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Wildlife Research

Supplementary material

Differing effects of productivity on home-range size and population density of a native and an invasive mammalian carnivore

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1. Field data collection

Table S1 Site details, trapping results and population density estimates for the Midlands study sites. Note that capture data was too limited to estimate population density at the Ross tracking site.

Site	Fragmentation		Annual rainfall (mm annum^{-1})	Cats***			ST Quolls***		
	Woodland proportion *	Native veg proportion **		M	F	ρ	M	F	ρ
Campbell Town	0.35	0.52	531	14	8	0.003 ± 0.001	8	4	0.002 ± 0.001
Cressy	0.30	0.39	606	8	8	0.010 ± 0.002	6	7	0.007 ± 0.002
Oatlands	0.20	0.20	540	5	7	0.007 ± 0.002	9	2	0.002 ± 0.001
Ross	0.10	0.21	505	5	2	-	0	0	-
Total				32	25		23	13	

* Within 5km radius circle, positioned on the centroid of trap locations at each site
** As above, but includes native grassland as well as woodland
*** M – number of males trapped, F – number of females trapped, ρ – estimated population density (animals ha^{-1})

Table S2 Trapping dates, fix schedules and GPS collar types used at the Midlands (current study) and Arthur River (Andersen et al. 2020) tracking sites.

Site	Trapping dates	Species	# captured	Fix rate	Successful (total) deployments	Collar model*
Midlands sites						
Campbell Town	Sep 2015 – July 2016	Spotted-tailed quoll	12	1 /5 min	5 (8)	Faunatech Robin Cell
		Feral cat	22		1 (3)	Faunatech Robin Cell
		Feral cat		1 /15 min	8 (11)	ATS W500
Cressy	July – Dec 2016	Spotted-tailed quoll	13	1 /5 min	4 (5)	ATS G10
		Feral cat	16		8 (8)	ATS G10
Oatlands	Jan – June 2017	Spotted-tailed quoll	11	1 /5 min	2 (4)	
		Feral cat	12**		6 (8)**	ATS G10, Telemetry Solutions
Ross	July – Nov 2016	Feral cat	7	1 /5 min	3 (4)	ATS G10
NW Tasmania						
Arthur River	Nov 2012 – Feb 2013; Oct 2013 – Jan 2014	Spotted-tailed quoll		1/ 15 min	10	Telemetry solutions

* All collars were fastened using a corrosive bolt drop-off mechanism, comprising a copper bolt and magnesium washer (Thalmann 2013). Over time, the washer corrodes and allows the loosened bolt to work itself off and the collar to drop off.

** Does not include cats with home-ranges centred on the Oatlands municipal tip

2. Literature review results

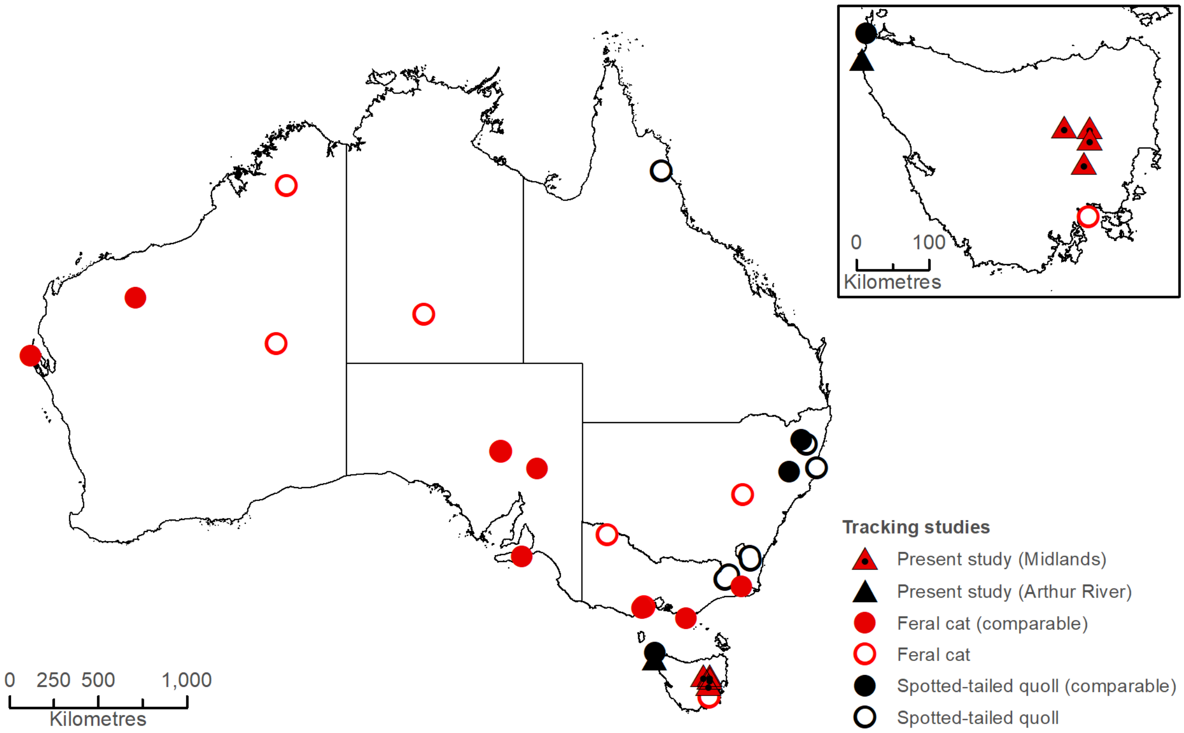

Figure S1 Study locations. GPS tracking sites from this study are represented as triangles (see inset): see Table S2 for species tracked at each site. Hollow symbols denote tracking studies of each species which were considered as part of the literature review, but which did not meet the criteria to be considered comparable for use in analyses.

Table S3 Site and details of studies which yielded comparable home-range estimates used in analyses of home-range variation with site productivity. Home-range estimates are presented in Table S4.

Source	Site	Annual rainfall (mm annum $^{-1}$)	Fix rate (mins bw fixes)	Ave # fixes	Ave # days	Sex	VHF/ GPS	n	Ave body mass (kg)
Feral cat									
Bengsen *et al.* (2012)	Kangaroo Island, SA	587	30 or 150	249	73	Female	GPS	4	3.20
						Male	GPS	9	4.38
Buckmaster (2011)	East Gippsland, VIC	1004	60 or			Female	GPS	1	2.90
							VHF	3	3.57
						Male	GPS	3	4.37
							VHF	1	5.20
This study	Campbell Town, TAS	531	5 or 15	3901	30	Female	GPS	2	4.25
						Male	GPS	6	3.84
	Cressy, TAS	606				Female	GPS	4	2.88
						Male	GPS	4	4.77
	Oatlands, TAS	540				Female	GPS	3	3.17
						Male	GPS	3	4.33
	Ross, TAS	505				Female	GPS	1	3.57
						Male	GPS	2	5.02
Hilmer (2010)	Dirk Hartog Island, WA	247	10, 40 or 80			Female	GPS	4	3.33
						Male	GPS	11	4.53
Hradsky (unpubl)	Otway Ranges, VIC	805 - 1095	30 or erratic	870	57	Male	GPS	3	4.48
Johnston *et al.* (2012)	Flinders Ranges, SA	341	180	5078	97	Female	VHF	9	2.74
						Male	GPS	7	4.16
							VHF	7	3.13
Johnston (2012)	Wilsons Prom, VIC	959	90	139		Female	GPS	3	2.53
						Male	GPS	7	4.06
Johnston *et al.* (2013)	Pilbara, WA	393		1683	63	Female	GPS	3	2.20

Source	Site	Annual rainfall (mm annum $^{-1}$)	Fix rate (mins bw fixes)	Ave # fixes	Ave # days	Sex	VHF/ GPS	n	Ave body mass (kg)
			15 or 180			Male	GPS	6	3.67
Johnston *et al.* (2014)	Roxby Downs, SA	173	15 or 60	1927	28	Female	GPS	7	3.04
						Male	GPS	11	4.21
Robley *et al.* (2010)	Anglesea, VIC	668	30	237		Female	GPS	2	3.30
						Male	GPS	7	4.57
Spotted-tailed quoll									
(Andersen *et al.* 2020)	Arthur River, TAS	1139	15	666	33	Female	GPS	3	
						Male	GPS	7	
This study (Midlands)	Campbell Town, TAS	531	5	2187	26	Female	GPS	2	2.58
						Male	GPS	2	3.21
	Cressy, TAS	606				Female	GPS	3	3.17
						Male	GPS	1	4.49
	Oatlands, TAS	540				Male	GPS	1	2.43
Körtner *et al.* (2016)	Guy Fawkes NP, NSW	948	24 fixes/ day, variable interval	297	34	Female	GPS	4	1.68
	Tuggolo SF, NSW	1095				Female	GPS	1	3.04
						Male	GPS	2	3.04
Troy (2014)	Woolnorth, TAS	864	120	203	30	Female	GPS	7	

3. Home-range estimates

The choice of home-range estimator can significantly affect the size of home-range reported (Plotz *et al.* 2016, Table S3). Three alternative home-range estimates were calculated for individuals tracked in this study (details on calculations below). Within the Midlands and Arthur River sites, movement-based kernel density estimates based on fine-scale tracking data (mKDE95) were consistently smaller than the subsampled kernel density estimates used in regression analyses (KDE95_1H, Table S3). The mKDE95 estimates are more tightly linked to actual tracking locations (Benhamou 2011), and therefore did not include areas of unsuitable habitat adjacent to or interspersed throughout the habitats used (e.g. Mitchell and Powell 2008). In all analyses, the choice of home-range estimator did not affect the direction or significance of the relationship between home-range size and productivity (data not shown), so the KDE95_1H estimator was chosen for consistency with previous studies. It does, however, affect the management implications of this study: while KDE95_1H estimates indicate that female spotted-tailed quoll home-ranges in the Midlands are up to 10 times greater than recorded in other regions, mKDE95 estimates indicate that the actual amount of native vegetation required by each female is only up to five times greater.

<u>Calculation details</u>

Firstly, home-ranges were estimated using 100% minimum convex polygons (MCP100, Mohr 1947). Although this method is prone to overestimating the true area used by an animal and is very sensitive to differences in sampling strategy, duration and data outliers (Fieberg and Börger 2012; Laver and Kelly 2008), it was the most consistently reported metric and was the only metric used in several VHF-based telemetry studies (e.g. Claridge *et al.* 2005; Glen and Dickman 2006; Jones and Coman 1982).

Secondly, we calculated 95% kernel density estimates (KDE95_1H) for feral cats and spotted-tailed quolls from the Midlands and Arthur River sites. Telemetry data were subset to 1 fix per hour for the purposes of comparison with previous studies and to minimise temporal autocorrelation.

Lastly, 95% movement-based kernel density estimates (mKDE95%) were calculated for feral cats and spotted-tailed quolls from the Arthur River and Midlands sites, using the full, detailed tracking data (1 fix per 5 mins or 1 fix per 15 mins, parameters Tmax = 1h, Lmin = 20m, hmin = 50m). These estimates were not used in analyses as they are not comparable with any previous studies. They are reported in Table S3 as a more accurate indication of the amount of suitable habitat required within the larger KDE95_1H home-range estimates, and for the purposes of comparison with future studies.

Table S4 Individual home-range estimates used in regression analyses. All home-range estimates used in analyses are calculated using 95% kernel density estimates (KDE95) unless otherwise indicated. Tracking data from Arthur River, Campbell Town, Cressy, Ross and Oatlands were subsampled to 1 fix per 1h for standardisation purposes. Alternative home-range estimates (100% MCP and 95% mKDE or movement-based kernel density estimates, both based on the full dataset) are also provided for purposes of comparison.
Reasons for excluding individuals from analyses are given in the right-hand column. Note Roxby Downs individuals are only from the Johnston et al (2014) study, as the Moseby et al (2009) tracking data included range shifts by individuals responding to baiting in nearby areas.

Site	ID	Sex	Weight (kg)	Track nights	KDE95 (ha)	Excluded	MCP (ha)	mKDE (ha)
				Spotted-tailed quoll				
Tuggolo SF, NSW (Körtner *et al.* 2016)	M-1644	Male		42	1503		2466	
	M-1644	Male		26	1327		2203	
	M-3F02	Male		43	637	Failed site fidelity test	1518	
	M-401C	Male		17	359		423	
	M-6346	Male		43	771		1404	
	M-6737	Male		38	547	Failed site fidelity test	2607	
	M-2411	Male		12	848		610	
	F-9768	Female		43	554		2203	
	M-0307	Male		19	689	Failed site fidelity test	819	
Guy Fawkes NP, NSW (Körtner *et al.* 2016)	F-0001	Female		38	381		704	
	F-202A	Female		41	231		342	
	F-202A	Female		46	235		382	
	F-716E	Female		32	459		504	
Woolnorth, TAS (Troy 2014)	1	Female		(28-36)	152		229	
	2	Female			349		386	
	3	Female			382		470	
	4	Female			485		439	
	5	Female			163		191	
	6	Female			380		427	
	7	Female			343		464	
Arthur River, TAS (Andersen *et al.* 2020)	Bear	Male		21	534		438	265
	Calypso	Female		46	555		609	327
	Capella	Female		50	168		148	98
	Chillax	Male		15	1619	Failed site fidelity test	1047	228
	Dino	Male		22	531		534	284
	Dipper	Male		50	962		975	435
	Helena	Female		37	458		523	254
	Pegasus	Male		51	634		503	292

Site	ID	Sex	Weight (kg)	Track nights	KDE95 (ha)	Excluded	MCP (ha)	mKDE (ha)
	Pluto	Male		15	1519		1277	371
	Saturn	Male		14	487	Failed site fidelity & asymptote test	259	139
Campbell Town, Midlands TAS (This study)	Banzai	Female	2.71	29	2486		2093	945
	Georgia	Female	2.44	46	1729		1782	946
	Mufasa	Male		6	10382	Collar failed after 6d	3809	820
	Pacha	Male	2.62	15	1882		2367	885
	Xavier	Male	3.8	16	3136	Failed site fidelity test	2663	799
Cressy, Midlands TAS (This study)	Betel	Female	2.46	38	789		808	461
	Hazelnut	Female	3.16	30	550		576	394
	Nutmeg	Female	3.9	12	943		738	418
	Waldo	Male	4.49	50	1108		1191	707
Oatlands, Midlands TAS (This study)	Aravis	Female	2.2	26	731	Limited data due to collar malfunction	417	223
	Caspian	Male	2.43	13	2481		1987	644
Feral cat								
Campbell Town, Midlands TAS (This study)	Agusto	Male		32	8421	Failed site fidelity test	4333	828
	Barnaby	Male	3.9	40	681		761	297
	Bronwyn	Female	4.5	29	598		833	336
	Donald	Male	3.53	21	952		1200	479
	Eric	Male	3.5	37	978		1257	413
	Joe	Male	4.93	32	1298		1422	749
	Mamo	Male	2.85	32	785		1252	452
	Pauline	Female	4	29	101		182	96
	Tony	Male	4.3	29	1191		1323	653
Cressy, Midlands TAS (This study)	Attilla	Male	5	16	661		588	368
	Bellatrix	Female	2.07	18	26		133	56
	Cruella	Female	3.23	7	188		257	179
	Jabba	Male	5.1	18	1197		950	468
	Joker	Male	4.5	30	903		1010	510
	Petunia	Female	2.7	17	379		269	186
	Rumpelstiltskin	Male	4.46	46	1235		1389	732
	Umbridge	Female	3.5	20	207		187	150
	ChairmanMiao	Male	4.73	20	272		567	154

Site	ID	Sex	Weight (kg)	Track nights	KDE95 (ha)	Excluded	MCP (ha)	mKDE (ha)
Ross, Midlands TAS (This study)	MadameMiao	Female	3.57	6	143	Did not reach asymptote	233	105
	Rasputin	Male	5.3	10	1920	Failed site fidelity test	615	174
Oatlands, Midlands TAS (This study)	Godzilla	Male	5.43	39	1320		1266	826
	Goliath	Male	4.49	33	398		522	274
	Gremlin	Male	3.08	59	486		436	212
	Mordred	Female	3	42	228		343	234
	Pontiak	Female	2.72	20	600		533	348
	Ursula	Female	3.8	42	29		81	37
	Gomez	Male	3.3	32	2	Cats confined to municipal tip	61	7
	Gorgon	Female	2	35	3		35	9
	Medusa	Female	3.2	8	6		12	10
	Morticia	Female	4.1	57	7		64	14
Kangaroo Island, SA (Bengsen *et al.* 2012)	Bm1	Male	3.8	54	186*		194	
	Bf1	Female	2.7	78	275*		287	
	Bm2	Male	3.6	104	362*		392	
	Bm3	Male	3.8	69	518*		782	
	Bm4	Male	3.8	106	861*		1455	
	Bm5	Male	5.4	92	1620*		1922	
	Pf1	Female	4.3	71	284*		363	
	Pf2	Female	3.2	72	459*		597	
	Pm2	Male	4.4	20	503*		534	
	Pm1	Male	5.1	66	511*		522	
	Pf3	Female	2.6	85	645*		818	
	Pm3	Male	3.3	64	652*		780	
	Pm4	Male	6.2	64	936*		957	
Dirk Hartog Island, WA (Hilmer 2010)	DH5	Male	5.1	75	387**			
	DH5.1	Male	4.25	66	715**			
	DH12	Male	5	>21	1110**			
	DH17	Male	5	>21	1854**			
	DH27	Male	5.1	>21	1193**			
	DH27.2	Male	4.5	>21	595**			
	DH29	Male	4.75	>21	1285**			
	MB8	Male	5.5	>21	888**			
	MB2	Male	2.7	>21	2622**			
	MB3	Male	3.2	>21	721**			
	MB6	Male	4.7	>21	410**			
	B2	Female	3.5	>21	367**			

Site	ID	Sex	Weight (kg)	Track nights	KDE95 (ha)	Excluded	MCP (ha)	mKDE (ha)
	MB5	Female	2.6	>21	1579**			
	B3	Female	3.7	>21	637**			
	MB7	Female	3.5	>21	274**			
East Gippsland, VIC (Buckmaster 2011)	Karen (F)	Female		42	179		141	
	Neil (M)	Male		~150	546		410	
	Hans (M)	Male		~90	446		370	
	Olof (M)	Male		~270	595		816	
	Liz (F)	Female		~570	137	VHF only	166	
	Chris (M)	Male		~540	246	VHF only	226	
	Hayley (F)	Female		~330	58	VHF only	53	
	Danielle (F)	Female		~420	90	VHF only	60	
Otway Ranges, VIC (Hradsky, unpubl.)	Ash	Male	4.5	30	818		653	
	Klaus	Male	4.45	29	820		724	
	Neko	Male	4.5	115	1735		1428	
Flinders Ranges, SA (Johnston *et al.* 2012)	890	Male	3.7	88	397**			
	470	Male	3.8	107	678**			
	1580	Male	4.5	113	684**			
	80	Male	4.5	79	886**			
	3580	Male	4.6	99	912**			
Pilbara, NT (Johnston *et al.* 2013)	150.178	Male	4.7	72	1260**			
	150.285	Male	3.3	60	1320**			
	150.003	Male	3.7	62	1630**			
	150.161	Male	2.6	67	660**			
	150.245	Male	3.8	56	670**			
	150.344	Female	2.9	56	430**			
Roxby Downs, SA (Johnston *et al.* 2014)	2	Female	3.4	27	200**			
	18	Male	3.5	13	210**			
	12	Male	5.1	15	260**			
	6	Female	2.2	17	280**			
	17	Female	3.7	32	280**			
	7	Female	3	45	290**			
	4	Male	4.3	40	300**			
	3	Male	4.9	18	330**			
	14	Female	3	41	400**			
	1	Male	4.3	42	420**			
	11	Male	3.4	23	450**			
	9	Female	2.5	18	480**			

Site	ID	Sex	Weight (kg)	Track nights	KDE95 (ha)	Excluded	MCP (ha)	mKDE (ha)
	15	Male	3.7	16	480**			
	10	Male	4.4	16	540**			
	5	Male	5	46	850**			
	16	Male	5	40	1050**			
	8	Female	3.5	20	1120**			
Wilsons Prom, VIC (Johnston 2012)	8	Female	2.8	31	294**			
	2	Male	3.5	90	370**			
	6	Male	3.8	45	499**			
	9	Male	3.7	28	653**			
	1	Male	4.3	96	778**			
	10	Male	4.7	30	800**			
	3	Male	3.6	90	1362**			

Home-ranges calculated using: *adaptive nearest local convex hulls (LoCoH); ** 95% minimum convex polygons (MCP)

4. Model comparison sets for all analyses

Table S5 Model comparisons for all formal statistical analyses. K indicates the number of parameters in the model. Home-range size (HR) was calculated using 95% kernel density estimates (KDE95_1H) in all analyses. . All save population density analyses use AIC_c adjusted for small sample sizes. In population density analyses AIC was used without adjustment following suggestions in the secr package documentation that AIC may perform better even with small sample sizes (Turek and Fletcher 2012). Where models are within 2 AIC_c units, the most parsimonious model is taken as the top model. For mixed-model analyses, the conditional R^2 term ($R^2_{GLMM(c)}$) reflects the variance explained by the entire model, including fixed and random effects.

Analysis	Dataset	Model	Model comparison				Goodness of fit	
	Spotted-tailed quoll		K	AICc	dAICc	AICcwt	LL	$R^2_{GLMM(c)}$
Productivity vs home-range size	Data from 4 comparable studies, comprising 33 animals from 7 tracking sites.	Log_{10}(HR) ~ Sex + AnnRain + 1|Site	5	5.02	0.00	0.63	3.60	0.61
		Log_{10}(HR) ~ Sex * AnnRain + 1|Site	6	6.82	1.80	0.26	4.20	0.63
		Log_{10}(HR) ~ Sex + 1|Site	4	9.04	4.02	0.08	0.19	0.67
		Log_{10}(HR) ~ AnnRain + 1|Site	4	12.47	7.45	0.02	-1.52	0.65
		Log_{10}(HR) ~ 1|Site	3	13.48	8.46	0.01	-3.32	0.65
	Feral cat		K	AICc	dAICc	AICcwt	LL	$R^2_{GLMM(c)}$
	Data from 10 comparable studies, comprising 97 animals from 12 tracking sites.	Cuberoot(HR) ~ Sex * AnnRain + 1|Site	6	380.31	0.00	0.74	-183.69	0.39
		Cuberoot(HR) ~ Sex + 1|Site	4	383.63	3.33	0.14	-187.60	0.34
		Cuberoot(HR) ~ Sex + AnnRain + 1|Site	5	383.87	3.56	0.12	-186.60	0.35
		Cuberoot(HR) ~ 1|Site	3	410.97	30.67	0.00	-202.36	0.16
		Cuberoot(HR) ~ AnnRain + 1|Site	4	411.93	31.62	0.00	-201.75	0.16

Analysis	Dataset	Model			Model comparison				Goodness of fit
Productivity (site) vs population density	**Spotted-tailed quoll**				K	AIC	dAIC	AICwt	
	Data from 3 sites in the Tasmanian Midlands (Cressy, Campbell Town and Oatlands) with trap history for both species.	Density ~ Site	g0~1	detection scale(σ) ~ Site	7	2050.56	0.00	0.63	
		Density ~ Site + Sex	g0~1	detection scale(σ) ~ Site + Sex	9	2051.70	1.14	0.36	
		Density ~ Sex	g0~1	detection scale(σ) ~ Sex	5	2059.86	9.30	0.01	
		Density ~ Site + Sex	g0~1	detection scale(σ) ~ Sex	7	2060.06	9.50	0.01	
		Density ~ Site	g0~1	detection scale(σ) ~ 1	5	2065.09	14.53	0.00	
		Density ~ 1	g0~1	detection scale(σ) ~ 1	3	2065.57	15.01	0.00	
	Feral cat				K	AIC	dAIC	AICwt	
	Data from 3 sites in the Tasmanian Midlands (Cressy, Campbell Town and Oatlands) with trap history for both species.	Density ~ Site + Sex	g0~1	detection scale(σ) ~ Sex	7	889.26	0.00	0.35	
		Density ~ Site	g0~1	detection scale(σ) ~ 1	5	889.53	0.26	0.30	
		Density ~ Site + Sex	g0~1	detection scale(σ) ~ Site + Sex	9	891.60	2.34	0.11	
		Density ~ Sex	g0~1	detection scale(σ) ~ Sex	5	891.78	2.52	0.10	
		Density ~ 1	g0~1	detection scale(σ) ~ 1	3	891.83	2.56	0.10	
		Density ~ Site	g0~1	detection scale(σ) ~ Site	7	893.11	3.85	0.05	

Analysis	Dataset	Model	Model comparison				Goodness of fit	
	Both species		K	AICc	dAICc	AICcwt	LL	$R^2_{GLMM(c)}$
Body mass vs home-range size	Data from 22 cats and 8 spotted-tailed quolls across 4 sites in the Tasmanian Midlands	Log(HR) ~ Spp * Sex + 1|Site	6	82.22	0	0.4	-33.36	0.59
		Log(HR) ~ Spp + Sex + 1|Site	5	82.55	0.33	0.34	-35.08	0.54
		Log(HR) ~ log(BodyMass) + Spp + Sex + 1|Site	6	85.18	2.96	0.09	-34.84	0.55
		Log(HR) ~ log(BodyMass) * Spp + Sex + 1|Site	7	85.39	3.18	0.08	-33.26	0.59
		Log(HR) ~ log(BodyMass) + Spp * Sex + 1|Site	7	85.49	3.27	0.08	-33.31	0.59
		Log(HR) ~ log(BodyMass) * Spp + 1|Site	6	93.33	11.11	0	-38.91	0.40
		Log(HR) ~ log(BodyMass) + Spp + 1|Site	5	94.06	11.85	0	-40.83	0.36
		Log(HR) ~ Sex + 1|Site	4	95.22	13.01	0	-42.84	0.23
		Log(HR) ~ log(BodyMass) * Spp * Sex + 1|Site	10	95.36	13.15	0	-32.18	0.62
		Log(HR) ~ Spp + 1|Site	4	96.06	13.84	0	-43.26	0.22
		Log(HR) ~ log(BodyMass) + Sex + 1|Site	5	97.44	15.23	0	-42.52	0.24
		Log(HR) ~ Null + 1|Site	3	100.32	18.11	0	-46.72	0.00
		Log(HR) ~ log(BodyMass) * Sex + 1|Site	6	100.54	18.32	0	-42.52	0.24
		Log(HR) ~ log(BodyMass) + 1|Site	4	102.56	20.34	0	-46.51	0.01

Analysis	Dataset	Model		Model comparison			Goodness of fit	
	Both species		K	AICc	dAICc	AICcwt	LL	R^2_{Adj}
Home-range size vs nightly movement	Data from 22 cats and 16 spotted-tailed quolls across 5 sites with fine-scale tracking data (4 in the Tasmanian Midlands, 1 in Arthur River)	AveDist ~ Species * HR + nightl	6	647.50	0	0.78	-316.39	0.52
		AveDist ~ Species * HR + Sex + nightl	7	650.47	2.97	0.18	-316.37	0.51
		AveDist ~ HR + nightl	4	655.93	8.43	0.01	-323.36	0.35
		AveDist ~ Species * Sex + HR + nightl	7	655.97	8.47	0.01	-319.12	0.43
		AveDist ~ Sex + HR + nightl	5	656.33	8.83	0.01	-322.23	0.37
		AveDist ~ Species * HR * Sex + nightl	10	657.36	9.86	0.01	-314.61	0.51
		AveDist ~ Species + HR + nightl	5	657.59	10.09	0	-322.86	0.35
		AveDist ~ Species + HR + Sex + nightl	6	658.60	11.10	0	-321.94	0.36
		AveDist ~ Sex * HR + nightl	6	659.16	11.66	0	-322.22	0.35
		AveDist ~ Species + Sex * HR + nightl	7	661.62	14.12	0	-321.94	0.34
		AveDist ~ Species * Sex + nightl	6	662.60	15.11	0	-323.95	0.29
		AveDist ~ Sex + nightl	4	665.00	17.50	0	-327.89	0.18
		AveDist ~ Species + Sex + nightl	5	667.10	19.60	0	-327.61	0.17
		AveDist ~ nightl	3	669.05	21.55	0	-331.17	0.05
		AveDist ~ Null	2	669.74	22.25	0	-332.70	0.00
		AveDist ~ Species + nightl	4	671.13	23.63	0	-330.96	0.04

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