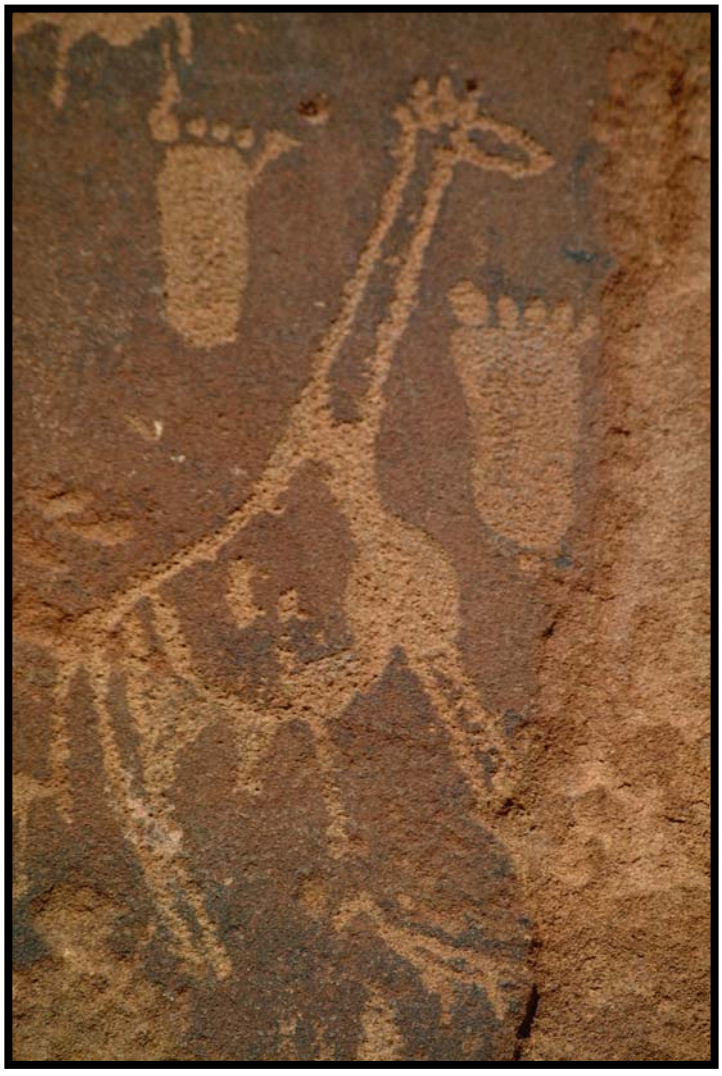
Ecology of desert-dwelling giraffe *Giraffa camelopardalis angolensis* in northwestern Namibia



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STATEMENT OF RESPONSIBILITY

This thesis is my original work, except where specifically acknowledged.

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"There is perhaps no animal living more graceful in form, more beautiful in colour, and more stately and majestic in appearance, than the camelopard…measuring eighteen feet from hoof of the fore-leg to the crest of its crown, it stands, as an American would express it, 'the tallest animal in creation'…a creature so strangely shaped, and possessing so much speed and strength, was certainly designed by the Creator for some other use than browsing upon the leaves of mimosa trees: but that use man has not yet discovered…"

Captain Reid, *The Giraffe Hunters*. vol. 1., London 1867

Abstract

The population size and range of giraffe *Giraffa camelopardalis* have been greatly reduced in Africa in the past century, resulting in geographical isolation of local populations and some herds surviving at the edge of the species' preferred range. Numerous factors have contributed to these declines, but historical analysis indicates that habitat loss and fragmentation, human encroachment, disease and poaching are the main threatening processes. These processes can be expected to continue to impact on giraffe populations, particularly as human populations grow and needs for land and resources increase.

This study used field data and laboratory analyses to investigate the taxonomy, behaviour and ecology of desert-dwelling giraffe *Giraffa camelopardalis angolensis* in the northern Namib Desert. This population resides at the extreme of the giraffe's range. My research also complements the community-based natural resource management (CBNRM) program of the Namibian government, and provides baseline data on the current population status and structure of giraffe in the Kunene Region.

The field data, genetic, habitat and forage samples used in this study were collected by myself and a number of research assistants over a period of two years (2001 to 2003), following preliminary research that I undertook between 1999 and 2001. Laboratory analysis of genetic samples was conducted by Dr R. Brenneman and his team at Henry Doorly Zoo, Omaha, NB., as well as by Mr D. Brown at UCLA, CA. Mr W. Gawa!nab and his team at the agricultural laboratory, Ministry of Agriculture, Water and Rural Affairs, Namibia, conducted chemical analyses on plant samples that form part of the giraffe's diet.

The genetic architecture of Namibian giraffe was investigated, including the samples from the desert-dwelling giraffe of the northern Namib Desert and giraffe from Etosha National Park. The results were compared with genetic profiles of giraffe subspecies throughout Africa, but in particular with *G. c. giraffa* which is the currently-accepted nomenclature of the Namibian giraffe. Results indicated that the Namibian giraffe has five unique haplotypes and is genetically distinct from *G. c. giraffa* or any other extant subspecies; it is considered here, tentatively, to represent *G. c. angolensis*. Furthermore, the Namibian

giraffe has been separated from other populations for an extended period. Some gene flow has occurred between the desert-dwelling and Etosha NP giraffe population, and can be attributed to recent translocations between these regions. Within the study region, a sharing of haplotypes between three studied subpopulations indicated gene flow among giraffe throughout the northern Namib Desert, and this was confirmed by field-based monitoring. Taken together, these findings suggest that Namibian giraffe should be viewed as important for the conservation of overall genetic variation within *Giraffa camelopardalis*, although further investigation into the taxonomy of the Namibian form is warranted.

Following these findings, I then investigated the behaviour and ecology of the desert-dwelling giraffe. As no previous study has been published on the ecology of *G. c. angolensis*, there is an information gap in our knowledge of this subspecies. One hundred and fifty six giraffe were identified individually using field-based identification methods and digital imagery. An assessment of the population structure and dynamics indicated marked variation in numbers, sex and age structure, herd structure and densities between three study areas. These variations possibly arose from differences in study area size, aridity, availability of forage and human impacts. I also investigated levels of associations between giraffe within the population using a simple ratio technique, and observed that increased association occurred in smaller populations; there appeared to be a matrilineal social structure. In one bull-biased population, a higher degree of association between bulls was observed compared to bulls in the other two populations.

To gain further insight into the distribution and range of giraffe, I collected GPS locations from a combination of field-based monitoring and GPS satellite collars. The GPS satellite collars were the first trial of this technology on giraffe in Africa. Using Range Manager, a MapInfo animal location analysis extension program, I estimated 100% and 95% minimum convex polygon for daily, monthly and annual home range sizes of giraffe in the northern Namib Desert. Giraffe were observed to have large home ranges, with the largest individual range for a bull, Africa-wide, being recorded in this study. Large home ranges correlated with low population density, reduced diversity of forage and, in bulls, increased search areas for receptive cows. Giraffe movements occurred predominantly along riparian woodlands, although seasonal use of other habitats was recorded. Observations

and data from four GPS satellite-collared giraffe provided high-resolution data on daily movements, and indicated a pattern of highly biphasic movement behaviour that correlated with ambient temperatures.

Diurnal activity budgets varied between the sexes, with cows spending more time feeding and resting, while bulls walked and ruminated more frequently. Juveniles rested more often than other giraffe. Seasonal variation in activity budgets was evident, perhaps reflecting use of an energy maximiser strategy for cows and an energy minimiser strategy for bulls. The establishment of artificial water points in the Hoanib River during the study period appeared to alter the seeming independence of giraffe on water in the northern Namib Desert, and also resulted in small-scale shifts in use of the riparian woodland by elephant.

To investigate the diet of giraffe, I observed animals feeding in the field and also carried out laboratory analyses of the chemical content of preferred plant species. Seasonal changes in the abundance, moisture and protein content of available food plants correlated with shifts in the diet of giraffe. Giraffe impacted on their preferred forage source, *Faidherbia albida,* causing distinct structural changes in the individual plants and the *F. albida* population. This impact, combined with elephant damage and seasonal flood events, has resulted in a shift in the age structure and dynamics of the *F. albida* population over the past two decades.

Finally, I present a brief overview on the history of conservation and management in the Kunene Region. The established CBNRM program provides a baseline for future wildlife conservation and management, of which the desert-dwelling giraffe could be an integral component for non-consumptive tourism. Long-term research on the population's status, range, behaviour, social structure, habitat requirements, and ecology would help to provide a better understanding of the giraffe's adaptation to the arid environment, while focussed legislation would enable increased control of communal lands and continue to benefit community-based conservancies.

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Acknowledgements

Namibia, the land God created in anger. The old wife's tale that Africa gets underneath your skin and never leaves has proven as true since my first visit to the Dark Continent. In that one year I experienced what part of life is about—entering adulthood and the loss of my old man. To say Africa has played a pivotal influence on my life would be an understatement! The ability to sit back and watch giraffe walk majestically across the dune field is but one of the memories which I have been afforded. True, this thesis focuses on the life and times of the 'Spotted ship of the Namib', but it is more than that—it was a desire, a bet with myself and proof to others that anyone can do it, if they just believe.

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