Table S1: Ecological details for species used in this study.

Species	Mass (g)	Diurnal T_b (ºC)	Nocturnal T_b (ºC)	Diet	Range distribution	Social system
Fawn-coloured lark	23.9 ± 0.7 (22.9 – 25.0) N = 6	42.5 ± 0.1 (42.4 – 42.6) N = 6	40.5 ± 0.4 (40.1 – 40.9) N = 6	Arthropods and seeds.	Arid savanna and woodland of southern Africa, centre of abundance in the Kalahari basin (Botswana, Namibia, northern South Africa).	Socially monogamous, solitary nester. Highly territorial.
African red-eyed bulbul	28.9 ± 2.1 (27.0 – 33.0) N = 8	43.0 ± 0.3 (42.4 – 43.4) N = 8	40.1 ± 0.4 (39.6 – 40.6) N = 8	Fruit and arthropods.	Widespread in arid and semi-arid regions of southern Africa including Botswana, Namibia, central and northern South Africa.	Socially monogamous, solitary nester. Forages in pairs or small, loose groups.
Sociable weaver	24.0 ± 0.9 (22.6 – 25.4) N = 11	42.7 ± 0.5 (42.0 – 43.5) N = 9	39.5 ± 0.5 (38.6 – 40.3) N = 9	Seeds and arthropods.	Arid savanna and woodland of Namibia, southeastern Botswana and northwestern South Africa.	Year-round stable colonies up to 500+ birds, containing multiple breeding pairs assisted by helpers. Forages in flocks.

Mass and body temperature (T_b) data were collected during this study; mass refers to the mean capture mass of individuals; T_b are individual means. Means are given ± 1 standard deviation, range in parentheses. Diet, range and social system information are drawn from Hockey, P. A. R., Dean, W. R. J. and Ryan, P. G. eds. (2005). *Roberts Birds of Southern Africa*. 7th ed. Cape Town: The Trustees of the John Voelcker Bird Book Fund.

Table S2: Behavioural thermoregulatory strategies (panting, activity reduction and shade seeking) as a function of mass, sex, social rank (1 = highest) and air temperature.

Species	Strategy	Mass (g)	Sex	Social rank	Ta (°C)	N
Fawn-coloured lark	Panting	**-1.03 (-1.91 – -0.15), z = -2.82**		0.14 (-0.16 – 0.44), z = 1.13	**0.22 (0.09 – 0.36), z = 4.07**	6
	Activity	-0.28 (-0.95 – 0.40), z = -0.98		0.10 (-0.15 – 0.36), z = 0.96	0.004 (-0.05 – 0.06), z = 0.16	6
	Shade-seeking	0.52 (-0.17 – 1.20), z = 1.80		**-0.36 (-0.64 – -0.08), z = -3.06**	**0.20 (0.11 – 0.29), z = 5.40**	6
Red-eyed bulbul	Panting	0.04 (-0.10 – 0.19), z = 0.76	**1.65 (0.29 – 3.01), z = 3.10**	**0.31 (0.04 – 0.57), z = 2.97**	**0.28 (0.19 – 0.37), z = 7.97**	10
	Activity	-13.2 (-9950 – 9920), z = -0.003	-28.6 (-4.23e06 – 4.23e06), z = 0.00	-1.27 (-995 – 992), z = -0.003	0.02 (-0.03 – 0.07), z = 0.95	10
	Shade-seeking	-0.02 (-0.16 – 0.11), z = -0.44	-0.44 (-1.60 – 0.71), z = -0.98	-0.20 (-0.42 – 0.03), z = -2.21	**0.11 (0.06 – 0.16), z = 5.75**	10
Sociable weaver	Panting	0.15 (-0.38 – 0.68), z = 0.74	-0.98 (-2.61 – 0.66), z = -1.55	0.16 (-0.07 – 0.39), z = 1.80	**0.35 (0.19 – 0.52), z = 5.53**	11
	Activity	-0.16 (-0.45 – 0.13), z = -1.40	0.30 (-0.54 – 1.14), z = 0.91	-0.04 (-0.15 – 0.08), z = -0.88	**-0.07 (-0.12 – -0.03), z = -4.13**	11
	Shade-seeking	0.02 (-0.25 – 0.29), z = 0.20	-0.53 (-1.30 – 0.24), z = -1.75	-0.03 (-0.14 – 0.08), z = -0.74	**0.19 (0.13 – 0.24), z = 8.92**	11

Data are model estimates (95% CIs), z-values. All 95% CIs for interaction terms included zero, so were excluded from the models. Sex is not included for fawn-coloured larks as all were male. Models are GLMMs with binomial error distribution (1 = panting, 0 = not panting; 1 = active, 0 = inactive; 1 = shade, 0 = sun) and logit link function with individual bird identity as a random factor. Bold indicates 95% CIs excluding zero.

Table S3: Nocturnal body temperature (T_b) as a function of mass, sex, social rank (1=highest), air temperature (T_a).

Species	Mass (g)	Sex	Social rank	Ta (°C)	Mass:Ta	Sex:Ta	Rank:Ta	N
Fawn-coloured lark	**0.50 (0.27 – 0.73), t = 5.21**		**-0.13 (-0.22 – -0.04), t = -3.51**	0.004 (-0.008 – 0.02), t = 0.78				6
Red-eyed bulbul	-0.53 (-1.18 –0.12), t = -2.09	**3.12 (0.41 – 5.84), t = 2.93**	-0.24 (-0.62 – 0.13), t = -1.63	-0.35 (-0.83 –0.12), t = -1.91	**0.02 (0.0003 – 0.03), t = 2.58**	**-0.17 (-0.27 – -0.07), t =-4.49**		7
Sociable weaver	-0.34 (-0.80 – 0.11), t =-1.93	0.43 (-0.67 –1.53), t = 0.99	0.06 (-0.08 – 0.21), t = 1.06	**0.12 (0.11 – 0.13), t = 30.19**				9

Data are model estimates (95% CIs), t-values. Interactions were removed from models if 95% CIs included zero. Sex is not included for fawn-coloured larks as all individuals were male. Effect size for sex is the difference between mean Tb for males compared to females, for other variables is change in Tb per 1 unit increase in the predictor variable. All were fitted as general linear mixed models with Gaussian error distribution and identity link function and contained individual bird identity as a random factor. Bold indicates 95% CI exclude zero.

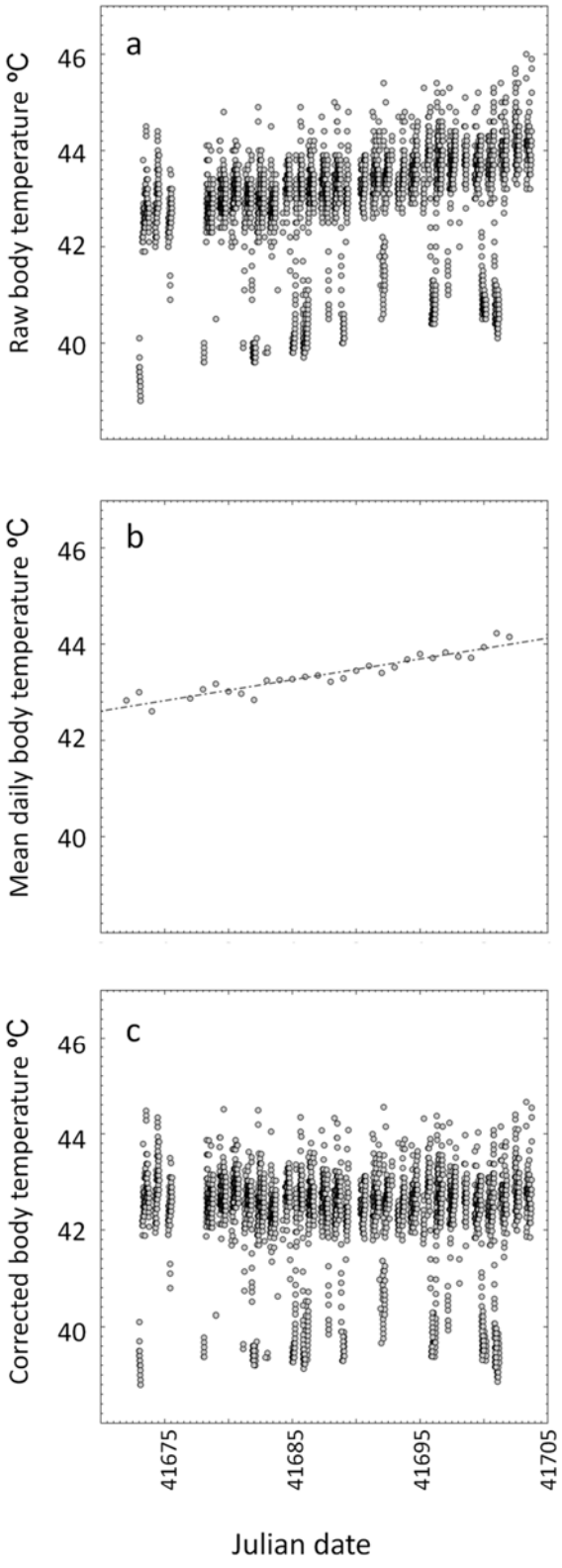

Fig. S1: Correcting drift in radio-transmitter body temperature readings. Example given is red-eyed bulbul APG. (a) Raw data downloaded from the transmitter shows distinct upward drift through time; (b) mean daily body temperature is calculated and a linear model fitted to extract the slope of drift (m in y=mx+c); (c) data are corrected back to horizontal by applying the formula $y_{corrected} = y - mx$.

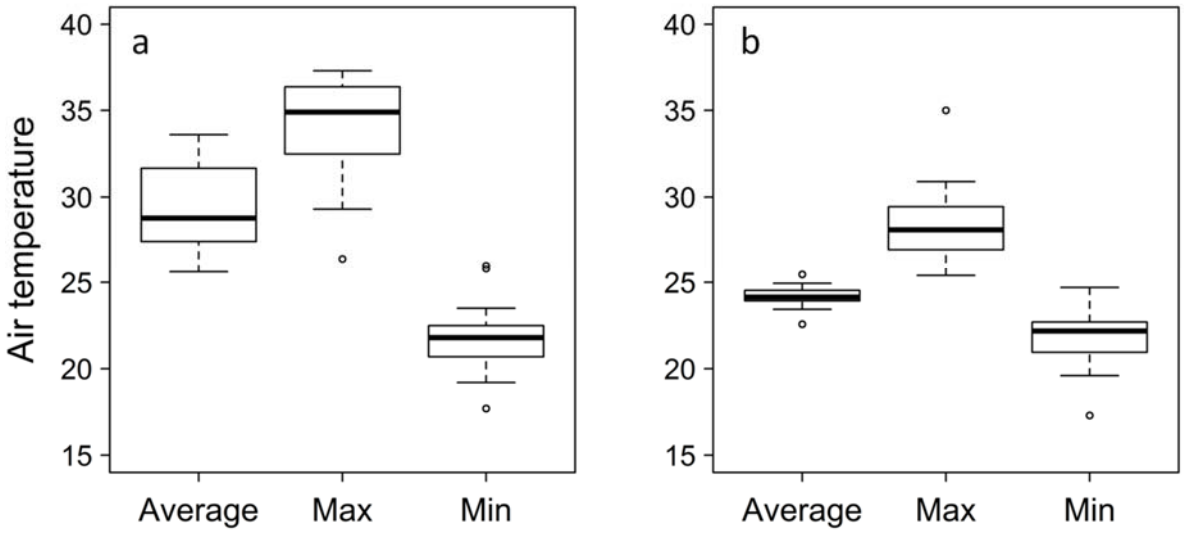

Fig. S2: Daily (a) diurnal and (b) nocturnal average, maximum and minimum temperatures recorded during the study period. The overall average air temperature recorded was 27.3 ± 4.9 ºC (range 17.3 - 37.3ºC).

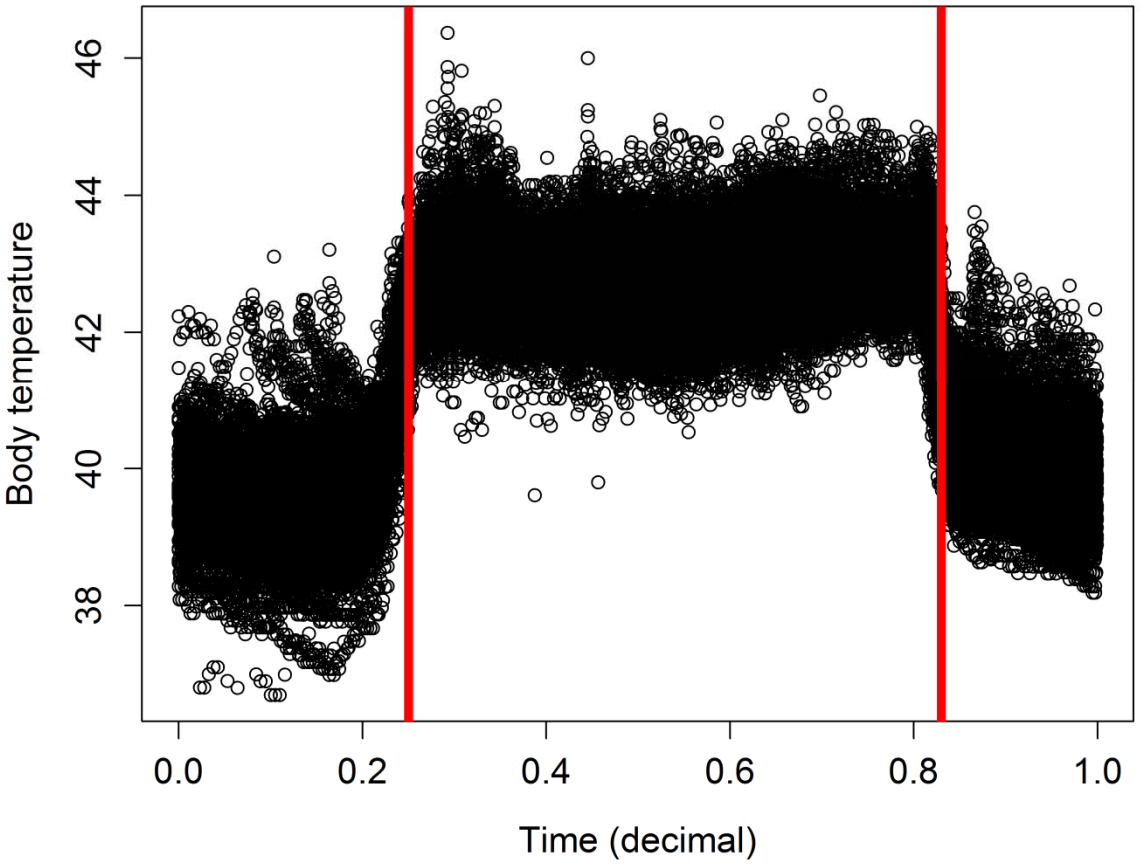

Fig. S3: Overlaid raw drift-corrected body temperature data from all birds collected across the entire study period. Time of day is presented on a decimal scale on the x-axis (0.0 corresponds to midnight, 0.5 to noon); birds' body temperature on the y-axis. The vertical red lines correspond to 6:00am and 8:00pm, the cut-off points we chose to divide the data into "diurnal" and "nocturnal" periods.