CHAPTER 2

STUDY AREA

Introduction

The study was conducted in the southwestern portion of the Kgalagadi Transfrontier Park in an area where the Park shares a common border with Namibia (Fig. 1). The Kgalagadi Transfrontier Park was officially proclaimed at a ceremony on 12 May 2000 (Donaldson 2000). Prior to the amalgamation the two components of the Kgalagadi Transfrontier Park the Kalahari Gemsbok National Park (South Africa) and the Gemsbok National Park (Botswana), had been managed as separate entities even though there was never any fence between the two parks. The Nossob River forms the border between South Africa and Botswana, and although this political boundary is in place for humans, there is no fence and it therefore has no effect on the movement of wild animals. The agreement ratified by the combining of the Parks stipulates that the whole area is to be managed according to the same management plan with the same goals, as opposed to two separate Parks with separate focuses and goals.

Location

The Kalahari system is a sand-covered area that stretches from 29° S on the Orange River to 1° N in the Democratic Republic of Congo. From east to west the Kalahari extends from 32° E in Zimbabwe to 11° E in Angola (Cooke 1957, in Thomas & Shaw 1991). The Kgalagadi Transfrontier Park covers an area of 36 200 km^2 in the southwestern portion of this system.

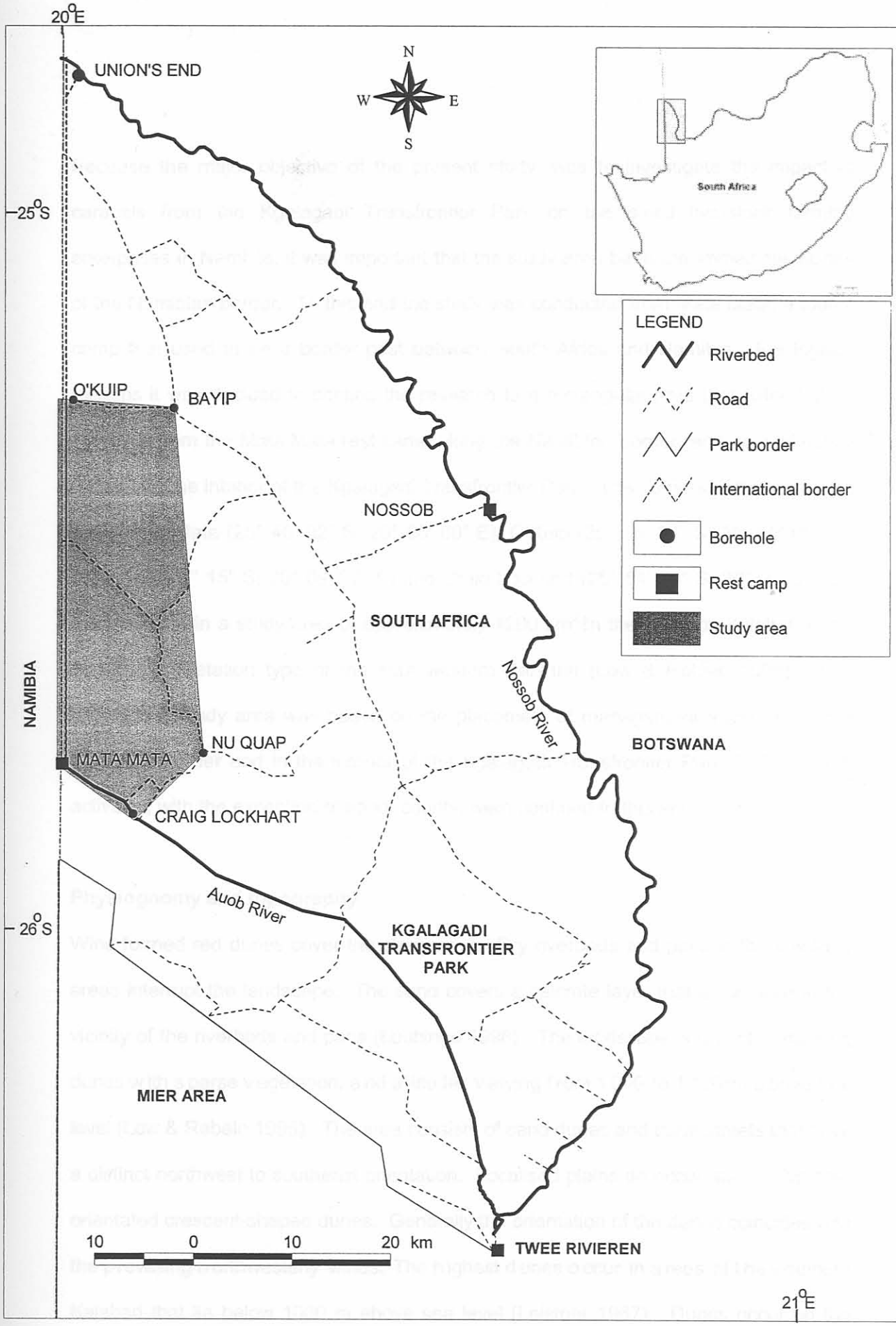

Figure 1: Position of the study area within the Kgalagadi Transfrontier Park.

Because the major objective of the present study, was to investigate the impact of caracals from the Kgalagadi Transfrontier Park on the small live-stock farming enterprises in Namibia, it was important that the study area be in the immediate vicinity of the Namibian border. To this end the study was conducted from Mata Mata, a tourist camp that used to be a border post between South Africa and Namibia. For logistic reasons it was decided to confine the research to a rectangular area that extended 60 km north from the Mata-Mata rest camp along the Namibian border, and approximately 20 km into the interior of the Kgalagadi Transfrontier Park. The corners of this rectangle were Mata Mata (25° 46' 02" S; 20° 00' 00" E), O'Kuip (25° 16' 28" S; 20° 00' 00" E), Bayip (25° 17' 15" S; 20° 09' 37" E) and Craig Lockhart (25° 51' 56" S; 20° 06' 07" E). This resulted in a study area of approximately 1200 km^2 in the Shrubby Kalahari Dune Bushveld vegetation type of the southwestern Kalahari (Low & Rebelo 1996). This rectangular study area was based on the placement of management tracks along the Namibian border and in the interior of the Kgalagadi Transfrontier Park. All research activities, with the exception of spoor counts, were confined to this area.

Physiognomy and topography

Wind formed red dunes cover the study area. Dry riverbeds and pans in the low-lying areas interrupt the landscape. The sand covers a calcrete layer that is exposed in the vicinity of the riverbeds and pans (Lubbinge 1998). The landscape is one of undulating dunes with sparse vegetation, and altitudes varying from 1 000 to 1 100 m above sea level (Low & Rebelo 1996). The area consists of sand dunes and dune streets that have a distinct northwest to southeast orientation. Localised plains do occur, as do atypically orientated crescent-shaped dunes. Generally the orientation of the dunes coincides with the prevailing northwesterly winds. The highest dunes occur in areas of the southern Kalahari that lie below 1000 m above sea level (Leistner 1967). Dunes occur on the

westerly and northwesterly banks of the Nossob and Auob rivers, while the underlying calcrete layer is exposed to a distance of approximately 500 m from the rivers on the southeasterly riverbanks (Leistner 1967).

Crescent-shaped dunes are distinguished by their shape and the upwind orientation of the arms of the crescent (Mckee 1983). The sand depth, in the vicinity of crescent–shaped dunes, varies from 3.5 to 35 m (Parris 1984). These dunes are usually formed as a result of a combination of two factors, fallen trees on dune crests and wind action (Eriksson *et al.* 1989).

The areas between the dunes are known as dune streets or dune valleys. The sand layer in these lower-lying areas is relatively shallow, especially in the north and west of the South African portion of the Kgalagadi Transfrontier Park. In some cases the sand is so shallow that the calcrete substratum is exposed (Leistner 1967).

Although the highest dunes are taller than 30 m, the mean vertical distance between dune crests and the floor of dune streets is 8.2 m. The distance between dune crests varies from 100 to 500 m with a mean of 228.5 m. Most of the dunes have flat crests that can be up to 9.1 m wide. The longest continuous, unbranched dune is 3.2 km long, but single dunes can stretch over distances of over 14.5 km.

Drainage

The Kgalagadi Transfrontier Park is situated in a huge land depression in southern Africa with a gradual southerly gradient. As a result of this, the fossil riverbeds follow the southward gradient. The four rivers that historically drained the southern Kalahari are the Nossob, Auob, Molopo and Kuruman Rivers. They all formed part of the Orange

River catchment basin. As far as it can be determined, the one that ceased flowing most recently is the Molopo, but it has not flowed consistently for at least the past 1000 years. Even in seasons of abnormally high rainfall, such as 1999 to 2000, none of the rivers flows to reach the Orange River. Of the above four rivers, only the Auob and Nossob Rivers pass through the Kgalagadi Transfrontier Park.

The Nossob and Auob Rivers originate in the highlands of Namibia and their lower riverbeds pass through the Kgalagadi Transfrontier Park. The Molopo and Kuruman Rivers originate in the east (Leistner 1967). Although neither the Nossob nor the Auob Rivers flow, even in years of exceptionally high rainfall, sporadic flooding of portions of the riverbeds ensures the replenishment of the water table and prevents the river courses from being blocked by dune formation (Leistner 1967). The Auob River floods locally more frequently than the Nossob River. The Auob River last flooded in March 2000 while the two most recent recorded floodings of the Nossob River occurred in 1934 and 1963 (Van Rooyen 2001).

Pans

There are numerous pans in the Kgalagadi Transfrontier Park (Van Rooyen 2001). They usually form circular depressions of varying sizes, with hard bases. They are created by wind erosion and periodically contain water (Lubbinge 1998, Van der Walt & Le Riche 1999). The bases of the pans can lie up to 20 m below the surrounding plains (Van der Walt & Le Riche 1999). Wild animals often congregate near the pans to take advantage of the water that accumulates in these depressions after rain (Van der Walt & Le Riche 1999, Van Rooyen 2001).

Van Rooyen (2001) differentiates between two basic pan types, those that are vegetated with grass and those that are bare. Van der Walt & Le Riche (1999) included a third category of pans that have a hard limestone floor.

The soils of the pans are more varied than in the surrounding dune veld, and a gradient of changing soil chemical composition exists between the centre of the pan and the dunes that surround the pan. The soil in the pans is generally more compacted and has a higher mineral content than that of the surrounding vegetation (Parris 1976). Due to the high mineral content, animals often use areas on the pan floor as natural salt licks (Parris & Child 1973, Parris 1976, Van der Walt & Le Riche 1999). The gradient of changing chemical composition also leads to the concentric zonation of vegetation as it merges from the centre of the pan into the surrounding veld (Leistner 1967, Parris & Child 1973, Van Rooyen 2001).

Geology

The geological formations of the Kgalagadi Transfrontier Park form part of the Kalahari Group (Malherbe 1984). Information relating to the pre-Kalahari formations was obtained while drilling boreholes and is made up of dolerite or sedimentary formations of the Karoo-sequence. Seven distinct geological formations have been identified in this area and include the Wessels, Budin, Lonely, Eden, Mokalanen, Goeboe Goeboe and Gordonia Formations. The Eden, Mokalanen and Goeboe Goeboe Formations are usually confined to the riverbeds and pans while the Gordonia Formation underlies the duneveld and areas surrounding the rivers and pans (Malherbe 1984, Main 1987).

Soil

The Kalahari sand is not simply a homogeneous unit, but varies greatly in colour, composition and texture (Thomas & Shaw 1991). The colour variation of the sand is a result of varying degrees of leaching (Van der Walt & Le Riche 1999). The sand layer in the Kalahari can be up to 30 m thick and is of aeolian origin (Thomas 1984). The soils can be divided into two primary groups, coarse and fine-textured soils that can be further divided into seven basic groups (Leistner & Werger 1973). The vast majority of the soil particles consist of sand grains that are primarily quartzite. The red colour of the sand grains is a result of ferrous oxide adhering to the grains. The only soils that differ are those white sands that occur in the low-lying areas such as riverbeds and pans. These areas act as dams for organic material and mineral nutrients. In the dunes the Hutton soil form dominates but further north and east into Botswana, the Clovelly form prevails (Van der Walt & Le Riche 1999). The soils of the riverbeds and pans fall into one of five forms namely; Oakleaf, Dundee, Valsrivier, Swartland and Mispah (Van Rooyen 1984).

Climate

The southern Kalahari is an arid savanna with a mean annual rainfall that varies from 150 mm (Fig. 2) in the southwest to 300 mm in the north (Leistner 1967, Low & Rebelo 1996, Lubbinge 1998, Van Rooyen 2001). The area falls between the 200 and 250 mm isohyets and is characterised by low irregular annual rainfall (Mills & Retief 1984). The rainfall is highly variable and can vary from < 100 mm to > 700 mm per year (Van Rooyen 2001). Van der Walt and Le Riche (1999) distinguished three distinct climatic phases;

- A wet phase when the rainfall is far above the annual mean.
- An arid phase when the rainfall is far below the annual mean.
- A transitional phase when the rainfall varies around the annual mean.

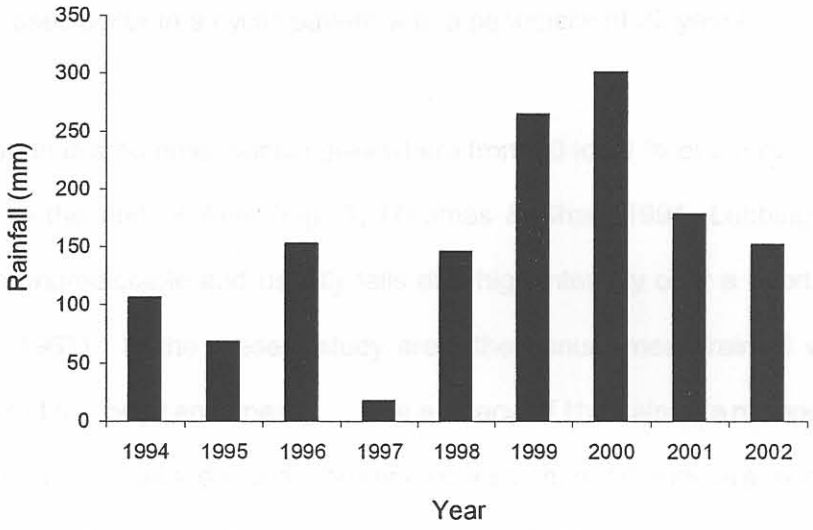

Fig 2: Recent annual rainfall for Mata Mata rest camp in the Kgalagadi Transfrontier Park from 1994 to 2002, where the mean annual rainfall is 152.3 mm.

These phases occur in a cyclic pattern with a periodicity of 20 years.

The Kalahari is a summer rainfall area where from 80 to 91 % of the rain falls from early October to the end of April (Fig. 3) (Thomas & Shaw 1991, Lubbinge 1998). The rainfall is unpredictable and usually falls at a high intensity over a short period of time (Leistner 1967). In the present study area, the annual mean rainfall was 153.5 mm (84.3 % of the long term mean). The efficacy of the rain is an important factor in relation to the vegetation and showers of less than 10 mm are considered to be ineffectual for the germination of seeds (Leistner 1967). The evaporation rate plays a huge role on the efficacy of the rain because the evaporation rate is 10 times that of the mean annual rainfall (Lubbinge 1998).

The Kalahari is subjected to some of the most extreme temperatures in southern Africa with a maximum daily temperature of 45.4° C and a minimum of – 10.3° C (Low & Rebelo 1996, Van Rooyen 2001). January is usually the hottest month with the lowest temperatures being recorded in June and July (Fig. 4) (Leistner 1967, Lubbinge 1998).

Vegetation

The vegetation is characterised by the trees *Acacia erioloba*, *Acacia haematoxylon* and *Boscia albitrunca* trees, a shrub layer of *Grewia retinervis* and *Rhus tenuinervis,* and a well-developed grass layer consisting mainly of *Stipagrostis amabilis*, *Eragrostis lehmanniana, Aristida meridionalis, Schmidtia kalihariensis* and *Centropodia glauca* (Low & Rebelo 1996).

The Kgalagadi Transfrontier Park forms the southern part of the greater Kalahari ecosystem. Because of the arid nature of the area, many of the plants there are

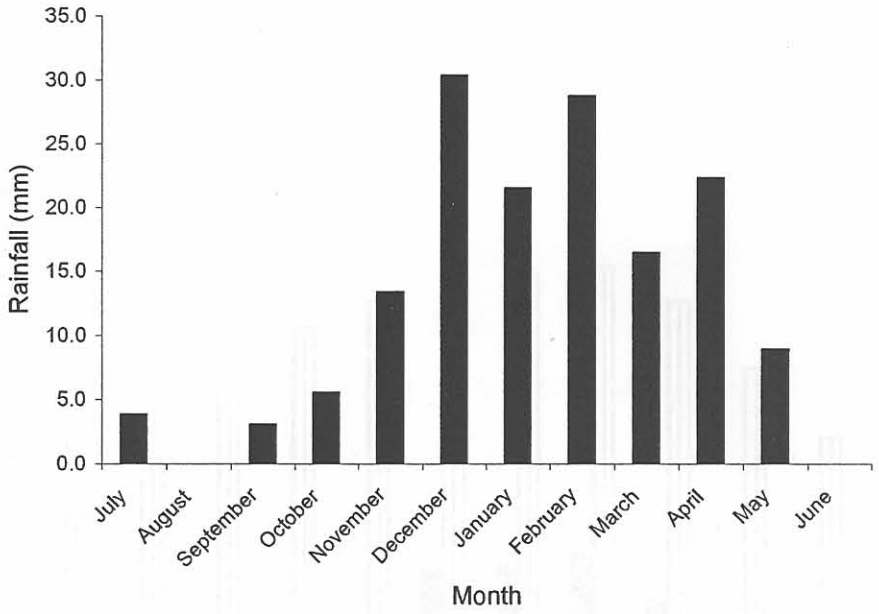

Fig 3: Mean monthly rainfall at Mata Mata rest camp in the Kgalagadi Transfrontier Park from 1994 to 2002

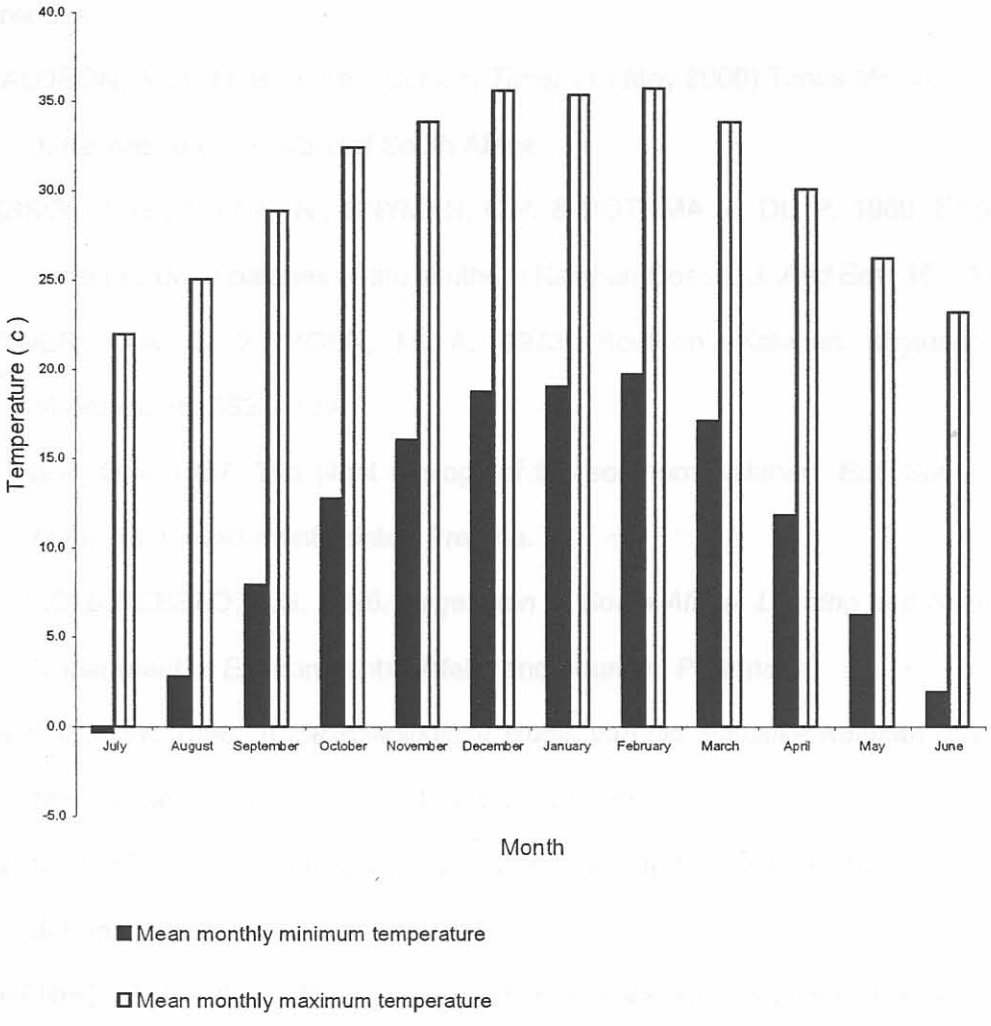

Fig 4 : Mean maximum and minimum temperatures for Mata Mata rest camp in the Kgalagadi Transfrontier Park from 1994 to 2002.

ephemeral. After sufficient rain, these plants germinate quickly to complete their life cycles in a short time (Eloff 1984).

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