeding preferences. Various other researchers (Lamprey 1963, van Zyl 1965 and Tinley 1969) have used direct observations to determine feeding preferences of herbivores. However, Field (1968) points out that it is difficult to identify grasses fed on unless the animals are close.

Monfort and Monfort (1974) maintain that oribi in Rwanda select certain parts of plants, however, they do not say which parts of plants. According to Leuthold (1977) many ungulates are selective with regard to different plant parts and structures. Viljoen (1982) maintains that oribi select certain plant parts while feeding.

Both Mentis (1978) and Oliver, Short and Hanks (1978) comment on the decline of food value during the winter forcing oribi to feed more selectively during the winter. Rowe-Rowe and Scotcher (1986) also report a high selectivity by oribi for parts of plants. With particular reference to the utilization of the inflorescences of Sporobolus centrifugus, which is considered an unpalatable increaser under over-utilization (Tainton 1981), the wheelpoint survey (Chapter 4) indicates a consistent presence though not a particularly high contributor to the basal cover of the oribi habitat. It is therefore proposed that the utilization of the inflorenscences during the summer (Table 29) has to do with a specific metabolic requirement by the oribi. Cohen (1988) notes similar tendencies regarding selection of plant parts by steenbok.

In conclusion it appears that oribi will utilize the most abundant species available in their habitat but show a marked selection for certain species at certain times of the year. Abundant species were utilized during the summer when they were at their most palatable (Heteropogon contortus and Tristachya leucothrix) and species such as Themeda triandra and Eragrostis curvula were utilized the year round, while certain species were utilized seasonally (Andropogon schirensis and Watsonia densiflora). These findings seem to support the classification of oribi as selective grazers (Jarman 1974) with selection increasing during the winter (Mentis 1978, Viljeon 1982, Rowe-Rowe 1982a and Rowe-Rowe and Scotcher 1986).

Viljoen (1982) reports only slight variation in seasonal differences in selection of plant species of oribi in the south-eastern Transvaal. He further reports a distinct increase in preference for forbs during the spring. In the south-eastern Transvaal an increased preference for Eulalia villosa occurs during the spring and summer and for Diheteropogon amplectens during the autumn (Viljoen 1982). Monfort and Monfort (1974) suspected that oribi in the Akagera National Park in Rwanda did not exhibit a clear seasonal change in their feeding preferences for specific plants. Preferred plants according to Monfort and

Table 29: Various plant species, parts of plants eaten and months of year in which they were eaten by oribi in the Golden Gate Highlands National Park, Orange Free State given highest preference first based on frequency of observations (March 1982 - December 1983).

PLANT SPECIES	NUMBER OF OBSERVATIONS PLANT PART USED				MONTHS OF THE YEAR												FREQUENCY OF TOTAL OBSERVATIONS	PREFERENCE * CATEGORY
	Roots/ Corms	Leaves	Flowers / Inflorescences	Total	J	F	M	A	M	J	J	A	S	O	N	D		
Sporobolus centrifugus	-		118	118	X	X	X	X						X	X	X	17,6	a
Themeda triandra	-	72	-	72	X	X	X	X	X			X	X	X	X	X	10,8	b
Monocymbium ceresiiforme	-	61	-	61			X	X		X	X	X					9,1	b
Watsonia densiflora	2	58	-	60	X				X	X	X					X	8,9	b
Cyperus obtusiflorus	-	50	5	55	X				X	X				X	X		8,2	b
Andropogon schirensis	-	46	-	46				X	X	X							6,9	b
Eragrostis curvula	-	42	-	42	X	X	X	X	X	X	X	X	X	X	X	X	6,3	b
Heteropogon contortus	-	38	-	38	X								X	X	X		5,7	b
Tristachya leucothrix	-	35	-	35	X	X		X					X	X	X		5,2	b
Penisetum clandestinum	-	25	-	25									X	X			3,7	c
Polygala hottentotta	-	10	12	22		X	X							X			3,3	c
Hypoxis argentea	-	-	20	20	X											X	3,0	c
Eulophia clavicornis	-	18	-	18					X	X		X					2,7	c
Gnaphalium indulatum	-	6	8	14									X	X	X		2,1	c
Aristida junciformis	-	12	-	12									X	X			1,8	c
Elionurus muticus	-	8	-	8								X	X				1,2	c
Stiburus alopecuroides	-	7	-	7								X					1,1	c
Gazania krebsiana	-	4	1	5						X	X	X					0,7	c
Cyperus rigidifolius	-	-	5	5												X	0,7	c
Helichrysum appendiculatum	-	-	2	2	X												0,3	c
Eragrostis caesia	-	-	2	2	X												0,3	c
Helichrysum callicomum	-	-	2	2	X												0,3	c
Total	2	492	175	669														

* Preference category: a = more than 11 percent utilization, b = 5 to 11 percent utilization, c = less than 5 percent utilization

Monfort (1974) are amongst others *Themeda triandra*, *Hyparrhenia filipendula*, *Loudetia simplex* and *Cymbopogon* sp. According to Tinley (1977) oribi in the Gorongosa National Park also exhibit only slight seasonal variation in plant species prefence the latter varying from grasses to even woody plants like *Ziziphus mucronata*.

WATER REQUIREMENTS

Opinions regarding the water requirements of oribi are many and varied. Roosevelt and Heller (1914) maintain that oribi are found in areas without any available surface water. Shortridge (1934) doubts that oribi ever drink water. In Rwanda, Monfort and Monfort (1974) noted that oribi never drink water and do not even migrate during the dry months when no water is available in their habitat. Viljoen (1982) maintains emphatically that oribi in the south-eastern Transvaal never drink water even when it is available. He further states that oribi are attached to their permanent territories and as these contain no permanent water they are dependent on water from other sources (plants or dew).

In contrast to all the above observations Stevenson-Hamilton (1929) maintains that oribi are always found near water. The oribi in the Golden Gate Highlands National Park were never seen drinking free surface water in two years and nearly 2 000 hours of daylight observation. Surface water was freely available from springs, streams, rivers, dams and in convex hollows in sandstone rocky plates. The distribution of potential surface water available in the area inhabited by oribi in the Golden Gate Highlands National Park during the study is plotted in Figure 18.

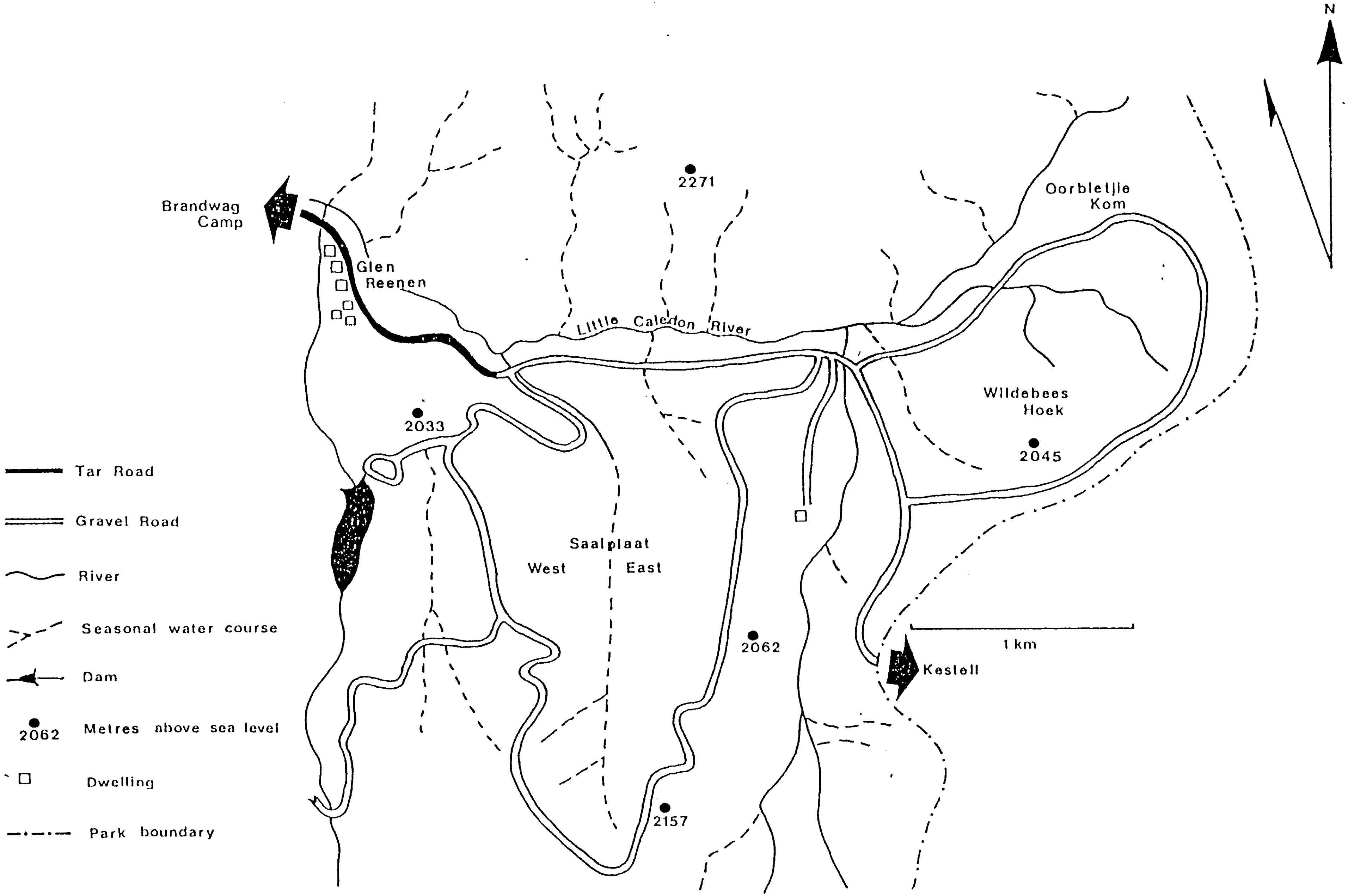


Figure 18: Potential surface water available in oribi habitat in the Golden Gate Highlands National

The only alternative source of water at Golden Gate is from food plants of the oribi. This water is obtained either from the water content of the plants or the frost and dew accumulated on the plants. Weinmann (1955) points out that the water content of young grass can be as high as 70 - 80 percent compared with dead or dormant grass where it is as low as 0 - 10 percent. Observations in the Golden Gate Highlands National Park excluded night activities although many unsuccessful attempts were made to observe oribi at night. In his study of oribi in the south-eastern Transvaal Viljoen (1982) measured the water content of the most favoured oribi food plant species over a 24-hour period. He found that the plants had the highest moisture content at 0600 and this corresponded with oribi peak feeding activity in both his study areas.

Frost (winter) and dew are also prevalent during the early morning and obviously contribute to oribi water intake. Monfort and Monfort (1974) also suspect that oribi utilize dew during early morning feeding activities in the Akagera National Park in Rwanda.

Viljoen (1982) mentions the possibility of oribi obtaining water by grooming the coat after precipitation in the form of rain, frost or dew has taken place. No other authors mention this characteristic but it was noted that oribi in the Golden Gate Highlands National Park spent time grooming particularly their flanks during the early morning. Eloff (1973) notes this behaviour in Kalahari lions.

Little is known of the water requirements of other species of the Neotragini. Shortridge (1934) and Norton (1980) maintain that the klipspringer is also independent of drinking water. According to Eloff (1959) the steenbok is also independent of available drinking water. Cohen (1988) in his studies of the steenbok in the Kruger National Park never observed the use of free water by the steenbok, although this observation is not directly comparable to the Golden Gate study area.

CHAPTER 9

SOCIAL ORGANIZATION AND INTRASPECIES RELATIONSHIPS

Introduction

The purpose of this part of the study was to determine the size of the oribi population in the Golden Gate Highlands National Park and to see if the oribi population was stable. An obvious departure point was to determine the total number of oribi in the Golden Gate Highlands National Park. Group composition was always noted so as to determine the sex ratios of the population.

In observation periods of up to eleven hours in length many social interactions among oribi were noted and although not an original goal in the study, some of these interactions may provide an insight into the well-being of the population as a whole.

Leuthold (1977) states that social organization is the result of all social interactions and spatial relationships between members of a single species population. Leuthold (op. cit.) further states that although social organization is mostly species specific it is subject to wide variation because of environmental factors like climate and vegetation types. Little is known of the social behaviour of members of the Neotragini although Viljoen (1982) reports that only 1 percent of all activities of oribi are spent in direct social interactions.

Territoriality among oribi is reported by several authors such as Hediger (1951), Gosling (1972) and territoriality of oribi in

Rwanda by Monfort and Monfort (1974). Viljoen (1982) proposes a mean territory size of 34 ha for oribi pairs in the Amsterdam area of the south-eastern Transvaal. Oliver, Short and Hanks (1978) found an ecological density of 21,8 ha per oribi in the Highmoor State Forest, Natal.

Methods

According to Robinette (1970) game occurring in open veld, in large groups or large animals can be satisfactorily enumerated by a total count. Taking into account attributes of the area to be counted and the animals to be counted Caughley (1977); Goodman (1977); Norton-Griffiths (1975) and Collinson (1985) are at one that the total count using a systematic search is the correct technique to use to count small ungulates like oribi in circumstances such as those in the Golden Gate Highlands National Park.

Aerial census of oribi on Golden Gate Highlands National Park was impractical because of the difficulty in seeing oribi from an aircraft and the cost and logistic implications involved. Ground counts over one daylight period were therefore made on foot and by vehicle every three months to establish:

(a) The total number of oribi in the Park

(b) The group sizes and composition

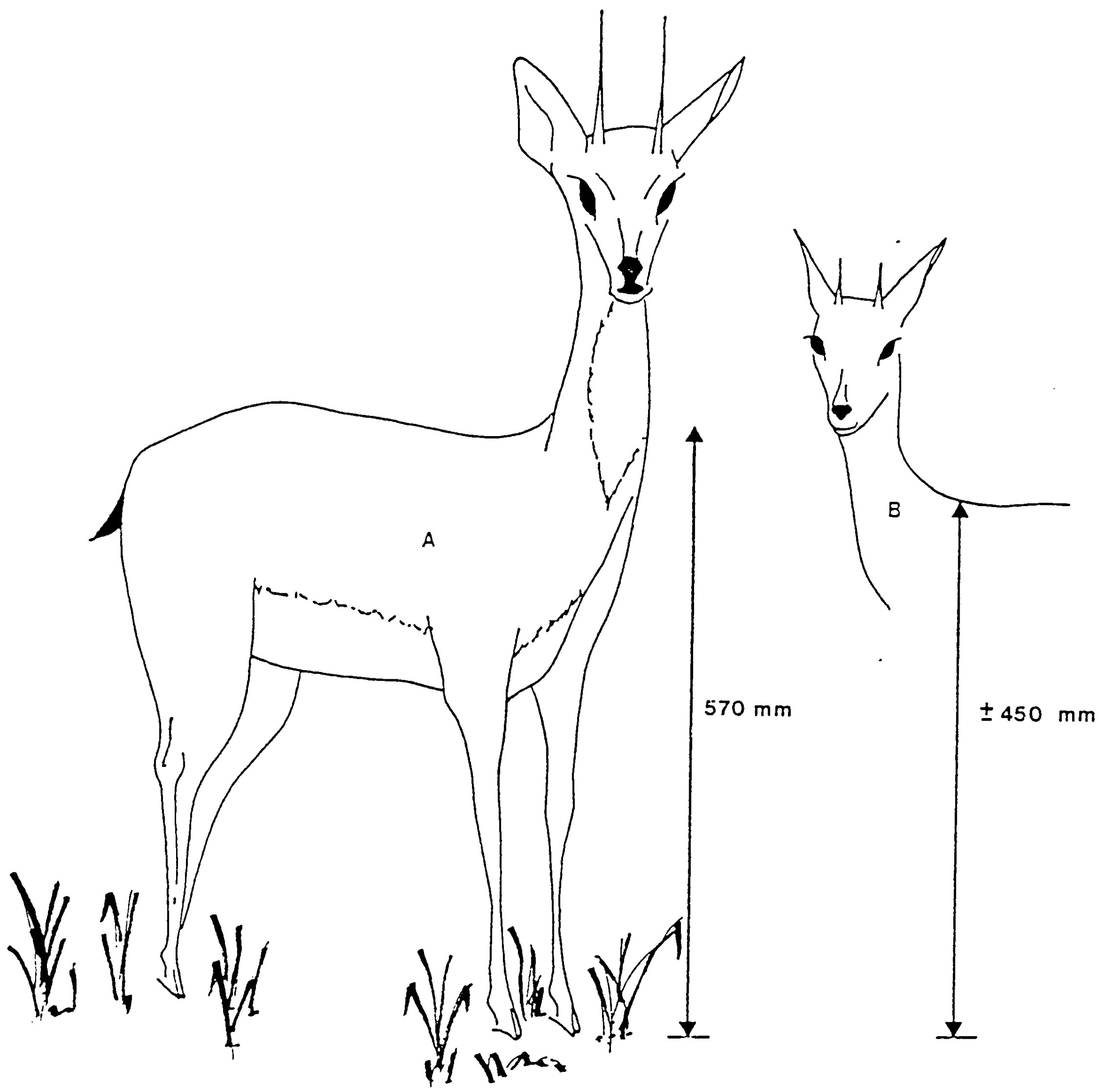
(c) Distribution patterns

The oribi in Golden Gate inhabited an area of 472 ha. This area is well bisected by water courses and roads and Robinette (op. cit.) recommends the use of small areas divided by easily distinguished landmarks in total censuses. The use of small census units is also recommended by Norton-Griffiths (1978).

The size of the area enabled each group of oribi to be pin-pointed and thereafter each group was counted and checked for during each total count. The animals in each group were sexed and aged (arbitrarily) with the aid of a pair of 10 x 50 Pentax binoculars. Males were classed as adults (physiologically) when more than 18 months old (Fig.19). Juvenile males were considered to be 6 - 18 months old. Those oribi less than 6 months old were classified as infants. Oribi females were classified as adults from the time they appeared to be the same shoulder height as an adult male (Fig. 20). Juvenile females were taken to include those females with a shoulder height of 50 - 75 percent of the shoulder height of a full-grown female as there were no horns for comparison. Infants were recorded as less than 50 percent shoulder height of the adult female. Few infants were recorded because they were only seen from the age of approximately 4 months.

With every observation pertaining to habitat utilization (Chapter 6) the relative age and sex composition of the observed group of oribi was noted.

With time, certain individuals could be recognized individually, and these observations provided data pertaining to local movements, territoriality and social interactions. According to Kitchen (1974) the recognition of individuals is essential when attempting to establish social behaviour. Territorial boundaries were established by observing the marking activities of the



A : Adult : 24 months old

B : Juvenile : 12 months old

Figure 19: A comparison of shoulder height of oribi males of different age classes as used for observations on oribi social organization in the Golden Gate Highlands National Park, Orange Free State.

Size of oribi territories was determined by routine mapping with the use of a polar compensating planimeter and a 1:50 000 topocadastral map.

Results and Discussion

SOCIAL ORGANIZATION AND BEHAVIOUR

Group size

Leuthold (1977) defines a group as a number of animals of the same species together at one time and distinguishable from a herd in that the first-mentioned is significantly smaller in number.

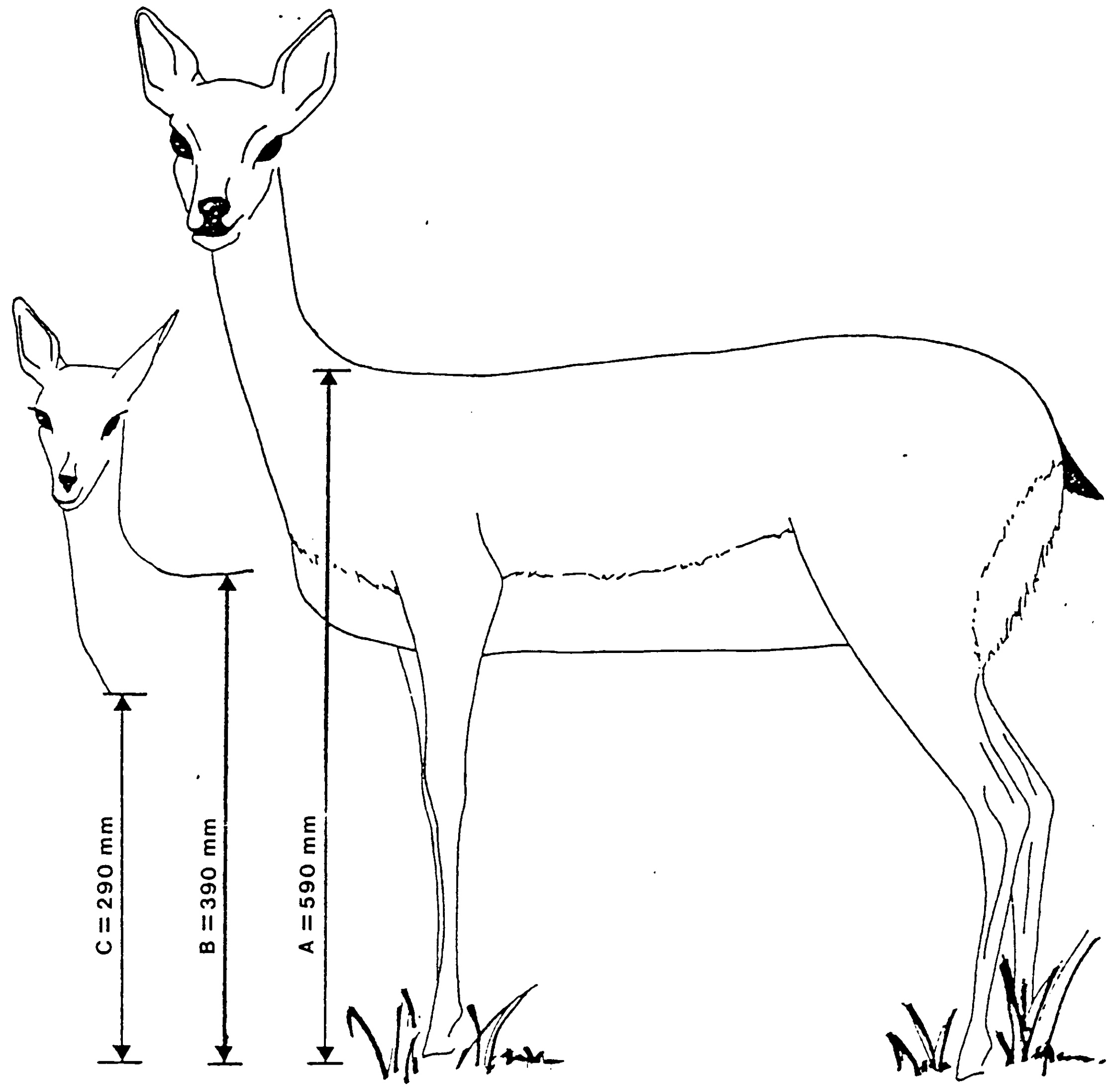
From Table 30 it is evident that oribi in the Golden Gate Highlands National Park do not occur in groups of more than 4. The mean group size is 2,0 (SD = 0,0703; CV = 3,533; n = 1223) and groups of 2 are significantly more common than (Chi-square 497,3; $p < 0,05$; df = 3) single animals and groups of 3 (Table 30).

Several researchers have corroborated that oribi typically occur in pairs or small family groups (Hediger 1951; Mason 1973 and Monfort and Monfort 1974). An overall mean group size of 1,89 is recorded for the Highmoor State Forest Land, Natal by Oliver, Short and Hanks (1978). Statistics are not given by either Viljoen (1982) or Oliver, Short and Hanks (1978) so the findings of this study could not be compared to those for the south-eastern Transvaal or Natal. Viljoen (1982) found that oribi in the south-eastern Transvaal also occurred mostly in pairs.Viljoen (1982) found an mean group size of 1,8 and 1,7 individuals for his two study areas (Amsterdam and Piet Retief respectively).

Table 30: Oribi group sizes in the Golden Gate Highlands National Park, Orange Free State as observed from March 1982 to December 1983.

NUMBER OF ORIBI IN GROUP	NUMBER OF OBSERVATIONS	TOTAL NUMBER OF ORIBI INVOLVED	PERCENTAGE OF ALL OBERSERVATIONS
1	349	349	28,5
2	583	1 166	47,7
3	251	753	20,5
4	40	160	3,3
Total	1 223	2 428	100,00

n = 1,99, S.D. = 0,0703, C.V. = 3,533



A : Adult : 24 months old

B : Juvenile : 12 months old

C : Infant : 3 months old

Figure 20: A comparison of shoulder height of oribi females of different age classes as used for observations on oribi social organization in the Golden Gate Highlands National Park, Orange Free State.

Table 31: Group composition and sex and age classes of oribi in the Golden Gate Highlands National Park,Orange Free State derived from counts from May 1982 to December 1983.

GROUP COMPOSITION	1982						1983						MEAN PERCENTAGE	S.D.
	May		August		December		May		August		December			
	Observed	Percentage of total	Observed	Percentage of total	Observed	Percentage of total	Observed	Percentage of total	Observed	Percentage of total	Observed	Percentage of total		
Adult male	3	27,3	4	33,3	4	36,4	4	36,4	4	30,8	5	35,7	33,3	0,448
Adult female	-	-	-	-	-	-	-	-	-	-	1	7,1	1,2	0,407
Juvenile male	-	-	1	8,3	-	-	-	-	1	7,7	1	7,1	3,9	0,387
Juvenile female	-	-	-	-	-	-	-	-	1	7,7	-	-	1,3	0,407
Adult male and female	4	36,4	4	33,3	2	18,2	2	18,2	4	30,8	2	14,3	25,2	1,095
Adult male and female plus juvenile male	1	9,1	-	-	-	-	1	9,1	-	-	-	-	3,0	0,423
Adult male and female plus juvenile female	1	9,1	-	-	-	-	1	9,1	-	-	-	-	3,0	0,423
Adult male and female plus infant	-	-	-	-	2	18,2	-	-	-	-	2	14,3	5,4	0,841
Adult male and two females	-	-	1	8,3	-	-	-	-	-	-	1	7,1	2,6	0,423
Adult male and two females plus infant	-	-	-	-	1	9,1	-	-	-	-	-	-	1,5	0,407
Adult male and two females plus juvenile male	-	-	-	-	-	-	1	9,1	1	7,7	-	-	2,8	0,423
Two adult males	2	18,2	2	16,7	2	18,2	2	18,2	2	15,4	2	14,3	16,8	0,0
Total	11	100,1	12	99,9	11	100,1	11	100,1	13	100,1	14	99,9	100,0	

Table 32: Comparison of oribi group composition in the Golden Gate Highlands National Park, Orange Free State (present study) and the mean group size from two study areas in the south-eastern Transvaal (Viljoen 1982), Chi-square values reflect whether or not occurrence of specific groups differed significantly.

GROUP COMPOSITION	STUDY AREA				STATISTICAL DATA		
	Golden Gate Highlands National Park	Amsterdam	Piet Retief	Mean	Chi-square value	p - value	df
Adult male	33,3	16,9	17,0	16,95	15,8	< 0,05	1
Adult female	1,2	12,8	20,6	16,7	14,4	< 0,05	1
Juvenile male	3,9	3,9	3,1	3,5	0,05	> 0,05	1
Juvenile female	1,3	1,9	0,9	1,4	0,07	> 0,05	1
Adult male and female	25,9	35,5	36,1	36,8	3,7	> 0,05	1
Adult male and female plus juvenile male	3,0	2,3	1,6	2,0	0,5	> 0,05	1
Adult male and female plus juvenile female	3,0	0,7	1,1	0,9	4,9	< 0,05	1
Adult male and female plus infant	5,4	1,5	1,4	1,5	10,1	< 0,05	1
Adult male and two females	2,6	9,5	8,5	9,0	4,6	< 0,05	1
Two adult males	15,0	1,9	0,5	1,2	158,7	< 0,05	1

It can thus be concluded that oribi group size in the Golden Gate Highlands National Park does not differ significantly from oribi groups in the south-eastern Transvaal or Natal.

GROUP COMPOSITION

With each count of oribi done in the Park the group structure (age and sex) was noted. Owing to the relatively small population of oribi in the Park each group became known through constant observation and changes within those groups soon became evident. Throughout the study no change took place in group structure or size except for the displacement of two older males by younger males and the birth of young.

The majority of oribi observed during counts were single males (Table 31) and these accounted for 33 percent of all observations. Juvenile males on their own made up a further 1,2 percent of the total number of observations (Table 31). The next most abundant group was a male and female pair accounting for 25 percent of the observations. These pairs accompanied by an infant (lamb) made up 5 percent of observations. Pair groups accompanied by either a juvenile male or a juvenile female made up 5 percent each of the total observations. The lowest contribution to the population structure was that made by lone females and lone juvenile females at 1 percent each. The largest group encountered were those of 4 individuals which made up 2 percent of the total. It was noted that 22 percent of observations consisted of ram groups (Tables 31 & 32).

A study of the population ecology of oribi on Highmoor State Forest Land, Natal by Oliver, Short and Hanks (1978) indicates that 53,1 percent of all observations of oribi groups consisted of one adult male, one adult female and the previous years young.

Viljoen (1982), in his study of the oribi in two study areas in the south-eastern Transvaal, also recorded the mean percentage occurrence of oribi groups. Comparison with the mean percentage occurrence of different oribi groups indicated that significantly higher frequences of adult lone males and adult male plus adult female with juvenile female occurred at Golden Gate (Chi-square = 15,8; $p < 0,05$; df = 1 and Chi-square = 4,9; $p < 0,05$; df = 1 respectively). It was also evident that an adult male plus 2 adult females per group was significantly higher in the south-eastern Transvaal (Chi-square = 4,6; $p < 0,05$; df = 1), and so also lone females (Chi-square = 14,4; $p < 0,05$; df = 1).

Comparison of data pertaining to oribi group composition at the Golden Gate Highlands National Park and two study areas in the south-eastern Transvaal is illustrated in Table 32 where the occurrence of each group in Golden Gate is tested with the mean occurrence of similar groups in two study areas in the south-eastern Transvaal. The oribi population in the Golden Gate Highlands National Park increased by 14 percent from May 1982 to December 1983. A mean of 21 oribi were counted with each census (S.D. = 0,9 and C.V. = 4,8) which relates to an ecological density of one oribi per 22,5 ha compared to an ecological density of 21,8 ha per oribi for the Natal Drakensberg (Oliver, Short and Hanks 1978).

Comparison of the results of observations of group composition of oribi by other authors (Oliver, Short and Hanks 1978 and Viljoen 1982) with the findings at Golden Gate indicate that greater similarity exists between the populations of Golden Gate and the Natal Drakensberg than between Golden Gate and the south eastern Transvaal highveld particularly with reference to lone adult males.

DOMINANCE AND SUBMISSIVITY

Dominance is defined by Leuthold (1977) as a characteristic that gives a certain individual access to resources at the expense of other individuals, without direct competition. Considering that territorial behaviour with reference to interactions between different territorial animals are not applicable within the oribi group. Dominance within the oribi group can be considered as an absolute social hierarchy where that hierarchical status of the individual involved cannot be influenced by external factors (Leyhausen 1965 In: Viljoen 1982).

According to Dunbar and Dunbar (1974) and Norton (1980) social interactions amongst klipspringer are kept to a minimum and this observation also holds true for the steenbok (Cohen 1988). Viljoen (1982) maintains that the majority of interactions occur amongst oribi males and that within the social order of the family dominance of the territorial male over juvenile males is evident. This pattern of dominance is identical in the oribi family groups in the Golden Gate Highlands National Park.

The findings of Viljoen (1982) that the oribi female determines movements particularly noticeable in flight reactions can be corroborated by observations at Golden Gate Highlands National Park.

SEX RATIOS

During six counts from May 1982 to December 1983 the mean number of animals was 21,6 and all of the oribi were sexed (Table 33).

Testing for parity of sexes after counts the ratio does not differ significantly from the stated sex ratio (1:1) at a 5 percent level (Chi-square = 3,27; $p > 0,05$; df = 5). A mean sex ratio of 0,46 females per male was recorded for adults (S.D. = 0,001; C.V. = 0,2 percent) and a mean sex ratio of 0,33 females per male was recorded for juveniles (S.D. = 0,25; C.V. = 76,9 percent) possibly owing to the small population size. Viljoen (1982) recorded sex ratio's of 1,23 and 1,31 females per male respectively for his two study areas in the south-eastern Transvaal.

The mean ratio of females per male for adult oribi for the Golden Gate Highlands National Park (0,46) does not differ significantly from the mean ratio of (1,27) females per male found by Viljoen (1982) in the south-eastern Transvaal (Chi-square = 0,52; $p > 0,05$ df = 1).

Table 33: Sex ratios of oribi in the Golden Gate Highlands National Park, Orange Free State based on six seasonal counts from March 1982 to December 1983.

ITEM	ASPECT INVOLVED	COUNT 1982 May	1982 August	1982 December	1983 May	1983 August	1983 December	TOTAL	MEAN	S.D.	C.V. Percent
Count	Total count	21	20	22	22	22	24		21,7	1,79	8,2
	Total sexed	21	20	21	22	22	22		21,7	0,73	3,5
	Adult males	13	13	15	13	13	14		13,5	0,70	5,2
	Adult females	6	6	6	6	6	7		6,2	0,17	2,7
	Juvenile males	1	1	-	2	2	1		1,2	0,35	29,2
	Juvenile females	1	-	-	1	1	-		0,5	0,25	50,0
Observed: females per male	Adults	0,46	0,46	0,4	0,46	0,46	0,5		0,46	0,001	0,2
	Juveniles	1	-	-	0,5	0,5	-		0,33	0,25	76,9
Chi-square: test for difference from a 1:1 ratio	Adults	0,29	0,29	0,36	0,29	0,29	0,25	1,77	-	-	-
	Juveniles	1	-	-	0,25	0,25	-	1,5	-	-	-
	p-value	> 0,05	> 0,05	> 0,05	> 0,05	> 0,05	> 0,05	-	-	-	-
	df	1	1	1	1	1	1	5	-	-	-

HOME RANGES

Home ranges are distinct from territories in the ungulate sense in that the territory is the actively defended part of the home range (Burt 1943, Eibl-Eibesfeldt 1970, Ewer 1973 and Leuthold 1977). As defence of a territory can be passive (Leuthold op. cit.) data collected in this section did not facilitate the determining of territory size but home ranges were plotted.

Oribi home ranges in the Golden Gate Highlands National Park do not overlap. Twelve oribi home ranges were distinguished in the Golden Gate Highlands National Park (Fig. 21) and the mean size of these home range was 23,1 ha (S.D. = 5,63; C.V. = 24,4). The largest home range was 33,6 ha and the smallest 14,4 ha and no difference in mean home ranges size for the individual or oribi group.

Home range estimates were made for seven oribi by Oliver, Short and Hanks (1978) in Highmoor State Forest Land, Natal, a mean home range of 49,2 ha for three adult males, 36,2 ha for a lone female and 11,5 ha and 11,2 ha for two juveniles was recorded.

Viljoen (1982) determined a mean home range of 34 ha (Amsterdam) and 27,9 ha (Piet Retief) respectively in two study areas. According to Monfort and Monfort (1974), oribi territories in the Akagera National Park are grouped or are widespread depending on the population density. Oribi home ranges are smaller in the Golden Gate Highlands National Park than in either the south eastern Transvaal (Viljoen 1982) or Natal (Oliver, Short and

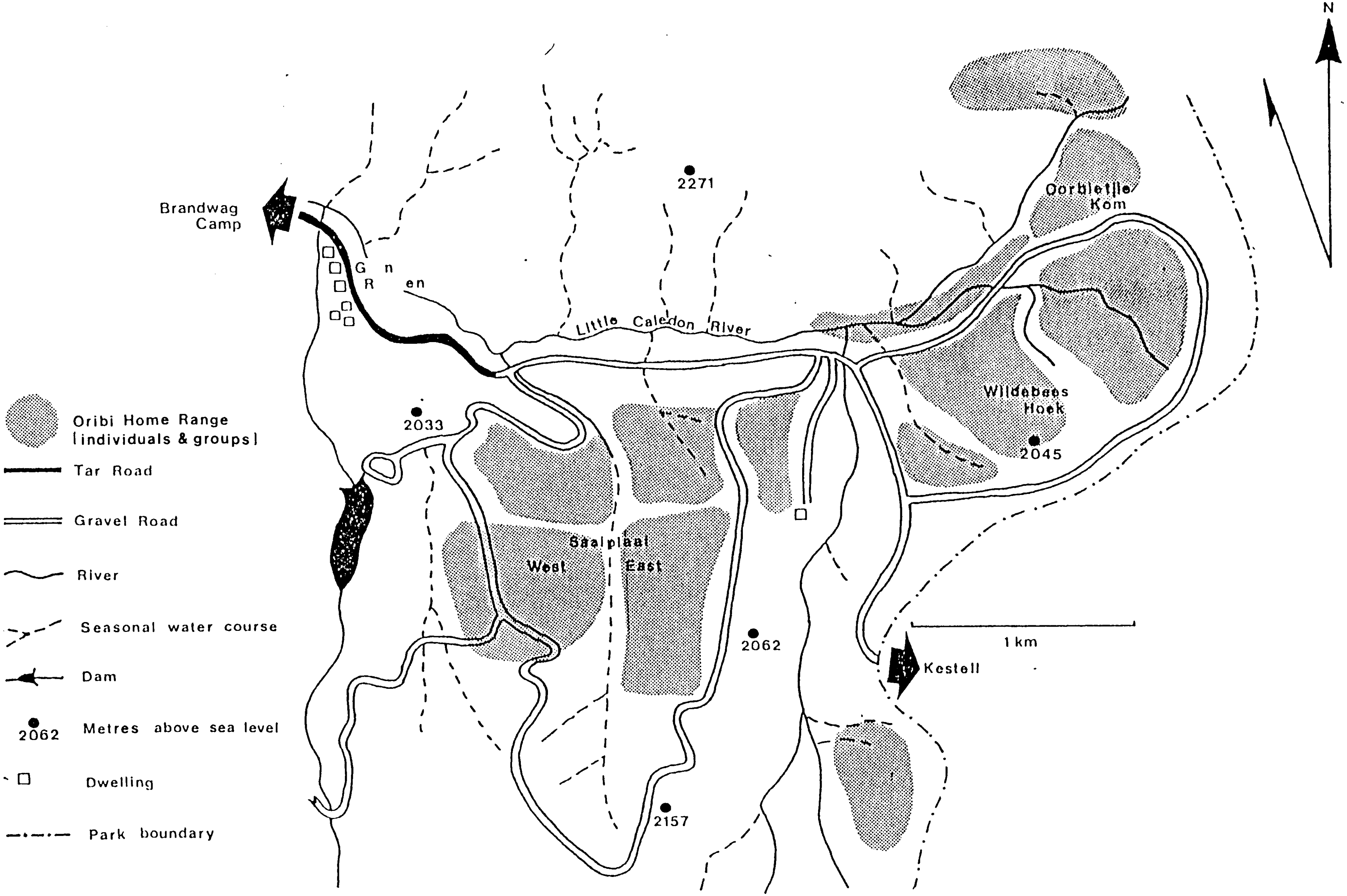


Figure 21: The location and size of oribi home ranges in the Golden Gate Highlands National Park,

Hanks 1978). It is difficult to speculate on reasons for this phenomena but a possible reason could be the lack of suitable habitat for the oribi population in the Golden Gate Highlands National Park. The record of a smallest home range of 14,4 ha in the Golden Gate Highlands National Park (Juvenile male) supports the findings of 11,5 ha and 11,2 ha for juvenile males in Natal by Oliver _et al_. Norton (1980) found that the klipspringers in the Cape Province have a mean territory-size ranging from 15 ha to 49 ha. Cohen (1987) maintains that steenbok males and females have separate but overlapping territories with a mean of 30 ha.

In classifying oribi according to Leuthold's (1977) territory/ home range classification they appear to fall somewhere between the SO-type 3b and SO-type 4 territory/home range. The SO-type 3b category is where both male and female participate in active and passive territory defence and the SO-type 4 is made up of territorial male and family group independent of one another. Viljoen (1982) maintains that this is not the case with oribi in the south-eastern Transvaal and places the oribi in Leuthold's (1977) broad classification of "exclusive territory/home ranges for both sexes". This classification is admirably suited to the oribi in the Golden Gate Highlands National Park.

GENERAL DISCUSSION AND CONCLUSIONS

The Head of the Research and Development section of the National Parks Board of Trustees expressed his anxiety during December 1981 at the apparent lack of viability of oribi in the Golden Gate Highlands National Park and was of the unsubstantiated opinion that this could be ascribed to direct competition with other large ungulates in the Park viz. blesbok and black wildebeest.

The results of this study indicate that the above-mentioned premise is false and that other ungulates are not a limiting factor on oribi in the Golden Gate Highlands National Park (Chapter 7). It has, however, become apparent that other possible limiting factors exist. Results indicate that oribi were more prone to disturbances from human activity.

Oribi appear to be sensitive to wind and the selection of habitats with gradients less than 15° on north and north eastern aspects makes the lack of suitable physical habitat a possible limiting factor. It is evident that the habitat where oribi were introduced into the Golden Gate Highlands National Park is saturated as the density compares favourably with larger populations of oribi in the Natal Drakensberg (Oliver, Short and Hanks 1978). Although the Noord Brabant and Tweelingplaat areas of the Park are physiographically similar to areas inhabited by oribi, and oribi in Golden Gate are insensitive to species composition and dry mass ranking of the grass stratum. A further in depth study of the nutritional aspects of oribi feeding in the Golden Gate Highlands National Park would enhance this conclusion. Human activity in the Little Caledon River Valley effectively cuts off the logical dispersion route to these areas.

Oribi in the Golden Gate Highlands National Park also avoid roads (see Chapter 6) and unfortunately the only road open to tourists in the Park traverses the habitat in which the oribi occur.

The most important implication for the survival of oribi in the Golden Gate Highlands National Park is the recently announced purchase of an additional 6 000 ha of land to the east and north east adjacent to the Park. Part of this area adjacent to Oorbietjie Kom/Wildebees Hoek is physiographically ideally suited to oribi and offers the population scope for expansion. If the population succeeds in colonizing and saturating the new areas available to them, then, the survival of oribi in this part of the Orange Free State seems to be assured. The purchase of this above-mentioned ground obviates the need to reintroduce a small group of oribi from outside the Park, however, such action will assist in the colonization of the new area and strenghten the genetic viability of the population. It would probably be advisable to monitor colonization of the new area.

It is also advisable to review the intrusion of humans particularly on foot in the area inhabited by the oribi as this was the cause of most of the disturbances. Although very little can be done about the existing roads due consideration must be given to oribi as roads tend to encroach on areas physiographically suitable for oribi, this is particularly important with regard to the recently purchased land.

During this study it was impossible to determine selection by oribi for burnt areas versus unburnt areas, however, findings by other authors (Rowe-Rowe 1982a) indicate that oribi select burnt areas but also require taller grass for cover. In the light of the above it may be advisable to institute a block burning program in the oribi habitat.

Critical assessment of this study brings to light possible problems in the analyses owing to the small sample sizes. Certain aspects not covered in this study are the possible effect on oribi of overgrazing by other ungulates as the year round presence of other ungulates could have a detrimental effect on the montane vegetation, comparison of microhabitats on the basis of microclimate and the phenology of plant species eaten.

was done of these areas and two other areas in the Park, viz. Tweeling Plaat and Noord Brabant that shared the same topographical attributes as the Saaiplaat east, Saaiplaat west and Oorbietjie Kom areas. The most important grass species in terms of dry mass ranking in the Saaiplaat west area of the Park are Eragrostis curvula and Sporobolus centrifugus while in the Saaiplaat east area Elionurus muticus, Aristida junciformis and Heteropogon contortus are the most important contributors to dry mass. In the Oorbietjie Kom/Wildebees Hoek area Stiburus alopecuroides and Elionurus muticus are the most important grass species contributors to the total dry mass ranking. In the Tweeling Plaat and Noord Brabant areas the most important contributors to the dry mass are Harpechloa falx and Eragrostis curvula respectively.

The basic activity patterns of oribi showed an increase in activity during the middle of the morning and afternoon. It was also apparent that the active and inactive peaks were different during the summer than during the early winter and the late winter. Activities were well coordinated within each oribi group.

Oribi showed a preference for northern and north-eastern facing slopes and for areas in excess of 150 m away from the nearest roads. Oribi show a negative selection for lower slopes and distribution is not associated with distribution of surface water. Oribi exhibit a positive selection for old lands and verges of old lands with gradients of less than 15°. The oribi also showed a preference for grasslands between 0,5 and 1,0 m tall for both food and cover.

tall for both food and cover.

The premise of competition from other ungulates can be discounted because data accumulated in this regard showed that oribi exhibited total indifference to other ungulates in 99 percent of encounters (621 observations). This result is duplicated in that other ungulates showed total indifference to oribi in 99 percent of encounters.

Analysis of the feeding preferences of oribi showed that they regularly utilized 22 different plant species with a seasonal preference for certain species and a selectivity for certain plant parts like inflorescences (Chapter 8). Oribi in the Golden Gate Highlands National Park have a high preference for *Sporobolus centrifugus*, *Themeda triandra*, *Tristachya leucothrix*, *Watsonia densiflora*, *Monocymbium ceresiiforme*, *Heteropogon contortus*, *Eragrostis curvula*, *Cyperus obtusiflorus* and *Andropogon schirensis*.

The oribi population in the Golden Gate Highlands National Park showed strong territorial behaviour and the December 1983 count showed a mean population of 21 animals in 14 different groups inhabiting an area of 472 hectares. Of the 14 groups in the Golden Gate Highlands National Park 7 groups are male groups.

Oribi in Golden Gate exhibit normal daily activity patterns comparable to oribi elsewhere (south eastern Transvaal, Viljoen 1982) but oribi in Golden Gate show specific preferences regarding the physiographic attributes of their habitat.

It has been established beyond reasonable doubt that the Golden Gate Highlands National Park has a thriving though small population of oribi.

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APPENDIX

Alphabetical list of plant species mentioned in the text with nomenclature according to Gibbs Russel et al. (1985) and Gibbs Russel et al. (1987).

Andropogon schirensis A. Rich.

Aristida congesta Roem. & Schult.

Aristida diffusa Trin.

Cynodon dactylon (L.) Pers.

Cyperus obtusiflorus Vahl

Cyperus rigidifolius Steud.

Digitaria eriantha Steud.

Diheteropogon filifolius (Nees) Clayton

Elionurus muticus (Spreng) Kunth

Eragrostis caesia Slapf

Eragrostis capensis (Thunb.) Trin.

Eragrostis curvula (Schrad.) Nees

Eragrostis racemosa (Thunb.) Steud.

Erica alopecurus Harv.

Eulalia villosa (Thunb.) Nees

Eulophia clavicornis Lindl.

Gazania krebsiana Less.

Harpechloa falx (L.f.) Kuntze

Helichrysum appendiculatum (L.f.) Less.

Helichrysum callicomum Harv.

Helichrysum pilosellum (L.f.) Less.

Heteromma decurrens (DC.) O. Hoffm.

Heteropogon contortus (L.) Roem. & Schult.

Hypochoeris radicata L.

Hypoxis argentea L.

Koeleria capensis (Steud.) Nees

Monocymbium ceresiiforme (Nees) Stapf

Moraea modesta Killick

Miscanthidium capensis (Nees) Stapf

Paspalum dilatatum Poir.

Pennisetum clandestinum Chiov.

Pentaschistis jugorum Stapf

Polygala hottentotta Presl.

Senecio coronatus (Thunb.) Harv.

Senecio harveianus MacOwan.

Sporobolus centrifugus (Trin.) Nees

Stiburus alopecuroides (Hack.) Stapf

Tagetes minuta L.

Themeda triandra Forsk.

Tristachya leucothrix Nees

Watsonia densiflora Bak.