

Several black servals from a single survey at the Luando Strict Nature Reserve, Angola

Authors:

*Sara Raquel Figueira Fernandes Elizalde^[1,3]

David Elizalde Castells^[1,3]

Neusa Maria Cardoso Neto de Freitas^[2]

Rosemary Joy Groom^[1,3]

Sarah M Durant^[1,3]

Affiliations:

[1] The Range Wide Conservation Program for Cheetah and African Wild Dogs

[2] Instituto Nacional da Biodiversidade e Áreas de Conservação – Ministério do Ambiente - Angola

[3] Zoological Society of London, Regents Park, London NW1 4RY

* corresponding author:

name: Sara R.F.F. Elizalde

email: sara.elizalde@ioz.ac.uk

address: Zoological Society of London, Regents Park, London NW1 4RY

1.1 INTRODUCTION

Melanism, or black coat coloration, has been documented in multiple felid species (Eizirik et al, 2003), however our understanding of the circumstances that favour its evolution and persistence within populations remains poor. Genetic analysis has demonstrated that melanism arises in felids as a result of genetic deletions, with at least four independent origins documented across three different species (Eizirik et al, 2003).

Servals *Leptailurus serval* Schreber 1776 have an unusually wide range of pelage patterns, ranging from a freckled pattern which dominates in regions within the equatorial rainforest belt in central and western Africa, to a combination of stripes and rows of spots that dominates in eastern and southern Africa. Melanism in servals was first documented in southwest Angola (Lönnerberg, 1898), when it was mistakenly described as a separate 'black' subspecies (*Felis togoensis niger* by Lönnerberg in 1907, later renamed as *Felis serval lonnerbergi* Cabrera, 1910). Since then there have been multiple reports of melanistic serval in East Africa, including Ethiopia, Kenya and Tanzania (York, 1973; Grimshaw et al, 1995; Sunquist & Sunquist, 2002; Hunter, 2013), and occasionally in central Africa (Hunter, 2013; Bout, 2015). But there have been no recent records of melanistic servals in Angola or elsewhere in southwestern Africa.

The persistence of the servaline pelage pattern in servals within the equatorial forest belt demonstrates the adaptive value of this coat pattern in this environment, where this morph has been documented at a rate of 62% in skins from eastern Democratic Republic of Congo (Rahm and Christiaensen, 1966 cited in Kingdon and Hoffmann, 2013). However, the adaptive value of melanism remains unclear. Here we provide photographic evidence of the persistence of melanism in servals in Angola, southwest Africa, and the only documented records since it was first documented in 1907. We go on to discuss these observations in light of a hypothesis that melanism may provide better camouflage for servals in darker habitats, thus favouring the persistence of this phenotype in these environments (Majerus & Mundy, 2003; Schneider et al, 2012; Hunter, 2013).

1.2 MATERIALS AND METHODS

The Luando Strict Nature Reserve (herein LSNR) is a narrow sigmoid-shaped region in central Angola that spans an area of 9,990 km², with the Cuanza River and its tributary, Luando River, as natural limits (Estes & Estes, 1974), almost forming an island (Figure 2). The elevations in the reserve range from 1000 to 1400m.a.s.l.. Average annual temperatures are between 20 and 22°C, with noticeable dry (May-September) and wet (October-April) seasons, the latter defined by an average annual rainfall of between 1100 and 1400mm (Estes & Estes, 1974; Diniz, 2006). LSNR lies in the Angolan Miombo woodlands ecoregion (Olson et al, 2001) with habitats ranging from dense deciduous broadleaf savannas and woodlands to open areas of edaphic and secondary grassland.

As part of a broader survey on terrestrial large and medium sized mammals (Elizalde et al, in prep.), 78 Cuddeback X-Change and Panthera V6 camera traps were installed along the northern and central areas of the reserve from June to September 2018 (Figure 2). Serval photographs were extracted for this article. Any image of the same serval taken at the same camera station within a 30-minute period was considered as a single observation event (Meek et al., 2014).

1.3 RESULTS AND DISCUSSION

The survey effort totalled 2889 camera trap days, with an average of 37 days/camera station. A total of 38 independent captures of serval were obtained by 18 camera traps (23%) with a Relative Abundance Index (RAI) of 1.32 captures per 100 camera trap days. Of these captures, there were four (10.5%) independent observations of melanistic servals at two different camera

trapping stations located at 1080 and 1090m.a.s.l., both at the edge of Miombo woodlands with open grasslands where the habitat is relatively darker.

The four observations were likely to comprise three different individuals (definitely at least two but no more than four) of the melanistic form of serval. Individual A seems to be captured twice at the same station, seven days apart, on August 17 and August 24; individual B was captured once at the same station as individual A 16 days later, on September 9; and individual C was captured once at a different station, on September 6 (Figure 3).

Individuals A and B could be differentiated by the lighter grey colouration present along the rump and thigh of both legs in individual A, while individual B seems evenly dark coloured and with different body constitution (Figure 3). The background pelage patterns are not entirely visible in the pictures and these belong to two different sides, therefore it is not possible to affirm these are different individuals. As for individual C, even though the image only shows the back of the animal (Figure 3), it clearly doesn't present the lighter pelage colouration on the hind legs as does individual A and it was captured with a difference of only three days from individual B, 55km away to the southeast. In light of a reported average daily movement for servals of 2.2km (Garland, 1983; Harris & Steudel, 1997) and a reported home-range of between 9.5 and 31.5km² (Hunter, 2013), we can discount the possibility of B and C being the same individual.

Melanism in servals has been previously associated with East African high elevation habitats, above 2400m.a.s.l. (Sunquist & Sunquist, 2002), with a frequency of 33% of serval captures recorded in a camera trap survey on the Shira plateau on Mount Kilimanjaro at around 3000-3500m.a.s.l. (Foley et al. 2014). Melanism is less frequently reported at lower elevations, although it has been recorded at some lowland sites, e.g. between 400 and 500m.a.s.l. in Guineo-Congolian forests (Hunter, 2013; Bout, 2015). Our observations provide rare documented evidence of melanism in servals at intermediate elevations (1080-1090m.a.s.l.). They are also the first in southwestern Africa for this century, and the first records in Angolan Miombo woodlands. The only historical record of the form in Angola was from the Angolan Mopane woodlands ecoregion at around 1100m.a.s.l. (Figure 1). The habitats at both these Angolan sites is dominated by forest mosaics (Figure 4) and hence does not contradict the hypothesis that darker habitats favor the persistence of melanism in servals. Further research is needed to understand the relationship between melanism and vegetation type, including understanding the adaptive role of pelage pattern in predation success and survival.

Almost three decades of civil war in Angola brought a halt to biodiversity research in the country. Now, as the country recovers and as access to remote areas improves with the ongoing removal of land mines, new field surveys are beginning to reveal the richness of Angola's remaining biodiversity. These records are likely to represent the beginning of many exciting new felid discoveries.

1.4 ACKNOWLEDGMENTS

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1.5 DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

1.6 CONFLICTS OF INTEREST STATEMENT

The authors declare that they have no conflict of interest.

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