GPS Satellite Tagging Report

# Tracking Masai giraffe in Tanzania to study Giraffe Skin Disease: A collaborative multidisciplinary conservation research effort

April 2020

While Masai giraffe (*Giraffa tippelskirchi*) are the world's second most abundant giraffe species, they have recently been listed as 'Endangered' by the International Union for the Conservation of Nature (IUCN) following a decline of ~52% over the past 30 years across their range. This decrease in numbers is generally attributed to habitat loss and fragmentation due to human activities, poaching and climate change. However, little is known on the impact that disease may have had on the decline of giraffe across their range. In particular, studies have recently focused on assessing the distribution and severity of an 'emerging' disease referred to as Giraffe Skin Disease (GSD). Giraffe Skin Disease has been recorded in several conservation areas across Africa distributed in at least seven sub-Saharan countries. The disease is commonly characterised by crusty, greyish-brown lesions that appears on various body parts of infected giraffe. Forms of the disease were first recorded in Murchison Falls National Park (NP), Uganda in 1995 where giraffe were observed with lesions on the neck, chest and shoulders. In Ruaha NP, Tanzania GSD was reported in 2000 where lesions were commonly observed on the front limbs of giraffe. In particular, Tanzania appears to be a hotspot of GSD with some of the highest prevalence rates recorded anywhere. For instance, Ruaha NP has a prevalence rate of 86%, while 63% of the giraffe population in Tarangire NP has shown external symptoms of GSD. Importantly, the Tanzania Wildlife Research Institute (TAWIRI) and other conservation stakeholders in Tanzania have identified GSD as a priority for giraffe conservation in Tanzania in the recently launched National Giraffe Conservation Action Plan 2020 – 2024.

To support the implementation of the Action Plan, the Giraffe Conservation Foundation (GCF) partnered with TAWIRI and Tanzania National Parks Authority (TANAPA) in January 2020 to deploy specially designed GPS satellite units on giraffe to study and monitor the movement of giraffe symptoms of GSD and healthy individuals. The units, designed together with GCF and built by Savannah Tracking, use an Iridium satellite connection and are solar-powered. The small units, weighing ~90g, were attached to the ossicone of giraffe, and set to record GPS positions once every hour. The units have been deployed in other parts of Africa including Chad, DRC, Kenya, Namibia, Niger, Uganda and Zimbabwe, to assess different aspects of giraffe spatial and behavioural ecology, support anti-poaching and post-translocation monitoring.

The Tanzanian tagging effort, which took place from 26 January to 6 February 2020, was the first-ever use of GPS satellite units on Masai giraffe anywhere across their range. This crucial exercise started with Tarangire and Serengeti NPs given the interconnectedness of the northern Tanzania tourism circuits. More importantly, both national parks have the highest rates of GSD in Tanzania outside of Ruaha NP. As such, this exercise was the first of a planned long-term collaborative multidisciplinary conservation research program to determine the causative agent of GSD in Tanzania and assess whether there exists a correlative link in the manifestation of the disease in the different areas where GSD has been recorded.

As part of the GPS satellite tagging exercise, each individual giraffe was darted remotely by the TAWIRI vet, Dr. Justin Shamanche, who was assisted by various assigned TANAPA vets. Additionally, a consulting vet Dr. Joel Alvez from Wildlifevets, who frequently works with GCF on giraffe immobilisation conservation programs was present to advise. The drug combination used to immobilise the giraffe was a mixture of thiafentanil and etorphine. Thiafentanil was used as it has been shown to have less deleterious effects on giraffe, requires less amounts to immobilise a giraffe, and animals respond quicker to the reversal drug, and thus increasing the overall safety of the animal and all involved in the procedure. On average, the first signs of induction appeared after 1.5 minutes. Once a giraffe showed signs that the drugs were taking effect, the capture team moved in quickly to safely rope the giraffe to the ground, after which the vet then immediately injected the reversal drug (diprenorphine). At all times, the monitoring team kept track of the temperature, respiration rates and other vital signs. We focused on female giraffe because prior research has shown that: 1) female giraffe are more susceptible to GSD, 2) female giraffe move more often within their home range and 3) female giraffe are less likely to drop the GPS units given that male giraffe use their ossicones to fight for dominance. Each giraffe 'ossi-unit' was fitted on one ossicone with two surgical steel bolts with no thread. The ossi-unit was placed in the middle of the ossicone (Fig. 1), far from the frontal sinus connected to the cranium.


**Fig. 1.** Ossi-unit fitted on the ossicone of a Masai giraffe in Tarangire National Park.

The ossicones have no innervation and as such, attaching the units is a painless and relatively low-risk procedure for the giraffe. To minimise any risk of infection, the drill bits and surgical steel bolts were sprayed with antiseptic spray before and during use. The hair on the chosen ossicone was shaved off to ensure that the ossi-unit could be attached and fitted securely. We also used ethyl-chloride spray to numb the drilling area and cool the drill bit. Once the ossi-unit was firmly attached, the bolts were cut to ensure that there were no protruding ends for the safety of the animal. It is important to note that the ossi-units were fitted after the reversal drug had been administered and the giraffe were fully awake, and very little signs of discomfort were observed. During the tagging exercise, we collected tissue and blood samples for further analysis. For individuals with GSD, tissue samples were collected on the edge of the GSD lesion as it has been recorded from prior studies in Uganda that the infection is more active in such areas of the lesion. Samples were collected from 11 giraffe in total (four from Tarangire NP and seven from Serengeti NP) then stored in RNAlater for further analysis. We also measured various biometric data to better understand the variation in giraffe body size including the lengths of the ear, legs, neck, head, body and tail, as well as shoulder height and ossicone diameter (Table 1).

**Table 1.** Biometric data and Giraffe Skin Disease severity of the giraffe that were fitted with GPS satellite units in Tarangire and Serengeti National Parks.

| Unit ID | Date | Location (NP) | Ear length (cm) | Ossicone diameter (cm) | Shoulder height (cm) | Leg length (cm) | Neck length (cm) | Head length (cm) | Body length (cm) | Tail length (cm) | GSD severity |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3448 | 30-01-20 | Tarangire | 19 | 6 | 277 | 95 | 220 | 64 | 100 | 84 | FR+FL: Mod |
| 3446 | 30-01-20 | Tarangire | 20 | 10 | 287 | 100 | 217 | 70 | 105 | 96 | FR: Mild |
| 3458 | 30-01-20 | Tarangire | *Giraffe too restless for measurements to be safely completed* | | | | | | | | None |
| 3456 | 31-01-20 | Tarangire | 19 | 7 | 283 | 95 | 210 | 64 | 113 | 85 | FR+FL: Mild |
| 3451 | 04-02-20 | Serengeti | 20 | 9 | 282 | 97 | 130 | 64 | 94 | 93 | None |
| 3447 | 04-02-20 | Serengeti | 23 | 10 | 276 | 95 | 195 | 63 | 109 | 80 | None |
| 3453 | 04-02-20 | Serengeti | 24 | 10 | 292 | 100 | 213 | 63 | 117 | 83 | None |
| 3444 | 05-02-20 | Serengeti | 19 | 9 | 265 | 93 | 176 | 57 | 93 | 96 | None |
| 3452 | 05-02-20 | Serengeti | 19 | 9 | 290 | 97 | 200 | 62 | 100 | 77 | None |
| 3450 | 05-02-20 | Serengeti | 21 | 10 | 281 | 98 | 167 | 57 | 100 | 75 | None |
| 3443 | 05-02-20 | Serengeti | 21.5 | 10 | 297 | 100 | 224 | 66 | 122 | 107 | FR: Mild |

Note: FR = Front right; FL = Front left; Mod = moderate

On average, the giraffe spent 8 minutes on the ground, which was enough time to fit the ossi-unit, collect the samples and record the biometric data. The aim of this initial step of the conservation program was to collar 10 giraffe each in Tarangire and Serengeti NP. However, the rainy season that is usually expected in November to mid-December extended to the later parts of January and February across East Africa. Despite the unpredictable weather conditions, the capture team had no mortalities or injuries, and human contact was kept to a minimum. After attaching the units, each individual giraffe was observed at the tagging site (Fig. 2) to ensure that the animal was in a good condition.

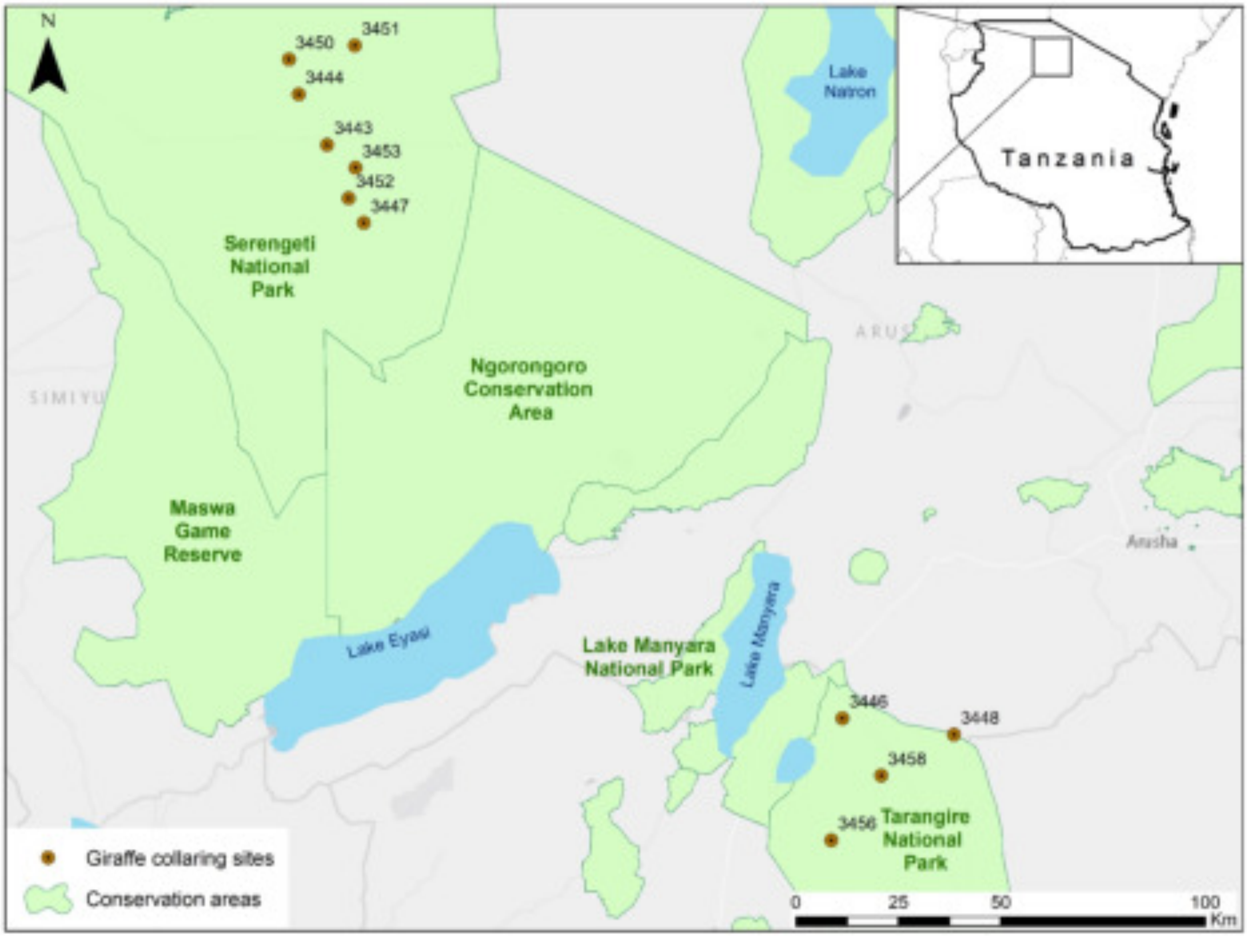


**Fig. 2.** Sites where the giraffe were tagged in Serengeti and Tarangire National Parks.

Preliminary data from the ossi-units show that there is variation in the movement patterns of giraffe in Tarangire NP. Specifically, since the collaring in January, individual 3446 has covered the most distance (n = 480.6 km) of all the giraffe in Tarangire NP, and in the process overlapping with two other tagged giraffe (3448 and 3458) at one point (Fig. 3 panel b). It is important to note however, that unit 3458 depowered shortly after deployment and has since switched on and off, emitted inconsistent data and as such as has been omitted from any analysis. Nonetheless, recent reporting, shows that the unit emits data once it has received enough charge from the sun.

Giraffe with signs of GSD on both limbs (3448 and 3456) in Tarangire NP covered shorter distances compared to giraffe 3446, which had only one mild GSD lesion on the front right limb (Table 1; Fig. 4). However, this is only preliminary data of GSD impacting giraffe movement and long-term monitoring is required. We intend to deploy additional collars in the Tarangire Ecosystem to better understand which biotic and abiotic factors impact giraffe movements and collect additional GSD samples. Similarly, in Serengeti NP, the sole giraffe that was tagged with GSD symptoms (3443) covered the shortest distance (n = 306.4 km) compared to other giraffe, though two other giraffe (3451 and 3452), without any GSD lesions, covered almost similar distances at ~ 329.7 km and 322.2 km respectively (Fig. 4).

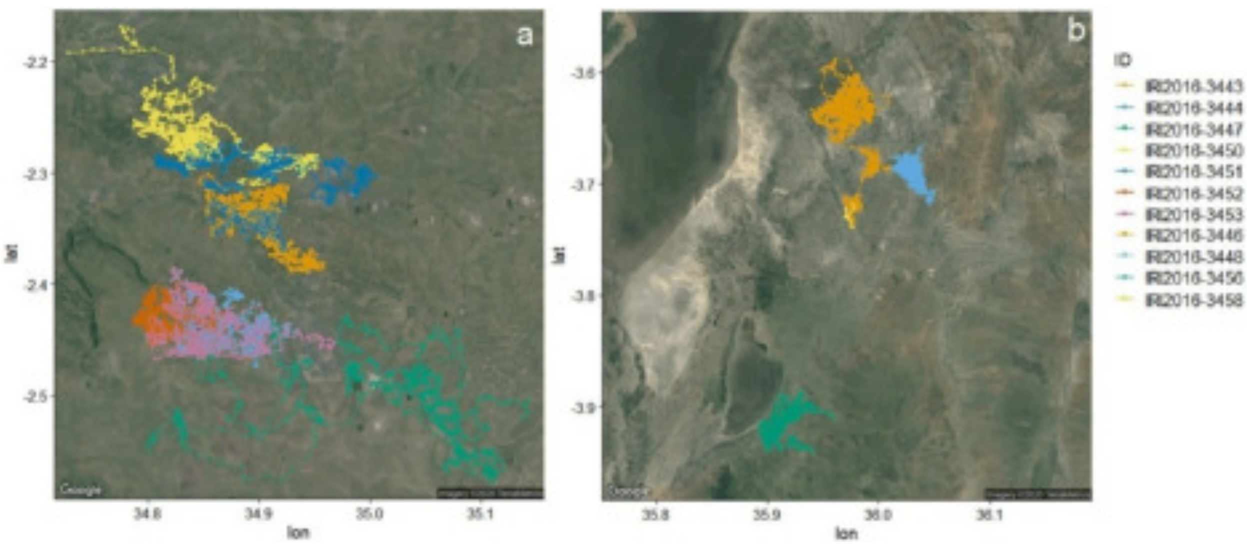


**Fig. 3.** Map detailing the movement patterns of the GPS satellite tagged giraffe in (a) Serengeti National Park and (b) Tarangire National Park, since the time of deployment to 10 April 2020.

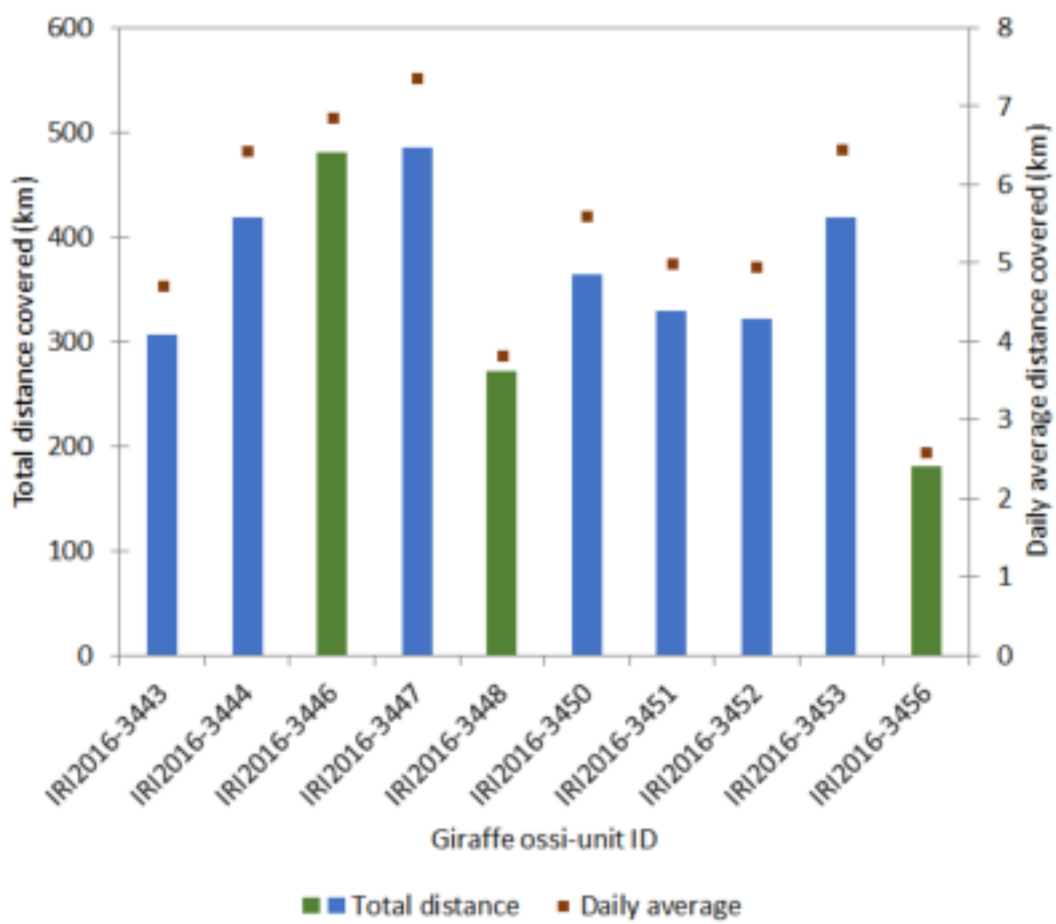


**Fig. 4.** Distances covered by the GPS satellite tagged giraffe in northern Tanzania. The blue bars represent giraffe tagged in Serengeti National Park while the green bars represent giraffe tagged in Tarangire National Park. The primary Y-axis shows the total distance covered by an individual giraffe while the secondary Y-axis shows the daily average distance covered. Figures are accurate as reported until 10 April 2020.

## Way forward

The ossi-units already fitted in northern Tanzania have provided useful data and we anticipate that more robust analysis with long-term data will provide valuable insights into the spatial ecology of giraffe with and without GSD lesions. The units are currently maintaining a good charge, rarely dipping below 90% of their voltage profile (Fig. 5). These ossi-units can run for at least two years and we will continue to collaboratively monitor the tagged giraffe. Additionally, we hope to deploy ossi-units and collect GSD samples from Ruaha, Mikumi and Selous NP, which are the epicentres of GSD in Tanzania. All field research activities will be conducted with collaboration and participation of Tanzanian collaborators and long-term the data will be shared with partners. Additionally, all tissue samples will be sent to US-based GCF conservation partner Colorado State University for laboratory analysis to determine the aetiological agent of GSD as well as evaluation of the pathophysiology of the disease.

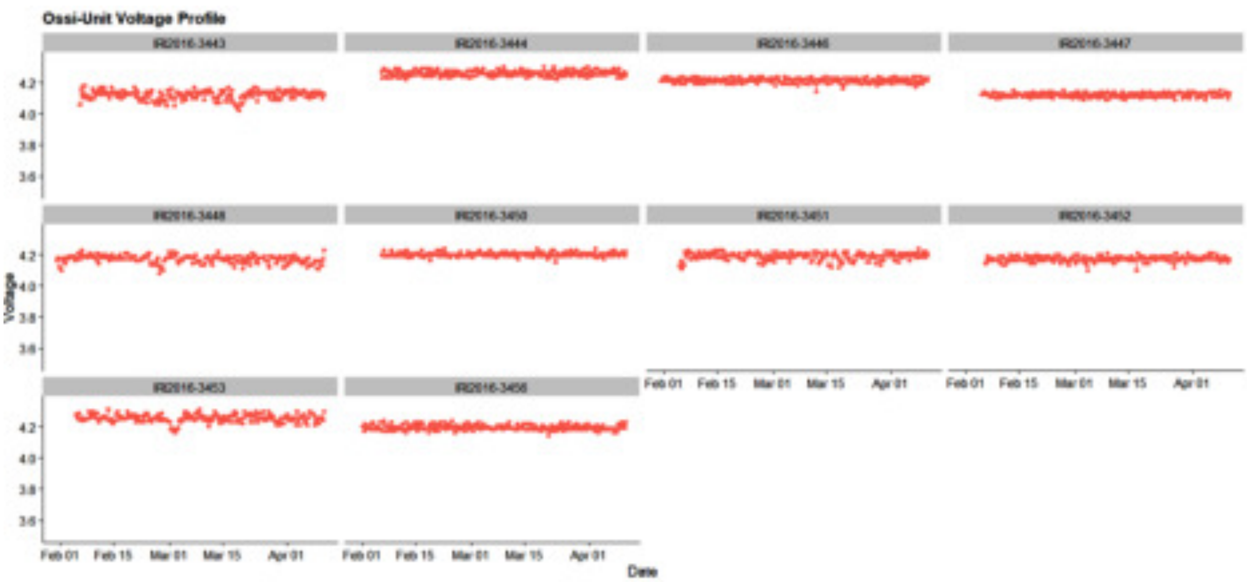


**Fig. 5.** Voltage profile of the ossi-units deployed in Serengeti and Tarangire National Parks in January and February 2020. Figures are accurate as of 10 April 2020.

## Acknowledgements

We express our sincere gratitude to TAWIRI and TANAPA for the permission to undertake this important and crucial work on Masai giraffe conservation in the country. We sincerely thank all field staff members for their hard work in challenging conditions and providing input that made the work run smoothly. We also thank all the technical advisors that provided crucial input that ensured the success of this conservation effort. Lastly, we thank Ivan Carter Wildlife Conservation Alliance and Stumberg Family Foundation that made this critical conservation research work possible.