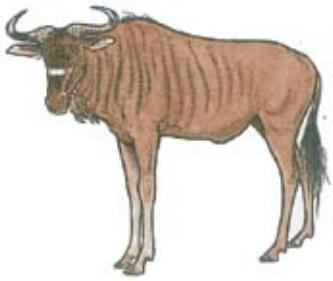
WORKING PAPER NO. 37 JULY 2009

Connochaetes taurinus mearnsi
western white-bearded wildebeest

C. t. taurinus
blue wildebeest
(brindled gnu)

C. t. albojubatus
eastern white-bearded wildebeest

C. gnou
black wildebeest
(white-tailed wildebeest)



C. t. johnstoni
Nyassa wildebeest
(white-banded wildebeest)

C. t. cooksoni
Cookson's wildebeest

STATUS OF THE WILDEBEEST
(Connochaetes taurinus)
IN THE WILD 1967–2005

by Richard D. Estes and Rod East

WILDLIFE CONSERVATION SOCIETY

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ACKNOWLEDGMENTS

I thank the Wildlife Conservation Society Tanzania Program, and Tim Davenport in particular, for recommending and funding this report. Sadly, Rod East did not live to see its publication. His contribution not only included the updated status of the different wildebeest populations from the 1980s through 2005, but also major pruning of the lengthy 1967 survey text.

FOREWORD

Few large mammals conjure up the wide-open spaces of the African savanna quite so evocatively as the wildebeest (*Connochaetes taurinus*). Known also by its Bushman name gnu, and across much of East Africa in KiSwahili as nyumbu, this charismatic antelope has become synonymous in the public mind with the short-grass plains of the great Serengeti. It is here that a million wildebeest seek out forage and calving grounds during the annual migration, offering one of the world's most extraordinary wildlife spectacles. This unique antelope remains the consummate flagship species, linked irrevocably to its landscape and epitomizing the free-ranging wildness that used to typify so many savanna ecosystems.

There is little doubt Tanzania is one of the most important countries in Africa for wildlife. Sadly however, the integrity of Tanzania's wild places faces grave challenges, not least in balancing the needs of a growing and developing human population with a globally significant environment. Against this background, it is important to remind ourselves that, of all Tanzania's mammals, the wildebeest is probably the single species that contributes most to the national economy. In a recent consumer survey, the wildebeest migration was cited as one of the main reasons tourists visited Tanzania. But the wildebeest is a species of continental fascination and value. It ranges across sizeable landscapes of eastern and southern Africa, and for each of its range states this unique animal provides meat, tourism revenue, and plays crucial roles in local cultures and ecosystems. The wildebeest is a harbinger of the success or failure of conservation interventions. For all these reasons, the *Status of the Wildebeest in the Wild 1967-2005* by Richard D. Estes and Rod East is not only an invaluable treatise on a pivotal large mammal, but also an extremely important conservation text.

It is perhaps no coincidence that such an important species should have been studied by two of the continent's most dedicated conservation biologists. Author of the highly acclaimed *The Safari Companion: A Guide to Watching African Animals*, *The Behavior Guide to African Mammals,* and the *National Audubon Society Field Guide to African Wildlife*, Richard Estes has an encyclopedic knowledge of the continent's mammalian fauna. Mentored early in his career by Konrad Lorenz and Niko Tinbergen, the co-founders of ethology and co-Nobel Laureates, Richard spent decades studying Africa's large mammals. However, it is in the wildebeest, subject of his doctoral dissertation, that

he has always had a particular interest, and his publications provide most of the world's knowledge of wildebeest behavior. Co-author Rod East rightly dubbed him the 'Guru of the Gnu'.

The late Rod East is generally considered to have contributed more to the conservation of African antelopes than any other individual. He was a long-standing member and co-chair of the Antelope Specialist Group, advising on the conservation of antelopes for the Species Survival Commission of the International Union for Conservation of Nature and Natural Resources (IUCN). He compiled and published key data on all African antelope species, including his mammoth 1998 African Antelope Database, and also raised considerable funds to protect threatened African antelope populations. His contribution to conservation was recognized with the Sir Peter Scott Award for Conservation Merit in 2006.

Together, these authors have compiled data on the wildebeest from forty years of research; the result is a monumental work that reaches across the continent. The Wildlife Conservation Society (WCS) has been active in Tanzania for a similar length of time, using science, education, and partnerships to help government and Tanzanians manage their unique natural heritage. In its current strategic plan, the WCS Tanzania Program identified four of the greatest challenges to wildlife as natural resource extraction, the interaction of human livelihoods and biodiversity, climate change, and landcover change. All these challenges now confront the wildebeest. The WCS Tanzania Program is consequently very proud to support this extraordinary volume, and is confident it will serve both to guide and inspire conservationists across the African continent for decades to come.

Tim Davenport
Country Director
WCS Tanzania Program

PART 1: PROLOGUE

The country-by-country survey of the common wildebeest chronicles mankind's destruction of the large ruminant that dominated acacia savanna ecosytems of eastern Africa. Its story is a particularly egregious example of the ways in which mankind has squandered Africa's heritage of large mammals.

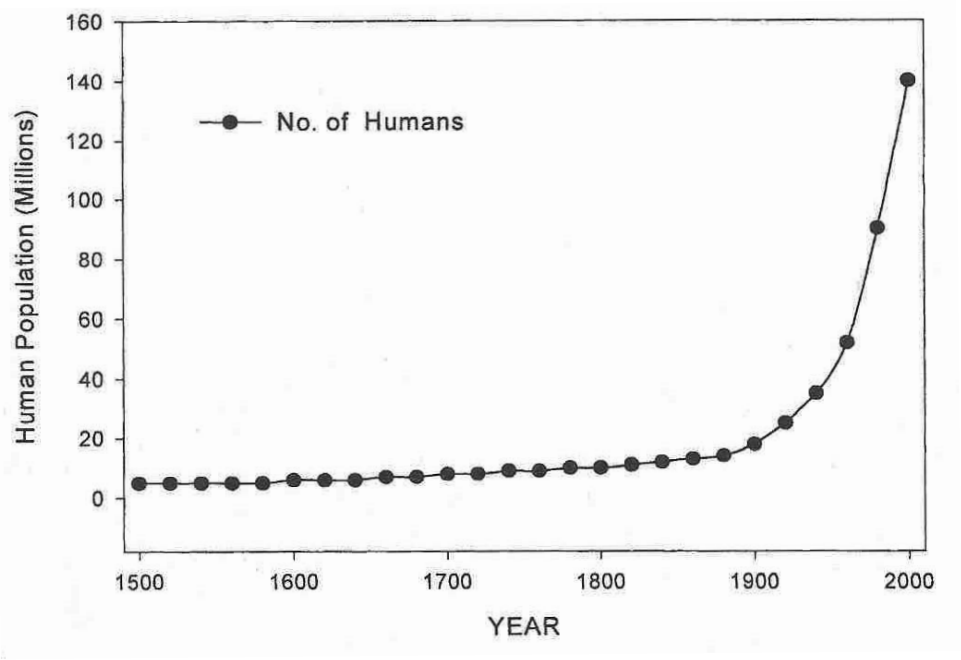
The abundance and diversity of large mammals in Africa was unmatched on any other continent. Only here did the Pleistocene Golden Age of Mammals (Huxley 1965) survive the Ice Ages and persist into modern times.

The Bovidae, the last great radiation of hoofed mammals, dominated herbivore communities. Of 76 recent African species (Vrba & Schaller 2000), all but three are antelopes. The new, superior ruminant digestive system enabled antelopes to partition virtually the whole range of African ecotypes (Hoffmann 1973; Estes 1974; Jarman 1974; Estes 1991; Sinclair 2000a)

Although few African mammals have gone extinct in recent times, nearly all are in decline, most populations are trending downward, and many populations have been extirpated in developed areas. The status of African antelopes at the end of the 20th century is summarized in East (1999), Vrba & Schaller (2000), Mallon & Kingswood (2004), and Chardonnet & Chardonnet (2004). Appendix 4 in East (1999) summarizes the status of all antelopes in each country of sub-Saharan Africa (including buffalo, girafe, and okapi). The decline of wild ungulates is the direct and indirect outcome of competition with *Homo sapiens* and, in particular, with his livestock and agriculture.

Africa's human population has grown exponentially since the creation of separate colonial countries. Between 1500 and 1900, Africa's human population increased very slowly (McEvedy 1980 in Cumming 1999) (Figure 1). Near the turn of the 20th century, the population began to increase. According to the Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, Africa's population will reach 1,033,043,000 in 2010 (http://esa.un.org/unpp). In wildebeest range states – Angola, Botswana, Kenya, Malawi, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia, and Zimbabwe – the human population has increased from fewer than 20 million people to over 140 million, and continues to grow at >3% per year. Tanzania's population tripled over the same period to 31 million; Kenya's population has tripled since 1960 and is now 29 million (Coughenor et al. 2000).

Figure 1: Graph of human population growth in southern Africa from 1500-2000 (Figure 3.1 in Cumming 1999).



With the world population increasing by 75-85 million per year, people profoundly affect virtually all natural ecosystems (McNeely 1997). In Africa, increasing anthropogenic pressure on remaining wildlife habitat will threaten all megafauna with extinction outside and eventually inside protected areas, over the entire continent.

The establishment of colonial governments in the 19th century set the stage for population explosion by curtailing tribal warfare, improving public health, promoting commercial agriculture, and adopting policies to increase livestock production at the expense of native ungulates. The Berlin Treaty of 1884 divvied up most of Africa among Britain, France, Germany, Belgium, Italy, Portugal, and Spain. The Berlin Act required the colonial powers to physically occupy whatever land they claimed with troops, missionaries, merchants, and infrastructure. The artificial boundaries of these new states divided tribes and clans, fragmented ecosystems, and cut across wildlife migration routes.

Colonial and post-colonial governments greatly increased human environmental impact in ways exemplified by the history of the wildebeest's decline. Governments pursued policies to increase agriculture and livestock production despite disadvantaging wildlife in designated areas. To protect cattle from wildlife diseases such as bovine sleeping sickness (nagana) (Parts 2.1, 2.3, 2.6, and 2.8), state-directed veterinary services undertook such measures as extermination of wild ungulates thought to harbour disease, aerial spraying of insecticide to make tsetse-infested habitats available for ranching (e.g., Botswana, Okavango Swamp), livestock vaccination, and fencing.

Fences have been the most disruptive of these efforts. Fencing along park boundaries prevents dispersal and truncates migratory ranges (Figure 2).

Figure 2: Game-proof fence (at left) on Botswana-Namibia border in 1969 (photo by RDE).

The most numerous and destructive were cordon fences in Botswana, erected largely for the benefit of politically powerful commercial cattle ranchers (Williamson & Williamson 1984; Williamson 1994). Supposedly installed to separate wildlife from cattle, the fences mainly served to open areas for ranching that had previously belonged to wild herbivores, numbering at least half-a-million and second only to the Serengeti ecosystem (Part 2.3). Over a period of four months in 1988, an estimated 50,000 Central Kalahari wildebeest died on the Kuke fence from lack of water access.

International donor agency projects to raise the standard of living in developing nations have often promoted development of agriculture and livestock production at the expense of the indigenous wildlife. For instance, the European Union's subsidy of Botswana beef producers in the form of a 40 percent external tariff makes beef exports to Europe Botswana's second largest income generator (Stevens & Kennan 2005).

Other factors also contributed to a precipitous decline of big game. These include firearms proliferation and commercial exploitation (for hides, meat, ivory, etc.) (MacKenzie 1988). Rinderpest, the cattle-borne disease that swept from Ethiopia to South Africa in the 1890s, devastating both domestic and wild ruminants, was the final blow.

In 1894, the colonial powers convened a London Convention Designed to Ensure the Conservation of Various Species of Wild Animals in Africa which are Useful to Man or Inoffensive. This agreement came into force in 1900, signed on behalf of Great Britain, Germany, Spain, Belgian Congo, France, Italy, and Portugal. But it would be another generation before organized international efforts began protecting wildlife. The 1933 London Convention, signed on behalf of South Africa, Belgium, Great Britain, Egypt, Spain, France, Italy, Portugal, and the Anglo-Egyptian Sudan, established protected areas and the first national parks. Land considered unsuited for agriculture or livestock was set aside for wildlife. Consequently, a piece of Transvaal Lowveld from which virtually all wildlife had been excluded was declared the Sabi Game Reserve in 1902 and became Africa's second national park in 1926 (the Parc National d'Albert in the Belgian Congo, gazetted in 1924, was first).

It was not until the 1970s that the plight of migratory species came to the world's attention. A 1972 recommendation of the United Nations Conference on the Human Environment called on the United Nations Environment Programme to pursue a multilateral agreement responding to concerns of wildlife biologists and conservationists. After more consultation, the Convention on Migratory Species (CMS, also known as the Bonn Convention) was adopted in Bonn, Germany, in 1979. The convention required all member countries to protect the most endangered migratory species, listed in its Appendix I. A framework thus finally existed for regional or multi-country agreements to conserve particular migratory species or groups of species across their known ranges.

It is debatable what, if any, benefit African migratory ungulates derived from the CMS. In a 2004 report marking the convention's silver anniversary, UN Secretary-General Kofi Annan warned, "People tend to underestimate the vulnerability of migratory species. Yet if current trends continue, more and more of them will be driven to the edge of extinction. I call on all Governments that have not yet done so, to accede to CMS. Let us keep the Convention itself – a unique global initiative – on the move," (Annan 2004).

Meanwhile, government subsidies still encourage new cultivation on increasingly marginal land to support burgeoning human populations. Despite doubling production of cereals and root crops in southern Africa between 1961 and 1994, food supply did not keep pace with population growth. Overall production of food – including meat, milk, and fish – declined 25% in the 1980s and 1990s, exacerbated by decades of subnormal rainfall (Cumming 1999). The low productivity of livestock is particularly striking. Livestock biomass is ten times that of wild herbivores, yet there are now fewer livestock units in the SADC region than people, i.e. less than one livestock unit per person. Cattle production has increased little, as the carrying capacity of increasingly arid range requires more hectares per livestock unit. Persistent overstocking has reduced rangeland productivity over the past century. Compared to levels of meat and milk production per animal and per person in Europe, productivity of southern Africa rangelands are 20 times less (Cumming 1999)!

Thanks to the downward trend of stocking rates in more arid regions, cattle herds are becoming too small to sustain traditional pastoralists. For example, in Tanzania's Ngorongoro Conservation Area, one-third of the Masai population is classified as below the poverty line. Their population has doubled to >40,000 in the past decade. In place of their traditional transhumant pastoral system, most are now settled in permanent houses and have to farm to supplement their diet (Anonymous 1996; Galvin & Boone 2001).

Increased crop dependence and cultivation in arid areas unsuited to agriculture are unsustainable and reduce rangeland. Wildlife and biodiversity are declining outside and even inside protected areas. Settlement has advanced to the boundaries of many parks and reserves (including Serengeti National Park – Fryxell et al. 2005; Kideghesho et al. 2006), while pressure to enter these protected areas is mounting and will eventually become irresistible as the human population continues to increase.

PART 2: WILDEBEEST SURVEY 1967-2005

Introduction

The common wildebeest or gnu (*Connochaetes taurinus*) formerly occurred widely in short grasslands and open bushland and woodland from southern Kenya to the Orange River in northern South Africa. Within this range it occurred locally in large concentrations. The wildebeest is adapted to close, rapid grazing of short, nutritious grass. It dominated areas of favourable habitat such as the extensive short-grass plains and adjoining acacia savannas of southern Kenya, northern and southeastern Tanzania, southwestern Zambia, southeastern Angola, Namibia, Botswana, and the major river valleys of Mozambique.

In the mid-1960s, the senior author (RDE) sent questionnaires to the wildlife authorities in all wildebeest range states to ascertain the species' ecological niche (habitat and food preferences, associated species, seasonal movements, etc.) and each population's status, trend, and habitat (Appendix 1). The resulting information, as well as a review of the published literature and personal observations in South Africa, Botswana, Zimbabwe, Tanzania, and Kenya, formed the basis of a manuscript prepared in 1967 which included country-by-country accounts of the wildebeest's status and ecology. Submission of the draft accounts to the respondents yielded corrections and additional information. For various reasons, this review has not been published until now.

This account compares the information on the wildebeest's status obtained in the 1960s with more recent information on wildebeest status obtained by the junior author (RE) during the 1980s (East 1988; East 1989), the 1990s (the *Antelope Survey Update* series compiled from 1995 to 1998; East 1999), and the current situation (correspondence with researchers and wildlife authorities in the range states carried out by RE from June to December 2005). In the following accounts of each wildebeest population, the initial text, headed *Status in the 1960s*, is taken from RDE's 1967 manuscript; more recent information is included under the headings *Status in the 1980s*, *Status in the 1990s*, and *Current Status*.

Subspecies

The following wildebeest subspecies are recognized in this account:

C. t. taurinus (blue wildebeest or brindled gnu). Namibia and South Africa to Mozambique north of the Orange River, from Mozambique to Zambia south of the Zambezi River, and from southwestern Zambia to eastern and southern Angola. Slate-blue coat with conspicuous dark stripes, black beard, and upstanding black mane. Shoulder height (Sh.) males 147 (140-156) cm, females 135 (129-140) cm; weight (wt.) males 237-252 kg, females 190-215 kg (Hitchins 1968; Attwell 1977).

C. t. cooksoni (Cookson's wildebeest). Restricted to the Luangwa Valley, Zambia. Vagrants occasionally range on to the adjacent plateau and into western Malawi (Part 2.7). Browner than other races. Wt. two males 235, 241 kg, two females 219, 224 kg (Wilson 1968).

C. t. johnstoni (Nyassa or Johnston's wildebeest). North of Zambezi River in Mozambique to east-central Tanzania, formerly as far north as the Wami River; southeastern Malawi (extinct). Sometimes referred to as the white-banded wildebeest for the pale chevron between its eyes (often absent in the Tanzania population – B. Nicholson & G.Child, personal communication, 1967). Sh. 130 cm, wt. 227 kg (Anonymous 1969).

C. t. albojubatus (eastern white-bearded wildebeest). Northern Tanzania to central Kenya just south of the Equator, west to the Gregory Rift Valley. Southernmost point in recent past (1950s) at least to the Handeni-Kondoa road (5° 30' S) (J. Kingdon, personal communication, 1998). The lightest-colored race, beard white to tan. Wt. males 243 (222-271) kg, females 192 (179-208) kg (Ledger 1964).

C. t. mearnsi (western white-bearded wildebeest). Serengeti-Mara ecosystem of northern Tanzania and southern Kenya west of the Gregory Rift Valley, formerly to Lake Victoria. Smallest race, dark gray or brown, mane lax and black, beard white to tan, horns shorter than in other races but with more developed boss in males. Sh. males 110-134 cm, females 107-123 cm. Wt. males 201 (170-242) kg, females 163 (141-186) kg (Sachs 1967).

Connochaetes gnou (black wildebeest). The black wildebeest, adapted to the temperate, treeless Highveld and Karoo of South Africa, barely overlapped with *C. taurinus*. It was nearly exterminated in the late 19th century and now exists only on fenced ranches and reserves.

Figure 3: Wildebeest species, subspecies, and distribution (Estes 2006).

Connochaetes taurinus mearnsi
western white-bearded wildebeest

C. gnou
black wildebeest (white-tailed wildebeest)

C. t. taurinus
blue wildebeest (brindled gnu)

C. t. cooksoni
Cookson's wildebeest

C. t. albojubatus
eastern white-bearded wildebeest

C. t. johnstoni
Nyassa wildebeest (white-banded wildebeest)

2.1 South Africa

1960s Status in South Africa

The Orange River, which originates in the Lesotho Highlands and flows westward 2,100 km across South Africa to the Atlantic, marks the southernmost limit of the blue wildebeest's range. While solitary bulls were occasionally reported south of the river, e.g., by Cumming (1855), according to Skead (1958), "The weight of evidence is strongly against the blue wildebeest having occurred south of the Orange River." Considering that it is not an impassable barrier (its lower course is often dry), the Orange River forms a remarkably definite boundary, not only for the blue wildebeest, but also for a variety of other essentially tropical forms, including such ungulates as the tsessebe, roan, impala, warthog, giraffe, common zebra, and white rhino (Lydekker 1926; Skead 1958; Bigalke & Bateman 1962).

While the Orange River marks a convenient geographical reference point, it is accurate to say the range of *C. t. taurinus* and the others was bounded by the arid tree savanna of northern South Africa; their distribution ended where the trees ended. Beyond stretch the immense open plains of the Karoo and the Highveld, which formerly teemed with black wildebeest, quagga, and springbok. The blue wildebeest is not adapted to a temperate climate, whereas the black wildebeest's coat apparently insulates it better against both cold and heat. The black wildebeest is also a mixed feeder rather than a pure grazer like the blue wildebeest, and hence can utilise the foliage of the Karoo's shrubs and bushes. Despite reports to the contrary, e.g., Harris (1840), Cumming (1855), and Sidney (1965), the blue wildebeest did not penetrate the Highveld, and the only known or probable overlap between the two wildebeest species' distributions was in the vicinity of the confluence of the Vaal and Orange Rivers, where Kalahari Thornveld, Highveld, and Karoo all came together (this area has since degraded to Transitional Karoo).

The former range of the blue wildebeest in South Africa was thus confined to the Kalahari Thornveld, Bushveld, and Lowveld of northern Cape Province, the northern and western Transvaal, and northern Natal. It has been exterminated in most of Northern Cape Province (Part 2.3) but survives in some parts of Natal and the Transvaal.

Natal

A tongue of Bushveld (semi-arid savanna) extends down the eastern side of Natal, between the upland grassland of the Drakensberg's steep eastern slopes and the coastal forest-savanna mosaic (now mainly replaced by sugar cane and settlement) between the altitudes of 460 and 1,220 m. Within this zone, wildlife survives in the acacia savanna of the drier country of Zululand, near the Mozambique and Transvaal borders.

In 1929, Zululand still harboured considerable numbers of wildebeest, zebra, impala, kudu, nyala, waterbuck, buffalo, and both rhinoceros species. Then, following an outbreak of nagana (bovine sleeping sickness or trypanosomiasis) among Natal cattle, a wildlife eradication campaign destroyed nearly all

big game outside a few reserves. No one can say just how many animals were slaughtered, but in the Zululand game reserves 5,637 wildebeest were shot in 1929-30 alone, including 996 in Hluhluwe and 3,041 in Mkuzi game reserves (J. Vincent, in litt., 1968). In the 1960s, big game in Natal were confined almost entirely to a few reserves, and even these were not inviolate. In another nagana shooting campaign between 1942 and 1950, an effort was made to eradicate all big game but the white rhino in the famous Umfolozi Game Reserve. Some 1,025 animals were shot in Umfolozi while 6,726 wildebeest were destroyed in the Mkuzi reserve (Sidney 1965). Yet thanks to the remarkable recuperative powers of African wildlife, Natal's three main reserves again became well-stocked – indeed overstocked – with some species.

Mkuzi Game Reserve

Created in 1912, the fenced Mkuzi Game Reserve contains 400 sq km of open savanna, floodplain, and grassland. In the absence of large predators, the most numerous ungulates, impala and wildebeest, increased to the level where habitat deterioration became a problem. Countermeasures included control shooting of surplus herbivores. The reserve's wildebeest population reached about 2,500 in 1962, but was reduced by shooting to less than 1,000; a count from the air in 1966 found 600.

Hluhluwe-Umfolozi Game Reserves

Established in 1897, Umfolozi Game Reserve contains 470 sq km of largely open, rolling *Themeda* grassland, with wooded savanna in the valleys. A corridor of state-owned land separated Umfolozi from Hluhluwe Game Reserve, also created in 1897 and consisting largely of closed bush and woodland with some areas of acacia-tree savanna. Both reserves are fenced. They are normally well watered by the Hluhluwe, Mona, Black and White Umfolozi Rivers, and their tributaries, but suffered drought years between 1959 and 1966. Despite the presence of spotted hyenas and reintroductions of lion and cheetah, culling and translocation were necessary during this period to keep ungulate populations in check. The wildebeest was one of the dominant herbivores here; an aerial count in 1967 tallied approximately 4,000. This represented a remarkable increase within about 15 years, for there were reportedly only 400 in Hluhluwe in 1944 and around 1,000 in 1951 (Sidney 1965). Yet these numbers do not represent the species' full breeding potential: another 3,216 were cropped from 1959 to 1967. This was barely adequate to maintain a stable habitat. Wildebeest were entirely eliminated from the Umfolozi reserve in the 1942-50 nagana campaign; wildebeest from Hluhluwe began recolonising Umfolozi after 1959.

The wildebeest of this area inhabited dense woodland in the valleys, usually adjacent to open tree savanna. The medium to long hilltop grassland of Umfolozi was not extensively used by wildebeest. The herds RDE observed in February 1965 were in wooded valleys between the hills.

The Hluhluwe-Umfolozi wildebeest population was sedentary, barring local movements and concentrations on the available grazing in the dry winter months. Movement patterns previous to this period are unknown, but there are references to a seasonal migration to and from the coastal plain, a distance of

15-35 km. Probably both wildebeest and zebra once concentrated around the marshes of the coastal plain during the dry season. Remnants of this former large population, now isolated, persisted at this time on the coastal plain across the border in Mozambique (Part 2.8).

Transvaal

The wildebeest was once abundant in the Transvaal Bushveld, particularly in the 160-kilometer-wide Limpopo-Sabi Depression which comprises the hot arid Lowveld, where rainfall amounts to 50 cm or less per year. As farms and fences divided the country, however, so wildebeest and other game declined. Many, if not most, of the farmers in this region resented the presence of the wildebeest and wanted it exterminated due to its carrying malignant catarrh, being suspected of polluting stock water sources, and its slow adaptation to fences.

In virtually the whole of the Transvaal, except Kruger National Park and its environs, this wish came true. The gnu was still locally plentiful in the remoter parts of the Limpopo drainage by 1951 and 1952, when 3,432 and 4,441, respectively, were shot. Sidney (1965) cites these figures as evidence that the species was still common in the Transvaal. Kettlitz (1962), however, estimated that less than 10,000 survived outside Kruger National Park, of which the great majority inhabited the Pilgrim's Rest District[1] on the park's western border. He wrote, "Numbers are slowly decreasing on account of intensified farming activities during the past ten years. The species has almost vanished in the Barberton District and numbers are becoming very low in the Rustenburg, Waterberg, Potgietersrust, Soutspanberg, and Letaba Districts." This list includes all the districts, except Pilgrim's Rest, in which the wildebeest still occurred.

In the mid-1960s, a 480-kilometer game fence was erected along the western boundary of Kruger National Park; the privately owned Timbavati Game Reserve and Sabi Sand Wildtuin, containing most of the wildebeest in Pilgrim's Rest District, were also fenced. This has both prevented emigration from the park and denied sanctuary to wildlife outside the fence. In 1968, Kettlitz (personal communication) estimated about 7,500 wildebeest still survived in the Transvaal outside the park, more than 90% of them in Pilgrim's Rest District; 5,000 head of these were confined to the two privately owned game reserves. Another 1,000 are found in Manyeleti African Reserve, leaving a balance of 1,500 in the rest of the Transvaal. Even this residue is distributed mainly in the Pilgrim's Rest District. Only isolated small herds persist in other districts, and only in their most remote areas.

[1] Although these places are no longer classified as districts, the cities, towns, and villages for which the districts were named can be found on maps of South Africa and listed in gazetteers. Pilgrim's Rest and Barberton are in Mpumalanga Province, Rustenburg is in Northwest Province, while Potgietersrus is in Limpopo Province. The Soutpansberg mountain range lies in North West and Limpopo Provinces.

Kruger National Park

Kruger National Park has its origins in a period of turbulence. In 1892, game was still plentiful in this poor, hot, and ill-accessible part of the Transvaal, a strip of Lowveld bordering Mozambique. Fever, tsetse fly, and generally harsh conditions had prevented African and European settlement in the area. In 1897-98, the first rinderpest epizootic, introduced by cattle from Somaliland or Ethiopia, swept eastern and southern Africa. The disease decimated most wild and domestic ruminant populations, including those in this region. It was at this moment, in 1898, that Paul Kruger, President of the Boer Republic, set aside this area as the Sabi Sand Game Reserve. On the heels of the epidemic

came the Boer War of 1899-1902 and its ensuing breakdown of law and order. When the reserve's first warden, Colonel Stevenson-Hamilton, took up his duties in 1903, only about three herds of wildebeest, estimated at 10-12 head each, remained. Other big game was similarly reduced; the two rhino species were exterminated (a few black rhino persisted until 1937 (Pienaar 1963). Yet once protection was instituted, the wildlife began a phenomenal recovery. The reserve was proclaimed Kruger National Park in 1926, with the inclusion of the old Shingwedzi Game Reserve and the intervening block of privately owned land (Pienaar 1963).

The total game population had risen from around 30,000 in 1912 to over 250,000 by 1960 (Pienaar 1963). This density was far higher than the Lowveld had probably ever supported before, attained through provision of boreholes (wells) and dams in areas previously inaccessible to most animals during the dry season. Artificial control in the form of culling and translocation became essential for the most prolific species, notably impala (population 180,000, Pienaar 1963) and wildebeest. Elephants, which began entering Kruger from Mozambique to escape hunting, presented the most serious overpopulation problem.

By 1966, the park's wildebeest population had increased to an estimated 13,800 head (U. de V Pienaar, in litt., 1966); in 1967, it numbered 14,300 and would have increased had not controlled shooting in the central district curtailed recruitment (Pienaar 1969). The bulk of the population, about 12,000, inhabited mixed *Combretum* savanna woodland and *Combretum-Acacia* tree savanna between the Sabi and Olifants Rivers, in Kruger's most open habitat. Pienaar (1963) called it "the outstanding game habitat, (which) supports the largest ungulate community of any one area in the park." The wildebeest frequents areas varying from open acacia savanna, similar to the species's East African haunts, to mixed *Acacia-Combretum* woodland. This population migrates regularly within the central district, from north to south at the beginning of the dry season, and from south to north at the beginning of the rains. According to Stevenson-Hamilton (1947), Kruger wildebeest used to migrate east-west, ranging in the winter up to 80 km west of their summer range. Erection of the game fence along the western boundary, as Pienaar (1963) points out, "cuts through established game habitats, excises important seasonal grazing grounds east of the Drakensberg escarpment, and deprives migrating game of traditional watering points during the dry season or drought conditions."

That wildebeest and zebra adapted to new conditions by changing their range and migration routes (Whyte & Joubert 1988) is a hopeful portent for the future of migratory wildlife in other fenced, or potentially fenced, parks. On the other hand, it means the decimation of wildlife outside the fence; the area between the Drakensberg and Kruger National Park is now practically devoid of large wild animals, except on private game reserves such as Sabi Sand and Timbavati, the Manyeleti African Reserve, and certain large private game farms.

Two smaller, distinct wildebeest populations occur in the southern and northern districts of Kruger National Park (Pienaar 1963). In the southern district, between the perennial Crocodile and Sabi Rivers, a population of about

1,130 individuals inhabits long-grass savanna woodland and tree savanna. In the northern district, from the Olifants River to the park's northern boundary, the estimated wildebeest population of approximately 7,500 is largely confined to a network of wide, shallow, and poorly drained grass valleys within the district's dense mopane-*Combretum* woodland. Both populations are essentially sedentary.

The Kalahari Gemsbok National Park is considered in the Botswana survey (Part 2.3).

1980s Status in South Africa

(From Anderson et al. 1989, and references therein)

National and Provincial Protected Areas

Throughout the 1970s and 1980s, South Africa continued to maintain an extensive network of effectively protected and managed conservation areas. Apart from the country's two large national parks, Kruger and Kalahari Gemsbok, these protected areas (national parks, provincial nature reserves, and other areas such as those established by the so-called independent black states, were all of moderate size (hundreds of square kilometers) or small (tens of square kilometers or less). Most were completely fenced and lacked large carnivores, and in many cases the larger indigenous ungulates had been reintroduced. Under these conditions, populations of blue wildebeest and other ungulates had to be actively managed to prevent habitat overgrazing. Management included both indirect (veld management) and direct (live capture and translocation, culling, and/or strictly controlled sport hunting) methods. In many reserves, intensive management, combined with climatic fluctuations, were the major determinants of the larger antelopes' and other big game species' population sizes.

Kruger National Park (19,624 sq km), now completely enclosed by fence, continued to support the country's major blue wildebeest population. It had declined markedly during the 1970s, probably because of the effects on vegetation density of a period of above-average rainfall which favored lion predation, but subsequently recovered with the onset of drier conditions in the early 1980s. Aerial censuses of the park conducted annually from 1980 to 1987 estimated the population at between 8,600 and 14,600. Substantial numbers of wildebeest also persisted in the privately owned reserves on Kruger's western boundary, with a total population of about 3,500 in the combined area (1,760 sq km) of Klaserie, Timbavati, and Sabi Sand Private Nature Reserves.

In Natal, wildebeest numbers were managed to somewhat lower levels than in the 1960s, with estimated populations of 1,800 in the Umfolozi/ Corridor/ Hluhluwe Game Reserve (now managed as a single complex of 960 sq km, within which movement of wildlife was unrestricted), 470 in Mkuzi Game Reserve (251 sq km), and an increasing population of 400 in the newly established Itala Game Reserve (259 sq km of *Acacia-Combretum* Lowveld, Middleveld, and open grassy Highveld on the Transvaal border).

Various other protected areas supported blue wildebeest populations in the hundreds. These include Pilanesberg National Park (560 sq km) in the Black State of Bophuthatswana (350-800 head), Pongola Nature Reserve (69 sq km) in the Transvaal (475 head), and Tussen-die-Riviere (175 sq km) in the Orange

Free State which supported an introduced (non-indigenous) population of about 300 blue wildebeest alongside 450 indigenous black wildebeest. Several other smaller provincial reserves, mainly in the Transvaal, had blue wildebeest populations of less than 100 individuals.

Privately Owned Land

After many decades (in some long-settled areas, several hundred years) of destruction of wild animals in favour of livestock farming, there was a marked shift in the attitude of South Africa's farming community to wildlife during the 1970s and 1980s. Many farmers began to establish populations of the larger antelopes on their land for economic and/or aesthetic reasons. Game farming, either alone or more often in combination with domestic livestock, expanded rapidly on private farmland, driven by the favourable economics of game meat production, trading live animals, recreational hunting, and game-viewing tourism. These activities conferred an increasing financial value on wildlife, which was no longer viewed as just a nuisance competing with domestic livestock for grazing. As a result, by the end of the 1980s most of South Africa's larger antelope species were more numerous than at any other time since the 1800s. The most abundant species on farmland were springbok, blesbok, impala, and kudu, but other species such as gemsbok, red hartebeest, nyala, and both wildebeest species also became established in significant numbers on private land. Rare species such as sable antelope were highly sought and fetched high prices at game auctions.

Though game farming expanded the range of antelope species by reintroducing them into areas of historical distribution where they had not been seen for years, it also had some detrimental impacts for conservation. These included the introduction of species to land outside their natural ranges and cross-breeding of related species such as blue and black wildebeest. Conservation authorities decided to discourage such practices to minimize or prevent unnatural genetic mixing and the spread of livestock disease.

Additional restrictions were placed on the movement of the blue wildebeest to control the spread of malignant catarrh. For instance, in the Transvaal, blue wildebeest could only be translocated to farms with existing herds of the species. Farmers nevertheless reintroduced it widely within its historical range, and introduced it extensively elsewhere. By the end of the 1980s, the species' total population in South Africa (protected areas and private land combined) was well into the tens of thousands and increasing.

1990s Status in South Africa

(From Anderson et al. 1996, and references therein)

National and Provincial Protected Areas

By the early 1990s, South Africa's major protected areas had benefited from several decades of the most advanced wildlife protection and management in Africa. The 1994 election, in which the former victims of institutionalized apartheid achieved political empowerment, spelled momentous political change for the country. Conservation priorities shifted in turn, from strict protection of pristine natural areas from which rural people were excluded to a participa-

tive approach attempting to balance the needs of conservation with those of the often impoverished, land-hungry communities in surrounding areas. This change resulted in less funding for conservation and an increasing demand for state conservation agencies to become financially self-sufficient.

World-famous protected areas such as Kruger National Park and Hluhluwe-Umfolozi Park (as this area was now known, the former corridor having been legally incorporated into the protected area) continued to be well protected and managed as icons of South Africa's large, growing tourism industry. But some of the lesser-protected areas did not fare as well. The country's provincial boundaries were extensively redrawn and provincial conservation agencies reorganized. Capacity of some agencies declined because of reduced budgets and staff loss.

Against this background, the country's key populations of blue wildebeest were generally stable; in the mid-1990s there were an estimated 12,800 in Kruger National Park, 1,900 in Hluhluwe-Umfolozi Park, 1,800 in Mkuzi, 1,200 in Itala Game Reserve, and 1,000 in Pongola Nature Reserve. Smaller, recently reintroduced, increasing populations in the low hundreds or less occurred in a few other national parks, such as Vaalbos (227 sq km) and Marakele (399 sq km). The species continued to be well represented in provincial reserves, but the mixed population of blue and black wildebeests in Tussen-die-Riviere had been eliminated prior to reintroducing pure black wildebeest. The total number of blue wildebeest in the country's protected areas was estimated to exceed 23,000 and to be stable or increasing.

Privately Owned Land

The private sector's involvement in wildlife conservation increased in the new South Africa. From 1979 to the mid-1990s, the country's total area of private reserves and game farms grew more than eight-fold to almost match the combined size of national and provincial conservation areas. South Africa now had thousands of private game ranches and a growing number of private wildlife conservancies. The latter were often formed by the amalgamation of neighboring former livestock farms, which were allowed to revert to natural vegetation prior to restocking with wildlife. This enthusiasm for restocking and the availability of modern veterinary and wildlife management techniques, however, continued to cause problems, such as the unnatural cross-breeding of species and formerly isolated subspecies.

By the mid-1990s, the estimated number of blue wildebeest on private land had reached 12,000 and was continuing to increase. Most of these animals were within the species' natural range in the Bushveld and Lowveld, in the north and east of the former Transvaal (now parts of Mpumalanga, Limpopo, and North West Provinces) and northern Natal (now KwaZulu-Natal). But there were also at least several hundred blue wildebeest on private farms outside the species' natural range, particularly in the Highveld. Legislation prohibiting the translocation of wildebeest had been changed to allow freer movement of both species, presumably leading to further increases in their numbers on private land.

The total population of the blue wildebeest in South Africa in the mid-1990s exceeded 35,000 and increasing, with most growth occurring on private land.

Current Status in South Africa

Trends of the blue wildebeest's distribution and abundance in South Africa have changed little since the 1990s, with generally stable numbers in state and provincial protected areas and growth on private land. No estimate of current numbers is available, but there are probably at least 40,000-45,000 blue wildebeest in total in South Africa.

National and Provincial Protected Areas

Wildebeest numbers in Kruger National Park show a negative correlation with annual rainfall (Mills et al. 1995); recent estimates vary from 10,500 in 1998 to 17,000 in 2002 (Anonymous 2003). The fences between Kruger's western boundary and the adjoining privately owned reserves have been removed; this area, now comprising 2,515 sq km, is in effect an extension of the park. On its eastern and northern boundaries, Kruger National Park has been combined with Mozambique's Limpopo National Park and adjoining areas in Zimbabwe to create the Great Limpopo Transfrontier Park, which covers a total area of about 35,000 sq km (Parts 2.2, 2.8, and part 4).

The larger KwaZulu-Natal protected areas continue to support significant wildebeest populations, as do other areas such as Pilanesberg National Park and Madikwe Game Reserve in the Bushveld of North West Province. At 620 sq km, Madikwe is slightly larger than Pilanesberg's 560 sq km. Both of these protected areas were created from former farmland and restocked with wildlife; they now support the full complement of the area's indigenous wildlife species.

Both Pilanesberg and Madikwe are outstanding examples of the successful restoration of natural communities. Each is enclosed within an electrified perimeter fence and is intensively managed to maintain a balanced wildlife community with an appropriate mix of charismatic species to attract visitors and generate revenue from tourism. The blue wildebeest is now among the dominant herbivores in both areas. In 2001, Hofmeyr (2001) reported the species' Madikwe population had reached 3,500. In Pilanesberg, wildebeest numbers increased from 350 in 1984 to more than 1,000 in 1995, stabilised at 800-1,000 over the next four years, but then declined to 470 in 2002. The decline apparently stemmed from the combined effects of harvesting for meat for local communities and elevated predation by the park's increasing lion population (Tambling & du Toit 2005); it was suggested lion numbers should be reduced to assist the wildebeest's recovery. Similar issues may become an increasing feature of conservation of the wildebeest (and other wildlife species) in Africa if intensive management of relatively small, sedentary populations rises as economic development and the demands of growing human populations reduce the land available for protected areas.

Privately Owned Land

The amount of private land (largely white-owned) utilised for game has reportedly continued to grow by 500,000 hectares per year for the last ten years, to the point where parts of South Africa resemble "a patchwork of game ranches" (Boddington 2004). Increased sport hunting is a prime cause of this growth, along with an expansion of game-viewing tourism. South Africa now has the continent's largest safari-hunting industry, with hunts taking place mainly on well-managed, fenced private lands that support a wide variety of reintroduced game species. Introduced, non-indigenous species are also a feature of some ranches.

While this situation appears to generally favor wildlife by promoting increases in distribution and abundance of species such as the blue wildebeest, privately owned land does not offer the same long-term security to wildlife as legally gazetted protected areas. Game farming and the trophy-hunting industry may clash with the government's commitment to land reform and the pressing needs of rural people for land to secure their socioeconomic rights. Compulsory acquisition of white-owned farms, including some game farms, for resettlement has recently commenced; the small scale of recent acquisitions may grow in the future. Even where large, privately owned farms persist, there is always a possibility that other forms of land-use may become more profitable and therefore preferable to game farming. Hence, despite South Africa's currently vibrant private wildlife sector, it is unclear to what extent game farms will contribute to the long-term conservation of the blue wildebeest and other wildlife.

Note: Swaziland

Swaziland was not included in RDE's 1960s survey. From west to east, the natural regions of this small, land-locked, independent kingdom include Highveld grassland, Middleveld and Lowveld, with the Lebombo Uplands on the eastern border separating the Lowveld from the coastal plain of Mozambique. The strip of Lowveld which runs from north to south through eastern Swaziland is contiguous with the Lowveld of adjoining South Africa (the former Transvaal to the north and the former Natal to the south); in the past, the blue wildebeest probably occurred throughout this region of Swaziland.

The country is densely populated and most wildlife species confined to protected areas. The blue wildebeest occurs in Hlane Game Reserve (163 sq km) and Mlawula Nature Reserve (120 sq km) in the Lowveld (Anderson 1989; Culverwell 1995). The species is common in Hlane, where the population was allowed to undergo several boom-and-bust cycles in the late 1970s and 1980s, at times increasing to several thousand individuals before crashing as a result of overgrazing. In the 1970s, the blue wildebeest was ill-advisedly introduced to Malolotja Nature Reserve (180 sq km) in the Highveld, outside its natural range, necessitating its subsequent elimination to avoid hybridisation with the reserve's black wildebeest population (Culverwell 1995).

2.2 Zimbabwe

1960s Status in Zimbabwe

Zimbabwe is that part of the ancient African plateau that lies between the Limpopo and Zambezi Valleys. The Highveld comprises a peneplane between 1,200 and 1,500 m on the watershed between the Zambezi and Limpopo-Sabi Valleys. The Highveld and adjoining Middleveld (on more broken country below 1,200 m) were formerly covered with *Brachystegia/Julbernardia* (miombo) woodland. In the southeast, a relatively narrow strip of land in the Limpopo Valley below 900 m forms the Lowveld. The driest and hottest part of the country, the Lowveld is dominated by mopane woodland, varying from open parkland to close scrub. Unlike the South African Lowveld on the other side of the river, wildebeest and other wildlife still survived in some numbers. Because the Mopaneveld canopy allows considerable light to pass through the butterfly-shaped leaves (mopane = butterfly), grasses and other vegetation grew beneath even dense mopane woodland. But if overgrazed, shrubs invade and the grass layer may largely disappear in the dry season; this happened on many Lowveld cattle ranches.

In the 1960s, the wildebeest (*C. t. taurinus*) occurred in two very different areas of Zimbabwe (known at that time as Rhodesia): the mopane woodland of the Limpopo Valley Lowveld, and the plateau Middleveld on Kalahari sands and Karoo sandstones in the west, carrying *Acacia-Commiphora* Bushveld and Rhodesian teak (*Baikiaea-Pterocarpus*) dry forest. The latter area, including Hwange National Park, lies mainly on Kalahari sand, and contained the highest density of wildebeest in Zimbabwe. Since the animals represent an offshoot of the gnu population of neighboring Botswana, they are included with the Kalahari populations (Part 2.3).

In the Lowveld, the gnu was generally distributed, from Plumtree on the Botswana border, at the edge of the Highveld watershed, eastward into Mozambique. Through introductions to national parks, small numbers were established outside their normal range, such as in Lake Chivero Recreational Park, 30 km southwest of Harare.

Given the sparse wildebeest population in the Mopaneveld of northern Kruger National Park (Part 2.1), one may wonder if wildebeest ever occurred in large numbers in Zimbabwe's Mopaneveld. The area seemed more closely wooded than normal wildebeest habitat. On the other hand, the South African populations showed that in hot lowland climates, wildebeest will take to surprisingly thick woods, as long as more open glades are nearby. Wildebeest were also found in unbroken mopane woodland, but there was so little undergrowth that the habitat was more open than might be supposed, especially after the trees shed their leaves in the dry season. (R. Dasmann, personal communication, 1965).

The Lowveld had seriously deteriorated "as a result of cattle overstocking and general mismanagement" (Roth 1966). Substantial wildlife populations survived on Lowveld ranches, but they were dominated by species such as impala and kudu that benefit from bush encroachment; populations of graz-

ers such as roan, sable, and tsessebe declined markedly. Wildebeest and zebra numbers were also substantially reduced by European landowner shooting (Dasmann & Mossman 1962). No complete census of Lowveld wildlife was attempted, but Roth (1966), formerly Chief Research Officer of the Department of National Parks and Wild Life Management (DNPWLM), considered there was no doubt that wildebeest numbers declined between the 1930s and 1960s. A rough estimate of the total Lowveld gnu population in the 1960s ranged from 5,000 to 20,000.

During the rainy season, these animals dispersed widely. In the dry season, they concentrated near waterholes along the major rivers. Such movements were localized rather than migratory. According to Roth (personal communication, 1967), "the habits of wildebeest in Rhodesia may definitely be described as sedentary to semi-nomadic. There are only localized movements (to and from water and pasture), no migrations, in the course of the seasons. This question has always been a subject of major dispute, but the above is borne out by marking records on Doddieburn (Henderson) Ranch."

Most remaining Lowveld wildlife occurred on privately owned land. The largest protected area in the region was Gona-re-Zhou Game Reserve, a fenced area of approximately 650 sq km at the southeastern end of the Lowveld on the Mozambique border. Wildebeest and all other game in this reserve were intensively hunted starting in 1964 as part of a tsetse fly-control campaign. But even before the control-shooting began, wildebeest had already become scarce; for years, the Portugese had been shooting game on their side of the border (Part 2.8) for the same purpose (H. Roth, personal communication, 1967).

In no other part of Africa had tsetse-control shooting been more relentlessly pursued for a longer period, producing clear evidence of the high cost and inefficiency – not to mention the wastefulness and inhumanity – of this practice. It was estimated that an average of 25,000 animals were shot annually in Zimbabwe between the 1930s and 60s (Grzimek & Grzimek 1960a). But examination of blood smears from tsetse flies in Zimbabwe, Sudan, Uganda, and Tanzania indicated that none of the dangerous fly species fed on wildebeest, hartebeest, topi, or zebra, and rarely bit impala, eland, waterbuck, baboon, monkeys, dogs, cats, or hyenas (Hindle 1959). The chief carrier is apparently the warthog, followed by the bushpig, bushbuck, kudu, buffalo, and roan antelope, along with goats, sheep, and cattle. Yet the other species continued to be indiscriminately slaughtered in the thousands, to no purpose, because of bureaucratic conservatism and prejudice against wildlife by government agriculturists, veterinarians, and farmers.

Between tsetse-control shooting and cattle ranching, it seemed that game on the north side of the Limpopo Valley was bound to suffer the same fate as that on the south side. But the possibilities of game ranching, first tried in the Lowveld on the Henderson Ranch and promoted by dedicated wildlife ecologists such as Dasmann, Mossman, Roth, and Savory, helped propagate the idea of wildlife as a valuable natural resource that can be harvested at a substantial profit. Wild game was proven to produce a higher sustained yield of protein per acre than cattle in such poor country as the Lowveld (Roth 1966; Savory 1968). The new industry became so well established in Zimbabwe that game venison

was sold in the butcher shops of cities and large towns. As commercial interest in ranching wildlife grew, pressure was expected to increase against squandering a valuable resource in tsetse-control operations.

1980s Status in Zimbabwe

(From Wilson & Cumming 1989, and references therein)

By the early to mid-1980s, one of Africa's best managed and most effectively protected systems of conservation areas was in Zimbabwe, where wildlife had become widely regarded as a valuable natural resource. Equally significantly, the Parks and Wild Life Act (1975) had conferred to landholders custodianship of wildlife on their land. This in effect turned private farms into proprietary wildlife units, combining ownership and management with cost and benefit. Due to consequent growth in the private-sector wildlife industry, the population of larger antelope species expanded in commercial farming areas where the species had been widely eradicated to make way for agriculture and cattle ranching. These areas included the Highveld and Middleveld, the first regions of the country converted to commercial farming, as well as the Lowveld. In addition to reintroductions, some wildlife species, including wildebeest, were introduced to private farmland (and state-owned protected areas) outside their natural ranges.

A 1982 amendment to the Parks and Wild Life Act led to similar custodianship benefits for rural communities on communally-owned lands. The Communal Area Management Programme for Indigenous Resources (CAMPFIRE) gave participating rural communities access to, control over, and responsibility for natural resources on their lands. The program, launched in 1986-88, allowed rural communities to economically benefit from controlled exploitation of wildlife through safari hunting, cropping for meat production, and non-consumptive tourism.

Within the Lowveld, the wildebeest became common on private land with numbers of at least several thousand head. In Lowveld state-owned protected areas, the animals were common in Tuli Safari Area (404 sq km) on the Botswana border and Matobo National Park (58 sq km), but uncommon and localised in Gonarezhou National Park (5,053 sq km). The wildebeest also occurred as introduced populations in a few Highveld protected areas, such as McIlwaine Recreational Park (now Lake Chivero Recreational Park) (61 sq km), Kyle Recreational Park (169 sq km), and Nyanga National Park (289 sq km). None of these protected-area populations exceeded a few hundred individuals.

1990s Status in Zimbabwe

(From Anderson & Wilson 1998, and references therein)

During the late 1980s and 90s there was a decline in the level of protection and management of Zimbabwe's national parks, safari areas, and other wildlife land administered by DNPWLM, even though some of these areas continued to play an important role in the growth of the country's tourism industry. Hwange National Park, for example, was virtually unpatrolled for the first five months

of 1993. This was due to DNPWLM's severe funding and personnel shortfall resulting from government-imposed austerity measures in conjunction with the International Monetary Fund's economic restructuring program for Zimbabwe. The country's rhino populations suffered heavy losses from poaching during the period, but the status of antelopes and other wildlife remained healthy in most of the country's protected areas, generally located in regions with sparse settlement and relatively few resident people. However, the wildlife of Gonarezhou National Park had suffered from heavy poaching during the mid-to-late 1980s and a severe drought in 1992-93.

In contrast, the wildlife industry on private land was booming, driven largely by the rapid growth of safari hunting. The number of registered private game ranches rose from 50 in 1960 to more than 650 in 1995. A similar development had occurred on communal lands; since it began in the mid-to-late 1980s, CAMPFIRE had extended its operations from two to more than 20 rural districts. As with private game ranches, safari hunting was the major source of revenue generated by CAMPFIRE districts. Despite some problems, CAMPFIRE produced significant economic benefits in many rural communities, with consequent reductions in poaching. International trophy hunters who visited Zimbabwe typically hunted elephant, buffalo, and lion on communal lands or DNPWLM safari areas, and plains game such as zebra and most antelope species on private land.

In some parts of the Lowveld, individual and neighboring ranches removed cattle fences and converted large land holdings back to wildlife. Tourism, trophy hunting, and other forms of sustainable utilization helped to build a diversified economic base for privately owned conservancies such as Save (less than 3,000 sq km), Bubiana (1,300 sq km), Malilangwe/Lone Star (450 sq km) and Chiredzi River. These conservancies also supported the development of community-based conservation initiatives around their borders.

The levels of wildlife protection and management were now much higher on private game ranches and conservancies than on DNPWLM land. But increasing pressure to provide land for resettlement of rural people began to influence the government; some senior government personnel publicly disparaged the conversion of cattle ranches into wildlife management areas by white farmers. DNPWLM policy shifted from facilitation of the game ranching industry toward greater emphasis on regulation and government control.

By the mid-1990s, there were at least 9,000 wildebeest on private land in Zimbabwe. Most of the animals were in the Lowveld, but the total included some that had been introduced to game ranches on the Highveld and Middleveld. Small, generally stable populations remained in Matobo and some other small protected areas, but the species seemed to have disappeared from Gonarezhou National Park, where it was adversely affected by the severe 1992-93 drought. A population of 130 was estimated for Gonarezhou in a 1989 DNPWLM aerial survey, but no wildebeest were seen in 1993 and 1995 surveys of the park.

Current Status in Zimbabwe

Zimbabwe's dramatic political developments since 2000 have hurt the country's wildlife industry. The country's long-term, accelerating economic decline has impaired DNPWLM's capacity to protect and manage the wildlife areas for which it is responsible. Consequently, protection of national parks has deteriorated since 2000. Parts of Gonarezhou National Park, for example, along with sections of the adjoining Save Valley Conservancy, were invaded and settled by so-called "war veterans" in 2002-03. Settlers' reoccupation of their traditional lands within the park effectively isolated Gonarezhou from the adjoining Malilangwe reserve. At the same time, Zimbabwe signed an agreement with South Africa and Mozambique to establish the Great Limpopo Transfrontier Park, linking Gonarezhou and the adjoining Malipati Safari Area, Manjinji Pan Sanctuary, and Sengwe communal land in Zimbabwe with South Africa's Kruger National Park and Mozambique's Limpopo National Park (Parts 2.1, 2.8, and 4). In 2004, the Zimbabwe government reportedly began relocating families that had settled illegally in and around Gonarezhou National Park. The relocation was a necessary step toward making the country's commitment to the Greater Limpopo Transfrontier Park a reality.

Since 2000, large sections of the private-sector wildlife industry have been obliterated by the Mugabe government's reckless program of land resettlement. More than 90 percent of the country's white farmers have reportedly been dispossessed of their land. Illegal occupation of large areas of privately owned land, including many game ranches, has often resulted in destruction of wildlife. In 2004, the government announced that 25-year leases would be granted for some nationalized (formerly privately owned) game ranches seized as part of the land resettlement program, to enable more black people to partake in this "lucrative sector"; nationalization of these areas would therefore not result in a change in land use. Whether any slackening of the current wholesale slaughter will ensue remains to be seen.

Zimbabwe's trophy-hunting industry has managed to stay afloat (unlike the near-total collapse of the tourism industry), despite a substantial decline in the number of international hunting clients. CAMPFIRE has continued to function without major disruptions, and some privately owned wildlife areas have so far escaped the carnage resulting from the land resettlement program. By 2005, only one of the large privately owned conservancies on the Highveld of Mashonaland had survived intact, a 300 sq km property owned by a French consortium (C. Howard-Williams, personal communication, 2005). In the Lowveld, several conservancies remained partially or completely intact, including Malilangwe Private Wildlife Reserve (400 sq km) in the southeast, operated by the Malilangwe Trust, parts of the Save Valley Conservancy, and the 2,600 sq km Lemco Safari Area (owned by a consortium of foreign investors), farther to the west, in Matabeleland.

Despite the challenges currently affecting Zimbabwe's wildlife sector, the wildebeest continues to occur in substantial numbers in the Lowveld. The species now numbers about 100 individuals in Gonarezhou National Park, where it was reintroduced after the 1992-93 drought, and there are populations of

a few hundred in privately owned wildlife areas such as Malilangwe and the contiguous Hippo Valley reserve, similar in area to the Malilangwe reserve. Together, these two areas currently support about 300 wildebeest (S. Clegg, in litt., October 2005). The largest surviving population in the country is probably that in Lemco Safari Area, which reportedly has as many as 8,000 wildebeest together with thousands of impala, zebra, eland, giraffe, and many other species (Boddington 2005). Originally developed for cattle ranching when its carrying capacity was raised by establishing numerous artificial waterholes, Lemco is now devoted entirely to wildlife. These numbers suggest the total population of wildebeest in the Lowveld at present may not differ greatly from the mid-1990s.

2.3 The Kalahari Region

1960s Status in the Kalahari Region

The Kalahari Desert area includes some 326,000 sq km of sand and scrub, comprising most of Botswana, the northern Cape Province of South Africa, and eastern Namibia. The Kalahari is bordered on the west and south by the Karooveld, on the southwest by the Highveld grassland, and on the east and north by Bushveld and Mopaneveld.

The Kalahari Desert is the southern end of an immense basin in the African Plateau that extends some 1,900 km from the Orange River to slightly north of the equator in Congo. Annual rainfall in the part called desert ranges from 50 cm in the northeast to about 13 cm in the southwest. That is surely dry, but it is still drier to the west and south where the Kalahari sand ends and the Karooveld begins.

The northern part of the Kalahari Basin receives more than 130 cm of rainfall a year. The Zambezi, the Cuando, the Cubango-Okavango, and numerous tributary streams born in the highlands of Angola, flow across the upper Kalahari Basin and transport an enormous volume of water into the desert to form the Okavango Swamp. But rain that falls on the Sandveld sinks immediately into the sand; there is no surface flow except during and right after heavy downpours. Subterranean flows surfacing as springs are virtually unknown.

In real deserts the ground may be absolutely bare for years until blessed by a thunderstorm. But nearly all the Kalahari is covered by sparse, continuous grassland. Few dunes relieve the monotony of a flat or imperceptibly undulating landscape, except where overgrazing has destroyed vegetation. Dunes of red and white sand occurring in southwest Botswana are covered to their crests in grasses, with sizeable trees growing on their flanks. However, in the extreme southwest, in the 20-centimeter rainfall zone, many naked dunes are always in motion (R. Smithers, in litt., 1967).

Varying from open plains to acacia tree savanna and acacia scrub woodland, the landscape becomes increasingly open toward the driest west and south, and grows more wooded to the east and north as arid blends with semi-arid savanna. Open grassland in the north has been associated with pans and old lake beds. In the 1960s, the most common acacias were the camelthoorn (*Acacia giraffe*), *A. gillettii*, and the aptly named wait-a-bit thorn (*A. detinens*) with its curved barbs. Dominant grasses included the perennial tall and short Bushman grass, *Aristida uniplumis* and *A. ciliata*, and deep-rooted *Eragrostis* spp., growing on dune ridge crests.

Despite the arid climate and scarcity of surface water, pastoralism was widespread, including cattle, sheep and goats, horses, and donkeys. Cultivation was negligible, except on the fringes. The pastoralists belonged to various ethnic groups: Herero, baLala, Hottentots, Bushmen, Colored (defined in the Southern African context as mixed-race), and Europeans. The main ethnic group was the baKalagadi, a Bantu tribe living even in driest southwest Botswana. A mid-1960s census found an average population of approximately 21,000 people, equal to one per square mile (one per 2.59 sq km) (Campbell 1965).

The wild ungulates of the Kalahari most adapted to desert conditions are the gemsbok, springbok, eland, kudu, red hartebeest, and steenbok. All go for long periods without drinking – though all (except perhaps the steenbok) will drink opportunistically (Selous 1899). Before veterinary cordon fences were erected, zebra were seasonal visitors to the Central Kalahari Reserve (G. Child, in litt., 1968). After the fence construction, zebra, like the tsessebe and buffalo, seldom ranged beyond the Bushveld. Yet several supposedly water-dependent species, including the wildebeest, impala, and warthog, occurred in all quarters of the Kalahari, even in the driest southwestern part (G. Child, in litt., 1968); the species did not necessarily migrate into areas with permanent water. Child suggested that impala and warthog, like the known water-independent species, could go for months without drinking in the Sandveld where local rains produced abundant plant growth such as tsama melons (*Citrillus vulgaris*) and tubers. "All these species," notes Smithers (in litt., 1967), "under Kalahari conditions, are great diggers for succulent roots that prove their water requirements or else seasonally they eat tsamma melons."

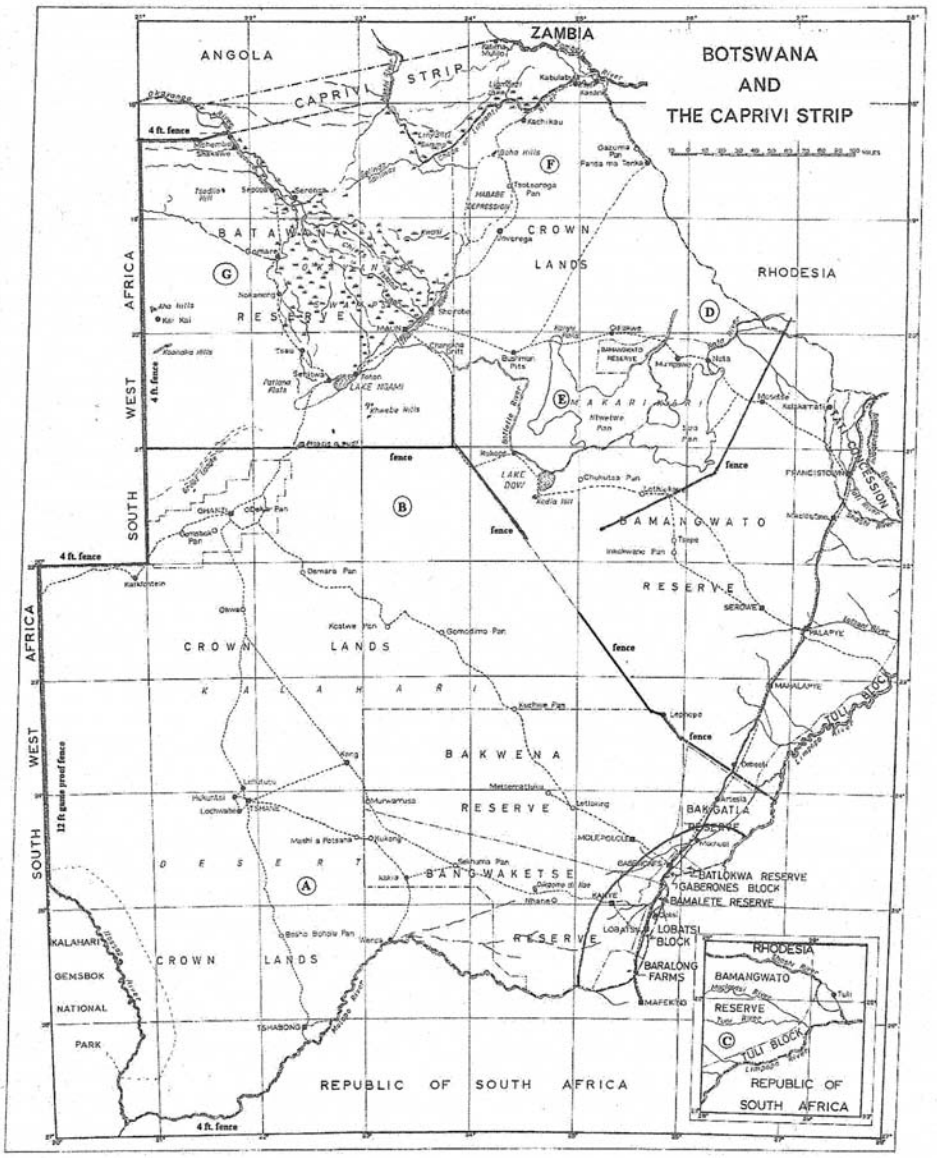
But arid savanna is not capable of carrying a high density of animals except during the rainy season, when free water is found in pans. The most common type of pan in the Kalahari is simply a slight depression in the lee of a low sand dune probably created by wind erosion and the trampling of game seeking essential salts, which are in short supply. Most pans become too saline for game within weeks or days of receiving rain (Child, in litt., 1968). According to Smithers (in litt., 1967), pans go dry within two months after rain in a good year – expected to fall between December and April – but not infrequently fail.

The main dry-season holding areas for migratory wildlife in the Kalahari region were the Makarikari Pans, the floodplains bordering the Okavango Swamp, the Lake Ngami depression, the Chobe River, the Etosha Pan, Ovamboland, and the Caprivi Strip. Because of the great concentrations and variety of animals found in these places during the dry season, northern Botswana along with what is now Namibia was long regarded as equal to East Africa in quantity of big game. In 1965, Leslie Brown wrote, "If there is any part of Africa that rivals the Serengeti Plains in its great game concentrations, this is it… No accurate figures exist, but it is estimated that at least a quarter of a million wildebeest are found in these sandy plains."

There may have been that many as recently as 1959, when a seven-year drought began. By the end of 1965, in the opinion of zoologists with a first-hand knowledge of the region, no more than 15,000-25,000 wildebeest were left in all of Botswana, and only 6,000 remained in Namibia (H. Ebedes; K. Tinley; R.H.N. Smithers, personal communications, 1965-1967). In their opinion, and in that of former Chief Game Warden of Bechuanaland P. Bromfield (personal communication, 1965) and of B. Kinloch (personal communication, 1965), the primary cause of mortality was not the drought, but a series of so-called Veterinary Disease Control Fences that were erected to protect the country's cattle from contracting diseases through contact with wild game (Figure 4). These fences restricted or entirely prevented movement of migratory wildlife between the Kalahari and the main dry-season holding grounds. Bromfield,

Smithers, and others reported seeing the fences lined for miles with the corpses of wildebeest, zebra, buffalo, and other game that had died of thirst while vainly seeking passage to their traditional watering places.

Figure 4: Cordon fences and possibly separate wildebeest populations in Botswana in 1965 (Smithers, in litt., 1967): (A) roughly 5000-6000; (B) no estimate; (C) 100s; (D) contiguous with Zimbabwean populations; (E) roughly 6000; (F) and (G) (formerly migrated into Namibia) separated by Okavango Swamp.



Botswana's government cannot be blamed for wanting to protect cattle – the impoverished country's economy was built on the industry. But Botswana cattle could only be exported through South Africa and Zimbabwe, both with exceptionally stringent health restrictions governing the import and export of live animals and meat. The fences were ostensibly constructed to satisfy these requirements. On the other hand, expatriate veterinary authorities' hostility toward wildlife conservation was well-known. As Kinloch (personal communication, 1965) remarked, "The disease-control fences have been sited without

taking into account their likely effects on the country's wildlife. The truth is that most cattle people and vets in Botswana regard game in general as an unmitigated nuisance, and wildebeest in particular as little more than disease-carrying vermin." By the end of the decade, attitudes had changed. According to Child (in litt., 1968), "The Veterinary Department's attitude ha[d] become much more reasonable." In addition, government awareness of the economic potential of wildlife for tourism and sport hunting had grown.

Yet perhaps the most basic problem facing Botswana was an over-population of cattle. There was an estimated five head of cattle for every one of Botswana's 350,000 human inhabitants. Veterinarians were largely responsible since they drastically reduced mortality due to disease. Riney & Hill (1963) summed up the problem: "Continuous overgrazing by cattle, especially since the turn of the century, has resulted in deterioration of pasture, in increased bush encroachment, and increased runoff of rainfall. Less water is retained in the soil and the characteristic final result has been a progressive decrease in available water at the end of the dry season." The authors warned that the cattle population was sure to crash. "With present management practices as they are, it is but a matter of time before the cattle industry must collapse, because the land that supports the cattle cannot permanently withstand the abuse involved in these practices."

As predicted, the cattle crash came as the long drought continued through 1965-66. The September 4, 1966 issue of *The New York Times* reported that almost half a million cattle died, and 120,000 of the country's people had been brought close to starvation by the drought. But what caused the drought? There was more than a suspicion that it was not the lack of rain; records kept for stations in the Makarikari Pans area showed rainfall was not far below a normal 45-50 cm, except possibly in 1964.

Child (in litt., 1968) disputes the assertion that the cordon fences were mainly responsible for wildlife destruction. "It is true," he writes, "that many wildebeest died on the fences, but to attribute the population crash to these fences is misleading and ignores many of the facts. Wildebeest died in large numbers in c. 1930 when there were no fences, and even in 1960-1965 they died miles from fences, having reached water. The wildebeest died near Lake Dow in 1964 and the cattle died there in large numbers the following year."

Speaking of the Makarikari Pans wildebeest population, Child notes that neither it nor the Chobe population encountered fences, yet both declined. Historical evidence indicates that wildebeest were plentiful on the Makarikari in the 1870s. Child postulates that their decline in the 1890s was caused by the great rinderpest pandemic. Over the next quarter-century their numbers peaked again by the 1920s, only to crash in the drought that occurred around 1930. After 25-35 years the population crashed once more in the 1962-64 drought. In both cases, the droughts were preceded by several years of abundant rainfall during which the population reached peak numbers. Child concluded, "The Makarikari population crashed in spite of and not because of the fences." But he admits that veld deterioration near pans with bore holes may have been an important factor in the die-offs.

While granting that the drought of the 1960s undoubtedly accounted for loss of great numbers of game animals, Silberbauer (1965) argued that "a diminution of this order (a loss of nearly 75 percent) in the fauna is unprecedented since the turn of the century and the rinderpest epidemic of that time. Droughts of equal severity have been survived without such drastic effects and it is clear that the presence of the disease-control fences is the only new factor of any significance." (Figure 4)

The Southern Kalahari Population

Physiographically and climatically, the north of Cape Province down to the Orange River is part of the Kalahari Desert. Once, blue wildebeest, springbok, and other game thronged these plains. In 1844, W. Cotton Oswell was one of the first English sportsmen to hunt in the Kalahari. In 1896, he wrote, "Though the flats between the Orange and Malopo Rivers were full of sameness, they were also full of antelope, gnu, and quagga." In 1896, this part of British Bechuanaland was annexed by South Africa, but practically all the plains game was shot out even before then. By the 1960s, the land had become fenced stock country. The "sameness" was overpowering and deadly, even though springbok and blesbok thrived on the farms (Bigalke & Bateman 1962). But wildebeest, hartebeest, gemsbok, and eland, reported now and again from the Gordonia, Kuruman and Vryberg divisions, were merely transients from Botswana that crossed the fossilbed of the Malopo River, marking the southwestern limit of their distribution. The section between the Malopo and the Orange represented the loss of about 129,500 sq km of the blue wildebeest's former range.

North of the fossil Malopo River, an 11,000-square-kilometer wedge of land between Botswana and Namibia was set aside in 1931 as the Kalahari Gemsbok Park. This salient was the only part of Cape Province where once-common plains game was still found in more or less natural conditions. With an average annual rainfall of less than 13 cm, the land is the driest part of the Kalahari arid savanna. The Karooveld begins a little to the west. Toward the east, the country becomes progressively better-watered. Bushveld, with 50 cm or more of rain a year, is reached near the Limpopo, in southeastern Botswana. This large area – from the Malopo River northward – was the home range of a wildebeest population estimated at between 5,000 and 6,000, but was sadly depleted by the late 1960s (R. Smithers, in litt., 1967). Wildebeest in this region were both migratory and nomadic, wandering west as far as the Karooveld during the rainy season, and migrating 320 km or more east during the long, dry winter. In the winter, they concentrated in the vicinity of pans with perennial springs (Eloff 1961). Child (in litt., 1968) questioned the existence of these perennial springs. Both he and Eloff (1962) mentioned irregular wildlife movements after rain that sometimes resulted in concentrations of all animals from a wide region.

The better land in the Bushveld zone of southeastern Botswana was relatively densely settled, and probably no wildebeest penetrating so far east could get past the fenced European farms to the upper Limpopo or Malopo. Before settlement, the margins of these rivers doubtless carried a much larger wildebeest population through the dry season, as well as zebra and water-loving species such as hippo, white rhino, buffalo, waterbuck, and elephant (Burchell

1822; Selous 1896). Destruction of the teeming wildlife of the upper Limpopo was foreshadowed by the earlier destruction of the teeming wildlife along the Orange River, as Europeans pressed northward and westward into the Kalahari wilderness.

How water can alter migratory habits is well-illustrated in Kalahari Park, where the drilling of wells in the Auob river bed in 1948 caused 46 wildebeest to drop out of a passing migration and take up residence at the Sixteenth Borehole (Eloff 1959). The sedentary population grew to 500 head, and colonized the banks of the Auob for a distance of 60 miles below the Sixteenth Borehole (Eloff 1966).

Eastern Botswana

There were still a few hundred wildebeest in the Bushveld of easternmost Botswana in the so-called Tuli Block between South Africa and Zimbabwe (Smithers, personal communication, 1967). They may have represented an isolated offshoot of the wildebeest of Zimbabwe's Lowveld (G. Child, in litt., 1968). The Limpopo on the south separated them from the wildebeest in neighboring Transvaal – if there were any left on the South African side. In the Tuli Block, large fenced European cattle ranches and game farms limited free ranging, whereas in the past, large numbers of migratory wildebeest would likely have been based on the Limpopo River during the dry season.

The Makarikari Pans Population

Before Disease Control Fences were erected, the part of Botswana bounded by the Makarikari Pans and the Okavango Swamp – the northern Kalahari thornveld and Zimbabwe's border – may have contained more wildebeest than any other region in southern Africa. The minimum estimate by the former Chief Game Warden, P. Bromfield, was 60,000.

In northern Botswana, the Kalahari Sandveld and acacia savanna merges with the "mixed" savanna or Bushveld. As the 50-centimeter rainfall isohyet is approached, acacia savanna interdigitates with mopane woodland, becoming more extensive to the east and north. Fauna reflected this blending of zones: arid-adapted species such as gemsbok, springbok, and red hartebeest. At their northern limit, acacia savanna and Bushveld species such as wildebeest, zebra, giraffe, impala, oribi, warthog, kudu, tsessebe, buffalo, and elephant were found, as well as mesic-savanna species such as sable, roan and waterbuck, and even floodplain-to-swamp species like reedbuck, puku, lechwe, sitatunga, and hippo. The diversity illustrates the "edge effect", in which the ecotone between different habitats tends to be richest in variety of species.

Drainage from the Angolan Highlands made this great variety of species possible, bringing perennial water into this otherwise semi-arid environment. The inflow maintained the huge Okavango Swamp and the smaller Linyanti and Zambezi swamps. Long ago, this drainage reached and filled the vast shallow tectonic basins of the Makarikari Pans, Lake Ngami, and the Mababe Depression, as well as a series of lesser pans. These old lake beds, occupied by more or less open grassland, made the area extremely important as a refuge for plains wildlife. Overflow from the Linyanti swamp, the Ngwezuma, and occa-

sionally from the Okavango, still reached the Mababe Depression (G. Child, in litt., 1968). During the rains, the Nata River, rising in neighboring Zimbabwe, delivers water to the eastern Makarikari Pans.

The Makarikari Pans, perhaps the largest alkaline pans in Africa, are blindingly white soda flats up to 65 km wide by over 160 long. In March 1965, RDE visited Botswana to observe the Makarikari wildebeest population. There had been very little rain; the plains were sere and the pans were dry. Several widely spaced pools in the Nata River and a few springs on the east side of Shua Pan were reportedly the only waterholes left in the entire region between the Zimbabwean border and the Botletle River. As if in confirmation, a concentration of several thousand wildebeest moved into the grassland around the mouth of the Nata River, several months earlier than usual, within two days of RDE's arrival. Every day, the animals were harassed by Africans hunting on foot, on horseback, and even from trucks. Probably as a result of the hunting pressure, most of the wildebeest remained in the open grassland all day and went to water only at night, instead of drinking by day and seeking shade by mid-morning as is this species' normal custom, especially in climates where the temperature rises to 40 degrees Celsius and well above.

This aggregation of about 3,500 head were the only wildebeest to be found, despite an extensive flight over about half the region. Warden Bromfield was convinced there were at least 65,000, the number estimated during an aerial reconnaissance he had made the year before. Yet Bromfield himself estimated that from 20,000 to 40,000 a year had died since 1958, especially along the new Disease Control Fences. In 1959, 19,000 wildebeest skins were purchased by the store in Nata alone. In 1962, an estimated 15,000-20,000 died or were shot between August and September alone. They were in such poor condition that only the hides were saleable, and half were rejected.

Despite losses of such magnitude, Bromfield insisted that gnus remained almost as plentiful as ever. In fact, the Game Department was actually backing a group of entrepreneurs that proposed turning up to 10,000 gnus a year into chicken-feed, or powdered biltong to add protein to cattle feed, by running them though a giant mincing machine. Many thought the proposal would demonstrate the economic potential of wildlife, serving as a rebuttal to those who wished to see it exterminated in the supposed interest of livestock production. A quota of 5,000 wildebeest had been set for the first year.

Yet when Kinloch (personal communication 1965) flew over the country looking for wildebeest a few months later, he hardly spotted more than RDE had, and Smithers (personal communication, 1965) estimated the Makarikari population at not more than 5,000-6,000 head. It seemed clear the population had suffered a disastrous crash and it would be many years before the losses were made up – if even possible while game fences remained in place and cattle subsisted on wildlife seasonal range.

The Makarikari population apparently depended on access to higher rainfall areas to the north and east during critical drought years. The population formerly migrated in the dry season as far as neighboring Zimbabwe, including to pans in the western part of Wankie National Park (now Hwange National Park). Interfering with wildlife movement to the waters of the Okavango Swamp and

across the Zimbabwe border was tantamount to imposing a death sentence upon thousands of animals in time of drought. This was precisely what the Disease Control Fences did. Animals on the "wet" side had a chance to survive and adjust to the loss of their dry-season range – as L. Tennant (personal communication, 1967), the Chief Game Warden of Botswana, suggested was happening. Most left on the "dry" side had apparently already succumbed.

The Wankie National Park Resident Population

Wankie Park wardens' reports dating back to 1931 revealed that severe droughts, in which gnus and other game by the thousands died in the Botswana-Wankie border area, occurred perhaps one year in every five. At such times the migratory wildebeest and other wildlife desperate for water pressed further north into country well beyond their normal range. In 1947, a drought year in which September-like conditions appeared in April, unprecedented game counts were made along the vehicle tracks in the northern part of Wankie during July, including 14,730 gnus.

In the early 1930s, not long after the 1928 creation of the Wankie Game Reserve and establishment of the first artificial waterholes, wildebeest appeared at them in growing numbers during each of several successive drought years. Some remained for the arrival of the next rainy season. Eventually, resident herds were established on all the large vleis along the Bulawayo-Victoria Falls railway, moving in as soon as permanent water became available. Thus, in the 1960s, a resident gnu population of 1,000-2,000 head in Wankie National Park came into being. The animals were limited to the larger vleis and the surrounding fringe of Rhodesian teak (*Baikiaea-Pterocarpus*) woodland and scrub, where they retired for shade during the heat of the summer days.

Postscript

Spinage (1992) documents historical evidence that the decline of Kalahari wildebeest actually began well before the erection of disease control fences. Archival records showed there was at one time a significant migration every winter east and south-east from the southern Kalahari to the Molopo River into South Africa through the unfenced boundary between Tsabong and Khuis (with wildebeest moving as much as 40 km per day). Wildebeest there were once so numerous that they were regarded as a menace by local farmers because they competed with local cattle for grazing and transmitted malignant catarrh. Large-scale killing of wildebeest followed until at least 1961, when the species was classified as a game animal that could only be hunted with a license.

1980s Status in the Kalahari Region

(From Anderson et al. 1989, Spinage et al. 1989, Wilson & Cumming 1989, Ross et al. 1998, and references therein)

By the 1980s, the Kalahari region of Botswana had changed dramatically. Two decades of extensive sinking of artificial boreholes enabled the cattle industry to expand from the well-watered areas in the country's east and southeast, where it was formerly concentrated, into the Kalahari. This led to widespread grassland degradation though overgrazing and consequent bush encroachment.

But Botswana retained important wildlife resources. National parks and reserves now covered more than 17 percent of the country's land area, even if the system of conservation areas was established more to prevent human settlement and cattle ranching in major areas than for the ecological requirements of wildlife. The wildebeest still occurred throughout much of the country, within and outside protected areas, apart from the more densely settled areas in the east and southeast.

By the mid-1980s, 30 years of erecting 1,200 km of veterinary cordon and other fences along the perimeter of the Botswana section of the Kalahari had largely prevented movement of migratory wildlife to and from the better-watered regions in the north and east of the country. At the beginning of the decade, the wildebeest population that migrated northward out of the Kalahari in very dry years still survived in large numbers. There were an estimated 260,000 wildebeest in the Botswana section of the Kalahari in 1979, a number substantially greater than the 1960s estimates. Perhaps the population had recovered from the droughts of the early 1960s; additionally, the earlier estimates did not benefit from data provided by systematic aerial surveys of Botswana's wildlife populations. But this population now had only very restricted access to permanent water – such as in the Lake Xau area to the south of the Okavango Delta – and it was dealt its final blow during the severe droughts of the early 1980s. Heavy mortality of wildebeest occurred during the dry seasons of 1981-83 when they concentrated around Lake Xau, where the grasslands were heavily overgrazed by large herds of cattle and the wildebeest were exposed to hunting and harassment by people. In 1983, with water supplies severely limited after five years of below-average rainfall, mortality was especially heavy; an estimated 52,000 wildebeest died in the Lake Xau area between July and November (Williamson & Mbano 1988). Whereas tens of thousands of wildebeest had passed through the northern section of Central Kgalagadi Game Reserve en route to Lake Xau in each dry season (June-August) from 1981 to 1983, fewer than 1,000 animals moved north to Lake Xau in 1984.

The Makgadikgadi (Makarikari) population fared somewhat better. This population's wet- and dry-season ranges were now reasonably well protected in Nxai Pan National Park (2,100 sq km) and Makgadikgadi Pans Game Reserve (3,900 sq km), respectively, although these two protected areas were separated by an unprotected area of pans and rangeland. The area's migratory wildebeest and zebra populations spent the wet season on the grass-covered pan and surrounding savanna woodland of Nxai Pan National Park, and the dry season on the Boteti (Botletle) River. Makgadikgadi Game Reserve included the northwestern section of the Makgadikgadi salt pans, and open grass plains and thornbush scrub and palm groves between the salt pans and the Boteti River. An estimated 11,500 wildebeest were present in the game reserve in February 1987.

Further north, the wildebeest occurred in substantial numbers in and around the Okavango Delta, and a small resident population of a few hundred survived in Chobe National Park. In adjoining Zimbabwe, the species remained common in the north and northeast of Hwange (formerly Wankie) National Park (14,650 sq km), where the population was stable at about 2,000.

In the southern Kalahari, the resident population of about 400 wildebeest in South Africa's Kalahari Gemsbok National Park (9,591 sq km) was regularly augmented by several thousand migratory animals that moved across the border from Botswana's adjoining Gemsbok National Park (24,800 sq km) for up to several months at a time.

Estimated from aerial surveys of all of the country's rangelands, the total number of wildebeest remaining in Botswana in 1986-87 was 39,000.

1990s Status in the Kalahari Region

(From Anderson et al. 1996, Anderson & Wilson 1998, Ross et al. 1998, and references therein)

During the 1990s, settlement and cattle industry expansion increasingly pressured Botswana's natural ecosystems. Governmental erection of veterinary cordon fences continued unabated, without pre-construction environmental impact assessments. As wildlife became more restricted to protected areas, the era of unfettered movement of game animals across the landscape came to an end. The Kuke veterinary fence along the southern boundary of Ngamiland and the fence along the eastern boundary of Central Kgalagadi Game Reserve effectively separated wildlife of the central and southern Kalahari from that of northern Botswana. Fences erected along and to the south of the Namibia border in the northwest threatened access of the area's wildlife to permanent water. Movement of wildlife to and from the Okavango Delta had become restricted by veterinary fences such as the northern and southern buffalo fences, while movement south and east of Makgadikgadi Pans was prevented by the expansion of settlement and livestock. In the central and southern Kalahari, wildlife had become increasingly concentrated in and around Central Kgalagadi Game Reserve and Gemsbok National Park, as settlements and livestock numbers expanded outside these protected areas.

On the positive side of the ledger, despite the often severe international criticism of Botswana's failure to prevent the near-extinction of its migratory wildlife – notably wildebeest – the country did retain globally significant wildlife populations and an extensive system of protected areas that is among the most important in Africa. This includes parks and reserves such as Chobe National Park (11,100 sq km) and Moremi Game Reserve (3,880 sq km) in the north, and the vast Central Kgalagadi Game Reserve (52,800 sq km) and Gemsbok National Park (26,590 sq km) in the central and southern Kalahari. In 1992, Makgadikgadi-Nxai Pan National Park was established by upgrading the former Makgadikgadi Pans Game Reserve to national park status (securing this area's future against attempts to degazette it) and joining it to Nxai Pan National Park, through the addition of Kudiakam Pans to the enlarged protected area. It had also become apparent that the much-maligned fences had positive, as well as negative, impacts on wildlife conservation; the southern buffalo fence which had been erected along the southern and southwestern perimeter of the Okavango Delta in 1981-82 had not caused the large-scale wildlife deaths predicted by some conservationists. Preventing cattle incursion in the southern Okavango had actually benefitted wildlife. Similarly, the fence on the eastern boundary of Central Kgalagadi Game Reserve had reduced incursions of cattle and poachers.

Aerial surveys conducted by the Department of Wildlife and National Parks (DWNP) indicated that the total wildebeest population of Botswana stabilized at about 35,000-45,000 individuals between 1986 and 1994. Since wildlife had become largely restricted to four discrete regions of the country by the 1990s, the status of the wildebeest can be considered separately for each region:

Northern Region

This region comprises about 80,000 sq km of savanna woodlands, open grasslands and floodplains and swamps of the Okavango Delta and Kwando-Linyanti-Chobe River system. Collectively, Chobe National Park, Moremi Game Reserve, and Makgadikgadi-Nxai Pan National Park cover about 25 percent of the region. Outside these protected areas, large swaths of land are wildlife management areas, which were gazetted in 1992 to provide the framework for developing community management of wildlife resources. Aerial surveys conducted by DWNP in the 1990s indicated a stable wildebeest population of about 15,500 in the region, comprising two separate concentrations; one (about 12,000 animals) centered on the Okavango Delta and extending at lower densities northward (Linyanti, Savuti Marsh), and the other (about 3,500 animals) in and around Makgadikgadi-Nxai Pan National Park. The latter population tended to move south toward the Boteti River within and outside the southern section of the park during the dry season, and dispersed northward and eastward to pans inside and outside the protected area in the wet season. Research conducted in the early 1990s showed that, unlike the area's migratory zebra population, the wildebeest seldom ranged as far north as Nxai Pan during the wet season.

Smaller, resident wildebeest populations persisted in Chobe National Park and across the Zimbabwe border in Hwange National Park. In 1996, the Hwange population was estimated to number 1,750 head, similar to the 1960s and 1980s, but its distribution within the park had changed markedly. The animals were now concentrated in the east of Hwange, with a marked decrease in numbers in the north of the park, possibly because the northern grasslands and mopane woodland had dried out considerably during the previous 25 years.

Namibia Border Region

This region of northwestern Botswana, in western Ngamiland District, supported a relatively low biomass of domestic livestock and moderate numbers of wildlife, including an estimated 3,300 wildebeest. Although wildlife management areas were planned for the region, its wildlife faced an uncertain future because of the construction of additional veterinary fences in Ngamiland. These fences were expected to hinder the access of species such as wildebeest to seasonal water and forage supplies.

Eastern Region

This region consists mainly of private land. Tuli Block farms are located in the Limpopo River area on the South Africa and Zimbabwe borders. Whereas the wildebeest appeared to face extinction on these farms in the 1960s, the species had made a strong comeback by the mid-1990s to an estimated total of 10,000 individuals on the Tuli Block farms. This number reflects the rapid growth of

game ranching during the 1980s and 1990s, when it became a profitable alternative to cattle in many of the drier parts of southern Africa. In the 1990s, the wildebeest was the region's second abundant larger antelope species after the impala. These animals were confined on fenced game ranches.

Southwestern Region

This region constitutes the central and southern Kalahari of Botswana. By the 1990s, game-proof veterinary fences had completely cut access of the region's migratory wildlife to ancestral sources of water in northern Botswana. Wildlife was also threatened by the expansion of the cattle industry into the Botswana section of the Kalahari, drought, poaching, and abuse of the citizen hunting system. Following the dramatic decline in numbers caused by veterinary cordon fences, the region's wildebeest population had stabilized at 10,000-15,000 individuals since the mid-1980s.

The wildebeest was one of only two wildlife species that showed strong seasonal movements in the region – the other was the red hartebeest. Like the wildebeest, the hartebeest had also undergone a population crash in the Kalahari, from an estimated 270,000 in 1979 to less than 50,000 in 1987, and its numbers had then stabilized at this lower level. Both species tended to occur in larger numbers inside protected areas in the dry season and outside protected areas in the wet season. The region's wildebeest now migrated only as far north as Central Kgalagadi Game Reserve in the dry season. Other animals moved southwest in the dry season into Gemsbok National Park and South Africa's adjoining Kalahari Gemsbok National Park, which continued to support a resident wildebeest population of about 700 individuals. The largest concentration of wildebeest in the wet season occurred in the Schwelle area, lying between Central Kgalagadi Game Reserve and Gemsbok National Park. Other animals remained in the game reserve during the wet season. The rise in the reserve's wet season population from a few hundred or less prior to 1990 to several thousand in 1994-95 appeared to indicate the establishment of a resident population in the Central Kalahari. The increase may have resulted from the construction of wildlife watering points within the Central Kgalagadi Game Reserve in the late 1980s. It is also possible that the intense selection pressures operating on the Kalahari wildebeest population in the early 1980s had produced a more drought-resistant, sedentary population (a small number of wildebeest was known to remain permanently in the Kalahari in the 1970s and 1980s rather than following the species' annual migration pattern, but it was unknown how these resident animals survived dry periods).

Although the region's migratory wildebeest and red hartebeest populations had suffered massive declines since 1979, the losses had been partly offset by increases in the numbers of more sedentary, water-independent species, notably gemsbok and springbok. Both species numbered more than 100,000 in the region by the mid-1990s. It was predicted that this change in the ungulate community, in areas such as Central Kgalagadi Game Reserve where there were few or no cattle, could have a long-term impact on vegetation. The greatly reduced populations of migratory grazers (wildebeest and hartebeest) could result in a reduced offtake of grass, leading to hotter and more frequent bush fires.

Lack of access to permanent water during severe droughts was still regarded as a serious threat to the long-term survival of the region's wildebeest population, unless water was artificially supplied in the species' dry-season concentration areas. Continued access to the core breeding range in the Schwelle area, where illegal meat hunting and habitat degradation resulting from cattle industry expansion had become significant problems, was also viewed as essential if a reasonably abundant wildebeest population was to persist in the southwestern region.

Current Status in the Kalahari Region

Countrywide dry-season aerial surveys in 2002 and 2003 (DWNP 2002; DWNP 2003) indicate that overall wildebeest numbers in Botswana have remained stable at about 46,000. However, substantial change in numbers has occurred in some regions. In the following accounts, population estimates for each region in 2002 and 2003 have been averaged since they generally have the wide confidence intervals typical of aerial surveys and do not differ significantly. For some areas, population estimates are also available for 1999 and 2001 from aerial surveys that did not cover all of Botswana's wildlife regions (DWNP 1999; DWNP 2001).

Northern Region

Wildebeest numbers remain stable in this region at about 14,000 individuals, with the largest numbers in the Okavango Delta and Makgadikgadi-Nxai Pan National Park. Within the Delta, the dry-season population estimate of wildebeest in Moremi Game Reserve in 1999-2003 averaged 3,700 and ranged from 240 to 6,100, probably reflecting the movement of animals between the reserve and adjoining parts of the delta. The Makgadikgadi population was estimated to number about 4,000 in 2002-03. Chobe National Park continues to support a small population of a few hundred or less. In adjoining Zimbabwe, no recent estimates are available for Hwange National Park, but when Wilson (in litt., 2005) visited the Main Camp and Sinamatella areas in the northern section of the park in June 2005, he observed several small herds of wildebeest totaling 55 individuals. Unfortunately, he did not visit the eastern part of Hwange, home to the park's main wildebeest population, because of the unavailability of fuel in Zimbabwe. There have been recent reports of uncontrolled poaching in Hwange National Park, but Wilson's observations indicate that the northern section of the park, at least, continues to support large numbers of elephant, numerous sable antelope, impala, zebra, buffalo, and warthog, among other wildlife species.

Botswana's wildlife-based tourism industry – a significant contributor to the economy – is rooted in the northern region. More than 60 privately operated tourist camps and lodges operate in and around the Okavango Delta and Linyanti, some within Moremi Game Reserve and Chobe National Park, but most in adjoining wildlife management areas. With only two tourist camps, Makgadikgadi-Nxai Pan National Park receives fewer visitors. The Okavango-Chobe region is also the center of Botswana's well-developed tourist hunting industry.

While the northern region's wildlife populations are generally stable, veterinary fences have continued to cause controversy. In 2003, the government of Botswana proposed to erect a new electrified fence alongside the Okavango Delta to enable the introduction of commercial ranching in the northwest of the country. That would effectively encircle the delta with fences to the south, north and west.

Livestock incursion from surrounding settlements increasingly pressured Makgadikgadi-Nxai Pan National Park. In 2003, the government decided to fence the boundary of this park to reduce conflicts between wildlife and local people. The goal was to exclude cattle from the park and wildlife from adjacent lands, minimizing competition between wild herbivores (primarily migratory wildebeest and zebra) and cattle for dry-season forage and water supplies along the Boteti River. The fence was also intended to control predation on cattle by the park's lions and consequent revenge killings of lions by local herders. In 2005, the fence was constructed around the western and southern edges of the park, with the eastern boundary still to be fenced. This reduced the number of waterholes available to wildlife and caused some mortality of wildebeest and zebra (Michler 2005). While the new fence may allow better protection of flora and fauna within the park, it may lead to long-term declines of the Makgadikgadi wildebeest and zebra populations.

There are also long-term threats to the Okavango Delta, which contains more than 95 percent of Botswana's surface water. Proposed large-scale removal of water for development is a continual challenge to the region's natural ecosystems. A proposal by Namibia in the late 1990s to extract water from the Okavango River upstream of the Delta and pipe it to Windhoek is an example of such water removal projects. Other threats to the Okavango include a proposed hydro-electric scheme on the Okavango River in Namibia, commercial-scale reed- and grass-cutting, uncontrolled fires, and elephant overpopulation (Michler 2004).

Namibia Border Region

The predicted decline in this region's wildlife populations appears to have occurred, with estimated wildebeest numbers now reduced to about 700.

Eastern Region

The wildlife populations of the Tuli Block farms have continued to grow. This region's estimated wildebeest population is now about 19,000, larger than any other region of the country. The population appears to be secure as long as the current management of the region's large, European-owned farms in favor of wildlife continues. It may be symbolic of the wildebeest's future over much of its remaining range in Africa that, since the 1960s, Botswana's largest population has changed from several hundred thousand animals roaming freely over vast areas of the country's rangelands to much smaller, sedentary herds on fenced land.

Southwestern Region

The wildebeest population of the southwestern region appears to have remained more or less stable from 1999 to 2003 at about 10,000-12,000 head. In contrast to the situation in the early to mid-1990s, wildebeest numbers are now greater during the dry season outside the region's protected areas than within them. The average estimated dry-season populations for the period 1999-2003 were 1,350 (ranging from 830-2100) in Central Kgalagadi Game Reserve, and 1,300 (ranging from 180-3,000) in Gemsbok National Park. This underscores the wildebeest population's continued vulnerability to loss of habitat and poaching outside the protected areas in this region.

In 2000, Botswana's Gemsbok National Park and South Africa's adjoining Kalahari Gemsbok National Park were united as the Kgalagadi Transfrontier Park (37,991 sq km). The park's management as an integrated unit is expected to enhance the level of protection and management of the entire area.

2.4 Namibia

1960s Status in Namibia

Until Europeans settled and fenced Namibia in the early 20th century, wildebeest (*C. t. taurinus*) ranged over probably the whole country east of the coastal Namib Desert and the bordering strip of sub-desert Karooveld. They may even have ventured into the Karooveld after rain fell. Shortridge's (1934) distribution map for the gnu shows it limited in the south to the Kalahari sandveld of the southeastern part of the territory. Sidney (1965) follows Shortridge. But K. Tinley (in litt., 1967) points out that the distribution Shortridge gives was man-made, the gnu having already been shot out of excellent habitat in the Inselberg region, from the plains and Karooveld of Damaraland.

Whereas the wildebeest was formerly considered the most abundant large herbivore in Namibia, with the possible exception of the kudu (Shortridge 1934; Sidney 1965), in the 1960s it was rare except in the northern part of the country and along the northeastern border with Botswana. The occasional herds seen along the southern border belonged to the southern Kalahari population (Part 2.3). In the 1950s, no one would have presumed to estimate the number of wildebeest in Namibia, or even attempted to distinguish separate populations, but it became a simple task. Disease Control Fences along the Botswana border and the fenced lands of European ranches so culled and isolated the populations that the biologists of Etosha National Park (H. Ebedes and K. Tinley, in litt. 1967) unofficially estimated that only about 8,000 remained in the whole country, including the Caprivi Strip.

No wildebeest were left on the sheep ranches of the plateau country stretching southward from the highlands of Damaraland; perhaps 1,000 lingered on farmland of Grootfontein District bordering Etosha National Park to the east, although most farmers shot them on sight. Another 1,500 survived on the Namibian side of the Control Fence on the Botswana border, and 1,500-2,000 to the north of Etosha Pan, in Ovamboland and the western Caprivi. The balance was found in Etosha National Park, the only area in this huge territory where wildebeest enjoyed official protection. It was just as simple to predict the trend of the gnu and most other wildlife: downward.

Western Okavango-Grootfontein District

The west side of the Okavango is similar to the east side: well-grassed Bushveld of varying denseness on Kalahari sand, with little or no surface water except in seasonal pans and in channels of the Okavango River. The movements of wildebeest on this side of the Okavango Swamp appeared to have been comparable to those of the Makarikari population in Botswana; indeed the absence of physical barriers between them suggested there may have been free interchange as they dispersed over the Kalahari during the rains. Perhaps all the wildebeest in the region actually belonged to a single population with a number of dry-season concentration centers, of which the Makarikari Pans, the western side of the Okavango and the Etosha Pan were most important. While some wildebeest based on the west side of the Okavango may have dispersed to the south during the rains, a considerable number evidently made a regular wet-season migration

westward to the Etosha Pan area, withdrawing to the Okavango floodplains again as the rainwater pans disappeared in the dry season (Shortridge 1934; Wilhelm 1935).

Construction of Disease Control Fences along the borders of the Okavango Territory, and between Namibia and Botswana, effectively curtailed migration to and from the Okavango and separated the wildebeest of east and west. According to an estimate by Tinley & Ebedes (in litt., 1967), the number on the Namibia side of the fence had already dwindled to 2,500, including the 1,000 found on Grootfontein fenced farmland, while between 3,000 and 5,000 survived on the Botswana side. As no census had been taken before erection of the fence, no one can say how many thousands died. It is only clear that one of the finest game areas remaining in Africa was drastically – and wantonly – depleted within a few short years, in the unfounded belief that it would benefit the livestock industry. Tinley (in litt., 1967) described what was left as "a perfect example of a smashed ecosystem." Perhaps a reduced population could adjust to the new conditions, but, as Tinley observed, "It takes time for the species and its habitat to recover – that is, if there are any individuals of that species left."

Caprivi Strip

The narrow corridor dividing Angola and Zambia from Botswana, negotiated in 1898 by Count Caprivi to give the German colony of South West Africa (now Namibia) access to the Zambezi River and thereby (he hoped) to the Indian Ocean, is cut off from the rest of Namibia, faunally speaking, by the Okavango River. It is cut again at about the halfway point by the Cuando River, the main source of the Linyanti-Chobe swamp. The section between the Okavango and Cuando Rivers is known as the Western Caprivi. The Eastern Caprivi is that portion bounded by the Cuando and Zambezi Rivers. The wildebeest of the Western Caprivi were part of the population that occured between the Cuando and Cuito Rivers in Angola (Part 2.5), while those which formerly occurred in the Eastern Caprivi were part of the upper Zambezi Valley population in western Zambia.

Etosha National Park

Etosha is one of the oldest African game reserves, having been set aside by the German administration in 1907. By the 1960s, it was a national park of approximately 22,000 sq km. The Pan itself, devoid of vegetation and animal life, is some 100 km long and almost 50 km wide, covering an area of some 5,950 sq km. It is very similar to the Makarikari both in appearance and in its origin, as a former internal drainage basin. In the 1960s, it still received some drainage from the north and east, but reportedly had not been wholly covered since 1934. Etosha Park lies in the Mixed Savanna zone, with types ranging from shrub and tree savanna to dense woodland and thicket. There are extensive short-grass plains in the vicinity of the Pan that play a key role in the distribution of plains game.

The Etosha wildebeest, along with the park's zebra and springbok populations, migrated between dry-season concentration areas, mainly on the plains to the south of the Etosha Pan where there were some 20 large saline springs and numerous smaller ones, and wet-season dispersal areas to the west, on

the Grootvlakte (Great Plains), where microperennial grassland provided fresh new growth during the rains (Bigalke 1958; Tinley & Ebedes, in litt., 1967). Although around 75% of the wildebeest population was migratory, perhaps one quarter remained in permanent residence around perennial waterholes (Ebedes, personal communication, 1967).

The number of wildebeest formerly occurring in Etosha National Park was apparently unrecorded, but it was probably on the order of 10,000, not counting an influx of migrants from Ovamboland during the wet season. Ebedes & Tinley estimated the population during this period at about 3,000. The reasons for the reduction are not clear. One suspected cause was ranchland fencing, which entirely cut off wildebeest and other nomadic wildlife from excellent range to the south and east of the park. By preventing dispersal in these directions, the fences may have caused overgrazing, especially by zebra, which in combination with preceding drought years led to habitat deterioration. As Tinley (in litt., 1967) commented, "The balance is tipped sharply to the deteriorated stage if there is a series of years with less than the mean annual rainfall; but this is not a problem to ungulates if there is room to move about – they simply move to other pastures, giving the damaged habitat time to recover. But, cut the migation routes or concentrate the animals and there is trouble for the species and its habitat."

Apart from the gradual deterioration of their habitat, the wildebeest population suffered an unusual and catastrophic accident in 1959, when 6,000-8,000 died of salt poisoning near the Ovambo-Etosha border. The severe drought of that year was the apparent cause; it forced a horde migrating from Ovamboland to reverse direction and fall back on permanent water. But so much water had evaporated that the salinity had risen to the point where it was lethal even for such salt-tolerant animals. The next year, a large number of gnus was reported to have left the park and moved through Ovamboland into Angola. Many hundreds were slaughtered en route and few, if any, ever returned.

Ovamboland

The native reserve of Ovamboland north of Etosha Park on the Angola border was the only sizeable area of Namibia with a high enough rainfall (over 50 cm) to support agriculture. But even here agriculture was subordinate to pastoralism. About 230,000 Ovambo people of eight related Bantu-speaking groups, or almost half the population of the entire territory, inhabited the reserve. The country is flat sandveld in which mopane woodland is the dominant vegetation type, merging with Bushveld on the south. There are also broad grassy plains, particularly in the most heavily populated northwestern region, and extensive vlei grasslands along seasonally waterlogged drainage lines.

Ovamboland was a dry-season concentration area for wildebeest and, like Etosha Pan, probably also harbored sedentary herds around permanent water points. During the rains, Ovambo wildebeest migrated southward into drier country to graze the short-grass plains west and north of Etosha Pan, where they mingled with herds that winter on the south and northeast (Andoni Plains) side of the Pan. At the end of the rains, the combined populations split as they returned to their respective dry-season ranges. Here, as in northern Botswana, the wildebeest may all have belonged to a single population with a number of

widely separated dry-season concentration areas, of which one is Ovamboland, including that part of adjacent Angola between the Cunene and Cubango Rivers. According to Bigalke (1958), wildebeest were formerly abundant in Ovamboland during the dry months; as an example, he reports that, "approximately 10,000 head were seen there on a patch of burnt grassveld some 10 miles square [approximately 25 sq km]" in late October of 1957.

That Ovamboland ceased to be a good refuge for wildebeest at any time may be inferred from the fact that the population in all of Namibia north of Etosha National Park and west of the Okavango River numbered only 1,500-2,000 head. Dense human population, overstocking, uncontrolled burning, extended droughts, habitat deterioration, and uncontrolled shooting were probably responsible for this dramatic decline in wildebeest and other large wildlife. The same factors have taken their toll in adjacent Angola (Part 2.5).

1980s Status in Namibia

(From van der Walt 1989, references therein, and additional references cited)

By the 1980s, the system of conservation areas had been expanded to cover 12% of the country. These areas, well protected and managed by the Directorate of Nature Conservation and Recreation Resorts, formed the basis of the growing tourism industry. In addition, after 40 years of destruction following the commencement of large-scale intensive livestock farming in the 1920s, game made a major comeback on private (white-owned) farmland during the 1970s and 1980s. This was stimulated by pioneering legislation in 1967 granting qualified ownership rights over certain game species to farmers on private land. The legislation was extended in the Nature Conservation Ordinance of 1975. As a result, whereas wild animals on private land had previously been state property and regarded as having little economic value, they were now treated as valuable assets and actively conserved by many landowners. The private-farm-based wildlife utilization industry grew rapidly, including cropping for meat and hides, trophy hunting, game capture for sale of live animals, and in some cases game-viewing tourism.

By the early-mid 1980s, the total numbers of each of the country's most abundant larger antelope species, kudu and springbok, were greater than 100,000, and other common species such as gemsbok, eland, and red hartebeest numbered in the tens of thousands; 80% to more than 95% of these species' populations occurred on privately owned farmland. In contrast, total numbers of the wildebeest, which had been ruthlessly eradicated from much of its former range when the intensive cattle industry was developed because it is a reservoir of malignant nasal catarrh, had continued to decline; the country's total wildebeest population was now a mere 3,900 head.

Etosha National Park (22,270 sq km) continued to support the largest numbers of wildebeest, but the park's resident population had declined to about 2,200 individuals. The erection of game-proof fences between 1960 and 1973 had eliminated the population which formerly migrated annually between Etosha (wet-season range) and Ovamboland to the north (dry-season range); as recently as 1965, 30,000 wildebeest had been counted within the park. The Etosha wildebeest population continued to decline throughout the 1970s,

apparently because of an anthrax epidemic and elevated predation rates arising from the large numbers of weak animals (Berry 1981a; Berry 1981b). By the early to mid-1980s, the population was showing signs of stabilising at its greatly reduced level.

Wildebeest had now disappeared from the Caprivi Strip, but a small population of 200 head occurred in the newly established Khaudom Game Park (3,841 sq km) on the Botswana border immediately southwest of Caprivi. With the demise of the Ovamboland population, the few survivors on communal lands (about 800 in total) were now found in Kavango, Bushmanland, and Hereroland in northeastern Namibia, to the east and southeast of Ovamboland. Small numbers (about 650) also survived on private land in the adjoining farming districts of Otjiwarongo and Gobabis.

1990s Status in Namibia

(From East 1999, and references therein)

Namibia's wildlife sector continued to strengthen during the 1990s. Wildlife-based tourism had become a major sector of the economy, including game viewing in the country's extensive system of protected areas, now managed by the Ministry of Environment and Tourism (MET), and game viewing and trophy hunting on private land. Wildlife utilization on farms had generally developed as a supplementary activity to livestock production, but an increasing number of properties were being converted completely to wildlife. Some individual landowners grouped together to share wildlife management activities within conservancies catering to trophy hunters and/or game-viewing tourists.

Wildebeest numbers had grown substantially since the 1980s, to a total of more than 9,000 head. While the population in Etosha National Park had increased to about 3,000, most of the increase had occurred on private farmland where there were now about 5,000 blue wildebeest. These animals were mainly in the northeastern farming districts, but the species had also been reintroduced to farming districts in the west and south of the country. Meanwhile, the total population of the introduced black wildebeest, which does not occur naturally in Namibia, had increased on farms from 150 in 1982 to more than 7,000, outnumbering the indigenous blue wildebeest on private land.

Current Status in Namibia

Namibia's wildlife sector has remained buoyant since 2000. Wildlife-based tourism has continued to grow, and the country's game ranches provide one of Africa's leading destinations for international trophy hunters. Discussions with MET staff in Etosha National Park in 2002 indicated that the Etosha wildebeest population has remained stable at between 2,000 and 3,000 head since the late 1970s. There is an increasing population of at least several hundred wildebeest in Khaudom Game Park and the adjoining Nyae Nyae Conservancy (established in 1998), which together cover about 13,000 sq km (Skyer 2004). Numbers on private farmland have probably continued to grow, although no estimate is available. It is likely the total number of blue wildebeest in Namibia now exceeds 10,000.

Despite the generally favourable current situation for wildlife in Namibia, the long-term future of the country's white-owned farms is unclear. The commercial farming districts were surveyed into farms for white settlers between the late 19th century and the mid-1950s. These farms range in size from 50 to 400 sq km and cover 43% of Namibia's land area (Barnes & de Jager 1996); the great majority are still white-owned. It is unclear for how much longer this situation will persist. Much of the country is still sparsely inhabited, but there is an increasing need for land to meet the socio-economic aspirations of black people. The government has recently initiated compulsory acquisition of white-owned farms for resettlement, albeit on a small scale. This may impact the future ownership of private farms, including those currently utilized for wildlife.

2.5 Angola

1960s Status in Angola

Very little was known about the distribution and status of mammals in Angola at this time; the most up-to-date account was that of Hill and Carter (1941), who collected mammals there for the American Museum of Natural History in the late 1930s. Sidney (1965) relies chiefly on this and several older accounts, although one personal communication giving some areas of Angola in which wildebeest occurred as of the mid-1950s is also included. Over 10 years later, it was still necessary to rely on unpublished information; J.C. Cabral of the Institute of Scientific Investigation of Angola in Sa da Bandeira kindly provided information on the current status of wildebeest in Angola.

In southern Angola, from the border of Namibia north to about 16 degrees S, the landscape resembles the semi-arid Bushveld of northern Botswana and Ovamboland. Indeed, water is as scarce here during the dry season as in the Kalahari Desert, and the only human beings found far from major rivers at this season were the Kung Bushmen. From west to east, the region's major rivers, all southward-flowing, are the Cunene, Cubango (Okavango), Cuito, and Cuando. Beyond 16 degrees S, rainfall exceeds 75 cm per year, and there is a gradual northward transition to the miombo woodland of the Angolan Plateau.

The gnu was found in greatest abundance near the principal rivers of southern and southeastern Angola (Hill & Carter 1941). There is no evidence it ever inhabited the miombo country, except where floodplain and watershed grasslands extended into the woodland zone. According to Cabral (in litt., 1967), the wildebeest was still found along the Cunene and Cubango, the Okavango and Luiana Rivers, and along the tributaries and headwaters of the upper Zambezi. Cabral (1967) provided specific information about wildebeest of the following areas.

West Side of the Cunene River

Wildebeest were probably never plentiful here. Cabral (1967) knew of two areas, in which a total of no more than a few hundred gnus were found: Bambere Plain just north of Quipungo, midway between Capelongo and Sa da Bandeira; and about 50 head on a floodplain grassland of the Cunene in the Integral Reserve of Bienar, some 30 km south of Capelongo.

Between the Cunene and Cubango Rivers

The plains of this triangle of land are continuous with the plains of Ovamboland to the south and part of the same ecosystem that includes the Etosha Pan game populations (Part 2.4). The Cunene and Cubango and their tributaries may well have been the most important dry-season concentration areas in the whole region. But they were also the concentration areas for the pastoral Cunhamas and their cattle. As they increased, wildlife declined. During this period, a large human population was concentrated along the Cunene, the Cuvelai (a small seasonally flowing river to the east), and the lower Cubango or Okavango. Wildebeest distribution was largely limited to a plains area of around 7,770 sq km, west of Caiundo on the Cubango between 15 degrees 30' and 16 degrees

30' S, 16 degrees 15' and 16 degrees 45' E. No estimate of the population could be given, but as there were no reports of a large population, there were probably a few thousand head at most.

Between the Cuito and Cuando Rivers

According to Cabral (1967), the gnu was apparently not found between the Cubango and the Cuito, partly due to a large human population, and partly because of "the lack of proper plains." But the gnu reached its greatest abundance in southern Angola between the Cuito and Cuando Rivers, particularly between the Okavango and the Luiana, a tributary of the Cuando. The western Caprivi Strip and the land north of the Okavango Swamp in Botswana were included in the same natural region; as probably all the wildebeest were actually or potentially interbreeding, they belonged to one population, with the greatest numbers likely found in Angola. Cabral gives information about four centres of population:

(a) "two small herds" near the Lumuna River, a tributary of the Luiana;

(b) over 400 head near several pans south of Tondo;

(c) approximately the same number to the north of Mucosso, on the Angola-Caprivi border;

(d) the bulk of the population, numbering approximately 6,000 head, along the south side of the Luiana.

Eastern Angola

No firm information was obtained about the distribution and status of wildebeest in this part of Angola, seemingly one of the least known regions of southern Africa at the time. It was known, though, that the floodplain and watershed grasslands characteristic of the upper Zambezi, the only extensive gnu habitat in Zambia (Part 2.6), reached far into Angola along a multitude of tributary rivers. Wildebeest were reportedly generally distributed in this region, nearly up to the Zambezi's source at the Zambia-Congo frontier. They were known to be present, for instance, in the national park of Cameia, at about 12 degrees S, 22 degrees E.

1980s - Current Status in Angola

(From Estes 1989, East 1999, and references therein, plus more recent information)

Wildlife conservation received scant attention in Angola until the 1930s, when the Portugese colonial government proclaimed the first national parks and reserves. But even then the government made little attempt to enforce conservation laws. Little progress was made until 1971-75; during this period, when B.J. Huntley served as ecologist with the Servicos de Veterinaria, there was a thorough review of the status of protected areas and a partially completed overhaul of their management. But in 1975, immediately following Angola's independence, the transitional government collapsed and the country descended into civil war. Armed conflict and widespread lawlessness affected large regions of the country until 1991, when the warring factions signed a fragile peace agreement. Sporadic outbreaks of fighting continued for another decade, and

not until 2002 did the prolonged civil war finally end. Angola continues to be affected by widespread crime, a shattered infrastructure, high levels of poverty and disease, and millions of unexploded landmines littered across the countryside.

A 1992 survey revealed that most populations of larger wildlife species had been annihilated during the civil war, both inside and outside former protected areas. The abundant wildlife of the southeast, for example, was largely wiped out between 1975 and 1983, with South African military personnel implicated in the heavy poaching that occurred in this region. This included the Luiana Partial Reserve (8,400 sq km) in the extreme southeast, where the country's largest wildebeest population had occurred in the 1960s.

Attempts have begun to rehabilitate the country's national parks and reserves, but this will probably be a long, slow process. In the northwest, the private Kissama Foundation is attempting to rebuild the infrastructure of Kissama National Park, including restoration of wildlife by translocating game animals from as far afield as South Africa and Botswana. These plans include the introduction of species that did not occur naturally in the Kissama park, including wildebeest. In the southeast, attempts are underway to restore the Luiana Partial Reserve, where small numbers of wildlife survive; the first step includes clearing landmines (Braack 2005).

The wildebeest has no doubt declined in keeping with the rest of the country's wildlife during the last 30 years. It still occurs in at least one area; part of the migratory Liuwa Plain population in Zambia enters adjacent eastern Angola seasonally (Part 2.6). No information is available on the current status of the wildebeest in the former Cameia National Park, which is situated 300 km north of Liuwa Plain and contains similar habitats of extensive seasonally inundated grasslands surrounded by plateau woodland and savanna, or in other areas of Angola.

2.6 Zambia

1960s Status in Zambia

Zambia comprises a series of plateaux at elevations of 915-1525 m, on which the dominant natural vegetation is open miombo (*Brachystegia/Julbernardia*) woodland with small-valley grasslands (dambos) along drainage lines. This type of woodland also covers large areas of Angola, southern Congo, western and southern Tanzania, Malawi, and Mozambique. The Zambian plateaux are dissected in the east and south by the Luangwa and Zambezi Valleys, where conditions are more arid and miombo is replaced by mopane woodland.

Extensive open plains are confined to watershed and floodplain grasslands, e.g., Barotse Plain and Kafue Flats. The distribution of wildebeest was closely linked to these limited areas of extensive open grassland. It was largely absent from plateau miombo woodland, where the nutrient content of the dambo grasses falls to very low levels during the dry season (Darling 1960) and the characteristic large herbivores are all low-density, highly selective grazers such as Lichtenstein's hartebeest, warthog, roan, and sable. Within Zambia, the wildebeest was confined to four areas: the blue wildebeest (*C. t. taurinus*) occured in Barotseland in the west, and Kafue National Park and the nearby Kafue Flats in the west-central region, and an isolated, endemic subspecies, Cookson's wildebeest (*C. t. cooksoni*) occured in the Luangwa Valley in the east.

After completing a faunal survey of Zambia in the early 1930s, the famous game warden, C.R.S. Pitman (1934) estimated the total number of wildebeest of the country as approximately 30,000. Between then and the 1960s, the human population more than doubled with a corresponding reduction in the range and abundance of wildlife. Judging from the decimation of game on the renowned Kafue Flats, recounted below, the decline of wildebeest was drastic outside the Luangwa Reserve and Kafue National Park. In Barotseland and adjacent North-Western Province, which includes over 80% of its range in Zambia, the gnu was not protected.

Barotseland

The upper Zambezi River and its numerous affluents from the continental divide traversing Angola and the Congo-Zambia border make a dendritic pattern of alluvial grasslands within the miombo woodland of western Zambia. Riverine plains extend like long fingers deep into Angola along such major tributaries as the Lungwebungu and the Luanzuinga. The most extensive of these grasslands is the Barotse Plain bordering the Zambezi between the confluences of the Luena and the Lui; counting the Luena Flats, the plain is 80 km wide at the north, and continues for 160 km, tapering to about 16 km wide at the Lui. The plains are inundated for several months every year, forcing both man and beast to take refuge in the woodland on bordering higher ground. The watershed grasslands of the Kalahari sand plain, which are not confined to the watercourses or even to the valleys, greatly extend the area of open plains in this region of western Zambia.

The wildebeest was the most plentiful wildlife species on the Barotse Plain; its distribution in western Zambia (Ansell 1959) conforms closely to the range of the Kalahari sands. No exact information on the size of the population was available, but the trend was reportedly downward (Sidney 1965). Probably less than 10,000 survived in Barotseland. Likewise, few observations were recorded of this population's seasonal movements, but the alluvial plains were presumably the dry-season concentration areas. Whether seasonal movements were merely local or extensive was not known.

Kafue Flats

The Kafue Flats is a 6,500 sq km floodplain inundated every year, starting in February at the western end, but not until April at the eastern end. The water subsides gradually during the dry season, exposing lush pastures at a time when higher pastures are dry or burnt off. The Flats thus made an ideal dry-season holding ground for a variety of herbivores. The dominant species was the lechwe (*Kobus leche*), although its numbers had declined from an estimated 250,000 in 1934 (Pitman 1934) to only 24,000 in 1966 (Bainbridge 1967). The zebra and wildebeest were the next most numerous species, but their combined populations probably did not exceed 25,000 even in 1934.

What happened to the wildlife of the Kafue Flats is a case study in the lack of protection of wildlife. Apart from competition with ever-increasing numbers of cattle, the game was subjected to continuing heavy poaching, while the colonial government tolerated the "chila", an incredibly wasteful annual slaughter of the lechwe, on the grounds that this communal hunt was a tradition of the Baila, an offshoot of the Tonga tribe. The outcome was graphically described by W.R. Bainbridge, the Chief Game Officer of Zambia (1967):

"The people lived in harmony with the wildlife until toward the end of the thirties, or the end of the war. Then the drain on the wildlife resource began to grow in ever-engulfing waves, as the much publicized chila drives, which killed off thousands of lechwe at a time (usually gravid females), and increased hunting pressure, with the use of firearms, slashed great gaps in the animal populations… Today you may fly over the… area and not see a living thing except herds of rather straggly indigenous cattle; a most sobering thought to those who witnessed the massacre of these great herds and were powerless to arrest the terrible slaughter in any way." [2]

The survival of Kafue Flats wildlife was due in large part to two European-owned cattle ranches, Blue Lagoon and Lochinvar, on either side of the Kafue River. Wildlife was vigorously protected on these ranches, and the owners willingly gave up cattle ranching altogether when the government of Zambia was persuaded to declare Blue Lagoon and Lochinvar as game management areas. In 1966, Lochinvar was purchased and set aside as a 410 sq km sanctuary. The estimated wildebeest population of Lochinvar had declined from 3,000 in 1937 (Robinette 1963) to 360 in 1966 (unpublished Game Department Report 1966); declines in Lochinvar's other wildlife species over this period were similar, e.g., lechwe numbers decreased from 20,000 to 7,500. Obviously the sanctuary was established in the nick of time.

[2] The Northern Rhodesian colonial government permanently banned the chila in 1957 (P. Berry in litt. 2006).

Kafue National Park

West and north of the Kafue Flats is the 22,400 sq km Kafue National Park, established in 1950. It is mainly woodland; miombo woodland and dambos on plateau soils in the northern half, interspersed with *msitu* thicket and forest, and miombo woodland on Kalahari sands in the southeast. The only extensive floodplain grassland is in the northern sector bordering the Busanga Swamp. Most wildebeest were found in the north on or near the Busanga Plain, where sizeable, mobile concentrations were common, particularly in the dry season. Movement here was similar to that on the Kafue Flats: wet-season dispersal in the more open woodland while the plains were flooded; dry-season concentrations on the plains, which advanced in pace with the drying margins of the grassland. Small, apparently sedentary herds were found in the south along minor floodplains and even on the larger dambos in the central section. No census of the Kafue National Park gnu population was published; a rough estimate was 3,000 head, of which 75% were located in the northern sector.

Luangwa Valley

The wildebeest of the Luangwa Valley, in northeastern Zambia, have been isolated long enough to become a recognised subspecies, Cookson's wildebeest (*C. t. cooksoni*), which is smaller and browner than the nominate race. Hundreds of miles of miombo woodland, mountains, and rift lakes separate *C. t. cooksoni* from other wildebeest populations; the nearest in the 1960s was on the other side of Lake Malawi in Mozambique.

Lying from 300 to 915 m lower than the miombo woodland of the plateau, the Luangwa and Zambezi Valleys are far hotter and drier and provide a corridor for a northward extension of the mopane woodland of Zimbabwe. Dense woodland grows right to the water's edge throughout most of the Middle and Lower Zambezi Valley, where the character of the river prevents the formation of floodplains, and it is too dry for the waterlogging that produces dambos. The dense growth is an absolute barrier to plains game. But in the upper Luangwa Valley, the mopane woodland flanks a floodplain of several kilometers' width, down which the river rushes with great force during the rains, constantly changing course as it eats into the banks, cutting off oxbows that may persist for a century or two as placid lagoons shaded by tall trees – until the river one day cuts back into and reclaims them. Darling (1960) describes this plain as "Acacia parkland", on which *Acacia albida* is the dominant species.

Cookson's wildebeest was formerly found on both banks of the Luangwa River, from about 11 degrees 30' to 14 degrees S. The southern limit in the 1960s was 13 degrees S, in the Luangwa Valley (South) Game Reserve, an area of almost 8,300 sq km, but in previous years lone individuals and isolated herds had been seen further south, and it is possible the species was in the process of re-extending its range (Ansell 1959). Its centre of distribution was in the Luangwa Valley (North) Game Reserve (4,636 sq km). Although generally confined to the actual floor of the valley, other offshoots emigrated eastward; thus, a small colony became established in the escarpment country of the neighbouring Lukusuzi Game Reserve, with wanderers seen occasionally on the Eastern

Province plateau. These range extensions suggested an expanding population which may have numbered several thousand head, compared to the 1,000 Cookson's wildebeest estimated by Pitman in the early 1930s (Pitman 1934). The increase was doubtless due to the creation of the game reserves.

The Luangwa population showed a well-defined pattern of wet-season dispersal and dry-season concentration, on a small scale. The river and alluvial plain are what make the valley habitable for grazers, and is a dry-season concentration area for all the valley's wildlife (Darling 1960). In the wet season, the floodplain was under water and the wildebeest forced back into the mopane woodland. The availability of suitably open habitat and pasture during the rains may have been the main limiting factor on the size of this wildebeest population.

1980s Status in Zambia

(From Jeffery et al. 1989, and references therein)

During the 1960s and 1970s, Zambia's system of conservation areas was among the best administered and managed in Africa. Many of the former game reserves were upgraded to national parks; those of direct relevance to wildebeest include Liuwa Plain National Park (3,660 sq km) on the Barotse Plain, Lochinvar (410 sq km) National Park on the Kafue Flats, and North Luangwa (4,636 sq km), Luambe (254 sq km), and South Luangwa (9,050 sq km) in the Luangwa Valley, as well as the existing Kafue National Park (22,400 sq km) on the western plateau. Most of these parks were surrounded by extensive game management areas designed to act as buffer zones.

In the late 1970s and throughout the 1980s, Zambia's economy declined. The decrease in purchasing power and a concomitant rise in the value of wildlife products, especially ivory and rhino horn, provided a powerful incentive to illegal wildlife utilisation. This proceeded virtually unchecked due to regional insecurity and reduction of law enforcement capability caused by economic constraints. The country's elephant and black rhino populations bore the brunt of the resultant massive increase in commercial poaching. Other wildlife species were also targeted, for instance for meat and hides, but not on the same scale, and many of the country's protected areas continued to support healthy populations of antelopes.

Barotseland

Little was still known about the wildlife of this remote region of western Zambia, but anecdotal reports suggested the wildebeest population in and around Liuwa Plain National Park numbered between 25,000 and 50,000, considerably greater than had been apparent in the 1960s. Wildebeest also occurred in other parts of Barotseland (Western Province), including Sioma Ngwezi National Park (5,276 sq km), which is situated in an area of mopane woodland in the extreme southwest of the country. [3]

Comments by P. Berry, in litt. November, 2006:

[3] The first aerial census of the Liuwa Plain was made in March 1970 by Leslie Allen, Barry Shenton, and myself with pilot Jack Uys, all of us from the Game Department. We obtained a total of 12,691 wildebeest on the Liuwa Plain, but some of the biggest groups of up to 2,000 were estimates. These, as often happens, may have been under-calculated. Quite possibly, the population was nearer 15,000-16,000.

Kafue Flats

The natural flooding regime of the Kafue Flats was severely affected by the construction of hydroelectric dams on the Kafue River at the western (Itezhitezhi) and eastern (Kafue Gorge) ends of the flats in the early 1970s. As a result, the area of seasonally inundated floodplain decreased, with the eastern end of the flats now permanently flooded and parts of the remaining floodplain permanently dry. The Kafue Flats lechwe population declined from 90,000 in 1970-72, before the closure of the dams, to 41,000 in 1981, but then stabilised until the late 1980s at 40,000-50,000 animals. The wildebeest population of Lochinvar National Park had increased to about 1,400 in 1972[4], but subsequently declined to a few hundred.

Kafue National Park

The wildebeest continued to be well represented in Kafue National Park, especially on the Busanga floodplain in the north, with an estimated population of at least several thousand.[5]

Luangwa Valley

Cookson's wildebeest remained common in the valley-floor areas of North Luangwa National Park, Luambe National Park, and the Nsefu sector of South Luangwa National Park (this sector lies on the eastern side of the Luangwa River). In Lukusuzi National Park (2,720 sq km), which is mainly plateau miombo woodland on the eastern side of the Luangwa Valley, the wildebeest was now described as "an occasional vagrant." The total population of Cookson's wildebeest was generally considered to be 5,000-6,000 individuals, although an aerial census in 1979 had suggested that it could be as high as 11,000.

1990s Status in Zambia

(From Jeffery et al. 1996, and references therein)

By the mid-1990s, poaching, encroaching settlement, illegal grazing by domestic livestock, uncontrolled fires, and lack of trained staff and equipment in the National Parks and Wildlife Service (NPWS) threatened the integrity of Zambia's protected areas system. In the absence of sufficient government funds, protection and management were poor or non-existent in many national parks and most game management areas. The only exceptions were those receiving external support from international NGOs and/or the bilateral donor community, such as North Luangwa National Park (Frankfurt Zoological Society [FZS]), South Luangwa National Park (Norwegian and Netherlands governments), and Lochinvar National Park (WWF). USAID and other donors also provided support to game management areas. Some poorly protected areas retained significant wildlife populations because they were in regions with few resident people.

Comments by P. Berry, in litt. November, 2006:

[4] I find it hard to believe that there were 1400 wildebeest on Lochinvar in 1972. I was there in that year, and never saw nor heard of such a number occurring there.

[5] Similarly, I question the estimate of "several thousand" wildebeest on the Busanga Plain in the 1980s. In October and November of 1972, I did ground counts of game in much of the KNP and saw a total of 570 wildebeest in the park and 87 in three of the adjacent GMAs. The Busanga and its periphery produced 359 wildebeest in total at a time when poaching was relatively light.

Barotseland

Despite being poorly protected and suffering from heavy poaching by meat-hunters from Zambia and Angola, Liuwa Plain National Park continued to support a large wildebeest population. The Liuwa Plain park is situated between two tributaries of the Zambezi, the Luanginga (or Luawanginga) and Luambimba Rivers, and comprises a huge flat 2,100 sq km plain of treeless grassland fringed with *Burkea* and *Baikiaea* woodland. Much of the park is flooded during the wet season. The wildebeest population was now known to be migratory, moving to the southeastern part of the Liuwa Plain towards the confluence of the Luanginga and the Zambezi from October to April, then northwest following the Luanginga River, leaving the park boundaries in May-June. The period June-August was spent up to 200 km or more to the west of the national park, in lightly wooded country in Zambia and Angola, where calving occured. The herds moved eastwards in August-September and re-entered Liuwa Plain National Park, congregating in one huge herd within the national park in September/October. In the 1990s, poaching by commercial meat hunters was exerting heavy pressure on the wildebeest and other wildlife of Liuwa Plain, with wounded animals frequently seen straggling behind the herds. No accurate counts had been made of this wildebeest population, but according to NPWS it numbered 25,000-30,000 and was apparently in decline from poaching.

A large part of Barotseland, to the west of the Zambezi River, lies within the vast West Zambezi Game Management Area (38,070 sq km), but very little wildlife was now to be seen in this area outside Liuwa Plain and Sioma Ngwezi National Parks. A few wildebeest survived in Sioma Ngwezi, but this park had suffered for more than 20 years from ongoing poaching, had no infrastructure, and lacked a permanent water supply. In the dry season, its wildlife was forced to run the gauntlet of heavy poaching to reach the Cuando River on the Angolan border to the west of the park.

Kafue Flats

Water flow on the Kafue floodplain was now almost entirely regulated by the two dams on the Kafue River, with a reduction in flood peaks and an increase in minimum flows compared to the former natural regime. The peripheral area of the floodplain, particularly the southern part, had become densely inhabited. Outside the two national parks, much of the flats, although included in the Kafue Flats Game Management Area (5,175 sq km), was now devoted to cattle grazing, and poaching of lechwe and other wildlife remained a major problem. Despite these adverse factors, the Kafue Flats lechwe population increased slowly during the late 1980s and early 1990s to reach about 65,000 head. Most of the lechwe were concentrated in and immediately south of Blue Lagoon National Park on the north bank of the Kafue River and in Lochinvar National Park on the south bank, extending into the adjoining game management area in diminishing numbers up to 14 km west of Lochinvar. Other surviving large wildlife species on the Kafue Flats, including wildebeest (now reduced to a population of about 200), had become confined to Lochinvar National Park.

Kafue National Park

Aerial surveys in the mid-1990s revealed that the wildlife of Kafue National Park had been reduced substantially by poaching, but the park still supported moderate populations of most species, and the habitat remained in good shape. Wildebeest numbers had apparently been affected less than those of some other species, with an estimated 2,750 in the park, including 1,750 (64%) on the Busanga Plain (960 sq km) in the north, and 990 (36%) in the southern region (3,796 sq km) [6]; very little wildlife survived in the central region, where poaching was heaviest. Observations of the Busanga Plain population confirmed that these animals moved to the plain in the dry season and into the adjacent woodlands in the wet season.

Luangwa Valley

A dry-season aerial survey of 31,000 sq km of the central and southern Luangwa Valley in October 1994 (Jachmann and Kalyocha 1994) produced a population estimate of about 5,500 Cookson's wildebeest for this part of the valley. Relatively small numbers were present in the three national parks within the survey area, South Luangwa (550 head), Luambe (175), and Lukusuzi (170). Almost all the wildlife observed from the air in Lukusuzi was in a small area on the border of the adjoining Lumimba Game Management Area; this park's miombo woodlands were devoid of wildlife apart from a few reedbuck and grey duiker, and it had been affected by illegal mining activities as well as heavy poaching. The bulk of the wildebeest population (4,600 individuals) was in two adjacent, relatively poorly protected game management areas, Lumimba (2,700 sq km) and Munyamadzi (2,500 sq km), which lie between North Luangwa and South Luangwa National Parks. The species had been reduced to a small remnant population, apparently by poaching, in Lupande Game Management Area to the east of South Luangwa National Park, and it was absent from the southern parts of the valley surveyed (Sandwe, Chisomo and West Petauke Game Management Areas). Numbers in the central part of the Luangwa Valley were substantially less than estimated from the 1979 aerial survey, but these estimates have wide confidence intervals and do not differ significantly.

The survey by Jachmann and Kalyocha (1994) did not include the northern part of the valley. A separate estimate of 4,700-6,000 wildebeest for North Luangwa National Park was provided by Delia Owens, with the caveat, "We have been conducting aerial censuses since 1986, so the figures should be somewhat accurate, although I am still convinced that such surveys are the most unreliable technique known to science!" (D. Owens, in litt. to Rod East, 1995). In light of more recent estimates for North Luangwa (see below), it is possible that the 1995 estimate for this park may have been inflated. An aerial survey by Kapungwe (1994) in November 1994 of the valley-floor section (8,354 sq km) of Musalangu Game Management Area (total area 17,350 sq km) in the northernmost part of the valley, to the north of North Luangwa National Park, produced a population estimate of 300 wildebeest; game populations in this section of the valley had been heavily depleted by poaching.

[6] The more recent figure of 1,750 for the Busanga Plain seems more realistic, though in Oct 1998 I counted (from the ground) only 193 wildebeest in one day over a large area of the Plains, a figure much less than my 1972 count (P. Berry, in litt., 2006).

These combined estimates suggested that the total number of Cookson's wildebeest in the Luangwa Valley protected areas in the mid-1990s may have been at least 10,000 head (perhaps less if the North Luangwa population was overestimated), with the main population stable in North Luangwa National Park. The status of the wildebeest reflected the overall status of antelope populations in the Luangwa Valley in the mid-1990s – generally stable populations in the better protected national parks (North Luangwa, South Luangwa, Luambe), relatively good numbers in a few game management areas, and depleted populations elsewhere.

Current Status in Zambia

In 1999-2000, NPWS underwent a rocky transition to the self-funding Zambia Wildlife Authority (ZAWA). Scout salaries dried up, half of NPWS's law enforcement staff were retrenched, and field operations virtually ceased for more than a year. As a result, poaching increased to even higher levels in most of the country's protected areas. Many of these areas now have severely depleted wildlife populations. Fortunately for the wildebeest, several of the areas in which it occurs were exceptions to this trend.

Barotseland

Until 2003, Liuwa Plain National Park continued to suffer badly from largely uncontrolled poaching by commercial and subsistence meat-hunters, to the point where several species of large herbivores were eliminated. The surviving wildlife, species such as zebra, tsessebe, and reedbuck, had become very wary of people and vehicles. Uncontrolled fires, tree-cutting, and commercial fishing were additional problems.

This situation has turned around since 2003-04, when African Parks, a Netherlands-based, not-for-profit foundation, signed a 20-year agreement for the management of Liuwa Plain National Park with ZAWA and the Barotse Royal Establishment. The objective of African Parks is to assist African governments through public-private partnerships to provide professional management and innovative finance for their protected areas, working in collaboration with local communities. The aim is to convert remote national parks into viable economic entities, in order to make them sustainable in the long term.

Since 2003, protection and management of Liuwa Plain National Park have been greatly enhanced and commercial poaching has been dramatically reduced (African Parks 2004). A major effort has also been made to provide benefits to local communities from the park. In 2004 there were 432 villages with close to 20,000 people living in and around the park; it was decided that these settlements should remain where they were, even though this could create long-term problems for the park's future. An aerial survey in December 2004 provided an estimate of 23,500 for the park's wildebeest population (Viljoen 2004). Plans are being considered to expand the park's boundary westwards towards the Angola border to include more of the wildebeest's dry-season range. This would be a major step toward securing the future of one of Africa's largest remaining migratory wildebeest populations.

The status of Sioma Ngwezi National Park has continued to deteriorate, to the point where its wildlife has largely been destroyed. As well as uncontrolled poaching, the settlement of thousands of people on the western boundary of the park has completely cut off access by the park's wildlife to the Cuando River, precluding the possibility of developing a dry-season water supply for the park. Consequently, African Parks abandoned plans to assist the rehabilitation of Sioma Ngwezi and shifted its focus to Liuwa Plain (African Parks 2003; African Parks 2004).

Kafue Flats

The Kafue Flats protected areas apparently suffered during and after the transition from NPWS to ZAWA. For instance, in Lochinvar National Park the game guards reportedly went on strike in mid-2003 because they had not been paid for several months. There were also reports of heavy poaching of lechwe and other wildlife on the Kafue Flats during this period. However, no recent estimates of the area's wildlife populations are available.

Kafue National Park

While Kafue National Park has suffered a long period of neglect since the 1980s, the situation has worsened in the last 5 years. After the formation of ZAWA, poaching reached new heights in the park and surrounding game management areas. Anti-poaching efforts have only recently improved (Booth et al. 2004). Except for a few localised areas, mainly in the north of the park, game densities are now extremely low, especially for charismatic species such as elephant, buffalo, roan, and sable. The park's institutional and physical infrastructure is described as "in a severely dilapidated state"; it is considered that rehabilitation will require sustained donor support over a long period, e.g., 10-15 years (Booth et al. 2004). Fortunately, such support appears to be on the horizon. A five-year World Bank project to rehabilitate Kafue National Park was scheduled to commence in 2005, with funding from donors such as the Global Environment Facility, NORAD (Norway), DANIDA (Denmark), and IDA (United Kingdom).

The situation in the northern region, including the Busanga Plain, is much less bleak, largely because of the continued presence there of the park's only two long-serving tourist lodges. In the late 1990s, a group of tour operators, lodge owners, and safari hunting operators with concessions in neighbouring game management areas saw the need to supplement the beleaguered efforts of NPWS/ZAWA to combat poaching. This group established the NGO Kafue Anti-poaching Company (KANTIPO), which has worked alongside, and in some cases in place of, ZAWA staff to supply logistical and personnel backup to the fight against poaching in northern Kafue National Park since 1997-98. In 2003, game densities were described as good in northern Kafue with poaching largely under control in the areas visited by tourists (Briggs 2003), and ZAWA was beginning to play a more active role in anti-poaching efforts.

While no recent estimates are available for wildlife populations, it is likely that the status of the wildebeest population of Busanga Plain, which comprises the bulk of the Kafue National Park population, has benefited from the rela-

tively high level of protection afforded to the northern section of the park in recent years. Hence there may still be 1,000-2,000 wildebeest in this part of the park, even if numbers have declined elsewhere.

Luangwa Valley

The ongoing, long-term FZS North Luangwa Conservation Project has played a major role in assisting ZAWA to develop and maintain high levels of protection and management of North Luangwa National Park and adjoining game management areas. Consequently, this park's wildlife populations, including the core population of Cookson's wildebeest, have not been affected by the recent upsurge of poaching in Zambia. In 2003, an aerial survey of the North Luangwa ecosystem (the park and its surrounding 10-km-wide buffer zone) gave a population estimate of 1,800 wildebeest with a 95% confidence interval of plus or minus 1,300 (E. van der Westhuizen, in litt., 2005). The wildebeest are normally found clumped on the floodplains close to the Luangwa River and some of its larger tributaries, which adds to the difficulty of obtaining precise estimates by extensive aerial surveys. This species' numbers in North Luangwa appear to have remained relatively stable over the last few years, although some of the open secondary grassland areas of the park are being recolonised by mopane which could be detrimental to grazers.

While the wildebeest's status appears to be satisfactory at present in North Luangwa, there are concerns it may be declining elsewhere in the Luangwa Valley. For instance, it is reportedly less common than before in the Nsefu sector of South Luangwa National Park and in some game management areas. South Luangwa has been the main focus of Zambia's wildlife tourism development and now has more than 30 lodges and bushcamps, mainly situated just outside the park on the eastern side of the Luangwa River in Lupande Game Management Area. Despite this strong tourism presence, or perhaps because of it (the tourism industry and resulting jobs and infrastructure have attracted more rural people to settle in the Mfuwe area), South Luangwa has suffered from increasing poaching since the late 1990s. This led to the formation of the South Luangwa Conservation Society, a private anti-poaching initiative analagous to KANTIPO in Kafue National Park, but poaching remains a serious problem.

An aerial survey of South Luangwa National Park and the adjoining Lupande Game Management Area by Dunham and Simwanza in 2002 produced an estimate of 530 wildebeest for these two areas combined (E. van der Westhuizen, in litt., 2005). This is similar to the estimate for this area in 1994, except that in 2002 almost all (98%) of the wildebeest were in Lupande rather than in the South Luangwa park, the reverse of the situation in 1994. It is not known to what extent this change reflects poaching pressures and/or localised movements. No recent estimates are available for Lumimba and Munyamadzi Game Management Areas, but the wildebeest is still common in this part of the valley between North and South Luangwa National Parks (Flack 2004). The total population of Cookson's wildebeest in the Luangwa Valley at present is unknown but is probably several thousand head, although the current population trend is unclear.[7]

[7] E. Sayer (in litt., 2006) points out that every year most grassland between the riverine belt and the mopane woodland was burnt, which he believes could be a major factor in the wildebeest's decline. "The effects of fire on their habitat has not been analyzed but the previous stronghold of Nsefu Sector (South Luangwa East Bank) (population 1990) circa 400 has been decimated to 30-40."

2.7 Malawi

1960s Status in Malawi

One of the smallest African countries, with an area of only 118,480 sq km (one-fifth of which is lake), Malawi (formerly Nyasaland) had and still has one of Sub-Saharan Africa's highest population densities. In 1961, Malawi had a higher population than Zambia, a country over six times larger than Malawi. Excluding Lake Malawi, population density was about 31 per sq km. For this reason, there was little wildlife in the country, particularly plains game, which had become rare by the end of the 19th century. No direct evidence indicates that wildebeest ever inhabited Nyasaland west of the lake or the Rift of the Shire River, which drains it on the south. However, it is possible, even probable, that Cookson's wildebeest (*C. t. cooksoni*) formerly occurred east of the Zambia-Malawi border in Kasungu District (Ansell, Benson & Mitchell 1962). At about 13 degrees S, 33 degrees 12' E there is open grassland called "Dambo la Nyumbwe", *nyumbwe* being the native name for wildebeest (the Swahili name is *nyumbu*).

According to Sidney (1965), the former range of the Nyassa wildebeest (*C. t. johnstoni*) in Malawi was bounded by Lake Malawi on the north, the Shire River on the west, and the Zambezi on the south. The alluvial plains of the river and Lakes Chilwa (Shirwa) and Chuita, shallow depressions surrounded by swamp and seasonal marshes, must once have supported a sizeable population. But as one of the best agricultural regions of the country, it was capable of supporting a large human population; therefore all the large conspicuous species of wildlife were fated to disappear. The few wildebeest that lingered at the south end of Lake Chilwa were finally shot out in 1925 (Sweeney 1959). But part of the same population apparently persists in adjacent Mozambique (Part 2.8).

Footnote

Occasional reports prior to 1980 of wildebeest in Kasungu National Park, which is on the Zambia border in western Malawi, presumably refer to Cookson's wildebeest which wandered up from the Luangwa Valley in Zambia; the miombo woodland habitat in Kasungu is completely unsuited to wildebeest, and the dispersal shows no signs of establishing a viable population (Bell 1989).

Majete Wildlife Reserve comprises 682 sq km of miombo woodland on undulating and hilly terrain on the west side of the Shire River in southern Malawi. This reserve was heavily poached during the 1980s and 1990s, but since 2003 it has been rehabilitated and managed by African Parks, a private Netherlands-based foundation, under an agreement with the Malawi government. Various species of wildlife which had become extinct in Majete were reintroduced in 2003-04; planned future translocations include Nyassa wildebeest from the Selous reserve in Tanzania (African Parks 2003), although Majete is outside the wildebeest's natural range.

2.8 Mozambique

1960s Status in Mozambique

Mozambique comprises a low-lying coastal plain (about half the country lies below 300 m) and an extensive inland plateau. Miombo woodland covers the plateau, with a mosaic of miombo (wetter areas on well-drained, sandy soils) and Bushveld (drier areas and poorer soils, including the lower valleys of the major rivers) on the coastal plain. The Bushveld is similar to that of the Transvaal and northern Kalahari and equally variable, including *Acacia* savanna, mopane woodland and broadleaf (*Terminalia/Pterocarpus/Combretum*) savanna. Mopane woodland occupies extensive areas on the western part of the coastal plain, in and between the valleys of the Limpopo and Save Rivers, the driest part of the country, and along the Zambezi River. On the coastal plain, the woodland and tree savannas are interrupted by extensive open grasslands and marshes, which occupy impermeable soils in valleys and slight depressions.

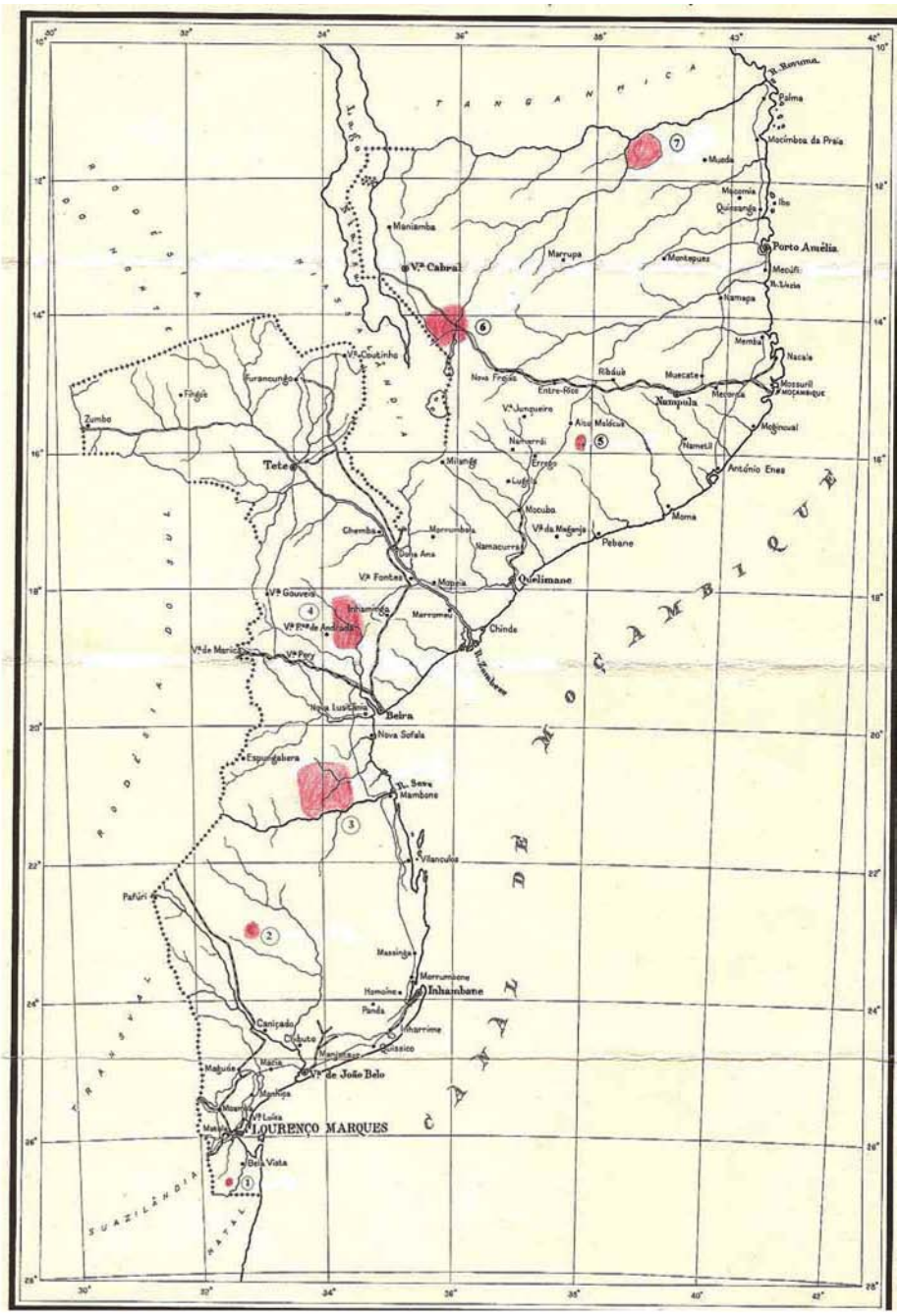
In former times the wildebeest was apparently widely distributed in the Bushveld, floodplain and Mopaneveld habitats of the coastal plain. North of the Zambezi, where the coastal plain narrows and miombo woodland dominates the landscape, wildebeest were largely confined to the larger river valleys like the Luria, Msalu, and Rovuma, and to a narrow strip behind the coast that afforded Bushveld and grassland habitat.

Since hardly any study had been made of wildlife in Mozambique, reliable, detailed information about any species was practically unobtainable. It is therefore possible to give only a very brief general account of wildebeest populations during this period. However, Dr. Travassos Dias of the Veterinary Laboratories of the University of Lourenço Marques provided information on the locations of seven populations, which apparently included most of the wildebeest surviving in Mozambique at the time, and the status of three of them (Figure 5).

Mozambique had a human population of 6.5 million in the 1960s, giving an average density of about 8 people per sq km, and had only begun enforcing hunting restrictions during that decade. Nevertheless, much of the country was considered a wildlife paradise until the 1950s. The presence of tsetse fly everywhere north of the Save River ruled out cattle ranching (there were only one million cattle in the country), while much of the southern coastal plain between Beira and the Limpopo, the very best game country, was largely unpopulated. What happened from about 1950 to the 1960s is reported by Spence (1963):

"The development of large-scale plantations of coconut palms, sisal, sugar and tea in the northern districts of Zambezia, Moçambique and Cabo Delgado, brought in its train the problem of feeding the thousands of Africans contracted to work on them. In accordance with existing regulations, all employers of labour had to supply their labourers with a properly balanced and adequate diet, which included protein in the form of meat or fish. Since the prevalence of tsetse fly ruled out cattle breeding, the obvious source of meat was the game itself, available on the doorstep, so to speak, in enormous quantities…

Figure 5: Map of Mozambique with wildebeest populations in 1960s hand-indicated by Travassos Dias (1967).



Professional hunter's licenses were easy to get and shooting restriction lax, with the result that it was not long before there were over a hundred of these hunters in action, each employing brigades of Africans to do the shooting for them. Since meat was the objective, the larger animals became the main target of these gangs who slaughtered on such a scale that they not only supplied the meat needs of the plantations, but also sold to Africans and traders.

"The result was uncontrolled slaughter on such a scale that the country between the Zambezi and Rovuma Rivers, which used to teem with game, ha[d] been almost completely denuded of wildlife… Only two closed game reserves, one along the Rovuma River in Niassa District, the other near Gile in Zambezia District, were spared."

Alarmed at last by the scale of the slaughter, the Portugese colonial government called a halt to hunting and passed much stiffer game laws in 1960, severely restricting the activities of professional hunters. The best game country on the coastal plain was divided into 16 shooting blocks leased to safari hunting firms, each responsible for controlling poaching and overshooting on its own land.

As of 1963, Spence summed up the status of wildlife south of the Zambezi as follows: the district of Manica e Sofala, which included the Gorongosa Game Park, was "still a hunter's paradise." In the inland arid area between the Save and Limpopo Rivers, "there were still reasonable quantities of game." But near the border with Zimbabwe, from the Save River southward, all game was slaughtered in a campaign to halt the advance of tsetse fly into Zimbabwe and South Africa. The destruction of game across the border in Zimbabwe's Gonarezhou Game Reserve (Part 2.2) was part of the same campaign.

From Inhambane, just south of the Tropic of Capricorn where the country narrows, population and agriculture increased rapidly, and game grew scarce. There was "still a certain amount" along the Transvaal border south of the Limpopo, owing to the proximity of Kruger National Park, but between Lourenço Marques and the Zululand border, "only a relatively small supply remains owing to increasing European settlement."

The distribution of wildebeest indicated by Dias (personal communication, 1967), if inclusive of the main remaining populations, suggested a further decline in Mozambique's game during the preceding five years.

(a) South of Lourenço Marques near the Zululand border [(1) on the map], Dias said there was "a great population" 30 years prior, which "was damaged by the troops, when trying to obtain protein." Afterwards, the area was left open to hunting; for this reason, "the population never recuperated from the massacre by the Army." Now about 50 remained on the Tembe Plains. Because this is apparently the same population referred to by Sidney (1965) as "nearing extinction" in the 1950s, and which was still hunted, it displayed remarkable tenacity, particularly as its movements were strictly curtailed by fencing on surrounding farms. As in the nearby Natal game reserves, these wildebeest shelter in relatively dense woodlands as well as using more open country.

(b) Another relic population of unknown size (2) inhabited an area of mixed Mopaneveld and Bushveld northeast of the Limpopo River within Gaza District.

(c) Between the Save and Gorongosa Rivers in Manica and Sofala District, there was a population (3) that Dias estimated at about 5,000 head. The preferred habitat was open *Acacia* parkland and broad-leaved deciduous (*Afzelia/Terminalia*) tree savanna. Since food and water were well distributed the year round, Dias considered the population sedentary. According to W. von

Alvensleben (personal communication, 1967), whose firm, Safarilandia, leased a hunting concession of approximately 20,720 sq km on both sides of the Save River, the total number of wildebeest in the general area was around 35,000 to 40,000 and increasing.

(d) Gorongosa National Park (4) – Situated 160 km northwest of Beira on either side of the Urema River, this is the one place in Mozambique well-known to the outside world for wildlife. Though far smaller than South Africa's Kruger National Park, the game is also far more concentrated, particularly on a vast floodplain bordering the Urema where "great herds of waterbuck, zebra, and wildebeest can always be seen grazing on the short runner grass that alone grows in that salty soil" (Spence 1963). The plains are fringed by yellow-barked fever trees, and clumps of deciduous trees and bushes occupy slight elevations. Aside from the Urema and Punga Rivers, the park is dotted with ponds and lakes.

Apparently no wildlife census was attempted, but according to Silva (1965), the gnu was "found throughout the park, in very large numbers, especially on the open plains and open woodland." The population was apparently sedentary, although aggregations concentrated on the floodplain grasslands bordering the Urema, when waterholes dried and/or the grazing on the taller grasslands of the interior was burnt off in the dry season.

(e) Dias identified three additional populations, of unknown status (Figure 5): in Gile Game Reserve in Zambezia District (5), and two in the far north of the country, in the area of the upper Lugenda River on the Malawi border near Lake Chilwa (6), and near the confluence of the Lugenda with the Rovuma River (7), which forms the border between Mozambique and Tanzania.

1980s Status in Mozambique

(From Tello 1989, East 1999, and references therein)

During the 1970s, knowledge of Mozambique's wildlife advanced considerably through the efforts of Smithers, Tello, Tinley, and others. Encouraging developments in conservation received government support following independence, but were not consolidated. Hunting was legally closed, but poaching and illegal trade in wildlife products were practised widely by all sectors of society, including military personnel, rural people, and anti-government rebels. By 1980, Gorongosa National Park was the only fully staffed conservation area in the country, and even there the situation was worsening with a lack of equipment for anti-poaching patrols. The status of wildlife continued to deteriorate during the 1980s. Increasing guerrilla hostilities and civil conflict forced the government to abandon protected areas, and all parks and reserves apart from the offshore islands of Bazaruto were militarily occupied. The various armies slaughtered most of the country's remaining wildlife with weapons ranging from assault rifles to helicopter gunships. Uncontrolled hunting for meat by rural civilians also contributed to the destruction of wildlife.

By the late 1970s, the wildebeest was already extinct throughout much of its former range in Mozambique. The surviving populations were largely as described in the 1960s (see above) except that the relic population on the

Tembe Plains south of Lourenço Marques (now Maputo) had disappeared. The Zambezi River was confirmed as the approximate southern limit of the subspecies *C. t. johnstoni*, with *C. t. taurinus* occurring south of the Zambezi, although the white facial marking characteristic of *johnstoni* also occurred at low frequencies in some populations which were regarded as belonging to the nominate subspecies, e.g., in the Save Valley.

The bulk of the country's surviving wildebeest were in Gorongosa National Park (3,770 sq km), where the population was estimated to number 12,500-16,000 in 1980. No subsequent estimates were available, but it was known that mortality from poaching escalated to high levels after 1980. Other surviving populations were already greatly reduced by the late 1970s/early 1980s. The wildebeest population of Banhine National Park (7,000 sq km), which had been established in 1972 in the area of Gaza Province northeast of the Limpopo River where Dias described a "relic population of unknown size" in the 1960s (see above), had been reduced to a declining remnant of about 100. In Zinave National Park (5,000 sq km), which was established in 1972 to the north of Banhine on the southern side of the Save River, there were about 100 wildebeest remaining in 1979; these animals were continuing to be shot for the rations of soldiers quartered in the Zinave Camp. The species was "on the verge of extinction" in Gile Game Reserve. In the far north, the population identified by Dias (see above) in the area of the Lugenda-Rovuma confluence occurred in and around Niassa Game Reserve, where there were estimated to be about 200 wildebeest in 1977. As for Gorongosa, no further information on these populations was available during the 1980s.

1990s Status in Mozambique

(From East 1999, Burlison et al. 2001, and references therein)

The 1992 peace accord between the Maputo government and rebel forces brought an end to almost two decades of civil war. The conflict left Mozambique in tatters with a ruined economy, towns and cities battered and isolated, and large stretches of land depopulated. The massive task of rebuilding the economy and the country's infrastructure then commenced, including redevelopment of wildlife conservation. Aerial surveys in the mid-1990s confirmed that most of the wildlife in areas such as Gorongosa National Park had been shot out during the war.

Rehabilitation efforts commenced with support from international donors in areas such as Gorongosa and Gaza Province; in the latter, a transfrontier conservation area was envisaged that would link 70,000 sq km of Gaza, extending from Coutada 16 on the South Africa border to Banhine and Zinave National Parks, with the contiguous Kruger National Park. In the mid-1990s, the Mozambican company Madal, owned by a Norwegian businessman, Halvor Astrup, commenced a privately funded conservation initiative in the remote Niassa Game Reserve in the far north. This area had been largely depopulated during the civil war as local communities fled to neighbouring countries; it consequently retained some of Mozambique's largest surviving wildlife populations.

By the late 1990s, it had become apparent that *C. t. taurinus* was almost extinct in Mozambique; the subspecies had apparently disappeared from Banhine and Zinave National Parks and was close to extinction in Gorongosa, where there were unconfirmed reports of sightings in 1997. The only confirmed survivors were a small number (perhaps 30) in Coutada 16 in Gaza Province. North of the Zambezi, there was no information from Gile Game Reserve or the upper Lugenda/Malawi border area, but *C. t. johnstoni* survived in the Niassa reserve, where a 1998 aerial survey of the reserve and its surrounding buffer zone (42,340 sq km) produced a population estimate of 770 wildebeest. The bulk (80%) of these animals was outside the reserve in the southeastern part of the buffer zone.

Current Status in Mozambique

C. t. taurinus

Considerable progress has been made in developing the Gaza transfrontier conservation area. Limpopo National Park (formerly Coutada 16) was proclaimed in 2000. This park covers 8,775 sq km with a 2,349 sq km buffer zone (in which sustainable utilization of natural resources by local communities will be permitted) on its eastern border. The formation of the Greater Limpopo Transfrontier Park (35,000 sq km) linking South Africa's Kruger National Park, Mozambique's Limpopo National Park and the adjoining area of Zimbabwe was formalised by the three countries' heads of state in 2002 (Parts 2.1, 2.2, and 4). It is envisaged that the transfrontier park will eventually be managed as a single, integrated unit.

Game densities are currently very low in the Mozambique section (Limpopo National Park), but considerable progress has been made in preparing a management plan, boundary demarcation, development of a voluntary resettlement policy (there were 21,000 people living in and around the new park when it was proclaimed), and removal of land mines that were laid during the civil war. Commencing in 2002, almost 2,000 animals, including a few hundred wildebeest, were translocated from Kruger National Park to a fenced 350 sq km sanctuary in the southern part of Limpopo National Park (Anonymous 2002; Anonymous 2004). Once the people living in the park have been resettled, it is planned to remove the sanctuary's perimeter fence to allow game to move northwards into the Shingwedzi River basin, which will be the core tourist area of Limpopo National Park. There will also be natural dispersal of wildlife across the border from South Africa, once Kruger's eastern boundary fence is removed.

However, natural dispersal of wildebeest from Kruger National Park may be limited, since Limpopo National Park adjoins the northern section of Kruger, where the Mopaneveld supports only a small population (Part 2.1). A small portion (20 km) of the Kruger boundary fence was dropped in 2003, in areas where it could be removed safely without causing boundary transgressions in the early stages of the transfrontier park's development. Removal of the boundary fence was scheduled to resume in 2005, when it was planned to take down another 50 km.

The current transfrontier park is the first phase of a larger conservation area of almost 100,000 sq km that will eventually include Banhine and Zinave National Parks, Corumana and Massingir development areas, and interlinking areas in Mozambique. The Banhine park is currently being rehabilitated with support from the African Wildlife Foundation; a recent survey of Banhine's wildlife confirmed that the wildebeest is now extinct there, along with other large species such as elephant, hippo, giraffe, zebra, and eland (Stalmans 2005).

The wildebeest has apparently also gone from Gorongosa National Park; none was seen during a 2004 aerial survey or in reconnaissance flights over the park (Dunham 2005). A similar fate has befallen Gorongosa's formerly abundant zebra herds.

C. t. johnstoni

Following on the initiative by Madal, since 1998 Niassa Game Reserve has been managed under a public/private sector partnership. The government retains ownership of the land and its wildlife resources but has granted a long-term lease to Sociedade de Gestao e Desenvolvimento da Reserva do Niassa (SRN) to manage and develop the reserve. In 1999, the reserve was almost doubled in size to 23,040 sq km and a 19,239 sq km buffer zone established on its western, southern, and eastern borders (the northern border is the Rovuma River), making a total protected area of 42,279 sq km. The buffer zone is divided into blocks which are contracted out to private sector operators for management, mainly for safari hunting.

Niassa Game Reserve comprises a gently undulating plateau at around 300-600 m altitude, rising to a higher plateau and hills in the west at around 1,370 m and gradually falling to 150 m at the confluence of the Rovuma and Lugenda Rivers in the northeast. The first detailed vegetation surveys of the reserve did not take place until 2003 (Timberlake et al. 2004); more than 90% is covered with miombo woodland which includes numerous, poorly defined dambos along drainage lines. The miombo is taller and denser in the west of the reserve, where rainfall is higher. As altitude and rainfall decline towards the east and in the major river valleys, there is a mosaic of vegetation, with miombo becoming less common and drier woodland types such as *Millettia* and *Combretum* becoming dominant; in the driest areas, *Acacia* tree savanna occurs around clay-rich pans.

The success of SRN's efforts in protecting and developing the Niassa reserve is illustrated by the general increase in wildlife populations since 1998, as revealed by regular aerial surveys (M. Souto, in litt. December 2005). Between 1998 and 2002-04, estimated populations increased for a wide range of species, such as elephant (from 8,700 to 12,500), sable (from 7,100 to 13,500), buffalo (from 2,100 to 6,500), eland (from 1,400 to 3,000), Lichtenstein's hartebeest (from 1,500 to 3,600), and waterbuck (from 300 to 1,200). In contrast, estimated wildebeest numbers have remained stable at about 600 to 900. This suggests the wildebeest population may be limited by the availability of suitable habitat; much of the plateau miombo woodland in the western and central parts of the reserve is clearly unsuitable for this species.

The long-term prospects for Niassa Game Reserve will be enhanced by the establishment of the Selous-Niassa Wildlife Corridor linking it with Tanzania's Selous Game Reserve (Part 2.9), which retains the largest surviving population of the Nyassa wildebeest.

No information is available on the survival of the Nyassa wildebeest in northern Mozambique outside the Niassa reserve area.

2.9 Southeastern Tanzania

1960s Status in Tanzania

In southeastern Tanzania as in northern Mozambique, the flora is predominantly miombo woodland (average annual rainfall 81-112 cm), and the wildebeest (*C. t. johnstoni*) is found primarily in the valleys of the major rivers, through which corridors of acacia savanna and valley grassland penetrate the miombo. The largest of these valleys is formed by the Great Ruaha and Rufiji Rivers which after joining 160 km from the coast, widen out into a great delta. Though wildlife has been pushed back from the coast by a burgeoning human population, the Rufiji/Great Ruaha valleys remain the distribution centre of Nyassa wildebeest in Tanzania.

According to Sidney (1965) the Nyassa wildebeest was "generally distributed throughout the Southern Province and in parts of Eastern Province." But according to B. Nicholson (personal communication, 1967), Principal Game Warden of the Eastern and Southern Regions, "whilst the species formerly occurred over the greater part of this zone in suitable areas, from the Rovuma River northwards to the Wami and from the coast at Bavuma on the Mavuji estuary, westwards to the vicinity of Songea, for practical purposes the main habitat now is the Selous Game Reserve and the Mikumi National Park."

Selous Game Reserve

This reserve covers 29,816 sq km around the Great Ruaha, Rufiji, Kilombero, Mbarangandu, and Matandu Rivers. The typical vegetation of the reserve is miombo woodland, with limited open mbugas fringed by mixed *Combretum* spp. and *Cassia* spp. Wildebeest in sedentary herds usually of between 20 and 40 head were found in the most open parts of this kind of habitat over the greater part of the reserve (B. Nicholson, personal communication, 1967).

Two other areas of the reserve in which wildebeest occured, often in sizeable concentrations, were more open and less floristically typical of the region (B. Nicholson, personal communication, 1967):

In the northeast, between the Rufiji and Ruvu Rivers, the country is undulating *Acacia* tree savanna, interrupted by thickets of *Spirostachys* and other shrubs. Approximately 10% of the area consists of seasonally flooded plains of black cotton soil where wildebeest concentrated early in the rains, apparently attracted by sprouting grasses. In May, June, and July, wildebeest concentrated in areas where *Themeda triandra* was sprouting fresh leaves, when most other grasses have become unpalatable.

On the eastern border of the reserve between the Lungonya River and the Tundu Hills, wildebeest utilized an area of treeless flood plain on alluvial hardpan bordered on the west by open *Terminalia/Acacia* woodland and taller miombo woodland. As in the northeast of the reserve, wildebeest concentrated on the flats early in the rains and on the *Themeda* pastures of the sandy ridges in May-July.

In these areas of extensive open country, Nicholson described the gnu as semi-nomadic, concentrating in greatest numbers during the dry season and at the beginning of the rains and dispersing during the rainy season.

In such a huge, largely wooded area as the Selous reserve, wildlife censusing is very difficult. No estimate of the wildebeest population had been made; it could only be said that it "runs into many thousands". Nicholson reported that gnus were on the increase, due to elimination of poaching and "a succession of years with rains at the critical time of the dry season, bringing about a high survival rate of calves."

Mikumi National Park

Mikumi is a small (450 square miles) park situated a little north of Selous Game Reserve at the south end of the Mkata Plain. It consists mainly of low-lying floodplain grassland surrounded by forested foothills and mountains. The park was gazetted in 1964. The plain runs north and south for about 160 km along the Mkata and other tributaries of the Wami and Great Ruaha Rivers.

In May 1968, the Warden, S. Stevenson (personal communication), estimated the park's wildebeest population at 4,000. However, only about 1,300 were counted during an aerial census early in 1967 (G. Child, personal communication, 1967). As this count was made during the rainy season dispersal period, when most of the plain was flooded, many wildebeest were possibly overlooked in the bordering woodland. Following the area's being made into a national park, it seemed likely that its wildlife populations would increase. But wildebeest and other game were scarce on the rest of the Mkata Plain, due to long-standing competition with domestic stock and shooting, and seemed likely to disappear unless protected.

1980s Status in Tanzania

(From Rodgers & Swai 1988, and references therein)

Aerial surveys conducted in 1979 and 1986 revealed the enormous numbers of wildlife harboured by the vast Selous Game Reserve (43,000 sq km) and the now contiguous Mikumi National Park (3,230 sq km) on its northern boundary. This included an estimated 65,000-70,000 wildebeest in the Selous reserve, which were concentrated on the short-grass areas in the east and northeast of the reserve, and an additional 12,500 wildebeest in Mikumi. But the region's wildlife populations were also under increasingly severe pressure from poaching. The levels of protection and management of Tanzania's protected areas declined markedly in the late 1970s and early-mid 1980s as a result of the country's economic difficulties at that time.

By the mid-1980s, organized gangs of commercial poachers had reduced the Selous reserve's elephant and black rhino populations to such an extent that it was proposed as one of the world's most endangered protected areas. While poaching of antelopes for meat was conducted primarily on a smaller scale by local people rather than by large-scale, organised poaching gangs, the 1986 aerial survey suggested that zebra and some antelope species were also in decline because of illegal offtake, especially in the eastern part of Selous Game Reserve. It was recognised that there was an urgent need to re-introduce effective anti-poaching measures to the Selous reserve.

1990s Status in Tanzania

(From TWCM et al. 1997, references therein, and additional references cited)

A dry-season aerial survey conducted by Tanzania Wildlife Conservation Monitoring (TWCM) in September 1994 showed that the Selous ecosystem (92,000 sq km) continued to support major wildlife populations. This included an estimated 72,000 wildebeest, of which 46,000 were within Selous Game Reserve, 1,000 in Mikumi National Park, and 25,000 in the game reserve surroundings. Comparison with similar aerial surveys in 1989 and 1991 suggested that numbers were stable. Wildebeest occurred in two large concentrations during the dry season, on the northern and northeastern boundaries of the game reserve, with each concentration partly outside the reserve boundary. The species was also observed at lower densities throughout the northern and central parts of the reserve, where it occurred mainly in small groups.

A subsequent dry-season aerial survey in October 1998 (TWCM 1998), which covered a larger area (98,725 sq km), produced a total population estimate for the ecosystem of 115,000 wildebeest, including 44,000 in Selous Game Reserve, 4,000 in Mikumi National Park, and 67,000 on surrounding lands. Despite the larger population estimate, the 1998 count was not significantly different from previous counts because of the large standard errors and wide confidence intervals of these population estimates.

The generally healthy state of the Selous Reserve's wildlife populations during the 1990s reflected the results of the Selous Conservation Programme (SCP), initiated in 1988 under bilateral assistance to Tanzania from Germany through the German Agency for Technical Cooperation (GTZ). The SCP focused initially on anti-poaching actions. The reserve's ranger force was re-equipped and motivated to resume anti-poaching patrols. Poaching was effectively suppressed by 1990 and has remained at low levels since. Some poaching of buffalo and antelopes for meat continued, mainly along parts of the reserve's boundaries, but the illegal offtake was probably less than 25% of the natural increase.

The emergency anti-poaching phase of the SCP subsequently developed into a systematic rehabilitation and development programme for the game reserve and rural communities on surrounding lands. Under the reserve's management plan, much of the area was utilized for trophy hunting, which generated about 90% of the reserve's revenue. A retention scheme introduced in 1993 enabled the game reserve to retain 50% of its total revenue for investment, operating costs, and allowances and incentives to game scouts. Consequently, the ranger force became well paid, vehicles and equipment could be purchased, and the reserve became increasingly well managed throughout the 1990s. A village wildlife utilization scheme was established in the buffer zone surrounding the reserve, with participating villages receiving quotas (mainly buffalo and wildebeest) for subsistence meat hunting. The legal offtake under this scheme of less than 1% of the wildlife population on village land was soon more than compensated by the reduction in poaching.

Observations in the 1990s confirmed that in the northern part of the Selous ecosystem, north of the Rufiji River, only 1% of the wildebeest have the clearly marked white stripe over the nose which is characteristic of *johnstoni*, whereas all of those south of the Rufiji have this stripe.

Mikumi National Park was not as well protected as Selous Game Reserve during the 1990s and was affected by encroachment of settlement, agriculture, and timber extraction. It is unclear to what extent the fluctuations of the park's wildebeest population, as estimated by aerial surveys, reflected real change, and if so whether this resulted from loss of animals to poaching or movement out of the park into adjoining areas.

Current Status in Tanzania

The most recent aerial survey of the Selous ecosystem was conducted in the late dry season in October-November 2002 (TAWIRI 2002). This produced a population estimate of about 57,000 wildebeest for the entire area surveyed (89,362 sq km), including 56,000 in Selous Game Reserve, 800 in Mikumi National Park, and 400 in a 1,138 sq km area to the north of the national park. Comparison with previous aerial surveys revealed no statistically significant differences in wildebeest population estimates over the period 1989-2002. As well as large standard errors, aerial surveys of wildlife populations in savanna woodland habitats are subjected to unknown levels of error through factors such as observer differences and undercounting bias through some animals being obscured by vegetation. The available evidence suggests the Selous ecosystem has supported a stable population of at least 50,000-75,000 Nyassa wildebeest since the 1980s, with about two-thirds of these within the game reserve.

The SCP has been outstandingly successful in rehabilitating Selous Game Reserve, which remains effectively safeguarded at present (Baldus et al. 2003). The conservation status of the reserve's buffer zone has also been improved greatly. By 2003, 50 villages in five districts were participating in the community wildlife management scheme in the areas surrounding the reserve, with a consequent reduction in poaching and the return of wildlife to areas where it had been absent for many years.

But the Selous ecosystem will face new challenges in the future, e.g., with the completion of the SCP in 2004 the reserve's budget will be reduced by more than 50% in the next two years. Human settlement is increasing in the region, particularly to the north and west of the protected areas, and developments such as mining for precious stones and the proposed construction of the Kidunda Dam on the Ruvu River at the northeastern tip of the reserve could threaten its wildlife (Baldus 2005). This dam, which is proposed to improve the water supply to Dar es Salaam, would destroy an important dry-season concentration area for >10,000 wildebeest and a wide range of other wildlife species in the northern Selous (Rustagi 2005).

While the SCP has now finished, German support is continuing for the development of the Selous-Niassa Wildlife Corridor in cooperation with UNDP. This corridor covers about 8,000 sq km and extends from the southwestern boundary of Selous Game Reserve to the Ruvuma River in the Niassa Game Reserve area on the Mozambique border. It will enable wildlife movements to continue between these reserves through the establishment of a network of village wildlife management areas. The proposed corridor supports significant wildlife populations, especially species such as elephant, buffalo, and sable antelope. The wildebeest is among the less common species, probably because

of poaching (Baldus 2005); in October 2000, a dry-season aerial survey of the corridor and surroundings (12,747 sq km) gave a population estimate of 200 wildebeest (TAWIRI 2000). But establishment of this corridor may be of major importance to enable continued genetic exchange between the Nyassa wildebeest populations of the Selous and Niassa reserves. A few wildebeest also survive to the east of the corridor and southeast of Selous Game Reserve, at least as far southeast as the small Msanjesi Game Reserve where there are currently 40-50 wildebeest, but none survives further south in the slightly larger Lukwika-Lumesule Game Reserve and adjoining areas (Baldus 2005). Poaching is an increasing problem throughout this region.

There is a small, introduced wildebeest population of a few hundred individuals in Saadani National Park (1,100 sq km), situated on the Tanzanian coast in the region of the Wami and Mligazi Rivers, to the northeast of the historical range of the Nyassa wildebeest. Saadani contains coastal savanna and forest. It was gazetted as a game reserve in the 1960s. Various non-indigenous wildlife species, including wildebeest and zebra, were introduced and indigenous species such as eland and lion reintroduced to join the resident populations of species such as elephant, buffalo, giraffe, and sable. Protection and management of the reserve was enhanced, and it was enlarged to its present size with German bilateral assistance commencing in 1998. This resulted in the upgrading of Saadani to a national park in 2003 (Baldus et al. 2001; Treydte 2004). The wildebeest which are now a common sight in Saadani are of the eastern Masailand subspecies *C. t. albojubatus*.

2.10 The Eastern White-Bearded Populations

1960s Status of the Eastern White-Bearded Populations

The white-bearded gnu inhabits the plains of East Africa. This savanna biome is divided into two distinct faunal regions by the Gregory Rift Valley with its associated highlands. While the Rift is not a complete faunal barrier, many ungulates occur in distinct subspecies on the eastern and western sides. The eastern white-bearded (*C. t. albojubatus*) and western white-bearded (*C. t. mearnsi*) wildebeests are separated by the western wall of the Gregory Rift.

The plains of northern Tanzania and southern Kenya were made famous by legions of explorers, hunters, and naturalists as the very essence of wild Africa. Visitors to the American Museum of Natural History have seen it in the superb dioramas of Carl Akeley's African Hall: the endless plains rolling into the empty distance, relieved by inselbergs standing like pyramids above the desert; the miniature rock kopjes where hyraxes live and where leopards and lions often lie up; the 1,000-foot wall of the Gregory Rift, overlooking shallow alkaline lakes and the arid low country with its moonscapes of termite mounds, gall-acacia scrub, candelabra euphorbias, and elephantine baobabs, all shimmering with heat waves. This superb setting exists as the background to the life of the plains, to numbers and variety of large mammals greater than anywhere except possibly the South African highveld: the wildebeest, zebra, Thomson's and Grant's gazelles, kongoni, eland, giraffe, waterbuck, topi, warthog, and the rest.

One can still see what it was like before the arrival of the European – in the dioramas of African Hall. No great game concentrations exist any more east of the Rift Valley. There are only pitiful remnants that barely suffice to relieve the monotony of empty plains. Fortunately, in the Serengeti Plains, Ngorongoro Crater, and the Mara Plains of Kenya – all to the west of the Rift Valley – the spectacle of plains wildlife is still preserved in all its original grandeur. Hopefully it will continue to survive for generations to come, as a living diorama of the African fauna, which Huxley (1965) called "the only easily accessible and readily studied remaining portion of the world's pre-human climax community at its tropical richest."

Eastern Masailand, Tanzania

The range of *C. t. albojubatus* in Tanzania lies on the Masai steppe, semi-arid to arid *Acacia* savanna and open plains lying between 915 and 1,830 m, with rainfall of 38-64 cm. Most of it is devoid of water in the dry season. It is bounded on the west by the western Gregory Rift wall, on the south by miombo woodland and dense bush, and on the east by the broad valley of the Pangani River. To the north, the eastern Masailand population extends up the Rift Valley to the vicinity of Lake Magadi in Kenya and eastward to Amboseli Game Reserve, just north of Kilimanjaro. The Kenya populations of *albojubatus* will be considered separately.

Like the gnu populations of the northern Kalahari region, to which the Masai steppe is comparable, the main population of eastern Masailand was nomadic and migratory. There were also several small satellite populations with sedentary habits in areas with permanent water. In pre-colonial days, the open grassland and *Acacia* savanna which covered virtually the whole of Masailand formed the wet-season dispersal area for wildebeest, zebra, and Thomson's gazelle, the three most numerous and most migratory plains species. In the dry season, these and other water-dependent herbivores (buffalo, elephant, rhino, waterbuck, warthog, etc. and cattle) concentrated around sources of permanent water.

The amount of game that inhabited eastern Masailand in former times is unknown. Considering that the Serengeti region currently carries over a million head of large mammals, the far larger area of eastern Masailand could presumably have carried at least as many. Surely the gnu population must have numbered at least 100,000 at the end of the 19th century.

While hunting and the 1896 rinderpest pandemic surely reduced game numbers, the decisive blow to the wildlife of eastern Masailand has been the progressive destruction of their habitat and the curtailment of their dry-season range by the tremendous overstocking of cattle, sheep, and goats since the introduction of European methods of veterinary care. Most of all, deprivation of watering places caused the decline of wildlife (H.F. Lamprey, personal communication, 1967). Exclusion of game animals from dry-season water supplies reserved for livestock and agricultural development may have been primarily responsible for the great reduction of the region's wild animal populations in the first half of the 20th century. Lamprey (1964) documents the loss of most of Masailand's major dry-season water supplies.

Due in great measure to the unsparing efforts of European agricultural and veterinary officers, Masailand has been subjected to tremendous overstocking of cattle, sheep, and goats. African pastoralists, who reckon a man's wealth by the number of cattle he owns, were only too happy to adopt prophylactic measures such as dipping and spraying that cut down the once-high mortality rate of their herds. By the early 1960s, only three important dry-season concentration areas for wildlife remained in eastern Masailand, all in the Rift Valley: two in Tarangire National Park and the third to the north of Lake Manyara. The main wet-season dispersal areas for wildebeest had become confined to the Simanjiro Plains east of Tarangire, and the Rift Valley east and south of Lake Natron (Lamprey 1964). Lamprey estimated the size of the main wildebeest population at 8,000-9,000, of which about 7,000 concentrated on the Manyara Plain in an area of about 52 sq km, and the balance (censused at 1,200) at Tarangire. The proposed Masailand cooperative ranching scheme possibly spelled the end of the main population.

Apart from the main migratory wildebeest population, several small, more or less sedentary populations existed in eastern Masailand, each comprising a few hundred animals.

The Ngaserai water furrow (irrigation canal), flowing through the open Ngaserai Plains northeast of Mt. Merus and west of Kilimanjaro, supported between 400 and 600 wildebeest, as well as a few hundred zebra and gazelles (Lamprey 1964 and personal communication, 1967). Although restricted to a comparatively small area, the members of this population dispersed in all directions during the rains. Whether any were truly resident was not known.

A little further south, 250 to 350 wildebeest inhabited the Sanya Plains, an area of about 78 sq km that lies between Arusha and Moshi. A few hundred zebras and gazelles also survived here. They concentrated near the Kikuletwea River in the dry season, and dispersed to the southwest and northwest in the rains, like the Ngaserai population, with which they then probably made contact.

The only resident population in a protected area was that of the small Lake Manyara National Park. The terrestrial component of this park, comprising an alluvial plain about 48 km long but hardly 1.5 km wide on the western side of the lake, supported approximately 700 wildebeest in 1961. In that year and for several years afterward, unusually heavy rains fell in northern Tanzania, with the result that Lake Manyara rose and spread, gradually engulfing the strip of plains grassland. As their habitat shrank, so did the wildebeest population, apparently because of both malnutrition and increased predation by the park's lions and spotted hyenas. Increasing settlement and cultivation around the northern and southern ends of the park eventually cut off access to the Masai steppe. By 1965, only seven wildebeest were left in the park (Watson & Turner 1965); the last wildebeest vanished before the end of the year.

Another isolated wildebeest population occurred on the Wembere Plains. This open grassland stretches 320 km southeast from Lake Eyasi, occupying the northern end of a long trough that represents a spur of the eastern Rift Valley, now separated from the main Rift by the Mbulu Highlands. The Eyasi-Wembere Plains lie close to but are separated from the Serengeti Plains by a belt of dense woodland and broken rocky country, and wildebeest collected here showed the characteristics of *albojubatus* rather than *hecki* (= *mearnsi*) (Brooks 1961). Vesey Fitzgerald (1954) described the Wembere Plains as badly overgrazed by large numbers of domestic livestock and the game population of the open plains as "very low".

The Kenya Populations

In Kenya, as in Tanzania, the wildebeest inhabited the Masai country – an adjoining area of about 41,440 sq km with similar climate and vegetation. In the 1960s, the range of the eastern race was situated almost entirely within Kajiado District, from the Rift Valley north to Nairobi, southeast along the Kenya-Uganda railway line to the Chyulu Hills on the western border of Tsavo National Park, and then south to the Tanzania border. At one time the gnu ranged over most of this area. But degradation through overgrazing of the former *Acacia* savanna climax to nyika thornbush, which is both an unsuitable habitat for wildebeest and an ecological barrier to its movements, fragmented this population. The wildebeest of the Athi-Kapiti Plains south of Nairobi were now virtually isolated from those of southern Kajiado, which in turn appeared to be broken up into more or less separate eastern and western populations.

The Kenya Rift Valley Population

Southern Kajiado District is relatively hot and dry, with annual rainfall of 25-50 cm. The hottest and driest spot is the Rift Valley between Lakes Natron and Magadi. Surprisingly, a number of wildebeest concentrated in this subdesert area in the dry season, together with zebra and Thomson's gazelle, apparently attracted by short new grass which sprang up in the neighborhood of the Natron lakes when they periodically went dry (Schillings 1905). The Kenya Game Department Report of 1954-55 (quoted in Sidney 1965) recorded an aerial count of 691 wildebeest in the Rift from Olorgesaille to the northern end of Lake Natron in September 1955.

Amboseli

The country north of Mount Kilimanjaro is so arid that it is known as the Nyiri Desert. The only permanent waters are springs from Kilimanjaro that feed the pools and swamps at Ol Tukai and Engon'ngo Naibor within Amboseli Game Reserve, an area of roughly 520 sq km that provides a dry-season concentration area for plains game, including several hundred wildebeest. The remainder of Amboseli Game Reserve's 3,261 sq km is waterless nyika frequented only by oryx, gerenuk, lesser kudu, and dikdik in the dry season. The wildebeest of Amboseli appeared to be a sedentary population, although there was some dispersal of plains game away from the swamps and into the surrounding country during the wet season, including the Rift Valley and plains east of the Namanga mountain range (Greenway, in litt., 1967).

In 1961, control of Amboseli was handed over to the African District Council of Kajiado, and the Masai elders of the area agreed that cattle would be kept out of the swamps and off the plains in the vicinity of Ol Tukai Lodge. Far from honouring this pledge, in the 1960s the Masai brought cattle in increasing numbers to Ol Tukai every dry season, despite the provision of adequate water at natural and artificial sites elsewhere in the reserve. This resulted in excessive damage to natural habitats (Simon 1963). There were already far more cattle than wild animals at Ol Tukai; in all likelihood Amboseli would cease to be a game reserve in all but name, unless control were taken away from the Masai or they suddenly showed an interest in conserving wildlife.

Kuku Plains

An isolated population of wildebeest survived on the dry, undulating Serengeti or Kuku Plain in eastern Kajiado to the northeast of Kilimanjaro below the Chyulu Hills. This formerly game-rich country was badly impacted by overstocking of domestic livestock. The wildebeest was thus much scarcer than in preceding years (Simon 1963).

H.F. Lamprey (personal communication, 1967) judged that the total number of eastern white-bearded wildebeest in Kenya was not more than 12,000, of which all but about 4,000 inhabited the Athi-Kapiti Plains. Since the combined number to be found in the Lake Natron concentration area and in Amboseli probably did not exceed 1,000, the population of eastern Kajiado District perhaps numbered 2,000-3,000. But only 281 were counted in a 3-day aerial survey in December 1955 (Kenya Game Department Report 1956, in Sidney 1965). According to Simon (1963), wildebeest were much scarcer in the eastern

part of Kajiado District than in former years. This stems largely from overstocking, which caused habitat deterioration to near-desert conditions; it is also in part because of measures taken by the Game Department since the 1940s to reduce the wildebeest population. Responding to complaints by the Masai that their cattle were short of grazing, several thousand wildebeest were shot.

Athi-Kapiti Plains

A remnant of the formerly abundant wildlife of the Athi Plains almost miraculously survived in and around Nairobi National Park, which lay within sight of Nairobi city. This small park provided the only remaining perennial water supply to the plains game of Athi-Kapiti. Before the countryside north and east of Nairobi was settled and fenced, wildebeest range extended another 84 km north to Ft. Hall and the Tana River, to within less than one degree of the equator. In the 1950s, the northern limit for the eastern race, according to Sidney (1965), was the Yatta Plateau a little south of the Tana River. In the 1960s, this wildebeest population's range was situated to the south of Nairobi on approximately 2,460 sq km (Talbot & Talbot 1963).

Wildebeest and other plains game concentrated within Nairobi National Park during the dry season and dispersed southward onto the Athi-Kapiti Plains in the wet season. The migratory population was estimated to number about 9,000, with a much smaller population of about 250 permanently resident within Nairobi National Park (Foster 1967). Competition with domestic livestock was a problem in Nairobi National Park until all domestic animals were finally evicted from the park in May 1967.

The failure of the short rains in November-December 1960, and of the following long rains in 1961, led to a severe drought over much of Kenya and northern Tanzania. It proved particularly disastrous on the Athi-Kapiti Plains and in Nairobi National Park. Almost certainly the wildlife would have suffered much less had they still enjoyed access to their old concentration areas and water sources in the north and west. The wildebeest population was reduced from 8,935 to 4,830 (Stewart & Zaphiro 1963), but had recovered to an estimated 7,050 by 1964 (D.R.M. Stewart, personal communication, 1965). However, it continued to decline in the park, where it was replaced as dominant herbivore by the kongoni (1,095 kongoni and only 252 wildebeest in a 1966 game count), at least partly because short pasture was replaced by tall *Themeda triandra* grassland when fire was excluded for three years running (author's observations).

1980s Status of the Eastern White-Bearded Populations

(From Hillman et al. 1988, Rodgers & Swai 1988, and references therein, and additional sources cited)

Tanzania

Aerial surveys in eastern Masailand indicated a marked increase in wildebeest numbers between the early 1970s and 1980, when there were an estimated 24,000 head. Most of these animals concentrated in Tarangire National Park (2,600 sq km) during the dry season and migrated east to the Simanjiro Plains in the wet season. A separate dry-season concentration continued to occur on

the plains around Lake Manyara. It is not known why this increase occurred. The limiting factor proposed by Lamprey in the 1960s – lack of access to dry-season water supplies – did not appear to be relevant since the distribution of permanent water in the Tarangire ecosystem had not changed significantly since the 1950s, and it seems that other factors such as reductions in poaching or disease may have been more important (C. Foley, in litt., August 2005). It is interesting to note that the increase in the migratory Serengeti population during the 1960s and 1970s was partly attributed to release from rinderpest (Part 2.12). Numbers in the Tarangire ecosystem remained more or less stable throughout the 1980s.

Wildebeest reappeared in Lake Manyara National Park following a fall in the lake level that restored the lakeside flats, and over 300 were present in 1987. But the future of this population was considered precarious unless a migration corridor was maintained to the plains to the north and east, through an area of rapidly expanding human settlement.

In general, Tanzania's protected areas were suffering severely from poaching, with infrastructure and staff morale in decline because of the severe economic difficulties suffered by the country at the time. In addition, expansion of human settlement and agriculture were seen as increasingly severe threats to the continued existence of migratory wildlife populations which spend only part of the year within protected areas, like the Tarangire wildebeest.

Kenya

Averaging the estimates of Kenya's resident wildebeest population obtained from aerial surveys of the country's rangelands by the Kenya Rangeland Ecological Monitoring Unit (KREMU) between 1977 and 1983 gives an estimate of 90,000-100,000 animals, with slightly under half in Kajiado District. This represents an approximately four-fold increase in the Kajiado population compared to Lamprey's estimates in the 1960s, suggesting that the same factors which led to the increase in Tanzania's eastern white-bearded wildebeest population during this period were also operating in Kenya. There were an estimated 8,000 wildebeest in the 5,000 sq km Amboseli ecosystem in the 1980s. The core area (392 sq km) of Amboseli Game Reserve had become a national park in 1974 and continued to be a dry season concentration area for wildebeest and other plains game. Competition for forage and water between wild and domestic herbivores remained a problem in the Amboseli area.

The Athi-Kapiti wildebeest population had also increased, to an estimated 20,000 head; the numbers present in the 117 sq km Nairobi National Park varied from few to none in some wet seasons to several thousand in the dry season and up to 15,000 during severe droughts, e.g., in 1973-74 and 1984, when considerable mortality occurred. Despite these relatively high numbers of wildebeest, the rapid increase of human settlement around Nairobi National Park was seen as an increasing threat to the free movement of this migratory population between the park and the wet-season range via the unfenced southern boundary of the park (the rest of the park's boundary was fenced).

In the Rift Valley, some hundreds of wildebeest continued to congregate in the dry season between Lakes Natron and Magadi.

1990s Status of the Eastern White-Bearded Populations

(From Butynski et al. 1997, TWCM et al. 1997, references therein, and additional sources cited)

Tanzania

Commencing in the mid-late 1980s, there was a gradual improvement in the levels of protection of Tanzania's parks and reserves, linked to the country's economic recovery and increased external support to its wildlife sector. By 1992, Tanzania had adopted a multi-party political system and a market economy, and the wildlife sector was being revitalized. Tarangire National Park continued to protect the dry-season range of eastern Masailand's migratory eastern white-bearded wildebeest and zebra populations. Aerial survey counts by TWCM from 1987 to 1994 showed that each year >23,000 wildebeest and >29,000 zebra concentrated near the park's permanent water sources during the dry season. In the wet season, both species migrated far outside the park, with wildebeest moving eastwards across the Simanjiro Plains. The future of these migrations was seen as increasingly threatened by the expansion of agricultural activities in the populations' wet-season dispersal areas to the north, east and southwest of Tarangire National Park.

The 1994 wet-season aerial survey of the Tarangire ecosystem (12,000 sq km) by TWCM produced an estimated wildebeest population of 45,000, but this and an earlier estimate of 48,000 in 1990 are probably inflated artifacts of flawed estimation techniques; it is unlikely that the size of this population exceeded 25,000 in the early 1990s (C. Foley, in litt., August 2005).

Aerial counts in the late 1990s indicated a sudden and dramatic drop in the size of the eastern Masailand wildebeest population to less than 10,000 individuals. This decline is attributed to uncontrolled bushmeat hunting on the Simanjiro Plains, along with extensive game cropping in this area in the early to mid-1990s by the parastatal Tanzanian Wildlife Corporation (C. Foley, in litt., August 2005). The population was dealt a particularly heavy blow in 1997-99 when abundant rains enabled wildebeest to remain on their wet-season range throughout the year. This coincided with the collapse of a Tanzanite mine in Mererani, which led to a local politician agreeing to a harvest of wild animal populations by local people as a form of "relief".

A small wildebeest population continued to survive in Lake Manyara National Park. With a land area of only 110 sq km and increasing isolation caused by the expansion of agricultural settlement in surrounding areas, some considered that this park may not be viable in the long term, at least for species such as wildebeest, without periodic introductions of animals from Tarangire.

In 1993, TWCM conducted an aerial survey of 2,500 sq km of rangeland to the south and east of Lake Eyasi. This revealed that only small numbers of wild animals survived among the area's much larger numbers of cattle, sheep, and goats. The remnant Eyasi-Wembere wildebeest population was estimated to number 90.

Kenya

Kenya's wildlife sector had deteriorated to a crisis state by the late 1980s. The majority of the country's protected areas were affected by declining infrastructure, poaching, illegal encroachment of cattle, and rampant corruption in the Wildlife Conservation and Management Department (WCMD). In 1989, the government disbanded WCMD and established the parastatal Kenya Wildlife Service (KWS). Under its first director, Richard Leakey, and with support from a 5-year project funded by the World Bank and other donors, KWS revitalised the country's protected areas during the first half of the 1990s. Major emphasis was placed on law enforcement, and poaching was reduced to low levels in most of the country's parks and reserves.

Unfortunately this favourable situation for wildlife did not last. After Leakey's replacement as director in 1994 and a major restructuring in 1996, KWS's emphasis shifted away from strict protection of parks and reserves towards improving co-existence of wildlife and rural communities. This included increased tolerance of domestic livestock within protected areas. Critics of this policy felt that peaceful coexistence between wildlife and Kenya's burgeoning human population was unattainable, and opening up protected areas such as Amboseli, Nairobi, and Tsavo National Parks to incursion by livestock would place unacceptable pressures on these parks' dry-season resources of forage and water. There were also increased risks of disease transmission between cattle and wild ungulates, highlighted by a major rinderpest outbreak in eastern Kenya in the mid-1990s. By the late 1990s, KWS was reported to be under severe financial constraints and to have lost the support of major donors.

Against this background, along with severe droughts in some parts of the country in 1991-93, 1996 and 1997, Kenya's wildlife had undergone a general decline. Aerial surveys of Kenya's rangelands by the Department of Resource Surveys and Remote Sensing (DRSRS), which had succeeded KREMU, revealed a general decline of wild herbivore populations of 40-60% between the 1970s/early 1980s and the 1990s. This reflected degradation and loss of wildlife habitat to expanding human populations and consequent changes in land use, as well as the effects of factors such as poaching, drought, and disease.

Total numbers of the eastern white-bearded wildebeest in Kajiado District had declined to an estimated 25,000, although Amboseli continued to be a dry-season concentration area for up to several thousand wildebeest. But several of Amboseli's other wildlife species had shown population declines, and incursions of Masai livestock into the national park continued. More than 20 years of international support to conservation efforts at Amboseli, including numerous attempts to settle conflicts between the Masai (who had lost their legal access to the area without compensation when it became a game reserve in 1961) and the park, had failed to resolve this problem.

By the late 1990s, increasing numbers of cattle were being grazed within Nairobi National Park, which was also affected in 1996 by a rinderpest outbreak. Expansion of human settlement in the Kitengela area to the south of the park, which commenced in the late 1970s, had become a major threat to the continued access of migratory wildlife to and from Nairobi National Park, and the number of wildebeest seen in the park had declined to about 2,000.

Current Status of the Eastern White-Bearded Populations

Tanzania

Aerial surveys by TWCM in 2001 and the Tanzanian Wildlife Research Institute in 2004 produced estimates of the wildebeest population in the Tarangire ecosystem of 5,000 and 7,000 individuals, respectively. These estimates have the large standard errors typical of aerial survey estimates of wildlife populations and do not differ statistically, but they suggest that this wildebeest population may have stabilised since the late 1990s. Comparison of dry-season road counts in Tarangire National Park in 1994-95 and 2003 confirms a major decline in the wildebeest population over this period (C. Foley, in litt., August 2005).

A count of wildebeest was conducted in Tarangire National Park at the height of the dry season in October 2005, when all of the large ungulates were in the park, by positioning observers in several vehicles along the key water sources. This produced a tally of 3,128 individuals. Allowing for animals which may have been missed, it appears that there are now no more than 5,000 wildebeest in the Tarangire ecosystem (C. Foley, in litt., November 2005).

Other species which leave the park in the wet season, e.g., oryx, kongoni, eland, and to a lesser extent zebra (which are a less preferred meat) have also declined in Tarangire, whereas the numbers of species such as buffalo and elephant which remain in thicker bush near the park boundary have shown little change. While the bushmeat trade poses the most immediate threat to the region's wildlife, the accelerating large-scale conversion of the Simanjiro Plains to agriculture is the greatest long-term threat to Tarangire's migratory ungulates.

Radio-tracking of collared wildebeest by the Tarangire Conservation Project suggests that there are three subpopulations of wildebeest in the ecosystem (C. Foley, in litt., August 2005). One resides in northern Tarangire National Park in the dry season and migrates along the eastern edge of Lake Manyara north to the plains of Engakura and Lake Natron in the wet season. A second subpopulation, comprising the bulk of the animals, shares the same dry-season range as the former but migrates eastwards to the Simanjiro Plains in the wet season. The third and smallest subpopulation spends the dry season in the southern part of Tarangire National Park and disperses to the short-grass plains around Kimotorok, south of the park, in the wet season.

Efforts are being made to preserve significant parts of the wet-season ranges of these subpopulations, such as through the development of wildlife management areas on communal lands whereby community-based organizations take over responsibility for the management of wildlife resources. But loss of rangelands to agriculture in the Tarangire ecosystem is increasing as pressures mount from population growth, including increasing migration of people from the crowded Arusha region to areas such as the Simanjiro Plains. The future of Tarangire's migratory wildebeest is therefore highly precarious. It is easy to envisage a scenario in which the wildebeest is eventually reduced to a smaller, resident population within an isolated, fenced national park surrounded by agricultural communities.

Lake Manyara National Park continues to support a small, resident population of wildebeest.

Kenya

In 2005, poaching for meat was occurring on a massive scale in many parts of Kenya, both within and outside protected areas. While KWS still has a number of highly competent and dedicated field staff, some local observers describe the organisation as broken, leaderless, demoralised, dysfunctional, corrupt, and "the biggest problem with conservation in Kenya" (Loefler 2004; Parker 2004). KWS is clearly in urgent need of a major overhaul, but this would require committed political support and a rational wildlife management policy, both of which are conspicuously absent in Kenya at present.

The downward trend of Kenya's eastern white-bearded wildebeest populations has continued and accelerated. R. Kock (in litt., 2005) estimated that the total population of this subspecies in Kenya is now in the low thousands, mainly in the Amboseli area. Amboseli's future has been further clouded by the decision of the Kenya government in 2005 to change the status of the national park to a reserve and to hand it over to the Kajiado County Council. This degazettement was illegal under the country's constitution and was done with little or no consultation with conservation organisations (including KWS). It appears to have been motivated by political patronage. Organizations such as the East African Wildlife Society have expressed fears that the Kajiado County Council has neither the capacity nor the experience to manage Amboseli (Kaka 2005).

The Athi-Kapiti wildebeest population has been decimated and the numbers seen in Nairobi National Park have fallen to an all-time low; the maximum dry-season count of wildebeest in the park in 2004 was 249 (Cowie 2005). The number of registered landowners in the Kitengela area has increased from 260 in 1979 to 19,687, and access to the Nairobi park for migratory wildlife from the Athi Plains has been cut off almost completely (Cowie 2004). There are now more cattle than wildebeest in this park (a sad reflection of the apathy of KWS), which appears to have no future except as a small, completely fenced reserve. The few wildebeest that still occur outside the park on the Athi Plains are unlikely to survive for much longer now that they have lost their access to assured dry-season water supplies.

2.11 The Kenya Mara Western White-Bearded Population

1960s Status of the Kenya Mara Western White-Bearded Population

The distribution in Kenya of *C. t. mearnsi*, the western white-bearded wildebeest, lies within Narok District, where the dominant vegetation type is relatively well-watered (about 71 cm of rain per year) *Acacia-Themeda* tree grassland. Here, the Masai Mara Game Reserve protects about 1,510 sq km of plains game habitat. Darling (1960) estimated the wildebeest population of the Mara-Loita Plains at 15,000 animals in 1958. In 1961, Stewart & Zaphiro (1962) counted 17,817, while in October of the same year Zaphiro & Stewart (Stewart, personal communication, 1967) counted 22,961. A Game Department count in June 1965, of the Loita Plains only, totalled 16,543 head. These figures represent what Darling (1960) called "a very drastic reduction of the stock" compared to the population prior to 1947, when it was estimated to number 50,000-100,000. This reduction resulted from the Mara-Loita Plains being opened up to uncontrolled commercial meat-hunters for a short period following World War II (Simon 1963).

The Masai Mara Game Reserve, though enlarged to some 1,500 sq km from an original 520 sq km, did not include any part of the Loita Plains, which lie to the east of the reserve and comprised the wildebeest population's main wet-season range. Vast and flat with a few volcanic cones to break the monotony, the Loita Plains calcareous loams support a typical "steppe" vegetation of naturally short grasses and herbs too sparsely distributed with too little litter to carry fire. Depending on rainfall, the Mara-Loita population could spend up to 5-6 months on the short-grass Loita Plains, where they usually calved (Darling 1960).

The population migrated westwards in the dry season to the long-grass plains between the Mara River and the Siria Escarpment known as the Mara Triangle on one side and the Lamai Wedge on the other side of the river. Wildlife movements here could vary greatly from year to year depending on availability of water, but with a general concentration along the Mara River (the only major perennial river on the Kenya side of the Serengeti-Mara region). The Mara maintains a strong flow through the dry season, thanks to heavy rains that continue to fall on the Mau Escarpment. Its banks are high where it flows across the deep black-cotton soils of the Mara Plain (Talbot & Talbot 1963). Here, even trivial-looking watercourses are cut deeply enough so that wildlife can only cross readily at fords where the banks have been broken down. Lined with low bushes and trees, these watercourses divide the plains like hedgerows into giant paddocks of no more than about 12 sq km.

The dominant vegetation type is *Acacia-Themeda* tree grassland similar to the Athi-Kapiti Plains, but being generally better watered (approximately 71 cm of rain a year) the herbaceious cover is correspondingly richer. Indeed, there are indications from surviving pockets and strips of forest in hillside ravines and riverside galleries that much of this savanna is secondary, having replaced

formerly extensive areas of forest due to a high frequency of manmade fires (Darling 1960). There are also patches of heavy brush on slightly elevated ground, especially old termite mounds.

Until the mid-20th century, the *hecki* or *mearnsi* race of the white-bearded gnu was not entirely restricted to the western side of the Rift Valley. Fifty years ago, a small, apparently resident population occurred in the Rift on the alluvial plain on the eastern and southern side of Lake Naivasha (Thomson 1885; Heller 1913; Roosevelt & Heller 1914; Meinertzhagen 1957). Passage between the Loita Plains and the Rift Valley was probably gained via the Mosiro Plateau, but that area has subsequently been so badly overgrazed, eroded, and covered with thorn scrub that it has become a barrier to the movement of wildebeest (Talbot & Talbot 1963). Once Europeans began large-scale farming in the Naivasha area following World War I, this wildebeest population quickly succumbed to fencing and uncontrolled shooting.

1980s Status of the Kenya Mara Western White-Bearded Population

(From Hillman et al. 1988, and references therein)

The Mara-Loita Plains comprise the northern section of the 25,000 sq km Serengeti-Mara ecosystem. KREMU aerial surveys indicated the resident wildebeest population of Narok District had increased to more than 50,000 animals by the late 1970s and early 1980s. This included at least several thousand permanently resident in the 1,510 sq km Masai Mara National Reserve.

In addition, commencing in 1969, a large proportion of the migratory Serengeti wildebeest population began to spend the dry season (August-November) in the Masai Mara reserve and adjacent areas of southwestern Narok District, returning to Tanzania for the rest of the year. This population had undergone a major increase during the 1960s and 1970s (Part 2.12). The peak wildebeest population of Narok District estimated from KREMU aerial surveys in 1977-83 was 682,000 in October 1980.

Despite this generally favorable situation with regard to the district's wildebeest numbers, increasing competition for forage and water between wild and domestic herbivores in the areas outside Masai Mara National Reserve and the expansion of wheat farming to the north of the reserve threatened the continued existence of large numbers of migratory ungulates. Prior to the 1980s, wildlife had more or less unrestricted access to the Masai-owned group ranches to the north and east of the Masai Mara reserve, but this was changing as traditional pastoralism began to give way to agriculture.

1990s Status of the Kenya Mara Western White-Bearded Population

(From Butynski et al. 1997, and references therein)

Aerial surveys of Kenya's rangelands by DRSRS showed that Narok District had a greater decline in wildlife populations between the 1970s and 1990s than almost all other parts of the country. Estimated numbers of most of Narok's wild ungulate species showed a statistically significant decline during

this period, apparently because the expansion of large-scale wheat farming and small-scale agricultural settlement were reducing areas for wildlife. The only exception to this trend was Masai Mara National Reserve, where resident wildlife populations were generally stable. In the case of wildebeest, this pattern was partially masked by the continued movement into Kenya during the dry season of 200,000 to 600,000 individuals from the migratory Serengeti population. These animals typically remained within Kenya for about 4 months (July-October), mainly within Masai Mara National Reserve.

Analysis of wildebeest population estimates with the Serengeti migratory component removed showed that the resident Kenyan population of *mearnsi* had declined by the early 1990s. In contrast to most of Narok's other wildlife species, the decline in wildebeest numbers had occurred inside the Masai Mara reserve, where the estimated resident population had decreased from the 1,000-10,000 range in the 1970s and early 1980s to a few hundred by the early 1990s. The district's resident wildebeest population that moved between the Masai Mara reserve (dry season range) and the Mara ranch areas (wet season range) had remained relatively stable at between about 12,500 and 20,000. By the mid-1990s, this pattern appeared to have reversed, with resident wildebeest numbers stable at about 600 within the reserve but declining on the ranches. The estimated total number of wildebeest in Narok District (excluding the Serengeti migrants) in the late 1990s was estimated to be only 25% of that in the mid-1970s (Ottichilo et al. 2001). The high agricultural potential of the Mara ranches, particularly in the north of the Mara-Loita region, provided an incentive for mechanised agricultural development, which can generate far greater revenues than traditional livestock management augmented by tourism. In addition, Narok District's human population was expanding rapidly, and heavy poaching for meat was occurring in areas outside the Masai Mara reserve.

Current Status of the Kenya Mara Western White-Bearded Population

Agricultural intensification has now effectively excluded this population from the northern part of its former wet-season range. Heavy offtake of the region's wildlife for meat also continues, although the Masai Mara National Reserve remains relatively well protected.

During the last decade, the resident Kenyan population of the western white-bearded wildebeest has declined further, by perhaps 50% (R. Kock, in litt. June 2005), implying that this population may now number no more than several thousand individuals. This includes several hundred permanently residing within the Masai Mara reserve, which continues to act as the dry-season range for a substantial component (hundreds of thousands of animals) of the migratory Serengeti population.

2.12 The Serengeti Population

1960s Status of the Serengeti Population

The Serengeti region of Tanzania carries the largest and most diverse assemblage of large mammals on earth. In the 1960s, there were over 1 million hoofed animals in an area of about 25,900 sq km, or perhaps as many as has ever lived there at any time. The survival nearly intact of this unequalled plains ecosystem is due to a combination of fortunate circumstances: a favorable range of climatic and vegetation types; Masai dominion over the region, which restricted settlement and cultivation to the vicinity of Lake Victoria; tsetse fly which kept the Masai from inhabiting the *Acacia* savanna; the aridity of the eastern Serengeti which permitted stock and most game to pasture there only during the rainy season; the inaccessibility of the region to hunting safaris; and the determination of dedicated individuals to preserve this unique example of the Pleistocene "Age of Mammals", which led to the establishment of the Serengeti National Park.

During the 1960s, the migratory Serengeti wildebeest (*C. t. mearnsi*) population spent the wet season on the short-grass plains in the eastern part of the ecosystem, most of which lay outside the national park in the Ngorongoro Conservation Area, and moved northward and westward as the dry season advanced toward the better-watered parts of the range, where water and grazing were normally available with or without fortuitous rainfall. Movements in response to local showers amounted to small-scale, random sorties superimposed upon the general pattern (Grzimek & Grzimek 1960b; Talbot & Talbot 1963).

The soils and vegetation of the Serengeti region fall naturally into two divisions: the hilly country of ancient granite rock, predominately *Acacia-Commiphora* wooded savanna, which lies to the southwest, west, and north partially ringing the open grassland on recent volcanic soils of the Serengeti Plains. The transition from long grass to short grass reflects a gradual succession in soil types from relatively mature, wetter soils in the northwest to juvenile, alkaline soils of volcanic origin in the southeast. As many as six subtypes have been described, but basically there are two zones: long grassland in the west and short grassland or "steppe" in the east, divided by a transition zone. The general character of the soils and the associated vegetation types of the Serengeti Plains have been described in a number of publications: e.g., Pearsall (1957), Swynnerton (1958), Grzimek & Grzimek (1960b), Heady (1960), Brooks (1961), Talbot & Talbot (1963), Anderson & Talbot (1965), and Watson & Kerfoot (1966).

The wildebeest population in the Serengeti region approximately doubled between 1961, when Stewart and Talbot counted 221,700, and 1966, when numbers exceeded 400,000 (Talbot & Stewart 1964). As well as the migratory animals, there are smaller, resident, non-migratory wildebeest populations on the alluvial plains near Lake Victoria in the western arm ("corridor") of Serengeti National Park (estimated to number 5,500 by Bell 1966), Ngorongoro Crater in the southeast of the ecosystem (10,000-16,000 head – Estes 1966), and Loliondo in the northeast of the ecosystem (in doubt).

1980s Status of the Serengeti Population

(From Rodgers & Swai 1988, and references therein)

The increase in the Serengeti wildebeest population that began in the 1960s continued until the mid-1970s when the population reached 1.3 million individuals, rivalling the barrenground caribou of the Canadian Arctic and Sudan's white-eared kob for the distinction of being the world's largest wild ungulate population. This increase was attributed to release from rinderpest in the 1960s, as a result of vaccination of cattle in the region, and an increase in the food supply during the 1970s resulting from a change in the seasonal rainfall pattern toward greater dry-season rainfall. After 1977, the Serengeti wildebeest population stabilised at between 1.0 and 1.5 million due to intraspecific competition for food.

The movement pattern of the migratory Serengeti population had become better understood during the 1970s. Typically, the wildebeest spend the wet season (December-April) on the treeless, short-grass plains in the southeast of the ecosystem, which lie partly within Serengeti National Park (14,760 sq km) and partly within Ngorongoro Conservation Area (8,280 sq km), migrating to the western woodlands and medium-grass plains in May-July, and to the northern woodlands in the dry season (August-November). Much of the population's dry-season range of *Acacia* savanna woodland lies within the national park, but also extends into adjoining areas. From 1969, the population's dry-season range extended increasingly northward across the Kenya border to the Masai Mara Game Reserve (Part 2.11). In addition to the huge migratory population, there were apparently stable resident populations each numbering 10,000-15,000 animals in the western corridor of Serengeti National Park, allegedly in the Loliondo Controlled Hunting Area and in the well-watered grassland on the 265 sq km floor of Ngorongoro Crater (10-30% of which moved out of the crater in the wet season).

While wildebeest numbers in the Serengeti had increased to unprecedented levels, some observers believed the population would decrease naturally with a return to a drier rainfall cycle or if rinderpest reappeared. There were also concerns that poaching for meat was becoming more prevalent in the northern and western Serengeti, where settlement was expanding rapidly. During Tanzania's economic difficulties in the late 1970s and early-mid 1980s, the national park's operating budget dropped markedly. The resulting decline in anti-poaching patrols allowed an invasion of the northern and western Serengeti by poachers, who virtually eliminated the park's black rhinos and majorly reduced elephant and buffalo numbers. Law enforcement capability increased again gradually after 1986, but curtailing illegal hunting remained a major problem.

1990s Status of the Serengeti Population

(From TWCM et al. 1997, and references therein)

By the early 1990s, land-use pressures in the Serengeti region were escalating, particularly in the west where the number of resident people had increased from low levels to more than one million though immigration over the previous 20 years. Consequent expansion of agricultural settlement had reduced the migra-

tory wildebeest population's dry-season range in the area outside the national park compared to the 1960s and 1970s.

The movement of many people into the area had also created a high demand for game meat. Annual poaching offtake of wildebeest was estimated to have increased to 7-9% of the population by the early 1990s, close to the maximum sustainable yield. This illegal hunting was conducted almost entirely by meat hunters from villages between the protected areas and Lake Victoria. Most poaching occurred in the northwestern part of the national park, where the terrain makes access difficult for anti-poaching patrols, and in Grumeti and Ikorongo Game Controlled Areas and Maswa Game Reserve, which comprise the park's western buffer zone. In contrast, the core of the national park and peripheral areas where vehicle patrols have good access, such as the predominantly flat western corridor, were well protected from poaching.

Unlike the western and northwestern woodlands, the short-grass plains of the northern and western Ngorongoro Conservation Area in the southeastern part of the ecosystem remained fully accessible to migratory wildlife. These short-grass plains (including those in the adjoining section of Serengeti National Park) are vitally important as the wet-season grazing and calving grounds of the migratory wildebeest and zebra. Despite concerns that the short-grass plains within the conservation area may be subjected to inappropriate development or overgrazing by Masai livestock, they continued to have very low human and livestock densities.

During June-December 1993, rainfall was very low, particularly in the migratory wildebeest population's dry-season range in the northern Serengeti. These animals were in poor condition with consequently high natural mortality. In addition, many wildebeest wandered among villages outside the northwestern boundary of the national park, where local people killed them for meat. This combination of factors reduced the Serengeti wildebeest population by about 300,000 to an estimated 917,000 in March 1994. A return to more favourable rainfall during the mid-late 1990s saw the population recover to about 1.3 million (Thirgood et al. 2004).

In Ngorongoro Crater, there had been long-term changes in the structure of the wild herbivore community following the removal of Masai pastoralists and their livestock in 1974. Numbers of wildebeest, formerly the dominant herbivore, had declined to <9,000 by the early 1990s, while buffalo numbers had increased markedly. Counts from 1993-98 indicated a further decline in the crater's wildebeest population to a mean of 6,500 (Estes et al. 2006).

Current Status of the Serengeti Population

The migratory Serengeti population is currently stable at an estimated 1,245,000 individuals and continues to be regulated by food availability in the dry season (Thirgood et al. 2004). Although losses to predators and poachers are high, they have little impact at present on the population's size, but further increases in poaching could cause over-harvesting and a population decline (Mduma et al. 1998; Mduma et al. 1999). Hence, poaching remains a major threat while the wildebeest are in their dry-season range in the western and northern Serengeti and adjoining Kenya.

In Ngorongoro Crater, wildebeest numbers increased from 1999 to 2002, when the average population estimate was 11,440, only to decline again to an average population of 7,250 in 2003-2005. It is possible that long-term changes in the crater's wildebeest population may result from exchanges with the migratory Serengeti population. This could account for the decrease in numbers in Ngorongoro Crater post-1986, the increase from 1999-2002, and the subsequent decline (Estes et al. 2006).

Recent studies of the movements of eight Serengeti wildebeest fitted with GPS collars have provided the first new telemetry data in 30 years on the annual movements of the migratory population (Thirgood et al. 2004). The broad pattern of the annual migration track was similar to the early 1970s. The GPS-collared animals spent 90% (328 days) of the year within well-protected core areas (Serengeti National Park, Ngorongoro Conservation Area, and Masai Mara National Reserve). But they also used the less-protected western and northern buffer zones more extensively than in the past, spending 16 days per year in what are now Grumeti and Ikorongo Game Reserves and adjoining open areas on the western/northwestern boundary of Serengeti National Park, and 11 days per year on the Mara ranches to the north of the Masai Mara reserve in Kenya. A further 10 days per year were spent in the unprotected Loliondo area, which lies on the northeastern side of Serengeti National Park in Tanzania. In addition and more importantly, the collared wildebeest spent about 33% of the year (121 days) within 10 km (a day's walk for a poacher) of a less-protected or unprotected area, primarily while they were in the western Serengeti National Park and Masai Mara National Reserve.

These findings clearly show that the migratory population spends a considerable part of the year in parts of the Serengeti-Mara ecosystem where poaching is a major problem. While wildebeest numbers appear stable at current poaching levels, a potential increase in illegal offtake from the ongoing human population growth on the ecosystem's western boundary is a concern (Thirgood et al. 2004). It is hoped the development of wildlife management areas, a new initiative in this region of Tanzania which will empower local communities to manage natural resources on village land, will lead to the replacement of unregulated poaching with sustainable harvesting in the open areas adjoining Serengeti National Park. If successful, these developments, along with efforts to improve protection of Grumeti and Ikorongo Game Reserves, now leased by the private company Grumeti Reserves, should protect the entire range of the Serengeti wildebeest within Tanzania.

What happens to the migratory wildebeest population will determine the future of the Serengeti-Mara ecosystem, since the wildebeest is the keystone species (Hilborn et al. 1995; Sinclair 1995). The successful conservation of this population since Grzimek & Grzimek (1960a) first brought it to the world's attention is an outstanding achievement by Tanzania's conservationists and the organizations that have supported their efforts over the last 50 years. Hopefully this success will continue; there is no higher priority in African wildlife conservation.

Summary of Status by Subspecies

This section summarizes the status of each subspecies, in the 1960s and at present, on a country-by-country basis, followed by an overall summary for the species.

We emphasize that estimates of wildebeest populations, like all wildlife species in African savanna habitats, are at best only rough approximations to actual numbers, even when based on quantitative sample surveys. Standardized aerial surveys, for example, have been widely used to monitor African wildlife populations for the last 30 years, but the resulting population estimates for large antelopes such as wildebeest typically have 95% confidence intervals of plus or minus at least 40% of the estimate. In addition to this statistical sampling error, aerial counts often underestimate the true population size because some animals in the counting strip are missed from the air, for example because they are obscured by vegetation. This counting bias may vary with conditions, such as flying height and counting-strip width, as well as among observers. In a few cases, such as with the migratory Serengeti wildebeest population, these problems have been at least partly overcome by using aerial photography of the herds while in open country to obtain a total count. But in general, wildebeest population estimates should be regarded as representing the order of magnitude of the actual numbers rather than as highly precise and accurate estimates, whether derived from intensive or extensive aerial or ground surveys, or from informed guesses. No allowance is made for undercounting during aerial surveys in the figures presented here.

Past and Present Status of the Subspecies

C. t. taurinus

South Africa

By the 1960s, the blue wildebeest had been shot out over most of its former range in the Kalahari thornveld, Bushveld, and Lowveld of the northern parts of the country. The major surviving populations were in Kruger National Park (13,000), Hluhluwe-Umfolozi Game Reserves (8,000), areas of the Transvaal outside Kruger (7,500, of which two-thirds were in the privately owned game reserves on Kruger's western boundary), Mkuzi Game Reserve (600), and Kalahari Gemsbok National Park (resident population of 500, augmented regularly by up to several thousand migratory animals moving across the border from Botswana). The total population was of the order 30,000, excluding the migratory animals from Botswana.

Current numbers include 10,000-17,000 in Kruger National Park, where the population fluctuates in response to factors such as rainfall and lion predation, and more than 10,000 in total in various smaller protected areas, such as Hluhluwe-Umfolozi Park and other parks and reserves in KwaZulu-Natal, Madikwe Game Reserve, and Pilanesberg National Park in North West Province; in these smaller areas, removal of animals by harvesting to supply meat to surrounding rural communities and/or by live capture for sale to game ranches is often the major population determinant. The population of Kalahari

Gemsbok National Park (now part of Kgalagadi Transfrontier Park) is similar to the 1960s. On private land, wildebeest numbers have increased markedly since the early 1980s with the growth of the private game-ranching industry, and may now exceed 15,000. There are probably at least 40,000-45,000 blue wildebeest in South Africa at present (excluding migratory animals from Botswana), but this is only a small fraction of the numbers which likely existed in the country 150 years ago.

Swaziland

The wildebeest probably occurred throughout the Lowveld region of Swaziland in the past, but the country is now densely populated and wildlife restricted to relatively small protected areas. At present, there are probably several hundred blue wildebeest in total in Hlane Game Reserve and a few other protected areas.

Zimbabwe

The wildebeest population of Hwange National Park in the Bushveld of western Zimbabwe became established in the early 1930s, when migratory animals from the Bostwana border area took up permanent residence around the park's newly established artificial waterholes. This population numbered 1,000-2,000 head in the 1960s and has since remained stable at this level, at least until the mid-late 1990s.

The other region in which the wildebeest occurs naturally is the Lowveld, in southern Zimbabwe. In the 1960s, the Lowveld population was at least several thousand and possibly more than 10,000. These animals occurred mainly on privately owned cattle ranches, where bush encroachment was leading to declines in the populations of grazing antelopes. In addition, wildebeest numbers had been reduced greatly through shooting by European farmers, and the Rhodesian government was rigorously pursuing a game destruction programme for tsetse control even in protected areas. At the time, the prospects for the Lowveld's wildlife looked bleak. This was reversed over the next 30 years by the growth of Zimbabwe's wildlife industry on privately owned land. By the mid-1990s, the total number of wildebeest in the country exceeded 10,000, including at least 9,000 head on private land mainly in the Lowveld. Since 2000, substantial parts of the country's private wildlife sector have been destroyed by the government's land resettlement program, but wildebeest numbers may not have been reduced greatly because some of the large private conservancies in the Lowveld have remained partially or completely intact.

Botswana

The Kalahari Desert, which occupies most of Botswana, the northern Cape of South Africa, and eastern Namibia, formerly supported one of Africa's great plains-game ecosystems. Resident humans were few, mainly Bushmen, and there was not enough surface water to support pastoralism. During the wet season, a large migratory wildebeest population dispersed throughout the Kalahari savannas. When these areas became waterless for several months during the dry season, and especially in severe drought years, the wildebeest concentrated near permanent water in areas such as the Makgadikgadi Pans, the Lake Ngami

depression and the Chobe River in Botswana, the floodplains bordering the Okavango Swamp in Botswana and Namibia, Etosha Pan, Ovamboland and the Caprivi Strip in Namibia, along the Cunene and Cubango Rivers in Angola, and formerly along the Limpopo River in Botswana and South Africa, and the Orange River in South Africa. This vast region may have been occupied by a single wildebeest population, which dispersed widely during the wet season but broke up into separate concentrations during the dry season. Its size will never be known, but it must have comprised at least several hundred thousand individuals.

Much of this system was still intact in the mid-20th century, but it has subsequently been destroyed by the erection of game-proof Disease Control Fences in Botswana and Namibia to protect cattle from wildlife-borne diseases. These fences have effectively cut off access between the former wet-and dry-season ranges of the migratory wildebeest. There were still an estimated 260,000 wildebeest in the Botswana section of the Kalahari in the late 1970s, before access to ancestral dry-season water supplies was finally cut off completely by the fences. Since then the cattle industry has expanded increasingly into the Kalahari through the extensive sinking of boreholes, adding to the pressures on wildlife.

The era of unfettered movement of wildebeest and other game animals across the Kalahari landscape has come to an end, and wildlife is now increasingly restricted to protected areas. The total wildebeest population of Botswana had declined to an estimated 39,000 head in 1986-87 and has subsequently stabilised at about this level; total numbers were estimated to be 35,000-45,000 in 1986-94 and 46,000 in 2002-03.

Like most other wildlife species in Botswana, the wildebeest has become fragmented into separate regional populations. The Okavango-Chobe-Makgadikgadi population in the north is currently stable at about 14,000; the erection of additional fences may isolate the Makgadikgadi component, which currently numbers about 4,000, from the population centred on the Okavango. The population of the Tuli Block farms in the east has grown from a declining remnant of a few hundred individuals in the 1960s to about 19,000 at present; this region now has the country's largest number of wildebeest. In central and southwestern Botswana, a more or less stable, remnant population of about 10,000-12,000 head survives in the central and southern Kalahari; this population is vulnerable to poaching and competition with livestock in areas outside Central Kgalagadi Game Reserve and Kgalagadi Transfrontier Park. There is a much smaller, declining population in the Namibia border region in the northwest.

Namibia

The wildebeest formerly ranged over all but the most arid parts of Namibia. Until the 1950s, it was probably the country's most abundant large herbivore; former numbers are unknown but may have reached the hundreds of thousands. The eastern and northern regions fell within the vast Kalahari ecosystem (see above). Development of the intensive cattle ranching industry on European-owned farms, ruthless eradication of the species on private land because it carries malignant catarrh, habitat deterioration through overstocking of livestock,

and construction of Disease Control Fences have since led to the annihilation of Namibia's wildebeest population. By the late 1960s numbers had apparently been reduced to less than 10,000; by the 1980s, less than 4,000 remained.

The main protected-area population is in Etosha National Park. Until the 1960s, the Etosha park supported up to 30,000 wildebeest seasonally, including perhaps 10,000 which moved within the confines of the park and larger numbers which migrated into the park from Ovamboland during the wet season. The Etosha population, now resident within the park, had declined to 2,000-3,000 head by the late 1970s and has subsequently remained stable at this greatly reduced level.

The wildebeest has made a small-scale comeback on private land since the 1970s, with the growth of Namibia's private-sector wildlife industry. There are now more than 5,000 head on private farms and conservancies and probably more than 10,000 in total.

Angola

There were formerly substantial populations of wildebeest in the Bushveld of southern Angola. The species also occurred on the seasonally inundated grasslands which penetrate far into the miombo woodlands of eastern Angola and adjoining western Zambia, along the numerous tributaries of the upper Zambezi River. In the 1960s, perhaps 10,000 wildebeest survived in the south. The largest number (about 6,000) occurred in the southeast, along the Luiana River in Luiana Partial Reserve; this population's range included the Western Caprivi Strip in adjacent Namibia. No information was available on wildebeest numbers in the upper Zambezi region of the country.

In 1975, shortly after attaining independence, Angola descended into a prolonged civil war that did not end until 2002. The country was left in ruins, including its wildlife sector. Very little information is available on the current status of wildlife, apart from the fact that most populations of larger wildlife species were destroyed during the war both inside and outside former protected areas, including the Luiana reserve.

Zambia

The distribution of *C. t. taurinus* in Zambia is confined to the country's western region, where there are extensive watershed and floodplain grasslands, notably in Barotseland (Western Province) along the upper Zambezi River and its tributaries, and further east on the Kafue Flats and the Busanga Plain. In the 1960s, little was known about the fauna of the remote western region of Zambia, but it subsequently emerged that Liuwa Plain National Park supports a large, migratory wildebeest population, believed to number about 25,000-50,000 head in the 1980s. Wildebeest also occurred in unknown numbers in some other parts of Barotseland, such as Sioma Ngwezi Game Reserve in the southwest.

The formerly abundant wildlife of the Kafue Flats had suffered from heavy legal and illegal offtake and by the 1960s was largely confined to two large European-owned cattle ranches, Lochinvar and Blue Lagoon, which subsequently became national parks. The decline in the flats' wildebeest population is illustrated by Lochinvar, which supported 3,000 head in 1937; by 1966, when Lochinvar first became a wildlife sanctuary, only 360 wildebeest remained.

Part of the Busanga Plain (960 sq km) was included in the northern section of Kafue National Park when it was established in 1950. In the 1960s, approximately 3,000 wildebeest existed in the Kafue park, including about 2,000 on the Busanga Plain.

Since the 1960s, such factors as escalating poaching, livestock encroachment, uncontrolled fires, and lack of effective law enforcement have threatened the integrity of Zambia's protected-area system, leading to a decline in the country's wildlife populations. But the wildebeest survives in substantial numbers in Liuwa Plain National Park, where the population was estimated at 23,500 head in a 2004 aerial survey; this population spends only part of the year within the park, migrating westwards toward and beyond the Angolan border for several months in the early dry season. This may be the largest surviving population of the nominate subspecies; it is also one of the very few remaining migratory populations of *C. taurinus* that can still access its ancestral wet- and dry-season ranges. The private foundation African Parks took over responsibility for the rehabilitation and management of the Liuwa Plain park in 2003; consideration may be given to extending the park's boundaries to include more of the wildebeest population's total range. Elsewhere in Barotseland, including Sioma Ngwezi National Park, the wildebeest – like most other wildlife – is close to extinction.

On the Kafue Flats, the species is now confined to Lochinvar National Park, where a remnant of about 200 survives. The status of the Busanga Plain population in Kafue National Park is probably better. This was estimated to number 1,750 in the mid-1990s and may currently be at a similar level; unlike the rest of the Kafue park, the northern section has been reasonably well protected against poaching over the last 10 years thanks to a private-sector initiative.

The total population of *C. t. taurinus* in Zambia is currently about 25,000. This is probably considerably less than in the 1960s, but the extent of the reduction is unclear because of the paucity of knowledge of the size of the major population in the Liuwa Plain area at that time.

Mozambique

The nominate subspecies formerly occurred widely in the Bushveld, floodplain, and Mopaneveld of the drier parts of Mozambique south of the Zambezi River. We can only speculate on the former numbers of this region's wildebeest, but it was probably at least many tens of thousands. Wildlife remained widespread and abundant until the mid-20th century, but was then reduced by uncontrolled shooting, including commercial meat-hunting, along with tsetse-control programs and the spread of agricultural settlement in some parts of the country. By the 1960s, *C. t. taurinus* was apparently reduced to four surviving populations: Gorongosa National Park, where it still occurred in large but unestimated numbers; the Save River area, where some estimates suggested that tens of thousands of wildebeest still occurred; unknown numbers in an area northeast of the Limpopo River which subsequently became Banhine National Park; and a relic population of about 50 on the Tembe Plains in the far south (this area had supported large numbers of wildebeest until they were massacred to feed troops in the 1930s).

Prior to and following independence, Mozambique suffered a long period of guerrilla hostilities and civil war until 1992; during this period, the government abandoned protected areas, and most of the country's remaining wildlife was slaughtered. By the mid-late 1990s, the wildebeest was almost extinct in Mozambique south of the Zambezi; the only confirmed survivors were about 30 animals near the Kruger National Park border in the south. The species has apparently been lost even from Gorongosa National Park, which supported an estimated 14,000 wildebeest when abandoned in 1980. The wildebeest's comeback in southern Mozambique has been initiated by the recent translocation of a few hundred individuals from Kruger National Park to Limpopo National Park, which is the Mozambique component of the newly established Greater Limpopo Transfrontier Park.

Table 1: Estimated total numbers of blue wildebeest (*C. t. taurinus*) in range states and trends since 1967 and 1995.

Country	Current Total Population	Trend Since 1967	Trend Since 1995
South Africa	>40,000	Increase	Increase
Swaziland	500?	Stable?	Stable?
Zimbabwe	>10,000	Increase	Stable?
Botswana	46,000	Decrease	Stable
Namibia	>10,000	Decrease	Increase
Angola	?	Decrease	?
Zambia	25,000	Decrease	Decrease
Mozambique	250?	Decrease	?
Total	**>131,750**	**Decrease**	**Stable/Increase**

The above summary suggests the total population of *C. t. taurinus* is currently of the order 130,000, with the largest numbers in Botswana, South Africa, and Zambia. This undoubtedly represents a marked overall reduction since the mid-1960s, when the subspecies may still have numbered as many as 400,000; actual numbers in the 1960s are unknown, partly because the timing is unclear of Botswana's and Namibia's massive population declines.

Between the 1960s and 2005, there have been particularly severe population declines in Botswana, Namibia, Angola, and Mozambique. Population growth on private land in South Africa, Zimbabwe, Botswana, and Namibia over the last 30 years partially countered the declines. There may now be about 50,000 of the subspecies on private land, representing about 40% of the subspecies' total numbers.

The current, short-term population trend of the subspecies is stable or increasing, both overall and in most individual range states.

C. t. cooksoni

Zambia

Cookson's wildebeest forms an isolated population in the Luangwa Valley of eastern Zambia, where it occupies the seasonally flooded alluvial floodplain of the Luangwa River, moving into adjacent mopane woodland on the valley floor during the wet season. Its numbers were estimated to be only 1,000 in the 1930s, but had apparently increased to several thousand head by the 1960s.

Much of this subspecies' range lies within protected areas, centred on North Luangwa National Park and adjoining game management areas, with smaller numbers in South Luangwa, Luambe, and Lukusuzi National Parks. The core population is well protected in North Luangwa, but poaching has become an increasing problem in most of the valley's other protected areas. Total numbers may currently be more or less stable at between 5,000 and 10,000 head.

Malawi

Wildebeest occasionally wander up from the Luangwa Valley onto the plateau of Zambia's Eastern Province and across the border into Kasungu National Park in western Malawi, but the miombo woodland of these areas is completely unsuited to the species, and the dispersal has shown no signs of establishing a viable population.

C. t. johnstoni

Malawi

The Nyassa wildebeest formerly occurred in southeastern Malawi, to the east of the Shire River and south of Lake Malawi. The alluvial plains of the river and Lakes Chilwa and Chuita may once have supported a sizeable population, but this region is now densely settled; the last wildebeest were shot out in the 1920s.

Mozambique

In northern Mozambique, north of the Zambezi, the larger river valleys and the Bushveld and grassland of the coastal hinterland probably supported substantial numbers of Nyassa wildebeest in the past. As in southern Mozambique, after about 1950 the wildlife of the north was greatly reduced by excessive meat-hunting, in part to feed the work force of large-scale plantations of coconut palms, sisal, sugar, and tea. By the 1960s, only three populations of this subspecies were known to survive in Mozambique: in Gile Game Reserve in Zambezia Province; near the upper Lugenda River across the Malawi border from Lake Chilwa; and near the confluence of the Lugenda and Rovuma Rivers in the far north. There was no information on the status of these populations.

No current information is available on the fate of the wildebeest populations of Gile Game Reserve (where the species was on the verge of extinction in the late 1970s) or of the upper Lugenda. But the population near the Lugenda-Rovuma confluence has persisted in what is now Niassa Game Reserve and its buffer zone; this was one of the few areas of the country where significant wildlife populations survived the prolonged civil war that ended in 1992. There is now a stable population of about 600-900 wildebeest in this area, mainly in

the relatively dry southeastern part of the Niassa reserve's buffer zone. Much of the reserve is dominated by miombo woodland, which is unsuitable habitat for wildebeest.

Tanzania

Southeastern Tanzania supports the great bulk of surviving Nyassa wildebeest. Within the region's predominant vegetation of miombo woodland, the wildebeest occupies areas of acacia savanna and open grassland which occur primarily in the valleys of the major rivers. In the past it probably occurred in suitable areas throughout the southeast, but by the 1960s it had become largely confined to Selous Game Reserve and Mikumi National Park. No estimate of its numbers had been made in the vast Selous reserve, where its population was considered to be "many thousands"; there were a few thousand in the much smaller Mikumi National Park.

Selous Game Reserve suffered from heavy poaching during the late 1970s and early to mid-1980s but has been subsequently rehabilitated with bilateral assistance from Germany. Poaching has been effectively suppressed since 1990, and a development programme has been implemented for the reserve and surrounding rural communities. A succession of aerial surveys over the period 1989-2002 showed that the Selous ecosystem supports a stable population of at least 50,000-75,000 Nyassa wildebeest, with about two-thirds of these within the game reserve and the rest on adjoining lands, including up to a few thousand in Mikumi National Park. This is now the second-largest surviving population of the species, after the migratory Serengeti population. Two large concentrations of wildebeest occur during the dry season on short grass plains on the northern and northeastern boundaries of Selous Game Reserve. Smaller groups are found over much of the rest of the reserve. A wildlife corridor is currently being developed to link the southwestern boundary of the Selous reserve with Niassa Game Reserve across the Ruvuma River in adjacent Mozambique.

C. t. albojubatus

Tanzania

The eastern white-bearded wildebeest formerly ranged widely over the open grasslands and acacia savannas of the Masai steppe in northern Tanzania, to the east of the Gregory Rift Valley. At the end of the 19th century, virtually the whole of eastern Masailand was probably a wet-season dispersal area for migratory plains game, which concentrated around permanent sources of water during the dry season; though numbers are unknown, there were probably at least hundreds of thousands of wildebeest.

Since then, factors such as disease, hunting, and loss of range and dry-season water supplies to expansion of livestock and settlement greatly reduced the wildebeest's numbers. By the 1960s, only about 9,000 wildebeest were estimated to survive in eastern Masailand. The few remaining dry-season concentration areas for wildlife were in the Rift Valley, in Tarangire National Park and to the north of Lake Manyara. The main wet-season dispersal areas had become confined to the Simanjiro Plains east of Tarangire and the Rift Valley east and south of Lake Natron.

During the 1970s, wildebeest increased markedly in eastern Masailand to an estimated 24,000 head; the reasons for this are unknown, but may be related to reductions in poaching and/or disease. Most of these animals concentrated in Tarangire National Park during the dry season and migrated east to the Simanjiro Plains in the wet season. The population remained stable throughout the 1980s and early to mid-1990s, but then decreased rapidly to its current level of about 4,000-5,000. This decline was apparently caused by excessive legal and illegal offtake by meat-hunters in the main wet-season range on the Simanjiro Plains. While the bushmeat trade poses the most immediate threat to the region's wildlife, the accelerating conversion of the Simanjiro Plains to agricultural settlement and gemstone mining are the greatest long-term threats to eastern Masailand's migratory ungulates.

Small populations of a few hundred or less of the eastern white-bearded subspecies also survive in Lake Manyara and Saadani National Parks. The latter, on the Tanzanian coast, is outside the species' natural range; various species of wildlife, both non-indigenous, including wildebeest, and indigenous, were translocated into Saadani prior to its upgrading from a game reserve to a national park in 2003.

Kenya

The eastern white-bearded wildebeest's range extends northward into the Masai country east of the Rift Valley in southern Kenya's Kajiado District, where the habitat is similar to Tanzania's eastern Masailand. The Kenyan population has declined from historical levels for the same reasons as in Tanzania; by the 1960s, the estimated total number of the subspecies in Kenya was about 12,000 in two more or less separate populations. The larger population (approximately 9,000 head) dispersed onto the Athi-Kapiti Plains in western Kajiado in the wet season and concentrated in Nairobi National Park during the dry season; the smaller (a few thousand head) occurred in southern and eastern Kajiado with dry-season concentration areas around Lake Natron, at Amboseli, and on the Kuku Plains.

As in Tanzania, the Kenyan population of *albojubatus* increased markedly during the 1970s and numbered about 40,000 by the early to mid-1980s, including 20,000 on the Athi-Kapiti Plains and about 8,000 in the Amboseli area. But numbers have subsequently declined, as Kenya's wildlife has suffered from a massive increase in poaching, as well as drought, disease, competition with livestock, and the lack of both a rational wildlife management policy and an effective organisation to implement it. The Kenyan population of the eastern white-bearded wildebeest now numbers in the low thousands, with most of the survivors in the Amboseli area. The Athi-Kapiti population has been decimated as a result of the expansion of settlement in the Kitengela area to the south of Nairobi National Park, which has nearly cut off access by migratory wildlife to the permanent water sources in the park. In recent years, the number of wildebeest seen in Nairobi National Park in the dry season has fallen from many thousands to only a few hundred.

Total numbers of C. t. albojubatus

The subspecies' total population increased from about 21,000 head in the 1960s to more than 60,000 in the 1980s, but has subsequently declined to its current level of perhaps 6,000-8,000. It now ranks with Cookson's wildebeest as one of the two least numerous subspecies.

C. t. mearnsi

Kenya

The distribution of the western white-bearded wildebeest in Kenya lies on the Mara-Loita Plains within Narok District. Formerly the Kenya-resident population numbered as many as 100,000 or more and migrated between the Masai Mara National Reserve area (dry-season range) and the Masai-owned group ranches to the east and north of the reserve (wet-season range). Smaller numbers remained permanently within the reserve. Since the 1970s, there has been a marked decline in the wildebeest population of Narok District (excluding the Serengeti migrants) because of loss of wet-season range to intensive agricultural development, largely wheat farming, and increasingly heavy poaching for meat, mainly outside the Masai Mara reserve. The resident Kenyan population of *C. t. mearnsi* now numbers no more than several thousand head and is dwarfed by the annual dry-season influx of several hundred thousand migratory wildebeest from Tanzania.

Tanzania

The range of the migratory western white-bearded wildebeest population of the Serengeti lies to the west of the Rift Valley in northwestern Tanzania and adjoining southwestern Kenya. It includes the open grasslands of the Serengeti Plains (wet-season range) and the *Acacia* savannas and woodlands (dry-season range) to the west and north. The population's total range, including the Kenyan component, covers about 25,000 sq km and is mainly within protected areas such as Serengeti National Park and Ngorongoro Conservation Area in Tanzania, and Masai Mara National Reserve in Kenya.

In the early to mid-1960s the estimated size of the migratory Serengeti population approximately doubled, from about 220,000 to more than 400,000. There were also smaller, resident, non-migratory populations in the western corridor of Serengeti National Park (5,500), Ngorongoro Crater (10,000-20,000), and (possibly) the Loliondo area. This growth continued until the mid-1970s when the migratory population had reached 1.3 million; the increase was attributed to release from disease (rinderpest) in the 1960s due to cattle vaccination in the region, and an increased food supply during the 1970s from greater dry-season rainfall. Since 1969, the migratory wildebeests' dry-season range has extended increasingly across the Kenya border to the Masai Mara Game Reserve and adjoining areas.

In the late 1970s and 1980s, the Serengeti wildebeest population stabilised at 1.0-1.5 million due to intraspecific competition for food. There was a drought-induced decline to about 900,000 in 1993-94, but the migratory population has subsequently recovered to about 1.25 million. The smaller, resident populations now number about 10,000-15,000 in the western corridor and about 7,000 in Ngorongoro Crater.

Although the Serengeti wildebeest population is stable, it suffers much higher losses from poaching now than in the 1960s. This illegal hunting is conducted almost entirely by meat-hunters from villages on the western and northern edges of the Serengeti, where there has been large-scale immigration of people since the 1970s. Recent telemetry studies show that the migratory wildebeest spend more than one-third of the year within 10 km of the boundaries of the protected areas and in the less well-protected western and northern buffer zones where poaching is a major problem; any further increase in the level of poaching could result in over-harvesting and population decline.

Past and present status of *Connochaetes taurinus*

As the following table shows, the migratory Serengeti population (approximately 1.25 million) dominates the total population of the wildebeest, which is of the order 1.5 million; the Serengeti migrants currently comprise more than 80% of the species' global population. The increase in the Serengeti population since the 1960s has more than compensated for the decreases in some other populations, including the loss of several hundred thousand migratory individuals in the Kalahari.

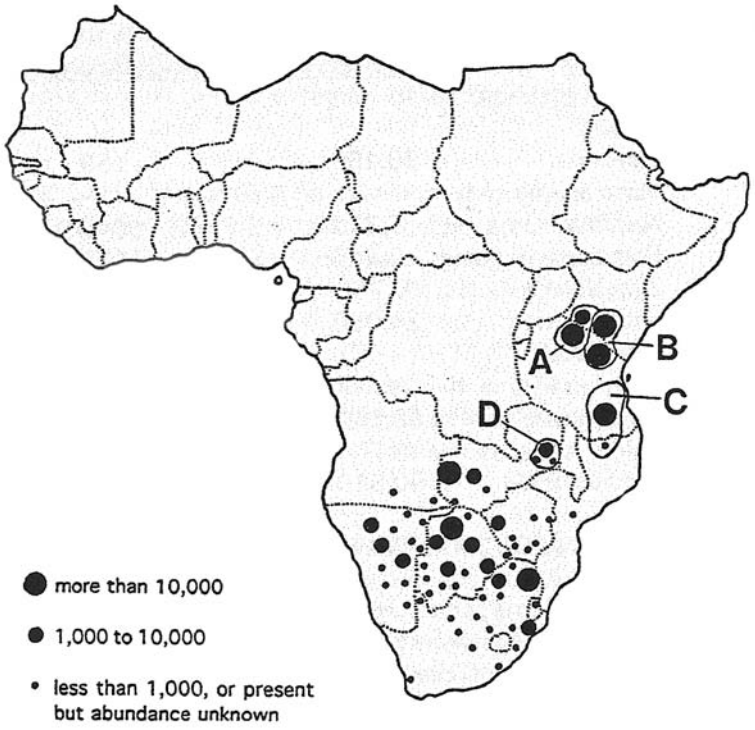
If the migratory Serengeti population is excluded, the overall status of the species is less satisfactory. Both the nominate subspecies and *albojubatus* have decreased markedly from their historical levels, and the latter has declined further in the last decade; these decreases have resulted in both short- and long-term declines in the species' total numbers.

While the wildebeest remains one of Africa's most abundant game species, these figures highlight both the significance of the migratory Serengeti population and the vulnerability of the species to further adverse developments, such as those which have affected the eastern white-bearded subspecies during the last decade.

Table 2: Estimated current total populations of wildebeest subspecies and trends since 1967 and 1995.

Subspecies	Current Total Population	Trend Since 1967	Trend Since 1995
C. t. taurinus	130,000	Decrease	Stable/Increase
C. t. cooksoni	5-10,000	Stable	Stable
C. t. johnstoni	50-75,000	Stable?	Stable
C. t. albojubatus	6,000-8,000	Decrease	Decrease
C. t. mearnsi	1,300,000	Increase	Stable
Total	approx. 1,500,000	Increase	Stable
Total excluding Serengeti migrants	**257,000**	**Decrease**	**Decrease**

Figure 6: Map of wildebeest population distribution and relative size (East 1999). Subspecies: A) *C.t. mearnsi*; B) *C. t. albojubatus*; C) *C. t. johnstoni*; D) *C. t. cooksonii*; the rest, *C. t. taurinus*.



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Status in the 1960s

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Current status

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PART 3: HOW THE WILDEBEEST CAME TO DOMINATE ACACIA SAVANNA ECOSYSTEMS

Which adaptations made the wildebeest the dominant herbivore of the African plains? The short answer is, this ungulate is the most specialized for a migratory existence in acacia savanna ecosystems within its geographic range. It exploits with remarkable success the most nutritious grasses produced seasonally in the most open savannas with annual rainfall ranging from < 500 to 1000 mm. Compared to the most abundant associated ungulates, it is water-dependent like the plains zebra but with a narrower habitat preference, and cannot stay in waterless areas like the Thomson's gazelle and springbok. The wildebeest's suite of adaptations for exploiting the acacia savannas are as follows.

Phenotype

It is a large antelope (shoulder height 117-138 cm, mass 163-274 kg), with the high shoulders sloping to lower hindquarters characteristic of the tribe (Alcelaphini), as in the associated topi and hartebeest. Size and build are well-suited for long-distance travel with least energetic cost (Dagg, 1969). Wildebeest can canter for hours and seldom trot except as an alarm signal. The spotted hyena, another noted traveler, has a similar conformation (Estes 1991).

The broad muzzle, wide incisor row, and loose lips are adapted for rapid close cropping of short and medium grasses (Gordon & Illius 1988). The gnu is classified as a bulk grazer (Hofmann 1973), whereas topi and hartebeest with their long narrow jaws are selective grazers (Murray & Brown 1993). It is most efficient at harvesting the short, colonial grasses that dominate alkaline soils overlying a shallow hardpan in semi-arid environments, as on the eastern Serengeti Plain (Bell 1970). These grasslands respond to grazing, trampling, and manuring with rapid regrowth when replenished with rain (McNaughton 1984).

Figure 7: Wildebeest conformation, lateral view (photo by RDE).

Environmental impact

Migratory wildebeest form the largest concentrations of any associated herbivores (Fryxell 1995). When thousands move onto a patch of grassland, other species are often displaced and appear confused. Stands of medium height are soon mowed too short for buffalo, topi, or hartebeest, removing some of their dry-season food supply, whereas gleaners like Thomson's gazelle prefer these mowed patches. In addition to the ecological impact of grazing, trampling, and manuring, horning of woody vegetation by adult bulls in the Serengeti population has been shown to be a significant factor in creating and maintaining the wildebeest's preferred open habitat (Estes 2008).

Social organization

Wildebeest populations may be either sedentary-dispersed or mobile-aggregated. Both forms occur in Ngorongoro Crater and in the western Serengeti National Park and are interchangeable (Estes 1966; Estes 1976; Estes 2006; Estes et al. 2006). Resident populations feature continuously occupied territories encompassing the ranges of semi-closed herds of females and young. Non-territorial males are segregated in bachelor herds. Territoriality is maintained in the migratory phase on a temporary basis, but there are no social bonds between individuals apart from cows with their calves and a percentage of yearling offspring. Aggregations include all classes. Despite the individual anonymity, there is clearly a powerful social attraction to conspecifics, the same herding instinct familiar in the flocking tendency of sheep. Mutual attraction is facilitated by the wildebeest's distinctive, highly conspicuous, counter-shaded coloration (Estes 2000; Estes 2006). The attraction of like to like even leads individuals of the same sex, age, and reproductive status to associate in definable subgroups within aggregations (Estes & Estes 1979). The only lone wilde-

beest (apart from orphaned calves and sick individuals) are males on territory. Wildebeest on the move follow one another in files and columns; the pungent odor of their interdigital glands lays a scent trail that can be followed on the darkest night.

A unique reproductive system

The wildebeest's reproductive system evolved as one of the principal adaptations to its gregarious and migratory way of life. The hider-calf strategy that distinguishes all other antelopes (and cervids) has been replaced by a follower-calf strategy exclusively in the common wildebeest, and in the black wildebeest and (less completely) in the blesbok of the South African Highveld (Estes 1974; Lent 1974; Estes & Estes 1979). The putative ancestral tan color of calves, well-suited to concealment in tall, tan grass, contrasts with the dark adult color and is ineffective camouflage on the short green grass frequented during the calving season (Figure 8). The mobility of aggregations would leave mothers with hider calves behind and very vulnerable. Accordingly, natural selection promoted the evolution of follower calves. But for that arrangement to work, selection favored a short annual birth peak, with up to 80% of the calves born within a three-week peak. That served both to glut predators and deny them a continuing source of easy prey. In addition, association of mothers with calves in nursery herds provided cover for neonates concealed during an abbreviated feeble stage among slightly older calves (Estes 1976; Estes & Estes 1979).

Figure 8: Wildebeest calving ground showing contrast in coloration of calves and adults (photo by RDE).

At the hand of man

Anthropogenic effects on wildebeest populations are noteworthy because this was the keystone species in the most productive savanna ecosystems, wherein the dominant species were migratory. The adaptations that equipped the wildebeest to exploit African savanna ecosystems more successfully than any other ungulate demonstrate how poorly adapted are cattle and the dependence of this Eurasian invasive species on man for survival. The measures taken in favor of the cattle industry could hardly have been better designed to disrupt the migratory movements essential to the survival of the wildebeest, zebra, gazelles/springbok, and other plains game.

Upon reviewing the suite of adaptations enabling the wildebeest to dominate acacia-savanna ecosystems, it can be said that the ecosystem defined the wildebeest and that the wildebeest defines the ecosystem. The coadaptation process proceeded over a period measured in millions of years. Is it any wonder, then, that cattle, sheep, and goats introduced from the Near East and Asia a few thousand years ago are still unadapted to African conditions?

Nevertheless, in pre- and post-colonial Africa, pastoralists and their livestock were able to coexist with wild herbivores in arid and semi-arid ecosystems without seriously degrading the ecosystem, by making the same seasonal movements. But the advent of borehole-drilling in seasonally waterless country and the resulting permanent settlement caused environmental degradation and desertification of arid lands (Part 2.3).

PART 4: CAN MIGRATORY POPULATIONS BE RESTORED?

Given the will and resources, there are still ways to bring back migratory populations of wildebeest and associated ungulates and restore the richly diverse savanna ecosystems that make Africa unique.

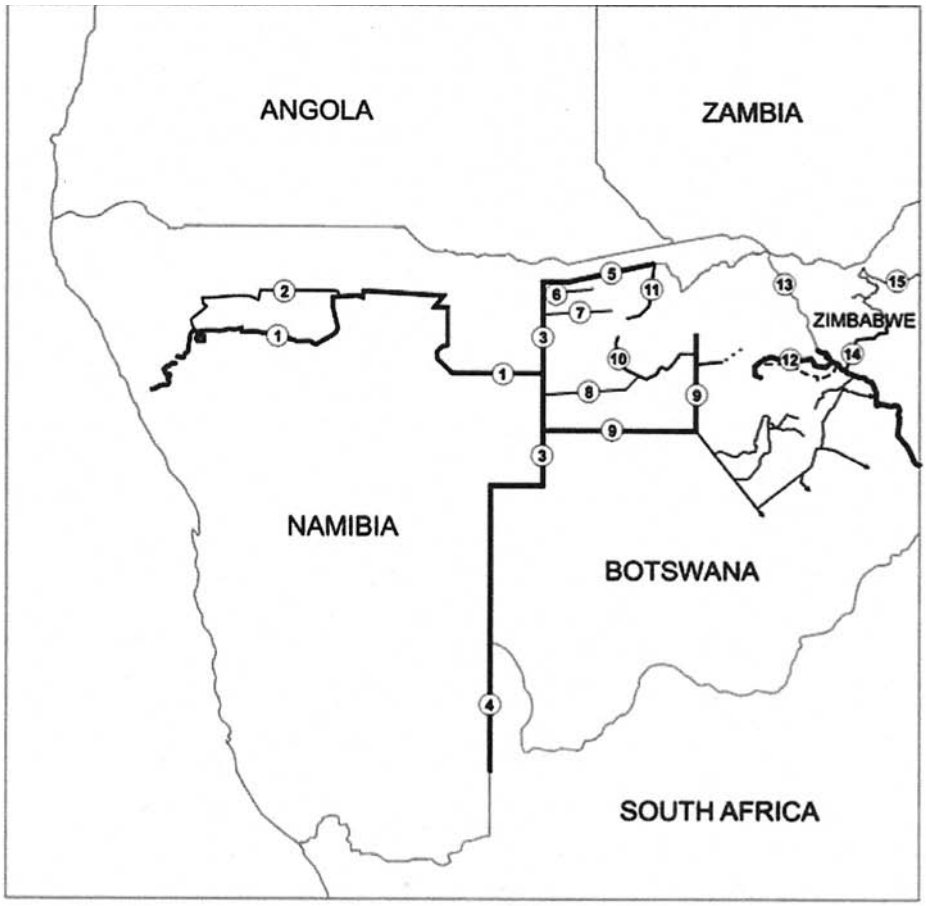
In some instances, it could be done simply by removing obstacles to migratory species' seasonal movements. Of course, this assumes the former range remains unsettled and in a more or less natural state. Removing the fences on the western border of Kruger National Park and their adjoining private conservancies cannot restore the former wildebeest migration, as the grassland habitat on the eastern slopes of the Drakensberg, where the migration used to spend the dry season, has been transformed by development. It is also now too late, for the same reasons, to restore Kenya's great Athi-Kapiti Plains ecosystem. But migratory populations of Botswana could conceivably be restored simply by removing fences (Figure 9) and allowing wild ungulates access to water.

Momentum might yet shift and better favor wildlife. The wildlife tourism industry continues to grow in both volume and earnings. Trade arrangements that subsidize cattle production may change and reduce ranchers' political power.

An important development is the recent movement to create trans-boundary protected areas (TBPA) or trans-frontier conservation areas (TFCA) – also known as peace parks – that would restore ecosystems that previously supported large populations of wildebeest and other migratory ungulates.

"The preservation of traditional animal migration patterns, ensuring sufficient food and water sources for population growth, are the primary reason for the creation of peace parks. Peace parks however also encourage tourism, economic development, and goodwill between neighbouring countries, as well as facilitating travel of indigenous inhabitants of the area" (http://en.wikipedia.org/wiki/Peace_park).

Figure 9: Veterinary and international boundary fences built in northern Botswana and Namibia, and neighboring Zimbabwe, from 1958 to 2000 (Martin 2004).



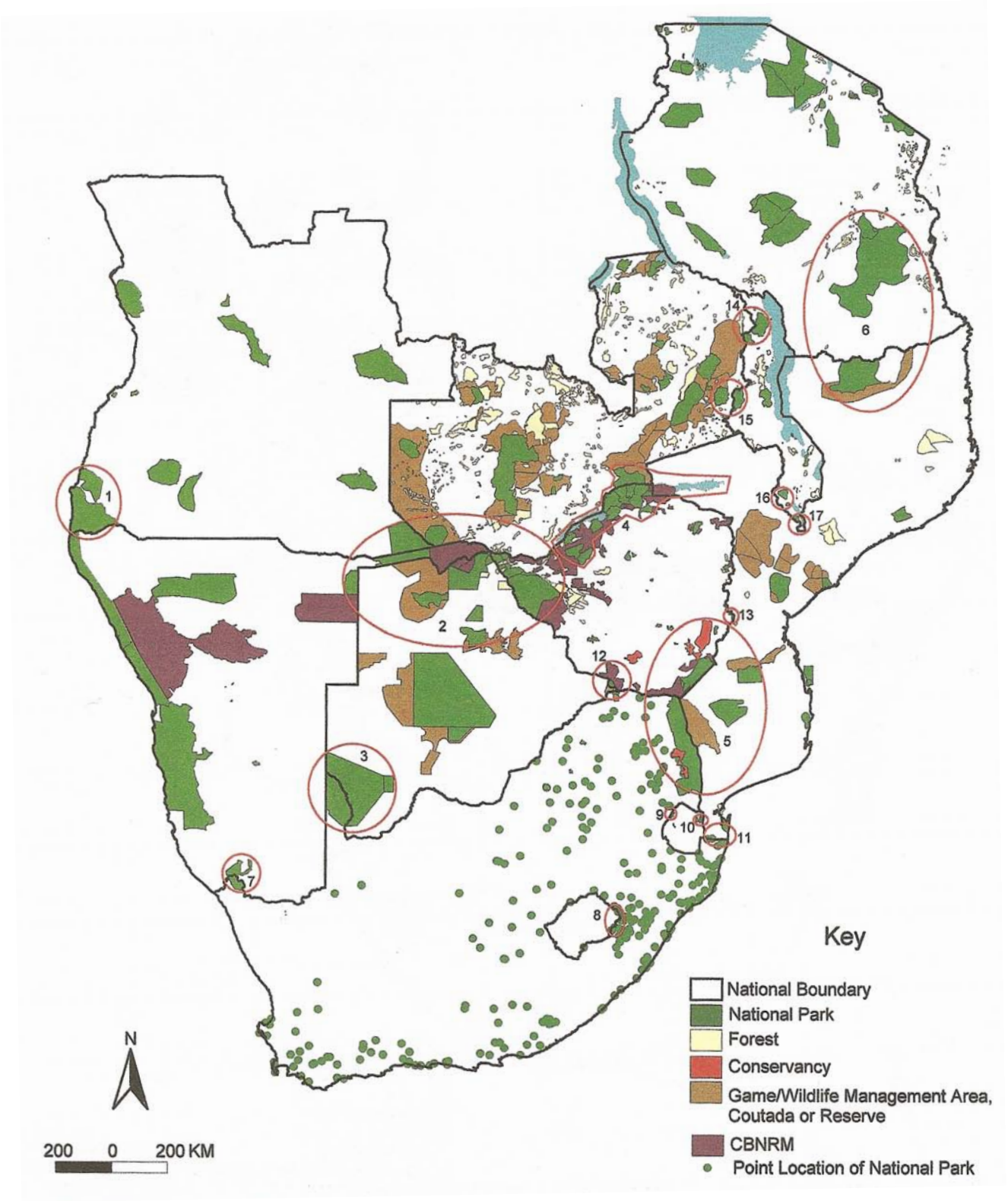
KEY TO VETERINARY CONTROL FENCES

1. Veterinary Cordon Fence: mid-1960s...
2. Etosha Northern Boundary. Fence: 1980s
3. Namibia/Botswana International Boundary: mid 1960s
4. Namibia/South Africa International Boundary: mid 1960s
5. Caprivi Border 1995 (Early fences 1970-80)
6. Samuchima 1995
7. Ikoga 1995
8. Setata 1996
9. Kuke 1958
10. Southern Buffalo Fence 1982
11. Northern Buffalo Fence 1991-96
12. Ngwatsha Fence 2000 (original Makalamabedi Fence1968 shown as dotted line below)
13. Botswana/Zimbabwe International Boundary 1984
14. Hwange National Park 1984
15. Sebungwe 1972

LEGEND

- Major Cordon Sanitaire
- Major buffalo-proof fence
- Secondary buffalo-proof fence
- Fence in disrepair
- Former fence location
- Fence continues

Figure 10: Proposed trans-frontier conservation areas in Southern Africa (Cumming 1999).



Cross-border conservation is not a new concept in Africa: South Africa and Botswana, and Tanzania and Kenya had connecting protected areas that encompassed parts of migratory ungulate ranges as long ago as the 1930s. However, proposals for African TFCAs began to proliferate in 1997 when the South African Peace Parks Foundation joined with three International Union for Conservation of Nature and Natural Resources (IUCN) commissions, the World Commission on Protected Areas (WCPA), the United Nations Environment Programme (UNEP) Programme on Protected Areas, and the Commission on Environmental Law in a joint undertaking to establish Parks for Peace. That collaboration led to the WCPA's Task Force on Transboundary Protected Areas, which at the 2003 World Parks Congress became the Transboundary Protected Area Global Network. Over 200 TFCAs are now catalogued in the UNEP/WCMC database.

The Landscape Concept

The impetus to establish TBCAs has grown in the last decade along with mounting alarm over diminishing biodiversity and indisputable evidence of global climate change. A landscape approach to preserving ecosystems, combined with gap analysis, is inspiring efforts to stretch some TBPAs far beyond their original borders to incorporate unprotected land between widely separated parks and reserves. Such huge size may be necessary to enhance ecosystem resilience and the connectivity of habitats. Indeed, several TFCAs could more than restore the truncated ranges of major migratory ecosystems. However, projected changes in climate and vegetation during the 21st century, coupled with human population increase and the spread of alien or exotic species, will not only hinder migration and successful breeding, but may also limit the availability of suitable habitats for some species (UNEP/CMS 2006).

Here, we consider which of the 22 proposed TFCAs in the Southern African Development Community (SADC) region are best suited to restore or nurture large migratory populations of wildebeest and associated species. Areas inside Botswana that formerly supported large migratory populations will be included in the discussion.

Whether and when any of the more ambitious protected TFCAs will become operational cannot be foretold. Problems needing resolution are many and daunting (Osofsky 2004). They include: incorporating rural communities in each TFCA, including land between protected areas not designated for conservation; repopulation of areas abandoned during civil wars; impact on natural resources; high poverty levels; removing landmines (including in Zimbabwe: even one field bordering the walk from the town to Victoria Falls – author's personal observation); controlling illegal hunting; resolving human-wildlife conflict; addressing a lack of effective disease control; livestock bias of veterinarians and agriculture ministries; resistance to removing fences on international borders; domination of TFCA development by South Africa; disproportionate sharing of benefits between stakeholders; growing pressure to access traditional land expropriated for parks and reserves; reconciling management among wildlife authorities of very different traditions and capabilities; language barriers; investment in ecotourism development; and, competition for tourist dollars among protected areas.

Transfrontier Conservation Areas Best Suited for Recreating Migrations

Botswana, Zambia, Zimbabwe, Namibia, and Angola

Kavango-Zambezi Transfrontier Conservation Area (Kaza Park)

Based on the wetland ecosystems of the Zambezi and Okavango rivers, the 30,000 sq km proposed target area of this TBPA includes a major part of the Upper Zambezi Basin, the Okavango Basin, and the Okavango Delta, comprising the largest contiguous wilderness, wetland, and wildlife area in the southern African region, with Victoria Falls as the hub. But the Kaza TFCA as now proposed is many times larger. In 2006, the tourism ministers of Namibia, Angola, Zambia, Botswana, and Zimbabwe signed a memorandum of understanding to create the world's largest transfrontier park, covering nearly 280,000 sq km. The following protected areas are to be included:

Angola

Longa-Mavinga National Prak, Luiana National Park, Mukosso Luenge National Park

Namibia

Mudumu and Mamili National Parks, Bwabwata National Park, Caprivi State Forest

Botswana

Chobe National Park, Moremi Reserve, Okavango Delta

Zambia

Barotseland, Kafue National Park, Liuwa Plain National Park, Mosi-oa-Tunya National Park, Sioma Ngwezi Plain

Zimbabwe

Binga Forest, Chizarira National Park, Hwange National Park, Kazuma Pan National Park, Matusadona National Park, Victoria Falls and Zambezi National Park.

"The attainment of functioning TFCAs is not envisioned as being either a rapid or a simple process; the long-term goal is being approached incrementally, with the first step being the building of linkages between Botswana and Namibia involving a number of joint species management programmes. Ultimately, these should facilitate larger transboundary conservation projects." (Martin 2004)

Freedom of movement and restoration of the several different migratory ecosystems will depend on removal of the veterinary cordon fences, chiefly in Botswana and Namibia, that have truncated migrations and caused the decline of most ungulate populations (Williamson & Williamson 1984; Williamson & Williamson 1988) (Figure 9). Divergent government planning agendas, however, complicate the process. Thus, veterinary and border fences continue to block wildlife movement from Botswana into Angola and Namibia (Figure 2).

Zambia

Liuwa Plain/Mussuma TFCA

The Liuwa floodplain of Barotseland has the distinction of being one of the first protected areas in Africa: it was declared a game reserve in the 19th century by the then King of the Losi people, Lubosi Lewanika. The wildebeest of the Liuwa Plain are among the last surviving migratory populations (Figure 11; Part 2.6). The population utilizes the Zambezi floodplain in the dry season, migrating to southeastern Angola in the wet season.

Figure 11: Migratory wildebeest running across flooded Liuwa Plain (Africa Parks Foundation).

Linking the Liuwa Plain National Park (3,660 sq km) to a still-to-be-declared area in Angola's Moxico Province and halting long-uncontrolled poaching in Angola would safeguard the ecosystem and allow the population of approximately 30,000 wildebeest (P. Viljoen, personal communication, 2007) to increase. The Lotsi people of Barotseland want to be involved. It is unfortunate that heavy settlement of the intervening Sioma-Ngwezi now blocks wildlife access to the Cuando River, precluding a dry-season water supply for this park, from which poaching has eliminated most game. Moreover, access to Angola via the Liuwa Plain may soon be blocked by the construction of a new 1,000 km border fence by Zambia, funded by the Netherlands to protect Zambian cattle from contagious bovine pleuropneumonia in Angola (Osofsky 2004).

Botswana

Ngamiland: Okavango Delta, Moremi, Chobe, Linyanti, and Savuti Area

With 18 species of antelopes (East 1999), the diversity of habitat and large mammals in this region is among the highest in Africa. However, old and new fences have spurred a steady decline of large mammal populations, including wildebeest, roan, sable, tsessebe, and buffalo (Martin 2004). For instance, in the Caprivi Strip, veterinary fences have isolated Mahango and Khaudum National Parks and broken linkages between the east and west Caprivi and between Botswana and Namibia (Martin 2004). Cooperation with growing local communities is critical to the successful establishment of wildlife corridors across the strategically located Caprivi.

Aerial surveys conducted by the Department of Wildlife Management and National Parks (DWNP) in the 1990s indicated a stable wildebeest population of about 12,000 animals centered on the Okavango Delta and extending at lower densities northward (Linyanti, Savuti Marsh).

Makgadikgadi Pans National Park/Nxai Pan National Park and surroundings

If created, this TFCA would comprise 9000 sq km.

A fence was built around this park border in 2004, and two features of it are of unusual interest. First, the fence was commissioned by the DWNP; second, an environmental impact assessment – the first in Botswana – was conducted in 1999 for the fence (Flores 2006). Unfortunately, the concerns of local pastoralists trumped concerns for wildlife. As a result, the fence excluded almost all boreholes in the Boteti riverbed. The predicted die-offs of zebra and wildebeest, in particular, occurred; the estimated 11,500 wildebeest present in the game reserve in February 1987 was reduced to about 5,000 in 2006 (Brooks in Flores 2006). Digging waterholes inside the park was meant to relieve the situation, but in so doing has turned migratory into resident populations. If the barriers were removed, zebra researcher Brooks estimates the combined zebra and wildebeest population would quickly increase from the present 20,000 to 100,000 animals.

But after spending $6.5 million to put up the fence, the government is unlikely to take it down anytime soon (Flores 2006). Removing any fence can take years, even after it no longer serves a useful purpose. The Nxai Pan Buffalo Fence, built in 1968 in a remote area northwest of Nxai Pan National Park, bisecting a major migration route to protected areas in the northwest, was officially decommissioned years ago, yet only 1.26 km of the 100 km fence has deteriorated such that wildlife can cross it. And, the 500 km electrified fence recently built along the Zimbabwe-Botswana border at a cost of Pula 27 million presents another insurmountable obstacle for wildlife interchange (South African Migration Project 2006). So, Makgadkgati migrants have lost another important drought refuge (it was during droughts in the 1930s that wildebeest first turned up in Hwange/Wankie National Park; Part 2.2).

Central Kgalagadi (Kalahari) Game Reserve (CKGR)

If the fences that have long blocked access to the Okavango Delta were removed (Figures 8 and 9), the present population of a few thousand wildebeest in the CKGR could increase to the 100,000 level present until droughts of the 1960s. Even by 1979, there were an estimated 260,000 wildebeest in the Botswana section of the Kalahari. Phefodiafoka Fence forms the northeastern boundary of the CKGR. Built in 1996 by DWNP and Department of Animal Health and Production (DAHP) in response to complaints of stock losses from predators, to stop cattle intrusion into the reserve, and as part of disease control objectives, the fence also bisects an important migration corridor between the Central Kalahari and the Boteti & Lake Xau areas. Massive migrations were recorded here in the past.

If created, this TFCA would comprise 52,800 sq km.

Kgalagadi Transfrontier Park

The Botswanan section constitutes 73% of this TFCA. This region of the Kalahari is marginal for wildebeest and zebra and likely to become still drier as global climate change proceeds. Development has long blocked access to the higher-rainfall area to the east. Kgalagadi nonetheless conserves a vital semi-desert ecosystem in which the dominant ungulates are gemsbok, red hartebeest, and springbok.

If created, this TFCA would comprise 37,991 sq km.

South Africa, Zimbabwe, and Mozambique

The Great Limpopo Transfrontier Park

A treaty signed in 2002 created the Great Limpopo Transfrontier Park, protecting some 35,000 sq km of varied acacia, scrub, and mixed savanna. It includes the Limpopo National Park (Parque Nacional do Limpopo, formerly Coutada 16) in Mozambique, Kruger National Park and the Makuleke area in South Africa, and in Zimbabwe Gonarezhou National Park, Malipati Safari Area, Manjinji Pan Sanctuary, and the Sengwe corridor.

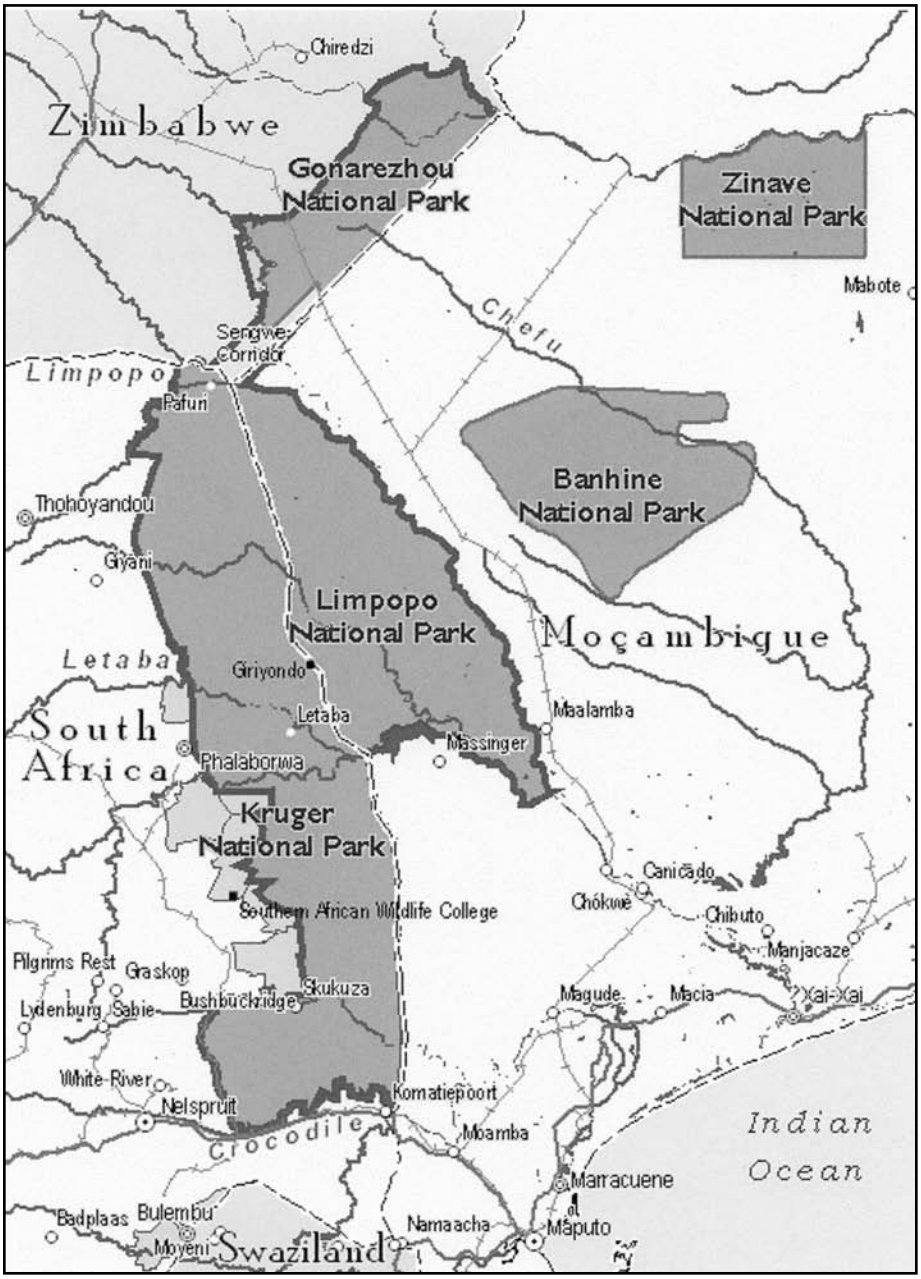
But promoters of this protected-areas network now have a far more expansive vision, of a landscape spanning nearly 100,000 sq. km, to be known as the Great Limpopo Transfrontier Conservation Area (GLTFCA) (Figure 12).

By connecting areas adjoining the core transfrontier park in each country, the GLTFCA would comprise a patchwork quilt of seven different land-use categories: national parks (Banhine, Gonarezhou, Kruger, Limpopo, and Zinave); private game parks (mostly those adjoining Kruger National Park); private conservancies (Malilangwe and Save conservancies in Zimbabwe); safari hunting areas under control of rural district councils and local communities in Zimbabwe; government-controlled hunting concessions (Coutada 4 and 5 in Mozambique); proposed ecotourism development areas (e.g., Mapulanguene area in Mozambique); and communal areas, including the Sengwe Corridor in Zimbabwe and vast areas in Mozambique. Connecting Gonarezhou National Park to the Great Park will require a 50 km land corridor. A broad-based consultative process, currently underway, will determine the area's final delineation. Once all parties have reached agreement, restoration of the included ecosystems will no doubt be measured in decades.

Mozambique's wildlife will take years to recover from destruction wrought before, during, and after the civil war (Part 2.8). Although little reliable information exists on the historic abundance of wildlife in Mozambique, the country still has much undeveloped wildlife habitat. How suitable the mixed Bushveld of Limpopo National Park is for wildebeest remains to be seen, but across the boundary fence in Kruger National Park, there are 14,000 wildebeest and over 100,000 impala.

Whether TFCAs comprising mostly Mozambique will become viable ecosystems with high biological diversity will depend on the rate of increase of severely depleted wildlife populations, not to mention the other challenges confronting peace-park establishment. Two other TFCAs offering suitable savanna habitat for wildebeest and other grazers are Lubombo Transfrontier Conservation and Resource Area (4,195 sq km), which lies on a coastal plain running from

Figure 12: Great Limpopo Transfrontier Park (Peace Parks Foundation).



Tembe Elephant Park and Ndumu Game Reserve in northern KwaZulu-Natal, South Africa, to the Maputo Elephant Reserve in Mozambique, and the Usuthu-Tembe-Futi and Nsubane-Pongola TFCA (Figure 10).

Mozambique

Gorongosa National Park

Among the projects intended to bring back Mozambique's wildlife, the most likely to succeed is the rehabilitation of Gorongosa National Park undertaken by the Carr Foundation in partnership with the Mozambican Tourism Ministry. Part of the $30 million the foundation has committed to spend in the next two decades will go into restocking wildebeest, zebra, and buffalo translocated from

South Africa, of which none to very few were present as recently as 2004 (Part 2.8). After a few years of many reintroductions, the emphasis will be on law enforcement, outreach, and development with surrounding communities to help these seed populations flourish (R. Beilfuss, personal communication, 2008).

The prewar population of approximately 5,500 wildebeest used to leave the park with the early rains and move north up the Rift Valley between the Zambezi and Pungue Rivers, then south again toward Lake Urema as conditions dried. By extending the Gorongosa protected area to include this range, growing wildebeest and zebra populations may establish or reestablish a migratory ecosystem (R. Beilfuss, personal communication, 2008).

Tanzania and Mozambique

Selous-Niassa TFCA

The Selous ecosystem protects the second-largest wildebeest population in Africa, presently estimated at 120,000 (Schuerholz & Baldus 2006). Except for a few hundred wildebeest surviving in Mozambique north of the Zambezi River, southeastern Tanzania contains all the Nyassa wildebeest subspecies *C. t. johnstoni*. The proposed Selous-Niassa TFCA will connect the Selous Game Reserve to the Niassa Game Reserve by way of a wildlife corridor 120 km long by 50 km wide. All together, an area of 154,000 sq km will be protected, forming one of the largest and most ecologically diverse transboundary ecoregions in Africa (Figure 10).

Being in a *miombo* woodland ecoregion, one would not expect great migratory plains game populations in this area. The wildebeest population is concentrated in the acacia savanna habitats along the major floodplains, especially in northeastern Selous along the Great Ruaha, and between the Rufiji and Ruvu rivers. However, the value of this TFCA for wildebeest is protection of the different subpopulations. It will contribute to restoration of *C. t. johnstoni* in northern Mozambique, although good wildebeest habitat there is also limited to the floodplains. Connecting the Selous and Niassa game reserves will facilitate movements of elephant and other large mammals into Mozambique and enable gene flow between isolated wildebeest populations. However, the wooded habitat of the corridor will limit passage of wildebeest, which also need to cross the barrier of the Ruvuma River. Moreover, community cooperation is critical to successfully establishing this wildlife corridor. Human population growth of 4.3% here threatens to convert the intact habitat to cultivation, undermining a unique opportunity to link the two largest conservation areas of Tanzania and Mozambique (Schuerholz & Baldus 2006).

How Many Wildebeest are Enough?

The wildebeest qualifies as a flagship, umbrella, or landscape species. As Schaller (2000) pointed out, "Wildlife spectacles, like the huge herds of migrating wildebeests, caribou, and Mongolian gazelles, also achieve flagship status. Focus on a flagship species should form the basis for protecting the whole habitat, with its wide spectrum of animals and plants." Just as the wildebeest migration defines the Serengeti ecosystem, so it once defined other migratory systems of eastern Africa.

How many wildebeest are enough? We endorse the answer given in Living Landscapes Bulletin 8: "Conservation should work toward historical levels, when people had collectively less influence on the planet," (Sanderson 2006). Perhaps a half-million wildebeest will never again range the Kalahari, once the greatest plains ecosystem after the Serengeti, but the current population of 35,000 could multiply if key fences curtailing migration were removed. If the proposed trans-frontier landscapes that once supported major migratory populations can protect large areas of intact, sparsely settled land, there is good reason to hope for further wildebeest recovery. But we are in a race with time, as the rising tide of human population floods the remaining unprotected wildlife habitats.

APPENDIX

A SURVEY OF THE WILDEBEEST (*Connochaetes taurinus*)

The following information is needed to complete a country-by-country survey of the distribution, habitat preferences, breeding season, habits, numerical status and trend of the populations of the species. Please answer as many of the questions as possible for each population.

I. Distribution and Numerical Status - On the accompanying map please show the approximate distribution of each population and assign each a different number or letter. Using a separate page for each population, please supply the following information:

1. Coordinates, the names of towns, rivers and/or mountain ranges, so that the limits of distribution may be entered as accurately as possible on a detailed map. Where a boundary is sharply defined by some topographic feature, kindly so indicate.

2. An estimate of the size of the population, indicating:
   a. Whether or not the estimate is based on a census and if so, when and what kind.
   b. The approximate confidence limits of the estimate (e.g. l0,000 ± l0%, 20% etc. Even a rough guess will be useful provided some idea of the range of variability that is possible is included).

3. The type of habitat frequented by the population.
   a. If open plain, specify the type (e.g. fire sub-climax if it is grassland kept open by annual burning; edaphic, e.g. dambo; flood plain; climax grassland; steppe, etc.)
   b. When describing a woodland type, please indicate the degree of cover, from scattered-tree savanna - thick bush or forest.
   c. Is the wildebeest's habitat deteriorating, stable, improving?

4. Trend of the population - Is it decreasing, increasing, or holding its own? If declining, why, in your opinion?

II. Habits - Choose the descriptions which best characterize the population (or write your own if none fits the case):

1. The population is sedentary in its habits, made up of separate small herds of females and young which remain resident in a small home range; adult males are often solitary and individuals may stay on the same small territory for months or years at a time. (Sedentary populations are dependent on permanent water and grazing.)

2. The population is semi-nomadic, behaving as No.1 part of the year, at other times forming large, mobile aggregations that move randomly in search of the greenest pasture.

a. If seasonally nomadic, at what season?
b. The population is entirely nomadic, moving about erratically throughout the year in search of green grass and does not settle down in any particular area. (This may be the pattern in semi-desert regions.)

3. The population is migratory, i.e. it makes regular seasonal movements from one part of its range to another. In between migrations, it behaves nomadically, or semi-nomadically.

4. Part of the population behaves as No.1, the remainder as No. 2, 3 or 4. Kindly estimate the percentages of each.

5. Is the present pattern the same as in the past, or is it new? E.g. a population that was formerly migratory may now be restricted by fencing, settlement, etc., while the establishment of bore holes may have given rise to a resident population.)

III. Breeding Season -

1. Does the population have a traditional calving area, where large aggregations of females foregather to drop their calves? Do they show a preference for any particular type of ground?

2. Please give dates of first calves seen, or still better, specify the two or three weeks of peak calving, for any years that this information is available.

a. Name the nearest town or location with a permanent rain gauge for which monthly records have been recorded in recent years (wanted only if data on first calves or peak calving season are given).

IV. Population Dynamics - Please indicate whether any sex- and age-ratio counts have been undertaken on any of the populations, and whether the results might be made available upon request. Accurate sex-ratio information is particularly wanted. Data on rates of increase and survival are desired for comparative purposes.

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