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Wildlife Research

Supplementary material

Experimentally testing the response of feral cats and their prey to poison baiting

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Table S1. Dates of monitoring periods and baiting in each year of the project.

Year	Pre-baiting	Baiting	Post-baiting
2013	9 Aug – 7 Sep	8 Sep	1 Oct – 6 Nov
2014	2 Apr – 9 May	11 May	20 May – 18 Jun
2015*	8 Apr – 8 May	5 June	19 Jun – 1 Aug
2016	30 Mar – 4 May	12 May	9 Jul – 7 Aug
2017	10 Apr – 12 May	19 May	26 May – 26 Jun
2018	3 Apr – 2 May	8 May	15 May – 13 Jun
2019	3 Apr – 2 May	8 May	15 May – 13 Jun

*As described in the methods, we do not present or analyse the 2015 data, but include the dates here for comprehensiveness.

Table S2. Detection covariates used in cat occupancy modelling.

Year	Covariates
2013	Shrub_old
2014	Shrub_old + Woodland
2016	Shrub_old + Salt_lake
2017	None
2018	Shrub_old + Salt_lake
2019	None

Additional details about pitfall trapping and sand pad monitoring

We used pitfall trapping data to estimate capture rates of small mammals and reptiles in the spring (September–November) prior to each baiting event. Small mammals were sampled at 6–16 pitfall trapping sites each year. Sites were split between young (8 to 20 years since last fire) and old (26 to >55 year since last fire) shrublands (Table S3, Fig. S1). Each site consisted of two parallel 25-cm high aluminum drift fences 60 m in length and separated by ~30 m. Six pitfall traps (4 x 20-L buckets and 2 x 15-cm diameter PVC pipes) were situated at 10-m intervals along the fences. Sites were sampled for 10 nights each in 2012 and 2013, and 4–5 nights in 2015–18 (mean = 4.3), so we truncated the earlier data to the first five nights of trapping. We calculated small mammal capture rates for each year as the number of individuals captured at each site divided by the number of trap-nights (number of nights × number of traps).

Table S3. Number of pitfall trapping sites in young (8 to 20 years since last fire) and old (26 to >55 year since last fire) shrublands sampled each year.

Year	Young shrublands	Old shrublands	Total sites
2012	8	8	16
2013	8	8	16
2015	4	4	8
2016	8	7	15
2017	7	6	13
2018	8	7	15

We used sand pad monitoring data to calculate an index of rabbit activity for both the spring and winter seasons prior to each baiting event (i.e. in the previous year). There was a circuit of 69 sand pads separated by 1–2 km each (Fig. S1), which were monitored for 3–6 days in each season and the presence/absence of rabbits and other animals was recorded each morning. The index was calculated as the proportion of days rabbits were detected on each sand pad, averaged across all sand pads. Sand pad data were not available for winter 2013 and spring 2012 and 2013.

Table S4. Dynamic occupancy modelling results for feral cats. Only models with a ΔAICc ≤ 2 are shown. ψ, initial occupancy; ε, extinction probability.

Year	Model		ΔAICc	Weight
2013	$\psi \sim$ Treatment,	$\varepsilon \sim 1$	0	0.44
	$\psi \sim 1$,	$\varepsilon \sim$ Treatment	1.52	0.21
	$\psi \sim 1$,	$\varepsilon \sim 1$	1.69	0.19
	$\psi \sim$ Treatment,	$\varepsilon \sim$ Treatment	2.00	0.16
2014	$\psi \sim 1$,	$\varepsilon \sim$ Treatment	0	0.29
	$\psi \sim 1$,	$\varepsilon \sim 1$	0.10	0.28
	$\psi \sim$ Treatment,	$\varepsilon \sim 1$	0.57	0.22
	$\psi \sim$ Treatment,	$\varepsilon \sim$ Treatment	0.72	0.20
2016	$\psi \sim 1$,	$\varepsilon \sim 1$	0	0.48
	$\psi \sim$ Treatment,	$\varepsilon \sim 1$	1.55	0.22
	$\psi \sim 1$,	$\varepsilon \sim$ Treatment	1.71	0.20
2017	$\psi \sim 1$,	$\varepsilon \sim$ Treatment	0	1.56
	$\psi \sim$ Treatment,	$\varepsilon \sim$ Treatment	1.40	0.28
2018	$\psi \sim 1$,	$\varepsilon \sim 1$	0	0.45
	$\psi \sim 1$,	$\varepsilon \sim$ Treatment	1.16	0.25
	$\psi \sim$ Treatment,	$\varepsilon \sim 1$	1.86	0.18
2019	$\psi \sim 1$,	$\varepsilon \sim$ Treatment	0	0.47
	$\psi \sim 1$,	$\varepsilon \sim 1$	1.40	0.23
	$\psi \sim$ Treatment,	$\varepsilon \sim$ Treatment	2.00	0.17

Table S5. Mixed modelling results for changes in cat activity in response to poison baiting. Values in cells are model parameter estimates and 95% confidence intervals are provided in parentheses. Time represents before or after baiting, Treatment represents baited or unbaited, and Interaction represents the interaction those two fixed effects. Bold text indicates variables where the 95% confidence intervals do not overlap zero.

Year	Intercept	Time	Treatment	Time×Treatment
2013	0.19 (-1.36 – 1.74)	0.10 (-2.06 – 2.26)	1.21 (-0.92 – 3.35)	2.76 (-0.24 – 5.76)
2014	1.17 (-0.86 – 3.21)	-1.00 (-3.14 – 1.13)	1.28 (-1.57 – 4.13)	2.54 (-0.48 – 5.56)
2016	5.04 (2.97 – 7.11)	-2.10 (-4.34 – 0.14)	-0.80 (-3.70 – 2.09)	2.77 (-0.61 – 6.16)
2017	4.79 (3.06 – 6.52)	**-2.84 (-5.18 – -0.50)**	-0.55 (-2.96 – 1.87)	**3.44 (0.18 – 6.70)**
2018	5.50 (4.08 – 6.92)	**-4.17 (-6.18 – -2.16)**	-1.99 (-4.03 – 0.05)	1.99 (-0.87 – 4.85)
2019	1.53 (0.49 – 2.57)	**-1.37 (-2.70 – -0.03)**	**1.64 (0.17 – 3.11)**	-0.56 (-2.45 – 1.32)

Table S6. General linear modelling results for the effect of environmental variables on baiting effectiveness. Values in cells are model parameter estimates and 95% confidence intervals are provided in parentheses. Rain_6m, total rainfall for the six months prior to baiting; Rain_12, total rainfall for the 12 months prior to baiting; Mammal_CR, capture rate of small mammals for spring prior to baiting; PP_ratio, ratio of prey availability to predator activity (see Methods); Rab_win, rabbit activity index for winter prior to baiting; Rab_spr, rabbit activity index for spring prior to baiting.

Predictor	Occupancy	Activity
Rain_6m (n = 6)	-0.0002 (-0.004 – 0.004)	0.01 (-0.01 – 0.03)
Rain_12m (n = 6)	0.001 (-0.003 – 0.004)	0.01 (-0.01 – 0.02)
Mammal_CR (n = 6)	-3.04 (-19.07 – 12.99)	11.77 (-75.10 – 98.64)
PP_ratio (n = 6)	-9.08 (-20.98 – 2.81)	10.93 (-68.19 – 90.05)
Rab_win (n = 5)	-1.80 (-6.84 – 3.23)	3.06 (-26.77 – 32.89)
Rab_spr (n = 4)	2.54 (-0.74 – 5.81)	5.68 (-27.44 – 38.81)

Table S7. Generalised linear mixed modelling results relating to differences in capture rates (CR) of small mammals and reptiles in response to Year, Treatment and the interaction. Values in cells are model parameter estimates and 95% confidence intervals are provided in parentheses. Bold text indicates predictor variables where the 95% confidence intervals do not overlap zero. The reference levels used for the intercept were 2012 and Baited.

Predictor	Level	Mammal_CR	Reptile_CR
Intercept	2012, Baited	0.03 (0.00 – 0.06)	0.24 (0.19 – 0.29)
Year	2013	-0.01 (-0.05 – 0.04)	**-0.10 (-0.17 – -0.04)**
	2015	**0.08 (0.02 – 0.13)**	-0.07 (-0.16 – 0.02)
	2016	**0.05 (0.008 – 0.09)**	**-0.19 (-0.19 – -0.05)**
	2017	0.02 (-0.02 – 0.06)	**-0.20 (-0.27 – -0.13)**
	2018	0.02 (-0.02 – 0.06)	**-0.17 (-0.24 – -0.10)**
Treatment	Unbaited	0.03 (-0.01 – 0.07)	-0.05 (-0.12 – 0.02)
Interaction	2013×Unbaited	-0.02 (-0.08 – 0.04)	0.05 (-0.05 – 0.14)
	2015×Unbaited	**-0.09 (-0.16 – -0.02)**	0.10 (-0.02 – 0.22)
	2016×Unbaited	**-0.06 (-0.12 – -0.01)**	0.01 (-0.08 – 0.10)
	2017×Unbaited	-0.03 (-0.09 – 0.03)	0.04 (-0.06 – 0.13)
	2018×Unbaited	-0.04 (-0.10 – 0.02)	0.08 (-0.01 – 0.17)

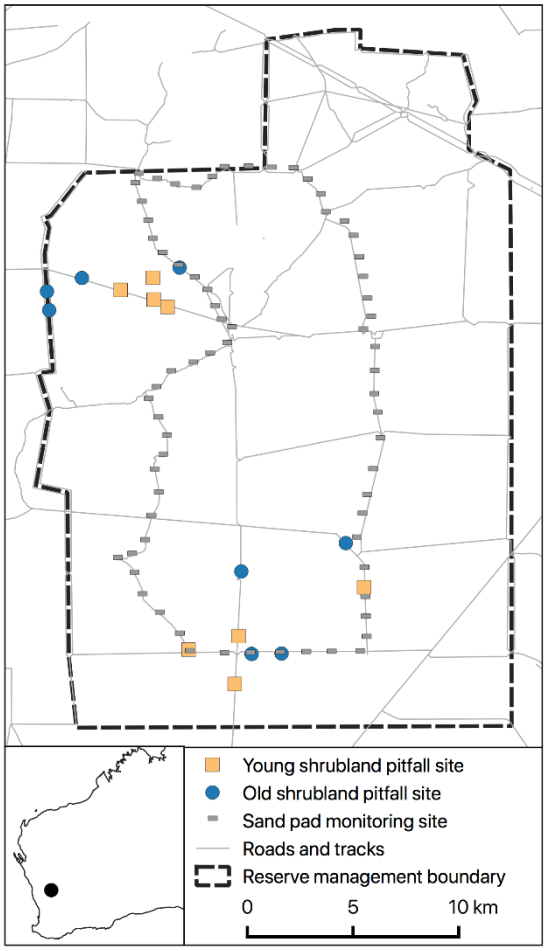

Figure S1. Map of the study site, pitfall trapping sites and sand pads, with the smaller map showing location within Western Australia.

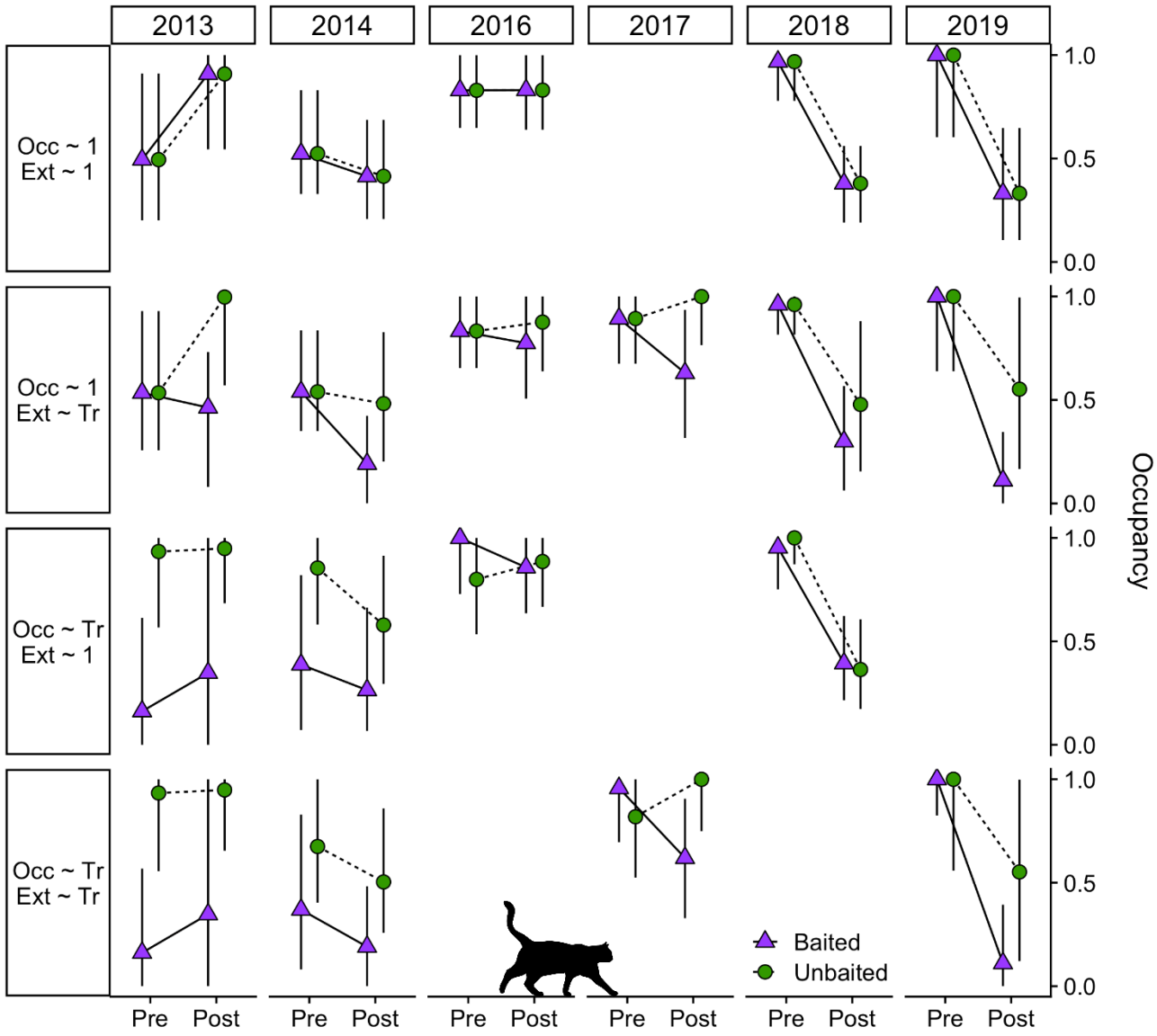

Figure S2. Estimated cat occupancy for all well supported models (ΔAICc ≤ 2) in each year. Occ, initial occupancy; Ext, extinction probability; Tr, treatment (baited/unbaited). Symbols represent means and bars represent 95% confidence intervals.

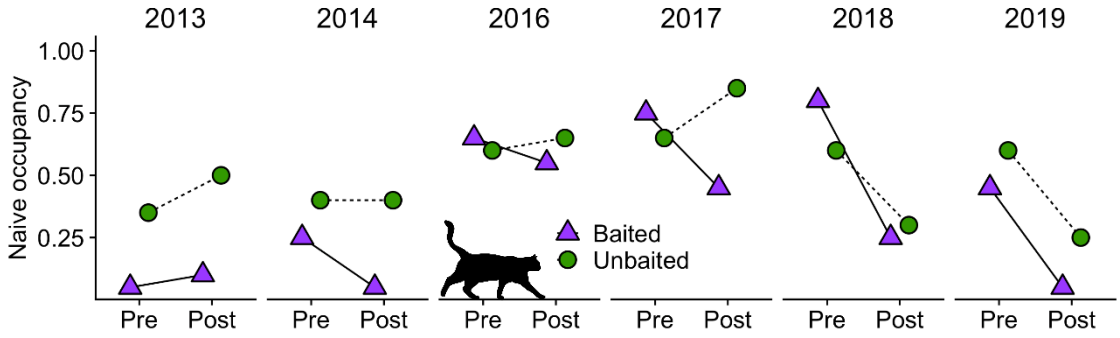

Figure S3. Naïve occupancy of cats (proportion of sites with cats present) pre- and post-baiting each year.

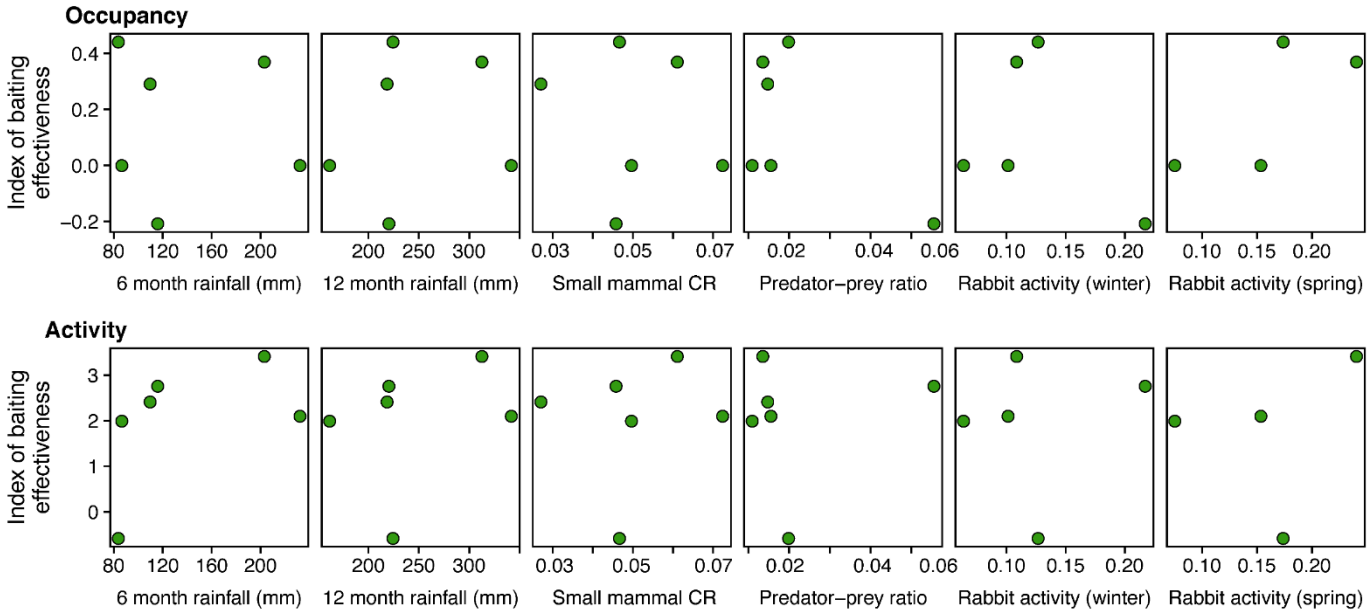

Figure S4. Relationships between baiting effectiveness and environmental variables. The top row relates to occupancy and the bottom row relates to activity. Values of 0 for the baiting effectiveness index indicate that the difference between treatments is equal for before and after baiting. Positive values indicate a greater difference in favour of control sites, i.e. impact sites decreased more than control sites and/or control sites increased more than impact sites. Negative values indicate a greater difference in favour of impact sites, i.e. control sites decreased more than impact sites and/or impact sites increased more than control sites.