



**HUMANE SOCIETY
INTERNATIONAL**

Giraffe

(Giraffa camelopardalis)



© Vanessa Mignon

This factsheet is part of a series highlighting species vulnerability to trophy hunting and lethal offtake.

IMPACTS OF TROPHY HUNTING

- Unsustainable offtake
- Decreased lifetime reproductive success
- Loss of important breeding adults and social leaders

POPULATION

The current population trend is decreasing with an estimated population size of 68,293 mature individuals in Africa as of 2015.¹ Giraffe populations have declined 36-40% over three generations (30 years, 1985-2015) due to ongoing threats that may not be reversible.¹

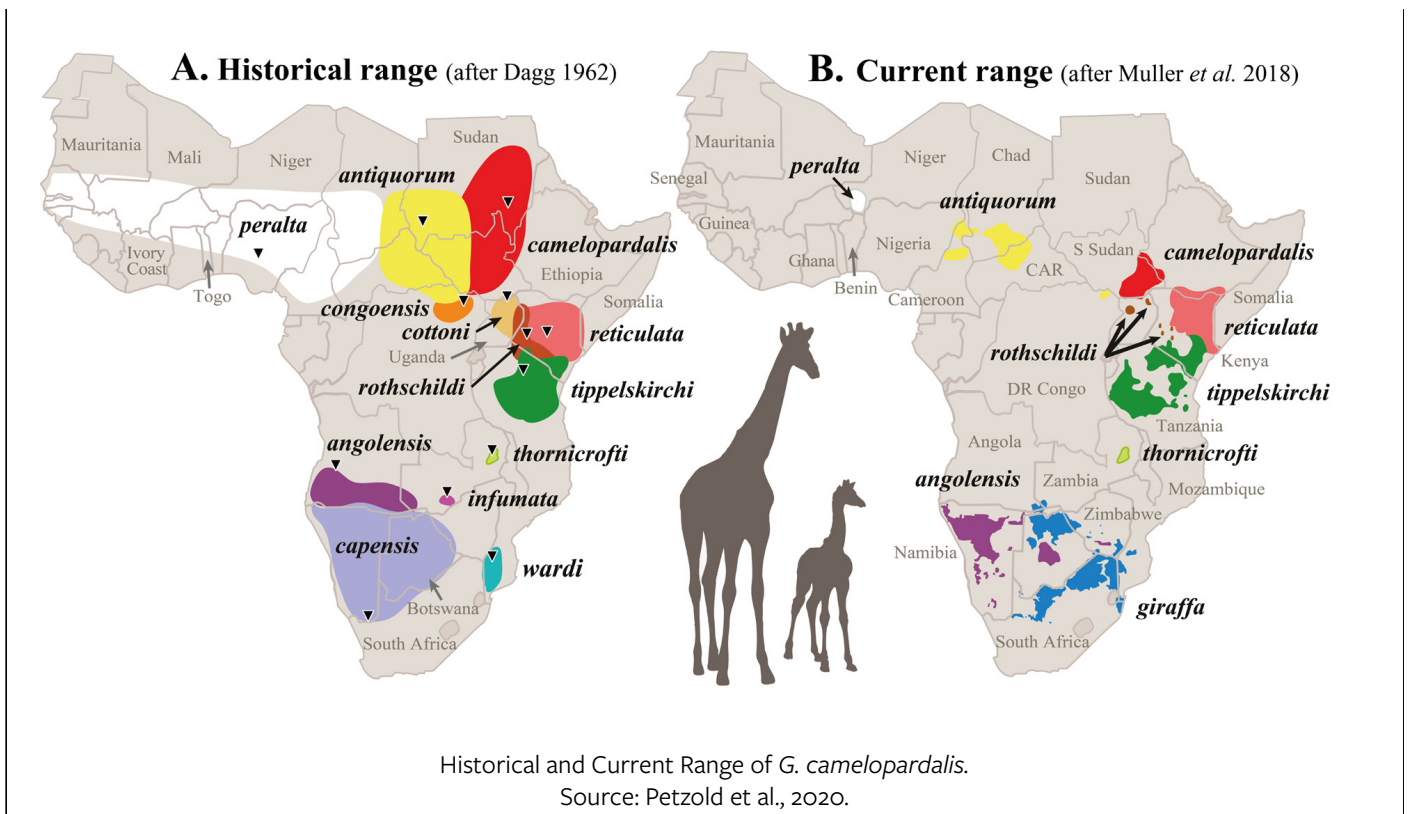
The IUCN Red List status of the giraffe throughout its range has changed from Least Concern in 2008 and 2010 to Vulnerable in 2016, highlighting the steady deterioration of the conservation status of this species. Species are classified as Vulnerable if they face a high risk of extinction in the wild in the immediate future.

QUICK FACTS:

Population Size:	68,293 mature individuals (2015), decreasing, 36-40% decline over three generations (30 years, 1985-2015)
Range:	55% of historic range lost
IUCN Red List:	Vulnerable (2016)
CITES:	Appendix II (2019)
International Trade:	Unknown. 3,744 giraffe trophies imported to the US 2006-2015
Threats:	Habitat loss and fragmentation, civil unrest, poaching, ecological changes (human activity and climate change)

Overall, the giraffe population across Africa is declining. However, each of the nine subspecies exhibits slightly different growth trajectories due to

Subspecies	Common name	Range States	No. of Mature Individuals	Trend	IUCN Status (Year Assessed)
<i>G. c. angolensis</i>	Angolan	Angola, Botswana, Namibia	10,173	Increasing	Least Concern (2018) ²
<i>G. c. antiquorum</i>	Kordofan	Cameroon, Central African Republic, Chad, Democratic Republic of Congo, South Sudan	1,400	Decreasing	Critically Endangered (2018) ³
<i>G. c. camelopardalis</i>	Nubian	Ethiopia, South Sudan	455	Decreasing	Critically Endangered (2018) ⁴
<i>G. c. giraffa</i>	South African	Botswana, Mozambique, South Africa, Zimbabwe	21,387	Increasing	Not assessed separately ¹
<i>G. c. peralta</i>	West African	Niger	425	Increasing	Vulnerable (2017) ⁵
<i>G. c. reticulata</i>	Reticulated	Kenya, Ethiopia, Somalia	11,048	Decreasing	Endangered (2018) ⁶
<i>G. c. rothschildi</i>	Rothchild's	Uganda, Kenya	1,399	Increasing	Near Threatened (2018) ⁷
<i>G. c. thornicrofti</i>	Thornicroft's	Zambia	420	Stable	Vulnerable (2018) ⁸
<i>G. c. tippelskirchi</i>	Masai	Kenya, Tanzania	35,000	Decreasing	Endangered (2018) ⁹



local and regional pressures.¹ See the table below for specific population sizes and trends for each subspecies.

RANGE

The giraffe was once widespread across Africa, with a large, contiguous range.¹⁰ However, throughout the continent, giraffes are now absent from most of their historical geographic range, and populations are becoming increasingly more fragmented.^{1,10} As of 2013, giraffes have lost 55% of their historical (1901-1970) range,¹¹ and additional range has been lost as of 2019.¹⁰ Giraffes presently inhabit 18 African countries and have been extirpated in at least seven countries (Burkina Faso, Eritrea, Guinea, Mali, Mauritania, Nigeria, and Senegal).¹ To improve the likelihood of giraffe survival into the future, giraffes have been translocated and reintroduced to their former ranges in Malawi, Namibia, Niger, and Uganda.¹⁰

Widespread losses in giraffe range are largely due to habitat loss, land degradation, climate change, and illegal poaching.^{1,10} Approximately 70% of the current geographic range of giraffe occurs outside government-managed protected areas,¹⁰ where human impacts and habitat degradation are greatest. Continued human population growth, expanded settlements, and geographic barriers will add to the precipitous decline and fragmentation of this species. Even from 2016 to 2018, giraffes experienced

an overall decline of 5.6% (101,133 km²) in their range.¹⁰ The greatest losses in range area during this period were identified in Chad, Uganda, Kenya, Malawi, Central African Republic, Zambia, and Cameroon (from 82% loss to 50% loss).¹⁰

LIFE HISTORY AND REPRODUCTION

Giraffe population growth is slow due to long lifespans, low reproductive rates, long intervals between births, long periods of calf dependency, and high calf mortality. The maximum lifespan for giraffes in the wild is 28 years for females¹² and 22 years for males.¹³ However, average lifespan for both sexes is 17 years.¹²

The average age at first birth in the wild is 6.4 years, and females can bear calves late into life and have been observed giving birth as late as 25 years old.^{12,14} Gestation lasts approximately 15 months.¹⁵ Giraffes typically give birth to one calf at a time, and the average age of independence is approximately 22 months. Giraffes give birth throughout the year,¹⁴ and the average interbirth interval between surviving calves is nearly 2 years but can be over 3 years.¹⁴ Lion predation is a source of mortality for calves and subadults, although predation risk greatly varies by location.¹⁶ Giraffes are a preferred prey species of lions.¹⁷ Approximately 45% of calves die due to predation within the first year, although calf death did

not reduce the time between births.¹⁴

Males are unlikely to successfully mate until they are 10 years old.¹² However, there are no data on the variation in male reproductive success.¹² There is evidence that older males exhibit greater sexual activity and higher androgen levels than younger males.¹⁸

Lifetime reproductive success, which is the number of offspring a female will contribute to the population over her lifetime, is highly variable and ranges from 0 to 11.¹⁴ Longevity and calf survival are the two most important predictors of lifetime reproductive success.^{12,14} Specifically, adult female survival has the strongest influence on population growth.^{19,20} Therefore, it is critical that females live long lives to produce as many calves as possible, and so they are present to raise their calves to independence. Males have a much shorter breeding lifespan than females, approximately 6 years, and thus all mature males are important for population growth.¹³ Further, adult survival has the greatest influence on population growth.²¹ Therefore, premature death due to human causes, such as poaching or trophy hunting, can be detrimental to population growth.

Habitat loss and fragmentation have led to decreased genetic diversity and inbreeding,^{22,23} which can have detrimental impacts on survival and reproduction. Inbreeding is especially a concern in fenced reserves where gene flow is limited.²² Limited genetic diversity is particularly concerning in species that experience stressful or changing environments and may limit the ability to respond appropriately. Giraffes frequently observed with mange and ticks may also be related to lower fitness due to inbreeding.²³

SOCIAL STRUCTURE

Giraffes live in multilevel social communities that exhibit fission-fusion dynamics, where individuals are continually joining and leaving subgroups within the community.^{24,25,26} Giraffe group sizes range from 1-44 individuals, with a mean group size of 5 individuals.^{25,27} Group sizes tend to be smaller in the dry season when food availability is low, which is likely to decrease competition.²⁷

Giraffes are more likely to form same-sex groups,^{24,25,26} and females are more likely to form stronger relationships with female kin.²⁶ Females form matrilineal groups, where mothers maintain long-lasting,

strong relationships with their daughters.^{28,26} In fact, the strongest relationships between all giraffe pairs are between mothers and daughters,²⁶ although unrelated female giraffes also form long-term relationships that last many years.²⁹ Mothers with dependent calves from co-operative nursing groups, which likely help maintain vigilance from predators, increase foraging opportunities for mothers, and provide early social experience for calves.³⁰ Mothers have also been observed staying with the remains of their dead calves for days.^{31,32}

Males may be solitary or join all-male bachelor herds.^{27,25} Some males form long-lasting relationships with females, although interactions are less frequent than same-sex relationships.²⁹ Social relationships in giraffes are likely important for sharing information about local resources and foraging sites, as well as potential reproductive and survival benefits.²⁹

Males tend to leave their birth range and roam to find mates,³³ while female dispersal patterns are not fully understood.³⁴ Females tend to remain within the same area for long periods of time,²⁹ and there is evidence of natal philopatry,³⁵ where females stay within their birth area. However, there is also evidence of female dispersal, either alone or in family groups.^{28,34}

The oldest female, or the matriarch, is most likely to lead the herd while traveling.³⁶ Researchers suggest that this is because older females are most familiar with the ecology of the area and are best suited to lead their herd to favorable habitats.³⁶ Scientists also believe that all-male groups are formed as a strategy to gain shared knowledge about habitat, as well as food and female distribution.³⁷ Specifically, older males act as a magnet to younger males due to their extensive knowledge of the habitat and resources.³⁷

Social relationships can be impacted by human disturbance. Females that live closer to human compounds have fewer social partners but exhibit stronger relationships with their partners.²⁴ Groups with calves tend to remain farther from towns.²⁷

HABITAT AND ECOLOGY

Giraffes are most often found in savanna and woodland habitats but range widely throughout Africa.¹ Giraffes primarily eat vegetation from trees, especially from the genus *Acacia*,³⁸ and must spend a

large portion of their time foraging. Groups of females exhibit more selectivity of foraging plants than male groups.²⁷

Giraffes can have large home ranges (up to 1,950 km²), with males having ranges over 2.5 times larger than females.^{39,40} The average home range size is 96-514 km² for adult males and 12-245 km² for adult females, depending on the population.^{25,40} Giraffes that live in areas with little rainfall and reduced food availability have larger ranges due to the need to travel further to find resources.^{39,41} Female home ranges also increase in size when close to densely-populated towns, suggesting the need to travel further for resources in human-disturbed habitats.⁴⁰ Giraffes can travel long distances per day (up to 22 km).⁴¹ Long distance movements are more commonly observed in males that are searching for mating or foraging opportunities, or due to human disturbance.³⁹

Giraffe Skin Disease (GSD) is a skin disease characterized by proliferative, crusty lesions on the forelimbs, neck, or torso of giraffes.⁴² It was first identified in 1995 and has been observed across seven countries.⁴² There is high variation in disease prevalence, but in many subpopulations, GSD is present in the majority of giraffes.^{42,43,44,45} Because GSD is an emerging disease, there is little information about the cause, how it spreads, or the effects on reproduction and survival.⁴³ However, several studies suggest that GSD is a parasitic or fungal infection.⁴² Soil type has been identified as a potential predictor, likely due to parasite presence or nutritional status from vegetation quality.^{44,46} Although an initial study found no mortality effect of GSD, there are still concerns about long-term impacts on giraffe populations.⁴⁶ Giraffes with GSD exhibit stiffness and difficulty moving, which could make them more vulnerable to predation, poaching, or trophy hunting.⁴⁵ There are also concerns that GSD may lead to secondary infections.⁴⁴

DIRECT ANTHROPOGENIC THREATS

The four major threats to giraffes are 1) habitat loss and fragmentation, 2) civil unrest, 3) poaching, and 4) ecological changes, such as mining activity and climate-related changes.¹

Giraffes have experienced widespread habitat loss and fragmentation due to deforestation, land use

conversion, expansion of agriculture, and human population growth.¹ Civil unrest, military action, war, and violence have also contributed to the decline of giraffe populations and habitat.¹ Giraffes are sensitive to human presence and tend to avoid human-impacted areas.⁴⁷ This threat is ongoing and expected to increase with future human population growth. Habitat loss can also make giraffe populations more accessible to poachers, while habitat fragmentation isolates populations and contributes to loss of genetic diversity. Human disturbance and climate change have contributed to continent-wide range loss for giraffes.¹¹ Giraffes lost 55% of their historical range from 1901 to 2013.¹¹

Large losses of suitable range due to environmental changes have occurred across the giraffe's range but especially in western Africa.¹¹ Suitable habitat for giraffes is expected to further decrease due to climate changes making their habitat less favorable.¹¹ Extreme events, such as droughts, are expected to become more frequent and intense with climate change. Droughts result in high giraffe mortality, especially for juveniles and large adult males.⁴⁸ Juveniles are critical for future population growth, and large males are also targeted by trophy hunters and poachers.

Although it is very difficult to monitor all illegal hunting activity, studies show that large numbers of giraffes are regularly killed by poachers.^{21,49,50} Poachers target giraffe for meat, hide, tail hair, and the misconception that giraffe parts can treat HIV/AIDS.⁵¹ Giraffes are hunted with guns, dogs, and snares, depending on the location.^{49,51} Wire snares are suspended in trees that tighten around the giraffe's neck and most often result in death.⁵¹ Adult males are more susceptible to wire snares,²¹ likely due to foraging higher in the tree canopy.⁵¹ Giraffe sex ratios in areas with high poaching pressure are heavily skewed towards females.⁵² Giraffe behavior also indicates that giraffes in areas with high rates of poaching experience high levels of stress.⁵² Poaching has been a long-term problem, with unsustainable offtake of approximately 30% of the giraffe population in the Serengeti ecosystem reported in the late 80s and early 90s.⁵³ From 1998-2001, poachers killed 40-68% of the giraffe population in the Katavi-Rukwa ecosystem in Tanzania.⁴⁹ In the same habitat, giraffe population declines from 1987-2004 were attributed to poaching.⁴⁹ In Serengeti National Park, giraffes comprised 45% of all snare reports from 1997-2010.²¹ Further, 96% of giraffes caught in

snare were adults, which is especially concerning because adult survival is the primary predictor of population growth.²¹ Indeed, anti-poaching efforts are associated with higher adult female survival and population growth.²⁰

Limiting the negative impacts of human-caused threats is critical to giraffe survival. However, as noted previously, approximately 70% of giraffe range occurs outside government-managed protected areas, leaving them vulnerable to numerous human impacts. Protected areas act as a source and repopulate non-protected areas, where poaching rates are high.¹⁹ This could drive the extinction of subpopulations in protected habitats as giraffes are drawn away from protection and killed. In Tanzania, giraffes were present at higher densities in areas that are protected by guards and where human settlement was prohibited.⁵⁴ However, even in protected areas, giraffes are vulnerable. Giraffes exhibit lower occupancy in the outer 5-km band compared to the core of the Katavi National Park (NP) in Tanzania.⁵⁵ Giraffes on the outer bands of the park would experience fewer protections and greater exposure to hunting and other anthropogenic impacts. The giraffe population in the park also declined from 1987 to 2009.⁵⁵

Giraffes are over-utilized for commercial and recreational purposes, yet the trade of giraffes has not been regulated. Historically, the trade of giraffe parts was not internationally monitored because giraffes were not listed on the Appendices of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). However, as of 2019, giraffes have been listed on Appendix II of CITES, meaning that trade must be controlled in order to avoid utilization incompatible with their survival. Without long-term knowledge of international trade, there is no way to ensure that trade in giraffes is sustainable. According to the most recent data available from the U.S. Law Enforcement Management Information System (LEMIS) trade database, 3,744 giraffe trophies have been imported into the U.S. from 2006 to 2015 alone.⁵⁶

Trophy hunting of giraffes is legal and has been largely unregulated. The lack of long-term monitoring of legal trade in giraffe parts combined with the inability to monitor or regulate the high rates of illegal poaching render it impossible to guarantee that any amount of trophy hunting offtake is biologically sustainable. Adult survival and female

longevity are the most important predictors of population growth,^{12,19,20} yet adults are targeted as trophies. In addition, males do not contribute to reproduction until late in life, highlighting the importance of maintaining older males in the population.^{12,13} Giraffes form social relationships that may last for long periods of time and provide numerous benefits, such as co-operative calf care, predator vigilance, foraging opportunities, and learning opportunities.^{24,25,26,29,30,36,37} Older giraffes are especially important for their role as social leaders given their extensive ecological and social knowledge.^{36,37} Removal of these important social relationships and group leaders may lead to widespread negative effects across the social group.

MANAGEMENT IMPLICATIONS

Despite population declines and widespread habitat loss, giraffes have received very few protections. Giraffes have only been listed on the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) since 2019, and the Convention on Migratory Species (CMS) since 2017. Giraffes have likely been over-utilized, and trade has been unregulated, which prevents proper management.

Poaching is a substantial threat to giraffes and has led to population declines.^{1,21,49,50,53} Anti-poaching patrols in Tanzania grossly underreport the number of giraffe deaths due to illegal offtake.²¹ High levels of poaching and population declines in protected parks across Africa indicate that management and enforcement are highly ineffective. This is especially apparent as unsustainable rates of poaching have been occurring for decades.

There is also evidence of poor management of giraffe populations. For example, in Cameroon, weak and ineffective management and law enforcement have contributed to the decline of giraffes.⁵⁷ In addition, hunting pressure may operate at a scale finer than the management unit.⁵⁸ There are also problems with small fenced reserves, where populations are heavily managed and regularly culled, and populations become genetically isolated.^{22,48}

Giraffes have experienced widespread habitat loss and fragmentation, which has led to large population declines and genetic isolation. Habitat loss due to human population growth is an ongoing threat that will only continue to increase. Further population loss and fragmentation are expected to continue with ecological changes due to habitat change and continued population growth.

REFERENCES

1. Muller, Z. et al. 2018. *Giraffa camelopardalis* (amended version of 2016 assessment). The IUCN Red List of Threatened Species: e.T9194A136266699.
2. Marais, A., Fennessy, J., Fennessy, S., Brand, R. & Carter, K. 2018. *Giraffa camelopardalis* ssp. *angolensis*. The IUCN Red List of Threatened Species 2018: e.T88420726A88420729.
3. Fennessy, J. & Marais, A. 2018. *Giraffa camelopardalis* ssp. *antiquorum*. The IUCN Red List of Threatened Species 2018: e.T88420742A88420817.
4. Wube, T., Doherty, J. B., Fennessy, J. & Marais, A. 2018. *Giraffa camelopardalis* ssp. *camelopardalis*. The IUCN Red List of Threatened Species 2018: e.T88420707A88420710.
5. Fennessy, J., Marais, A. & Tutchings, A. 2018. *Giraffa camelopardalis* ssp. *peralta*. The IUCN Red List of Threatened Species 2018: e.T136913A51140803.
6. Muneza, A. et al. 2018. *Giraffa camelopardalis* ssp. *reticulata*. The IUCN Red List of Threatened Species 2018: e.T88420717A88420720.
7. Fennessy, S., Fennessy, J., Muller, Z., Brown, M. & Marais, A. 2018. *Giraffa camelopardalis* ssp. *rothschildi*. The IUCN Red List of Threatened Species 2018: e.T174469A51140829.
8. Bercovitch, F., Carter, K., Fennessy, J. & Tutchings, A. 2018. *Giraffa camelopardalis* ssp. *thornicrofti*. The IUCN Red List of Threatened Species 2018: e.T88421020A88421024.
9. Bolger, D. et al. 2019. *Giraffa camelopardalis* ssp. *tipelskirchi*. The IUCN Red List of Threatened Species 2019: e.T88421036A88421121.
10. O'Connor, D. et al. Updated geographic range maps for giraffe, *Giraffa* spp., throughout sub-Saharan Africa, and implications of changing distributions for conservation. *Mamm. Rev.* 49, 285–299 (2019).
11. Martínez-Freiría, F., Tarroso, P., Rebelo, H. & Brito, J. C. Contemporary niche contraction affects climate change predictions for elephants and giraffes. *Divers. Distrib.* 22, 432–444 (2016).
12. Bercovitch, F. B. & Berry, P. S. M. Life expectancy, maximum longevity and lifetime reproductive success in female Thornicroft's giraffe in Zambia. *Afr. J. Ecol.* (2017). doi:10.1111/aje.12370
13. Berry, P. S. M. & Bercovitch, F. B. Darkening coat colour reveals life history and life expectancy of male Thornicroft's giraffes. *J. Zool.* 287, 157–160 (2012).
14. Bercovitch, F. B. & Berry, P. S. M. Reproductive life history of Thornicroft's giraffe in Zambia. *Afr. J. Ecol.* 48, 535–538 (2010).
15. Dagg, A. *Giraffe biology, behavior and conservation*. (Cambridge University Press, 2014).
16. Strauss, M. K. L. & Packer, C. Using claw marks to study lion predation on giraffes of the Serengeti. *J. Zool.* 289, 134–142 (2013).
17. Hayward, M. W. & Kerley, G. I. H. Prey preferences of the lion (*Panthera leo*). *J. Zool.* 267, 309–322 (2005).
18. Seeber, P. A., Duncan, P., Fritz, H. & Ganswindt, A. Androgen changes and flexible rutting behaviour in male giraffes. *Biol. Lett.* 9, (2013).
19. Lee, D. E. & Bolger, D. T. Movements and source-sink dynamics of a Masai giraffe metapopulation. *Popul. Ecol.* 59, 157–168 (2017).
20. Lee, D. E., Bond, M. L., Kissui, B. M., Kiwango, Y. A. & Bolger, D. T. Spatial variation in giraffe demography: A test of 2 paradigms. *J. Mammal.* 97, 1015–1025 (2016).
21. Strauss, M. K. L., Kilewo, M., Rentsch, D. & Packer, C. Food supply and poaching limit giraffe abundance in the Serengeti. *Popul. Ecol.* 57, 505–516 (2015).
22. Austin, J. D. et al. Conservation genetics of an isolated giraffe population in Swaziland. *Afr. J. Ecol.* 56, 140–145 (2018).
23. Winter, S. et al. Species assignment and conservation genetics of giraffe in the Republic of Malawi. *Conserv. Genet.* 20, 665–670 (2019).
24. Bond, M. L., König, B., Lee, D. E., Ozgul, A. & Farine, D. R. Proximity to humans affects local social structure in a giraffe metapopulation. *J. Anim. Ecol.* 1–10 (2020). doi:10.1111/1365-2656.13247
25. VanderWaal, K. L., Wang, H., McCowan, B., Fushing, H. & Isbell, L. A. Multilevel social organization and space use in reticulated giraffe (*Giraffa camelopardalis*). *Behav. Ecol.* 25, 17–26 (2014).
26. Bercovitch, F. B. & Berry, P. S. M. Herd composition, kinship and fission-fusion social dynamics among wild giraffe. *Afr. J. Ecol.* 51, 206–216 (2012).
27. Bond, M. L., Lee, D. E., Ozgul, A. & König, B. Fission-fusion dynamics of a megaherbivore are driven by ecological, anthropogenic, temporal, and social factors. *Oecologia* 191, 335–347 (2019).
28. Bercovitch, F. B. & Berry, P. S. M. Ecological determinants of herd size in the Thornicroft's giraffe of Zambia. *Afr. J. Ecol.* 48, 962–971 (2010).
29. Carter, K. D., Brand, R., Carter, J. K., Shorrocks, B. & Goldizen, A. W. Social networks, long-term associations and age-related sociability of wild giraffes. *Anim. Behav.* 86, 901–910 (2013).
30. Saito, M., Bercovitch, F. B. & Idani, G. The impact of Masai giraffe nursery groups on the development of social associations among females and young individuals. *Behav. Processes* 180, 104227 (2020).
31. Strauss, M. K. L. & Muller, Z. Giraffe mothers in East Africa linger for days near the remains of their dead calves. *Afr. J. Ecol.* 52, 122–125 (2013).

32. Bercovitch, F. B. A comparative perspective on the evolution of mammalian reactions to dead conspecifics. *Primates* 61, 21–28 (2020).
33. Bercovitch, F. B., Bashaw, M. J. & del Castillo, S. M. Sociosexual behavior, male mating tactics, and the reproductive cycle of giraffe *Giraffa camelopardalis*. *Horm. Behav.* 50, 314–321 (2006).
34. Carter, K. D., Seddon, J. M., Frère, C. H., Carter, J. K. & Goldizen, A. W. Fission-fusion dynamics in wild giraffes may be driven by kinship, spatial overlap and individual social preferences. *Anim. Behav.* 85, 385–394 (2013).
35. Deacon, F. & Bercovitch, F. B. Movement patterns and herd dynamics among South African giraffes (*Giraffa camelopardalis giraffa*). *Afr. J. Ecol.* 56, 620–628 (2018).
36. Berry, P. S. M. & Bercovitch, F. B. Leadership of herd progressions in the Thornicroft's giraffe of Zambia. *Afr. J. Ecol.* 53, 175–182 (2015).
37. Bercovitch, F. B. & Berry, P. S. M. The composition and function of all-male herds of Thornicroft's giraffe, *Giraffa camelopardalis thornicrofti*, in Zambia. *Afr. J. Ecol.* 53, 167–174 (2015).
38. Shorrocks, B. *The Giraffe: Biology, Ecology, Evolution and Behaviour*. Animal Behaviour (John Wiley & Sons, Ltd, 2016). doi:10.1007/978-1-4615-9781-0_11
39. Fennessy, J. Home range and seasonal movements of *Giraffa camelopardalis angolensis* in the northern Namib Desert. *Afr. J. Ecol.* 47, 318–327 (2009).
40. Knüsel, M. A., Lee, D. E., König, B. & Bond, M. L. Correlates of home range sizes of giraffes, *Giraffa camelopardalis*. *Anim. Behav.* 149, 143–151 (2019).
41. McQualter, K. N., Chase, M. J., Fennessy, J. T., McLeod, S. R. & Leggett, K. E. A. Home ranges, seasonal ranges and daily movements of giraffe (*Giraffa camelopardalis giraffa*) in northern Botswana. *Afr. J. Ecol.* 54, 99–102 (2015).
42. Muneza, A. B. et al. Regional variation of the manifestation, prevalence, and severity of giraffe skin disease: A review of an emerging disease in wild and captive giraffe populations. *Biol. Conserv.* 198, 145–156 (2016).
43. Muneza, A. B. et al. Quantifying the severity of giraffe skin disease via photogrammetry analysis of camera trap data. *J. Wildl. Dis.* 55, 770–781 (2019).
44. Lee, D. E. & Bond, M. L. The occurrence and prevalence of giraffe skin disease in protected areas of Northern Tanzania. *J. Wildl. Dis.* 52, 753–755 (2016).
45. Epaphras, A. M., Karimuribo, E. D., Mpanduji, D. G. & Meing'ataki, G. E. Prevalence, disease description and epidemiological factors of a novel skin disease in Giraffes (*Giraffa camelopardalis*) in Ruaha National Park, Tanzania. *Res. Opin. Anim. Vet. Sci.* 2, 60–65 (2012).
46. Bond, M. L., Strauss, M. K. L. & Lee, D. E. Soil correlates and mortality from giraffe skin disease in Tanzania. *J. Wildl. Dis.* 52, 953–958 (2016).
47. Riggio, J. et al. Sensitivity of Africa's larger mammals to humans. *J. Nat. Conserv.* 43, 136–145 (2018).
48. Mitchell, G., van Sittert, S., Skinner, J. D. & Mitchell, G. The demography of giraffe deaths in a drought. *Trans. R. Soc. South Africa* 65, 165–168 (2010).
49. Caro, T. Decline of large mammals in the Katavi-Rukwa ecosystem of western Tanzania. *African Zool.* 43, 99–116 (2008).
50. Wilfred, P. & Maccoll, A. D. C. Status of wildlife at trophy hunting sites in the Ugalla Game Reserve of Western Tanzania. *Trop. Conserv. Sci.* 9, (2016).
51. Strauss, M. Illegal hunting of giraffes: news from northern Tanzania. *Giraffa* 3, 6–7 (2009).
52. Marealle, W. N., Fossøy, F., Holmern, T., Stokke, B. G. & Røskoft, E. Does illegal hunting skew Serengeti wildlife sex ratios? *Wildlife Biol.* 16, 419–429 (2010).
53. Campbell, K. & Borner, M. Population trends and distribution of Serengeti herbivores: Implications for management. *Serengeti II Dynamics, Management, and Conservation of an Ecosystem* (1995).
54. Caro, T. M. et al. Consequences of different forms of conservation for large mammals in Tanzania: Preliminary analyses. *Afr. J. Ecol.* 36, 303–320 (1998).
55. Kiffner, C., Stoner, C. & Caro, T. Edge effects and large mammal distributions in a national park. *Anim. Conserv.* 16, 97–107 (2013).
56. LEMIS data obtained from United States Fish and Wildlife Service through FOIA requests between 2006 and 2015, filtered for imports of *Giraffa camelopardalis*.
57. Marais, A.J., S. Fennessy, & Fennessy, J. (2013). Country profile: A rapid assessment of the giraffe conservation status in Cameroon. Giraffe Conservation Foundation. doi:10.1596/24697
58. Kiffner, C. et al. Interspecific variation in large mammal responses to human observers along a conservation gradient with variable hunting pressure. *Anim. Conserv.* 17, 603–612 (2014).