An Assessment of an Aerial Baiting Program for the Control of Feral Cats at the Gibson Desert Nature Reserve, Western Australia.

G. L. Liddelow, B. G. Ward, G. J. Angus and N. Hamilton. July 2002.

Introduction

Control of feral cats in Western Australia has been achieved at various locations, employing a range of bait media and baiting densities (Burrows *et al*; in prep; Project Eden, unpublished data; Algar *et al*, 2001a; Algar *et al* 2001b; Short *et al*, 1997). However successful baiting campaigns and bait acceptance studies here and elsewhere have been mixed with those where bait acceptance has been poor (See for example Veitch, 1985; Risbey *et al*, 1997; Short *et al*, 1997; Algar *et al*, in press). The focus of recent investigations has variously been the nature of the bait media employed (Risbey *et al*, 1997; Short *et al*, 1997; Algar *et al*, in press), the potential of various lures (Short *et al*, 1997; Algar *et al*, in press), the influence of season/prey availability (Short *et al*, 1997; Burrows *et al*, in prep.; Algar *et al*, in press) and the density of bait distribution (Angus *et al*, 2002) and their impact upon bait acceptance by feral cats. The over-riding conclusion from these studies has been that, independent of bait medium, lures and density of bait distribution, bait acceptance is strongly dependant upon seasonal conditions and the consequent availability of certain prey species.

The efficacy of introduced predator control programs was predicted to be greatest at the Eagle Bore study site during the autumn-winter months, when prey availability is generally at its lowest. Rabbits are absent over much of the study site and have not been found to comprise a significant proportion of predator diet (Burrows *et al*, in prep.; Angus *et al*, 2002). Small native vertebrates do form a significant proportion of introduced predator diet and trapping at the site has indicated that these species are less active in the winter months (Burrows *et al* in prep). Foxes and dingoes have been successfully controlled at this site by toxic baiting operations in autumn, winter and spring (see Burrows *et al*, in prep). Feral cats have not responded to spring baiting but good control was achieved by baiting at just 5 toxic baits per km^2 in late autumn 1994 and 22 baits per km^2 in 1996. The use of non-toxic, Rhodamine B-labelled baits in winter 2001 confirmed that baiting at this time of year could achieve at least a 90% reduction in feral cat density (Angus *et al*, 2002).

Risks to non-target native fauna were predicted to be lowest at this site during autumn-winter. Small mammal activity is lowest at this time of year and reptile activity essentially ceases (Burrows *et al*, in prep.). Field investigation of those non-target species that are active at this time of year indicated that no individual consumed bait material (Angus *et al*, 2002).

Based upon these findings, a toxic baiting was carried out in June 2002. Fifty toxic feral cat baits, containing 4.5 mg sodium monofluoroacetate (1080) were distributed per km^2, over an area of 625 km^2. Efficacy of the baiting program

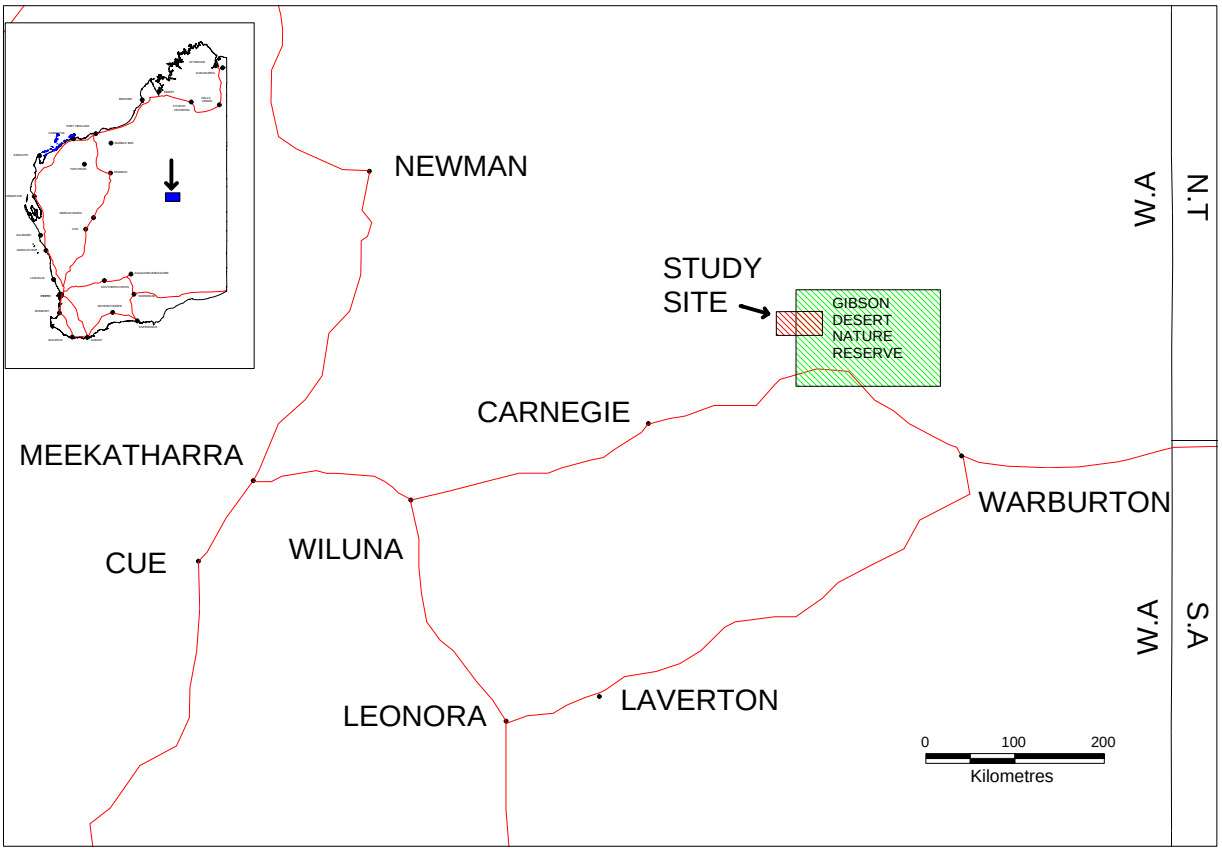
was assessed by observation of track activity and through comparison with an adjacent, unbaited control site.

Method

Study Site

This study was conducted at the Eagle Bore study site, within and adjacent the 1.8 million ha Gibson Desert Nature Reserve, Western Australia (Figure 1). Christensen and Burrows (1994), Burrows *et al* (in prep) and Angus *et al* (2002) all provide detailed descriptions of geology, landform and vegetation.

Figure 1: Location of the Eagle Bore study site.



Track Activity Assessment

Predator activity was assessed by observation of paw imprints on cleared transects with soft substrates. Transects were cleared of previous animal activity and loamy substrates given a powdery surface by towing iron drags behind a motor vehicle. Prior to initial assessment, transects were dragged repeatedly, until hard or compacted surfaces were broken sufficiently to reliably detect and identify predator imprints. Consequently the transect surfaces were generally of sufficient quality to readily detect the presence of

very small vertebrates such as birds, small rodents, pygopods, dragons and skinks. During activity assessment, transects were traversed by motor vehicle at a speed of <10 km h^{-1}. Upon observation of predator paw imprints, the vehicle was stopped for close examination of the position, direction of movement and approximate size of imprints. Imprints of individual animals were initially differentiated on the basis of position on the transect. An imprint was assigned to an individual animal if no imprint of that species was present on at least the previous 2 km of transect. Subsequent imprints were also assigned to that individual unless at least 2 km was traversed with no new imprints present, or the imprint could be clearly differentiated on the basis of size or the direction of travel or the direction of entry/exit to and from the transect. Individual cats were differentiated between sampling traverses on the basis of position and size. That is, imprints present on separate sampling traverses were assigned to a single individual unless they were at least 2 km distant from the extent of imprints present on a previous traverse or of clearly distinguishable size.

Two transects were employed to assess predator activity, one within the area to be baited, the other within the non-baited control (Figure 2). Assessment was carried out simultaneously on the two transects by two separate teams. Transects were assessed on the three days before baiting was carried out (pre-baiting, 21-23 June 2002) and for three consecutive days, commencing nine days after baiting (post-baiting, 3-5 July 2002). The unbaited control transect traversed 32.7 km of this treatment. The baited treatment transect (black line – Figure 2) traverses both the core (23.3 km) and nominal buffer zones (5 km). Following baiting, an additional 11.1 km transect was established within the core baited area (Green line – Figure 2). This transect was assessed post-baiting only (3-5 July 2002).

Bait Medium

Baits used during this program were developed and produced by the Department of Conservation and Land Management, specifically for the control of feral cats. The bait medium is a small sausage, primarily composed of kangaroo meat and is described in more detail by Angus *et al* (2002). The principle differences in the bait medium used in the present study are that no Rhodamine B (RB) was added to the bait medium, one flavour enhancing ingredient (no longer commercially available) was omitted and each bait was injected with 4.5 mg of the toxin 1080.

Baits were handled as described by Angus *et al* (2002) except that during the present study, sunny and warm conditions caused the fatty portions of the bait medium to exude from the sausage skin, coating the bait surface.

Bait Distribution

The area baited was 625 km^2; nominally a 15 km x 15 km quadrat with a 5 km buffer on all dimensions (Figure 3). Baits were distributed from a Cessna 210 aircraft, flying at a nominal 100 kt and 1000 ft AGL. The aircraft was guided by an AG-NAV navigation system with pre-set flight lines for the target area. The

point of bait ejection was recorded by a sensor in the bait delivery tube. Course deviation indicator was set to ± 50 m. A timing light indicated to the bombardier a preset interval, at which baits must be distributed, to achieve the desired bait distribution. Flight cells were 1 km intervals and baits packaged on site to contain the required number of baits per cell, to achieve a nominal distribution of 50 baits per km^2. Baits were delivered to the baiting tube, such that a single bait package was delivered 'evenly' over each cell. All baits were distributed on 24 June 2002.

Figure 2. Location of track assessment transects.

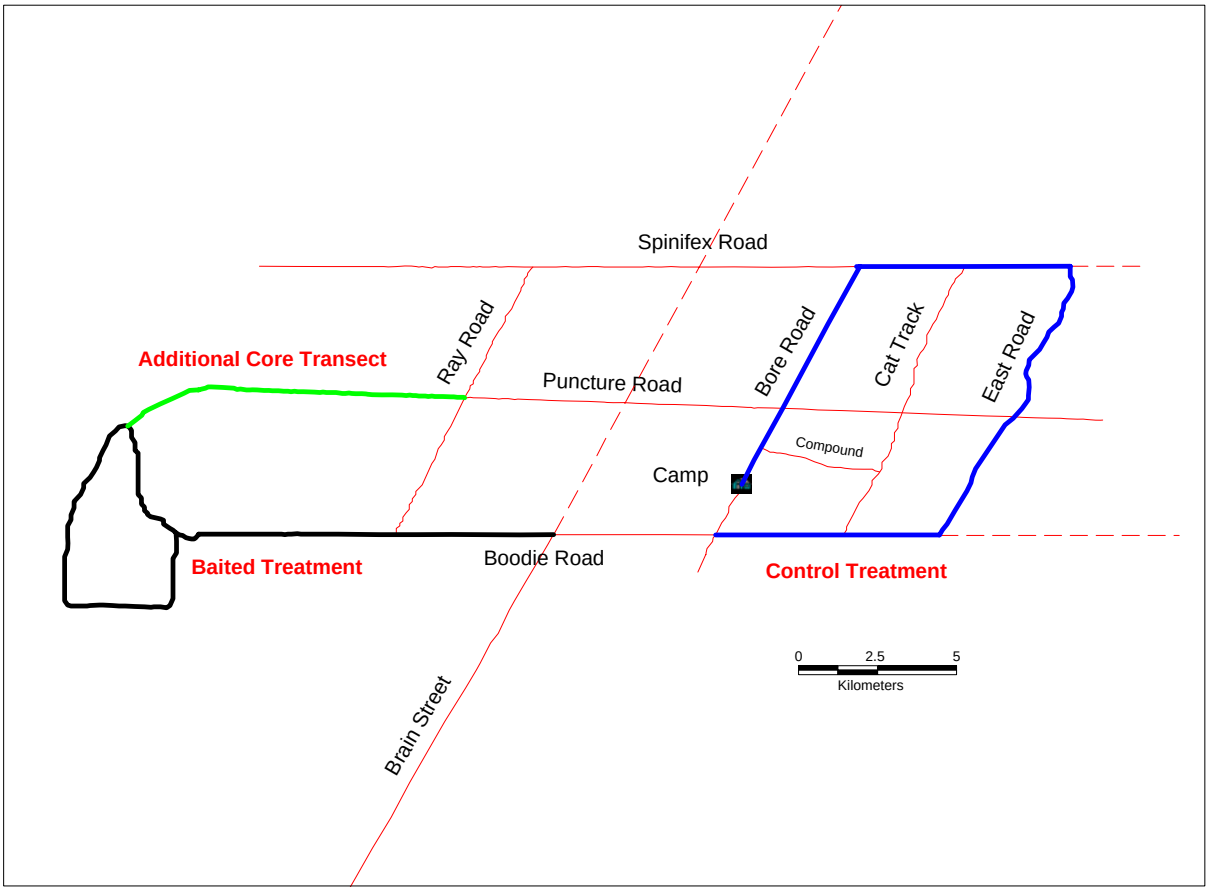
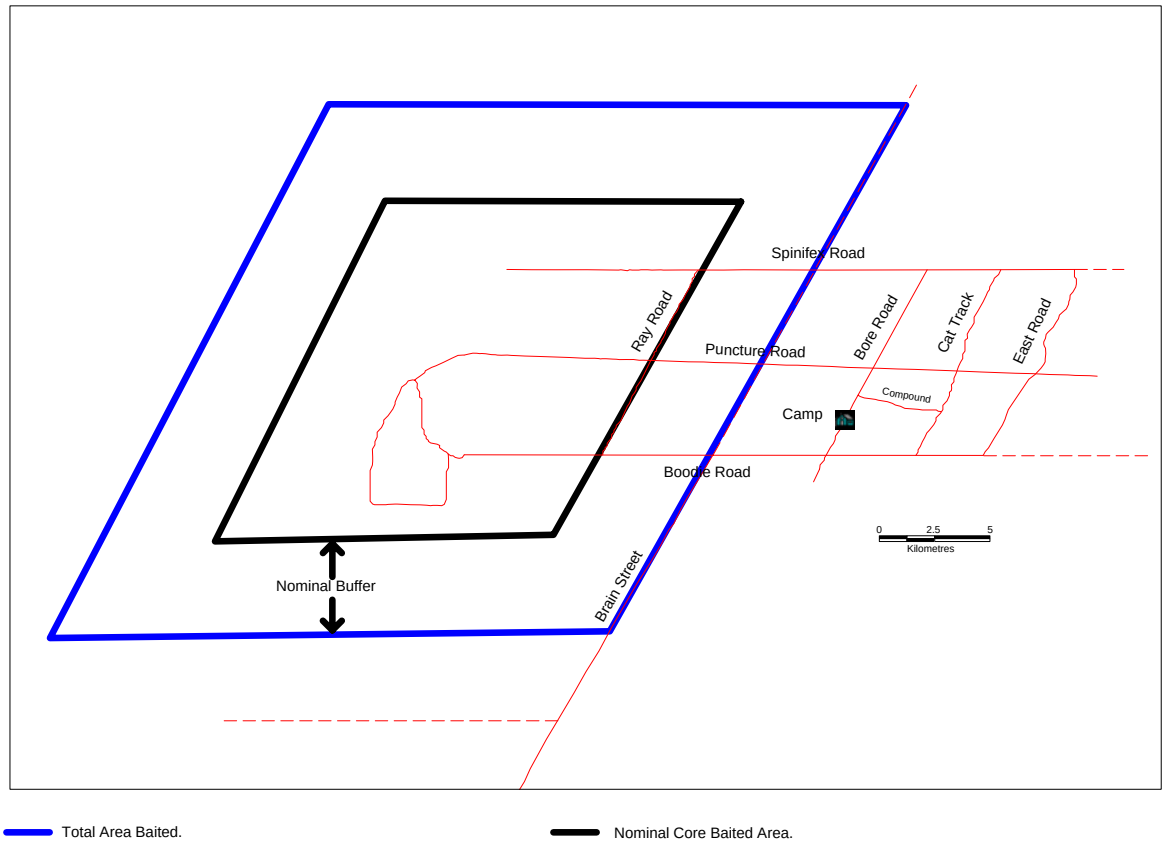


Figure 3. Orientation of baited core and buffer areas.



Results

Twenty individual cats were present on both the control and core baited treatments respectively, over the three days prior to baiting (Figure 4). Four individual cats were present within the baited buffer zone. Tables 2 and 4 indicate a 97% decrease in both the mean number of individual cats present per day and the density index, within the core baited area. Only one individual cat was observed within the core baited area, following baiting. Table 5 indicates a 95% decrease in the number of individual cats present in the core baited area, following baiting. Although one more individual was identified within the non-baited control, post-baiting, both the mean number of cats present per day and the mean cat density index was the same for the pre- and post-baiting assessments on this transect.

Foxes were absent from both treatments, following baiting (Tables 3 and 4). There was a slight increase in dingo activity, within the control treatment after baiting and a 67% decrease in activity in the baited treatment (Tables 3 and 4).

Figure 4. Location of cats on transects, over the three days prior to baiting.

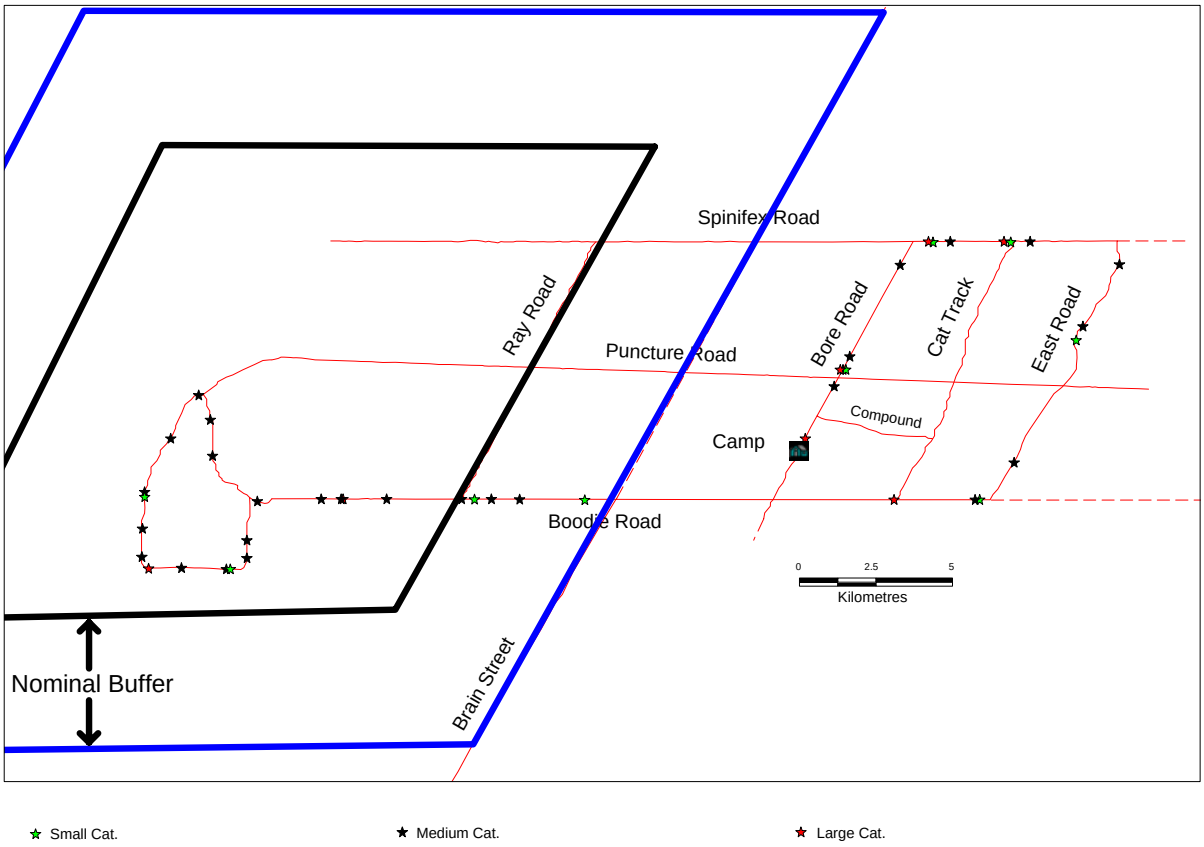


Table 1. Pre-baiting track activity of predators in the non-baited control treatment.

Species	Individuals Present				Density Index (Individuals per 100 km of transect)			
	Day 1	Day 2	Day 3	Mean	Day 1	Day 2	Day 3	Mean
Cat	13	11	10	11.3	39.8	33.6	30.6	34.7
Fox	0	2	0	0.7	0	7.3	0	2.4
Dingo	5	6	4	5.0	15.3	18.3	12.2	15.3

Table 2. Pre-baiting track activity of predators in the core baited treatment.

Species	Individuals Present				Density Index (Individuals per 100 km of transect)			
	Day 1	Day 2	Day 3	Mean	Day 1	Day 2	Day 3	Mean
Cat	10	8	14	10.7	42.9	34.3	60.1	45.8
Fox	1	3	1	1.7	4.3	12.9	4.3	7.2
Dingo	4	4	7	5.0	17.2	17.2	30.0	21.5

Figure 5. Locations of cats on transects nine-eleven days after baiting.

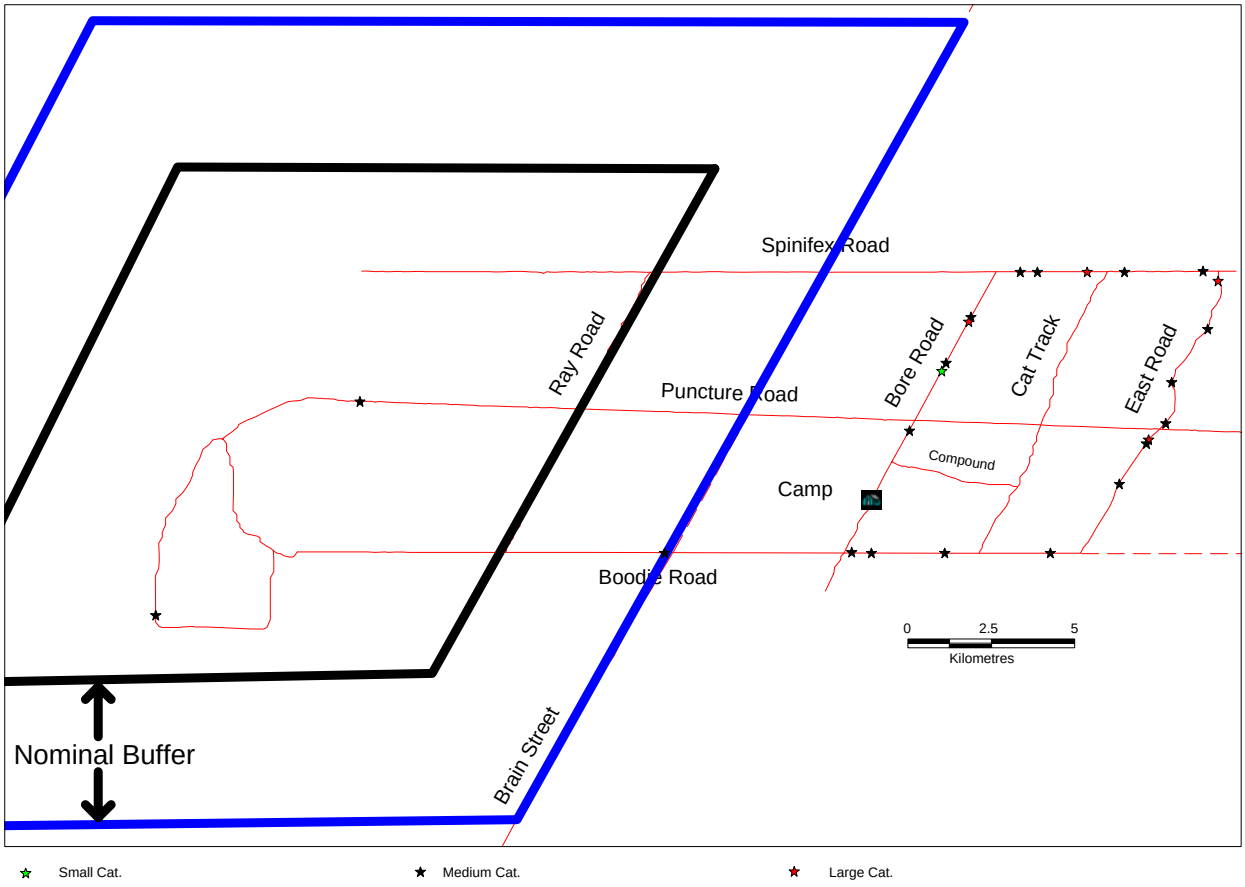


Table 3. Post-baiting track activity of predators in the non-baited control treatment.

Species	Individuals Present				Density Index (Individuals per 100 km of transect)			
	Day 1	Day 2	Day 3	Mean	Day 1	Day 2	Day 3	Mean
Cat	8	14	12	11.3	24.5	42.8	36.7	34.7
Fox	0	0	0	0	0	0	0	0
Dingo	8	9	5	7.3	24.5	27.5	15.3	22.4

Table 4. Post-baiting track activity of predators in the core baited treatment.

Species	Individuals Present				Density Index (Individuals per 100 km of transect)			
	Day 1	Day 2	Day 3	Mean	Day 1	Day 2	Day 3	Mean
Cat	0	0	1	0.3	0	0	4.3	1.4
Fox	0	0	0	0	0	0	0	0
Dingo	2	3	0	1.7	8.6	12.9	0	7.2

Table 5. Individual cat track activity over the pre- and post-baiting assessment periods.

	Date	Unbaited Control Treatment			Core Baited Treatment		
		Individuals Present	New Individuals	Cumulative Total	Individuals Present	New Individuals	Cumulative Total
Pre-baiting Assessment							
	21/06/02	13	13	13	10	10	10
	22/06/02	11	6	19	8	4	14
	23/06/02	10	1	20	14	6	20
Post-baiting Assessment							
	03/07/02	8	8	8	0	0	0
	04/07/02	14	8	16	0	0	0
	05/07/02	12	5	21	1	1	1

Discussion

The efficacy of this program confirms previous findings from this site that baiting for predators in the autumn-winter months, when prey availability and non-target risk are low, can achieve effective control. The baiting regime employed here is further confirmed as a valuable tool for the conservation of fauna in Western Australia and the efficacy achieved compares favourably with that achieved through assessments of operational fox baiting techniques, in arid areas of this State. However if dingoes are considered to be a threat to fauna recovery programs, they will require a separate control regime, due to their larger home range usage (see Angus *et al*, 2002).

This baiting density has been used with RB-labelled baits at this site (2001), Pimbee Station and Peron Peninsula (2002) and with toxic baits at Peron Peninsula and this site (2002). These treatments have achieved consistently high results in the predicted and actual control of feral cats. Previous treatments at lower baiting intensities here at Eagle Bore and also at Peron Peninsula have resulted in significant reductions in feral cat numbers (Burrows *et al* in prep, Project Eden unpublished). On-track baiting at 100 m intervals (an extremely sparse bait distribution) has achieved a high level of actual (Heirisson Prong - 74%Short *et al*, 1997) and implied (Argyle Diamond Mine- 80%, Sinagra and Algar 1998; Cosmos Nickel Mine - 61%, Onus *et al*, 2002) efficacy elsewhere. High uptake by non-targets, particularly birds and varanids, is common with this work, thus reducing bait availability further. This evidence suggests that the present baiting regime may be higher than required and significant cost savings and reductions in non-target risk can be achieved with lower densities. Lower baiting densities should be investigated as a priority.

Small semi-dried kangaroo meat baits have been used successfully on more than one occasion at Peron Peninsula and Eagle Bore. The bait medium used in the present study was deficient in one flavour enhancing ingredient compared to that used in the RB trial at Eagle Bore in 2001. A higher level of control was achieved during the present study than that predicted using baits

containing this particular ingredient. These field studies bring into question the value of 'flavour enhancing' materials, when effective control has been achieved in the absence of some or all of the ingredients presently used. Short *et al* (1997), Algar & Angus (2001) and Burrows *et al* (in prep), show that the three different baits they have trialled are only effective in times of low prey availability. Given that prey availability is the controlling factor in bait acceptance by feral cats, the current kangaroo meat sausages, without flavour enhancers, may work as efficiently as those in present use.

Now that a high level of control has been achieved at the site, opportunity exists to clarify issues of the capacity of feral cat populations, in particular, to recover and reinvade. This site offers the opportunity to monitor the effectiveness of the nominal buffer employed and identify the likely requirement for repeated control efforts to maintain or restore control. Note that Thomson *et al* (2000) found that reinvasion of foxes into buffer and core areas was simultaneous and related to the dispersal of young.

Once the question of reinvasion by cats into the core area has been answered and the size of a buffer to protect the core has been established then there is the possibility of reintroducing mainland extinct fauna from off-shore islands or from captive breeding colonies. It is also possible to protect and enhance known populations of extant native fauna with this technique, using the timing and application rate used in this study.

Recommendations

Conduct regular monitoring exercises at this site to examine the timing (seasonality) and rate of recovery/reinvasion of predators in the baited area.

Compare activity data spatially to determine whether or not there is an indication of a likely buffer effect.

Examine seasonality of reinvasion and recovery to determine whether or not there is a relationship between periods of dispersal and reinvasion, which will give us an indication of the timing and frequency of control efforts required.

Re-examine the findings of Christensen and Burrows (1994), supported by others, provided introduced predator control can be maintained, we locate and prepare areas suitable for the reintroduction of extinct mainland fauna to arid areas. This fauna can come from existing populations on offshore islands or captive breeding colonies.

Examine the feasibility of establishing a program to protect extant populations of species important to conservation. Young Ranges (Gibson Desert NR) in close proximity to the study site offers the opportunity to examine the possible benefits of predator control to extant populations of at least three species important to conservation. Other areas such as the Calvert Ranges (protection of rock wallabies) or new additions to the conservation estate should also be considered for arid-land predator control.

Examine the potential savings and reduction of non-target risk by substantially reducing the density of baits applied.

Examine the potential cost reductions by field examination of the value of 'flavour-enhancing' additives to the bait medium.

Examine the potential cost reductions by field examination of the value of various processes in bait manufacture i.e. blanching, sweating etc.

Examine methods of reducing bait handling and packaging in the field.

Continue investigations on the impact of baiting with the cat bait on non-target animals.

Acknowledgments

We wish to thank Dr Neil Burrows for help and guidance with this project. Thanks also to Rob Brazell and Bruce Whithnell at the bait factory, Rob Roland of Esperance Air Services and staff at Goldfields Region, Kalgoorlie.

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