Quarterly Update – Kordofan giraffe (*Giraffa camelopardalis antiquorum*), Garamba National Park, Democratic Republic of Congo

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Introduction

Garamba National Park (GNP) in the Democratic Republic of Congo (DRC) was first established in 1938, one of the first in Africa, by virtue of its uniqueness. Throughout its long history the Park was first made famous with the world's only elephant domestication program, coupled with its high numbers of elephant and buffalo, and home to the world's last northern white rhino (*Ceratotherium simum cottoni*) population. Additionally, the Park was designated a UNESCO World Heritage site in 1980 and on the List of World Heritage in Danger in 1996. Sadly, the Park's infamy has increased through losing the last northern white rhino, and being plagued by numerous groups of rebels, in particular the Lord's Resistance Army.

In fact, the Park, being nestled in the far north-eastern corner of the country, is writing history every day again, not because of the countries' own destabilised politics (the 2,000km between the Park and the countries' capital creates an efficient buffer), but because of its war against armed militia coming from neighbouring countries.

GNP, and its adjacent Hunting Reserves, are also home to DRC's only population of giraffe, historically named 'Congo giraffe' (Amube et al. 2009; De Merode et al. 2000; East 1999) but genetically identical to other Kordofan giraffe across Central Africa (Fennessy et al. 2016).

Due to illegal hunting, current giraffe numbers in the Park and surrounding areas were reported to be less than 40 individuals – and less than 2,000 Kordofan giraffe (*Giraffa camelopardalis antiquorum*) remain in the wild (Muller et al. 2016). The numbers have never been so low since the first aerial census of Garamba National Park was undertaken in 1976, when 350 giraffe were estimated (Savidge et al. 1976).

Interestingly, poaching of giraffe by local tribes living in the adjacent Hunting Reserves to Garamba NP has been relatively limited. This is because they believe that consuming giraffe meat causes leprosy. However, some giraffe were poached in the last decade for their tail hair which is a status symbol for tribe chiefs (African Parks, 2012). Amube et al. (2009) reported that the traditional taboos have largely died out with the influence of modern society and the invading *muharaleen* horsemen, who specifically value giraffe tails as part of their dowries, have increased

their illegal hunting of giraffe. A decline in general wildlife populations in the Park is furthermore linked to post war instability, power struggles and exploitation of resources, particularly from neighbouring countries (Hillman Smith & Amube 2005).

The giraffe population of the DRC was formerly recognised as a separate taxon, the Congo giraffe (*G. c. congoensis*), but numerous authors have since subsumed it into *G. c. antiquorum*, and more recently a subspecies of the Northern giraffe (*Giraffa camelopardalis*) (Fennessy et al. 2016).

In the context of the above, the DRC Institut Congolais pour la conservation de la Nature (ICCN) and African Parks Network has been undertaking key conservation and management of the Park, and more recently a focus has been on preserving the last remaining few. GCF with support from its partners has provided some technical and financial support to the Park, and the latest is through my conservation research efforts to assess the situation and to develop an adequate management plan for the remaining giraffe population. This quarterly conservation update provides an overview of the work undertaken from January – March 2017 but is following up on a first quarterly update that covers the work undertaken in the period October – December 2016.

Population dynamics

With the dry season lasting from December 2016 – March 2017 and frequent fires that burn the densely-grassed savannah, Garamba's wildlife has become easier to monitor. A lot of data was collected during the quarter, including several new giraffe observed.

Being dispersed over four different regions Garamba's giraffe are categorized into four categories (East, Northwest, Southwest and West). Besides two bigger populations in the East and Southwest, there are two small populations in the West and Northwest, home to 4 and 5 giraffe respectively. One other giraffe (GIR43F), which was fitted with a GPS Satellite collar, was isolated from others but crossed back over the river during this Quarter and has since been seen with other giraffe.

	Juvenile (4)	Subadult (9)		Adult (33)	
	Male/Female (4)	Male (4)	Female (5)	Male (13)	Female (20)
East	GIR44U GIR45U	GIR02M GIR15M GIR17M	GIR01F	GIR04M GIR09M GIR10M GIR14M GIR21M GIR38M GIR39M GIR41M	GIR03F GIR05F GIR06F GIR08F GIR12F GIR13F GIR16F GIR20F GIR37F GIR43F
Southwest	GIR48U GIR49U		GIR29F GIR30F	GIR46M GIR19M GIR47M	GIR11F GIR42F GIR50F GIR53F GIR51F GIR28F
Northwest		GIR35M	GIR34F	GIR32M	GIR33F
West			GIR26F	GIR27M	GIR22F GIR23F GIR24F

Figure 2. Population dynamics of giraffe in Garamba NP categorised by region observed in.

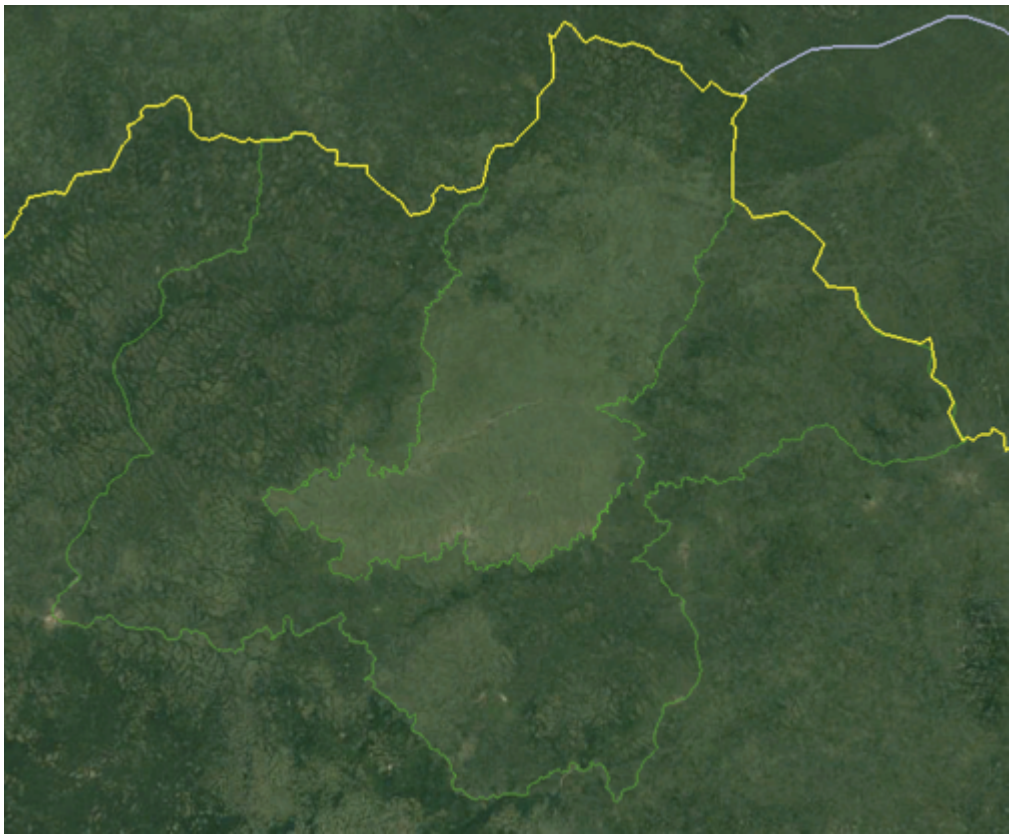

Figure 3. Satellite image of Garamba NP containing suitable habitat for giraffe and bordered all around by densely wooded areas.

The population dynamics of Garamba's giraffe are highlighted below. The age class ratios are currently 1: 0.27: 0.12 (adult 71.7%: sub-adult 19.6%: juvenile 8.7%), while the sex ratio is 1: 0.67 (Female 60%: Male 40%), compared to the average of 1:1 (Female 50%: Male 50%).

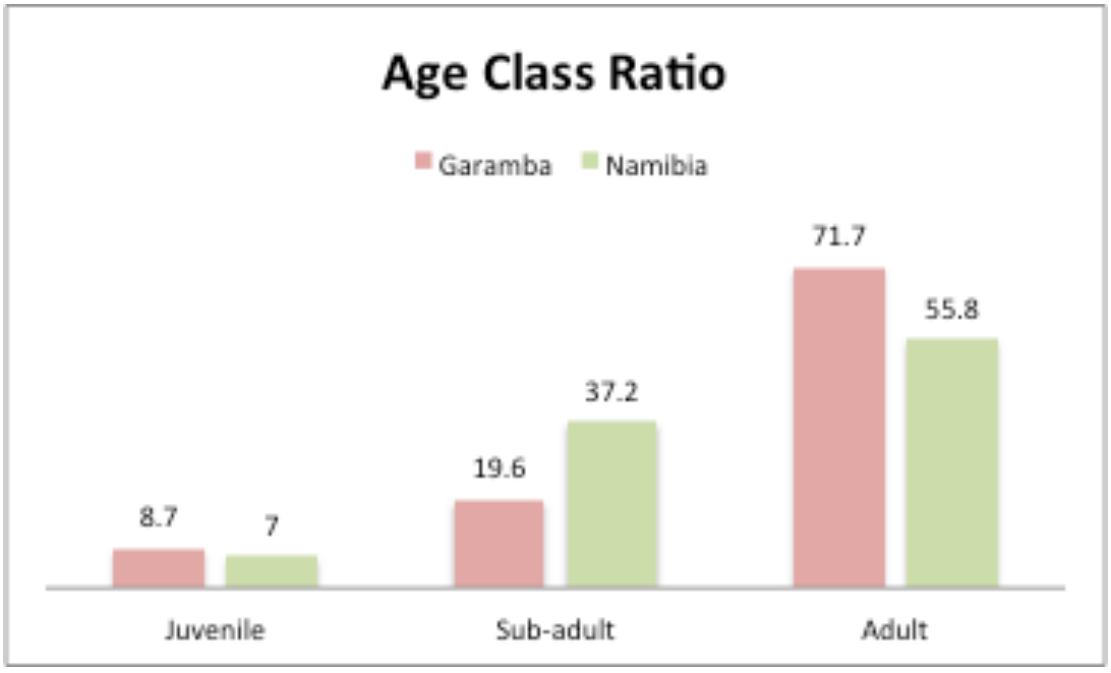

Figure 4. Age class ratios of Garamba's giraffe compared with Namibian data (Fennessy, 2004).

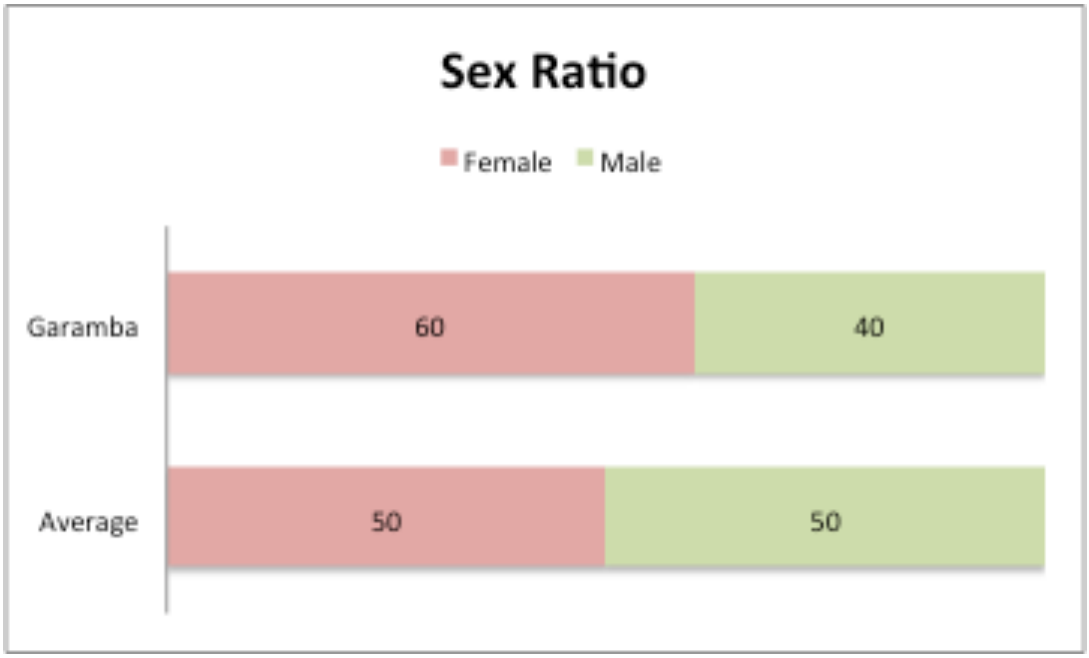

Figure 5. Sex Ratio of Garamba's giraffe compared with the average sex ratio.

With the knowledge that there are twenty adult female giraffe in the population and females usually conceiving between 3 - 9 months after giving birth (Foster & Dagg 1972; Pellew 1983b; Bercovitch et al. 2006), we would expect a theoretical 10 – 13.3 offspring in 2016/17 (15 months of pregnancy plus 3 - 9 months for conceiving). Only five juveniles were observed in 2016, much less than expected, possibly explained by two reasons. Firstly, giraffe calves may sometimes die before they are being picked up by the team as some individuals are only rarely seen. Secondly, adult female giraffe may not fall pregnant because of low population densities and highly dispersed groups.

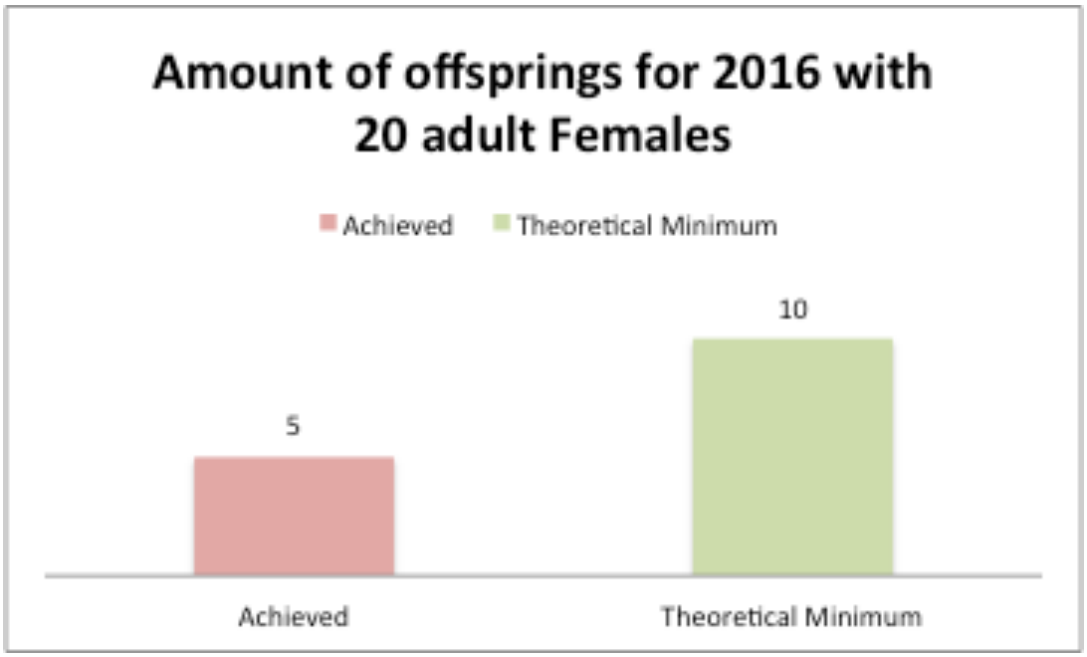

Figure 6. A comparison between the observed and a theoretical minimum offspring numbers for 2016 with 20 adult females in the population.

Calculation of home ranges and core area's to assess suitability of habitat

In the September-December 2016 update I noted that Garamba consists of relatively non-ideal habitat, compared to other areas across Africa because of its low *Acacia* densities, playing an important role in a giraffe's diet.

Food availability is directly related to home range size (Fennessy, 2009), and greater when food densities are low. During January and February 2015, eight giraffe were fitted with a GPS collar (harnass type supplied by AWT telemetry). Data was transmitted on an average of 3-4 times per day, but fluctuated between weeks without any transmitted signal to a maximum of 586 data points on a day. All collars had a different lifespan with one collar, Mwambe, currently still active.

N°	Name	Sex	Age	Lifespan Collar (days)	Total transmitted data points
1	LIBOSO	M	Adult	190	3272
2	MIBALE	F	Adult	206	632
3	MISATO	M	Adult	114	335
4	MINEI	M	Adult	311	842
5	MITANO	M	Adult	135	393
6	MOTOBA	M	Adult	51	173
7	SAMBO	F	Adult	51	153
8	MWAMBE	F	Adult	382	947

Figure 7. Table highlighting the different GPS Satellite collared giraffe and associated data.

In calculating giraffe home ranges the Animove plugin for QGIS was used to estimate individual Minimum Convex Polygons (MCP) – these highlight the amount of habitat they use over the analysed period. Since the interval of transmitted collar data was irregular, all data was manually processed. Processing consisted of standardising the interval between each two data points as much as technically possible, usually resulting in three data points per day.

As noted below, three collared individuals 'migrated' during the period observed. The same was noted for Minei, an adult bull who 'migrated' towards the more wooded region East of his usual home range – most likely because of the wound he has since been seen with.

Important to note that data from two of the giraffe are represented in the home ranges figures below but their data not used in calculating averages due to inconsistencies. Mwambe, an adult female, moved quickly away from her capture site and became isolated from other giraffe on the other side of a river as it rose. When the water level dropped again, she made regular migrations to other parts of the Park but failed to establish a stable home range. Most recently she has been seen with other giraffe in the region where she was collared. Sambo, an adult female, of which we only collected data over 51 days, showed a very small home range compared to other giraffe but the data is limited.

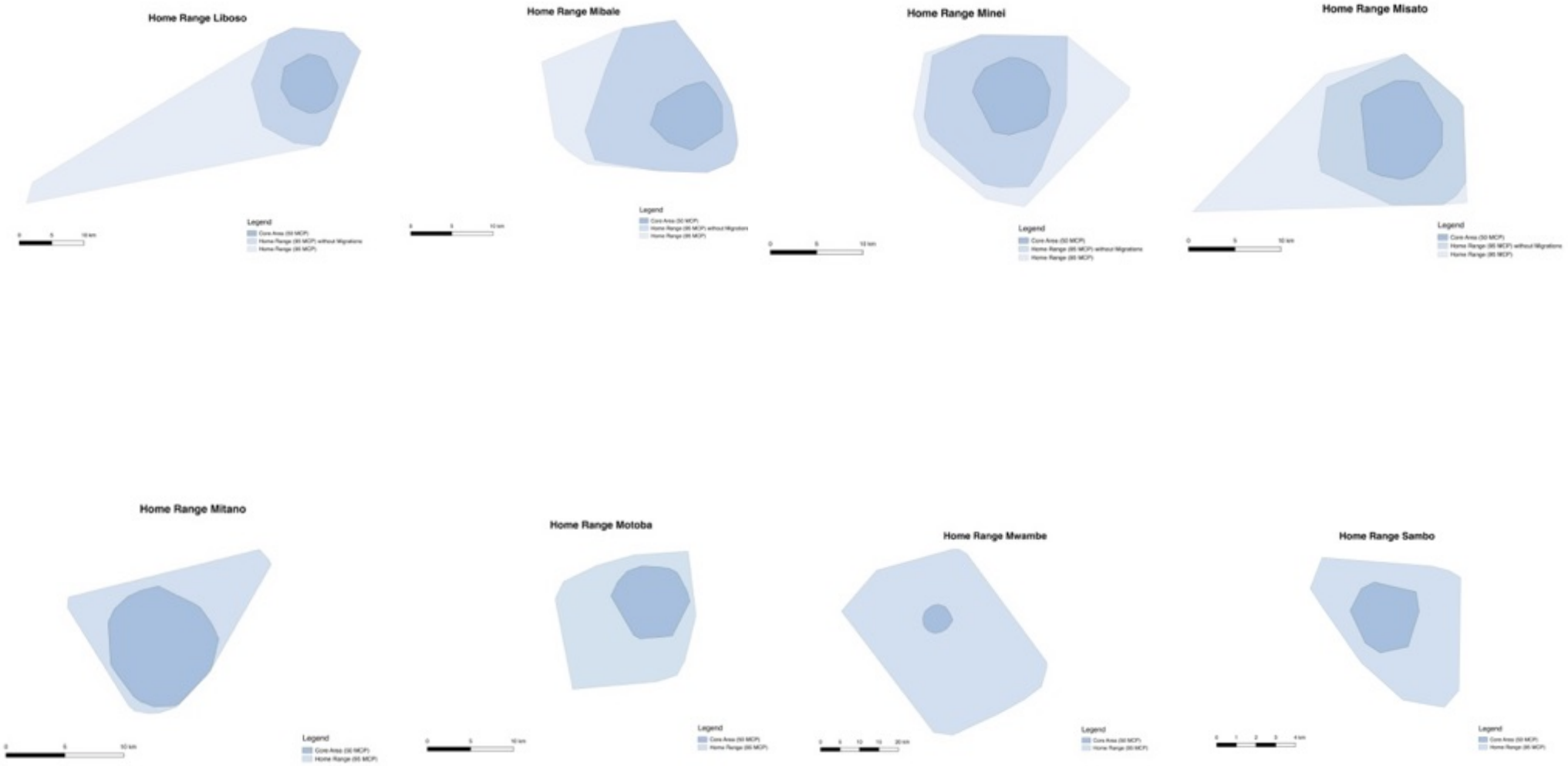

Figure 8. Home range visualisation of the giraffe fitted with GPS satellite collars

N°	Name	95 MCP (km^2)	95 MCP without migrations (km^2)	50 MCP (km^2)
1	LIBOSO	598,5	220,1	59,0
2	MIBALE	339,2	257,4	51,7
3	MISATO	325,4	202,0	73,8
4	MINEI	302,8	206,5	52,9
5	MITANO	134,4	134,4	71,4
6	MOTOBA	210,1	210,1	56,6
7	SAMBO	41,2	41,2	9,2
8	MWAMBE	384,9	384,9	10,5
Average		**318,4**	**205,1**	**60,9**

Figure 9. Home range and core area were calculated using Minimum Convex Polygon (MCP). Outcomes for Sambo and Mwambe were not used in calculating the average due to limited data.

The preliminary average home range of the eight collared giraffe is 205.1 km^2. On comparison with other studies (see table below) we see that this is rather high.

Mitano, an adult male, has a significant smaller home range compared to other giraffe. This is possibly because of the much more wooded area he lives in compared to those in much more sparsely wooded savannah. Another possible explanation could be that his home range is restricted because of the human activity that surrounds where he inhabits.

Since there is a correlation between the humidity of an environment and the expansiveness of a home range (Du Toit 1990; Fennessy 2009; Le Pendu & Ciofolo 1999), home range is often greater in dryer areas. In Garamba NP one would expect to find smaller home ranges because of the abundance of water, however, the forage preference for giraffe is sparsely spread. If the different study areas are compared with Africa's habitat and vegetation types (see below), much smaller home ranges are observed in other deciduous forest-woodland savannahs e.g. 68 km^2 for Luangwa Valley and 7,09 km^2 for Ruma NP, compared to Garamba NP .

Gieling (2011) noted that besides the availability of food and water, giraffe's home range can be influenced by other factors like climate, topography and the presence of herbivores, predators or humans (poaching, deforestation, fences). Therefore, one should be cautious as Garamba's relatively large home ranges maybe due to limited food availability as highlighted. Additionally, Garamba's herbivore populations have declined markedly over at least the last decade. Poaching is a known severe threat to giraffe in the Park whilst the impact of predation on the population remains unknown.

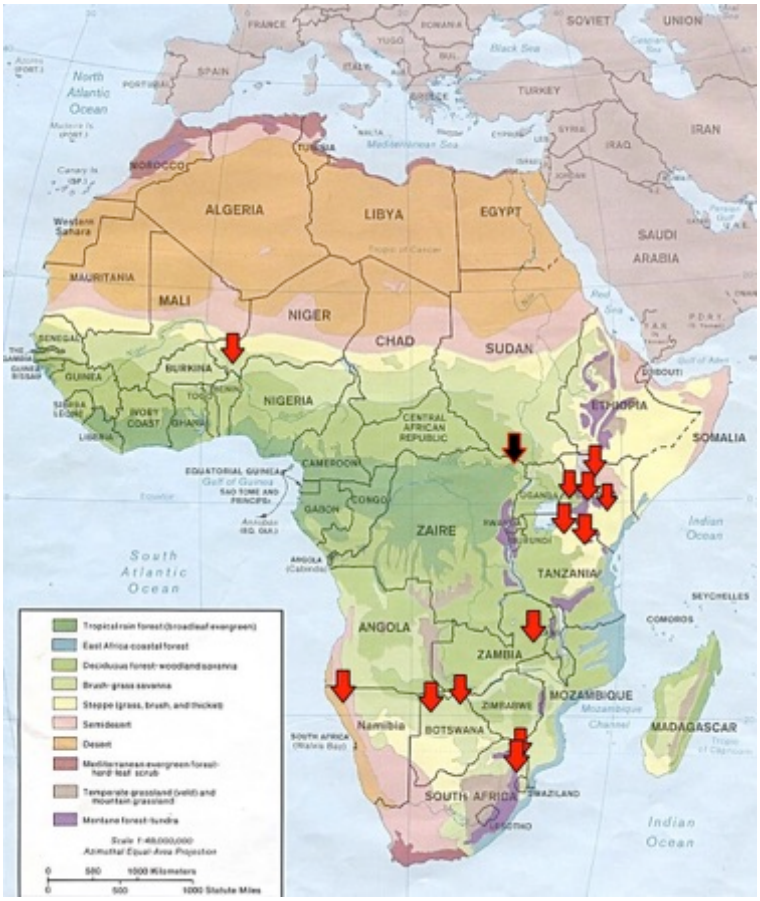

Figure 10. Locations of different home range studies across vegetation zones in Africa in comparison with those in Garamba NP.

Herd size

In the September-December 2016 update I noted that Garamba's giraffe may form small herds to avoid browsing competition and because of the Park's non-ideal habitat, could make them more vulnerable to predation. This preliminary assumption needs to be seen in the context of the research where an answer to the question 'Why is Garamba's giraffe population so low?' is being sought.

The herd size average of the 1,043 giraffe observed in 310 herds between June 2014 and February 2017 is 3.36 individuals. Interestingly, of all observed herds, 95 (31%) consisted of single individuals (singletons). If we leave these herds out of the dataset, the average herd size is: 4.41.

When we look at the Southwest population, who inhabit a much more forested area, the average herd size is much smaller at 2.55 giraffe (n=49). In contrast, the giraffe the East which is a much more typical giraffe habitat average higher herd sizes of 3.85 giraffe (n=209).

These numbers do not differ from known data in which herds tend to average 3-6 animals as observed by many studies e.g. Innis 1958; Foster 1966; Leuthold 1979; Pratt & Anderson 1985; Le Pendu *et al.* 2000; Bercovitch & Berry 2009. Some of these authors also reported that giraffe herds are smaller in woodland and thicket areas than in open habitats, regardless of season.

To conclude, even though the Garamba NP data is based on a small dataset to date, it can be inferred that the average herd size of giraffe in the Park do not differ from elsewhere. The average herd size of 3.36 is rather low and as such its giraffe might be more vulnerable to predation as

previously thought. Because of this, further research into the level of predation might help to understand if this threat be an important factor in the decline of the population.

Migrations by giraffe of the Eastern population towards the Western population

Except for normal intra-home range movements, three giraffe fitted with a GPS collar made a remarkable migration of ~50km towards the West away from their normal area. All three individuals made this migration separately, but the patterns were very similar in all other aspects. Migrations took about one week in total of which 4-5 days were spent on the actual travel and 2-3 days were spent in the West. Apart from the three GPS collared giraffe of which their movements could be closely followed, other giraffe from the same region are known to make similar migrations to the West.

The reason for these migrations is still unknown but is possibly normal social behavior with giraffe in this region. It is not known whether giraffe of the Western population make similar migrations towards the East. Besides social behavior, it could be that these migrations are being made to give birth to their young. GIR05F, who has always been seen in the East, was seen in the West only days before giving birth to her offspring. After which she was seen migrating back to her normal home range in the East.

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