Neumann's enigmatic gazelle (*Gazella erlangeri*)

Threatened taxon or domesticated gazelle?

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Introduction

One of the most challenging questions in regard to Arabian gazelles is the status of *G. erlangeri* Neumann, 1906 (Fig. 1). Gazelles currently kept in captivity at King Khalid Wildlife Research Centre in Saudi Arabia and Al Wabra Wildlife Preservation in Qatar (Fig. 2) show the described combination of diagnostic features, and thus, were considered to represent *G. erlangeri*, even though the exact provenance of these gazelles remains obscure. However, captive '*G. erlangeri*' may have also originated from eastern Oman and could be therefore assigned to *G. muscatensis* (Fig. 3). Both taxa are considered 'extinct in the wild' by the IUCN Red List. Past conservation efforts have been plagued by confusion about the phylogenetic relationship among various—phenotypically discernable—populations (*e.g.*, *G. erlangeri*, *G. muscatensis*), and even the question of species boundaries was far from being certain. This lack of knowledge had a direct impact on conservation measures, especially *ex situ* breeding programmes, hampering the assignment of captive stocks to potential conservation units.

Fig. 1 Drawing of *G. arabica erlangeri* Neumann, 1906 in Sclater and Thomas' (1898) 'Books of Antelopes'

Fig. 2 Putative *G. erlangeri* kept at Al Wabra Wildlife Preservation in Qatar

Fig. 3 Drawing of *G. muscatensis* Brooke, 1874 kept at London Zoo

Methods

In our study we provide a phylogenetic framework based on a SPN network of mtDNA sequences (1007 bp cytochrome *b*) as well as results from population genetic analyses using 11 microsatellite markers. Furthermore, we used morphometrical data to investigate possible characteristics of these forms.

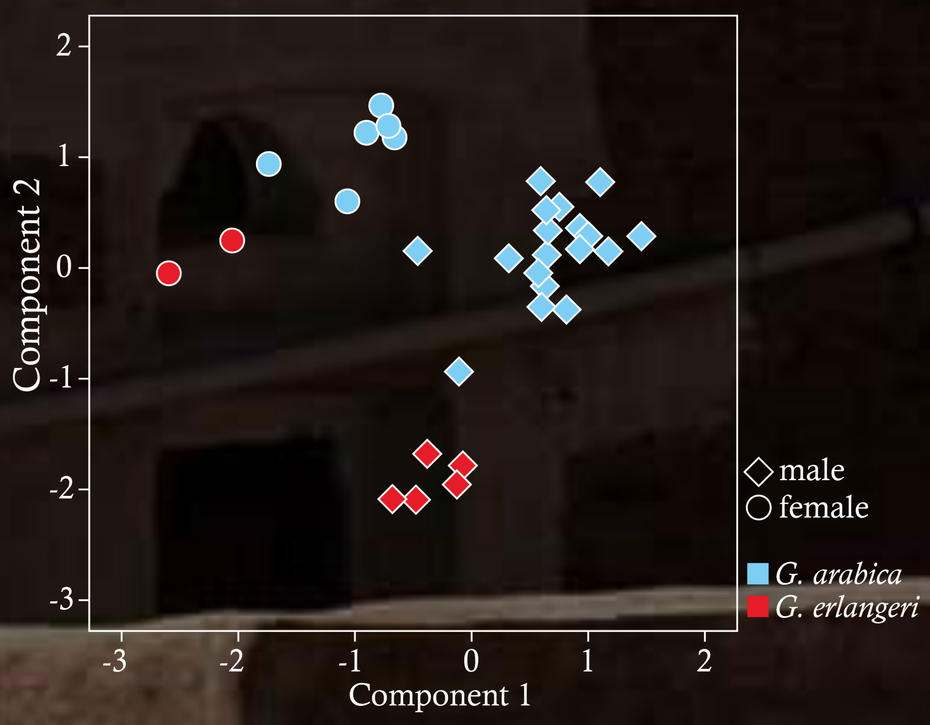

Fig. 3 Principal component analysis of skulls using 32 linear measurements. Component 1 reflects differences in horn length and horn diameter, occipital height, braincase length and skull width. Component 2 is influenced by horn distance and horn width, as well as the distance from snout tip to horn base.

Results

Morphometric results (Fig. 3) as well as population genetic analyses (Fig. 4) clearly showed diagnostic differences between putative *G. erlangeri* held in captivity and other mountain gazelles (*G. gazella* and *G. arabica*). Nevertheless, phylogenetic analyses (Fig. 5) did not find a monophyly of putative *G. erlangeri* and placed them within the mountain gazelle clade.

Discussion

Therefore, we argue that animals held in captivity are the product of selective breeding leading to smaller, darker and tamer forms of mountain gazelles with no equivalent found in the wild. These findings correspond with the historic mention of pet gazelles from Yemen and southern Saudi Arabia.

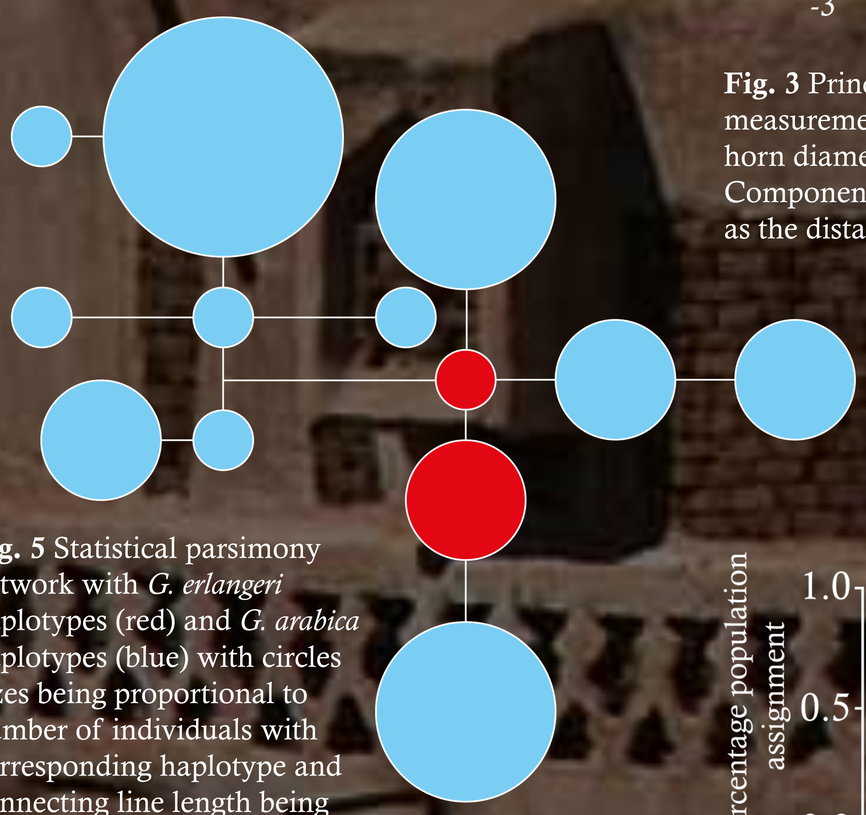

Fig. 5 Statistical parsimony network with *G. erlangeri* haplotypes (red) and *G. arabica* haplotypes (blue) with circles sizes being proportional to number of individuals with corresponding haplotype and connecting line length being proportional to mutation steps

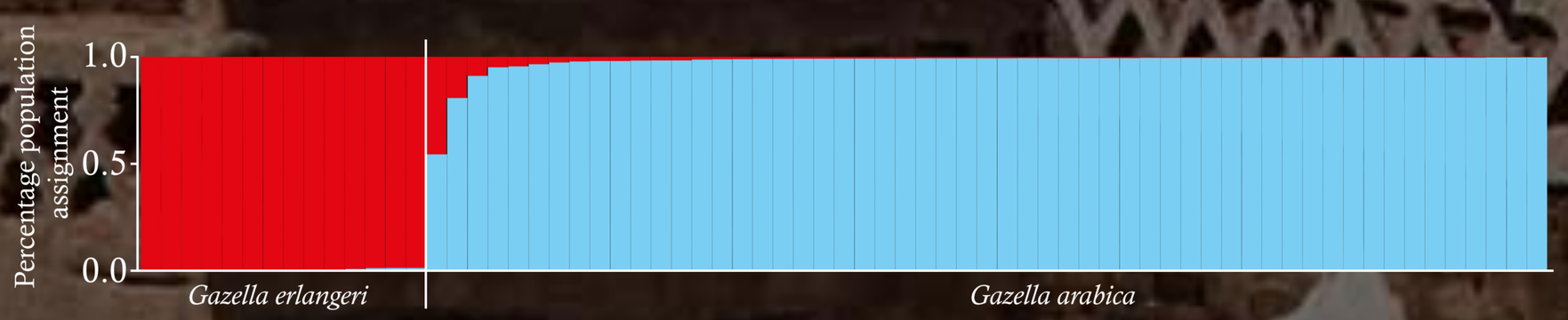

Fig. 4 Percentage population assignments to inferred genetic clusters $K = 2$. Animals were sorted by Q values for each population .

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