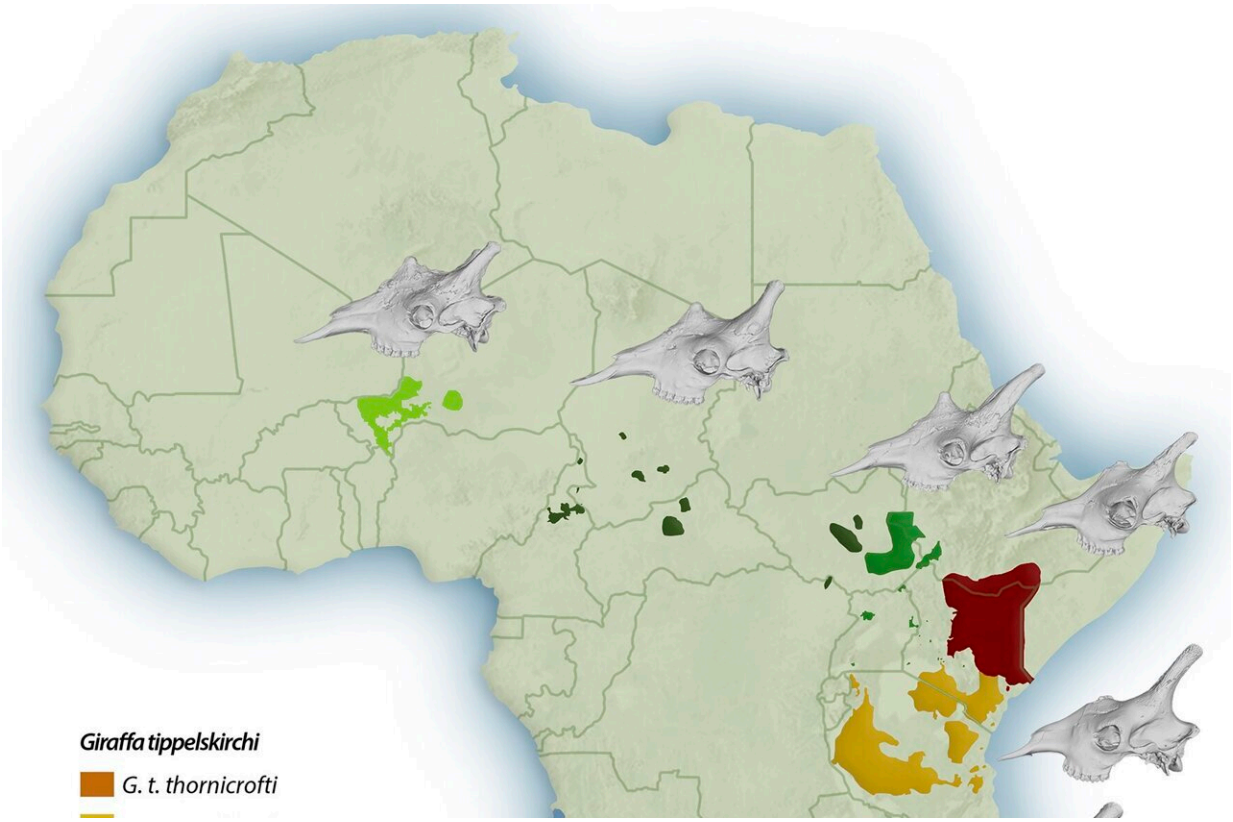
Morphological evidence supporting four giraffe species classifications

December 28 2024, by Justin Jackson



Map showing the geographical range of the extant giraffe species and subspecies as well as representative male skulls of each subspecies in lateral view. Credit: *PLOS ONE* (2024). DOI: 10.1371/journal.pone.0315043

The University of Cape Town, along with the Giraffe Conservation Foundation, have conducted a large-scale study identifying significant

cranial shape differences between four genetically distinct giraffe species. The findings suggest that these species exhibit unique developmental and morphological characteristics, which have implications for conservation efforts.

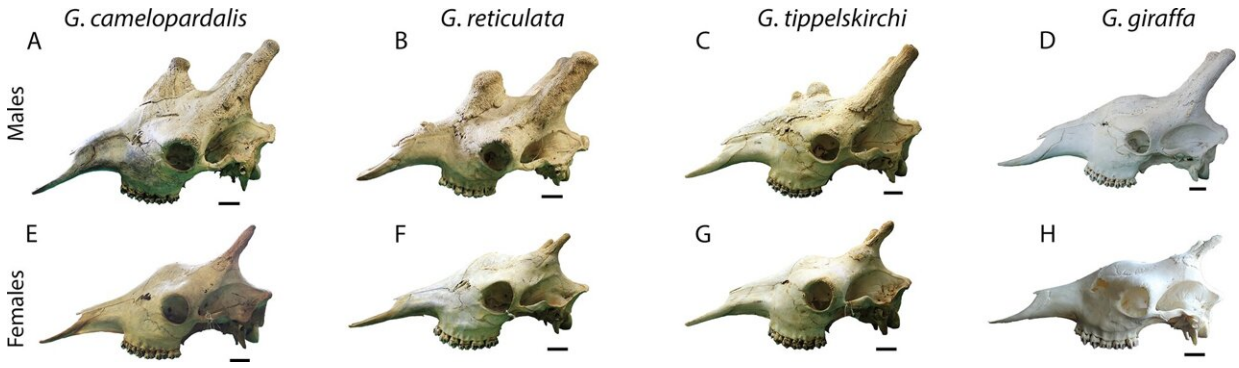
Taxonomic classification is critical for guiding good conservation strategies. Giraffes have long been categorized as one species with geographic variants, though advancements in research are reshaping this perspective.

In the study, "Heads Up—Four Giraffa Species Have Distinct Cranial Morphology," published in *PLOS ONE*, researchers examined 515 giraffe skulls with 3D geometric morphometrics to analyze patterns of cranial variability. The dataset, the largest of its kind, included specimens from museum collections, wild populations, and taxidermy sources across Africa.

Skulls were digitized using handheld surface scanners and CT imaging, creating 3D models for analysis. Researchers used a landmarking protocol to identify anatomical features and applied Procrustes superimposition to align data for statistical evaluation.

Principal Component Analysis, Canonical Variate Analysis, and Discriminant Function Analysis were employed to detect shape differences. Regression analyses assessed the role of allometry and ontogeny in how size and shape change over the course of development.

Significant sexual dimorphism in cranial morphology was identified, with males showing larger ossicones (the short antler-like structures on the head) and broader cranial structures than females. Skull shape differences between northern and southern clades were also detected, with distinct ontogenetic trajectories.



Comparison of male and female skulls of the four species in lateral view. Credit: *PLOS ONE* (2024). DOI: 10.1371/journal.pone.0315043

Data revealed statistically significant differences between all four giraffe species: the northern giraffe (Giraffa camelopardalis), reticulated giraffe (G. reticulata), Masai giraffe (G. tippelskirchi), and southern giraffe (G. giraffa). Morphological differences centered on ossicone structure, cranial crests, and palate shape.

Most subspecies distinctions were less pronounced, though a few, such as G. t. thornicrofti and G. t. tippelskirchi, displayed measurable differences.

Ossicone morphology stood out to researchers as a key taxonomic trait, noting its influence on giraffe behavior and reproduction. Northern giraffe species exhibit prominent, sharply pointed median ossicones, whereas southern giraffes possess minimal or absent median ossicones, resembling ancestral traits. Findings align with recent genetic studies supporting the classification of giraffes into four species.

Understanding that all giraffe species are not one then requires distinct

conservation strategies for each. Translocation or hybridization between unrelated taxa could have negative consequences.

As current conservation frameworks, such as the International Union for Conservation of Nature, treat all giraffes as one species, they may need revision to reflect these findings.

More information: Nikolaos Kargopoulos et al, Heads up–Four Giraffa species have distinct cranial morphology, *PLOS ONE* (2024). DOI: 10.1371/journal.pone.0315043