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HABITAT USE AND GROUP SIZE OF AFRICAN WILD UNGULATES IN A NAMIBIAN GAME RANCH

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ABSTRACT

Aim of this research was to gather information on group size and habitat use by the different ungulate, Artiodactyla *and* Perissodactyla*, species and spatial overlap among species. Data were collected in the dry season (October-November 2003) in a fenced area (5,021 ha) of a game ranch in Namibia during 44 game drives along five different routes. For each sighting, we recorded species, day, time, location (on a map divided into square grid units of 500-m sides), number of animals and habitat type. Duiker,* Sylvicapra grimmia*, was the more solitary species, followed by steenbok,* Raphicerus campestris*, and warthog,* Phacochoerus africanus*, while hartebeest,* Alcelaphus buselaphus*, blue wildebeest,* Connochaetes taurinus*, eland,* Tragelaphus oryx*, and mountain zebra,* Equus zebra hartmannae*, usually formed large groups. This is in agreement with the normal social behaviour of these species. Nevertheless, the high percentage of solitary oryx,* Oryx gazella*, greater kudu,* Tragelaphus strepsiceros*, springbok,* Antidorcas marsupialis*, and impala,* Aepyceros melampus*, is unusual. The frequent presence of isolated individuals in gregarious species may indicate a dispersion of the animals in the territory due to reduced food availability. Some of the species showed their typical habitat use; however, some species also used less suitable habitats. A low degree of spatial overlap was observed between most of the species. In spite of this, in some cases a considerable overlap occurred. For example, kudu and springbok, which had a wide spatial distribution, showed a high degree of spatial overlap with other species (*e.g.*, all of the grid units used by zebra were used in common with kudu, and 88% of the grid units used by blesbok was in common with springbok). Data indicate that animals are overabundant in this fenced area and they are suffering from the dry season.*

I. INTRODUCTION

Wildlife represents a great potential resource for Namibian economy, as it can help to increase tourism activities, especially from overseas, thus creating a considerable income of foreign currency. Namibia is very attractive because of the beauty of its landscapes, its favourable climate all year round, its political stability and because it is pollution free and it is also one of the few malaria free zones in Africa. Wildlife is perhaps one the most attractive traits of Namibian landscapes. This can be exploited in terms of trophy hunting and meat hunting, but also for game drives or photographic safaris. In order to optimise game ranching systems and to provide professional hunters and tourist guides with reliable information on the best habitats where to take hunters or tourists for viewing the greatest number of animals, it is important that reliable information is available in relation to different seasons and environmental conditions (OMPHILE and POWELL, 2002). This requires that specific studies are carried out in a wide range of possible situations, as it is known that the ecology and the ethology of wild ungulates may vary in response to different factors, such as water availability, weather conditions, habitat type or population density (KREBS and DAVIES, 1993).

Aim of this research was to gather information on group size and habitat use by the different ungulate species and spatial overlap among species during the dry season, in order to provide useful information to wildlife managers for improving management strategies on farm and to professional hunters and tourist guides for choosing the best sites to sight animals.

II. MATERIAL AND METHODS

II.1. STUDY AREA

Data were collected at "Mountain View Game Lodge", a game ranch in the District of Windhoek, Dordabis Conservancy (Republic of Namibia). Most of the ranch area lies between 1,000 and 1,500 m a.s.l., with peaks up to 1,766 m a.s.l., and its total extension is 12,256 ha, 5,021 of which are limited by a two-meter high fence, which does not allow animals to move outside or to enter inside. The rest of the ranch is surrounded by a low fence, which do not prevent animals' movements. Our research was carried out only within the high fence area. In this area, four different habitat types were classed: open plain (Kalahari type sand soils, with presence of grasses, dominated by *Schmidtia kalahariensis* and *Eragrostis lehmanniana*), savannah (open area covered with grasses, but also including scattered trees, mainly *Acacia* spp.), bushveld (thick vegetation cover, dominated by the presence of *Combretum apiculatum* and *Acacia* spp.) and mountain (mountainous and rocky area, with well mixed vegetation including grass, bush and trees).

The number of ungulates counted inside the high fence by aerial census (du P. BOTHMA, 2002) in 2003 was: 114 hartebeests, *Alcelaphus buselaphus*, 23 blesboks, *Damaliscus dorcas*, 245 blue wildebeests, *Connochaetes taurinus*, 17 elands, *Tragelaphus oryx*, 29 giraffe, *Giraffa camelopardalis*, 17 impalas, *Aepyceros melampus*, 119 greater kudus, *Tragelaphus strep-*

siceros, 30 mountain zebras, *Equus zebra hartmannae*, 290 ory, *Oryx gazella*, and 132 springboks, *Antidorcas marsupialis*. Warthog, *Phacochoerus africanus*, duiker, *Sylvicapra grimmia*, and steenbok, *Raphicerus campestris*, were also present in the high fence, although they were not counted in the census because of their low number and/or because of the difficulty to spot them (due to their small size and to their frequent presence in areas with dense vegetation cover). Due to the same reasons, the number of some species using mainly bushveld areas, like the kudu, is probably underestimated (for this species, counting success may vary from 30 to 80%, depending on the vegetation structure and on the topography; FURSTENBURG, 2002).

Although all the herbivore species in Mountain View seem to be well adapted to this area (their general conditions are good in most of the ranches throughout this region), this community is not natural: in fact, blesbok is an exotic species and blue wildebeest, eland, mountain zebra and giraffe were artificially introduced in the high fence area. The ranch was also restocked with additional oryx, springbok and hartebeest in order to expand the genetic pool.

Predators in the study area are represented by leopard, *Panthera pardus*, in the mountains and by cheetah, *Acinonyx jubatus*, caracal, *Caracal caracal*, and black-backed jackal, *Canis mesomelas*, in the savannah. Their movements are not limited by the high fence and their presence is sporadic.

II.2. DATA COLLECTION

Data collection took place in October-November 2003, which in Namibia correspond to the dry season. Data were collected during game drives along five different routes, which were selected in order to cover the whole high fence area. Each game drive was repeated at alternate times in such a way that, within each week, all of them were driven both in the morning and in the afternoon. The average duration of each game drive was 2-3 hours.

During these game drives, all animal sightings were reported on maps of the farm (divided into square grid units of 500-m sides) and the following informations were noted on specific forms: date, departure and arrival time, name of the observer(s), weather conditions and characteristics of the sighting (species, number of animals, sex and - when possible - age class, and habitat type - open plain, savannah, bushveld or mountain -).

II.3. DATA ANALYSIS

Percentages were calculated for group size and habitat use. Group size was classed as follows: solitary animals (only one animal); small groups (2-5 animals/group); middle-size groups (6-10 animals/group) and large groups (more then 10 animals/group). Univariate descriptive statistics (mean ± s.e., minimum, maximum) were used to describe group size. Within each species, differences in group size depending on habitat type were compared by non-parametric analysis of variance (Kruskal-Wallis; SIEGEL and CASTELLAN, 1992).

The extension of the area used by each species was estimated by multiplying the number of grid units where each species was seen per the area of each grid unit (25 ha). Spatial overlap was calculated between each couple of species by the Coefficient of Spatial Overlap (CSO = number of grid units used in common by both species/total number of grid units used by one of the two species; MATTIELLO *et al.*, 2003).

III. RESULTS

III.1. GROUP SIZE

Group size greatly varied according to animals species (Table I). Duiker was the most solitary species, followed by steenbok and warthog, while hartebeest, blue wildebeest, eland and mountain zebra were seldom seen isolated and usually formed large groups (more then ten individuals).

Habitat type did not affect the size of the group for most of the considered species, except for blue wildebeest (Kruskal-Wallis test, $\chi^2 = 28.78$, $P < 0.001$; Figure 1) and oryx ($\chi^2 = 14.01$, $P < 0.01$; Figure 2), which showed a smaller group size in the bushveld and in the mountain.

TABLE I
Percentage of groups belonging to different group-size classes (number of animals per group), and group size (mean, SE, minimum, maximum) according to the species of ungulates in a 5,021 ha fenced area of a game ranch in Namibia in the dry season (October-November 2003).
TABLEAU I
Pourcentage de groupes appartenant à différentes classes de taille de groupe (nombre d'animaux par groupe) et taille des groupes (moyenne, erreur type, minimum, maximum) en fonction de l'espèce d'ongulés dans un espace clos de 5 021 ha d'un ranch de gibier en Namibie au cours de la saison sèche (octobre-novembre 2003).

Species	Percentage of groups according to group size class				Group size				*n*
	1	2-5	6-10	>10	Mean	SE	Min.	Max.	
Blesbok *Damaliscus dorcas*	10	41	17	32	8.3	1.0	1	24	41
Blue wildebeest *Connochaetes taurinus*	4	17	19	60	16.1	1.2	1	66	126
Duiker *Sylvicapra grimmia*	100	0	0	0	1.0	0.0	1	1	32
Eland *Tragelaphus oryx*	0	17	33	50	11.0	2.0	4	16	6
Giraffe *Giraffa camelopardalis*	26	67	7	0	2.6	0.2	1	8	15
Greater kudu *Tragelaphus strepsiceros*	27	57	14	2	3.4	0.2	1	20	207
Hartebeest *Alcelaphus buselaphus*	4	27	38	31	11.2	2.0	1	47	26
Impala *Aepyceros melampus*	16	40	12	32	7.1	1.2	1	20	25
Oryx *Oryx gazella*	39	34	15	11	4.4	0.5	1	32	125
Springbok *Antidorcas marsupialis*	32	40	14	14	5.5	0.5	1	64	244
Steenbok *Raphicerus campestris*	88	12	0	0	1.1	0.0	1	3	137
Warthog *Phacochoerus africanus*	40	60	0	0	1.9	0.3	1	3	10
Mountain zebra *Equus zebra harmannae*	7	13	20	60	11.7	1.6	1	22	15

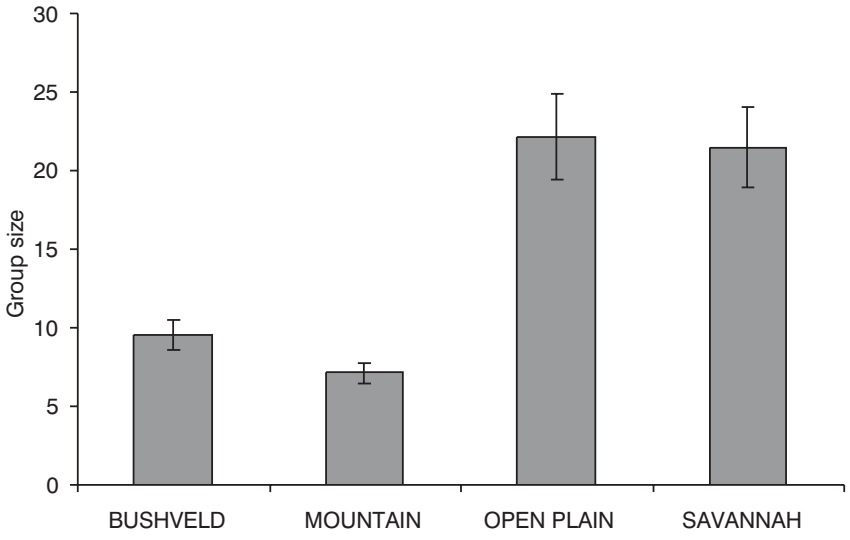

Figure 1: Average size (± SE) of blue wildebeest, *Connochaetes taurinus*, groups in different habitats (bushveld $n = 47$, mountain $n = 10$, open plain $n = 33$, savannah $n = 36$) in a 5,021 ha fenced area of a game ranch in Namibia in the dry season (October-November 2003).
Figure 1 : Taille moyenne (± écart type) des groupes de gnou bleu, *Connochaetes taurinus*, dans différents habitats (bush $n = 47$, montagne $n = 10$, plaine ouverte $n = 33$, savanne $n = 36$) dans un espace clos de 5 021 ha d'un ranch de gibier en Namibie au cours de la saison sèche (octobre-novembre 2003).

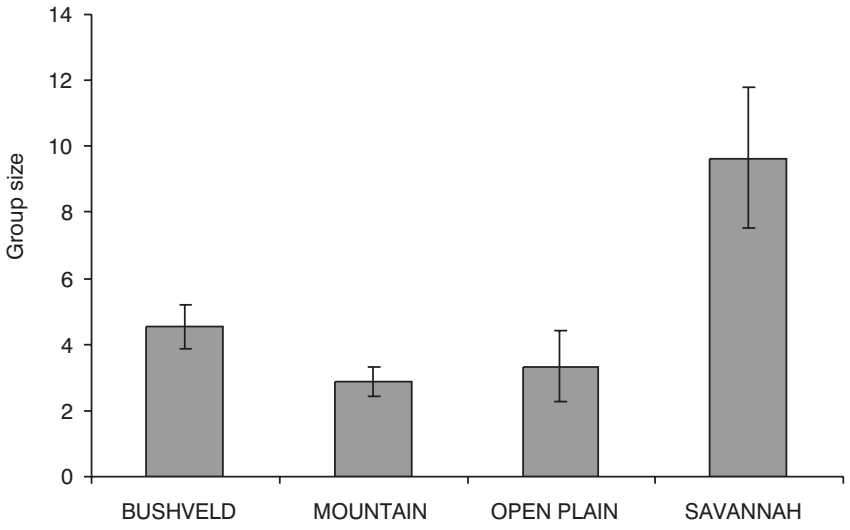

Figure 2: Average size (± SE) of oryx, *Oryx gazella*, groups in different habitats (bushveld $n = 42$, mountain $n = 57$, open plain $n = 9$, savannah $n = 17$) in a 5,021 ha fenced area of a game ranch in Namibia in the dry season (October-November 2003).
Figure 2 : Taille moyenne (± écart type) des groupes ($n = 125$) d'oryx, *Oryx gazella*, dans différents habitats (bush $n = 42$, montagne $n = 57$, plaine ouverte $n = 9$, savanne $n = 17$) dans un espace clos de 5 021 ha d'un ranch de gibier en Namibie au cours de la saison sèche (octobre-novembre 2003).

III.2. SPACE AND HABITAT USE

Kudu and springbok used the widest surface areas, representing more than 50% of the whole high fence area (Table II). Habitat use differed among species, ranging from highly specialised species, such as mountain zebra (observed only in the mountain), to more opportunistic species, such as springbok, oryx, hartebeest, blue wildebeest or warthogs which were observed in different habitats (Table III).

A low degree of spatial overlap was observed between most of the species (Table IV). However, in some cases a considerable overlap occurred, especially for those species that had a wider spatial distribution, such as kudu and springbok (Table II).

IV. DISCUSSION

IV.1. GROUP SIZE

Most of the species exhibited their normal social behaviour: duiker and steenbok confirmed their non gregarious behaviour (BERGSTROM and SKARPE, 1999; APPS and du TOIT, 2000), warthogs were observed as solitary individuals or in their normal small family groups (SOMERS *et al.*, 1995), while species with a high sociality level (hartebeest, blue wildebeest, eland and mountain zebra; du P. BOTHMA *et al.*, 2002) were seldom seen isolated and usually formed large groups (more than ten individuals). Nevertheless, the

TABLE II
Number of 25-ha grid units and surface (ha, % available surface) used by each species of ungulates in a 5,021 ha fenced area of a game ranch in Namibia in the dry season (October-November 2003).
TABLEAU II
Nombre de quadrats de 25 ha et surface (ha, % de la surface disponible) utilisés par chaque espèce d'ongulés dans un espace clos de 5 021 ha d'un ranch de gibier en Namibie au cours de la saison sèche (octobre-novembre 2003).

Species	Number of 25-ha grid units used	Surface used	
		ha	% of available surface
Blesbok *Damaliscus dorcas*	26	650	13.0
Blue wildebeest *Connochaetes taurinus*	76	1,900	38.0
Duiker *Sylvicapra grimmia*	29	725	14.5
Eland *Tragelaphus oryx*	6	150	3.0
Giraffe *Giraffa camelopardalis*	48	1,200	24.0
Hartebeest *Alcelaphus buselaphus*	23	575	11.5
Impala *Aepyceros melampus*	19	475	9.5
Greater kudu *Tragelaphus strepsiceros*	102	2,550	51.0
Oryx *Oryx gazella*	72	1,800	36.0
Springbok *Antidorcas marsupialis*	121	3,025	60.5
Steenbok *Raphicerus campestris*	89	2,225	44.5
Warthog *Phacochoerus africanus*	9	225	4.5
Mountain zebra *Equus zebra harmannae*	10	250	5.0

TABLE III
Percentage of sightings of a given species of ungulate observed in a 5,021 ha fenced area of a game ranch in Namibia in the dry season (October-November 2003) according to habitat type.
TABLEAU III
Pourcentage d'animaux d'une espèce donnée d'ongulé observé dans un espace clos de 5 021 ha d'un ranch de gibier en Namibie au cours de la saison sèche (octobre-novembre 2003), en fonction du type d'habitat (montagne, bush, savanne, plaine ouverte).

Species	Number of sightings	Percentage of animals observed in each habitat type			
		Mountain	Bushveld	Savannah	Open plain
Blesbok *Damaliscus dorcas*	341	0.0	4.7	61.3	34.0
Blue wildebeest *Connochaetes taurinus*	2,025	3.5	22.2	38.2	36.1
Duiker *Sylvicapra grimmia*	32	3.1	50.0	37.5	9.4
Eland *Tragelaphus oryx*	66	0.0	84.8	15.2	0.0
Giraffe *Giraffa camelopardalis*	147	2.7	70.1	25.9	1.4
Hartebeest *Alcelaphus buselaphus*	291	4.8	30.6	32.6	32.0
Impala *Aepyceros melampus*	117	35.0	65.0	0.0	0.0
Greater kudu *Tragelaphus strepsiceros*	706	31.6	57.4	6.4	4.7
Oryx *Oryx gazella*	547	29.8	34.7	30.0	5.5
Springbok *Antidorcas marsupialis*	1,138	0.7	35.4	31.3	32.6
Steenbok *Raphicerus campestris*	157	0.0	60.5	22.3	17.2
Warthog *Phacochoerus africanus*	19	26.3	42.1	5.3	26.3
Mountain zebra *Equus zebra harmannae*	175	100.0	0.0	0.0	0.0

high percentage of solitary oryx (39% of the total observed social aggregations), kudu (27%), springbok (32%) and impala (16%) is unusual for these gregarious species. This may be partly explained by the fact that the birth season was approaching during the study period (females were looking for isolated place to give birth), and also by the presence of solitary males, which is quite common in these species (PERRIN, 1999; STUART and STUART, 2000; du P. BOTHMA *et al.*, 2002); however, the frequent presence of isolated individuals in gregarious species may also indicate a dispersion of the animals over the territory due to reduced food availability.

In some social species (blue wildebeest and oryx), group size was significantly affected by habitat type. These can be interpreted as a defensive behaviour against predators. It is known that sociality may have positive effects on the detection of predators, reducing the time of vigilance and allowing more time for foraging to the individuals (KREBS and DAVIES, 1993; APPS and du TOIT, 2000). However, in some ungulate species, it seems that a smaller group size can represent a better anti-predatory strategy when the vegetation cover is thicker, as in such an environment animals can better hide from predators when they are in small groups (SCHAAL, 1982).

IV.2. HABITAT USE AND SPATIAL OVERLAP

Some of the species showed their typical habitat use (STUART and STUART, 2000; du P. BOTHMA *et al.*, 2002); however, some species also used less suitable habitats. For example, some typical grazers like the blue wildebeest

TABLE IV

Coefficient of Spatial Overlap (CSO) among all the species of ungulates in a 5,021 ha fenced area of a game ranch in Namibia in the dry season (October-November 2003). The numbers represent the percentage of 25-ha grid units used in common by each couple of species out of the total number of grid units used by one of the species in the row. Bold characters: CSO ≥ 50%. BB=blesbok, *Damaliscus dorcas*, BWB=blue wildebeest, *Connochaetes taurinus*, D=duiker, *Sylvicapra grimmia*, E=eland, *Tragelaphus oryx*, G=giraffe, *Giraffa camelopardalis*, HB=hartebeest, *Alcelaphus buselaphus*, IM=impala, *Aepyceros melampus*, K=greater kudu, *Tragelaphus strepsiceros*, OR=oryx, *Oryx gazella*, SPB=springbok, *Antidorcas marsupialis*, STB=steenbok, *Raphicerus campestris*, WH=warthog, *Phacochoerus africanus*, Z=mountain zebra, *Equus zebra hartmannae*.

TABLEAU IV

Coefficient de recouvrement spatial (CSO) entre toutes les espèces d'ongulés dans un espace clos de 5 021 ha d'un ranch de gibier en Namibie au cours de la saison sèche (octobre-novembre 2003). Chaque nombre représente le pourcentage de quadrats de 25 ha utilisé en commun par un couple d'espèces sur la totalité des quadrats utilisés par une des 2 espèce en ligne ou en colonne. En gras : CSO ≥ 50%. BB= blesbok, BWB= gnou bleu, D= céphalophe, E= éland, G= girafe, K= grand koudou, HB= bubale, IM= impala, OR= oryx, SPB= springbok, STB= steenbok, WH= phacochère, Z= zébre de montagne.

	BB	BWB	D	E	G	HB	IM	K	OR	SPB	STB	WH	Z
BB	.	**69**	23	0	23	19	0	23	35	**88**	38	12	0
BWB	24	.	20	3	24	9	9	43	33	**72**	43	8	5
D	21	**52**	.	0	21	7	10	45	14	**62**	**59**	10	3
E	0	33	0	.	17	0	0	**67**	17	17	17	0	0
G	13	38	13	2	.	4	13	50	29	**69**	50	8	2
HB	22	30	9	0	9	.	4	48	30	**61**	43	9	0
IM	0	37	16	0	32	5	.	**79**	**53**	42	47	5	16
K	6	32	13	4	24	11	15	.	43	48	41	3	10
OR	13	35	6	1	19	10	14	**61**	.	**58**	31	1	7
SPB	19	45	15	1	27	12	7	40	35	.	45	4	2
STB	11	37	19	1	27	11	10	47	25	**61**	.	6	4
WH	33	**67**	33	0	44	22	11	33	11	**56**	**56**	.	0
Z	0	40	10	0	10	0	30	**100**	50	20	40	0	.

(STUART and STUART, 2000; du P. BOTHMA *et al.*, 2002) were frequently seen in the bushveld, while in the mountain we can find species which are typical of plain areas, such as the oryx or the warthog. It seems that animals are encouraged to spread over a wide surface area and to occupy sub-optimal areas in order to satisfy their nutritional requirements, in response to the restriction of food resources. A perfect example is given by the behaviour of the springbok, which was dispersed over more than 60% of the high fence area, often with isolated individuals, using all kinds of habitats, including even mountain areas.

The dispersion of the animals over the territory was probably affected both by the population density and by the level of water dependence of each

species. Although present in a considerably high number, the blue wildebeest and the hartebeest used only a small portion of the high fence area, as they are strongly dependent on the proximity to water sources, while the springbok was widely dispersed, as it is not a water dependent species (du P. BOTHMA *et al.*, 2002, REDFERN *et al.*, 2003). The wide dispersion of greater kudu, a water dependent species, is probably justified by the fact that their actual number was much higher than that estimated by aerial census, as we counted more than 100 kudus during a single game drive in one sector of the high fence. This dispersion may also be interpreted as an indicator of adaptation of this flexible species to a specific environmental situation, where the research of food becomes more important than the proximity to water, thus pushing the animals to spread around in search of food.

The degree of spatial overlap was highly dependent on the extension of the area used by the different species. Kudu and springbok, which used a considerable percentage of the total area, often overlapped with other species (Table IV). However, the degree of spatial overlap between most of the species was rather low. This is in agreement with the results by DEKKER *et al.* (1996) and FRITZ *et al.* (1996) showing that, in similar areas, during the dry season, different African ungulate species were quite separated in their use of plant communities and tended to be highly selective.

V. CONCLUSION

In conclusion, our data seem to indicate that, at the time of this survey, the animals were overabundant in this fenced area and that they were suffering from the dry season. The wide dispersion over the territory and, in some cases, the use of unsuitable habitats and the unusual social behaviour suggest that some species, such as the kudu and the springbok, were particularly depressed. For the kudu, this can be confirmed by the data contained in the preliminary report of the kudu project for the Dordabis Conservancy (FURSTENBURG, 2002). In fact, if we assume that the number of kudus counted at Mountain View was at least 30% underestimated, the actual density within the high fence was at least of 1 animal per 32 ha, while the maximum carrying capacity for the greater kudu in Dordabis Conservancy was estimated to be 1 animal per 35-40 ha. Furthermore, the body conditions of the animals (much poorer than in the neighbouring ranches and even in Mountain view itself, outside the high fence) clearly confirmed that the number of animals at the time of this research exceeded the carrying capacity of the fenced area.

Obviously, these data refer only to one season which was particularly hard for the animals, and more information about group size and habitat use by the different species should be collected also during the wet season in order to compare the results in different environmental conditions. However, at the same time of the year the situation in the surrounding game ranches (with lower population densities) was not so dramatic, suggesting that the unusual results from this investigation are not merely a consequence of the dry season, but also of a high population density.

Variations in group size and habitat use throughout the time may give useful indications about the status of animal populations and, if compared with

data collected in different seasons for years, they can be of practical use to wildlife managers, helping to optimise game ranching systems and giving reliable information on the best habitats where to take hunters or tourists for viewing the greatest number of animals (OMPHILE and POWELL, 2002).

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UTILISATION DES HABITATS ET TAILLE DES GROUPES CHEZ DES ONGULÉS SAUVAGES AFRICAINS DANS UN RANCH DE GIBIER DE NAMIBIE

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MOTS-CLÉS: Ongulé, *Artiodactyla, Perissodactyla*, grand koudou, *Tragelaphus strepsiceros*, gazelle, *Antidorcas marsupialis*, ranch de gibier, taille des groupes, utilisation des habitats, recouvrement spatial, Namibie.

RÉSUMÉ

Le but de cette recherche était de récolter des données sur la taille des groupes, l'utilisation des habitats et le recouvrement spatial pour différentes espèces d'ongulés, Artiodactyla *et* Perissodactyla*. Elles ont été récoltées pendant la saison sèche en octobre-novembre 2003, dans un espace clos de 5 021 ha d'un ranch à gibier de Namibie, à l'occasion de 44 battues de chasse suivant cinq parcours différents. Pour chaque observation, on a relevé : le nom de l'espèce, le jour, l'heure, la localisation (sur une carte divisée en quadrats de 500 m de côté), le nombre d'animaux et le type d'habitat. Le céphalophe de Grimm,* Sylvicapra grimmia*, était l'espèce la plus solitaire, suivie par le steenbok,* Raphicerus campestris*, et le phacochère,* Phacochoerus africanus*, alors que le bubale,* Alcelaphus buselaphus*, le gnou bleu,* Connochaetes taurinus*, l'éland,* Tragelaphus oryx*, et le zèbre de montagne,* Equus zebra hartmannae*, formaient généralement des grands groupes. Ces observations correspondent au comportement social habituel de ces espèces. Cependant, le pourcentage élevé de solitaires chez l'oryx,* Oryx gazella*, le grand koudou,* Tragelaphus strepsiceros*, le sprongbok,* Antidorcas marsupialis*, et l'impala,* Aepyceros melampus*, est inhabituel. La présence fréquente d'individus isolés appartenant à des espèces grégaires peut signifier une dispersion des animaux sur le territoire due à une réduction de la disponibilité en nourriture. Certaines espèces révèlent une utilisation classique de l'habitat, alors que d'autres utilisent aussi des habitats moins favorables. Un faible degré de recouvrement spatial a été observé entre la plupart des espèces. Malgré cela, dans certains cas, un fort recouvrement a été observé. Par exemple, pour le grand koudou et le springbok, qui ont une dispersion spatiale étendue, un degré élevé de recouvrement spatial avec d'autres espèces a été constaté (par exemple : toutes les parcelles utilisées par les zèbres étaient aussi utilisées par le grand koudou, et 88% des parcelles utilisées par les blesboks étaient communes à celles des springboks). Les données indiquent que les animaux sont en surabondance dans cet enclos et souffrent du fait de la saison sèche.*