

Supplementary Material

Table S1: Current status of large mammals in Upemba National Park, with the principal evidence underlying each status assessment. Status categories reflect current management interpretation rather than formal IUCN assessment and are based on a heterogeneous evidence base including published sources, grey literature, recent field records, and expert field knowledge. Records based on personal communications, indirect signs, or local reports were used cautiously and are interpreted as management-relevant evidence rather than as formal abundance or occupancy estimates.

Species	Current status	Basis for status
Black rhinoceros (<i>Diceros bicornis</i>)	Extirpated	The last known black rhinoceros in Upemba was found killed in June 1957 near Kabengele (Kisamba), in the Butumba chiefdom, on the park's western edge (Verschuren, 1975; d'Huart, 1991). Four years later, in 1961, a last report of tracks was noted by conservateur De Wilde (UNESCO, 1986). Unconfirmed rumors about possible survivors in the southern part of the park persisted until the 1970s (Verschuren, 1975). Black rhinoceros is treated here as the earliest large-mammal loss in the Upemba landscape.
Cheetah (<i>Acinonyx jubatus</i>)	Extirpated	The last cheetah report from Upemba dates back to 1983 (Kapia, pers. comm.). From 1987, cheetahs were considered extinct in the park (Verschuren, 1987; d'Huart, 1991). In Kundelungu, traditionally the stronghold for cheetah in the country, the extinction was slightly later, with the last individual observed in October 1990 at Mibango, a livestock post 200 km north of Katwe (Mafuku Gireneza, pers. comm.).
African wild dog (<i>Lycaon pictus</i>)	Extirpated	Packs numbering 40-70 African wild dogs were reported during the 1940s (Verheyen, 1951). Two individuals were observed in Upemba National Park in 1986, the first documented sighting in over 15 years (Woodroffe et al., 1997). Verschuren (1987) still considered them present in the 1980s. By 1991, they

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Lion (<i>Panthera leo bleyenberghi</i>)	Extirpated	were considered locally extinct (d'Huart, 1991). Field rangers reported a sighting between 1997 and 1999 near the Fubwe River (Kapia, pers. comm.). Three wild dogs were sighted in the Kasongo region along the Kiniama road in 2003, outside Upemba (Hasson, pers. comm.). Prides of over 30 lions were seen in Upemba in the 1940s (Verheyen, 1951). In 1973, Letiexhe estimated the population on both plateaus at a minimum of 80 individuals (Letiexhe, 1973). In 1988, a lion was reported from Kundelungu (Hasson, pers. comm.). They were still regularly reported from Upemba in 1990 (Hasson, 2003) and 1991 (d'Huart, 1991; Jackson & Nowell, 1996). By around 2000, lions were considered extinct in the region (Bauer & van der Merwe, 2004). The Swedish zoologist Einar Lönnberg described the Katanga lion (<i>Panthera leo bleyenberghi</i>) as a subspecies in 1914 (Lönnberg, 1914).
Lichtenstein's hartebeest (<i>Alcelaphus lichtensteini</i>)	Probably extirpated	Hartebeest occurred in restricted numbers in Upemba in 1975 (Verschuren, 1975). d'Huart observed them on the Kibara plateau in 1991 (d'Huart, 1991), Kapia in 1998 (Kapia, pers. comm.), and a single individual was still seen in 2003 (Hasson, 2015). One sighting of two individuals was reported from nearby Kundelungu National Park in 2008 (Van Leeuwe et al., 2009), and rangers mentioned tracks of three individuals close to Kiubo in the adjacent Lubudi-Sampwe hunting reserve in 2016 (Kapia, pers. comm.).
Livingstone's eland (<i>Taurotragus oryx livingstonii</i>)	Probably extirpated	A record herd of 500 eland was seen at the spring of the Bwalo river on Kibara in 1961 (Nouvelles Approches, 2002-2004). They were frequently seen in Upemba National Park in 1975 (Verschuren, 1975). By 1991, however, they

Species	Current status	Basis for status
Roan antelope (<i>Hippotragus equinus cottoni</i>)	Possibly extant, unconfirmed	were reported as rare (d'Huart, 1991). In 2005, the last sighting was recorded by field rangers (Poutrou, pers. comm.). In 2012, tracks of approximately 10 individuals were found in the south of the park. In 2013, tracks were reported close to the Lufira Valley (Kapia, pers. comm.). Roan antelopes were reported as "fairly numerous" and seemingly increasing on the plateaus in the northern sector of Upemba National Park in 1975 (Verschuren, 1975). In 1991, they were occasionally observed around Lusinga (d'Huart, 1991) and a sighting of two individuals was reported in 2008 (Van Leeuwe et al., 2009). In 2012, tracks of a herd of approximately 15 were found in the south of the park. More recently, in 2023, tracks of two individuals were found and photographed near Lusinga (Kapia, pers. comm.; Mbulanga, pers. comm.; Poutrou, pers. comm.).
Waterbuck (<i>Kobus ellipsiprymnus defassa</i>)	Possibly extant, very low numbers	Two individuals were recorded in 2008 (Van Leeuwe et al., 2009). A confirmed sighting occurred at Lusinga in 2023 (Eckel, pers. comm.), and tracks were reported along the Senze River in 2024 (Kapia, pers. comm.).
Spotted hyena (<i>Crocuta crocuta</i>)	Possibly extant, very low numbers	Hyenas were considered rare in Upemba in 1990 (Jackson & Nowell, 1996; d'Huart, 1991). In 2011 they were considered present along the road between Kapelo and Lusinga. Tracks were identified in Kapelo in 2021 (Lain, pers. comm.) and a sighting recorded in 2024 on the southern plateau (Dobbie, pers. comm.). Akeley (1950) also mentions spotted, brown and striped hyena, although no other reference suggests the occurrence of brown or striped hyena, even historically, in Katanga.

Species	Current status	Basis for status
Leopard (<i>Panthera pardus</i>)	Probably extant	Common throughout the park in the 1940s (Verheyen, 1951), leopards were considered present in Upemba as of 1990 (Jackson & Nowell, 1996). A poacher with a dead leopard was arrested in 1998 (Kapia, pers. comm.). In 2008 evidence of leopard was recorded in the west of the Kibara plateau (Van Leeuwe et al., 2009). Leopards may now be absent from the southern regions of Upemba National Park and may occur only as vagrants in the south of Kibara (Kapia, pers. comm., Poutrou, pers. comm.).
Impala (<i>Aepyceros melampus katangae</i>)	Probably extant outside the park	Einar Lönnberg described the Katanga impala (<i>Aepyceros melampus katangae</i>) as a distinct subspecies based on morphological comparisons of museum specimens in 1914 (Lönnberg, 1914). Although declared extinct by Verschuren in 1971, rediscovered around the same time by park staff (Verschuren, 1975), considered extinct again around 2000 (Nouvelles Approches, 2002-2004), impala were still present in the Dikulwe area east of Upemba in 2018 (Hasson, pers. comm.). Unconfirmed reports of impala in the adjacent Lubudi Sampwe hunting reserve were received in 2024 (Ilunga Lwalaba, pers. comm.).
Greater kudu (<i>Tragelaphus strepsiceros</i>)	Probably extant outside the park	An aerial count in the early 1970s confirmed the presence of approximately 200 greater kudu in the southern part of the park (Lukwessa Lwamatwi, 1973). Kudu were reported near Kiubo in 1975 (Verschuren, 1975). By 1991, however, they were considered rare in the park (d'Huart, 1991). Bushmeat labelled locally as “giraffe” was reported from restaurants at Bunkeya in 2025 and may

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Sable antelope (<i>Hippotragus niger kirkii</i>)	Extant	have belonged to this species, although this remains unconfirmed (Kalombol, pers. comm.). Sable antelopes were reported as fairly numerous and seemingly increasing in 1975, particularly on the Brachystegia woodland slopes of the high plateaus (Verschuren, 1975). In 2003, a herd was seen on Kibara (Hasson, pers. comm.). In 2008, a sighting of 20 individuals was recorded in Kundelungu (Van Leeuwe et al., 2009). Between 2021 and 2025, herds of up to a dozen were reported regularly around Lwingila (Kabwe, pers. comm.; Kapia, pers. comm.).
Upemba lechwe (<i>Kobus anselli</i>)	Extant, highly threatened and localised	Only described in 2005 (Cotterill, 2005), the Upemba lechwe is endemic to Upemba's Zone Annexe and currently listed as critically endangered (IUCN SSC Antelope Specialist Group, 2017). Thousands of individuals were found until around 1950 on lakes Kisale and Upemba. Thought to be extinct, up to 22,000 lechwe were found during aerial counts in the early 1970s (Makabuza, 1972; Van Leeuwe et al., 2009; Hasson, 2003). In 1991, the species was considered "rare" (d'Huart, 1991), following intensive hunting by the military from Bukama (Verschuren, 2001). Hasson saw a few individuals in 2008 (Hasson, 2015). During an aerial survey in March 2025, 10 individuals were located east of Lake Kabwe in the Kamalondo Depression, and the population estimated as fewer than 100 (Weber et al., 2025).

Species	Current status	Basis for status
Hippopotamus (<i>Hippopotamus amphibius</i>)	Extant, very reduced and localised	Hippopotami were seldom seen in the Lualaba, Lufira, and the lakes in 1975 (Verschuren, 1975). In 1991, they were considered rare in the region (d'Huart, 1991). Only eight individuals were recorded along the Lufira River between Kiubo and Mbwe in January 2025. Occasional reports from individuals in the Kamalondo Depression occur.
Elephant (<i>Loxodonta africana</i>)	Extant, mostly outside park; probably <100 individuals in the park and <200 in and around the park	Elephants were already considered uncommon in Upemba before independence (Verschuren, 1958). The Lufira Valley used to form part of an elephant migration system linking Upemba to the Zone Annexe of Kundelungu via the Lufira Valley, and perhaps extending into Zambia (Hasson, pers. comm.). This migration ceased around 1993 due to poaching (Nouvelles Approches, 2002-2004). The last known sighting on the Kibara plateau occurred in 1997 (Kapia, pers. comm.). In 2002, the conservateur of Upemba, Batechi, spoke of an estimated 500 individuals on the plains north of the park, between the Lufira and the Lualaba. A herd of 85 was photographed in 2007 in that same area (Hasson, 2015). Mululwa (2008) reported a sighting of 275 elephants at the Mukoney patrol post in the north of the park on June 22, 2008. Further sightings included 68 elephants in 2016 in the park (Katembo, 2016) and 105 along the Malemba-Nkulu/Manono axis north of the park in the same year (Katembo, 2016). As of 2026, most of the region's elephants are outside Upemba, with the largest herd of approximately 100 individuals north of the park.

Species	Current status	Basis for status
Cape buffalo (<i>Syncerus caffer</i>)	Extant, probably less than 50 individuals near Ngulungu	Buffalo herds of 200 were regular in the 1940s (Verheyen, 1951). 30 years later they were found in "very low numbers" near Lusinga (Verschuren, 1975) and were considered rare by 1991 (d'Huart, 1991). Hasson still found a herd of 50 on Kibara around 1985, and dung and tracks in 2003 (Hasson, pers. comm.). In 2014, three individuals were reported near the Senze and Lubanga rivers (Kapia, pers. comm.). In 2024 and 2025, track counts and camera traps estimated the population at less than 50 individuals, concentrated near the Ngulungu patrol post in the south (Alenga, pers. comm.).
Grant's zebra (<i>Equus quagga boehmi</i>)	Extant, c. 200 individuals near Lusinga	Herds of 300 individuals were regular in the 1940s (Verheyen, 1951). In 1975, the national zebra population was estimated to be under 1,000 individuals, with the majority concentrated near Lusinga (Verschuren, 1975). About 400 individuals were counted in the early 1970s (Lukwessa Lwamatwi, 1973), 600 in the 1980s (Hasson, 2003), and 200 in 1991 (d'Huart, 1991). By 2003, the population had probably fallen to c. 20 individuals (Hasson, 2003). It has grown since, with 54 zebras in 2015 (Katembo, pers. comm.), 90 in 2019 (Mujinga, pers. comm.), 170 in 2024 and 197 in 2025 (pers. obs.). Zebras are the only species where quantitative evidence suggests a recovery in recent years.

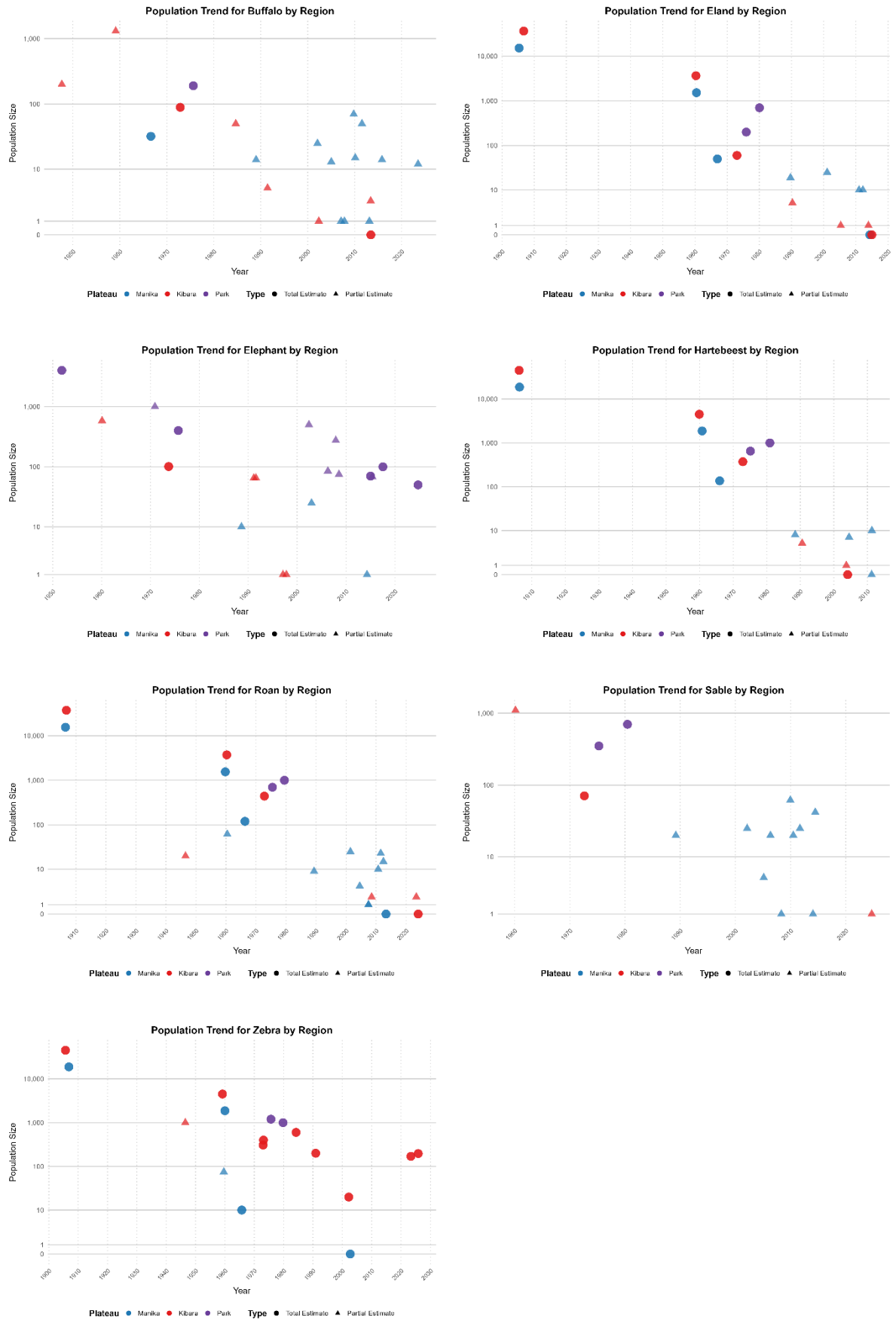


Figure S1: Heuristic reconstruction of broad long-term trends in selected large herbivores in Upemba, based on heterogeneous historical and recent sources. Values are not strictly comparable across years and should be interpreted as indicative rather than as

standardized abundance estimates. The values for 1906 are an extrapolation of the densities observed by Sharp (1956). Estimates for 1960 and 1966 are extrapolations from Prigogine (1967), numbers from 1973 and 1976 are from Letiexhe (1973). Other estimates are from Verheyen (1951), Verschuren (2001), d’Huart (1991), Van Leeuwe et al. (2009), and various internal reports and sources. The adjective “frequent” was interpreted as indicating a population of at least 25 individuals, and “present” as indicating a population of at least 5 individuals. Except for the zebra population, Kibara had higher densities of most large game populations until the 1990s, due to Manika’s proximity to the large centers and the massacres committed by UN soldiers in the early 1960s. From the 1990s, Kibara became more impoverished than Manika, and lost most large herbivores first. Generally, large wildlife concentrated on the plateaus during the dry season and migrated into the valleys during the rainy season, especially elephants and buffalo.

Supplementary references

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