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Source: Wildlife Research, 49(7) : 637-645

Published By: CSIRO Publishing

URL: https://doi.org/10.1071/WR21090

RESEARCH PAPER
https://doi.org/10.1071/WR21090
WILDLIFE RESEARCH

Impacts of 'Curiosity' baiting on feral cat populations in woodland habitats of Kangaroo Island, South Australia

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Handling Editor:
Penny Fisher

Received: 14 June 2021
Accepted: 21 February 2022
Published: 26 April 2022

Cite this:
Hohnen R *et al.* (2022)
Wildlife Research
49(7), 637–645. doi:10.1071/WR21090

ABSTRACT

Context. Across Australia, feral cat (*Felis catus*) control and eradication programs are conducted to conserve threatened and vulnerable species. Controlling feral cats effectively at a landscape scale, particularly in remote woodland habitats, remains a significant challenge. Unfortunately, some standard feral cat control methods, such as shooting and cage trapping, require road access. Poison baiting is one of the few methods available to control feral cat populations in remote and inaccessable areas. **Aims.** We aimed to examine the impact of a Curiosity® (Scientec Research PTY LTD, Melbourne, Australia) baiting program on the feral cat population found in continuous woodland habitat of the Dudley Peninsula, on Kangaroo Island, South Australia. **Methods.** The density of cats was monitored using camera traps set up across both treatment and control sites using a before–after control–impact approach. Feral cat density was calculated using a spatially explicit capture–recapture framework. In addition, 14 feral cats were GPS collared at the treatment site, and their status and location, before and after baiting, was monitored. **Key results.** At the treatment site after baiting, feral cat density fell from 1.18 ± 0.51 to 0.58 ± 0.22 cats km^{-2}. In total, 14 feral cats were GPS collared, and of those, eight were detected within the treatment zone during and after bait deployment. Six of those eight cats died shortly after baiting, likely from bait consumption. A new individual cat was detected in the treatment zone within 10 days of baiting, and within 20 days, four new individuals were detected. Both before and after baiting, the number of feral cat detections was highest on roads, suggesting cat recolonisation of baited areas may be assisted by roads. **Conclusions.** Curiosity baiting was found to be an effective method for reducing the density of feral cats in continuous woodland habitats of Kangaroo Island. Roads may act as access routes aiding cat recolonisation. **Implications.** Curiosity baiting programs on Kangaroo Island (and elsewhere) would benefit from incorporating follow-up control, particularly along roads, to target feral cats re-colonising the area.

Keywords: camera trapping, Curiosity baiting, *Felis catus*, habitat use, invasive species, Kangaroo Island, spatially explicit capture–recapture, threatened species, woodland habitats.

Introduction

On a global scale, invasive generalist predators have caused extensive biodiversity loss (Medina *et al.* 2011; Doherty *et al.* 2016). In Australia, feral cats (*Felis catus*) are distributed right across the continent (Legge *et al.* 2017), have caused the extinction of at least 22 mammalian species, and are thought to have contributed to the extinction of many others (Woinarski *et al.* 2014). Cats negatively impact native wildlife through predation and competition, and also through their role in transmitting parasites and disease (Nishimura *et al.* 1999; Veitch 2001; Medway 2004; Phillips *et al.* 2007). As a result, cats are continuing to cause declines of many Australian species at both local and national scales (Woinarski *et al.* 2014, 2016). Controlling feral cats effectively and on a landscape scale remains one of the big challenges in Australian conservation (Doherty *et al.* 2015, 2016).

Across Australia, poison baiting is increasingly being trialled as a means of controlling feral cats at a landscape scale, to protect threatened species (Comer *et al.* 2020; Wysong *et al.* 2020*b*). The Curiosity® (Scientec Research PTY LTD, Melbourne, Vic., Australia) feral cat bait was approved as an agricultural chemical in 2020. Each bait consists of a meat sausage, and within it sits a plastic pellet referred to as a hard-shelled delivery vehicle (HSDV). This pellet encases the active poison *para*-aminopropiophenone (PAPP) (Johnston 2012; Johnston *et al.* 2014). This delivery mechanism was developed to help minimise impacts on non-target (native) species that are attracted to the bait (Hetherington *et al.* 2007; Heiniger *et al.* 2018). Trials suggest that some native species will consume the sausage but chew around the HSDV and discard it, significantly decreasing exposure of those species to the poison. In comparison, cats tend to swallow the baits in several large bites resulting in consumption of the HSDV and the poison (Hetherington *et al.* 2007; Buckmaster *et al.* 2014).

Some studies indicate that poison baiting can cause marked declines in feral cat population size (Algar and Burrows 2004; Algar *et al.* 2010, 2013), but others found the method to be largely ineffective (Fancourt *et al.* 2021) or to have negative impacts on some native species (Wysong *et al.* 2020*b*). Despite numerous trials in arid areas (Johnston 2009, 2014; Johnston *et al.* 2012), only three have occurred in temperate southern Australia: Cape Arid in Western Australia, Wilsons Promontory in Victoria (Algar D, Hamilton N, Onus M, Hilmer S, Comer S, Tiller C, Bell L, Pinder J, Adams E, Butler S, unpub.data; Johnston 2012), and Tasman island in Tasmania (Robinson *et al.* 2015). Unfortunately, logistical issues and unfavourable weather conditions caused these trials to fail (Johnston 2012). As a result, uncertainty remains regarding how feral cat populations in these areas may respond to Curiosity baiting in more favourable conditions.

Commencing in 2020, a feral cat eradication is currently underway on the Dudley Peninsula of Kangaroo Island, in South Australia (Natural Resources Kangaroo Island 2015). The island is home to threatened species, including the southern brown bandicoot (*Isoodon obesulus*) and the Kangaroo Island dunnart (*Sminthopsis fuliginosus aitkeni*), that are extremely vulnerable to cat predation (Johnson and Isaac 2009). Feral cats also act as the primary host for parasites such as toxoplasmosis, which have significant financial impacts on the sheep farming industry (Taggart *et al.* 2020). Camera surveys indicate that feral cats are found throughout the peninsula, including remote and continuous woodland pockets (Hohnen *et al.* 2020). High vegetation density and poor road access has meant that conventional methods, including cage trapping and shooting, are not effective in these areas. Feral cat baiting may be one of the few control methods available to target cats in these habitats. Curiosity poison baits were trialled in this study because other feral cat poison baits available in Australia (such as Eradicat® and Hisstory®) include the poison sodium fluoroacetate (1080), to which some Kangaroo Island wildlife are less tolerant (Hohnen *et al.* 2019).

The aim of this study was to examine the impact of Curiosity baiting on the feral cat population found within woodland habitats of Kangaroo Island. We sought to examine (1) how Curiosity baiting impacts the density of the feral cat population, (2) the recolonisation rate of feral cats post baiting, and (3) the activity of cats on and off both roads and trackways pre- and post-baiting. This study provides information on the efficacy of this control method within continuous and remote woodland habitats of Kangaroo Island, and aims to identify ways in which implementation can be improved in future programs. The results of this study can be used to inform feral cat eradication programs on Kangaroo Island, and in similar habitats elsewhere.

Materials and methods

Study site

The baited site (18.68 km^2) sat within the Simpson Conservation Park and surrounding woodland, owned and managed by Bushland Conservation Pty. Ltd. (treatment site). The unbaited zone (8.21 km^2) sat within the Lesueur Conservation Park (control site). Both sites are located on the Dudley Peninsula of Kangaroo Island, and consist of semi-isolated woodland patches with farmland on some boundaries (4405 km^2) (Fig. 1). The area is subject to warm dry summers and cool wet winters. The Dudley Peninsula receives between 500 and 550 mm of rainfall annually (Bureau of Meteorology 2020). Foxes are not present on Kangaroo Island, and therefore neither fox nor cat control (including cage trapping or feral cat baiting) had occurred at this site prior to this study.

Curiosity baiting

Each Curiosity bait consists of a meat sausage, within which is a single small hard plastic pellet (HSDV). This HSDV contains 78 mg of the active poison *para*-aminopropiophenone (PAPP). The treatment site consisted of an 18.68- km^2 zone within the Simpson Conservation Park and Bushland Conservation Pty Ltd reserve, with the boundaries directed by the 2019 South Australian Directions for Use (Department for Primary Industries and Regions South Australia 2021) and the wishes of neighbouring landholders (Fig. 1). A 500- m bait-free buffer was established around all dwellings and the property boundaries of any landholders that did not want baits deployed on or near their boundary. One day prior to deployment, baits were defrosted and warmed so that strong smelling oils began to form on the sausage skin. On 16 June 2020, baits were deployed across the treatment site at a density of 50 baits km^{-2} (943 baits laid). To ensure both even spread of the baits across the study area and that baits landed on the ground in dense woodland, the treatment site was divided into grid cells (330 × 330 m). In each cell 4–5 baits were

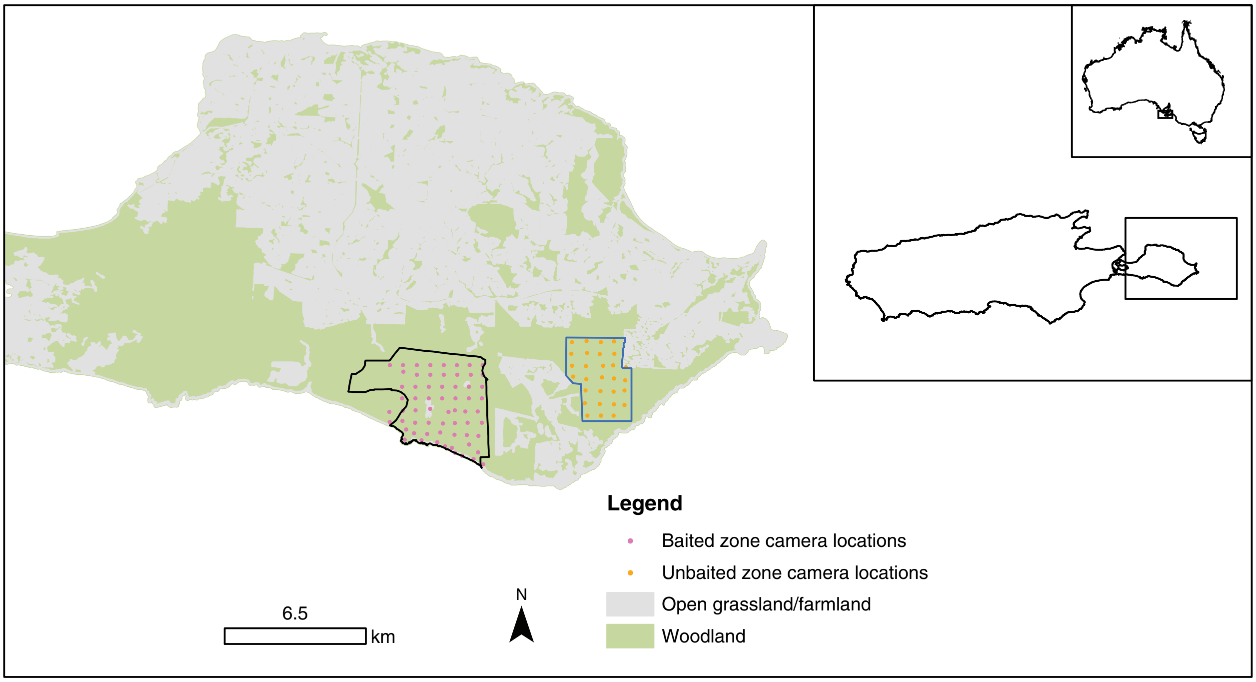

Fig. 1. Location of study site on Kangaroo Island, showing location of cameras within the treatment site at Simpson Conservation Park (indicated by the black line), and the control zone within Lesueur Conservation Park (indicated by the blue line).

dropped in a relatively open area from a helicopter hovering 200 m above the ground. Aerial baiting cannot be conducted within 500 m of roads; therefore within each grid cell near a road, 4–5 baits were deployed by hand more than 10 m off the road (as directed by the 2019 S. A. Directions for Use). Baiting occurred on 16 June, so the pre-baiting period was defined as the 4 weeks prior to baiting (17 May 2020 until 15 June 2020) and the post-baiting period as the 4 weeks following baiting (16 June 2020 until 14 July 2020).

Post-baiting mortality of GPS-collared feral cats

Combined VHF/GPS collars were used to monitor cat movements during the study. Cats were trapped in cage traps (Crestware Industries 40 × 40 × 80 cm and 30 × 30 × 70 cm), baited with chicken and tuna oil. Cages were deployed at 121 locations across the park, during April and May of 2020. Each trap was set at dusk and checked at dawn. Captured cats were moved into tough, dark cloth bags at the point of capture. Cats of sufficient weight (greater than 2 kg) were fitted with a Lotek™ Litetrack 140 RF GPS/VHF collar weighing 130 g (less than 5% of body weight). These collars were deployed on the cats for 1–4 months (depending when they were captured) between May and July of 2020. The GPS component of the collar recorded one waypoint every 30 min, and the VHF component emitted a standard signal and a 'mortality signal' that activated after the animal was still for more than 12 h.

Prior to baiting, GPS-collared cats were tracked (using the VHF signal) every 2–3 days, with GPS data downloaded remotely on each occasion. After baiting occurred cats were monitored daily for 2 weeks, and then every 3–4 days for the following 2 weeks. Because PAPP intoxication is characterised by anoxia, we used regurgitated baits and/or pale blue tongue and gum colour as indicators of bait consumption (Johnston *et al.* 2012). Curiosity baiting impacts were assessed by examining the number of cats confirmed to be within the treatment site prior to baiting, and comparing that with the number of collared cats remaining alive after baiting.

Pre- and post-baiting density of feral cats

To examine changes in feral cat density during the study, a grid of 63 Reconyx™ HyperFire HF2X cameras was deployed at the treatment site, spaced 500–700 m apart (Fig. 1). Cat densities were also monitored at the control site, with a grid of 29 cameras also spaced 500–700 m apart. Changes in the density of feral cats were monitored at the control site to determine if there was variation in cat density happening independently to the trial, across the whole peninsula. We were also interested in examining if cat activity varied among habitat features, including roads, animal trackways and woodland locations where no animal trackways were visible. Therefore, at the treatment site 15 cameras were deployed on roads, 24 were deployed on animal trackways (such as kangaroo or wallaby tracks), and 24 were deployed in woodland locations. At the control site eight cameras were deployed on roads, 11 on animal trackways, and 10 in woodland locations. Cameras were programmed to take three images per trigger, 1 s apart, with no time delay between consecutive triggers. All cameras were deployed on either trees or stakes, and were set approximately 0.5 m off the ground and angled at 45–60° towards a cleared area 0.5–2 m away. No cameras were lured.

Each series of images of a cat passing in front of a camera was examined, and the pelage markings (particularly on the lower legs and tail) were noted. Individual identification of cats based on these pelage markings was carried out using the methods outlined in McGregor *et al.* (2015), where markings observed on a given cat are then used to identify individuals on subsequent passes. Once all cats from an array had been identified, the set of photos was re-examined twice for any inconsistencies in identification. Feral cat encounter histories were split over nights, and individual cats were recorded if present at a given detector (camera) on a given night. Feral cat densities at the treatment and control sites were calculated separately between the 4-week pre-baiting period and the 4-week post-baiting period.

Density was estimated using a spatially explicit mark–resight approach in the package 'secr' v 3.2.1 in the program R (Efford 2020). This approach requires the estimation of a buffer, which is the maximum distance from the estimated home range centre of a given animal to where the probability of detection approaches zero. We chose a buffer of 2180 m, which is the diameter of a circle with an area of 3.72 km^{-2}, the average home range of feral cats on eastern Kangaroo Island based on a study of 33 cats (P. Hodgens, unpubl. data). In all models we used the half normal detection function (HN). The models included three parameters: g0, σ and D. The parameter g0 describes the probability of detecting an individual if a detector was placed in the centre of its home range. The variable σ is a spatial scale parameter relating to home range size, and density (D) is the number of individuals per hectare in the study area. Both g0 and σ are combined in the model to form the detection function and estimate the third parameter D, which was held constant in all models (See McGregor *et al.* (2015) for further details). We created a set of models that were biologically relevant to cats, with variables that influence g0, including: '*b*', a learned response to cameras; '*t*', variation in detection with time; and 'v1', variation in detection between cameras on roads or cameras on trackways. We also modelled a set of variables that might affect σ, including: '*t*', variation in home range though time; and 'h2', variation in home range size between sexes (females tend to have smaller home ranges than males McGregor *et al.* (2015)). All models were compared using Akaike Information Criterion (AIC) scores; the model with the lowest AIC value was used to predict cat density (Supplementary Table S1).

Variation in cat activity with habitat features

At the treatment site we compared feral cat activity on roads, animal trackways and woodland sites, both pre- and post-baiting, by calculating the percentage of trap nights with feral cat detections for each camera and then computing averages across the three categories.

Results

Post-baiting environment

Baits were deployed during a 12-h period (6 am–6 pm) on 16 June. Rain did not fall for 4 days following bait deployment until 20 June, when 12 mm fell, followed by 8.8, 13 and 3.6 mm on the subsequent days (Bureau of Meteorology 2020).

Post-baiting mortality of GPS-collared feral cats

In total, 17 cats were captured on 34 occasions during 835 trap nights (0.04 trap success). Eight cats were female (weighing on average 2.7 ± 0.10 kg) and nine cats were male (weighing on average 3.0 ± 0.36 kg). GPS collars were deployed on seven female and seven male cats. All cats appeared to be in good body condition with no visible ectoparasites.

Feral cats were VHF tracked to determine their whereabouts both before baiting (i.e. if they had moved from treatment site), and after bait deployment to determine their status (alive/dead) (Fig. 2, Supplementary Fig. S1). All GPS-collared cats were originally captured within the treatment site, but some cats did not return to the site after collaring and instead moved into surrounding areas (Supplementary Fig. S1). In the 2 weeks following baiting, 8 of the 14 GPS-collared feral cats were resident in or had moved through the treatment site. Of those eight cats (five females and three males), six were dead (five females and one male) within 5 days of bait deployment (Fig. 2, Table 1). All cats were located within 24 h of the mortality signal (on the GPS collar) activating, and no carcasses had evidence of consumption by other animals. All had blue gums (evidence of bait consumption), and two bodies were found within 1 m of regurgitated baits. Four cats were found under bushes or shrubs, and two were found in the open woodland (not under any dense cover).

Pre- and post-baiting density of feral cats

Cats were detected on 142 occasions over the 8-week duration of the study, and the mean distance between consecutive detections of cats was 824 m. From the camera images, 28 cats were identified, with 21 of these cats from the treatment site and 8 from the control area. Individual cats could not be identified from 17 images either due to poor image quality or the animal moving so quickly through the frame that the image was blurred (Table 2); these detections were omitted from the density estimation modelling.

At the treatment site before baiting, feral cat density was estimated to be at 1.18 ± 0.51 cats km^{-2}. The best-fitting

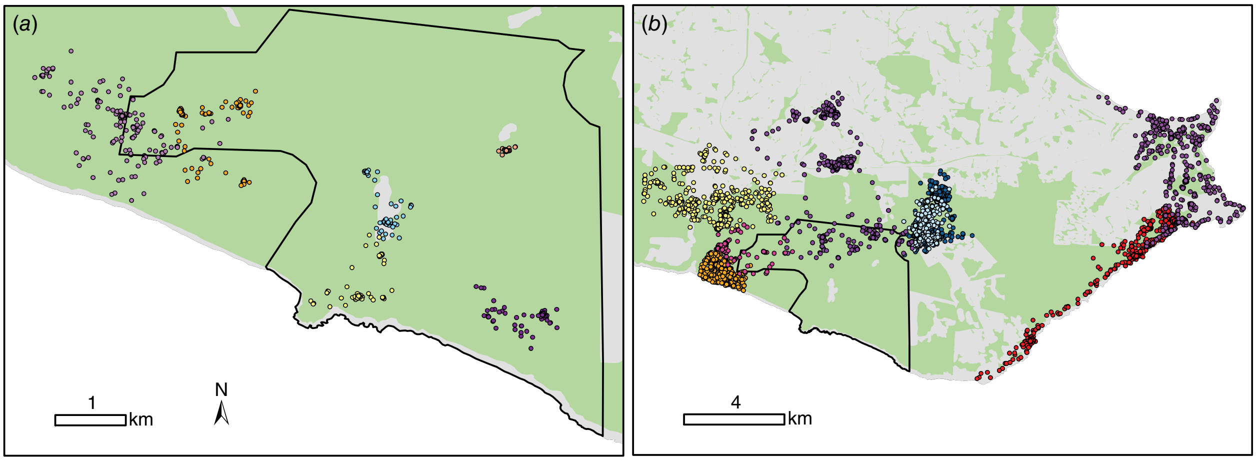

Fig. 2. Two weeks of location data of the (*a*) six GPS-collared cats that died following baiting and (*b*) the eight GPS-collared cats that survived baiting, from 16 June (the day of baiting) until 30 June. The black line indicates the zone within which Curiosity baits were deployed, green indicates woodland, and grey indicates open areas (such as dunes) or farmland. Note that the individual in dark blue does not have a complete data set (16–22 June) due to collar failure; however, this individual was detected on camera on 12 July, indicating it survived baiting. Also, cats that died as a result of consuming a bait survived between 1 and 4 days post-baiting, resulting in different numbers of points displayed by these individuals.

Table 1. Cats within the treatment site prior to baiting, post-baiting mortality, and days survived post-baiting.

Collar number	Sex	Cat found within the treatment site prior to baiting	Post-baiting mortality	Days survived post-baiting
32674	F	Yes	Yes	1
32676	F	Yes	Yes	1
32679	F	Yes	Yes	2
32680	F	Yes	Yes	2
32681	F	Yes	Yes	2
32671	M	Yes	Yes	4
32678	M	Yes	No	NA
32677	M	Yes	No	NA
32670	F	No	No	NA
32673	F	No	No	NA
32684	M	No	No	NA
32683	M	No	No	NA
32675	M	No	No	NA
32669	M	No	No	NA

model included the σ variable 'h2', which describes variation in home range size among individuals (Supplementary Table S1). At the treatment site after baiting, the cat density had dropped to 0.58 ± 0.22 cats km^{-2}, and the best-fitting model included the g0 variable 'v1', which describes variation in detections between cameras on roads and cameras off roads. At the control site cat density before baiting was 0.3 ± 0.14 cats km^{-2}, and the best-fitting model also included the g0 variable 'v1' (described above). At the control site after baiting the cat density had slightly increased to 0.48 ± 0.32 cats km^{-2}, with the best-fitting model being the null model (Fig. 3, Table 3). Estimates of detection probability (*g*0) were highest at the treatment site before baiting (0.03), and were similar between the treatment site after baiting and both control site estimates (all estimated g0 at 0.01).

At the treatment site prior to baiting, 16 individuals were identified, and after baiting, 9 individuals were detected. Of those nine cats, five (55%) had not been previously seen at the site in the month prior, suggesting they were either residents from the treatment site that had been outside the site in the 4 weeks prior to baiting, or were completely new individuals that were recolonising the site (Supplementary Fig. S2). After baiting, new cats were first seen within the bait zone after 10 days, with four new individuals detected after 16 days (Supplementary Fig. S3). In comparison, at the control site seven individuals were present before baiting, and six individuals found at the site after baiting. Of those six cats detected after baiting, only one of those individuals was new (16%).

Variation in cat activity with habitat features

At the treatment site both before and after baiting, the average proportion of nights with feral cat detections (per camera) was highest on roads, followed by animal trackways and sites in woodland (Fig. 4). After baiting there were fewer detections of cats on animal trackways (0.97%) and at sites in the woodland (0.13%) compared with pre-baiting levels (3.19 and 0.43% respectively). In contrast, after

Table 2. Number of cats identified before and after baiting at the treatment site (Simpson Conservation Park) and the control site (Lesueur Conservation Park).

Array	Cat passes	Unidentifiable cat passes	Number of individuals	Trap nights	Average distance between passes (m)
Treatment pre-baiting	86	9	16	1860	824
Treatment post-baiting	29	7	9	1860	641
Control pre-baiting	17	1	7	1860	1058
Control post-baiting	10	0	6	1860	960

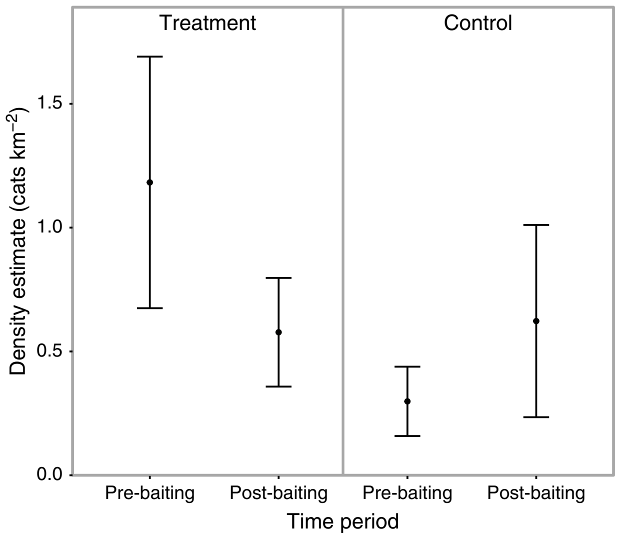

Fig. 3. Density of cats before and after baiting at the treatment site (Simpson Conservation Park) and the control zone (Lesueur Conservation Park).

baiting there was, on average, a greater proportion of detections of cats on roads, compared with pre-baiting levels (6.44 and 4.24% respectively).

Discussion

Broadscale Curiosity baiting was found to effectively drive a decline in the feral cat population within woodland habitats of Kangaroo Island. Six of the eight GPS-collared feral cats that moved through the baited zone after baiting died, likely as a result of consuming a bait. Further, the density of feral cats at the treatment site declined after baiting to approximately half of the pre-baiting levels (1.18 ± 0.51 to 0.58 ± 0.22 cats km^{-2} respectively). In contrast, minimal change in cat density was observed at the control site (from 0.30 ± 0.14 pre-baiting to 0.48 ± 0.32 post-baiting). In the period following baiting, a large number of previously undetected new cats (55% of individuals) were seen moving through the treatment site, suggesting that post-baiting recolonisation may have occurred. More females than males consumed baits, potentially because there were more females within the treatment site when baiting began. Given that the activity of cats both before and after baiting was high on roads, this habitat feature may act as an access route for recolonising individuals. Therefore, roads and trackways could be strategically targeted (with other control techniques) to limit recolonisation and enhance the impact of the baiting on the cat population.

The results of this study, particularly the decline in the cat density observed, are comparable to previous successful Curiosity trials in other parts of Australia. For example, Curiosity baiting in the Flinders Ranges of South Australia caused a cat population decline of approximately 50% (estimated by spotlight surveys; Johnston *et al.* 2012). Curiosity baiting on Dirk Hartog Island caused a 75% decline in the resident cat population (estimated by monitoring the fate of GPS-collared individual cats; Johnston 2009).

Previous studies have discussed the importance of baiting in dry conditions as wet conditions can significantly degrade the sausage bait and compromise palatability (Eason *et al.* 1992; Johnston *et al.* 2007). In the present study heavy rain fell 4 days after baiting; however, this appeared to allow sufficient time for cats to encounter baits while they were still palatable. Baiting at times of year when the cats are likely to be hungry (such as winter) also appears important (Johnston *et al.* 2007; Robinson *et al.* 2015). Long periods of high rainfall can impact the availability of prey and therefore the cats' hunger, which influences the likelihood cats will consume baits (Algar *et al.* 2020). Baiting efficacy observed in our study may therefore vary among years, and factors such as the availability of prey should be taken into account when planning baiting programs (Algar *et al.* 2020).

There was variability between the treatment and control sites, as well as the time period (pre- and post-baiting), in the models that best fit the respective detection histories. At the treatment site prior to baiting, the model describing variation in home range size between sexes best fit the data. After baiting, the best-fitting model included variation in detection probability with roads. Potentially, the increased importance of roads in describing the cat detections post-baiting may reflect the role roads play as either access routes for recolonisation, or use of recently unused parts of a cat's home range. For the control site, the best-fitting model prior to baiting also included variation in detection probability with roads, further highlighting the influence roads have on impacting the movement of cats. Post-baiting at this site, the null model

Table 3. Density of cats before and after baiting at the treatment site (Simpson Conservation Park) and the control site (Lesueur Conservation Park).

Array	Cats per km^{-2}	s.e.	Lower confidence interval	Upper confidence interval	g0^{A}	g0 value	s.e.	σ^{B}	σ value	s.e.
Treatment pre-baiting	1.18	0.51	0.67	1.69	*n*	0.03	0.01	h2	184.19	47.01
Treatment post-baiting	0.58	0.22	0.36	0.80	vI	0.01	0.00	*n*	579.22	89.49
Control pre-baiting	0.30	0.14	0.16	0.44	vI	0.01	0.01	*n*	1796.77	995.49
Control post-baiting	0.48	0.32	0.17	0.80	*n*	0.01	0.00	*n*	793.93	309.56

[A]Variables that influence g0 include: '*b*', a learned response to cameras; '*t*', variation in detection with time; and 'vI', variation in detection between cameras on roads or cameras on trackways.
[B]Variables that influence σ include: '*t*', variation in home range though time; and 'h2', variation in home range size among individuals.

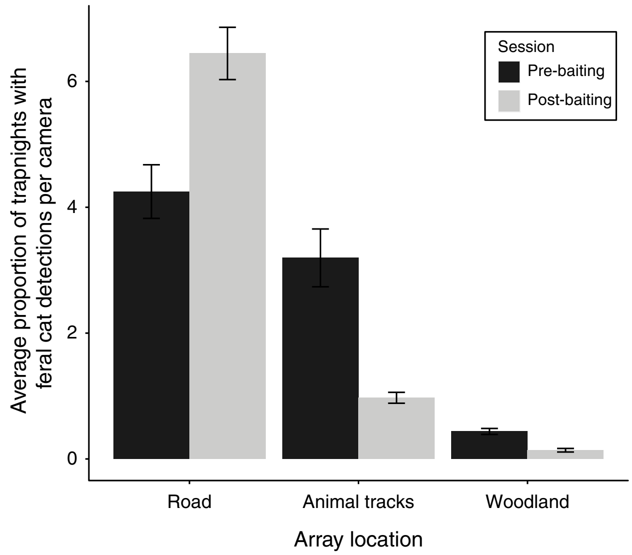

Fig. 4. The average percentage of nights with cat detections on roads, animal trackways and woodland habitats both before and after baiting at the treatment site.

best fit the detection history, suggesting that road use is not consistent through time.

After baiting, new cats were detected moving into the treatment site, with activity highest along roads. Lazenby *et al.* (2015) also observed rapid re-immigration of cats following control in temperate forests of Tasmania, and suggested that this may be driven by the increased use of area by roaming subordinate individuals. Potentially, feral cat control such as cage trapping could be conducted on roadways after baiting occurs, to help remove newly arriving individuals before they become established. Most new cats arrived at the treatment site between 10 and 20 days post-baiting; therefore if post-baiting cat control along roads did occur, it would be important to consider this time period. An alternative to post-baiting trapping of cats on roads could be the deployment of a second round of bait. Such an approach may facilitate control of new individuals, but is not likely to control cats that are bait-averse, such as the two GPS-collared cats in this trial that moved through the treatment site within the first 5 days after baiting (when other cats died), without appearing to have consuming a bait. These cats may have either found baits unpalatable, or may have regurgitated the bait prior to intoxication and therefore survived (Johnston *et al.* 2020).

Roads are often used by carnivores to move through both fragmented and continuous habitats in other parts of Australia (Hradsky *et al.* 2017; Wysong *et al.* 2020*a*, 2020*b*), and baiting on or near roads has been suggested as a tool to maximise baiting efficacy elsewhere (Geyle *et al.* 2020). High use of roads by cats may have occurred in this study because there is minimal traffic within the reserves, and no competition with other mesopredators (e.g. foxes (*Vulpes vulpes*) or Dingoes (*Canis lupis*)) for use of roads, which has been observed elsewhere (Fancourt *et al.* 2021). This extensive use of roads by cats, both before and after baiting, suggests that where possible (and within the 'Directions of Use' for the product), the placement of baits on or near roads is likely to maximise cat exposure to the baits and increase the likelihood of a cat population decline occurring as a result of baiting.

Examining the impacts of Curiosity baiting on non-target (native) species was not an aim of this study, but potential impacts are discussed briefly here for the benefit of future programs. Some species native to Kangaroo Island are likely to consume baits. These include Rosenberg's goanna (*Varanus rosenbergi*), brushtail possums (*Trichosurus vulpecula*), bush rats (*Rattus fuscipes*), Australian ravens (*Corvus coronoides*), and on rare occasions southern brown bandicoots (*Isoodon obesulus*) (Hohnen *et al.* 2019). Rosenberg's goanna has a low tolerance to PAPP (LD50 13.2 mg or 0.16 baits (McLeod and Saunders 2013)), but negative impacts can been avoided by baiting during cold months when they are less active (as prescribed by the South Australian 'Directions of Use' (Department for Primary Industries and Regions South Australia 2021)). Both brushtail possums and bush rats have a high tolerance to PAPP (LD50 1750 mg or 21 baits, LD50 87.1 mg or 1.08 baits respectively (McLeod and Saunders 2013)) and are less likely to consume the HSDV (Buckmaster *et al.* 2014). Australian ravens are also tolerant of PAPP (LD50 79.3 mg or 0.9 baits (McLeod and Saunders 2013)) but may swallow baits whole and ingest the HSDV. Brown bandicoots have a low tolerance to PAPP (LD50 5.4 or 0.06 baits (McLeod and Saunders 2013)) and have been found to chew through a HSDV on rare occasions (Heiniger *et al.* 2018), so monitoring should also be considered for this species. In our study, bandicoots were detected at one site prior to baiting and then at three sites post-baiting, suggesting in this case that no negative population-level impacts occurred.

Overall, Curiosity baiting was an effective tool for managing cats in continuous and remote woodland habitats on Kangaroo Island. This technique may be a useful cat-management tool in temperate habitats elsewhere, but site-specific differences such as impacts on non-target species should be considered. Future Curiosity baiting programs would benefit from understanding habitat preferences of feral cats, including potential preferential use of habitats such as coastal heathland or farmland edges, where baiting could be targeted. Cat activity appeared to be high along roads both pre-and post-baiting, suggesting that baiting near roadways is likely to increase encounter rates between cats and the baits themselves. Likewise, conducting further feral cat control along roads and tracks after baiting has occurred may slow the rate of cat recolonisation in the control area. Ultimately, baiting is a method that can be used to cause feral cat population declines in continuous woodland habitats where other cat control techniques are not feasible.

Supplementary material

Supplementary material is available online.

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Data availability. The data in this paper are publicly available at Figshare: https://doi.org/10.6084/m9.figshare.16994119.v1

Conflicts of interest. The authors declare no conflicts of interest.

Declaration of funding. This study was funded through the Kangaroo Island Landscapes Board, by the Australian Government's Regional Land Partnerships Program.

Acknowledgements. Big thankyou to everyone who contributed to the fieldwork for this project. Thanks to Michael Johnston and Julie Quinn for providing advice regarding the timing of baiting. Thanks also to adjacent landholders who generously let us trap cats on their land and conduct the trial nearby – Bushland Conservation Pty Ltd., Jeff Howard, Val Howard, Brody Howard, the Helyar family, John Turnbull, Geoff Wallbridge and Hillary Parsons. This study was conducted under the South Australian Animal Ethics Permit 53-2019M2.

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