Nubian Giraffe Survey

Murchison Falls National Park, Uganda

June 2023

Background

Murchison Falls National Park (NP) in Uganda supports the largest naturally occurring population of Nubian giraffe (*Giraffa camelopardalis camelopardalis*) (Brown et al. 2019; 2021; Coimbra et al. 2021). The population has steadily grown from <200 individuals in the 1970s (Olivier 1991; Sommerlatte & Williamson 1995; Lamprey & Michelmore 1996; Rwetsiba 2006; Rwetsiba et al. 2012) to an estimated ~1,692 individuals in 2019 (Brown et al. 2021). Recent surveys by the Giraffe Conservation Foundation (GCF) show that the population continues to grow. Despite this increase, the population is threatened with illegal hunting, disease, and large-scale infrastructure development linked to resource extraction (UWA 2019). Given their numbers, conservation threats, geographic isolation, and recent classification as a distinct subspecies of the Northern giraffe (*G. camelopardalis*) (Fennessy et al. 2016; Winter et al. 2018; Coimbra et al. 2021), the Nubian giraffe population of Murchison Falls NP warrants high priority for conservation and science (UWA 2019).

GCF launched a long-term study of the giraffe in Murchison Falls NP in 2014 to monitor trends in their population growth, movement, health, and distribution. GCF continues to collect data to support the conservation and management of giraffe in in the park. Since 2014, 19 road-based photographic spatial encounter surveys have been conducted. This report outlines preliminary summary findings of Round 18 and 19 surveys conducted in November/December 2022 and March/April 2023 respectively.

Methods

We conducted spatially explicit individual-based photographic surveys along predefined fixed routes across the existing road network in northern MFNP. We divided the roads into four loops covering all giraffe habitats (Figure 1) and surveyed each loop three times. We recorded age and sex of each individual giraffe encountered, presence of giraffe skin disease (GSD), signs of snare-related injuries, and obtained right side georeferenced images. We characterised GSD as patchy lesions on the body, neck, legs, or shoulders of giraffes (Muneza et al. 2016). While snare-related wounds manifest as cuts of varied severity on the legs. We cropped each image to retain the extent of giraffe coat patterns (i.e., body and lower neck) for individual identification in Wild-ID (Bolger et al. 2012). These images were compared against an existing database of previously encountered giraffe and were assigned codes unique to each animal.

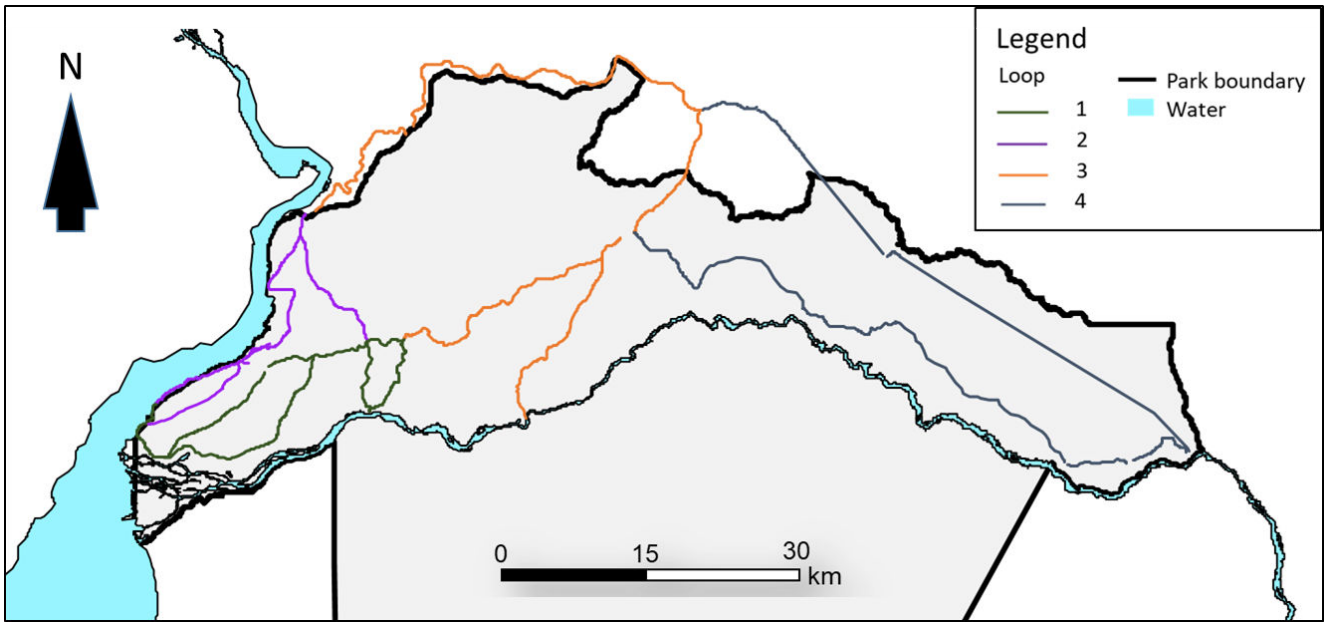

Figure 1. Survey loops (1-4) used to conduct photographic Nubian giraffe surveys in Murchison Falls NP, Uganda, during the Round 18 and 19 surveys.

Results & Discussion

Cumulatively, we recorded 4,936 individual giraffe encounters from both surveys. These giraffe were observed in 336 groups, which comprised of 12 individuals on average (range = 1-114 individuals; Figure 2). From these encounters, we obtained a total of 8,423 images, of which we retained 50.4% (n=4,242) for manual individual visual matching. After visual matching against the available database, we identified 1,140 unique individuals for Round 18 and 1,122 for Round 19. Across both surveys, we observed marginally more females (53%, n=601 for Round 18; 59.2%, n=664 for Round 19) than males (41%, n=469 for Round 18; 38.3%, n=430 for Round 19), whilst sex for some individuals was unidentified (6%; n=70 for Round 18; 2.5%, n=28 for Round 19; Figure 3). The majority of giraffe encountered were adults (82.3%, n= 938 for Round 18; 83.4%, n= 936 for Round 19), followed by calves (9.3%, n= 106 for Round 18; 9%, n=101 for Round 19), sub-adults (8.4%, n= 96 for Round 18; 7.6%, n=85 for Round 19; Figure 3). Age for some individuals was unidentified for Round 18 (1%, n= 12; Figure 3).

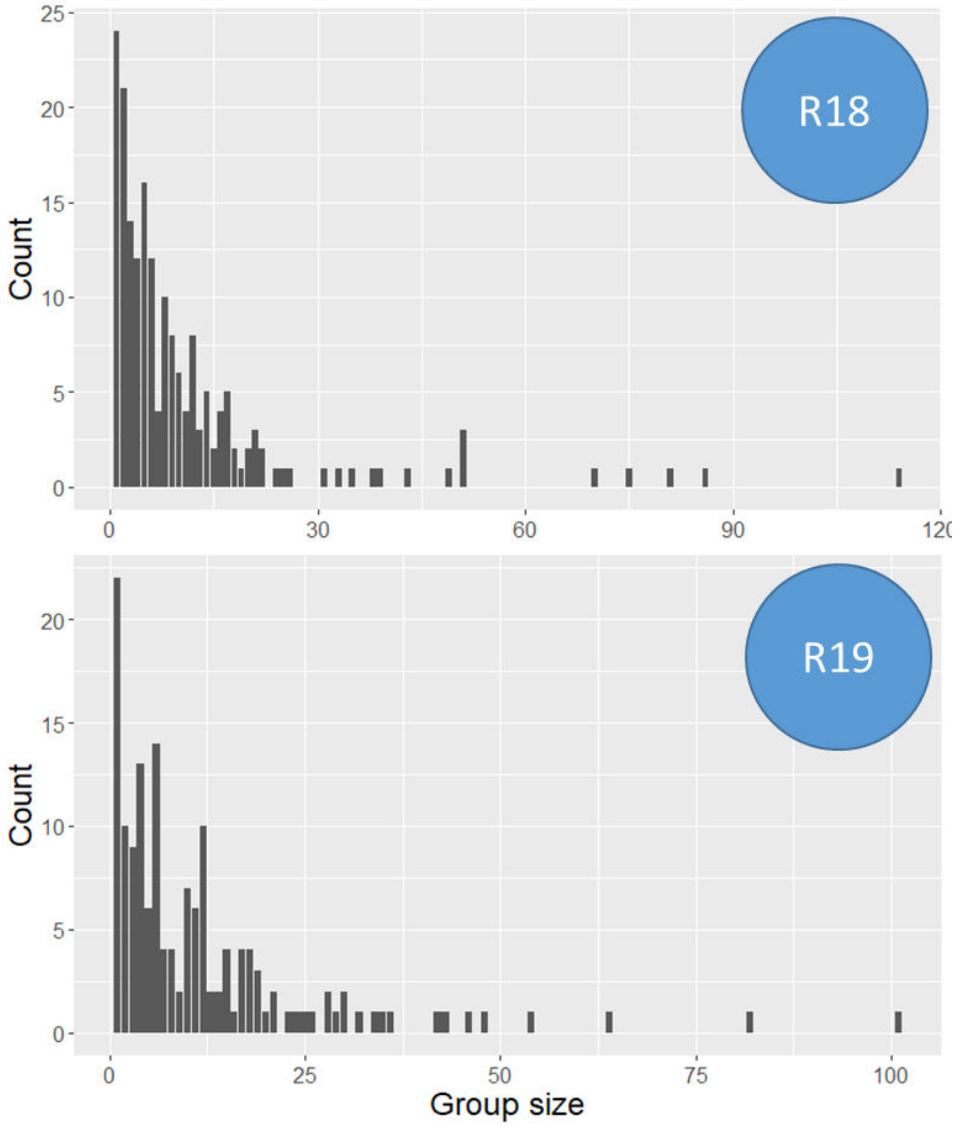

Figure 2. Nubian giraffe group sizes encountered in Murchison Falls NP, Uganda during the Round 18 (R18) and 19 (R19) surveys.

The patterns in demographic characteristics (including age class distribution, sex ratio, and distribution of group sizes) of the population were similar across both surveys. The consistency among these results is not surprising because of the relatively short time interval between both surveys (i.e. three months). Within three months, it is unlikely to observe substantial changes in giraffe demographic patterns. However, it remains to be ascertained

whether spatial capture-recapture modelling will return similar population and density estimates for both rounds.

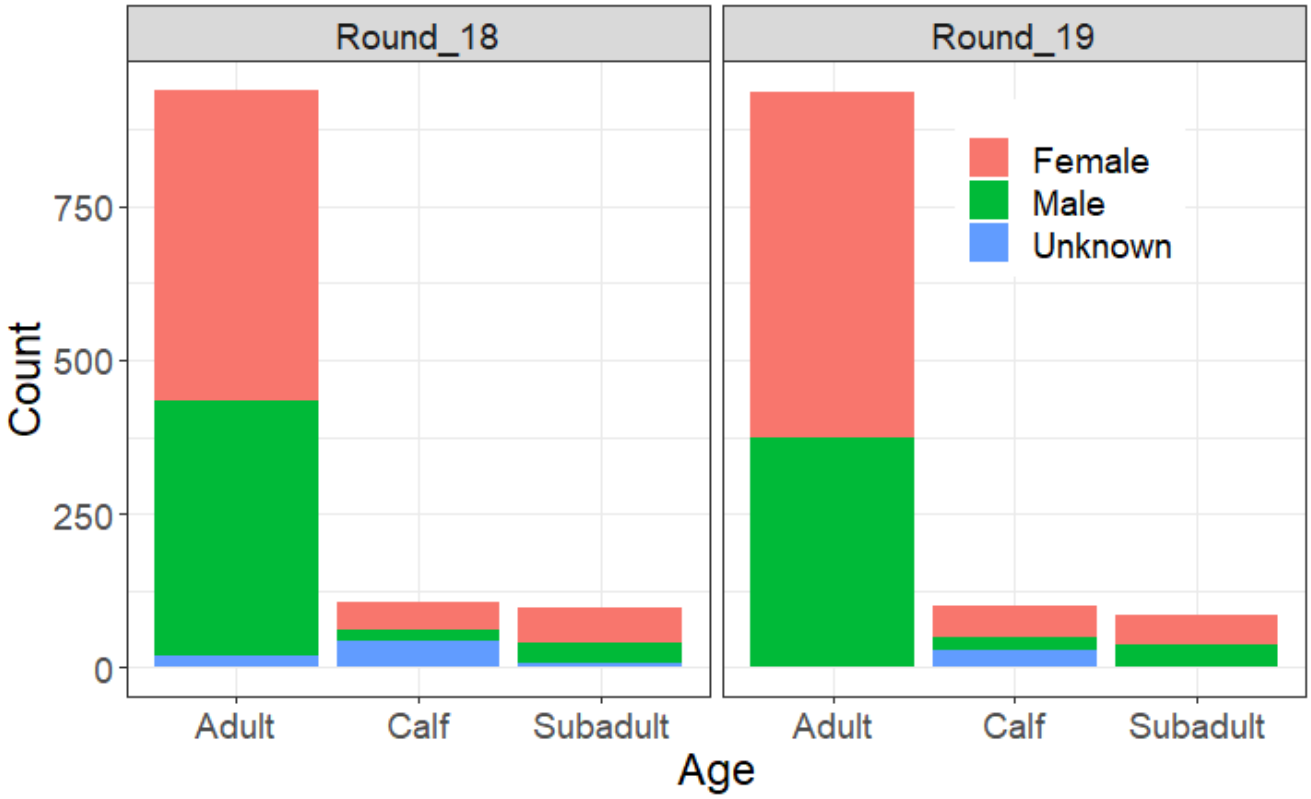

Figure 3. Sex composition across age classes of Nubian giraffe encountered in Murchison Falls NP, Uganda during the Round 18 and 19 surveys.

We identified several individuals with GSD in both Round 18 and 19 surveys. For Round 18, 36.8% (n=420) of the individuals had visible signs of GSD, including slightly more males (54%, n=228) than females (45%, n=189). Additionally, the majority of giraffe with GSD were adults (98.8%; n=415), followed by sub-adults (1%; n=4), and calves (0.2%; n=1). For Round 19, we identified 30% (*n*=336) of the individuals with visible signs of GSD, including slightly more males (55%, *n*=185) than females (45%, *n*=151). Again, the majority of giraffe with GSD were adults (99.1%; *n*=333), followed by sub-adults (0.9%; *n*=3). Across both surveys, giraffe with GSD were most common in the west (Figure 4). It is unclear if GSD should be expected to have any influence on giraffe spatial distribution in Murchison Falls NP. Additionally, factors underlying the spatial distribution of GSD in the park are not known. Research on GSD within the park has predominantly focused on identifying the etiological agent but the full life cycle of the parasite remains poorly understood (Han et al. 2022). Thus, the implications of giraffe with GSD survival and demographic patterns in Murchison Falls NP are yet to be established.

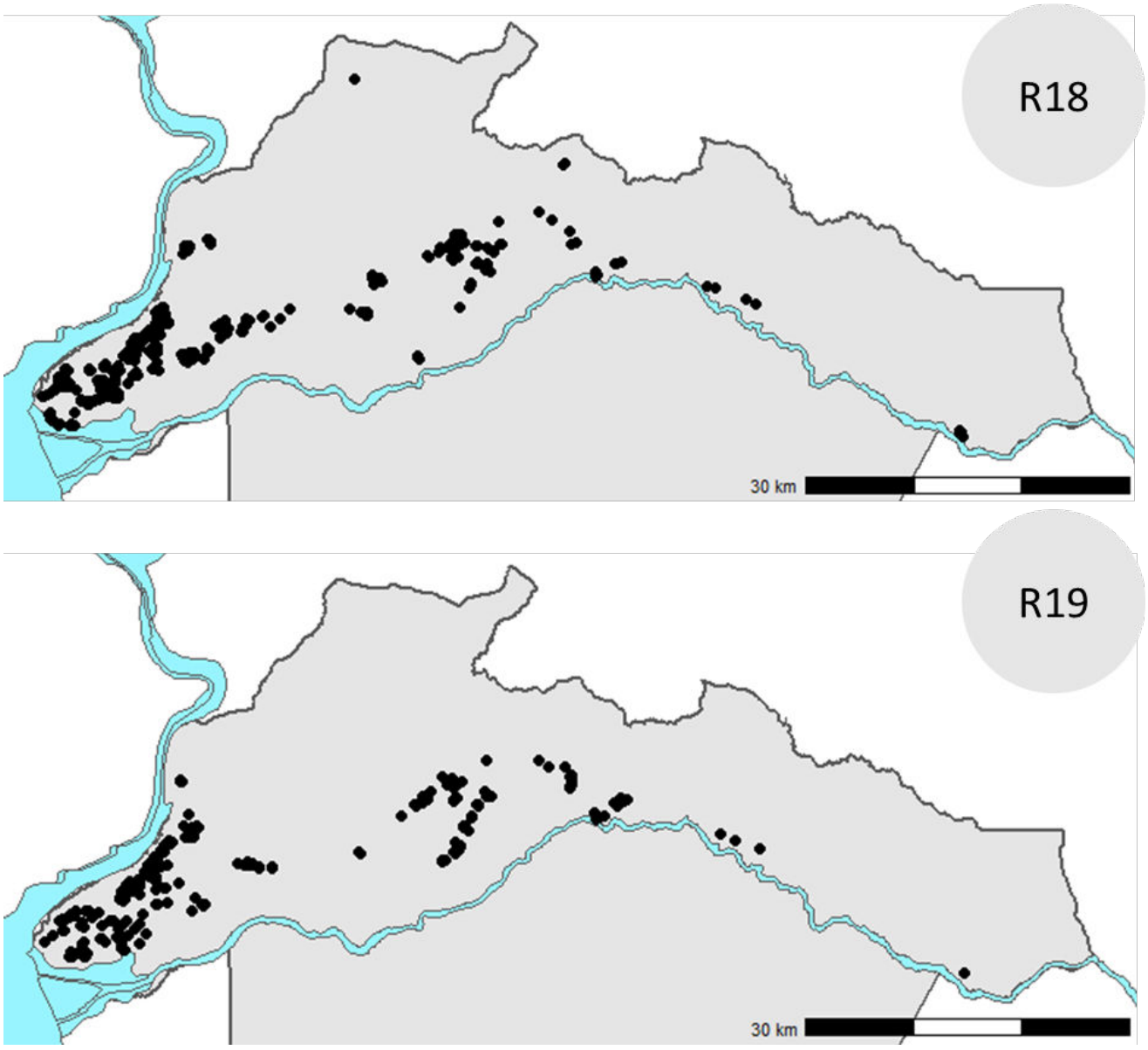

Figure 4. Spatial distribution of Nubian giraffe with skin disease in Murchison Falls NP, Uganda during the Round 18 and 19 surveys.

Finally, we observed a small proportion of individuals with snare injuries in both surveys. These included only 3% (n=35, including 24 males and 11 females) for Round 18 and 2% (*n*=20, including 10 males and 10 females) for Round 19. For Round 18, the majority of individuals with snare injuries were adults (n=28), followed by five sub-adults and two calves. Again, for Round 19, the majority of individuals with snare injuries were adults (n=19), followed by one sub-adult. Poaching using wire snares is a critical threat to wildlife in the park. The small proportion of individual giraffe with snare injuries during both surveys could suggest relatively low rates of giraffe entanglement with wire snares, a rapid response rate of the joined mobile veterinary team of GCF and the Uganda Wildlife Authority, or low survival rates when snared. Additional research is needed to examine the rates of capture as well as impacts of wire snares on giraffe survival and welfare. All the snaring injuries that we observed were positioned on giraffe legs. These snaring injuries could have negative consequences for life history strategies such as mating and foraging. In both surveys, we detected a bias in the spatial distribution of giraffe with snare injuries toward the west (Figure 5). The spatial distribution of snare-injured giraffe potentially highlights areas of intense pressure (hot spot) within Murchison Falls NP, where recent estimates have highlighted snare densities of up to ~5 snares/km^2 (Mudumba et al. 2020).

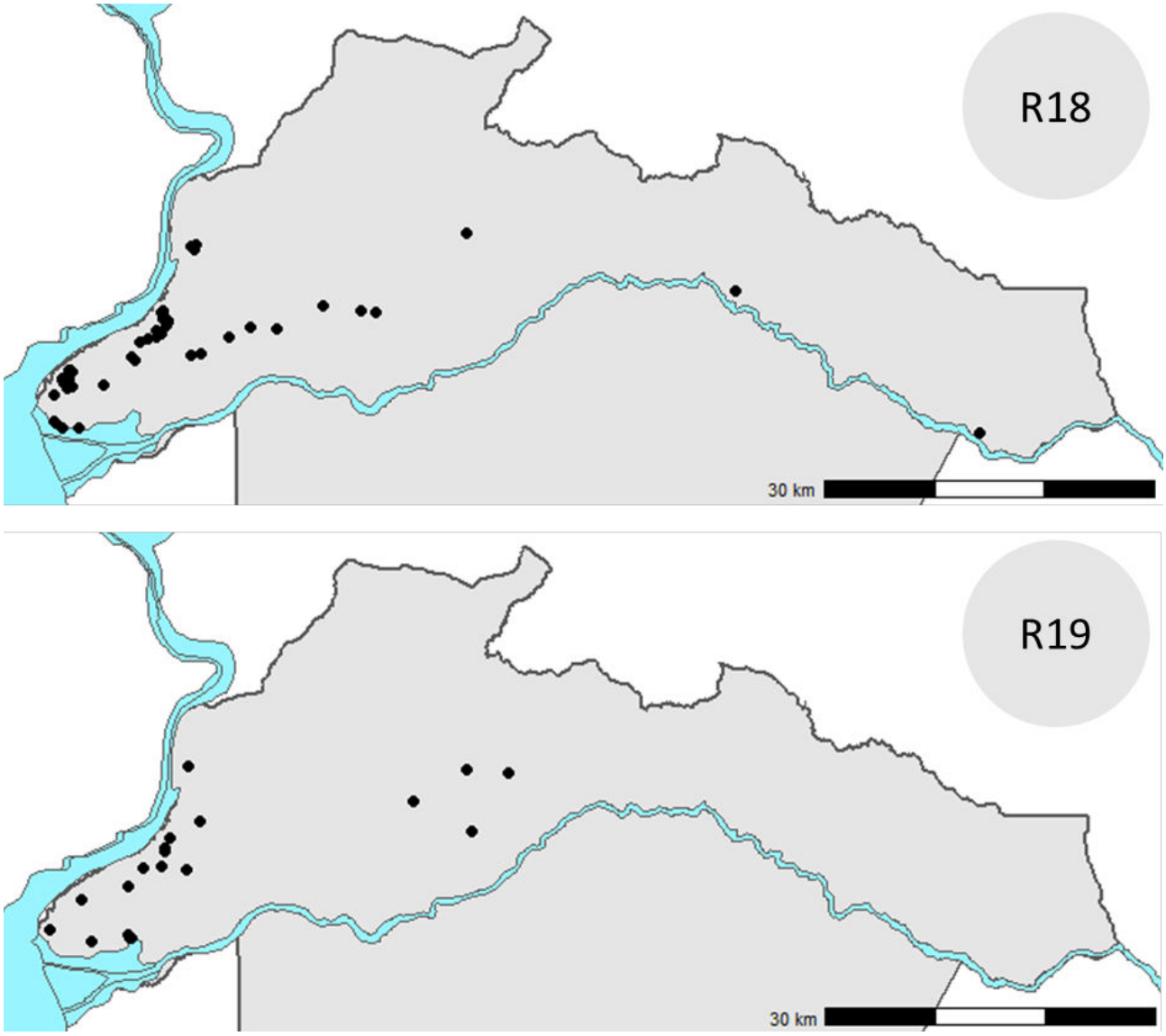

Figure 5. Spatial distribution of Nubian giraffe with snare-related injuries in Murchison Falls NP, Uganda during the Round 18 and 19 surveys.

Conclusion

Based on the Round 18 and Round 19 surveys, the Nubian giraffe population in Murchison Falls NP is estimated at ~2,258 individuals. GCF's long-term giraffe monitoring efforts are crucial for documenting demographic patterns and threats to giraffe conservation in Murchison Falls NP. Ultimately, the data collected will be useful in examining long-term shifts in giraffe demographic patterns in response to conservation threats such as oil development and poaching. Additional conservation research for the management of giraffe in Murchison Falls NP would be valuable, including addressing seasonal variation in snaring, individual-level consequences of snaring (shifts in habitat and forage use, and survivorship), and comparing snaring of giraffe with other species.

Partners & Supporters

UWA

Makerere University

CHESTER ZOO ACT FOR WILDLIFE

CLEVELAND METROPARKS ZOO SECURING A FUTURE FOR WILDLIFE

References

Bolger, D.T., Morrison, T.A., Vance, B., Lee, D. & Farid, H. 2012. A computer-assisted system for photographic mark-recapture analysis. *Methods in Ecology and Evolution* 3: 813-822.

Brown, M.B., Kulkarni, T., Ferguson, S., Fennessy, S., Muneza, A., Stabach, J.A. & Fennessy, J. 2021. *Conservation Status of Giraffe: Evaluating Contemporary Distribution and Abundance with Evolving Taxonomic Perspectives.* In: DellaSala, D. A. & Goldstein, M. I. (Eds.) Imperiled: The Encyclopedia of Conservation.

Brown, M.B., Bolger, D.T. & Fennessy, J. 2019. All the eggs in one basket: a countrywide assessment of current and historical giraffe population distribution in Uganda. *Global Ecology and Conservation* 19: e00612.

Coimbra, R.T.F., Winter, S., Kuma, V., Koepfli, K., Gooely, R.M., Dobrynin, P., Fennessy, J. & Janke, A. 2021. Whole-genome analysis of giraffe supports four distinct species. *Current Biology* 31: 2929-2938.

Fennessy, J., Bidon, T., Reuss, F., Kumar, V., Elkan, P., Nilsson, M.A. et al. 2016. Multi-locus analyses reveal four giraffe species instead of one. *Current Biology* 26(18): 2543-2549.

Han, S., Dadone, L., Ferguson, S., Bapodra-Villaverde, P., Dennis, P.M., Aruho, R., Sadar, M.J., Fennessy, J., Driciru, M., Muneza, A.B., Brown, M.B., Johnston, M. & Lahmers, K. 2022. Giraffe skin disease: Clinicopathologic characterization of cutaneous filariasis in the critically endangered Nubian giraffe (*Giraffa camelopardalis camelopardalis*). *Veterinary Pathology* 59(3): 467-475.

Lamprey, R.H. & Michelmore, F. 1996. Surveys of Protected Areas, Phase I and Phase II. Ministry of Tourism, Wildlife and Antiquities, Kampala, Uganda.

Mudumba, T., Jingo, S., Heit, D. & Montgomery, R. A. 2020. The landscape configuration and lethality of snare poaching of sympatric guilds of large carnivores and ungulates. *Afr. J. Ecol.* 51 (1): 51-62.

Muneza, A.B., Montgomery, R.A., Fennessy, J.T., Dickman, A.J., Roloff, G.J. & Macdonald, D.W. 2016. Regional variation of the manifestation, prevalence, and severity of giraffe skin disease: a review of anemerging disease in wild and captive giraffe populations. *Biological Conservation* 198: 145-156.

Olivier, R.C.D. 1991. *Aerial total counts of elephants in Uganda National Parks, March-April 1991*. Unpublished Report to Uganda Wildlife Authority, Kampala, Uganda.

Rwetsiba, A. 2006. *Aerial sample counts of medium-large mammals in Lake Mburo Conservation Area, Uganda*. Monitoring and Research Unit, Uganda Wildlife Authority, Kampala, Uganda.

Rwetsiba, A., Wanyama, F., Kisame, F. & Owoyesigire, G. 2012. *Aerial survey of medium-large mammals in Murchison Falls Conservation Area*. Draft Report. Ecological Monitoring and Research Unit, Uganda Wildlife Authority, Kampala, Uganda.

Sommerlatte, M. & Williamson, D. 1995. *Aerial Survey of the Murchison Falls National Park, the Karuma Game Reserve and the Bugungu Game Reserve, April 1995*. Report to Murchison Falls National Park Rehabilitation Project, GTZ, Kampala, Uganda.

Uganda Wildlife Authority (UWA). 2019. *National Giraffe Conservation Strategy and Action Plan for Uganda (2020-2030)*. Uganda Wildlife Authority, Kampala, Uganda.

Winter, S., Fennessy, J. & Janke, A. 2018. Limited introgression supports division of giraffe into four species. *Ecology and Evolution* 1-11.