Notes on distribution and relative abundances of some animal species, and on climate in the Kruger National Park during prehistoric times

INA PLUG

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Faunal remains obtained from archaeological sites in the Kruger National Park, provide valuable information on the distributions of animal species in the past. The relative abundances of some species are compared with animal population statistics of the present. The study of the faunal samples, which date from nearly 7 000 years before present until the nineteenth century, also provides insight into climatic conditions during prehistoric times.

Key words: Prehistory, climate, fauna, archaeozoology, Kruger National Park.

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Introduction

During archaeological excavations in the Kruger National Park faunal remains were recovered from 22 sites. The distribution of these sites is shown in Fig. 1, based on information obtained from Meyer (1986). The sites are referred to by a code which consists of the first two or three letters of the name of the district in which the site occurs plus a number which relates to the number of sites discovered. Thus Sh27 stands for Shingwedzi district, site number 27. The following abbreviations are used: Pa (Pafuri), Sh (Shingwedzi), Le (Letaba), Ma (Mahlangene), Ph (Phalaborwa), Mo (Mooiplaas), Ti (Timbavati), Ol (Olifants), Tsh (Tshokwane), Sk (Skukuza), and Pr (Pretoriuskop). The system is based on the demarcation of game warden districts as they were in 1976.

All but three of the 22 sites are situated on the banks of rivers or streams. The three exceptions are Ph1, better known as Masorini, Sk4, and Pr34. The latter two are shelter sites, but the other 20 are open-air sites. The sites represent three different phases in prehistory, namely Later Stone Age, Early Iron Age, and Late Iron Age (Plug 1988). The oldest site, Sk4, dates to almost 7 000 BP, whereas the youngest, Ph1, dates to the end of the 19th century AD (Table 1).

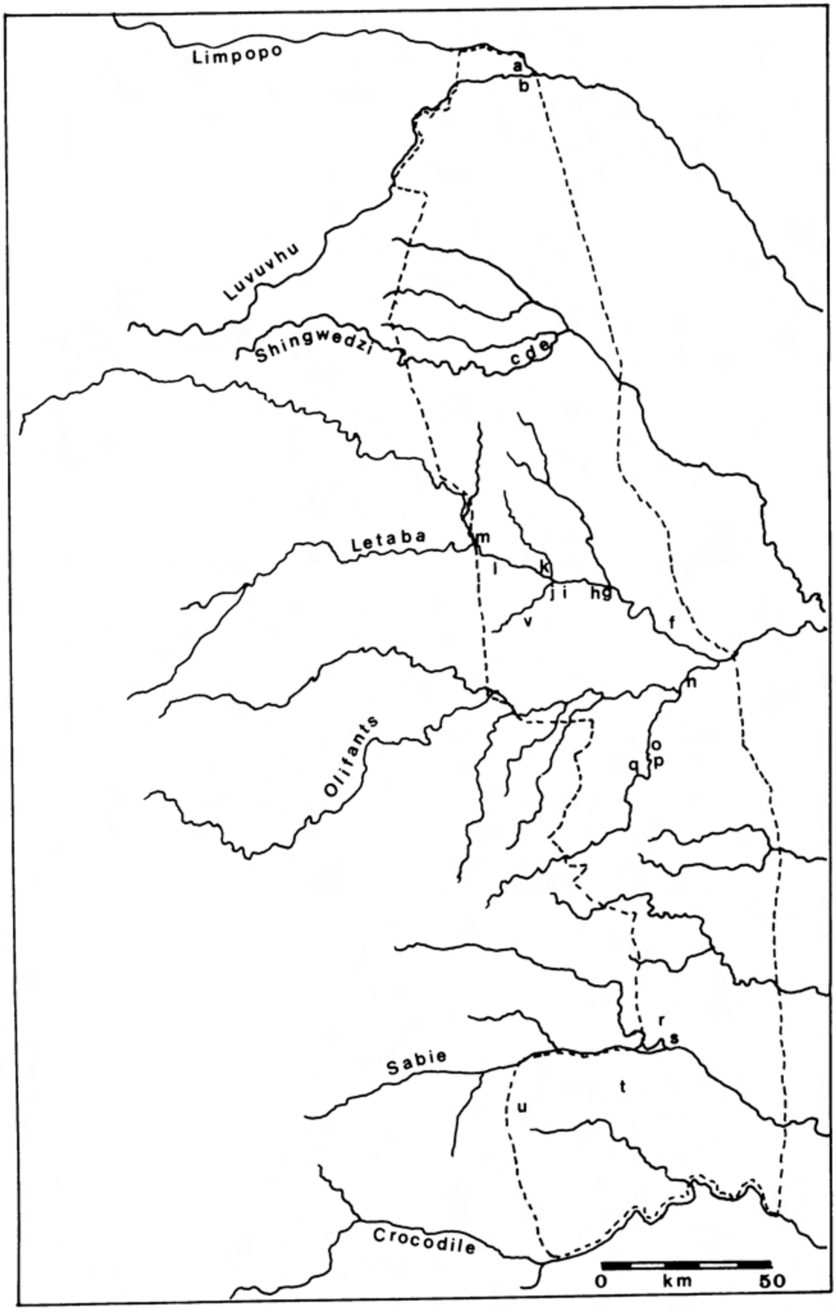

Fig. 1. Distribution of archaeological sites in the Kruger National Park.

a: Pa8,	b: Hapi Pan (HP),	c: Sh16,	d: Sh14,	e: Sh27,	f: Mo8,
g: Le7,	h: Le6,	i: Le2,	j: Ph9,	k: Ma38,	l: Ph6,
m: Ma4,	v: Ph1,	n: Ol20,	o: Ti3,	p: Ti6,	q: Ti5,
r: Tsh1,	s: Sk17,	t: Sk4,	u: Pr34.		

Table 1
Archaeological sites, cultural association, and chronology

Site	Cultural association	Approximate date Site
Sk4	Later Stone Age	7 000 — 2 000 BP
Pr34	Later Stone Age	Middle to late Holocene
Ma38	Early Iron Age	470 AD
Mo8	Early Iron Age	300 — 600 AD
Le7	Early Iron Age	300 — 830 AD
Le6	Early Iron Age	500 — 800 AD
Tsh1	Early Iron Age	510 AD
Sk17	Early Iron Age	740 AD
Pa8	Early Iron Age	850 AD
Ph9	Early Iron Age	800 — 900 AD
Ma4	Early Iron Age	800 — 900 AD
Ol20	Early Iron Age	850 AD
Sh14a	Early Iron Age	800 — 900 AD
Sh14b & Sh16	Late Iron Age	1 200 AD
Ph6	Late Iron Age	1 200 — 1 400 AD
Hapi Pan	Late Iron Age	1 720 AD
Ti5	Late Iron Age	1 750 — 1 900 AD
Ti3 & Ti6	Late Iron Age	1 750 — 1 850 AD
Le2	Late Iron Age	1 500 — 1 800 AD
Sh27	Late Iron Age	1830 AD
Ph1	Late Iron Age	1890 AD

The faunal samples and methods of analysis

The faunal remains were obtained from ash pits and middens, on the open sites, and from stratified deposits on the shelter sites. Nearly 170 000 bones were examined, of which 22 percent could be identified to species or animal group. The bones were very fragmented, with bone flakes seldom exceeding a median length of 34 mm. As a result, morphometric studies could not be done. The only bones that were occasionally found complete were phalanges, carpal and tarsal bones. The heavy fragmentation of the bones is the result of human butchering and cooking methods, rather than of post-depositional factors (Plug 1988).

The faunal remains were identified according to procedures developed at the Transvaal Museum (Plug 1988). Species identifications are based on teeth as well as on post-cranial remains. Diagnostic features of post-cranial bones have been described by Boessneck, Mueller, & Teichert (1964), and expanded upon by Von den Driesch (*pers. comm.* 1986) and (Peters 1988).

Discussion

(i) *Animal distributions during the past*

The species found at the archaeological sites have been listed in Table 2. Most of them still occur in the Kruger National Park today, but there are a few exceptions, as well as some differences between present and past distribution patterns.

Table 2

Species identified and number of bones per species represented in the Kruger National Park samples

SPECIES	Sk4	Pr34	Pa8	HP	Sh16	Sh14	Sh27	Mo8	Le6	Le7	Le2	Ph6	Ph9	Ph1	Ma4	Ma38	O120	Ti3	Ti5	Ti6	Tsh1	Sk17
Bat	1																					
Atelerix frontalis																					1	
Homo sapiens sapiens	4	2																			1	
Papio ursinus	7	1								18							1					1
Cercopithecus aethiops										1												
Lycaon pictus	5																					
Canis adustus					6																	
Canis mesomelas	8															9	5				2	3
Canis sp.	7									9												
Aonyx capensis										1												
Ictonyx striatus	1																					
Civettictis civetta	6									1							1					
Genetta sp.	2										1											1
Mongoose	23	1															12					3
Crocuta crocuta	1							6									2					3
Leopard sized felid										1												
Panthera leo	1								6	4												1
Felis caracal	1																					
Felis lybica	7																					
Felidae	1								1	3												
Large carnivore				6					2												1	
Medium carnivore	2				4				2	2											2	
Small carnivore	14																					2
Loxodonta africana					9					1											30	
Diceros bicornis									20	11												
Rhinoceros					1			5									3					7
Equus burchelli	8	1	3	3	41	18	30	37	211	252	38	11	27	1	14	37	65			12	47	188
Procavia capensis	6																					
Orycteropus afer									2		2					6						
Phacochoerus aethiopicus	143	16					6		4	27	2					3	3				1	3
Potamochoerus porcus									1	8						7						

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Table 2 Continued

SPECIES	Sk4	Pr34	Pa8	HP	Sh16	Sh14	Sh27	Mo8	Le6	Le7	Le2	Ph6	Ph9	Ph1	Ma4	Ma38	O120	Ti3	Ti5	Ti6	Tsh1	Sk17
Suidae					1		5		5	7											1	1
Hippopotamus amphibius	4			1	6					6							5					
Large mammal	1				3	1		2	5	2											4	2
Giraffa camelopardalis	2				54		5	2	56	10	4						14	2			1	29
Bos taurus				4					96	96	18				25		48					10
Ovis aries			4							8											177	40
Ovicaprine			12		8		5		8	17	3	2			3	4					449	4
Connochaetes taurinus	55	6			7	7	5	46	12	99	20	1	36			3	110	1		4	61	76
Damaliscus lunatus	8					1				5		1									2	1
Alcelaphine									7				1									2
Cephalophus natalensis	3																					
Sylvicapra grimmia	51		3	4						4							9				6	3
Oreotragus oreotragus							6															
Ourebia ourebi	1																					
Ourebia/Raphicerus	1																					
Raphicerus campestris	116	3			4				3	6	14			8			17				1	
Raphicerus sharpei	8																					
Raphicerus sp.	5																					
Aepyceros melampus	369	11	5		20	2		44	49	92	31	7	38	2	5		493		1	15	53	383
Hippotragus equinus	2	1							5							1						
Hippotragus niger	2									6		1					2					
Hippotragus sp.																					1	
Syncerus caffer	1	1	2	8	4	1		70	39	58	14	1					35		1			222
Tragelaphus strepsiceros		2			7			5		5				4		9					2	
Taurotragus oryx									2	6												
Redunca arundinum	1									1												
Redunca fulvorufula	9																					
Redunca sp.	7																					
Kobus ellipsiprymnus			1				6		5	6	3						5					1
Bov. I	303	9	1		11	6	5	2	16	41	6	2	4	1	1	5	21				33	10
Bov. II non-domestic	328	9	5	2	32	19	17	12	120	82	11	19	11		62	19	46				14	111
Bov. II indeterminate					47	8	19	4	21	117	2										323	43
Bov. III non-domestic	163	24	15	4	237			52	330	307	42	35	20	2	22	143	175			3	277	453

Table 2 Continued

SPECIES	Sk4	Pr34	Pa8	HP	Sh16	Sh14	Sh27	Mo8	Le6	Le7	Le2	Ph6	Ph9	Ph1	Ma4	Ma38	O120	Ti3	Ti5	Ti6	Tsh1	Sk17
Bov. III indeterminate				8		43	70	5	233	485	22						17					2
Bov. IV	6		1	4	19	9	19	4	182	121		1			1	4					6	12
Pedetes capensis	48	5							11		4						1					
Hystrix africaeaustralis	6															4					4	4
Thryonomys swinderianus					12		1			10											1	
Cryptomys hottentotus										11												
Otomys angoniensis					4																	
Otomys sp.		16			1																	
Gerbillurus paeba									5													
Mastomys sp.																						18
Small rodent	48	8			1					3				3			2				9	82
Medium rodent	15				2				2	1	1										5	
Large rodent	3				1																	1
Lepus saxatilis								1			15						122					
Pronolagus sp.										1												
Hare	37	4			5					6	2		3		2	1					12	3
Insectivore	2																					
Struthio camelus	239	18			1				4	29							16				41	3
Francolinus natalensis											4											2
Francolinus swainsoni											3											
Francolinus sp.	2																2				1	2
Coturnix sp.											1											
Numida meleagris	3																1				3	4
Owl	1	1																				
Heron sized bird										1												
Guineafowl sized bird										6												2
Starling sized bird																						
Pigeon sized bird	12																					1
Small bird	5									11											1	
Medium bird										1												2
Large bird									5	1											2	

Table 2 Continued

SPECIES	Sk4	Pr34	Pa8	HP	Sh16	Sh14	Sh27	Mo8	Le6	Le7	Le2	Ph6	Ph9	Ph1	Ma4	Ma38	O120	Ti3	Ti5	Ti6	Tsh1	Sk17
Cordylus tropidosternum jonessi	1																					
Gerrhosaurus validus validus	1																					
Lizard	16	1																				
Varanus niloticus niloticus					3		10		12	13												
Varanus sp.	138	1				2			4	4	2		1				12				6	4
Snake	11	1															1				208	
Crocodylus niloticus			1						4													
Geochelone pardalis							34															
Tortoise	4970	49			439	20	60	56	367	291	80	19	39	17	15	48	1529	2		1	101	150
Reptile	29																				2	
Pyxicephalus adspersus	12									1				11							2	
Frog/toad	111	9			1				11	4	11										7	
Hydrocynus vittatus											4											
Clarias gariepinus	8				3	1	3	2	13	11	35						7					
Clarias sp.	4									3	18											
Synodontis zambezensis											2											
Tilapia rendalli swierstrae											12											
Cichlid											134											
Cichlid/Cyprinid											48											
Fish	2				7	1			305	18	240	2		4			1				1	27
Coleoptera																						2
Freshwater crab	5																					
Sheldonia sp.																					2	
Ledoulxia mozambicensis	180	3					3															
Trachycystis sp.	1																					
Achatina sp.	7423	225			65	92	62	12	57	75		37	14	16		1	697	4		6	503	33
Euonyma sp.		5															1				3	
Curvella sp.																						
Pupilla sp.	1																					
Rhachidina sp.	1																					
Eduardia sp.	18																					

Table 2 Continued

SPECIES	Sk4	Pr34	Pa8	HP	Sh16	Sh14	Sh27	Mo8	Le6	Le7	Le2	Ph6	Ph9	Ph1	Ma4	Ma38	O120	Ti3	Ti5	Ti6	Tsh1	Sk17
Rachis sp.	2																					
Succinea sp.	1				1																	
Lymnaea natalensis	1																				3	
Lymnaea sp.	1																					
Gyraulus costulatus																					4	
Bulinus sp.	4	1																			2	
Tropidophora sp.	119	5												2							2	
Cleopatra cf. *ferruginea*																					1	
Melanoides tuberculata											1											
Melanoides sp.												2									2	
Terrestrial gastropod	12	2			5				7	9											6	
Freshwater gastropod	1																					1
Unio caffer						42	122															
Aspatharia wahlbergi	1					2	489															
Aspatharia petersi					1		555															
Aspatharia sp.	8				176	494	330	10	16	80		43	9	10			525		4	22	1	9
Unio/*Aspatharia*	47	1				2521			41	11	1	1					24				12	15
Corbicula africana											1											
Nerita sp.																					1	
Cypraea sp.	1							1						1								1
Natica sp.																					1	
Polinices tumidus																					3	
Nassarius kraussianus	3																					

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The reconstruction and interpretation of past distributions from the archaeological record must be approached with care. First, most animals were brought into the deposits by humans, and carcasses could conceivably have been transported over some distance. However, the predation patterns of the people who lived in the Kruger National Park do not provide evidence for the transport of carcasses over long distances (Plug 1988). It is therefore reasonable to assume that animals whose remains were identified at sites outside their present range, were indigenous to the region at the time that the site was inhabited.

Second, although the Kruger National Park is a large reserve (nearly 20 000 km^2), its present animal distributions cannot be regarded as entirely natural. Fences prevent the natural annual movements of the migratory species, changing their migration patterns and routes, which may affect their distribution patterns. The provision of dams and boreholes for animals that can no longer reach their traditional watering points also presumably affects distributions. Some discrepancies between present and past distribution patterns can therefore be expected.

The following animals have been found at sites outside their present distribution range when compared to present distributions as described by Pienaar, Joubert, Hall-Martin, De Graaff & Rautenbach (1987). The present and past distributions are illustrated in Figs. 2 and 3.

(a) Mammals

Atelerix frontalis (A. Smith, 1831)
The skull of an adult hedgehog was found in the deposits on Tsh1. There is no record for the presence of this species in the Tshokwane area in modern times. Hedgehogs are at present extremely localised in the Kruger National Park, with recorded sightings from the Pretoriuskop area only.

Diceros/Ceratotherium
Rhinoceros remains occur on a number of sites along the Shingwedzi, Letaba, Olifants, and Sabie rivers. Their distribution during recent times is still under investigation as they were reintroduced to the Kruger National Park in 1961 *(Ceratotherium)* and in 1971 *(Diceros)*. Their presence on Ol20, along the Olifants River, is interesting as there are no records to suggest that they occurred in the area during historical times. The black rhinoceros remains from Le6 and Le7 suggest that these animals also had a wider distribution during Early Iron Age times, as there is no evidence to suggest that they recently occurred in the area.

Procavia capensis (Pallas, 1766)
Dassie remains were found only at Sk4 in the Skukuza district. At present dassies occur north of the Olifants River and in the extreme southwest corner of the Kruger National Park. Rocky outcrops suitable for dassies occur in the Skukuza region and the absence of the species from the region at present cannot be satisfactorily explained.

Potamochoerus porcus (Linnaeus, 1758)
Bushpig remains were found on Ma38, Le6, and Le7. There are no records of these animals along that part of the Letaba during historical times. At present

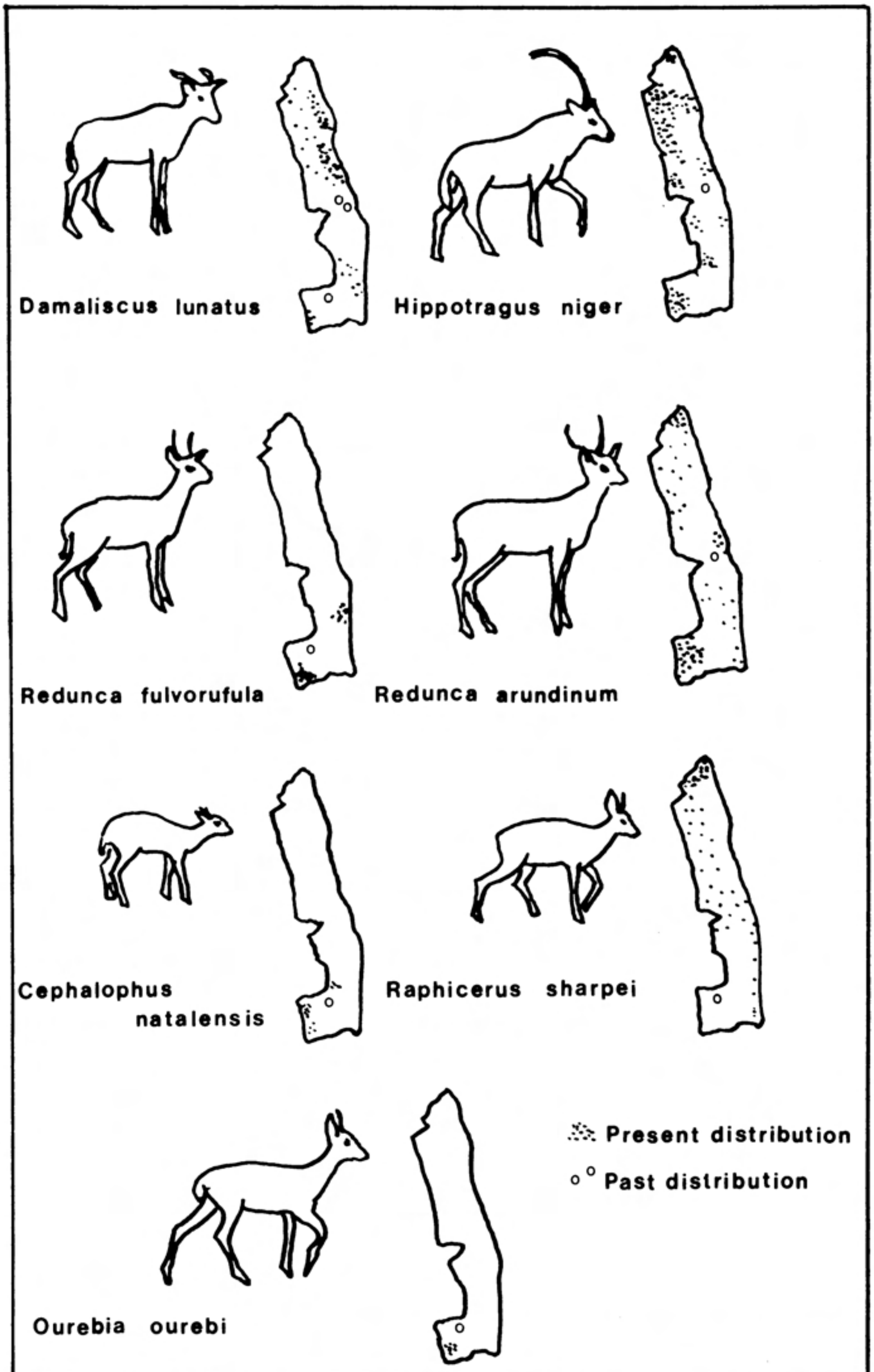

Fig. 2. Present distibutions of antelopes in the Kruger National Park, and their prehistoric occurrence outside these regions. Present distributions are based on Pienaar *et al.* (1987).

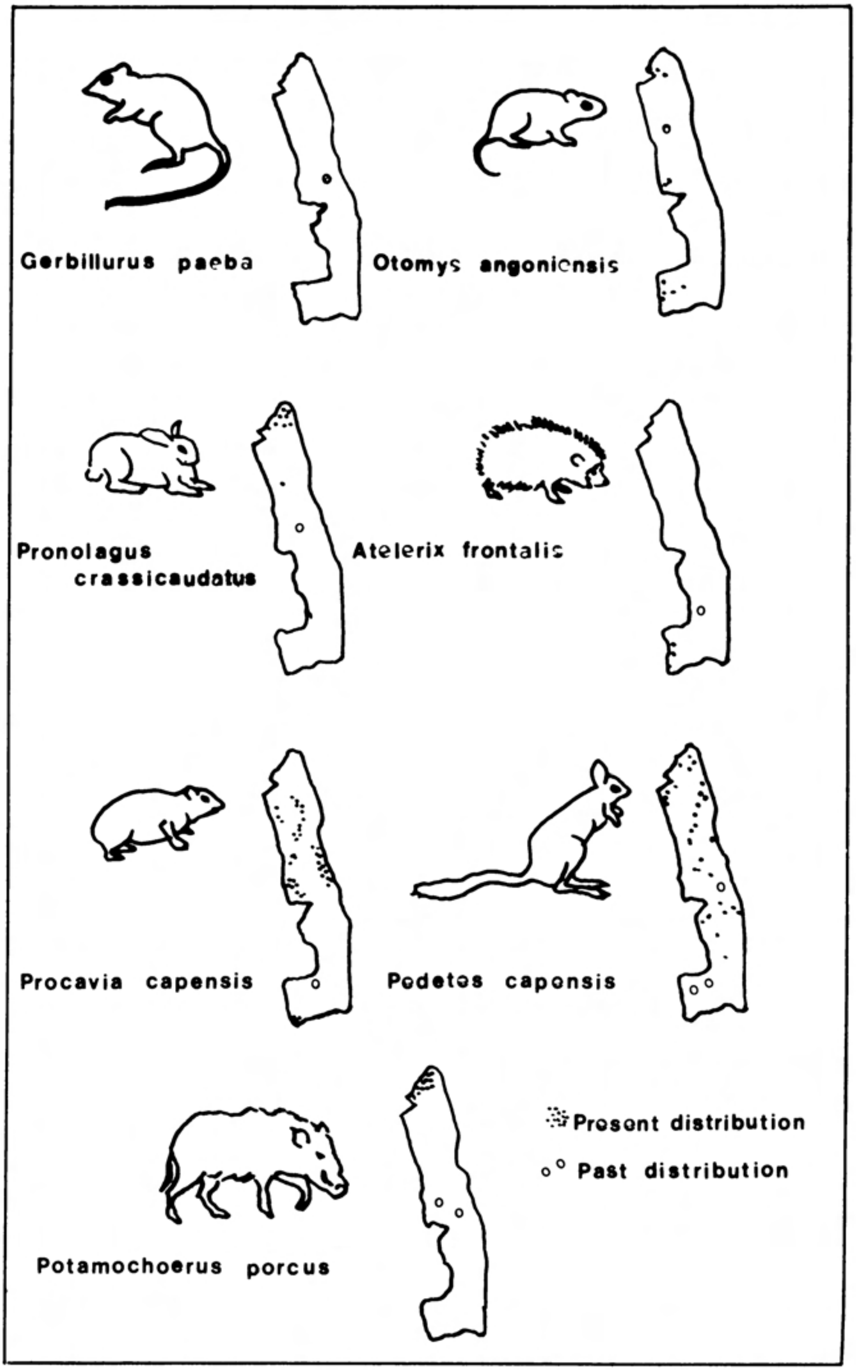

Fig. 3. Present distributions of various animals in the Kruger National park, and their prehistoric occurrence outside these regions. Present distributions are based on Pienaar *et al.* (1987).

their distribution is limited to the Luvuvhu region and the Olifants River gorge in the east. Bushpigs appear to prefer dense vegetation along rivers, and their presence along the Letaba during the Early Iron Age suggests a denser vegetation than the area supports at present. A slight increase in rainfall, could have provided the extra cover and moistness that these animals seem to prefer. At present, agriculture favours them, provided suitable cover is available near by, as it increases their food supply. This has caused them to be a nuisance to farmers in some areas of Zimbabwe (Smithers 1983) and along the Limpopo in the northern Transvaal. It is doubtful if Early Iron Age agriculture could have attracted these suids to the Letaba valley, as even modern agriculture has apparently not affected their distribution very much. It seems, therefore, that their natural habitat was wider in the Kruger National Park during the Early Iron Age.

Ovis aries Linnaeus, 1758, and Ovicaprines
Sheep were introduced into the Kruger National Park by Early Iron Age herders. Herds were probably small and only on Tsh1 were remains relatively common. The ovicaprine remains are probably also from sheep, but the presence of goats cannot be excluded, although no diagnostic elements were identified. At present the environment of the Kruger National Park is not suitable for the herding of sheep.

Bos primigenius f. *taurus* Bojanus, 1827
Cattle were also introduced into the area by Iron Age herders. Indigenous cattle breeds are heat tolerant, and have some immunity to many endemic diseases, but not to nagana. The environment of the Kruger National Park is not very suitable for cattle herding, as the grazing potential for large herds of cattle is limited (Bonsma 1976). The remains are not very common, indicating that herds were probably small.

Damaliscus lunatus(Burchell, 1823) and Alcelaphine
Remains of tsessebe were found on Sk4, Tsh1, Sk17, Le6, and Le7, of which the first and the last two are outside the animal's present distribution range. However, there is historical evidence that these antelope were more widely distributed in the past (Pienaar *et al.* 1987), which may have brought them within reach of all the sites mentioned.

Cephalophus natalensis A. Smith, 1834
This small duiker was found at Sk4 only, in a level below the one dated to 3 000 BP. At present the animal has a very limited distribution, and Sk4 is outside its present range. It prefers a wooded, evergreen habitat, of which little is present in the area today.

Ourebia ourebi (Zimmermann, 1783)
This small buck was identified at Sk4 only. It has not been seen in the region of the site in recent years, but there is evidence that it did occur there during historical times (Joubert *pers. comm.* 1987).

Raphicerus sharpei Thomas, 1897
Although this antelope occurs in many areas of the Kruger National Park, its numbers are small and its distribution patchy (Pienaar *et al.* 1987). Remains were identified at Sk4 only, but at present it does not occur there. The closest region where it has been recorded is the Tshokwane district.

Hippotragus equinus (Desmarest, 1804)
Roan antelope remains occur in the Le6, Sk4, and Pr34 samples. Although this species is still occasionally seen in the Sk4 and Pr34 area today, its numbers are very small. The few groups still present in the area appear to be relict populations of a species that had a much wider distribution pattern in the past (Joubert *pers. comm.* 1987). The presence of its remains on the two stone age sites suggests that it may have been more readily available during stone age times than today. Roan antelopes do not at present occur in the immediate vicinity of Le6, but have been recorded from north of the Letaba, not far from the site.

Hippotragus niger (Harris, 1838)
Sable antelope were identified at Sk4, Ol20, Le7, and Ph6. Sk4 lies within the present distribution pattern for this species, but the other sites are outside its present range as indicated by Pienaar *et al.* (1987). Its presence at Ol20 particularly, suggests that it too may have been more widely distributed in the past.

Redunca arundinum (Boddaert, 1785)
Reedbuck were present on Sk4 and Le7. These buck are still found in the Sk4 region, but Le7 falls outside their present distribution range. However, small numbers occur north of the Letaba River.

Redunca fulvorufula (Afzelius, 1815)
Mountain reedbuck was identified on Sk4. Although it does not occur in the Skukuza district at present, it does inhabit the broken country of the Stolsnek and Berg-en-dal regions to the south (Pienaar *et al.* 1987)

Pedetes capensis (Foster, 1778)
These rodents at present occur mainly in the sandveld regions in the northern districts. Remains were found on Sk4, Pr34, Ol20, Le6, and Le2. Of these sites the first three are far outside the animal's present range, suggesting a much wider distribution in the past.

Otomys angoniensis Wroughton, 1906
This vlei rat species was represented in the Sh16 faunal samples and was identified by R.H.N. Smithers (*pers. comm.* 1986). The Shingwedzi River is outside its present recorded range, which is in the far north of the Kruger National Park and in the Pretoriuskop area.

Gerbillurus paeba (A. Smith, 1836)
Remains of this small rodent were found in the deposits of Le6, and were identified by R.H.N. Smithers (*pers. comm.* 1986). There is at present no record of its occurrence in the Kruger National Park.

Pronolagus sp.
Only one species of red hare, *Pronolagus crassicaudatus,* occurs in the Kruger National Park today, and the remains found on Le7 probably represent this species. At present it is found in the Punda Maria and Pafuri districts only.

(b) Other
None of the birds or reptiles found on the archaeological sites occurred outside their present habitat. The freshwater and terrestrial molluscs also appear to be indigenous to the areas where their remains were found, although no

intensive research has been done in the Kruger National Park on the distribution of these taxa, and particularly of the terrestrial molluscs. The identification of the indigenous *Aspatharia* species, and a possible revision of their taxonomy, are still under consideration by C. Appleton of the University of Natal. The introduced molluscs found during this study are all east coast marine or coastal estuarine species, and their presence can be explained by trade links that existed during Iron Age times.

Several of the antelope and other species found outside their present distribution ranges could have been brought in by hunters, as suggested earlier. However, the number and variety of these animals suggest a somewhat wider distribution pattern for most of the species in the past. Furthermore, the bushpig remains found along the Letaba River suggest that some changes to the habitat must have occurred between the Early Iron Age and the present.

(ii) Relative abundances

The relative abundances of certain species in the archaeological samples were compared to the present day relative abundances of the same species in the Kruger National Park (Table 3). The present day figures are based on the aerial census surveys of the last seven to ten years. The following species are considered: impala, buffalo, kudu, blue wildebeest, sable, roan, tsessebe, eland, waterbuck, elephant, zebra, warthog, and giraffe. The figures available for rhinoceros were not used as these animals were only recently reintroduced, and their numbers and distribution patterns may not yet have stabilised.

Table 3

Census figures and prehistoric predation based on Minimum Number of Individuals (MNI) counts

Species	Census		LSA		EIA		LIA		Total pre-history
	No	%	No	%	No	%	No	%	%
Impala	119296	54	27	40	54	22	14	20	26
Buffalo	29020	13	2	3	29	12	7	10	11
Zebra	27636	13	6	9	70	28	18	25	25
Wildebeest	11262	5	10	15	46	19	13	18	18
Kudu	9389	4	1	1	5	2	3	4	2
Elephant	7757	4	0	0	1	1	1	1	1
Giraffe	5031	2	2	3	7	3	7	10	4
Waterbuck	3710	2	0	0	7	3	2	3	2
Warthog	3458	2	16	24	13	5	4	5	4
Sable	1987	1	2	3	2	1	1	1	1
Tsessebe	981	1	2	3	4	2	2	3	2
Eland	675	1	0	0	2	1	0	0	1
Roan	342	1	0	0	3	1	0	1	1

The species that were most often hunted by the prehistoric communities, are also the most abundant at present. Impala are today the most numerous of all the species surveyed. They were also most frequently utilised during the Later Stone Age, but were second on the list during the Iron Age. Zebra were the most popular prey during the Iron Age and wildebeest took third place. Buffalo was fourth during the Early Iron Age, and joint fourth with giraffe during the Late Iron Age. Warthog was the fifth most utilised animal during the Iron Age, but was second during the Later Stone Age.

Compared to the census figures, impala, buffalo, kudu, and elephant were underutilised during prehistoric times, while zebra, wildebeest, roan, tsessebe, giraffe, and warthog were heavily overutilised. The remaining species were also overutilised, but not as much. The percentage of wildebeest taken is more than three times, and zebra almost twice that of the relative abundances based on the census figures. Although present census figures cannot perhaps be reliably used to reconstruct prehistoric abundances, it seems that zebra and wildebeest were heavily exploited in the past. It does not appear, however, that these animals were ever in short supply, and it may be assumed that the density of the human populations during prehistoric times was too low to have affected animal populations seriously. It was only during the nineteenth century that both European and African hunters with firearms nearly exterminated the game in the area.

(iii) Past climates of the Kruger National Park

Attempts to reconstruct palaeo-climatic conditions in South Africa have met with variable and often limited success. The best results have been obtained through the study of pollen from cave and spring deposits, deep sea cores, and cave sediments. However, suitable study material is rare, particularly from the interior.

No studies of the palaeo-climate have been done in the Kruger National Park and surrounding areas, although some information is available for Swaziland during the late Pleistocene and the northern Transvaal during the Holocene (Tyson 1986). Reconstructions of past climatic conditions in the Kruger National Park based on present knowledge, are therefore mere extrapolations. However, the past animal distributions and human settlement patterns may provide some evidence of climatic changes.

The time span considered in this paper covers the period from the mid-Holocene to the end of the nineteenth century. The oldest dated site is Sk4. The following dates, based on the dating of bone, are available for the deposit: level 4 has been dated to BP 3 329 ± 90 Pta-4 455 and level 11 to BP 6 820 ± 120 Pta-4 454. The other sites, with the exception of Pr34 which may be of similar age as Sk14, are younger than 2 000 years.

At present very little is known about climatic changes in southern Africa during the Holocene. There is, however, some evidence for the commencement of a moister and apparently also warmer phase (compared to current conditions) around 9 000 BP, which lasted until approximately 4 000 BP (Van Zinderen Bakker 1982; Tyson 1986). There is also some evidence suggesting that conditions were still somewhat wetter 3 000 years ago over much of the region, but that drier conditions prevailed in some areas, for example Kathu Pan in the northern Cape (Van Zinderen Bakker 1983). Evidence from the Soutpansberg indicates that the vegetation around 5 000 BP was very similar to that of the present. However, at around 3 000 BP a decrease in tree pollen, and an increase in grass pollen occurred, indicating more open savannas and possibly a somewhat cooler climate (Scott 1984). At about that time a general world-wide cooling appears to have taken place, and the period between 3 000 and 2 000 BP was characterised by glacial advance throughout the world. Van Zinderen Bakker (1962) noted lower tree lines in the high mountains of East Africa and Europe, indicating a lowering of the snow line.

From the above it appears that conditions during the Holocene were variable and that our present knowledge is too limited to provide a reliable overview of Holocene climatic conditions for the whole of southern Africa. How these variable conditions affected the Kruger National Park is difficult to assess.

The only new evidence for this period available at present is contained in the fauna of Sk4. This evidence is, unfortunately, not conclusive. The species present at Sk4 (Table 2) seem to suggest that some climatic changes may have taken place between 7 000 and 3 000 BP. The fauna from the lowest levels, around 7 000 BP is very much like the fauna found in the area today. Most species are small territorial animals, while large bovids are poorly represented. If the climate was wetter than it is today, as it was over much of southern Africa at the time, it was not wet enough to produce detectable changes in the fauna.

Around 3 000 BP the species composition differs somewhat from that of the earlier period and from that of today. First, large, gregarious herd species are better represented. Most of these species, such as zebra, blue wildebeest, buffalo, and tsessebe, are associated with open savanna. At present the Sk4 area is wooded, and although these species still occur in, or close to the area today, their numbers are small. The evidence therefore seems to indicate that a more open savanna existed in the area around 3 000 BP.

Second, the remains of *Raphicerus sharpei* occur in the levels around 3 000 BP, but not in the earlier levels, while the species is absent from the Skukuza area today. Sharpe's grysbok is at home in dry savanna, and its presence therefore suggests both a more open savanna around the site during that time, and that the climate was somewhat drier than at the present.

The distribution of ostrich eggshell fragments in the deposits of Sk4 also seems to support a more open savanna around 3 000 BP. Ostriches, which prefer a more open savanna, occur in the vicinity at present, but their population density is low. Ostrich eggshell remains are common in all the levels of Sk4, and there is evidence that beads were made on the site, indicating that eggs were collected near by. Eggshell fragments are, however, generally more numerous in levels 2-5, during the 3 000 BP period. This suggests that ostriches may have been more common in the region at that time than at present.

There is, however, an anomaly in the presence of *Cephalophus natalensis,* a species preferring a moist, wooded, evergreen environment. Its presence at Sk4 cannot be satisfactorily reconciled with the drier savanna conditions inferred above. At present it occurs only to the east and north of the site (Pienaar *et al.* 1987).

Warmer conditions appear to have prevailed in Europe around 1 000 AD, and also in the southern Cape (Tyson 1986). However, this does not necessarily mean that the climate of the Transvaal lowveld was also warmer. The Early Iron Age fauna of the present study is very similar to the fauna of the area today, although the distribution patterns of some species are a bit different.

It is possible that rainfall was somewhat higher, and that the region was better watered during the first millennium AD than it is today. This is suggested by the fact that some settlements were situated on the banks of streams that are now mostly dry. Tsh2 (not excavated) and Tsh1, for example, lie on the banks of the Mutlumuvi River. The Tsh1 settlement is one of the largest found in the Kruger National Park and must have supported a considerable population. At present the Mutlumuvi is dry during most of the year, and would not be able to provide enough water for a community that large. The river arises in the Kruger National Park and is therefore not influenced by recent overutilisation, which seriously affects rivers that arise outside the boundaries of the Kruger National Park. A slight increase in annual rainfall would allow the Mutlumuvi River to flow regularly. Alternatively, the water table may have been higher at the time the site was inhabited, as a drop in the groundwater table would also have caused the river to dry up. Such a drop could have been caused by a decrease in precipitation, but also by an increase in tree cover. Either of these possibilities implies some (albeit a relatively small) climatic difference between the Early Iron Age and the present.

An environment with fewer trees and more open grassland at Tsh1 at the time the site was occupied, is supported by the species found there including sheep (Table 2). Zebra, and blue wildebeest which prefer open grassland, are well represented, suggesting that they were readily available. Although these animals occur in the area today, their numbers are limited.

Sheep remains also occur on some other Early Iron Age sites besides Tsh1 (Table 2), supporting the suggestion that conditions were somewhat different at the time over much of the area. This is further supported by the presence of bushpig along the Letaba River.

Tree-ring studies indicate that the period from the fourteenth to the mid-fifteenth centuries was cooler in the summer rainfall regions of southern Africa (Tyson 1986). This cooler period was experienced world wide and is referred to in Europe as the little ice-age. Unfortunately there were no settlements excavated which date to that period (the few sites which may belong to that period have not yet been studied). Therefore no deductions relating to the climate of the period is available.

The eighteenth and nineteenth centuries appear to have been marked by alternating wet and dry periods. Between 1820 and 1840 it appears to have been very dry in South Africa. It was also dry between 1897 and 1905 (Tyson 1986). The present century is characterised by a similar pattern of alternating wet and dry cycles, although Stevenson-Hamilton (1934) maintains that the lowveld was better watered during the nineteenth century than during the first few decades of the present century. There is no evidence from the late Iron Age faunas that conditions were much different from those prevailing during the twentieth century.

Conclusions

In general past animal distributions in the Kruger National Park within the time span represented by the sites discussed, do not differ remarkably from those of the present. There are, however, some exceptions as discussed above. These warrant further research. The presence of some animals in areas outside their present range may perhaps be explained in terms of climatic change, with consequent changes in the vegetation. Evidence for past climatic changes is inconclusive, but the faunal remains indicate that the climate around 3 000 BP, and during the first millennium AD, may have been somewhat different to that of today. To fully understand human and animal behaviour in the past, we will have to pay more attention to past climate and environment. It would therefore be of interest to conduct more extensive research into the past climate not only of the Kruger National Park, but also of the surrounding lowveld.

The effects that settled human communities may have on an environment should also be considered. For example, herders achieve an increase in grass cover by removing trees and bush. In this manner they improve grazing conditions for their herds, and at the same time cause changes in the faunal and floral compositions of the relevant area. Therefore, an increase in grass cover and a change in fauna species, do not necessarily indicate climate change. However, the evidence for a better water supply along the Mutlumuvi, the presence of bushpig along the Letaba, and of sheep on a few Early Iron Age sites, suggest that rainfall could have been higher during the first millennium AD, and that the environmental differences between those times and the present cannot be attributed to human action alone.

Although it appears that there may have been some minor climatic changes in the Kruger National Park during the Holocene and Early Iron Age, these changes were not dramatic enough to cause major changes in the fauna. It would be of interest to determine the distribution of the major vegetation zones during the past, for example that of the mopane, through the study of pollen and sediments in an effort to reconstruct past ecological conditions in the Kruger National Park.

The presence of cattle during the Iron Age in the Kruger National Park is of great interest. Nagana and therefore tsetse fly (*Glossina* sp.), is endemic to the region and has been historically documented (Fuller 1923; Plug 1988). The presence of cattle in the Kruger National Park during the Iron Age indicates that the region was free of tsetse when the various sites where their remains were found were inhabited. Further research may shed some light on the dynamics of tsetse fly populations.

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References

BOESSNECK, J., H.H. MUELLER and M. TEICHERT. 1964. *Osteologische Unterscheidungsmerkmale zwischen Schaf* (Ovis aries *Linne) und Ziege* (Capra hircus *Linne).* Kuehn-Archiv, Band 78. Berlin: Akademie Verlag.

BONSMA, J. 1976. *Bosveldbome en weistreke.* Pretoria: Van Schaik.

FULLER, C. 1923. Tsetse in the Transvaal and surrounding territories: an historical review. *Entomology Memoirs 1 (1).* Union of South Africa, Department of Agriculture.

MEYER, A. 1986. *'n Kultuurhistoriese interpretasie van die Ystertydperk in die Nasionale Krugerwildtuin.* Doctoral Dissertation, University of Pretoria, Pretoria.

PETERS, J. 1988. Osteomorphological features of the appendicular skeleton of African buffalo, *Syncerus caffer* (Sparrman, 1779) and of domestic cattle, *Bos primigenius* f. *taurus* Bojanus, 1827. *Zeitschrift fur Säugetierkunde* 53: 108-123.

PIENAAR, U. DE V., S.C.J. JOUBERT, A. HALL-MARTIN, G. DE GRAAFF and I.L. RAUTENBACH. 1987. *Field Guide to the Mammals of the Kruger National Park.* Cape Town: Struik.

PLUG, I. 1988. *Hunter and herders: An archaeozoological study of some prehistoric communities in the Kruger National Park.* Doctoral Dissertation, University of Pretoria, Pretoria.

SCOTT, L. 1984. Palynological evidence for Quarternary paleoenvironments in southern Africa. Pp. 65-80. *In:* KLEIN, R.G. (ed.). *Southern African Prehistory and Paleoenvironments.* Rotterdam: Balkema.

SMITHERS, R.H.N. 1983. *Die Soogdiere van die Suider-Afrikaanse Substreek.* Pretoria: University of Pretoria.

STEVENSON-HAMILTON, J. 1934. *The Low-veld: its Wild Life and its People.* London: Cassell.

TYSON, P.D. 1986. *Climatic Change and Variability in Southern Africa.* Cape Town: Oxford University Press.

VAN ZINDEREN BAKKER, E.M. 1962. A late-Glacial and post-Glacial climatic correlation between East Africa and Europe. *Nature* 194: 202-203.

VAN ZINDEREN BAKKER, E.M. 1982. Pollen analytical studies of the Wonderwerk cave, South Africa. *Pollen et Spores* 24: 235-250.

VAN ZINDEREN BAKKER, E.M. 1983. The late Quarternary history of climate and vegetation in east and southern Africa. *Bothalia* 14: 369-375.