

A study of animal movement in the Hoanib River catchment, northwestern Namibia

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Seasonal movements of domestic stock and wildlife were analysed across the Hoanib River catchment. Data were gathered by ground and aerial surveys and represent the seasonal movement of animals, rather than the total number of animals in the catchment area. Domestic stock movement and distribution did not vary substantially and appeared to be associated with the seasonal, spatial availability of water and grazing in different places, and with human settlements. There was an apparent movement of cattle out of the catchment area during the hot-dry season. Only African elephant and springbok were found close to human settlements. Giraffe, Hartmann's mountain zebra and oryx were found to avoid human settlements and were predominantly observed in areas with little disturbance from humans and domestic stock. Wildlife had distinctive wet- and dry-season ranges, with larger concentrations occurring in the Hoanib River during the cold-dry and hot-dry seasons when grazing and browsing was limited elsewhere.

Key words: wildlife density, elephant, giraffe, zebra, domestic stock.

INTRODUCTION

The traditional herding practices of pastoralists in southern Africa have been described by Kinahan (1991), Owen-Smith & Jacobsohn (1991) and Fuller (1993). In northwestern Namibia, traditional pastoralism involves the continual movement of stock between grazing areas, dependent on the spatial distribution of annual rainfall. Fuller (1993) stated that cattle and small stock were moved by the young men of the family unit (both Damara and Otjiherero), often over great distances. Pastoralists also coped with arid environments by dividing cattle herds into smaller units to farm out to relatives at different seasonal locations. This dispersal of herds was a method of 'spreading the risk' and thus increasing the chances that some of the herd might survive the arid period (McClure 1998). Most small stock were traditionally kept nearer the village and not herded, as they were used for food and not considered to have the same value as cattle (Fuller 1993).

Historical wildlife distributions in northwestern Namibia have been reported by a number of authors (e.g. Shortridge 1934; Bigalke 1958; Joubert & Mostert 1973; Viljoen 1988). More recently, wildlife populations have been regularly monitored by the Ministry of Environment and Tourism (MET), non-governmental organizations (NGOs) and contractors (Owen-Smith 1970;

Joubert 1972a,b; De Villiers 1975; Viljoen 1977; Visagie 1977; Le Roux 1978; Carter 1990; Loutit 1993, 1995; Special Support Services 1999). Owen-Smith & Jacobsohn (1991) reported that poachers and drought decimated the large populations of large mammals previously occurring in the area during the late 1970s and early 1980s. Since this time, communities of the northwest have been mobilized by the MET and NGOs in support of conservation. This combined with effective law enforcement has resulted in the initial stabilisation and then increase of wildlife numbers (Owen-Smith 1996).

The aim of this study was to quantify the seasonal movement of domestic animals and wildlife in the Hoanib River catchment, one of twelve major ephemeral river catchments in the semi-arid area of northwestern Namibia (Fig. 1). As with other ephemeral rivers, the Hoanib forms a 'linear oasis' where water-dependent riparian vegetation and wetlands support animal and human populations (Jacobson *et al.* 1995). The Hoanib River catchment occupies an area of 17 200 km² consisting of 3% private farmlands, 91% communal farmlands and 6% protected as areas of Etosha National Park and Skeleton Coast Park. A broad floodplain (70 km²) lies in front of the moving dunes of the coast, approximately 15 km from the coast. It is only during exceptional rainfall years that the river has sufficient force to break through the dune field and reach the coast (Jacobson *et al.* 1995).

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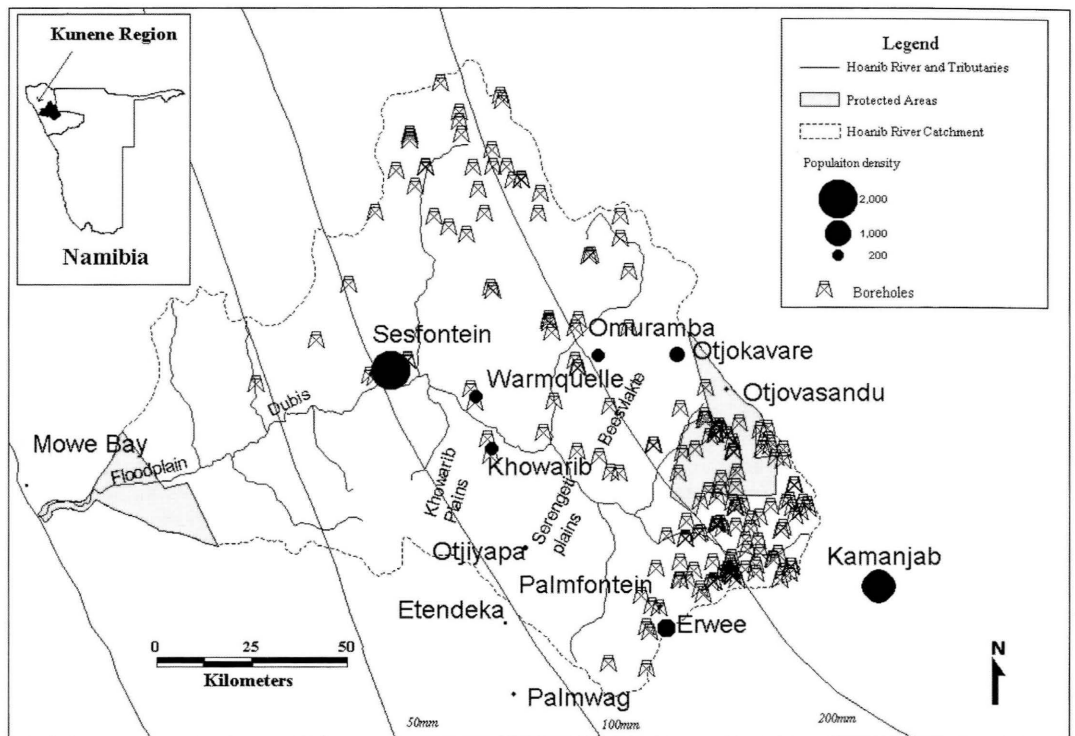


Fig. 1. Location of the Hoanib River catchment, northwestern Namibia

MATERIALS & METHODS

Aerial surveys

Three aerial surveys were conducted during the wet (April 1999 and April 2000) and hot-dry (October 1999) seasons. These seasons were considered the most appropriate seasons for aerial surveying as wildlife tends to be most dispersed during the wet season and most concentrated during the hot-dry season. Surveys varied between 16 and 18 hours flying time and represented a 4% sample count of the catchment. The same aircraft (Cessna 182), pilot, observers and sample blocks were used for all surveys. The airspeed of the aircraft during each transect was between 60–100 knots, an altitude of 150 m (determined by altimeter) was maintained and a strip width of approximately 400 m was used. Flight parameters, however, depended on wind conditions and topography. In high winds or mountainous terrain transect speed and altitude increased, while strip width decreased. Intensive surveying (approximately 50% aerial cover of trees and shrubs) was undertaken along the Hoanib River, selected tributaries and known

wildlife areas (Fig. 2). Known wildlife areas were determined prior to aerial surveying by local knowledge and intensive ground surveying by vehicle on routes, which were not included in the bimonthly ground surveying. In addition, 20 randomly chosen 3×3 km grid squares were flown (in an east/west direction) in areas known not to be inhabited by wildlife. Counts were also undertaken during the ferrying flights to, from and between survey blocks. If wildlife or domestic stock were observed during these flights, counts were conducted. Whenever possible, surveys were conducted in the morning or evenings to take advantage of maximum visibility conditions. In addition, morning and evening flights corresponded to the periods when the animals were most active and not seeking shelter under trees to escape the heat.

When animals were located in the sample blocks, their positions were marked using a global positioning system instrument and manually recorded. These data were later transferred to geographical information system programme, MAPINFO.

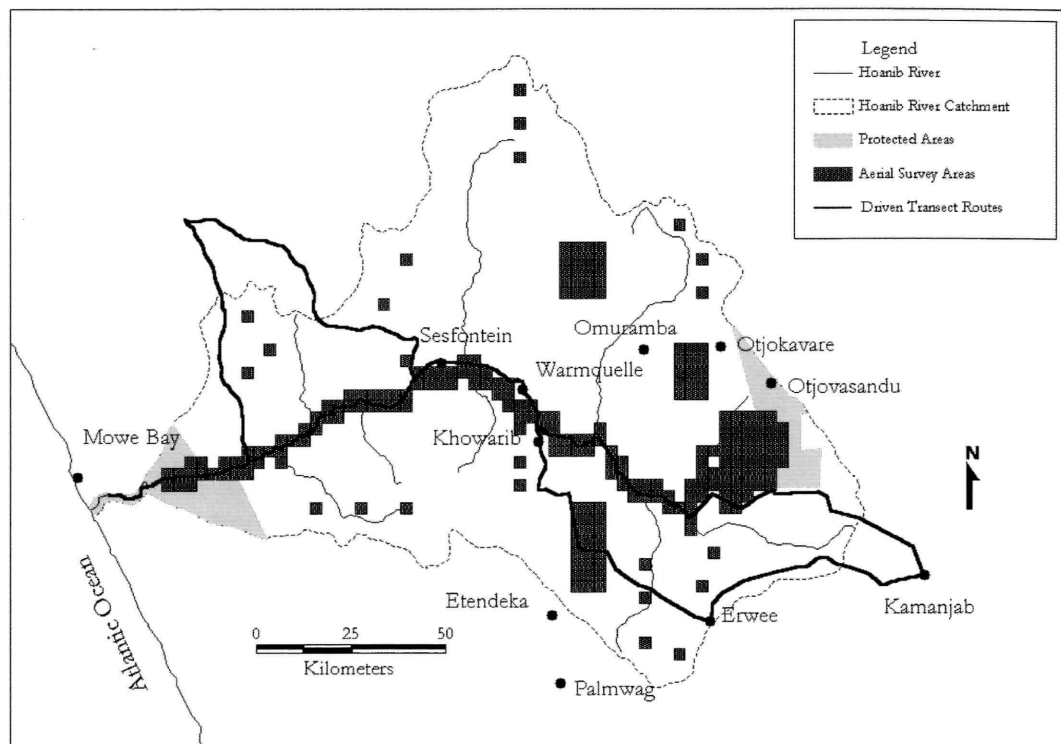


Fig. 2. Aerial survey blocks and driven transect route in the Hoanib River catchment, northwestern Namibia.

Ground-based surveys

From January 1999 to November 2000, researchers undertook systematic ground surveys by vehicle along the length of the Hoanib River on fixed transect routes (Fig. 2). Owing to lack of adequate routes some segments of the transect were traversed twice, where this did occur no data were recorded during the second traverse. During the study period, 14 fixed transect route surveys were undertaken (Table 1). The location, number and where possible, age, sex, and general activity of wildlife and domestic stock were recorded.

Surveys of areas around villages by community members

Community members (CMs), trained by the researchers on how to identify, count, sex and age wildlife and domestic stock, collected data within a 15 km radius of their home villages (Sesfontein, Warmquelle, Khowarib, Omuramba, Otjokavare and Erweë). The data obtained by CMs were purely incidental as no fixed routes were used and the mode of transport varied. In addition, CMs were trained only to record animals once (i.e. if they were walking/riding/driving between fixed

Table 1. Number of fixed route, incidental and aerial count surveys undertaken in the Hoanib River catchment, northwestern Namibia, 1999/2000.

	Surveys	
	1999	2000
Wet Season		
Fixed route ¹	3	2
Incidental ²	2	4
Aerial count ³	1	1
Total	6	7
Cold-dry season		
Fixed route ¹	4	2
Incidental ²	4	4
Aerial count ³		
Total	8	6
Hot-dry season		
Fixed route ¹	2	1
Incidental ²	4	2
Aerial count ³	1	
Total	7	3

¹Fixed-route surveys undertaken by researchers.

²Incidental surveys undertaken by community members.

³Aerial counts undertaken by researchers.

points they would only record the data on the way out and not on the way back, if at a watering point then only if the animals drank). Most of the data were obtained while CMs were engaged in other pastoral activities and presented in written monthly reports to the researchers. During the course of the study a total of 20 incidental surveys were undertaken by CMs (Table 1). Their knowledge of seasonal domestic stock and wildlife numbers, locations and movement has been incorporated into the distribution maps, and the maps showing the suggested directions of movement.

Ground (from all sources) and aerial survey data were combined to determine the distribution of wildlife and domestic stock in different seasons. There are three recognizable seasons (Viljoen 1988) namely a wet season (January–April), a cold-dry season (May–August), and a hot-dry season (September–December). Although these seasons are used to present data in this paper and have been used by previous researchers, they are functional definitions only rather than accurate descriptions. In practice, the seasons are variable, e.g. the 1999/2000 wet season commenced in October 1999. Rainfall in the western section of Namibia is spatially and temporally variable (Leggett *et al.* 2001a). During the project, rain gauges were placed in the main villages and the community researchers recorded data daily. However, in most areas of the catchment, rainfall was evidenced only by the flush of vegetation and subsequent aggregation of animals.

It should be noted that the results do not represent the total numbers of animals in the Hoanib River catchment. The distribution maps (Figs 3–9) for wildlife and domestic stock exhibit the seasonal distribution of animal occurrence and possible movement patterns.

RESULTS

Domestic stock

The distribution of cattle (*Bos taurus* (Linnaeus, 1758)), donkeys (*Equus asinus* (Linnaeus, 1758)), goats (*Capra hircus* (Linnaeus, 1758)), horses (*Equus caballus* (Linnaeus, 1758)) and sheep (*Ovis ammon* (Linnaeus, 1758)) appeared to be closely linked to human settlements and water dependence. There was some wet-season herding of cattle, thus expanding their range into areas where seasonal grazing, pans and springs were available (southern section of the Khowarib and Serengeti plains) (Fig. 1). However, during the hot-dry season the cattle rely on the permanent water sources, thus

restricting their available grazing range. Observed numbers indicated a net movement of cattle out of some areas of the catchment area during the hot-dry period. During a series of community meetings held between the researchers and local communities, pastoralists from the Omuramba area indicated that they would send their cattle to relatives outside the catchment (Fig. 3). They normally herded the cattle to the higher rainfall areas in the north unless better grazing was available elsewhere. During this study, the majority of domestic stock observations were made within a 15 km radius of settlements.

All other domestic stock had similar distributions to each other and to cattle within the catchment area (Fig. 4). Goats and sheep were associated with settlements. During the wet season some goats and sheep were herded to seasonal grazing areas along with cattle, but towards the end of the cold-dry season when the seasonal water sources were depleted, they returned to the permanent water sources. There was no movement of goats and sheep out of the catchment. The daily movement of goats and sheep was dependent on the distribution of available graze, reaching a maximum of 5–7 km during the dry seasons. The distribution of donkeys and horses was closely associated with human populations and assured water sources.

Wildlife distributions

Of the wildlife species studied, only springbok (*Antidorcas marsupialis* (Zimmerman, 1780)) and African elephant (*Loxodonta africana* (Blumenbach, 1797)), were found in areas of high human and domestic stock density. All other species studied appeared to be limited to areas where human and domestic stock densities are low. Elephant distribution appeared to be associated with riverbeds (in the western catchment), particularly during the hot-dry season (Fig. 5) (Viljoen 1988, 1989). During the wet season and early cold-dry season there was an increase in elephant numbers in the Hoanib floodplain, and at Hobatere. During the wet and cold-dry seasons, relatively high elephant densities were observed around the human settlements at Omuramba and during the hot-dry season elephants were only observed in the river beds in both eastern and western sections of the catchment.

Giraffe (*Giraffa camelopardalis* (Linnaeus, 1758)) appeared to be most abundant along the riverbed between Sesfontein and in the extreme western

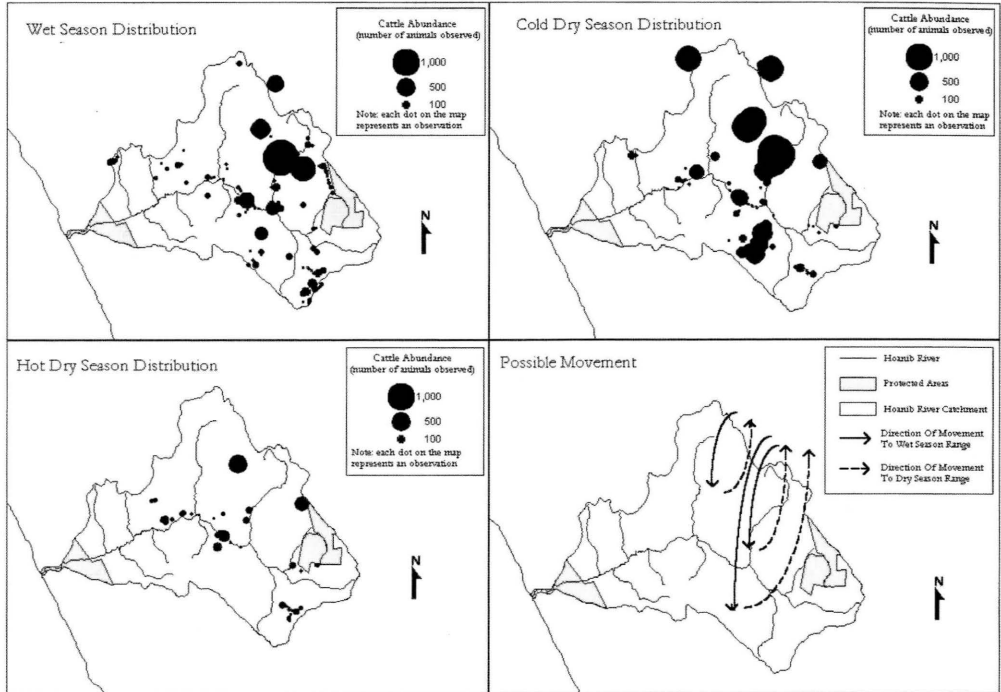


Fig. 3. Seasonal distribution of cattle in the Hoanib River catchment, northwestern Namibia, 1999/2000.

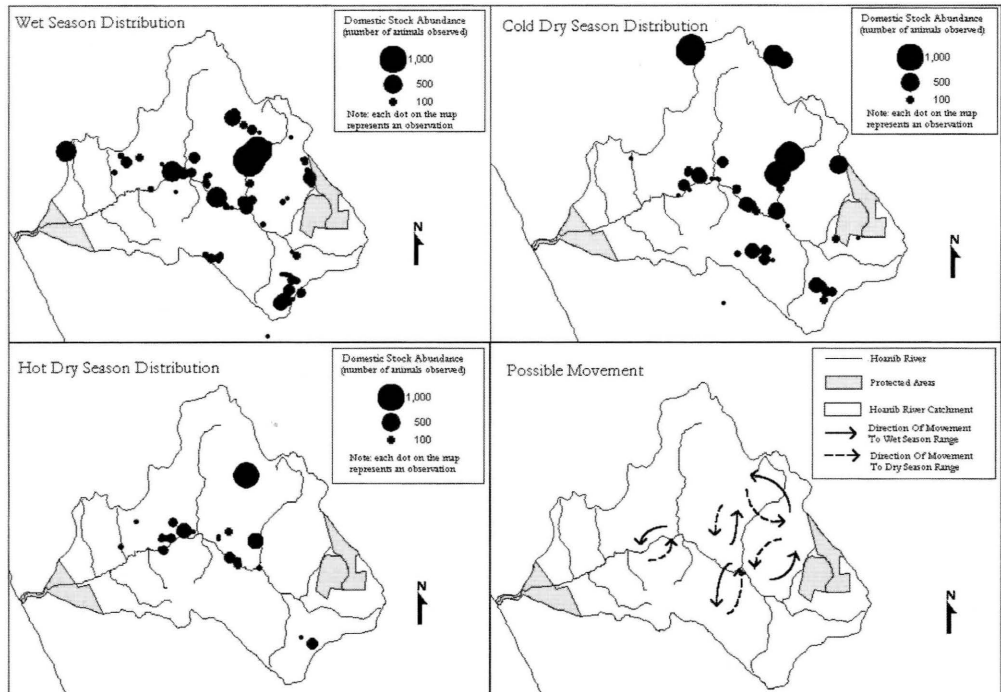


Fig. 4. Seasonal distribution of other domestic stock (donkey, goat, horse and sheep) in the Hoanib River catchment, northwestern Namibia, 1999/2000.

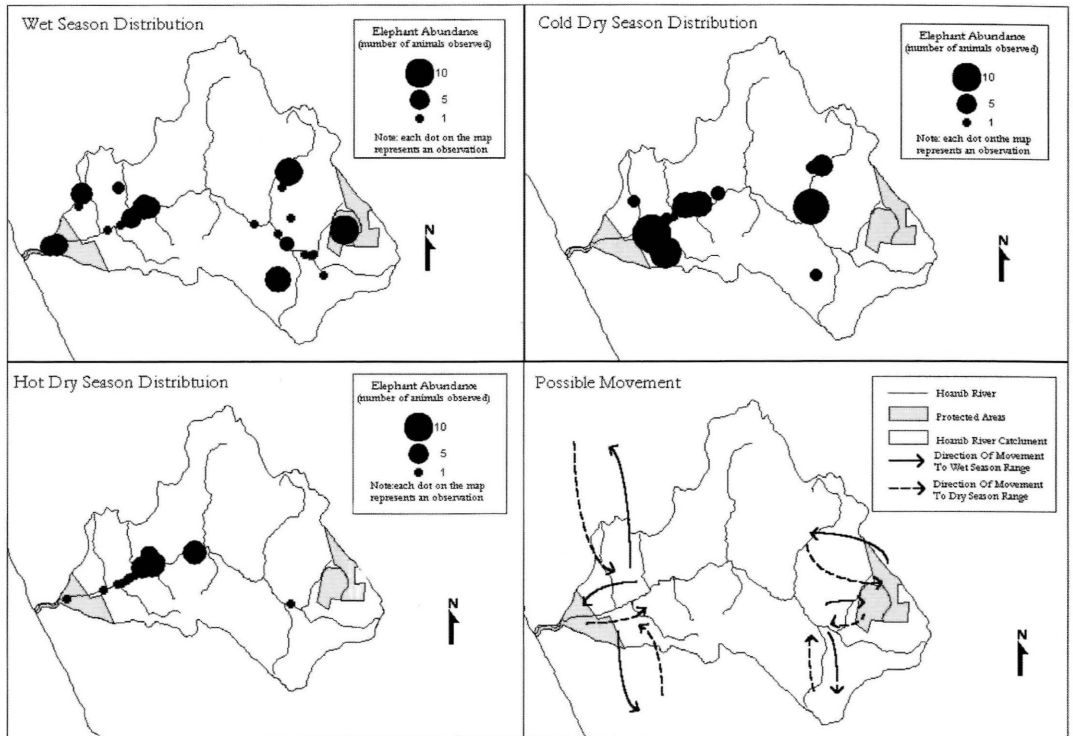


Fig. 5. Seasonal distribution of African elephant in the Hoanib River catchment, northwestern Namibia, 1999/2000.

section of the catchment (Fig. 6). However, in the eastern section they were most abundant along the Ombonde River, Hobatere and in the Etendeka Mountains. Giraffe numbers appeared to increase in the riverbeds during the hot-dry season and in the wet season at Hobatere and in the mountains to the west.

The main population density of oryx (*Oryx gazella* (Linnaeus, 1758)) appeared to be between Sesfontein and the coastal dune system in the west, while in the east oryx were found in Hobatere and in the isolated southern areas of the Etendeka Mountains. A seasonal increase in numbers was observed in the Hoanib floodplain during the wet and early cold-dry seasons (Fig. 7).

Only limited data were available for Hartmann's mountain zebra (*Equus zebra hartmannae* (Matschie, 1898)). However, they were observed during the wet season in the mountainous regions to the south of the catchment area, in and to the immediately west of Hobatere Game Park (Fig. 8). With the exception of Hobatere Game Park, Hartmann's mountain zebra were not observed in other areas of the catchment during the cold-dry and hot-dry seasons by any survey method (aerial count, fixed

route or incidental). While there was a seasonal movement of Hartmann's mountain zebra into and out of Hobatere Game Park, their seasonal movement and distribution in the rest of the catchment remains unknown.

Most springbok were observed in the area between Sesfontein and the coastal dune system in the western section of the catchment (Fig. 9). There appeared to be localized concentrations in the Khowarib plains, Beesvlakte, Omuramba and Ombaadjie areas. At the end of the wet season and into the cold-dry season, large numbers were observed in the southern section of the catchment throughout the Etendeka Mountain. The wet and cold-dry season range appeared to be far more extensive than the hot-dry season range when most springbok records were associated with the riverbed. Although the range covered by this species was extensive, it was regularly observed to occupy the same range as domestic stock.

DISCUSSION

The maximum daily grazing range of domestic stock is determined by how far they need to move to find grazing, graze and then return to drink

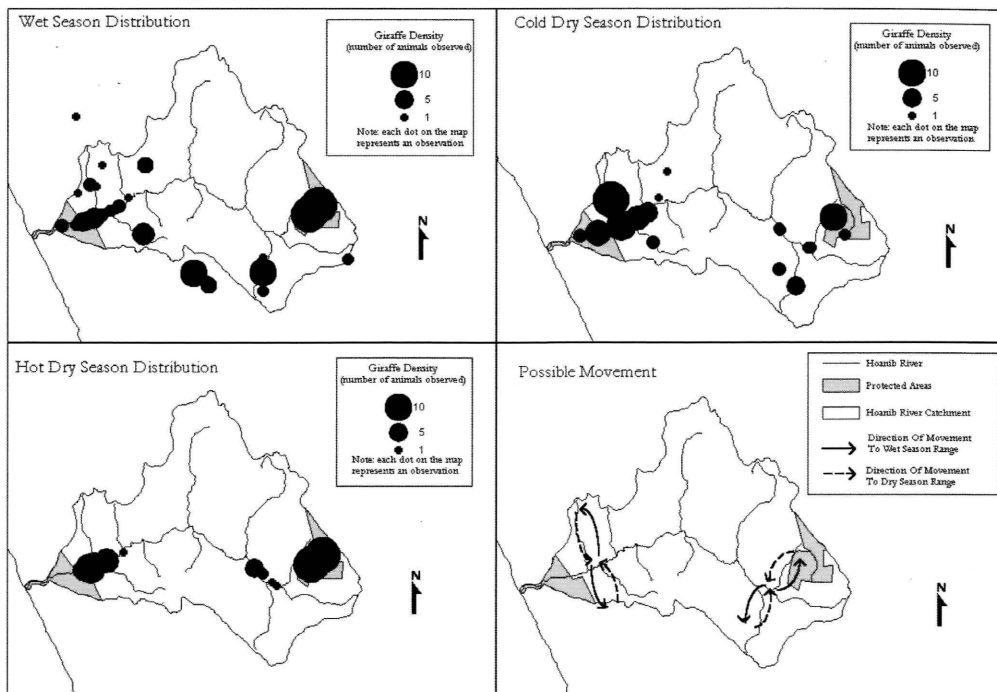


Fig. 6. Seasonal distribution of giraffe in the Hoanib River catchment, northwestern Namibia, 1999/2000.

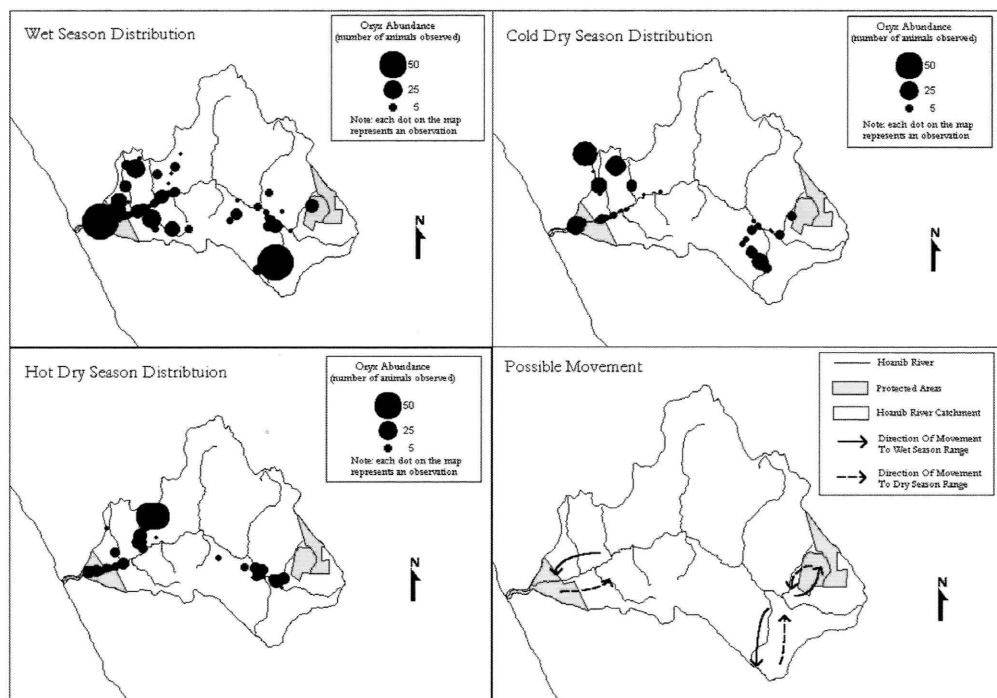


Fig. 7. Seasonal distribution of oryx in the Hoanib River catchment, northwestern Namibia, 1999/2000.

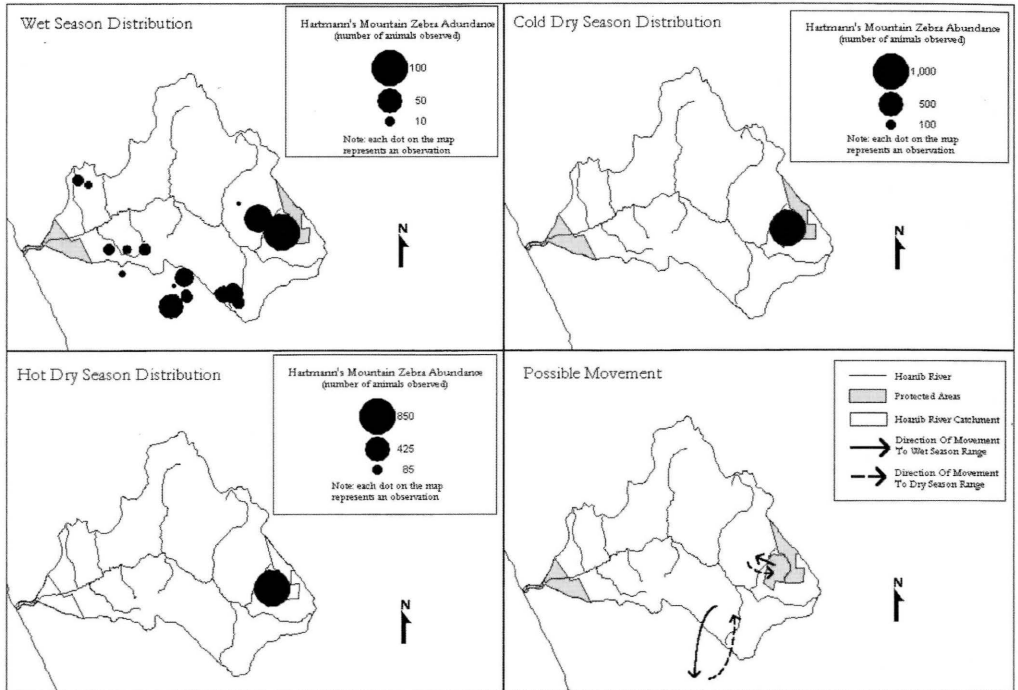


Fig. 8. Seasonal distribution of Hartmann's mountain zebra in the Hoanib River catchment, northwestern Namibia, 1999/2000.

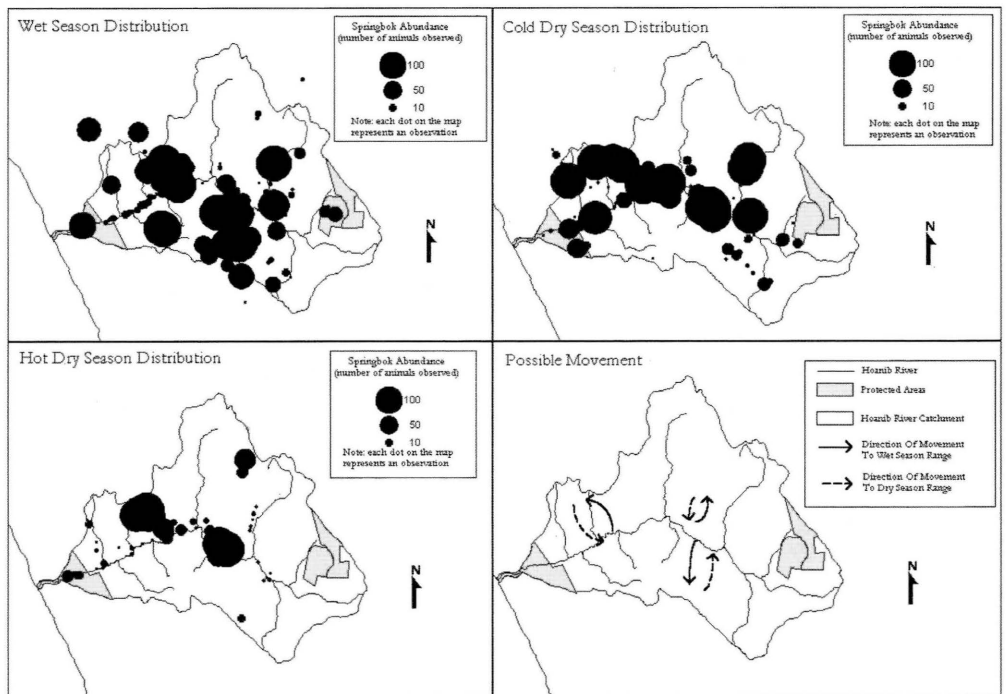


Fig. 9. Seasonal distribution of springbok in the Hoanib River catchment, northwestern Namibia, 1999/2000.

(Auer 1997). Data obtained during this study revealed that small stock graze up to a maximum of 5–7 km away from a water source, while cattle were observed to graze up to a maximum range of 15–18 km away. In an arid environment free-ranging donkeys and horses have similar feeding ranges to that of cattle (Verlinden *et al.* 1998). However, observations and discussions with farmers in the research area showed that they tend to be closely associated with humans and settlements as they are used as 'beasts of burden' i.e. for transport of people and goods. The distribution distances for small stock and cattle around water sources are similar to those reported by Verlinden *et al.* (1998) from the southern Kalahari in Botswana.

The seasonal pastoral ranges of domestic stock are dependent on the spatial distribution of rainfall and the availability of grazing (Fuller 1993; Owen-Smith & Jacobsohn 1991). The wet season ranges of domestic stock tend to be more dispersed, with the stock being herded to seasonal grazing, generally some distance from permanent settlements (Owen-Smith & Jacobsohn 1991). In the Hoanib River catchment area, domestic stock was herded to the area south of the Khowarib plains and the Serengeti plains across to Palmfontein in the southeast corner. During the dry seasons, when seasonal grazing and seasonal water became limited, stock were herded back to the permanent villages and water sources (Owen-Smith & Jacobsohn 1991). The exception to this appears to be cattle. It is thought that they are still farmed along the traditional pastoral practices as reported by Fuller (1993). Cattle numbers declined across the catchment during the hot-dry season, especially in the Serengeti and Beesvlakta area, as cattle were 'farmed out' to relatives in areas where better rainfall and grazing were available.

The exception to these traditional pastoral activities was observed to occur during a drought (1997/98), when grazing was limited over the entire Kunene Region. Cattle were then herded into areas termed *ehi rakururuka* or 'hard times' grazing areas. In the Hoanib River catchment, the pastoralists of Otjokavare used the area located in the southeast (Serengeti plains to Palmfontein). This area has only limited water sources, poor grazing, and a rugged terrain. Although there appeared to be grazing available most of the year (sometimes at a distance from the watering points) (Leggett *et al.* 2001b), the area was not frequently used by pastoralists as cattle lose condition rapidly when they have to move long distances between

water and grazing (Auer 1997). The 1998 wet season received less than average rainfall over most of the Kunene Region and, as a result of this, up to 5000 cattle were herded into this area (R. Loutit, pers. comm.). Some of the cattle grazing in the southeastern corner of the catchment during this period came from an area north of Opuwo (approximately 200 km away) (Local herder, pers. comm.). During this study only 800–1000 cattle were observed in this area.

During the wet season, wildlife appeared to be widely distributed throughout the catchment, while wildlife aggregations were observed on the Khowarib and Serengeti plains, and in the Otjiyapa spring area (Etendeka mountains). Seasonal aggregations of wildlife are not uncommon in the western areas of Namibia and have been reported by Tarr & Tarr (1988) and Viljoen (1982, 1989). Tarr & Tarr (1988) reported on the increase in annual and perennial grasses (Poaceae) due to exceptionally good rains during the 1982 wet season with a subsequent east–west movement of wildlife. Similar east–west movements of wildlife along the riverbeds from regions of higher rainfall were observed during the course of this study. This movement was aided by the flooding of the rivers and greater availability of water along the watercourses in the arid western regions.

During the wet and towards the middle of cold-dry seasons, wildlife was observed to be concentrated in the areas where seasonal grazing was available. These aggregations of wildlife continued until the seasonal vegetation was exhausted, whereupon wildlife was observed to form smaller group sizes and return to the riverbeds. Elephant populations were observed to aggregate on the floodplain and western section of the river during the wet and early cold-dry seasons, presumably associated with the availability of browsing and grazing in these areas. However, by the middle of the cold-dry season, grazing in these areas was exhausted and the elephants dispersed, with a number of herds moving north to the Hoarusib River. Giraffe also dispersed in smaller herds and over a wider area. This trend continued into the hot-dry season with wildlife concentrating in the riverbeds. Towards the end of the hot-dry season, several aggregations of elephant and giraffe were observed feeding on maturing seedpods of *Faidherbia albida* (Del.) in the riverbeds. These pods may provide a valuable source of protein when there is little nutrition elsewhere. Viljoen (1989) and Scheepers (1992)

reported similar observations to these. In addition to the nutritional value of the seeds and fodder, *F. albida* have extensive canopies that offer shelter to wildlife during the hottest part of the day.

There appeared to be a mass movement of wildlife away from the rivers and into the veld and mountainous regions at the onset of the wet season. In October 1999, large concentrations of game had moved out of the rivers within 24 hours of the first substantial rainfall. In the east, wildlife was observed to have moved up to 30 km from the riverbed into the Etendeka Mountains and Serengeti plains. Aerial survey results during the same period (October 1999) in the Hobatere area confirmed this movement. Prior to the wet season the population of wildlife within the game park was high, but with the onset of the wet season the population of wildlife dispersed into the hills surrounding the game park. During the dry seasons, the populations of wildlife concentrated again within Hobatere as the seasonal grazing and water decreased.

Only springbok and elephant were observed to be in close association with people and domestic stock. In the central areas of the catchment, springbok were observed to aggregate into large herds (up to 1000) on the Khowarib and Serengeti plains and the Beesvlakte, areas where domestic stock and human populations are high. Verlinden *et al.* (1998) reported similar movement patterns of springbok in the Kalahari. The authors reported that springbok were attracted to areas around human settlements and intensively grazed range by the lower grass cover. African elephants require approximately 100–300 l of fresh water a day (Sikes 1971) and boreholes near settlements offer a convenient and readily accessible source of fresh water. Human/elephant conflicts are well known and reported (e.g. Watson *et al.* 1972; Parker & Graham 1989; Barnes *et al.* 1995) and most conflicts are a result of competition for resources (i.e. water and grazing/browsing) (Parker & Graham 1989).

All other wildlife species studied (oryx, Hartmann's mountain zebra and giraffe) appeared to have little tolerance for humans and domestic stock, as they are generally restricted to areas of low human influence and disturbance. Vehicle movement, legal and illegal hunting are thought to be major disturbance factors. Similar observations to these were reported for oryx by Verlinden *et al.* (1998).

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