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ORIGINS AND FUTURE OF HARTEBEEST IN LAIKIPIA

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Have you heard the one about the taxonomist who found a hartebeest skull with different shaped horns on either side? He named two separate species from the same skull. This was related by a curator at the British Museum via a colleague who went there to measure hartebeest skulls. It is apocryphal (passing for humour in those dusty archives!), but aptly illustrates the exceptional variation in hartebeest morphology across Africa, and the difficulty taxonomists have had making sense of that variation.

For more than a century hartebeest in this ecosystem have been known to be somehow 'special'. They have been variously referred to as 'Laikipia', 'Jackson's', 'Kenya', or 'Lelwel' hartebeest, but rarely with formal reference or definition. Many resemble true Lelwel hartebeest, with robust horns that stand upright then sweep backwards, but there is broad variation in horn shape and size. Laikipia hartebeest have long been considered by some to be hybrid between Lelwel and Cokes. Cokes is the common form in southern Kenya and northern Tanzania. Lelwel were once distributed between central Kenya and the Central African Republic, but persist today in highly fragmented remnants.

Hartebeest in Laikipia enjoy 'flagship' status because only one other morphologically similar population persists in Kenya, in the tiny Ruma National Park (NP) near Lake Victoria. Aiming to resolve their evolutionary origins, we recently compared the genetic makeup of hartebeest in Laikipia with those in Ruma NP, Meru NP, and elsewhere in Africa, using DNA analysis.

We found only subtle genetic differences between hartebeest with Lelwel morphology (in Laikipia and Ruma NP) and those with Cokes morphology (in Naivasha, Meru NP, Nairobi NP, the Mara-Serengeti, and Ngorongoro), and the genetic transition between them appeared seamless. This was surprising because morphological differences between the two are striking, even over distances as short as 100 km (see photos).

Previous analyses have suggested that different hartebeest forms in Africa diverged over the last two hundred thousand years when climate changes triggered continent-wide habitat shifts, 'temporarily' confining separate hartebeest populations to isolated savanna patches. Our results agree with this scenario, but further suggest that Cokes and Lelwel subsequently re-contacted each other and interbred, presumably after the climate cycle reversed, and hartebeest spread as the savannas expanded once more. As a result, the

populations in Laikipia, Ruma NP, and Meru NP are hybrid, but each has a subtly unique genetic makeup and morphology. The former two have greater affinities with Lelwel, the latter, at least morphologically, with Cokes (curiously, the Meru hartebeest were not closely aligned with Cokes in Nairobi NP and Naivasha in the genetic sense).

A conventional approach to conserving hartebeest might aim to preserve or restore populations wherever they occurred naturally, particularly in protected areas. A more contemporary approach would ask *exactly what are we aiming to conserve?* We should attempt to conserve or even recreate the fragmented and diverse remnants of intricate evolutionary processes that have been operating over vast space and time, like the one described here involving hybridization between different forms.

For example, dwindling numbers in Meru NP prompted conservation managers to propose supplementing the Meru hartebeest with individuals imported from elsewhere. Similarities in gross morphology might suggest a suitable source population to be Naivasha or Nairobi NP. A preferable strategy would aim to conserve the evolutionary products of hybridization by breeding up the remaining individuals at Meru in a large, predator-free area. If supplementation from elsewhere becomes mandatory, the goal would be to maintain a population with hybrid characteristics. The Laikipia population is also declining and is nowhere formally protected. A strategic plan should be designed to conserve the remaining hartebeest in Laikipia, particularly those in Solio Ranch in the extreme south, which holds by far the highest densities (if necessary, moving them elsewhere in Laikipia or beyond, but still retaining their identity). Similarly, suitable alternative refuges should be identified to keep the Ruma NP hartebeest intact, should this protected area not survive extreme pressures from surrounding humanity.

In Kenya there has been little unnatural mixing of wildlife populations by translocation, so opportunities to define and conserve ongoing evolutionary processes persist, and should be strenuously pursued. As this project has shown, the relevant research can be achieved by Kenyans through collaborations among national and international partners, in this case Mpala Research Centre, Kenyatta University, the Kenya Wildlife Service, the International Livestock Research Institute in Nairobi, and the Laboratory of Genomic Diversity in Maryland.

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Frontal and lateral views of male horn morphology in Nairobi NP (A; *A. b. cokei*), Meru NP (B; resembles *A. b. cokei*), Solio Ranch, Laikipia District (C; mix between *A. b. lelwel* and *A. b. cokei*), and Ruma NP (D; resembles *A. b. lelwel*; photos by N. Georgiadis).

A

B

C

D