

We studied more than 500 giraffe skulls from all over Africa, and confirmed there are 4 distinct species

January 30 2025, by Nikolaos Kargopoulos, Julian Fennessy



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Giraffes are among the world's most recognizable animals. With their [elongated necks](#) and long legs, their gracious movements and [unique coat patterns](#), they have inspired people's imaginations for centuries.

But is a giraffe just a giraffe? Or is there more variety between the animals at a genetic level than is evident just from looking at them?

For more than a decade many researchers have compared the DNA of [giraffes](#) from all parts of Africa. These studies have revealed that there are [four distinct giraffe species](#): the southern (*Giraffa giraffa*), Masai (*Giraffa tippelskirchi*), reticulated (*Giraffa reticulata*), and northern (*Giraffa camelopardalis*) giraffe.

Different giraffe species [face different risks](#). Some are among the most threatened large mammals in the world. While the southern and the Masai giraffe are relatively numerous and their populations [estimated at](#) approximately 45,000 and 50,000 individuals respectively, the situation does not look quite as rosy for the reticulated and the northern giraffe. Based on the latest estimates from the [Giraffe Conservation Foundation \(GCF\)](#), only 16,000 and 6,000 individuals respectively remain in the wild.

Therefore, it is critical to verify whether there are indeed [different species](#) of giraffe or not so that direct conservation efforts for the most threatened species can be increased before it's too late.

The [concept of species](#) is fundamental in biology—but there is no consensus on its definition. There are many [different approaches](#) depending on individual scientists' points of view. The best possible way to clarify the taxonomy (the system that organizes living entities into groups) of organisms is through [multiple approaches](#).

There have been [several studies of giraffe species](#) based on their DNA, as well as on their [ecology](#), behavior, health and coat patterns.

But there haven't been many based on their skulls. That's where our [new study](#) comes in. By examining the skulls of more than 500 giraffes from

across the African continent, we were able to show that there are significant differences in the skull shapes of the different types of giraffe—and confirm that there are four species.

These new findings are crucial for giraffe [taxonomy and, ultimately, their conservation](#).

How the study was done

Giraffe skulls are important to the animals' [reproduction and evolution](#). That's because of their [ossicones](#), the horn-like structures that are longer and wider in males than in females.

The size and shape of the ossicones is important in the dominance of males and their mating success with female giraffe. While some [preliminary data](#) already suggested some potential differences in the ossicone morphology between the giraffe species, limitations on the available specimens and the methodologies at the time reduced the validity of the results.

[For our research](#) we used state-of-the-art equipment and methodologies, and we studied more than 500 giraffe skulls from all over Africa. The skulls were directly sampled in the field from across their natural range in Africa, as well as museum collections, wildlife authority offices, and taxidermists in different countries in Africa, Europe and the US.

This [extensive study](#) required help from many different partners. While the project was initiated and guided by the Giraffe Conservation Foundation and the University of Cape Town, many colleagues in Africa, Europe and North America contributed.

We used a handheld 3D scanner to capture the skulls' shape in 3D. Then we used [3D geometric morphometrics](#) methods to compare the shape of

the giraffe skulls and find out if we could group them and find any significant differences. We chose so-called landmarks—specific points on the skulls—and captured their coordinates in space (their 3D distance from the center of mass of the skull).

Finally, specialized [software](#) was used to compare the differences in the coordinates of landmarks between our specimens and to conduct statistical analyses to show if these differences were significant or not.

Skull variations

These rigorous analyses allowed us to show skull variations between four species.

These differences mostly concerned the ossicones. But there were also minor differences in their face, eye sockets, the region around the teeth, and the back part of the skull.

The most striking difference concerned the median ossicone of the males. This is a smaller third ossicone situated in the midline of the [skull](#) above their eyes. We determined that there is a general trend in the size and shape of this ossicone that follows geography and taxonomy. In southern giraffe, the third ossicone is practically a small protrusion; in northern giraffe it is large and pointed; the Masai and reticulated giraffe have ossicones that are somewhere between those two forms.

Such differences are likely important in the way individuals of a species recognize each other, thus affecting their reproductive success. Males with more developed ossicones [intimidate their rivals](#) to gain access to territory and females.

Attention for individual species

Our study is confirmation of what scientists have known for almost a decade and supports the [taxonomic split of the giraffe](#).

Similar discussions over two decades finally resulted in the African elephant being split into two distinct species in 2021.

The [International Union for the Conservation of Nature](#) (IUCN)—which, it must be pointed out, is not a taxonomic authority—still only recognizes [one species of giraffe](#). It lumps all giraffes into one broad, threatened Red List category.

We strongly believe that the IUCN needs to stand tall for these animals and reassess their status. It is time for each giraffe species to get separate and enhanced attention, both locally and internationally, in particular when it comes to their conservation. Giraffes and their wild habitats must be protected before it's too late.

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