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Extending the geographical distribution of Side-striped Jackal, *Lupulella adusta* (Sundevall, 1847) (Carnivora, Canidae), in South Africa

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Abstract. Side-striped Jackal, *Lupulella adusta* (Sundevall, 1847), occurs in a vast area within sub-Saharan Africa. In South Africa, the current geographical distribution is limited to eastern coastal regions. Recent sightings from north-central areas of the country suggest a wider geographical distribution. Here we report on 5,130 confirmed, repeated detections of Side-striped Jackal. Of these, 3,625 captures were from 471 new locations not previously recorded in the scientific literature, thereby expanding their current geographical distribution. These new records were captured in 33 vegetation types, including the forest and grassland biomes where they are not commonly detected.

Keywords. Camera trap; *Canis adustus*; range extension; species distribution

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Introduction

Side-striped Jackal, *Lupulella adusta* (Sundevall, 1847) (previously *Canis adustus*; Krofel et al. 2022), is a medium-sized canid which occupies a vast range in sub-Saharan Africa, from The Gambia and Senegal through the Sahelian regions of west Africa to the horn in the east and southwards into southern Africa (Loveridge and Macdonald 2013). Its occurrence is limited to the eastern parts of southern Africa, with it being absent and generally replaced by Black-backed Jackal, *Lupulella mesomelas* (Schreber, 1775) (previously *Canis mesomelas*; Krofel et al. 2022), in the more arid western regions (Fig. 1) (Skinner and Chimimba 2005; Loveridge and Macdonald 2013). In this article, we use the genus name *Lupulella* Hilzheimer, 1906 instead of *Canis* Linnaeus, 1758 for both *L. adusta* and *L. mesomelas*, since recent studies have suggested they be placed in a distinct genus, i.e., *Lupulella* (Zrzavý and Řičánková 2004; Lindblad-Toh et al. 2005; Dinets 2015, Viranta et al. 2017; Krofel et al. 2022). The most southernly occurrence of Side-striped Jackal on the continent is in north-eastern KwaZulu-Natal, South Africa (Rowe-Rowe 1992) (Fig. 1 A). In South Africa, it is also distributed throughout parts of Mpumalanga and Limpopo provinces. Records are also available from parts of Swaziland but none from Lesotho (Camacho et al. 2016). The current area of occurrence (AOO) and extent of occurrence (EOO) for this species across its range are estimated at 16,950 km^2 and 111,335 km^2, respectively (Camacho et al. 2016). Within its range, Side-striped Jackal occupies a variety of habitats. These include wet woodlands and woodland mosaics in central and west Africa (Coe and Skinner 1993; Skinner and Chimimba 2005). It is commonly observed in disused farmland, marshes, and montane habitats up to 2,700 m a.s.l. (Yalden et al. 1996; Estes

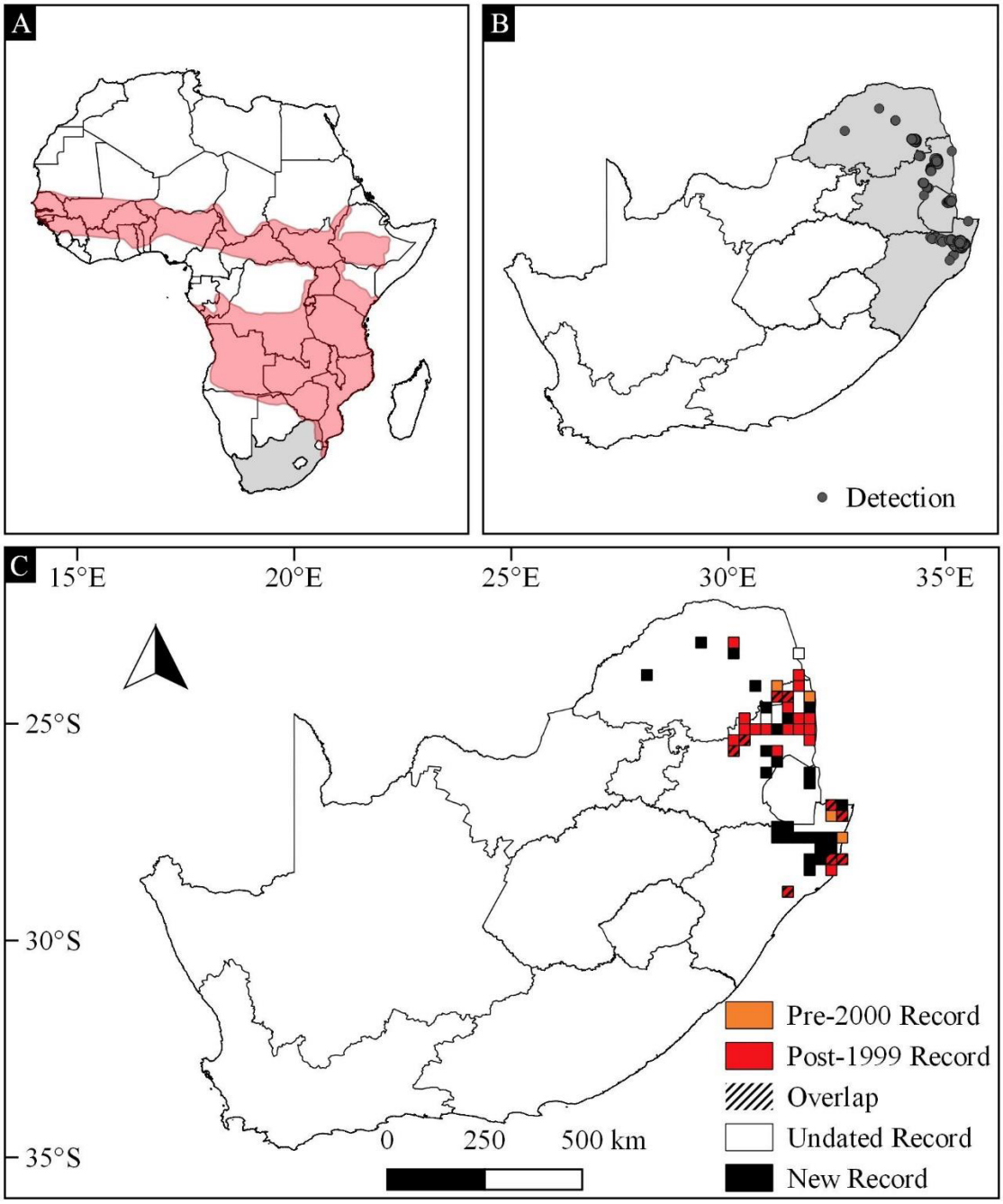

Figure 1. Geographic range of Side-striped Jackal, *Lupulella adusta* (Sundevall, 1847). **A.** The species' range (red) within Africa, grey represents South Africa. **B.** Detections in new quarter degree grid cell areas. Grey polygons represent Swaziland, and the Limpopo, Mpumalanga, and KwaZulu-Natal provinces in South Africa. **C.** Historic, recent, undated, and new distribution records of the species in South Africa and Swaziland.

2012; Kingdon 2015) and favours densely wooded areas over open savanna grasslands (Skinner and Chimimba 2005). This species is also often found in the vicinity of rural residences and occasionally urban areas (Skinner and Chimimba 2005). The species is classified as Least Concern by both the IUCN (Hoffmann 2014) and the Red List assessment in South Africa, Swaziland, and Lesotho (Camacho et al. 2016). In this study, we report on new distribution records for South Africa and Swaziland, and we suggest a possible range extension for the species into habitat types and areas not previously recorded in the literature.

Methods

Camera trapping is a non-invasive research technique and we did not require any permits to do this study. Data for this study was taken from two sources. First, we used occurrence data from 59 camera trap surveys conducted at 22 nature reserves from a long-term, large-scale Leopard, *Panthera pardus* (Linnaeus, 1758), population monitoring project (Rogan et al. 2019) (Appendix Table A1). In addition, occurrence data from one site came from opportunistic camera-trap sampling by JPBF responding to wildlife conflict calls in Limpopo, South Africa (Appendix Table A1). Second, a visual

sighting and DSLR camera photograph was received from M. Petford on a farm in the Soutpansberg Mountains, Limpopo, South Africa. Data from the Leopard monitoring project spanned from May 2013 to July 2021 and covered areas within the KwaZulu-Natal, Mpumalanga, and Limpopo provinces of South Africa, and one reserve in Swaziland. The opportunistic camera trap data was collected during July 2018, and the direct observation took place in June 2016. Occurrence data from the leopard monitoring project and the opportunistic camera trap sampling were predominantly within the savanna biome, whereas the human observation was made in the forest biome. See Table 1 for details on capture rates in different biomes and vegetation types.

Leopard monitoring surveys deployed an array of 41 (mean; range: 27–64) camera traps in a systematic grid. Nearest camera trap stations were placed on average 1.1 km apart (range: 0.3–8.2 km), ~40 cm off the ground on metal stakes or trees, and generally on vehicle roads or animal paths. Trap deployment and placement for the Leopard monitoring surveys covered on average 165.6 km^2 (range: 66.7–321.2 km^2), and were designed to maximize detection of Leopard with two cameras placed at each station, on opposite sides of the trail/road to photograph both flanks of a leopard. Survey duration varied between sites (40–84 days) and averaged 4,057 camera trap days (range: 1,740–7,157). For the opportunistic camera trap data, a single camera trap was placed at six locations, ~40 cm off the ground, and spaced between 0.3 and 0.5 km from each other. Station locations were based on carnivore sightings reported by resident farmers. No bait or lures were used during any of these surveys, and camera traps were programmed to continuously capture images if movement was detected.

Results

Data on Side-striped Jackals were collected over 239,335 camera trap days (21 May 2013–11 July 2021) from 21 reserves and two privately owned farms in South Africa, and one nature reserve in Swaziland. The majority of Side-striped Jackal detections were in the savanna biome (88.7% of independent captures; here, independent captures refer to images of Side-striped Jackal taken at the same camera trap, on the same day, but >30 minutes apart), followed by forest (3.3%), azonal vegetation (3.1%), Indian Ocean coastal belt (3%), grassland (1.8%), and near freshwater lake areas (0.1%) (Fig. 2). The human observation was captured in Northern Mistbelt Forest vegetation type (Mucina and Rutherford 2006) in the Soutpansberg Mountains, Limpopo, South Africa. Elevation at capture locations ranged between 7 and 1,430 m a.s.l.

New records. A total of 5,130 images (3,751 independent captures) of Side-striped Jackals were recorded. Of these, 3,265 captures (2,342 independent captures, representing 471 distinct geographic locations) were recorded in 27 new quarter-degree grid cells not documented in the *Red List of Mammals of South Africa, Swaziland and Lesotho* (Camacho et al. 2016). Whereas 455 captures were recorded in seven recent (post-1999) distribution quarter-degree grid cells, 60 in two historic

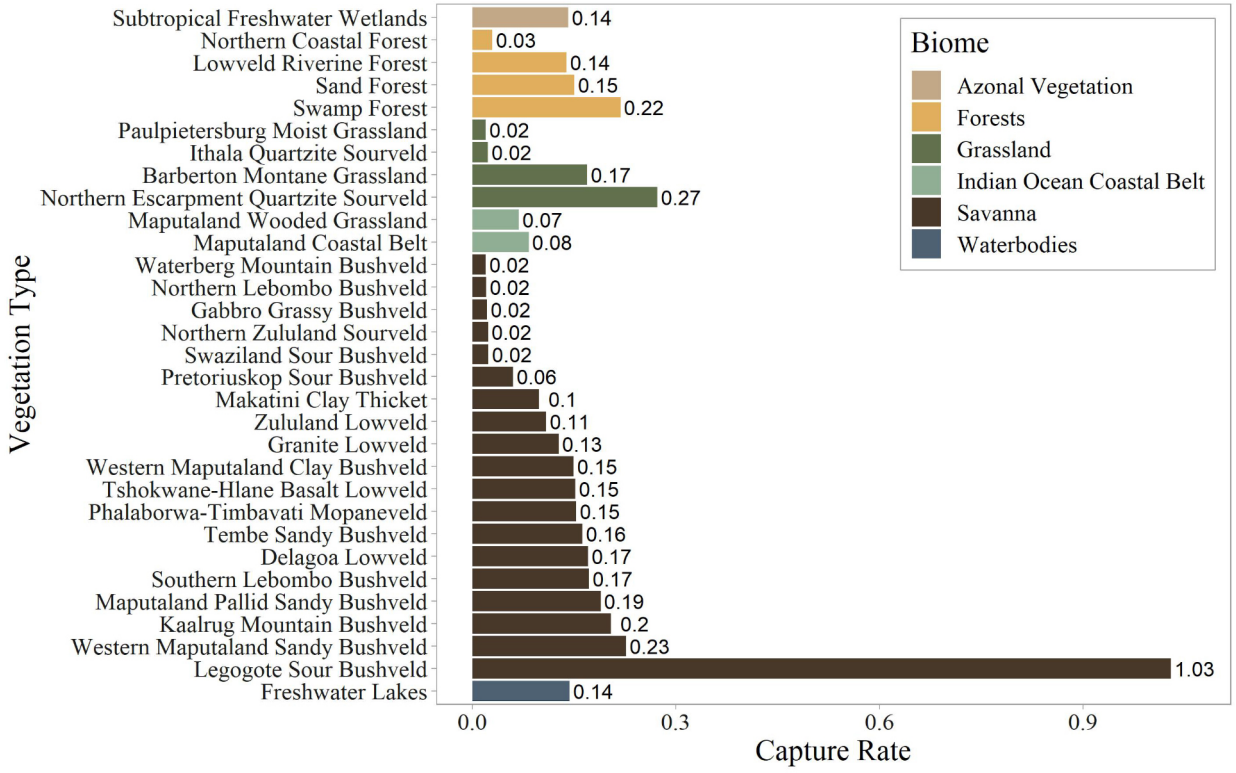

Figure 2. Side-striped Jackal, *Lupulella adusta* (Sundevall, 1847), capture rate within each vegetation type (capture rate taken as the sum of the number of independent captures divided by the number of trap days for each station).

Table 1. Capture rate (sum of independent captures divided by number of trap days at the camera trap station(s) where the detection(s) came from) per vegetation type from all Side-striped Jackal, *Lupulella adusta* (Sundevall, 1847), detections within each biome in South Africa and Swaziland, May 2013–July 2021.

Biome	Vegetation type	Capture rate	% of captures
Savanna	Legogote Sour Bushveld	1.029	4.00
Grassland	Northern Escarpment Quartzite Sourveld	0.273	0.69
Savanna	Western Maputaland Sandy Bushveld	0.226	1.36
Forests	Swamp Forest	0.218	1.15
Savanna	Kaalrug Mountain Bushveld	0.204	1.01
Savanna	Maputaland Pallid Sandy Bushveld	0.189	2.03
Savanna	Southern Lebombo Bushveld	0.172	4.24
Savanna	Delagoa Lowveld	0.170	0.40
Grassland	Barberton Montane Grassland	0.169	1.01
Savanna	Tembe Sandy Bushveld	0.162	8.93
Savanna	Phalaborwa-Timbavati Mopaneveld	0.153	3.31
Savanna	Tshokwane-Hlane Basalt Lowveld	0.151	2.85
Forests	Sand Forest	0.150	0.99
Savanna	Western Maputaland Clay Bushveld	0.149	13.25
Waterbodies	Freshwater Lakes	0.143	0.13
Azonal Vegetation	Subtropical Freshwater Wetlands	0.141	3.09
Forests	Lowveld Riverine Forest	0.139	0.77
Savanna	Granite Lowveld	0.127	38.55
Savanna	Zululand Lowveld	0.109	3.09
Savanna	Makatini Clay Thicket	0.098	4.32
Indian Ocean Coastal Belt	Maputaland Coastal Belt	0.083	2.43
Indian Ocean Coastal Belt	Maputaland Wooded Grassland	0.068	0.61
Savanna	Pretoriuskop Sour Bushveld	0.060	0.83
Forests	Northern Coastal Forest	0.029	0.35
Savanna	Swaziland Sour Bushveld	0.024	0.11
Savanna	Northern Zululand Sourveld	0.023	0.13
Grassland	Ithala Quartzite Sourveld	0.022	0.05
Savanna	Gabbro Grassy Bushveld	0.021	0.05
Savanna	Northern Lebombo Bushveld	0.020	0.05
Grassland	Paulpietersburg Moist Grassland	0.020	0.03
Savanna	Waterberg Mountain Bushveld	0.020	0.03
Forests	Northern Mistbelt Forest	*	0.03
Savanna	Makhado Sweet Bushveld	†	0.13

* No trap effort available, one image was captured in this vegetation type using a handheld camera.
† No trap effort available for this site. Five captures came from this vegetation type.

(pre-2000) distribution quarter-degree grid cells, and 1,350 in five quarter-degree grid cells that had both recent and historic occurrence data (Fig. 1, Appendix Table A2). Detailed information on these records is presented in the supplementary material.

Identification. We identified the Side-striped Jackal by several characteristics, which included; 1) a long, white-tipped tail; 2) a definite white or buff-coloured stripe on its side running from shoulder to hip with a black margin below it; and 3) a tan to buff-grey pelage with darker colouration on the back and cream-coloured undersides and throat (Fig. 3) (Skinner and Chimimba 2005; Kingdon 2015).

Discussion

In this paper, we expanded the current range of Side-striped Jackal in South Africa by adding 27 new quarter-degree grid cells where the species was not detected before. One of these new quarter-degree grid cells was recorded on Lapalala Game Reserve in 2016, >180 km south-south-west from the nearest previous records in Camacho et al. (2016). However, only one individual was captured at this site, even though subsequent camera trap surveys were conducted in 2017, 2018, 2020, 2021, and 2022. Therefore, we cannot confirm whether a breeding population is present at this site. Nonetheless, our findings support suggestions

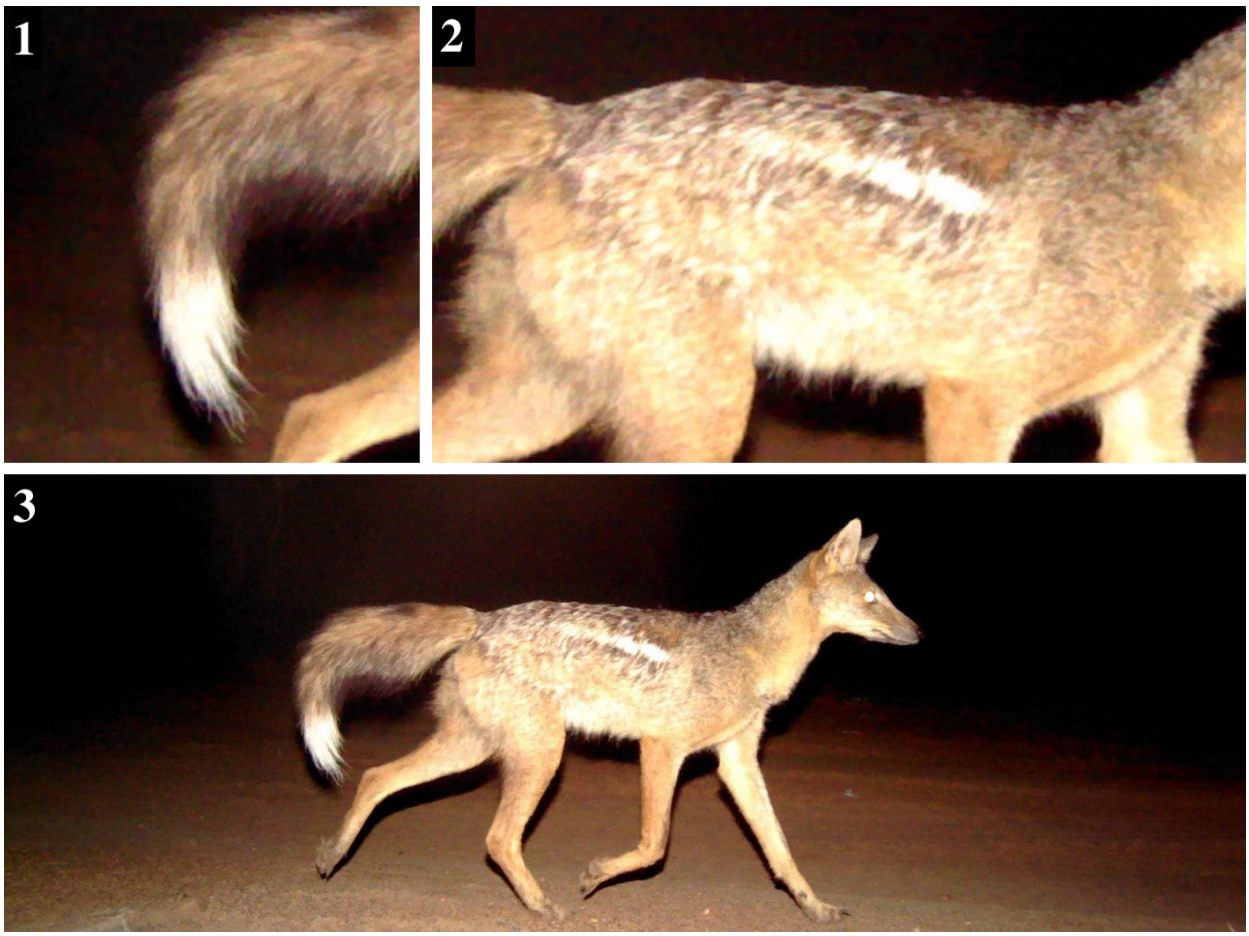

Figure 3. Side-striped Jackal, *Lupulella adusta* (Sundevall, 1847), camera trap photograph showing the species' identifying features. **1**. A long, white-tipped tail. **2**. White or buff-coloured stripe on its side running from shoulder to hip with a black margin below it. **3.** Full-body image showing the tan to buff-grey pelage with darker colouration on the back and cream-coloured undersides and throat.

of a westward range extension for Side-striped Jackal in the last two decades (Camacho et al. 2016). Although these new locations suggest a range extension, the species might well have gone undetected during historic surveys due to its secretive nature, or it might have been misidentified as Black-backed Jackal.

The majority of our detections were from bushveld habitat types (savanna biome), which concurs with previous research on Side-striped Jackal (Skinner and Chimimba 2005). These habitat types are characterised by an herbaceous layer usually dominated by grass species with a discontinuous (sometimes open) woody component (Mucina and Rutherford 2006). Side-striped Jackal is reported to avoid open savanna grassland and prefers areas with more thickly wooded vegetation (Skinner and Chimimba 2005). However, Side-striped Jackals appear to be highly adaptable to different habitat types (Macdonald et al. 2004). For example, in the Highveld of Zimbabwe, they have been noted to preferentially utilize grassland habitats, whereas in Hwange (approximately 500 km north-east of the Highveld), they use grasslands less than expected and occupy woodland and ecotone areas more frequently (even though resources were higher in the grassland areas) (Loveridge and Macdonald 2002). As such, the use of grasslands concurs with some of our observations where we recorded detections in four vegetation types in the grassland biome (Northern Escarpment Quartzite Sourveld, Barberton Montane Grassland, Ithala Quartzite Sourveld, and Paulpietersburg Moist Grassland), and one from the Indian Ocean Coastal Belt (Maputaland Wooded Grassland) (Mucina and Rutherford 2006). It should be noted that Ithala Quartzite Sourveld is considered an ecotonal area between grassland and savanna where the dominant grassland gives way to woodland (Mucina and Rutherford 2006), thus containing more wooded areas. The extension of Side-striped Jackal into the grassland biome might suggest their use of potential niche openings due to the persecution of Black-backed Jackal in these areas (Minnie et al. 2015; Nattrass et al. 2019). Black-backed Jackal, despite being smaller than Side-striped Jackal, aggressively displaces the latter where they co-occur (Loveridge and Macdonald 2002; Macdonald et al. 2004). Persecution of Black-backed Jackals (and other predators) may therefore be releasing Side-striped Jackals from suppression and competitive exclusion. Furthermore, Side-striped Jackal is an opportunistic omnivore with a broad dietary niche (Atkinson et al. 2002), and

it could therefore successfully exploit grassland small mammal communities (Loveridge and Macdonald 2002) in the absence of Black-backed Jackal.

We document one record of Side-striped Jackal in the Northern Mistbelt Forest vegetation type in the Soutpansberg Mountains (Mucina and Rutherford 2006). This confirms the previous presence of Side-striped Jackal in the Mistbelt Forest (Camacho et al. 2016). Even though it appears that the species does not occur in forested parts of South Africa (Skinned and Chimimba 2005), Kingdon (2015) reported the species utilizing the equatorial forest belt. This concurs with some of our observations where we detected the species in other forest biome vegetation types (including, Lowveld Riverine Forest, Northern Coastal Forest, Sand Forest, and Swamp Forest (Mucina and Rutherford 2006), suggesting that the use of forest by the species is more common than previously thought. The presence of the species in the forested parts of South Africa can suggest exploitation of a niche deprived of Black-backed Jackals, or corridor utilization since forest patches often connect mountainous habitat types.

While we suggest the westward range extension of the species, which might be attributed to vacant Black-backed Jackal niches (Loveridge and Macdonald 2002) due to persecution (Nattrass et al. 2020), we provide an alternative equally plausible hypothesis. Ongoing bush encroachment throughout South Africa's savannas is increasing the wooded biomass in areas that were previously classified as more open savanna habitat types (O'Connor et al. 2014). Such newly wooded areas may create unfavourable habitat for Black-backed Jackal and possibly provide a competitive edge to Side-striped Jackal.

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Authors' Contributions

Conceptualization: LHS, JPBF. Data curation: JPBF, LF. Formal analysis: JPBF. Funding acquisition: LHS. Investigation: LHS, JPBF. Methodology: LHS, JPBF. Resources: LHS, JPBF. Supervision: LHS. Visualization: JPBF. Writing – original draft: LHS, JPBF. Writing – review and editing: LHS, JPBF, LF, KWE.

Supplementary File

Side-striped Jackal, *Lupulella adusta*, occurrence records from South Africa and Swaziland, May 2013–July 2021 (Excel spreadsheet).

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Appendix

Figure A1. Images of Side-striped Jackals, *Lupulella adusta* (Sundevall, 1847), captured within each of the new quarter-degree grid cells. **A.** E028S23CC, 2016-12-07 01:37. **B.** E029S23AB, 2016-06-27 14:03. **C.** E030S23AC, 2018-07-22 03:02. **D.** E030S24BA, 2017-09-08 05:41. **E.** E030S24DB, 2016-10-02 18:29. **F.** E030S25DB, 2016-07-25 02:22. **G.** E030S26BB, 2016-04-26 03:46. **H.** E031S24CD, 2018-05-23 18:46. **I.** E031S24DB, 2018-10-14 03:07. [Continued next page.]

Figure A1 [Continued]. **J.** E031S25AA, 2018-07-18 01:52. **K.** E031S25CC, 2016-08-02 20:54. **L.** E031S26BB, 2015-07-01 23:36. **M.** E031S26BD, 2015-07-06 01:41. **N.** E031S27AC, 2014-07-05 21:37. **O.** E031S27AD, 2014-08-06 01:56. **P.** E031S27CA, 2018-06-07 18:25. **Q.** E031S27CB, 2018-05-13 05:58. **R.** E031S27DA, 2017-12-01 19:10. **S.** E031S27DB, 05:41. **T.** E031S28BB, 2014-06-09 01:09. **U.** E031S28BD, 2018-05-06 19:57. **V.** E032S26DC, 2017-10-01 04:33. **W.** E032S27CA, 2017-02-27 20:51. **X.** E032S27CB, 2019-11-01 22:00. [Continued next page.]

Figure A1 [Continued]. **Y.** E032S27CC, 2020-12-02 23:44. **Z.** E032S27CD, 2017-12-20 00:17. **AA.** E032S28AA, 2015-05-11 00:34.

Table A1. Summary of camera trap surveys conducted in South Africa and Swaziland, May 2013–July 2021. All reserves are in South Africa, except for Hlane Royal NR in Swaziland. Nature Reserve = NR, Game Reserve = GR, National Park = NP.

Reserve name	Start date	End date	Trap days (mean by station)	Longitude	Latitude	No. of camera stations	Min. distance between nearest cameras (m)	Area (km²)
	(YYYY-mm-dd)			WGS84 (mean)				
Barbeton NR	2016-07-12	2016-08-25	2472 (29.43)	31.0807	−025.6939	33 (65)	895	193.67
Blyde River Canyon NR	2016-09-13	2016-10-27	3316 (41.97)	30.8410	−024.6489	31 (65)	1159	265.93
Hlane Royal NP	2015-06-26	2015-08-09	4790 (44.77)	31.8784	−026.2673	41 (84)	1490	191.52
Hluhluwe GR	2014-04-30	2014-06-14	2040 (44.35)	31.9463	−028.2158	46 (46)	1286	283.16
Hluhluwe GR	2015-05-01	2015-06-14	2047 (44.35)	31.9464	−028.2158	46 (46)	1286	283.17
Hluhluwe GR	2018-03-27	2018-05-24	2219 (44.50)	31.9490	−028.2161	46 (46)	1182	286.03
Isimangaliso NP	2014-10-22	2014-12-05	6041 (48.24)	32.4909	−028.2104	40 (102)	737	134.98
Isimangaliso NP	2015-09-25	2015-11-08	4880 (44.77)	32.4915	−028.2139	41 (84)	825	133.51
Isimangaliso NP	2016-09-16	2016-10-30	5131 (44.23)	32.4912	−028.2145	41 (94)	733	132.90
Isimangaliso NP	2017-09-18	2017-11-10	3896 (39.76)	32.4903	−028.2135	41 (98)	734	132.48
Isimangaliso NP	2018-06-14	2018-07-24	3936 (37.13)	32.4877	−028.2179	41 (106)	797	132.38
Isimangaliso NP	2019-06-11	2019-08-07	4058 (46.64)	32.4880	−028.2191	41 (87)	797	132.07
Isimangaliso NP	2020-05-26	2020-07-15	3354 (36.46)	32.4885	−028.2180	41 (92)	8	131.34
Isimangaliso NP	2021-05-20	2021-07-11	2712 (28.85)	32.4897	−028.2149	40 (94)	798	131.93
Ithala GR	2013-08-27	2013-10-10	4529 (42.73)	31.2922	−027.5130	36 (83)	322	198.42
Ithala GR	2014-06-29	2014-08-12	3637 (42.79)	31.2903	−027.5114	31 (67)	1549	209.00
Ithala GR	2017-07-24	2017-09-15	2882 (43.01)	31.2975	−027.5127	30 (67)	1530	176.19
KwaZulu Private GR	2015-11-03	2015-12-16	6812 (42.58)	31.6279	−027.6183	62 (127)	911	254.75
KwaZulu Private GR	2017-10-20	2017-12-10	3428 (42.85)	31.6247	−027.6217	36 (80)	1257	134.93
Lapalala GR	2016-10-29	2016-12-20	4028 (50.35)	28.2971	−023.8362	40 (80)	1536	290.54
Makalali GR	2014-02-02	2014-04-01	7058 (54.29)	30.6611	−024.1309	50 (103)	1169	186.42
Makalali GR	2015-09-07	2015-11-30	5867 (59.87)	30.6611	−024.1331	40 (82)	1530	169.22
Makalali GR	2016-09-03	2016-10-25	5251 (50.01)	30.6593	−024.1323	40 (85)	1533	169.17
Makalali GR	2017-08-28	2017-10-31	4304 (53.14)	30.6611	−024.1319	40 (81)	1523	169.26
Makalali GR	2020-09-05	2020-10-24	3771 (43.34)	30.6620	−024.1311	40 (87)	1523	169.26
Mala Mala GR	2018-07-31	2018-09-27	3784 (39.01)	31.5396	−024.8209	46 (97)	681	133.30
Manyoni Private GR	2015-07-29	2015-09-11	4617 (44.83)	32.0260	−027.7404	40 (84)	1089	162.33
Manyoni Private GR	2017-02-15	2017-04-09	3683 (41.85)	32.0220	−027.7374	39 (86)	1039	151.80
Manyoni Private GR	2020-11-23	2021-01-10	2959 (32.52)	32.0246	−027.7339	40 (91)	1045	152.92
Mostertsgeluk Farm	2018-07-11	2018-08-15	*	30.0142	−023.4336	6 (6)	300	*
Nwanetsi, Kruger NP	2018-08-27	2018-10-18	3965 (45.06)	31.9592	−024.3908	43 (88)	1308	206.13
Soutpansberg Mountain	2016-06-27	NA	*	29.4357	−023.0307	1 (1)	NA	NA
Phinda GR	2014-07-01	2014-08-14	5660 (44.22)	32.3350	−027.7942	42 (92)	936	168.24
Phinda GR	2016-06-24	2016-08-19	5223 (54.41)	32.3359	−027.7912	42 (85)	929	168.17
Phinda GR	2017-11-30	2018-01-18	3678 (39.55)	32.3343	−027.7930	42 (93)	929	168.30
Phinda GR	2019-10-03	2019-12-16	3925 (38.86)	32.3359	−027.7958	42 (101)	944	165.90

Reserve name	Start date (YYYY-mm-dd)	End date (YYYY-mm-dd)	Trap days (mean by station)	Longitude WGS84 (mean)	Latitude WGS84 (mean)	No. of camera stations	Min. distance between nearest cameras (m)	Area (km²)
Pretoriuskop, Kruger NP	2018-06-25	2018-08-16	3866 (42.96)	31.2544	−025.1193	45 (90)	1247	170.46
Sabie Sand	2018-03-26	2018-06-14	4607 (47.49)	31.5443	−024.9262	45 (97)	945	106.09
Singita GR	2017-06-14	2017-07-29	3096 (39.19)	31.4346	−024.7931	37 (79)	299	66.55
Singita GR	2018-10-08	2018-12-03	3955 (40.77)	31.4062	−024.7918	45 (97)	1168	127.72
Lower Sabie, Kruger NP	2018-03-26	2018-06-14	7157 (51.49)	31.7538	−025.0360	64 (139)	1069	321.24
Somkhanda GR	2013-05-21	2013-07-04	4931 (44.42)	31.8826	−027.5438	37 (73)	1388	154.73
Somkhanda GR	2014-02-14	2014-03-30	4599 (40.70)	31.8880	−027.5508	39 (95)	1388	182.76
Somkhanda GR	2015-01-30	2015-03-15	5247 (43.36)	31.8948	−027.5516	40 (100)	1380	183.07
Songimvelo GR	2016-03-08	2016-04-21	3009 (42.38)	30.9637	−025.9970	27 (60)	718	85.28
Tembe Elephant Park	2017-09-13	2017-10-26	2639 (38.25)	32.4686	−026.9662	32 (69)	1304	141.61
Tembe Elephant Park	2018-09-23	2018-11-15	3068 (42.61)	32.4676	−026.9706	32 (72)	1263	141.53
Timbavati Private NR	2013-10-29	2013-12-27	5062 (47.31)	31.2979	−024.3731	40 (85)	1056	155.36
Timbavati Private NR	2014-10-16	2014-12-23	5534 (53.73)	31.2972	−024.3705	40 (82)	1070	155.87
Timbavati Private NR	2015-10-01	2015-12-04	5365 (58.32)	31.2976	−024.3722	40 (76)	1086	155.95
Timbavati Private NR	2016-09-02	2016-10-21	3822 (48.38)	31.2961	−024.3719	40 (79)	1089	155.95
Timbavati Private NR	2017-08-26	2017-10-19	3918 (45.56)	31.2964	−024.3711	40 (86)	1093	155.96
Timbavati Private NR	2018-10-22	2018-12-07	3566 (40.07)	31.2952	−024.3707	40 (89)	1093	155.96
uMkhuze GR	2013-06-12	2013-07-26	5243 (44.43)	32.2440	−027.6404	41 (92)	667	127.16
uMkhuze GR	2014-03-29	2014-05-12	1740 (43.50)	32.2412	−027.6431	40 (40)	10	126.95
uMkhuze GR	2015-06-02	2015-07-16	4542 (44.10)	32.2435	−027.6429	40 (86)	1136	121.92
uMkhuze GR	2016-05-27	2016-07-10	4820 (44.63)	32.2454	−027.6422	40 (86)	1143	122.37
uMkhuze GR	2017-05-26	2017-07-20	2004 (50.10)	32.2449	−027.6424	40 (40)	1151	122.25
uMkhuze GR	2018-07-31	2018-09-19	3596 (39.52)	32.2462	−027.6430	40 (91)	1155	122.08
uMkhuze GR	2019-08-11	2019-10-04	2087 (52.18)	32.2448	−027.6424	40 (40)	1166	122.34
uMkhuze GR	2020-07-24	2020-09-13	1909 (47.73)	32.2441	−027.6414	40 (40)	10	117.85

* No data available to calculate estimate.

Table A2. Number of independent captures of Side-striped Jackals, *Lupulella adusta* (Sundevall, 1847), for each year in all surveyed reserves in South Africa and Swaziland, May 2013–July 2021. Number of camera trap stations which captured Side-striped Jackal and the quarter-degree grid cell (QDGC) within which detections were made are also indicated. All reserves are in South Africa, except for Hlane Royal NR in Swaziland. Nature Reserve = NR, Game Reserve = GR, National Park = NP.

Reserve name	Year	QDGC	Number of camera stations	Number of captures
Barbeton NR	2016	E031S25CC	5	21
Barbeton NR	2016	E031S25CA	13	125
Barbeton NR	2016	E030S25DB	5	127
Blyde River Canyon NR	2016	E030S24DB	3	26
Isimangaliso NP	2014	E032S28AD	3	3
Isimangaliso NP	2014	E032S28AB	3	6
Isimangaliso NP	2015	E032S28BA	2	2
Isimangaliso NP	2015	E032S28AB	2	4
Isimangaliso NP	2015	E032S28AD	3	4
Isimangaliso NP	2016	E032S28BA	2	7
Isimangaliso NP	2016	E032S28AB	2	10
Isimangaliso NP	2017	E032S28AB	3	5
Isimangaliso NP	2017	E032S28AD	5	8
Isimangaliso NP	2017	E032S28BA	3	8
Isimangaliso NP	2018	E032S28AD	2	3
Isimangaliso NP	2018	E032S28BA	7	9

Reserve name	Year	QDGC	Number of camera stations	Number of captures
Isimangaliso NP	2018	E032S28AB	3	23
Isimangaliso NP	2019	E032S28AD	2	2
Isimangaliso NP	2019	E032S28BA	3	28
Isimangaliso NP	2019	E032S28AB	4	38
Isimangaliso NP	2020	E032S28AB	4	13
Isimangaliso NP	2020	E032S28AD	4	15
Isimangaliso NP	2020	E032S28BA	7	19
Isimangaliso NP	2021	E032S28AB	4	14
Isimangaliso NP	2021	E032S28BA	4	22
Hlane Royal NP	2015	E031S26BB	8	42
Hlane Royal NP	2015	E031S26BD	13	62
Hluhluwe GR	2014	E031S28BB	1	2
Hluhluwe GR	2015	E032S28AA	1	1
Hluhluwe GR	2015	E031S27DD	1	2
Hluhluwe GR	2015	E032S27CC	2	5
Hluhluwe GR	2018	E031S28BD	1	2
Ithala GR	2013	E031S27CA	1	1
Ithala GR	2014	E031S27AC	1	1
Ithala GR	2014	E031S27AD	2	2
Ithala GR	2014	E031S27CB	3	3
Ithala GR	2017	E031S27CB	1	1
KwaZulu Private GR	2015	E031S27DA	6	7
KwaZulu Private GR	2017	E031S27DA	1	4
Lapalala GR	2016	E028S23CC	1	1
Makalali GR	2014	E030S24BA	11	20
Makalali GR	2015	E030S24BA	17	60
Makalali GR	2016	E030S24BA	11	28
Makalali GR	2017	E030S24BA	18	67
Makalali GR	2020	E030S24BA	23	92
Mala Mala GR	2018	E031S24CD	29	126
Mala Mala GR	2018	E031S24DC	34	128
Manyoni Private GR	2017	E031S27DB	1	6
Manyoni Private GR	2020	E031S27DB	2	6
Manyoni Private GR	2020	E032S27CC	6	24
Manyoni Private GR	2021	E032S27CA	1	3
Manyoni Private GR	2021	E032S27CC	2	3
Mostertsgeluk Farm	2018	E030S23AC	3	5
Nwanetsi, Kruger NP	2018	E032S24CA	2	2
Nwanetsi, Kruger NP	2018	E031S24DB	1	2
Nwanetsi, Kruger NP	2018	E031S24BD	4	45
Soutpansberg Mountains	2016	E029S23AB	1	1
Phinda GR	2014	E032S27CC	1	1
Phinda GR	2014	E032S27CD	25	242
Phinda GR	2016	E032S27CD	19	112
Phinda GR	2017	E032S27CD	12	49
Phinda GR	2018	E032S27CD	5	10
Phinda GR	2019	E032S27CD	11	75
Pretoriuskop, Kruger NP	2018	E031S25AA	8	15
Pretoriuskop, Kruger NP	2018	E031S25AB	7	18

Reserve name	Year	QDGC	Number of camera stations	Number of captures
Singita GR	2017	E031S24CB	6	31
Singita GR	2017	E031S24CD	25	159
Singita GR	2018	E031S24CB	3	10
Sabi Sand GR	2018	E031S25BA	3	3
Somkhanda GR	2013	E031S27DB	2	2
Somkhanda GR	2014	E031S27DB	4	6
Somkhanda GR	2015	E031S27DB	2	3
Songimvelo GR	2016	E030S26BB	1	1
Tembe Elephant Park	2017	E032S26CD	2	2
Tembe Elephant Park	2017	E032S26DC	2	2
Tembe Elephant Park	2018	E032S27AB	1	1
Timbavati Private GR	2013	E031S24AC	2	17
Timbavati Private GR	2013	E031S24AD	24	174
Timbavati Private GR	2014	E031S24AC	6	34
Timbavati Private GR	2014	E031S24AD	24	205
Timbavati Private GR	2015	E031S24AC	3	7
Timbavati Private GR	2015	E031S24AD	23	84
Timbavati Private GR	2016	E031S24AC	1	2
Timbavati Private GR	2016	E031S24AD	14	75
Timbavati Private GR	2017	E031S24AC	2	2
Timbavati Private GR	2017	E031S24AD	19	192
Timbavati Private GR	2018	E031S24AC	1	1
Timbavati Private GR	2018	E031S24AD	3	6
uMkhuze GR	2013	E032S27CB	1	1
uMkhuze GR	2013	E032S27CA	4	16
uMkhuze GR	2014	E032S27CA	9	16
uMkhuze GR	2014	E032S27CB	16	62
uMkhuze GR	2015	E032S27CB	9	23
uMkhuze GR	2015	E032S27CA	11	31
uMkhuze GR	2016	E032S27CA	7	42
uMkhuze GR	2016	E032S27CB	22	101
uMkhuze GR	2017	E032S27CA	11	126
uMkhuze GR	2017	E032S27CB	25	133
uMkhuze GR	2018	E032S27CB	21	53
uMkhuze GR	2018	E032S27CA	11	74
uMkhuze GR	2019	E032S27CA	9	54
uMkhuze GR	2019	E032S27CB	19	109
uMkhuze GR	2020	E032S27CB	4	18
uMkhuze GR	2020	E032S27CA	7	55