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STATUS OF THE CHEETAH IN TANZANIA IN THE MID 1990'S

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ABSTRACT

This paper presents the results of a field interview survey and a literature review of the status of the cheetah (*Acinonyx jubatus*) in Tanzania. The survey was conducted between September 1993 and May 1994. The presence of cheetahs was documented in 30 areas (seven national parks, Ngorongoro Conservation Area, six game reserves, 13 game controlled areas, and 3 open areas), where a minimum of 366 cheetahs was estimated based on the sightings collected. In each of the 30 areas, cheetah status was evaluated in terms of distribution, frequency of observation, relative abundance, perceived trends in total numbers, and, where possible, minimum density estimates.

The densities estimated, ranging from 1 cheetah per 40 km² to 1/925 km², were lower than the average density in Africa. Estimators of abundance, frequency of observations, and trends tended to indicate a better cheetah status in the northern acacia savannas than in the southern miombo savannas. Family groups and large groups of adults were common in the north, while sightings of lone adults predominated in the south.

Recommendations for the conservation of cheetahs in Tanzania include: starting a nationwide monitoring of populations using this study as a blueprint and its results as a baseline; maintaining spatial connections between currently established cheetah populations; and favouring semi-nomadic pastoralism over farming and intensive ranching on rangelands.

INTRODUCTION

No assessment of the status of the cheetah (*Acinonyx jubatus*) in Tanzania has been made since Myers' (1975) survey of the whole of sub-Saharan Africa. Information specific to Tanzania dates back even further (Graham & Parker, 1965; Swynnerton & Hayman, 1950). In this paper, I present the results of a field-interview survey of the cheetah's status conducted in 30 areas of Tanzania between September 1993 and May 1994. I document cheetah status in terms of occurrence, frequency of observation, apparent abundance, apparent trends in numbers, and, where feasible, minimum density estimates. I also report actual cheetah groups observed and the specific locations they visited. Finally, I discuss

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possible connections between the sub-populations described, and report recent land-use practices that might influence the status of the species.

METHODS

Areas where cheetahs were likely to occur in Tanzania were determined by reviewing past literature (Swynnerton & Hayman, 1950; Graham & Parker, 1965; Myers, 1975; Kingdon, 1978) and through discussion with conservationists in Tanzania. Data were collected in the most promising of those areas through detailed interviews in English or Kiswahili with over 370 respondents including staff of protected areas and wildlife administration (153), local villagers and traditional pastoralists (90), tour operators and tour guides (52), professional hunters (29), expatriates farmers, naturalists, artists, and missionaries (28), and wildlife researchers and conservationists (18). Respondents were asked to report all the cheetah sightings that they could clearly remember, specifying location, date, total number of cheetahs, number of adults, number of cubs, and when possible sex of adults and relative age of cubs (age 1 = gray cub to jackal-sized cub, approximately 2–6 months; age 2 = jackal-sized to 2/3 of adult size cub, approximately 6–10 months; age 3 = 2/3 of adult size to full-sized cub, approximately 10–18 months). In addition, each respondent was asked to rank on a qualitative scale both the abundance of cheetahs (absent; very rare; rare; moderately numerous; numerous; very numerous) and the frequency of their observations (less than once every 6 months; 1/month to 1/6 months; 1/week to 1/month; at least once in a week). Knowledgeable people who resided for at least ten years in a given area were asked if they thought that the number of cheetahs in that area had increased, remained constant, or decreased over time.

I estimated the minimum number of cheetahs in an area by considering that all similarly composed sightings described the same animals unless made simultaneously in locations more than 5 km apart, the average distance a cheetah travels daily (McLaughlin, 1970). After eliminating all potentially redundant sightings at a given site, cheetah density was computed by adding up all cheetahs (i.e. adults, sub-adults, and cubs) in the remaining sightings reported at this site and by dividing this figure by the area of the site in km². This method produces reliable density estimates (Gros *et al.*, 1996). Areas of national parks, game reserves, and some game controlled areas were taken from the literature (Serengeti Research Institute, unpublished reports; Sinclair & Arcese, 1995). When the information was unavailable areas were estimated from maps using a modified acreage grid (Milton, 1942).

Each respondent was asked to name species on a picture montage including all carnivores found in Tanzania to ascertain his/her knowledge of the cheetah. To further minimize possible confusion with other predators, I asked for a detailed description of the behaviour of the observed animals and of the time and place of observation. My assistant C. Mtema and myself independently rated respondents for reliability on a 1–4 scale based on 1) their knowledge of the species inferred from picture recognition and behavioural description, 2) the precision of their answers, 3) the detection of error in their answers, and 4) their eagerness to participate. Responses ranking 2 or lower by C. Mtema or myself were discarded.

RESULTS AND DISCUSSION

Interviews yielded 1050 sightings of cheetahs in seven national parks, Ngorongoro Conservation

Table 1. Sightings of Cheetah where the species is rare in Tanzania.

Protected Area/Region	Date	Location	Individuals Seen	Observer	Additional Information		
Arusha National Park	1989	Ngurdoto	6 fully grown	Mr. I. Mwavapesa, Lake Manyara N.P. ranger			
	1993, January	East of Meru Crater	1 adult	Mr. Steven, guide for Ranger Safari			
Lake Manyara National Park	1990, dry season	between hippo pool and Mkindu circuit	1 adult	Mr. Shafuri, Lake Manyara N.P. guide	Sighting frequency < 1/6months (n = 2)		
	1991, dry season	hippo pool	2 adults	Mr. F. Mantia, Lake Manyara N.P. ranger			
	1993, September	Yambi	1 adult	Mr. Seleman, Lake Manyara N.P. ranger			
	1993, October	Yambi	2 adults	Mr. I. Mwavapesa, Lake Manyara N.P. ranger			
	1993, December	Mkindu	1 adult	Lake Manyara National Park ranger			
	1993, December	Marera	1 adult	Mr. Seleman, Lake Manyara N.P. ranger			
	1994, December	Maji Moto	2 adults	Mr. Hatibu, guide for State Travel			
	Mikumi National Park	1975	along Morogoro Iringa road	1 adult		Mr. H. Ramadani, Selous G. R. ranger	Sighting frequency < 1/6 months (n = 3)
		1977	Ikoya	1 adult		Mr. Kasimba, Mikumi N.P. ranger	
		1979, dry season	Mbogayaga	1 adult		Mr. J. Makuru, Serengeti N.P. ranger	
1982, dry season		near airstrip	2 adults	Horace, Tarangire National Park ranger			
1985, January		Towards Mwanambogo dam	1 adult	G. Mercer, naturalist, highschool teacher			
1986		Mwanambogo area	1 adult	Mr. Kasimba, Mikumi N.P. ranger			
1986		Mwanambogo Kisangura area	2 adults	Mr. Bahati, Mikumi N.P. ranger			
1986, dry season		N of Visada circuit (baboon site 5)	1 adult female	Dr. S. Waser, Mikumi Baboon project Director			
Dry 1985 to dry 1987		N of Visada circuit (baboon site 5)	1 adult male	Dr. S. Waser, second hand information from Mr. J. Rodgers			
1989, August		near Visada circuit	1 adult	G. Mercer, naturalist, highschool teacher			
1990, rainy season	korongo near Okoya forest	1 adult	Mr. W. Marua, technician on baboon project				
1990, dry season	Mkata River near hippo pool, crossed highway	1 adult	Mr. W. Marua, technician on baboon project				
1992, November	Visada River Bridge area	1 female & 3 medium-sized cubs	Mr. Maurice, Mikumi N.P. ranger guide				
1992, November	Mwanambogo-Kisangura area	3 adults	Mr. Bahati, Mikumi N.P. ranger				
1992, June	Mwanambogo-Kisangura area	1 adult	Mr. Bahati, Mikumi N.P. ranger				

Protected Area/Region	Date	Location	Individuals Seen	Observer	Additional Information
Selous Game Reserve	1992, November	Pwaga	2 adults	Mr. Bahati, Mikumi N.P. ranger	Sighting frequency once every 2 years (n = 7)
	1993, May	near Chamgore	2 adults	Mr. J. Francis, Mikumi N.P. hotel staff	
	1967, dry season	block LL1 on Mwendu river	1 adult male shot by hunter	Mr. A. Rodgers, FAO officer	
	1970	Manze	1 adult	Mr. B. Policalipi, Selous G.R. ranger	
	1971, dry season	Mtawatawa mbuga, Kingupira area	1 adult	Mr H. Ramadhani, Selous G. R. ranger	
	1975	South west of Kingupira	1 adult	Mr Wakara, guide for Ker and Downey	
	1978	near Mbuyu going towards BeoBeo	1 adult	Mr. G. Atanas, Selous G. R. ranger	
	1981, June	between Fuga station and Matambwe	1 adult	Mr Yudanyangango, Rufiji River camp employee	
	1982	Stiegler's gorge	1 adult	Dr. Markus Borner, Frankfurt Zoological Society scientist	
	1983–1984	block Z1, around Siwandu lake	1 adult	Mr. Ng'anguti, Selous G. R. ranger accompanying Dr. R. Leakey	
1983–1984	block Z1, around Siwandu lake	1 female & 4-5 cubs	Mr. Ng'anguti, Selous G. R. ranger accompanying Dr. R. Leakey		
1985	block LL1	1 adult	Mr. G. Alexiou, professional hunter		
1987–1993	Mwanamungu	1 adult	Mr Ngomarufu, Selous G.R. warden		
Mkata Plain Open Area	1993, dry season	BeoBeo airport	2 adults	General Manager BeoBeo camp	
	1993, May	BeoBeo airport	3 adults	General Manager BeoBeo camp	
	1993, July	Southern part of the reserve	1 adult	Mr. Baltazar, Savannah Tour Cie driver	
	1968	East of Wami	1 female and 1 cub	Mr. Mushi, Regional Game Officer for Morogoro	
	1968	East of Wami	1 adult	Mr. Mushi, Regional Game Officer for Morogoro	
	1980	Dakawa	1 adult	Mr. C. Voltaire, hunter for 34 years in the Mkata plains	
	1982	near Doma	1 adult	Mr. W. Marua, technician on baboon project in Mikumi N.P.	
	1989, December	Melela	1 adult	Mr. C. Voltaire, hunter for 34 years in the Mkata plains	
1990, March	Mindu village	1 female & 4 cubs	Maurice, Mikumi N.P. ranger and guide		
1992, July	Mkata villages	1 adult	Mr. C. Voltaire, hunter for 34 years in the Mkata plains		

Protected Area/Region	Date	Location	Individuals Seen	Observer	Additional Information
Rungwa Game Reserve	1992, August	Dakawa	1 adult	Mr. Mkunjira, Game ranger	
	1992, November	Ngerengere	1 adult	Mr. Mkunjira, Game ranger	
	1993, March	unspecified	1 adult	Mr. Mkunjira, Game ranger	
	1993, March	unspecified	1 adult	Mr. Mkunjira, Game ranger	
	1993, July	unspecified	1 adult	Mr. Mkunjira, Game ranger	
	1993, July	unspecified	1 adult	Mr. Mkunjira, Game ranger	
	1983, dry season	Bwana la mtemi	1 adult	Mr. Juma Mzee, Rungwa G. R. ranger	Abundance very rare (n = 11)
	1987, dry season	Bwana la mtemi	1 adult	Mr. E. Bisai	Sighting frequency <1/6 months (n = 6)
	1989	plain East of Iriki mountain	1 adult	Mr. S. Mgimura, Rungwa G. R. ranger	
	1990, rainy season	Headquarters area	1 adult	Mr. E. Bisai	
	1990–1991–1992	Rungwa village	1 adult interacting with a dog	Mr. Arcado, J. Hussein A. Rachidi and E. Bisai, Rungwa G. R. rangers	
	1991, rainy season	HQ area near airstrip	1 adult	Mr. J. Jumapili, Rungwa G.R. ranger	
	1992, dry season	Mabigiri area	1 adult	Mr. P. Damid, Rungwa G.R. ranger	
	1992	Headquarters Area near airstrip	1 adult	Mr. J. Jumapili, Rungwa G.R. ranger	
	1992, October	in the reserve near the villages	1 adult	Mr. Chris Fox, camp Manager Ruaha N.P.	
1992, November	Swira mbuga on Mwamwagembe Sasa road	1 adult	Mr. Mahundi, Rungwa G.R. warden		
1992, December	Mwamwagwembe: between village and station	2 adults	Mr. Mahundi, Rungwa G.R. warden		
1993, August	M'Pera block	2 adults	Mr. H. Seia, professional hunter, Tanzania Hunting Safari Cie.		
1993, September	Makwassa area	2 adults, 1 male	Mr. Issam, Rungwa G. R. ranger		
1993, November	Makwassa area	1 adult	Mr. Arcado, Rungwa G.R. ranger		
Kisigo Game Reserve	1989	Kizigo Central: Kilimela area	1 adult	Mr. R. Kamota, ranger	
	1992, dry season	Kizigo West	2 adults & 4 cubs	Mr. R. Kamota, ranger	
Utengule Swamps Game Controlled Area	1981	unspecified	4 cheetahs	Mr. Magamga, Game Scout at Idunda	Abundance rare (n = 8)
	1983	unspecified	3 cheetahs	Mr. Magamga, Game Scout at Idunda	Sighting frequency <1/6 months (n = 4)

Protected Area/Region	Date	Location	Individuals Seen	Observer	Additional Information
Usangu Flats Open Area	1990, August	unspecified	2 cheetahs	Mr. Rujewa, farmer and hunter	Trends decreasing (n = 3)
	1992, September	unspecified	1 adult	Mr. Magamga, Game Scout at Idunda	
	1993, August	unspecified	3 adults	Mr. Rujewa, farmer and hunter	
	1984, dry season	Maji moto area	5 adults	Game Scout at Regional Game Office, Mbeya	
	1984, dry season	Upagama area	2 cheetahs	Game Scout at Regional Game Office, Mbeya	
	1987	unspecified	1 adult shot	C. Fox, Ruaha tourist camp Manager	
	1992, dry season	between Igunda and Upagama	2 adults	District Game Officer, Mbeya	
	1992, dry season	between Utuya and Msanga	5 cheetahs	District Game Officer, Mbeya	
	1992, May	Mwansaya area	3 medium-sized cubs	Mr. Magamga, Game Scout at Idunda	
	1992, August	unspecified	5 cheetahs	Mr. Rujewa, farmer and hunter	
Luganzo Game Controlled Area	1991, July	unspecified	3 cheetahs	professional hunter	
Mlele Game Controlled Area	1993, dry season	Nyensi, near Ugalla River	2 cheetahs	Mr. H. Muller, professional hunter	
Ugalla Game Reserve	1992, September	unspecified	1 adult	Mr. H. Muller, professional hunter	
	1993, July	unspecified	2 adults	Mr. C. Paria, professional hunter	
	1993, August	unspecified	1 female & 3 cubs	Mr. C. Paria, professional hunter	
	1993, September	unspecified	1 adult male	Mr. C. Paria, professional hunter	
	1993, September	unspecified	2 adults	Mr. C. Paria, professional hunter	
	1993, September	unspecified	2 adults	Mr. C. Paria, professional hunter	
Katavi National Park	1997, dry season	surroundings of Lake Chada	1 adult	Graystoke Safari tour operator and tourists. Reported by R. Lewison, researcher in Katavi	
Tabora Region	1988	Mlala hills	1 adult	na	
	1992, August	Sikonge	1 adult	na	
Mara Region	1991	between Fort Ikoma and Mugumu	2 adults	Father Williams, priest at Isenye	
	1994, January	Embakassi plains	2 adults	Seminarist at Isenye	
	1993, August	30km from Fort Ikoma towards Musoma	3 adults, 3 young	Raphael Anthony, TAWICO guide	
Mwanza Region	1990–1991	Kijerechi Lodge 1km towards Mwanza	3 adults	Manager of Kijerechi Lodge	
	1990–1991	Kijerechi Lodge	1 adult chased by baboon	Manager of Kijerechi Lodge	
Ruvuma Region	1957	Ionides, between Songea and Mtwara road	1 adult	Alan Rodgers, FAO Officer	

Area, six game reserves, 13 game controlled areas, and three open areas of Tanzania. The results for Northern and those for Southern Tanzania are presented separately because of a strong contrast in cheetah status between the two regions. Sightings of cheetahs in the areas of Tanzania where the species was rare are listed in table 1. For areas where cheetah sightings were more common, minimum population estimate, perceived abundance and trends, and sighting frequency are summarized in table 2.

Northern Tanzania

Arusha National Park, Lake Manyara National Park, and Mkomazi Game Reserve

ARUSHA NATIONAL PARK. Although cheetahs were not resident in Arusha National Park (ANP), they were occasionally reported in the park (table 1). Rainforest and swamps, which are unsuitable habitats for cheetahs, predominate in ANP. However, a small grassland, Serengeti Ndogo, is found around the junction of Momela gate and Ngurdoto gate roads. The cheetahs observed in ANP were likely to be visiting from Longido, Natron, Mto-wa-Mbu, or Simanjiro Game Controlled Areas.

LAKE MANYARA NATIONAL PARK. There was no resident population in Lake Manyara National Park (LMNP). LMNP, with large tracks of ground water forests and woodlands and a high lion (*Panthera leo*) density, offered only marginally suitable habitats to cheetahs. Nevertheless, single adults and pairs of cheetahs were occasionally seen in both the northern and southern tips of the park. The cheetahs observed in the north of LMNP probably came from the adjacent Mto-wa-Mbu Game Controlled Area, and those reported in the south of the park either from Lake Burungi-Tarangire National Park area or from the northern tip of the park.

MKOMAZI GAME RESERVE. Mkomazi Game Reserve (MGR) population included both family groups and adults (table 2). Cheetah numbers were reported to increase, possibly because wild herbivore densities increased following the 1987 resettlement of pastoralists outside of the MGR's boundaries and the 1989 ban on hunting (T. Fitzjohn, Mkomazi Project Manager, pers. comm.).

Seventy percent of MGR is covered in *Acacia-Commiphora* bushland and shrub thickets (Wandogo & Leuschner, 1994). These habitats, rare in Northern Tanzania, are thought to be particularly suitable for cheetahs (Hamilton, 1986). Despite restoration efforts, cheetah habitats were threatened in Mkomazi. Agricultural burning at the edge of the reserve created a high fire hazard, and illegal cattle grazing and herbivore poaching were a concern (Mr Hassani, Mkomazi Assistant Project Manager, pers. comm.).

Southern Masailand

TARANGIRE NATIONAL PARK. Cheetah density in Tarangire National Park (TNP) appeared constant to long term observers. Although cheetahs were reported in all the habitats of the park, sightings concentrated around Lemiyoni, Matete, the Tarangire River, Silale swamp, and the Gursi-Kuro area. Only a few sightings were made in Burungi and Kitibong areas, which are occupied by dense bush, and none in Mkungunero and Nguselororobi marshes, which are rarely visited by people due to lack of roads.

Most of the cheetah observations (70 %, n=79 sightings) were made during the dry season, which lasts about 58 % of the year. Although part of the population may follow the herbivore wet season migration outside of Tarangire's boundaries, some cheetahs remain in the park during the rains.

Cheetahs were seen outside of TNP between Kwa Kuchinia and Lake Burungi, suggesting that movements were possible between TNP and Mto-wa-Mbu Open Area. Conversely, only one sighting was made south of TNP, next to Shuriro swamp. Cheetah movements towards

Table 2. Estimators of the status of cheetah populations in areas of Tanzania where the species is relatively common.

Area	Minimum population		Period	Abundance	Trends	Sighting frequency
	Minimum density [No. of cheetahs]	Composition				
Mkomazi Game Reserve (3276 km ²)	1/193km ² [17]	M=male, F=female, C=cub Adults: 1M, 2, 3, 4 Families: F+2C, F+3C	04-93/04-94	Moderate (n = 7)	Increasing (n = 3)	1/month (n = 5)
Tarangire National Park (2600 km ²)	1/108km ² [24]	Adults: 1M, 1F, 2M, 3M, 4, 5 Subadults: 3 (1M 2F); Families: F+2C; F+1C	12-92/12-93	Moderate (n = 5)	Constant (n = 4)	1/mth to 1/6 mths (n = 14)
Simanjiro Game Controlled Area (7703 km ²)	1/171km ² [45]	Adults: 1M, 1F, 2M, 3M, 4, 5 Families: F+2C, 2x[F+3C], 2x[F+4C], F+7C	03-93/03-94	Moderate (n = 22)	Constant (n = 16)	1/week to 1/month (n = 17)
Loikisale Game Controlled Area (na)	na [12]	Adults: 1M, 3M Families: F+2C, F+4C	02-93/02-94	na	na	na
Ruvu/Kitwei Game Controlled Areas (9058km ²)	1/755km ² [12]	Adults: 1, 2, 3 Unspecified: 6	03-93/03-94	Moderate (n = 3)	Constant to Decreasing (n = 4)	1/mth to 1/6 mths (n = 7)
Natron Game Controlled Area 6789 km ²)	1/251km ² [27]	Adults: 1, 2, 3, 4 Families: F+1C, F+2C, F+4C; Unspecified 7	03-93/03-94	Numerous (n = 17)	Constant (n = 14)	1/week to 1/month (n = 9)
Longido Game Controlled Area (1433 km ²)	1/84km ² [17]	Adults: 1, 3, 4 Families: F+1C, F+2C, F+3C	02-93/02-94	Rare to Moderate (n = 2)	na	1/month (n = 2)
Mto-wa-Mbu Game Controlled Area (2347km ²)	1/98km ² [24]	Adults: 1M, 2, 3, 4M Families: F+1C, F+2C, F+3C, F+4C	03-93/03-94	Moderate (n = 9)	Constant (n = 6)	1/month (n = 7)
Loliondo Game Controlled Area (6056 km ²)	1/233km ² [26]	Adults: 1M, 2, 4, 5 Families: F+3C, 2x[F+4C]	03-93/03-94	Moderate (n = 12)	Constant (n = 9)	1/week to 1/month (n = 8)
Ngorongoro Conservation Area (8288 km ²)	1/296km ² [28]	Adults: 1M, 2M, 3M, 4 Families: 2x[F+2C], 2x[F+3C], 4C	04-93/04-94	Moderate (n = 10)	Constant (n = 4)	1/ month (n = 5)
Serengati National Park (14763 km ²)	*1/59km ² [250]	na	01-93/04-94	Moderate (n = 29)	Constant (n = 8)	1/week to 1/month (n = 31)
Grumeti Game Controlled Area (598 km ²)	1/40km ² [15]	Adults: 1, 2 Families: F+2C, F+3C, F+4C	03-93/03-94	Moderate (n = 3)	Constant (n = 2)	1/week to 1/month (n = 2)
Ikorongo Game Controlled Area (na)	Na	Adults: 1, 2	03-93/03-94	na	Constant (n = 1)	na
Ruaha National Park (12950km ²)	1/925km ² [14]	Adults: 1M, 1F, 2, 3M, 4 Families: F+2C	11-92/11-93	Rare (n = 6)	Constant (n = 3)	1/ month (n = 5)
Lunda Open Area (4600 km ²)	1/230km ² [20]	Adults: 2, 3, 5, 7 Families: F+2C	10-92/10-93	Moderate (n = 7)	Constant to Increasing (n = 4)	1/mth to 1/6 mths (n = 7)

* Caro and Durant 1995

the Kitwei plains were limited by the villages and croplands abutting the park's southern boundary, and by the dense woodlands extending further south. Threats on the cheetah population of TNP included a sharp edge of dense settlements along the western boundary of the park, and heavy honey gathering within the park boundaries with its associated risk of fire.

SIMANJIRO GAME CONTROLLED AREA. Cheetahs were reported in constant numbers in Simanjiro Game Controlled Area (SGCA). As in Tarangire National Park most of the cheetah sightings (72 %, n=68 sightings) were made during the dry season, possibly because of better visibility and road accessibility at that time of the year.

In the early 1990's the Masai communal grazing lands in Simanjiro were undergoing rapid transformations as the Masai population increased and non-Masai people settled. Communal lands were being subdivided in a shift from communal ownership to private ownership, generally associated with commercial crop farming, in the areas of Naberera and Loikisale. Woodlands were being cleared for charcoal in north and central Simanjiro, and poaching was severe in the surroundings of Arusha and Kibaya and around mining centers in the plains (D. Peterson, Dorobo Safari, pers. comm.). Finally, poisoning and overhunting were thought to negatively impact large predators' density (P. Oliver, Oliver's camp manager, pers. comm.).

RUVU, KITWEI, AND SANYA PLAINS GAME CONTROLLED AREAS. Cheetahs were reported in low to moderate numbers in Ruvu and Kitwei Game Controlled Areas which had one of the lowest estimated densities (table 2). Cheetahs were observed less often than in Simanjiro, and only adults were seen. Populations were probably declining. No cheetah was reported in the Sanya Plains Game Controlled Area where the species used to occur in the 1970's. Massive habitat destruction had taken place there in the 1980's and early 1990's (G. Alexiou, professional hunter, pers. comm.).

Northern Masailand

NATRON GAME CONTROLLED AREA. Masai pastoralists, who made the majority of the respondents in Natron Game Controlled Area (NGCA), considered cheetahs numerous and their number constant. However, a density of only 1 cheetah/251km² was derived from their sightings. Since Masai tend to overstate carnivore numbers (pers. observation), it is reasonable to believe that cheetah numbers were moderate in NGCA as in similar areas of Northern Masailand. Most observations were centered on the areas of Gelai and Kitumbeine, possibly reflecting the distribution of pastoralist observers. The major threat to cheetah's habitats in NGCA was overgrazing promoted by the growth of Masai herds (Engaruka village officials, pers. comm.). As elsewhere in Masailand, large carnivores had been poisoned on a large scale in the late 1970's and in the 1980's, with the effect of reducing lions and spotted hyenas (*Crocuta crocuta*) numbers (P. Higgins, professional hunter, pers. comm.). On the migration route from Tarangire to the Kenya Masailands, NGCA could play a strategic role in linking the cheetah populations of northern Tanzania and those of southern Kenya.

LONGIDO GAME CONTROLLED AREA. Although cheetahs were reported in low to moderate numbers in Longido Game Controlled Area (LGCA), the computed density was relatively high (1/84km²). This could be an effect of the comparatively small area of LGCA (table 2). Most sightings were made around the temporary marsh of Mbuga Ngaserei. Only one sighting was reported along the northern boundary of LGCA, which is contiguous to Amboseli National Reserve in Kenya. Cheetahs have undergone a marked decline in Amboseli in the late 1980's (Gros, 1998), and the reserve did not seem to act as a source for

cheetahs in LGCA at the time of study.

The growth of Longido, Namanga and Arusha, and the settlement of non-Masai people severely threatened the fragile sub-arid habitats of LGCA. Land reclamation for agriculture, intensification of woodcutting for firewood and charcoal, and rampant poaching constituted the main threats (P. Biabato, Professional Hunter, pers. comm.; Mr Kone, District Officer, pers. comm.)

MTO-WA-MBU GAME CONTROLLED AREA. Cheetahs were reported in moderate and apparently constant numbers in Mto-wa-Mbu Game Controlled Area (MGCA). Observations concentrated between Mto-wa-Mbu and Makuyuni, and around Selela and Engaruka. Cheetahs were already common around Selela in the 1970's when TAWICO used to trap them for live exports (Orio, TAWICO professional hunter, pers. comm.).

Habitats were severely impacted around Mto-wa-Mbu and Makuyuni by woodcutting for charcoal production (J.P. Leroux, professional hunter, pers. comm.), local commercial meat poaching (E. Mollel, Game Ranger in Mto-wa-Mbu, pers. comm.), and overgrazing by Masai herds during the dry season. Lion numbers in MGCA were thought to be declining as a result of hunting and poisoning, and cheetahs were killed in response to stock depredation.

Herbivore migrations confirmed that the connections between MGCA and both Tarangire and the northern Masailands were still functional. Conversely, the heavily settled high plateaus probably inhibited movements of cheetahs between MGCA and the Serengeti ecosystem.

LOLIONDO GAME CONTROLLED AREA. Cheetah numbers were considered moderate and constant in Loliondo Game Controlled Area (LGCA). Sightings were made year-around and frequently. They tended to be more common towards the west of the reserve along the border of the Serengeti National Park.

Although wild ungulates and livestock coexisted in LGCA overgrazing was not yet a problem (Loliondo District Game Officer, pers. comm.) and poaching remained limited (D. Peterson, Dorobo Safari, pers. comm.). Dry season fires, set by pastoralists, caused the reserve to burn in 1993 (Moses, LGCA warden, pers. comm.). The professional hunting community worried that the pressure of sport hunting in LGCA was too high and affected lions among other species.

The Serengeti Ecosystem

NGORONGORO CONSERVATION AREA. Cheetah numbers seemed constant in Ngorongoro Conservation Area (NCA). Sightings occurred in all parts of NCA except the Bulbul depression and Olmoti, Empakaai, and Kerimasi Craters. Most sightings were made on the plains lying west of the calderas, particularly in Malanja depression, Olbalbal, Oldupai, and Ndutu areas. Reports were scarcer in the Lemutei and Angata Salei plains and in the southern tip of the Serengeti Plains south of Ndutu, possibly due to the lesser tourist frequentation there. Sightings were rare in the woodlands surrounding Lake Eyasi.

Periodically a group of males claimed the Ngorongoro Crater as part of their home range. From December 1993 until at least March 1994 a pair of males was repeatedly seen in the Caldera. They were apparently the first occupants since 1988 when another pair of males was seen regularly (Sophie, H. Van Lawick film crew, pers. comm.). There were also two unconfirmed reports of a trio of males in the Caldera in March 1994. The last confirmed sighting of a family group in the Caldera, a female and three medium-sized cubs, dated from June 1983 (by Graham Mercer, high school teacher and naturalist). The rarity of cheetahs, especially that of females accompanied by cubs, might be due to the unusually high concentration of lions ($1/2.5 \text{ km}^2$, Hanby *et al.*, 1995) and spotted hyenas ($1/0.5 \text{ km}^2$, Hanby *et al.*, 1995) in the Caldera.

Masai pastoralists considered lion numbers low and spotted hyena numbers moderate in NCA outside of Ngorongoro Crater. They acknowledged killing the lions, spotted hyenas, and cheetahs attacking their stock. For example a cheetah was killed in Kimba in September 1992 (Moses, Roy Safari Company, pers. Comm.).

Cheetahs could move freely between NCA western plains and Serengeti National Park, Maswa Game Reserve, and Loliondo Game Controlled Area. To the southwest of NCA, the rift escarpment and the highly populated highlands of Mbulu District probably prevent cheetah movements towards the Mto-wa-Mbu Game Controlled Area and Tarangire ecosystem.

SERENGETI NATIONAL PARK. The Serengeti National Park (SNP) cheetah population, probably the largest protected population in East Africa, has been studied since 1969 (Caro, 1994). This provides an opportunity to compare the results of this interview survey to demographic data derived from a long-term study in the field. Caro and Durant (1995) estimated 250 adults and cubs in the entire park, i.e. 1 cheetah/59km². A density of 1 cheetah/20.4km² is reached on the Serengeti plains alone, based on individually known animals (S. Durant, Serengeti Cheetah Project leader, pers. comm.); a result approximated by the interview method: 1 cheetah/22.8km² (Gros *et al.*, 1996). Respondents reported moderate cheetah numbers in SNP: 1 cheetah per 59 km² is moderate and 1/20.4km² high on the scale of documented cheetah densities across Africa (1/500 to 1/10.6km², Gros *et al.*, 1996).

Respondents considered cheetah numbers constant. However, Laurenson (1992) showed that the average number of cubs accompanying their mother had decreased in SNP between the early seventies and the late eighties, and suggested that cheetah recruitment rates, and possibly population size, might be decreasing in the park, an opinion shared by S. Durant (pers. comm.).

The cub-to-adult ratio figure derived from interview reports (0.416) was high and close to that computed for the known population (0.452) at the time of survey.

On the Serengeti Plains some males are year-round residents in relatively small territories (37.4 km², Caro & Collins, 1987), while family groups and non-territorial males follow the NW/SE migration of Thomson's gazelles (*Gazella thomsoni*) across the plains and onto Ngorongoro Conservation Area (Durant *et al.*, 1988). Male turnover in the studied population is high (Kelly *et al.*, 1998), suggesting movements to nearby populations. Nothing impedes cheetah movements between SNP and the surrounding game reserves and game controlled areas in Tanzania, nor between SNP and Masai Mara National Reserve, in Kenya.

Although cheetah numbers might be limited by competition with larger carnivores within SNP, and although disease have recently affected other carnivore populations in the park (wild dogs, Gascoyne *et al.*, 1993; lions, Roelke-Parker *et al.*, 1996), there is no apparent immediate threat on the cheetah population of SNP.

GRUMETI AND IKORONGO GAME CONTROLLED AREAS. Respondents reported cheetahs in moderate and constant numbers in Grumeti Game Controlled Area (GGCA). Cheetah numbers also seemed constant in Ikorongo Game Controlled Area (IGCA), though no family group was seen there. Sightings were made in Sabora, Nyasiron, and Ruwana plains in Grumeti, and around Ikoma and Mwangwesi in Ikorongo. It is likely that the home ranges of some of the cheetahs observed within the small GCAs' boundaries extended either into adjacent Serengeti National Park or into Isenye Open Area.

Cheetahs were reported in Isenye Open Area (table 1) east of Isenye-town, the least disturbed area of Mugumu District. The district was densely populated by farmers and settled pastoralists who practice intensive subsistence and commercial meat poaching using snares to

which cheetahs are susceptible (pers. obs.). Fires set for poaching and grazing purposes were a major threat to habitats (Raphael Anthony, professional hunter, pers. comm.; Father Williams, pers. comm).

MASWA GAME RESERVE. Maswa Game Reserve is thought to have a healthy cheetah population. Although I did not receive permission to conduct interviews there, I obtained confirmation that cheetahs were present in the areas of Kimali, Makau and Mgono 1991–1993. Despite serious efforts to curtail poaching, snare lines were particularly numerous in the north of the reserve near Mamarehe, and in the south around Makau and Mbono (H. Muller, professional hunter, pers. comm.).

Southern Tanzania

The Selous Ecosystem and the Mkata plains.

MIKUMI NATIONAL PARK. Cheetahs were rarely seen in Mikumi National Park (MNP) (table 1). Almost all sightings occurred in the flood plains lying west of the Morogoro-Iringa road. This area, encompassing about one quarter of the park, was the focus of ranger patrols and tourist visitation. The cheetahs observed could have been part of a small population established in the miombo savannas occupying the remaining and rarely visited three quarters of the park. Alternatively, they could have been transients from populations established outside of MNP. There was, however, no obvious source of transient cheetahs in the region. Cheetah reports were scant in the Mkata Plains and in the Selous Game Reserve. The closest sizeable populations occurred in Ruaha National Park separated from MNP by the Rubeho Mountains and the Iringa highlands, and in the Kitwei Plains lying 180 km north beyond the Mkata Plains and the Nguru Mountains.

SELOUS GAME RESERVE. Cheetahs were reported about once every two years in the Selous Game Reserve (SGR). Mainly lone adults were observed north of the Rufiji River (table 1) where most of the reserve's open habitats occur, and in LL1 hunting bloc in the east of SGR. These findings confirm previous distribution data (R. Baldus, undated). As in MNP, openness of vegetation and observation pressure co-vary which prevents teasing apart the effect of those two factors on the frequency of cheetah reporting. The nearest cheetah reports were in MNP. Cheetahs might still be present in Ruvuma region south of SGR but the last positive sighting there dates from 1957 (Myers, 1975 and table 1).

MKATA PLAIN OPEN AREA. Cheetahs were rare in this heavily hunted open area. Single adults were observed on average once every three months (table 1). Cheetah numbers on the plains had apparently declined since the 1970's (Mr Mushi, Regional Game Officer, pers. comm.) and possibly since the 1980's (Mr Mkunjira, Regional Game Assistant, pers. comm.). Cheetahs could move between the Mkata plains and Mikumi National Park immediately to the South.

The Greater Ruaha Ecosystem

RUAHA NATIONAL PARK. Sightings concentrated in the south of the park along the Great Ruaha River where cheetahs occurred at a density of at least 1/64km². Sightings were common between Mwangusi and Mdonya sand rivers, where tourist visitation was high, and around Lunda and Jongomeru ranger posts. Sightings of adults alone or in pairs were more common than observations of females with cubs and large groups of adults. The density based on sightings for the entire park was 1 cheetah/925km², while Chris Fox (Mwanguzi River Camp Manager) estimated 1 cheetah/648km². As in Mikumi National Park and Selous Game Reserve cheetahs were seen frequently over a short period of time then vanished for months (Peter Fox, 10-year Ruaha River camp manager, pers. comm.). Long-term observers

believed that cheetah numbers increased in Ruaha between 1970 and 1990 as burning (L. Patterson, Ruaha Project Manager, pers. comm.) and elephant damage (N. Heeding, Senior Forest Officer, pers. comm.) resulted in vegetation opening and higher density of plain herbivores.

Wildlife movements occurred between RNP and the Utengule swamps-USangu flat area, Lunda Open Area, and Rungwa Game Reserve. Movements seemed possible to the northwest up to Ugalla Game Reserve (L. Patterson, pers. comm.). However, connections with Mikumi National Park or with the Selous Game Reserve were thought unlikely (C. Fox, pers. comm.).

RUNGWA AND KISIGO GAME RESERVES. Cheetahs were observed in Rungwa (RGR) and Kisigo (KGR) Game Reserves in the 1980's and 1990's (table 1). Although reported previously in the area (Graham & Parker, 1965), the cheetah used to be so rare that it did not figure on official species lists (Mr Ngovo, RGR Project Manager, pers. comm.).

Cheetahs were still considered very rare in 1993-94 when lone individuals and occasionally pairs of adults were reported on average less than once in 6 months. A single adult was observed repeatedly between 1991 and 1993 near the headquarters and Rungwa village in RGR (table 1). In addition, Mr Ngovo observed a group of three cheetahs in KGR. Only two family groups were reported: two adults and four cubs in KGR (table 1), and a female with 2 cubs (Ngovo, pers. comm.) in an unspecified area of the complex. Mr Ngovo also reported seeing cheetahs in 1991 and 1992 in the areas of Ikili-Makwassa in RGR, Kiremera in KGR, and Igunga in Muhesi. In his opinion cheetahs frequented mostly the western part of the RGR, covered in open miombo, and the open woodlands of Itende and Jamono. Chris Fox guesstimated that Ruaha and Rungwa combined might hold as many as 50 cheetahs.

In the late 1980's to early 1990's honey collectors and farmers set fires that burned 50 to 60 % of the reserve yearly. As a result the canopy of the woodlands opened, which might explain the increase of cheetah observations locally.

LUNDA OPEN AREA. Cheetahs were reported in moderate numbers in Lunda Open Area (LOA) where their density recently increased. Unusually large groups of adults were observed (table 2).

The species was rare in Lunda in the period between 1950 and 1980 and several reasons seem to have contributed to its recent increase (G. Fliakos, hunter). Fire, overgrazing, and woodcutting by newly settled pastoralists, and elephant damage caused a succession from dense bush to semi-open bush and plains. Habitat opening and wildlife protection in Ruaha, gazetted as a national park in 1965, increased herbivore density in Lunda. Finally, lions and spotted hyenas densities decreased as a result of poisoning.

UTENGULE GAME CONTROLLED AREA AND USANGU FLATS OPEN AREA. Rare and scarcely observed in the area, cheetahs appeared to have decreased in numbers in the 10 years preceding this study. Cubs were reported only once between 1990 and 1993 (table 1).

Since the 1970's pastoralists from the Tabora, Shinyanga and Mwanza regions had been using the marshes as dry season pastures, and the Usangu plains' marshes were becoming seasonal as a result of overgrazing and tree cutting (L. Patterson, pers. comm.). The recent gazetting of Usangu Game Reserve may improve the status of the cheetah in the area.

OTHER LOCATIONS. Cheetahs were also reported in Luganzo and Mlele Game Controlled Areas, in Ugalla Game Reserve, and in Katavi National Park, and in locations outside of protected areas in Mara, Mwanza, and Tabora regions (table 1).

CONCLUSION

This study confirms the presence of cheetahs in 30 areas of Tanzania, home to a minimum of 366 individuals. Respondents considered cheetah numbers low or moderate (but see results for Natron GCA), and densities derived from interviews were lower than the average cheetah density in Africa (1 cheetah/48 km², Gros *et al.*, 1996). The status of cheetah populations in northern Tanzania was in striking contrast with that of populations in southern Tanzania. In northern Tanzania, numbers were generally reported as moderate, trends as constant, and sightings as frequent (> once per month). The few exceptions to this rule were Ruvu, Kitwei, and Longido Game Controlled Areas, where cheetahs could be declining, and Lake Manyara and Arusha National Parks, which include little habitats suitable for cheetahs. In contrast, cheetahs were considered rare in southern Tanzania, where they were rarely observed (<once per 6 months). Cheetahs were too rarely seen for respondents to perceive trends in their numbers except in Usangu flats-Utengule swamps where a decline was suggested. Only in the southeast of Ruaha National Park and its adjacent Lunda Open Area was there an indication of larger populations, following the opening of habitats by fire, grazing, and elephant browsing.

The rare cheetah sightings in miombo savannas tended to occur in bursts over short periods of time. Cheetahs may roam extensive home ranges in the miombo where prey density is low (East, 1984), very infrequently coming back to exploit a particular area for a short period. Alternatively, unusually favorable observation conditions, such as burnt or stunted grass, could lead to the reported clusters of observations of otherwise undetected cheetahs.

In Lunda Open Area and in the Rungwa-Kisigo-Muhesi complex, where cheetahs used to be exceedingly rare, an increase in cheetah numbers was noticed after the recent arrival of pastoralists in the area. This result supports the idea that semi-nomadic pastoralism creates favourable habitat conditions for cheetahs, as suggested by Burney (1980), possibly through the elimination of larger predators and/or the opening of habitat by fire and grazing.

RECOMMENDATIONS

I suggest the following recommendations to improve the conservation status of cheetahs in Tanzania:

- *Monitor cheetah populations in protected areas.* The ranger forces of national parks, game reserves, and game controlled areas could be asked to keep a systematic record of all sightings of cheetahs encountered during patrols. This study provides a blueprint and a base line for the monitoring.
- *Survey for cheetahs in the regions of Tabora, Dodoma, Singida, and Shinyanga.* These regions, which were not covered in detail in this study, are likely to hold small cheetah populations based on past distribution and current land-use.
- *Study cheetah demographics in a traditional pastoralist setting* to determine and quantify the livestock husbandry practices that foster good cheetah status.
- *Focus on curtailing wild herbivore poaching within the cheetah's range.* The example of Mkomazi Game Reserve suggests that prey recovery is quickly followed by an increase in cheetah numbers.
- *Maintain connectivity between the areas of the cheetah's range* by protecting herbivore migration routes in northern Tanzania, and by insuring the persistence of connective habitats between the miombo areas of the species' range. Connectivity is the key factor underlying the occasional presence of cheetahs in marginal habitats, as seen in Arusha

National Park, and the quick demographic response to new favorable habitat conditions, as seen in Lunda Open Area.

- *Encourage semi-nomadic pastoralism on communally owned land*, since this land-use is compatible with cheetah persistence.

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