

Supplementary Material

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Identification of land predators of African Penguins *Spheniscus demersus* through post-mortem examination

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Background: Canine measurements (Figure S1) and bite-mark impressions (Figure S2) were produced from specimens in the collection of the Iziko South African Museum (Cape Town, South Africa). Skulls of the following known and potential terrestrial predators of the African Penguin *Spheniscus demersus* were evaluated (accession codes are provided in Table S1): Cape Fur Seal *Arctocephalus pusillus pusillus* ($n = 5$), Caracal *Caracal caracal* ($n = 7$), Leopard *Panthera pardus* ($n = 4$), Black-backed Jackal *Canis mesomelas* ($n = 5$), Cape Clawless Otter *Aonyx capensis* ($n = 6$), Cape Grey Mongoose *Galerella pulverulenta* ($n = 6$), Marsh Mongoose *Atilax paludinosus* ($n = 3$), Egyptian Mongoose *Herpestes ichneumon* ($n = 5$), Large-spotted Genet *Genetta tigrina* ($n = 6$), and Small-spotted Genet *Genetta genetta* ($n = 6$). Only adult specimens of these carnivores, collected in the Western Cape Province, South Africa, were evaluated, except for Cape Fur Seals, where both adult and sub-adult specimens from Namibia were evaluated (as specimens from the Western Cape were not in suitable condition).

The following measurements were obtained for the upper and lower jaw of each skull (see Figure S1): distal inter-canine spread (distance between the two canines of the same jaw, measured at the tip of the cusps); proximal inter-canine spread (distance between the two canines of the same jaw, measured at the mesial aspect of the base of the crown); major axis canine width (labial-lingual width, measured at the base of the crown); minor axis canine width (mesial-distal width, measured at the base of the crown); and canine length (distance from the tip of the cusp to the base of the crown, measured at the labial aspect). Bite-mark impressions were produced by gently pressing the skulls against modelling clay.

Table S2 summarises the canine measurements obtained from the museum specimens; Figure S2 provides a comparison of the bite-mark impressions in these species. The bite mark of the Cape Fur Seal can be distinguished by the deep canine-like marks of its third upper incisors and its first upper premolars. The greater canine length and width and the inter-canine distance of the Leopard differentiate its bite from that of the Caracal. Bite marks of the Cape Clawless Otter can be distinguished by the rounded shape of the upper canines and the characteristic shape of the premolars and molars. The arc disposition of the incisors of the Black-backed Jackal is clearly distinct from the straighter disposition seen in the other species. In contrast, it seems unlikely that the bite marks of the different species of Mongooses and Genets could be reliably distinguished, owing to their similar shapes and overlapping measurements.

Figure S1: Illustration of measurements of canine teeth, obtained from museum specimens. CL = canine length; CW1 = major axis canine width; CW2 = minor axis canine width; DCS = distal canine spread; PCS = proximal canine spread

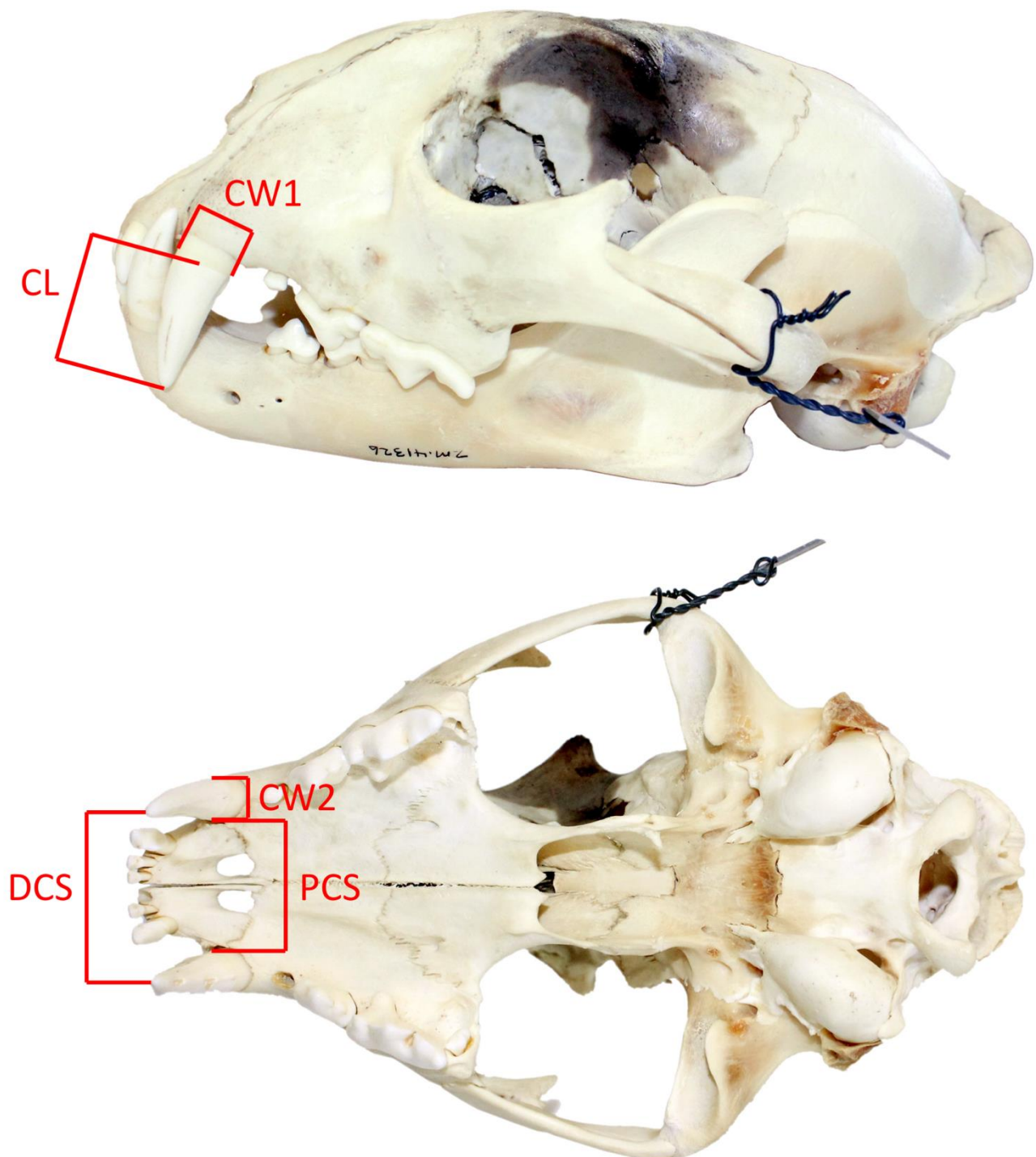


Figure S2: Comparison of the bite marks of known and potential terrestrial predators of the African Penguin *Spheniscus demersus*

UPPER JAW



LOWER JAW



CAPE FUR SEAL
Arctocephalus pusillus

LEOPARD
Panthera pardus

CARACAL
Caracal caracal

CAPE CLAWLESS OTTER
Aonyx capensis

BLACK-BACKED JACKAL
Canis mesomelas

UPPER JAW



LOWER JAW



MARSH MONGOOSE
Atilax paludinosus

EGYPTIAN MONGOOSE
Herpestes ichneumon

CAPE GREY MONGOOSE
Galerella pulvurenta

LARGE-SPOTTED GENET
Genetta tigrina

SMALL-SPOTTED GENET
Genetta genetta

Table S1: Accession codes of the skull specimens examined in the collection of the Iziko South African Museum, Cape Town

Species	Accession codes
<i>Arctocephalus pusillus pusillus</i>	ZM-39247, ZM-34640, ZM-34641, ZM-34796, ZM-25029
<i>Caracal caracal</i>	ZM-038183, ZM-038185, ZM-038187, ZM-038188, ZM-038189, ZM-038190, ZM-038196
<i>Panthera pardus</i>	ZM-041313, ZM-041326, ZM-041400, ZM-041401
<i>Canis mesomelas</i>	ZM-037908, ZM-037909, ZM-037911, ZM-037912, ZM-037913
<i>Aonyx capensis</i>	ZM-035133, ZM-037105, ZM-038937, ZM-040585, ZM-040702, ZM-040993
<i>Galerella pulverulenta</i>	ZM-040633, ZM-040634, ZM-040635, ZM-040636, ZM-040637, ZM-040640
<i>Atilax paludinosus</i>	ZM-012963, ZM-037172, ZM-039517
<i>Herpestes ichneumon</i>	ZM-1883, ZM-38545, ZM-36184, ZM-40347, ZM-39701
<i>Genetta tigrina</i>	ZM-010233, ZM-017664, ZM-019152, ZM-035639, ZM-036153, ZM-036256
<i>Genetta genetta</i>	ZM-35679, ZM-35642, ZM-36852, ZM-35811, ZM-9056, ZM-17658

Table S2: Canine measurements of known and potential carnivore predators of the African Penguin *Spheniscus demersus*. Values are given in millimetres, as the median (minimum – maximum)

Species	Jaw	Distal inter-canine spread	Proximal inter-canine spread	Major axis canine width	Minor axis canine width	Canine length
<i>Arctocephalus pusillus</i>	Upper	4.24 (2.84 – 5.06)	2.28 (1.70 – 3.32)	1.12 (0.88 – 1.40)	0.99 (0.73 – 1.11)	1.99 (1.62 – 2.30)
	Lower	3.55 (2.59 – 4.95)	1.55 (1.12 – 2.34)	1.20 (0.80 – 1.94)	1.04 (0.65 – 1.10)	2.30 (1.66 – 2.88)
<i>Panthera pardus</i>	Upper	3.29 (3.17 – 3.65)	2.99 (2.81 – 3.25)	1.15 (1.07 – 1.20)	0.87 (0.75 – 0.91)	2.84 (2.54 – 3.03)
	Lower	3.52 (2.95 – 3.58)	1.80 (1.73 – 1.82)	0.98 (0.80 – 1.04)	0.82 (0.66 – 0.84)	2.38 (2.14 – 2.48)
<i>Caracal caracal</i>	Upper	2.28 (1.95 – 2.85)	1.87 (1.61 – 2.31)	0.63 (0.60 – 0.79)	0.50 (0.42 – 0.64)	1.52 (1.21 – 1.58)
	Lower	1.87 (1.73 – 2.14)	0.88 (0.79 – 1.12)	0.57 (0.44 – 0.78)	0.43 (0.40 – 0.51)	1.19 (1.08 – 1.42)
<i>Aonyx capensis</i>	Upper	2.72 (2.60 – 2.77)	2.02 (2.00 – 2.15)	0.66 (0.59 – 0.71)	0.60 (0.55 – 0.68)	1.60 (1.37 – 1.79)
	Lower	2.47 (2.19 – 2.53)	1.24 (1.03 – 1.34)	0.64 (0.51 – 0.71)	0.57 (0.46 – 0.66)	1.43 (1.20 – 1.52)
<i>Canis mesomelas</i>	Upper	2.50 (2.12 – 2.61)	1.78 (1.68 – 1.80)	0.68 (0.60 – 0.73)	0.41 (0.38 – 0.48)	1.60 (1.41 – 1.64)
	Lower	2.18 (2.10 – 2.41)	1.09 (1.01 – 1.17)	0.58 (0.51 – 0.64)	0.47 (0.33 – 0.49)	1.39 (1.22 – 1.42)
<i>Atilax paludinosus</i>	Upper	2.16 (2.06 – 2.46)	1.65 (1.55 – 1.75)	0.64 (0.60 – 0.76)	0.44 (0.43 – 0.45)	1.36 (1.32 – 1.38)
	Lower	2.10 (2.03 – 2.15)	0.83 (0.75 – 0.91)	0.58 (0.54 – 0.62)	0.44 (0.43 – 0.44)	1.35 (1.21 – 1.37)
<i>Herpestes ichneumon</i>	Upper	1.76 (1.64 – 1.87)	1.25 (1.14 – 1.32)	0.45 (0.44 – 0.48)	0.32 (0.27 – 0.35)	0.97 (0.90 – 1.00)
	Lower	1.48 (1.40 – 1.68)	0.79 (0.56 – 0.91)	0.49 (0.42 – 0.51)	0.34 (0.30 – 0.35)	1.09 (0.98 – 1.13)
<i>Galerella pulverulenta</i>	Upper	0.99 (0.86 – 1.25)	0.82 (0.77 – 0.87)	0.26 (0.23 – 0.35)	0.20 (0.18 – 0.26)	0.75 (0.60 – 0.77)
	Lower	0.94 (0.83 – 1.02)	0.47 (0.40 – 0.50)	0.27 (0.23 – 0.34)	0.20 (0.18 – 0.27)	0.69 (0.63 – 0.77)
<i>Genetta tigrina</i>	Upper	1.08 (0.87 – 1.17)	0.84 (0.79 – 0.88)	0.30 (0.29 – 0.33)	0.25 (0.22 – 0.27)	0.81 (0.78 – 0.88)
	Lower	1.06 (0.79 – 1.27)	0.48 (0.38 – 0.52)	0.31 (0.21 – 0.36)	0.23 (0.18 – 0.25)	0.80 (0.60 – 0.94)
<i>Genetta genetta</i>	Upper	1.15 (0.98 – 1.25)	0.84 (0.72 – 0.87)	0.34 (0.32 – 0.38)	0.26 (0.25 – 0.27)	0.78 (0.75 – 0.85)
	Lower	0.96 (0.76 – 1.14)	0.46 (0.38 – 0.48)	0.32 (0.28 – 0.33)	0.23 (0.21 – 0.26)	0.79 (0.68 – 0.85)