OPERATION WANJARRI: OPTIMISING FERAL CAT BAITING STRATEGIES IN THE ARID ZONE

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Abstract

A research program was conducted at an arid zone site where bait acceptance by feral cats was monitored at monthly intervals over a year to highlight possible differences in bait consumption over time with respect to seasonal/rainfall influences. At the same time, the abundance of prey species was monitored to enable comparison of bait uptake with season and prey availability, which would potentially indicate a broad optimum period, or periods, for baiting.

Bait acceptance by feral cats across the study period was high, but increased and became more consistent from mid autumn onwards (83 – 100% over the period May 2001-January 2002). There was no significant relationship between bait uptake by cats and season/rainfall or prey abundance.

To maximise the effectiveness of baiting campaigns it is suggested that the optimum time to conduct these programs is late autumn/winter. At this time, rainfall which will cause degradation of baits is less likely to occur than during the summer months, and the abundance of all prey types, in particular predator-vulnerable young mammalian prey and reptiles, is at its lowest. The consistently high bait acceptance observed here extends the possibility of predator control to the arid zone. As cats are controlled in target areas, it will be possible to return native animals to their former habitats, allowing fauna recovery programs to proceed that were previously obstructed by predation by feral cats.

Introduction

Control of feral cats is recognised as one of the most important conservation issues in Australia today. The impact of feral cats on native fauna is acknowledged by Commonwealth legislation, as outlined in Schedule 3 of the *Endangered Species Protection Act 1992*. The national 'Threat Abatement Plan for Predation by Feral Cats' (Anon. 1999) lists 38 species on Schedule 1 of the above Act for which there is a known or inferred threat from feral cat populations. That is, 38 endangered species have been identified as potentially benefiting from effective feral cat control, as part of their management/recovery programs.

Predation by feral cats (*Felis catus*) has been identified as one of the major obstacles to the reconstruction of the fauna, particularly small to medium-sized mammals, in the arid and semi-arid zones of Australia (Dickman 1996; Anon. 1999). Anecdotal evidence has indicated that predation by feral cats, either acting singly or in concert with other factors, has resulted in the local extinction of a number of species on islands and mainland Australia. As many as ten vertebrate species have become locally extinct in the north eastern Goldfields, the region in which this present study was conducted. Many of these species are now restricted to several offshore islands, others have undergone dramatic contractions in their former mainland range. Due to small population sizes and restricted geographic ranges these species are vulnerable to total extinction. These species include: - Rufous Hare-wallaby (*Lagorchestes hirsutus*); Golden Bandicoot (*Isoodon auratus*); Chuditch (*Dasyurus geoffroii*); Red-tailed Phascogale (*Phascogale calura*); Bilby (*Macrotis lagotis*); Burrowing Bettong (*Bettongia lesueur*); Brush-tailed Possum (*Trichosurus vulpecula*); Greater Stick-nest Rat (*Leporillus conditor*); Shark Bay Mouse (*Pseudomys fieldi*) and Black-footed Rock-wallaby (*Petrogale lateralis*).

Predation by feral cats also affects the continued survival of many native species persisting at low population levels (Dickman 1996; Smith and Quin 1996) and has prevented the successful re-introduction of species to parts of their former range (Gibson *et al*. 1994; Christensen and Burrows 1994). The study area supports three species (*Dasycerus cristicauda*, *Egernia kintorei* and *Leipoa ocellata*) that are listed as Threatened Fauna – Vulnerable under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* and Schedule 1 (Fauna that is rare or is likely to become extinct) of the *Western Australian Wildlife Conservation Act 1950*. *Sminthopsis longicaudata*, also present in the study area, is listed as Priority 4 (Taxa in need of monitoring) under the Priority Fauna listings, provided for by the *Western Australian Wildlife Conservation Act 1950*.

Broadscale baiting offers the best option to control feral cats in strategic areas and is seen as the method most likely to produce an effective operational method for cat control (Anon. 1999). Development of an effective baiting technique for the control of the feral cat is cited as a high priority by the national Threat Abatement Plan for Predation by Feral Cats (Anon. 1999). The Department of Conservation and Land Management has designed and developed a bait medium that is attractive to feral cats and effective in controlling them on a localised scale. The baits are manufactured at the Department's Bait Factory at Harvey. This bait medium has been employed as an integral part of successful island cat eradication programs off the Western Australian coast (Algar and Burbidge 2000; Algar *et al*. in press) and was used as the sole tool of eradication on Faure Island (Algar *et al.* in prep.). A program is in progress that is aimed at developing optimal broad-scale control programs for feral cats. One aspect of this program is to determine when bait uptake by cats is at its peak and therefore the optimum time of the year to conduct baiting campaigns.

Examination of bait uptake by feral cats has indicated temporal variability in bait consumption (Algar *et. al.* in press). This variability has correlation to the availability of live prey. If the correlation between prey availability and bait uptake is real, variability across months/seasons is likely to occur giving a seasonal/temporal trend. As predator-vulnerable young prey become more abundant, which is a function of long-term weather conditions (season/rainfall), bait uptake is likely to decline. In the arid zone, where rainfall is unreliable, the time and intensity of rainfall events such as cyclones and thunderstorms will determine the abundance of live prey such as rabbits (King *et al.* 1983).

A research program was conducted at an arid zone site where bait uptake was monitored at monthly intervals over a year to highlight possible differences in bait consumption over time with respect to seasonal/rainfall influences. At the same time, the abundance of prey species was monitored to enable comparison of bait uptake with season and prey availability, which would potentially indicate a broad optimum period, or periods, for baiting. The results of this research program are presented in this document.

Methodology

Study Site

Wildfire swept through the original study site on Albion Downs Station during the January 2001 monitoring period and necessitated relocation of the study. The February and subsequent monitoring periods were conducted on Wanjarri Nature Reserve. Wanjarri Nature Reserve (53 248 ha, 27^0 10'S and 121^0 00'E) is situated in the north eastern Goldfields approximately 60 km north of the township of Leinster and 90 km south east of Wiluna (see Figure 1) and is surrounded by the pastoral leases (Yakabindie, Yandal, Mt. Keith and Barwidgee).

This study was conducted primarily in areas of sometimes loamy red-orange, aeolian sand plains and dunes. Sandier plains and dunes are vegetated by *Triodia basedowii* grasslands variously with no overstorey, open stands of *Eucalyptus gongylocarpa*, scattered mallees (mainly *E youngiana*) or scattered *Acacia coolgardiensis*, *A*. *aneura* and *A colletioides*. Loamier areas support tall, open stands of *A*. *aneura* over *T*. *basedowii*, commonly in association with medium shrubs such as *Eremophila forrestii* and *Senna spp*. A small proportion of the site (see below) was over sandy colluvial plains. These are vegetated by tall, open *Acacia aneura* shrublands over medium shrubs and wanderrie grasses (*Eragrostis spp* and *Eriachne spp*). Common medium shrubs include *Eremophila forrestii*, *E margarethae*, *E latrobei*, *Senna sturtii* and *Acacia tetragonophylla*. Pringle *et al.* (1994) provides a more complete description of geomorphology, soils and vegetation units of the study area.

The climate of the region is described by Gilligan (1994) and summarised below. The region is arid with a mean annual rainfall of less than 250 mm and is subject to a 'desert: summer and winter' bioclimate. The summer pattern is influenced by anticyclonic systems to the south-east and occasionally by southern extensions of the Intertropic Convergence Zone which may bring thunderstorm activity. The winter pattern is influenced by a continuous sequence of anticyclones and associated depressions bringing rain bearing frontal systems. Rainfall is irregular in the area and there may be long periods between significant falls of rain. Summer rainfall is greater than that during the winter pattern and tropical cyclones or their remnants can occasionally bring heavy rains in the summer months. On average there are 40 rain days per year. July is generally the coldest month with a mean minimum of 4.9^0C while the hottest month, January, averages a mean maximum of 36.1^0C.

Bait Uptake Trials

Baits

Departmental researchers have recently completed development of a bait to control feral cats. The baits were manufactured at the Department's Bait Factory. The bait is similar to a chipolata sausage, approximately 25 g wet-weight, dried to 20 g, blanched (that is, placed in boiling water for one minute) and then frozen. The bait is composed of 70% kangaroo meat mince, 20% chicken fat and 10% digest and flavour enhancers (Patent No. AU13682/01). Prior to laying, baits were generally thawed and placed in direct sunlight. This process, termed 'sweating', causes the oils and lipid-soluble digest material to exude from the surface of the bait. All baits were treated with an ant deterrent compound (Coopex®) at a concentration of 12.5 g l^{-1} Coopex as per the manufacturer's instructions. This process is aimed at preventing bait degradation by and attack and the deterrent to bait acceptance from the physical presence of ants on and around the bait medium.

Bait laying procedures

During January 2001 three transects were operated at Albion Downs Station, all over sand plain/sand dune. Each transect was operated once and the site abandoned because of wildfire. Four transects (T1-T4, Figure 2) were then used to assess bait uptake at Wanjarri Nature Reserve. One transect was operated per day, during each monthly sampling exercise, from February 2001 until January 2002.The length of each transect was nominally 15.9, 17.2, 12.8 and 20.0 km for T1-T4 respectively. Transects 2-4 were entirely over sand plain/sand dune. Transect 1 was also over sand plain, except for the first 2 km and last 5 km which were over sandy colluvial plains.

Tracks were chain-dragged as the baits were laid to clear sign of previous activity. Bait laying commenced two hours before dark. Baits (bait stations) were laid, in the centre of the track, at 100 m intervals, measured by the vehicle odometer. Baits were positioned only on sandy substrate where it was possible to observe track activity.

Temporary compaction of some portions of the transects, following rainfall, rendered them unsatisfactory for the purposes of track identification, therefore the entire length of each transect was not used during each sampling exercise. On several occasions, the entire length of some transects was too compacted for reliable track identification and they were omitted from the sample. Table 1 indicates the transects used and total distance of transect for each sampling period.

Table 1. Transects employed and cumulative length of transect for each monthly sampling exercise

Month	Transects employed	Cumulative transect distance (km)
January 2001	Albion 1-3	46.9
February 2001	T2	17.9
March 2001	T1-4	67.8
April 2001	T1-4	71.0
May 2001	T1	10.4
June 2001	T1-4	57.8
July 2001	T1-4	69.8
August 2001	T1-4	65.6
September 2001	T1-4	64.5
October 2001	T1-4	65.3
November 2001	T1-4	64.2
December 2001	T1-4	64.7
January 2002	T1-4	64.1

Assessment of bait response

Transects were examined the morning following bait placement, commencing one hour after dawn. Track assessment was conducted from a 4-WD vehicle, driven at a speed of less than 10 km/h. The observer was seated in an elevated position on a chair bolted to the kangaroo bar. Each bait station was inspected and the response of individual cats was recorded as no tracks present, a bait pass, visit or uptake. These bait responses are described by: -

- No track — No cat track on the transect at the bait station position.
- Pass — Cat track on the transect at the bait station with no deviation from its path to inspect the bait.
- Visit — Cat tracks within 0.5 m of the bait with deviation from its path to inspect the bait.

- Uptake — Bait removed. Cat prints approaching the bait, pes and/or tail imprints present, indicating the cat had assumed a sitting position. No non-target prints within reasonable reach of the bait position.

Bait consumption was assigned to a particular non-target species when no other was within reasonable reach of the bait position.

Individual cats were arbitrarily differentiated by clear differences in pad size (taking into consideration the variation caused by substrate type) and/or when two individual tracks were more than 1 000 m apart. The spacing of baits on the transects often enabled individual cats to encounter more than one bait. The response of individual cats was recorded for each bait station, however the highest ranking bait response for each individual animal was used in bait uptake summaries and statistical analyses. As such, if an individual cat passed one bait station then visited another, the individual cat's bait response was categorised as a visit, and so on.

Cat Activity

The location of individual cats along transects was recorded and their on-track distances logged. Feral cat use of vehicular tracks, as a measure of activity, was based upon the actual distances travelled on the track, rather than the total span of interaction with the track. The total on-track activity of all individuals present was recorded, including those that did not encounter baits.

Measuring exact on-track distances travelled by individuals was impractical. For the purposes of this exercise, the only objective measures of distance available to observers, were the 100 m intervals (initially measured with the vehicle odometer) at which baits were placed. Therefore recording of distance travelled was effectively coded for distances of <100 m, 100 m or multiples thereof. Distances of <100 m were nominally coded as 10 m, or multiples thereof. The total on-track distance travelled was the sum of all <100 m and 100 m intervals assigned to the particular individual.

Prey Availability

Assessment of Rabbit Abundance

Rabbits, when present, can form a substantial proportion of feral cat diet (e.g. Jones and Coman, 1981; Martin *et al.*, 1996; Algar and Angus 2000). The presence of such a food source was seen as potentially impacting upon bait acceptance by feral cats. Therefore individual rabbit tracks were counted over a 10 m interval of transect, at each 100 m bait station. The number of rabbits at each station was recorded as a category based on the number of tracks present. It was not possible to differentiate tracks from two or more rabbits and as such four categories were used: 0= rabbits absent; 1=1 rabbit; 2=2 rabbits and 3=> 2 rabbits.

Assessment of small native mammal abundance
Two sites were randomly selected along each bait uptake transect at which small mammals were sampled. Each site comprised two lines, approximately 10 m apart, of medium Elliot box traps, with each line having five traps spaced at 10 m intervals. This provided 20 trap nights per daily bait uptake transect and 80 trap nights per monthly sampling period, when all transects were in operation. Table 1 indicates the number of transects operated during each sampling exercise. No small mammal sampling was undertaken during the January 2001 exercise.

Elliot traps were baited with a peanut paste and ground ("quick") rolled oats mixture, with sufficient peanut paste to bind the oats. The ground beneath each trap and the immediate surrounding area was sprayed with Coopex ®, at the same concentration used for cat baits. Coopex was used to prevent bait degradation by ants and to prevent ant attack on trapped animals.

Weather Data

Rainfall data was obtained from the Australian Bureau of Meteorology Automatic Weather Station located 8 km south west of the study site, on Yakabindie Station (See Anon. 1995 for specifications).

Statistical Analyses

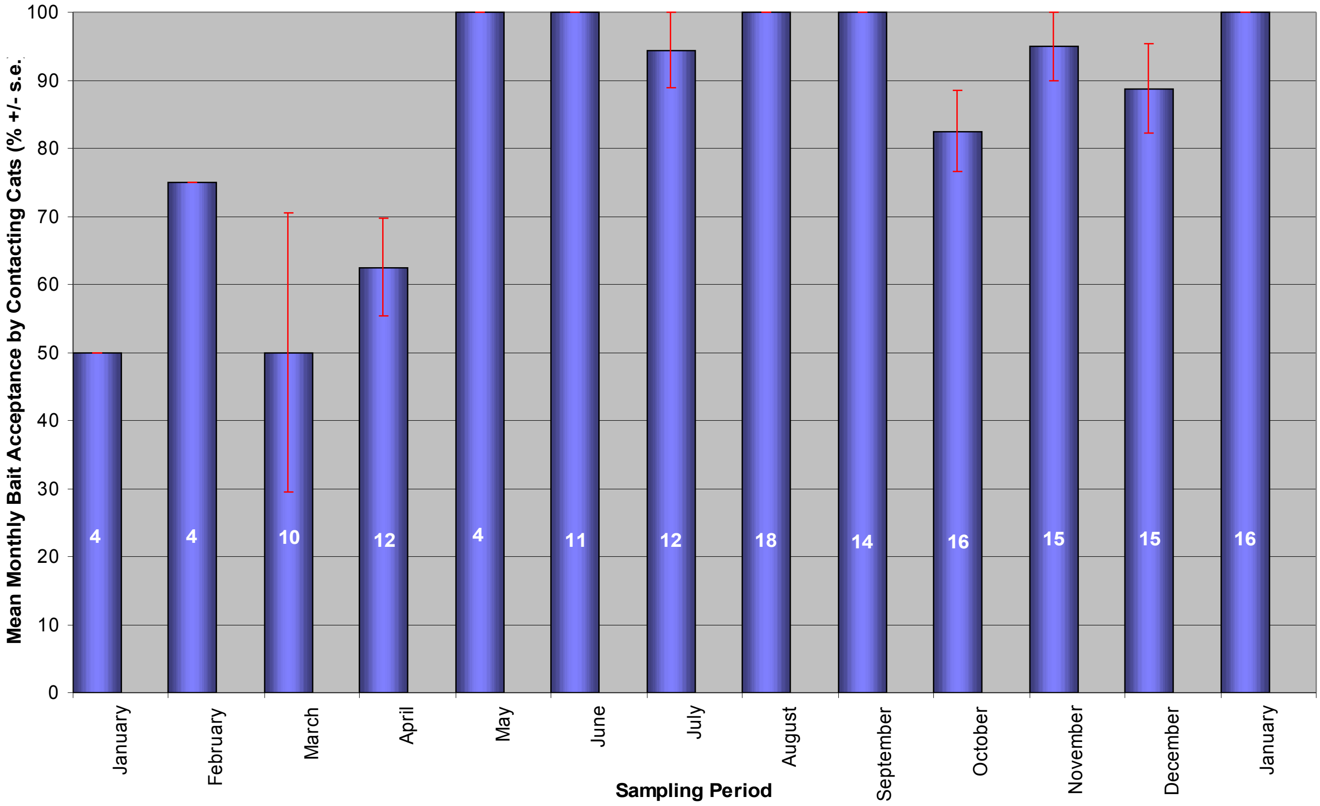
Simple descriptive statistics ($\mu \pm$ se) were used to summarise the data collected. Regression analyses were performed on the data sets to test for the significance in the relationships between rainfall, prey abundance and bait uptake.

Results

Bait Uptake by Feral Cats

A total of 7 345 baits was deployed during this study, of these 1 194 baits (16%) were consumed by feral cats. The average number of baits ($\mu \pm$ s.e) consumed by cats per day was 9.1 $\pm$ 0.6 over the entire period. Bait uptake by feral cats across the study period was high, particularly from mid autumn onwards (Figure 3).

Figure 3. Mean monthly bait uptake by cats that encountered baits. The sample sizes for each month are indicated within the respective bars



The data are also presented as daily bait uptake fro each month to indicate variability in bait uptake fro each period (see Table 2).

Table 2. Daily bait uptake (μ ± se) for each month. The data are expressed as the percentage of individual cats that contacted a bait and consumed a bait it each day

Sampling period	**N° sampling days**	**N° days cats contacted baits**	**N° cats that contact baits (entire sampling period)**	**Daily N° cats that contacted baits (μ ± se)**	**Daily bait uptake (%) (μ ± se)**	**Comment**
January	3	2	4	1.0 ± 0.6	17 ± 17	Fire
February	1	1	4	4.0	75	Rain
March	4	4	10	2.5 ± 0.5	50 ± 20	
April	4	4	12	3.0 ± 0.6	63 ± 7	
May	3	1	4	4.0	100	Rain
June	4	4	11	2.8 ± 0.5	100 ± 0	
July	4	3	12	3.3 ± 1.3	94 ± 6	
August	4	4	18	4.5 ± 1.0	100 ± 0	
September	4	4	14	3.5 ± 0.3	100 ± 0	
October	4	4	15	3.8 ± 0.3	88 ± 7	

The average number of baits consumed by cats (μ ± se) for each sampling period is presented in Table 3. The average number of baits consumed per cat during the first six months was generally lower and more variable, between months, than that recorded in the later part of the study.

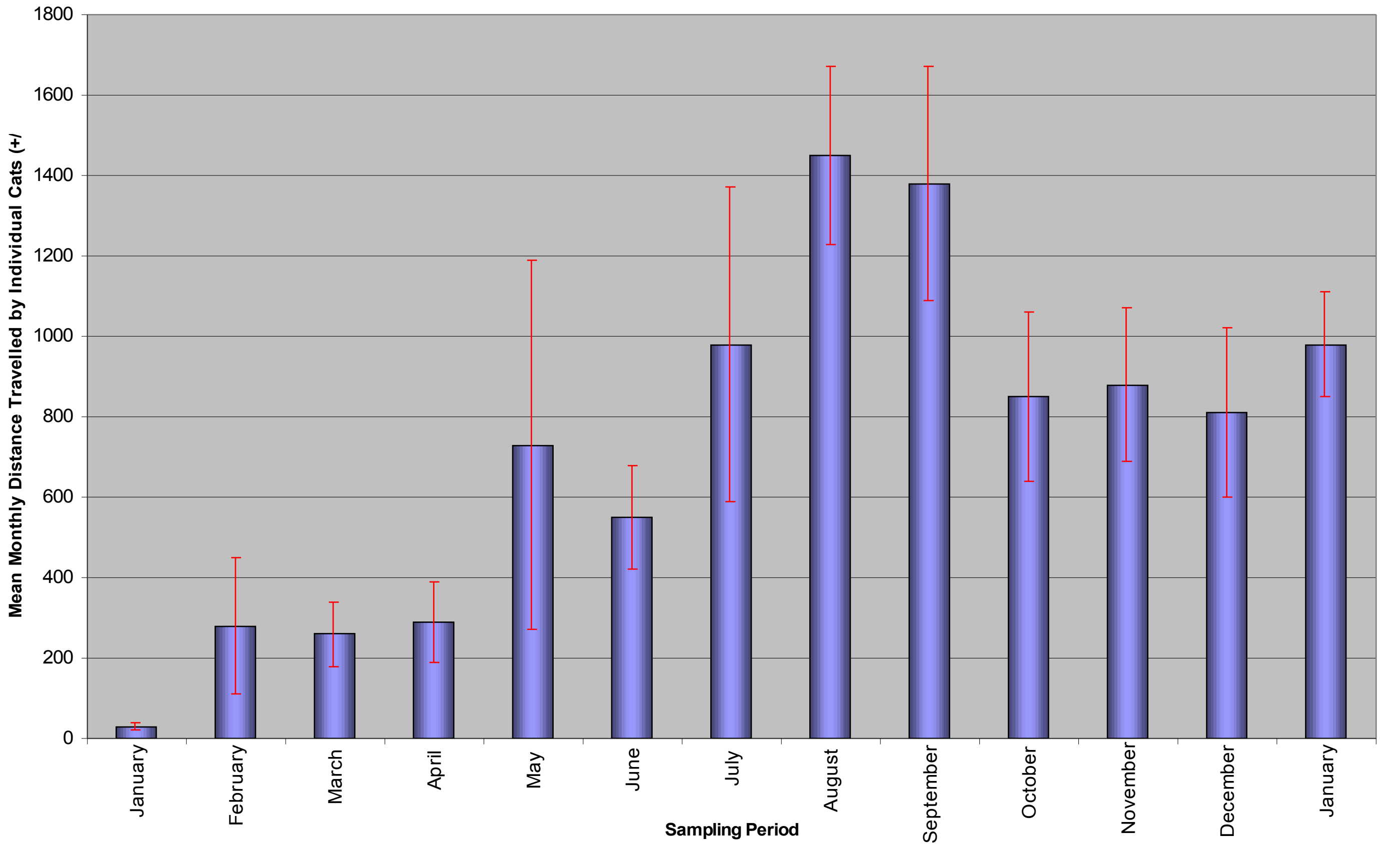
Table 3. Average number of baits consumed by cats (µ ± se) for each sampling period

Sampling period	**Average number of bait uptakes/cat (µ±se) that consumed baits**
January	1.0
February	4.7±3.2
March	1.8±0.4
April	7,4±1.7
May	7.8±4.2
June	5.7±1.8
July	10.1±2.2
August	12.8±1.7
September	9.9±1.9
October	9.8±1.9
November	8.8±1.8
December	9.6±2.0
January	9.4±1.3

Cat Activity

The average on-track distances (µ±se) travelled by cats for each monthly sampling period is presented in Figure 4. On-track distances travelled were highest in July, August and September. The on-track distances travelled during the last four months of this study were greater than those recorded during the first six months.

Figure 4. Mean monthly distances travelled by all cats present on transects



Non-target Bait Uptake

Bait uptake by non-target species, across the study period and for each monthly sampling period, is summarised in Table 4. The mean daily bait uptake (μ ± se) by non-target species was 17.0% ± 3.4%. Corvids and Pied Butcherbirds (*Cracticus nigrogularis*) were most frequently responsible for non-target bait uptake. The majority of this bait uptake (66%) occurred on T1. Uptake by Emus was almost always multiple takes by an individual or small group. *Varanus gouldii* was the most frequently observed varanid during sampling. Tracks associated with bait uptake by this family were consistent with that of a medium to large varanid that may have included several species known to be present in the study area. Only two baits were removed by non-varanid reptiles, one bait by *Teliqua* spp. and by an agamid. Rodent tracks consistent with *Notomys alexis* were noted in association with sausage baits throughout the study period. This species was responsible for rolling some baits from the original location at the bait station. Where baits were rolled off the transect alignment and could not be relocated, they were presumed to have been consumed by this species or removed for storage in the burrow. As such they were noted as being 'taken' by *N alexis*.

Table 4. Mean monthly bait consumption (μ± se) by non-target species.

Month	% of total baits (μ ± se) removed by non-target species

	Corvids/ Butcherbird	**Emu**	**Varanid**	**Non-varanid reptiles**	**Rodent**	**Total**
January	7.7± 5.7	1.3±0.7	1.7±0.9	0	0	10.7± 4.2
February	0	0	0	0	0	0
March	8.0± 7.0	0	2.3±1.2	0	3.0±3.0	13.3± 7.3
April	2.3± 0.6	0	0	0	0	2.3± 0.6
May	50.0±50.0	1.0±1.0	0	0	0	51.0±51.0
June	25.8±16.5	0	0	0	0.8±0.5	26.5±16.3
July	18.3± 5.1	1.0±1.0	0	0	0	19.3± 5.5
August	13.0± 9.4	0	0.5±0.3	0	0	13.5± 9.6
September	27.0±18.3	0	0	0.3±0.3	0.8±0.5	28.0±17.9
October	27.5±15.1	0.3±0.3	0	0	0	27.8±15.4
November	8.3± 2.7	0	0.5±0.5	0	0	8.8± 2.8
December	3.5± 1.0	0	0.5±0.5	0	0	4.0± 1.2
January	24.3±19.3	0	1.3±1.3	0.3±0.3	0.3±0.3	26.3±18.8
Entire Study	**14.6**	**0.2**	**0.4**	**<0.1**	**0.4**	**15.6**

Prey Abundance

A summary of rabbit presence/absence over the study period is presented in Figure 5. The data (& ± se) indicate that rabbit activity was very low in the study area, with a maximum of only 4.9 ± 1.3 % presence in September. Small mammal abundance is also presented in Figure 5. As with rabbit abundance, small mammal species abundance was also low. A total of 880 trap nights yielded a trap success of 3.2% with only 28 captures (17 *Psuedomys hermannsbergensis*, 8 *Notomys alexis*, 1 *Ningaui ridei* and 2 *Mus domesticus*).

Rainfall Data

Rainfall data have been recorded on Yakabindie Pastoral Station since 1931. The monthly average rainfall figures (μ±se) for this period are summarised in Figure 7. Also presented in this Figure are the monthly rainfall figures for the period of this study. The annual rainfall recorded during the study period was greater than the long-term average, and this has been the trend since 1994.

Figure 5. Measured abundance of rabbits and small mammals on transects sampled

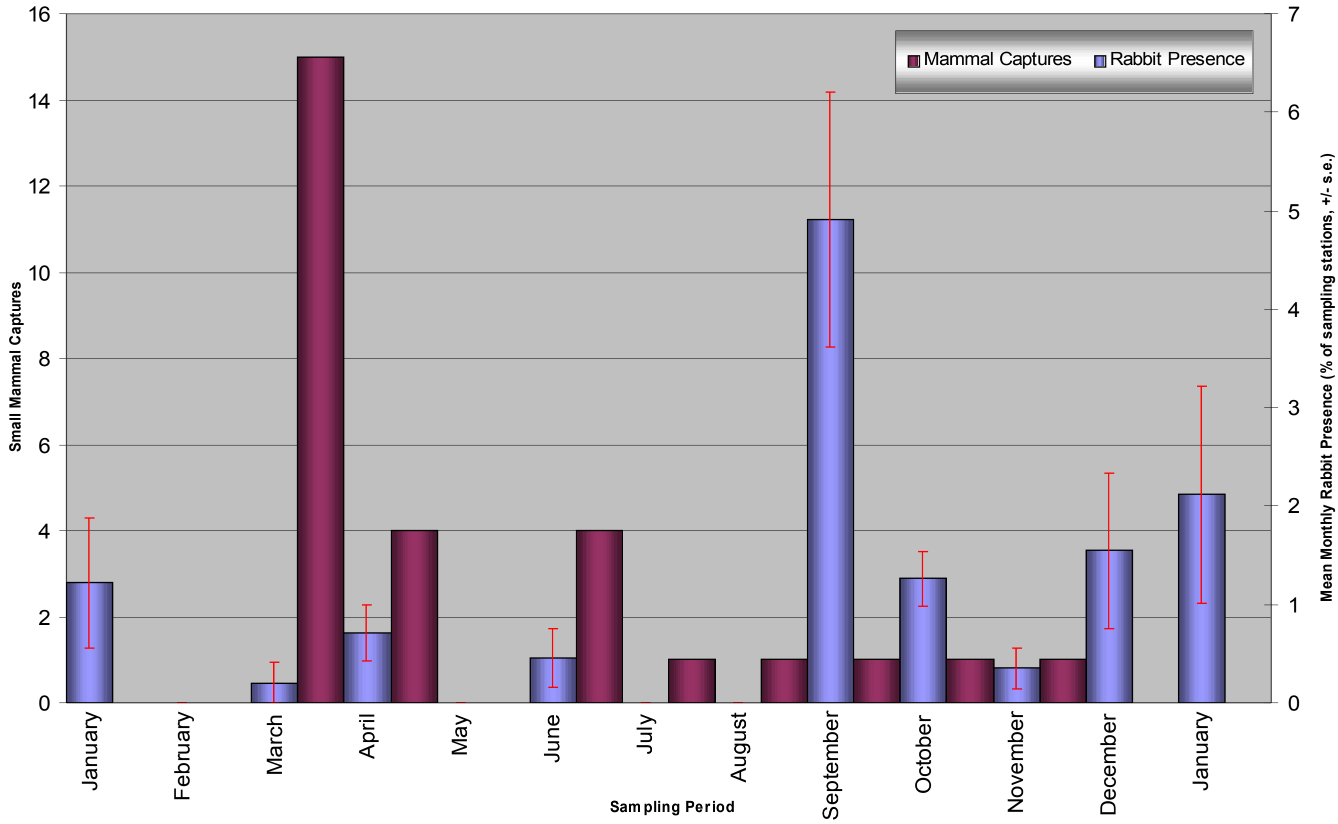
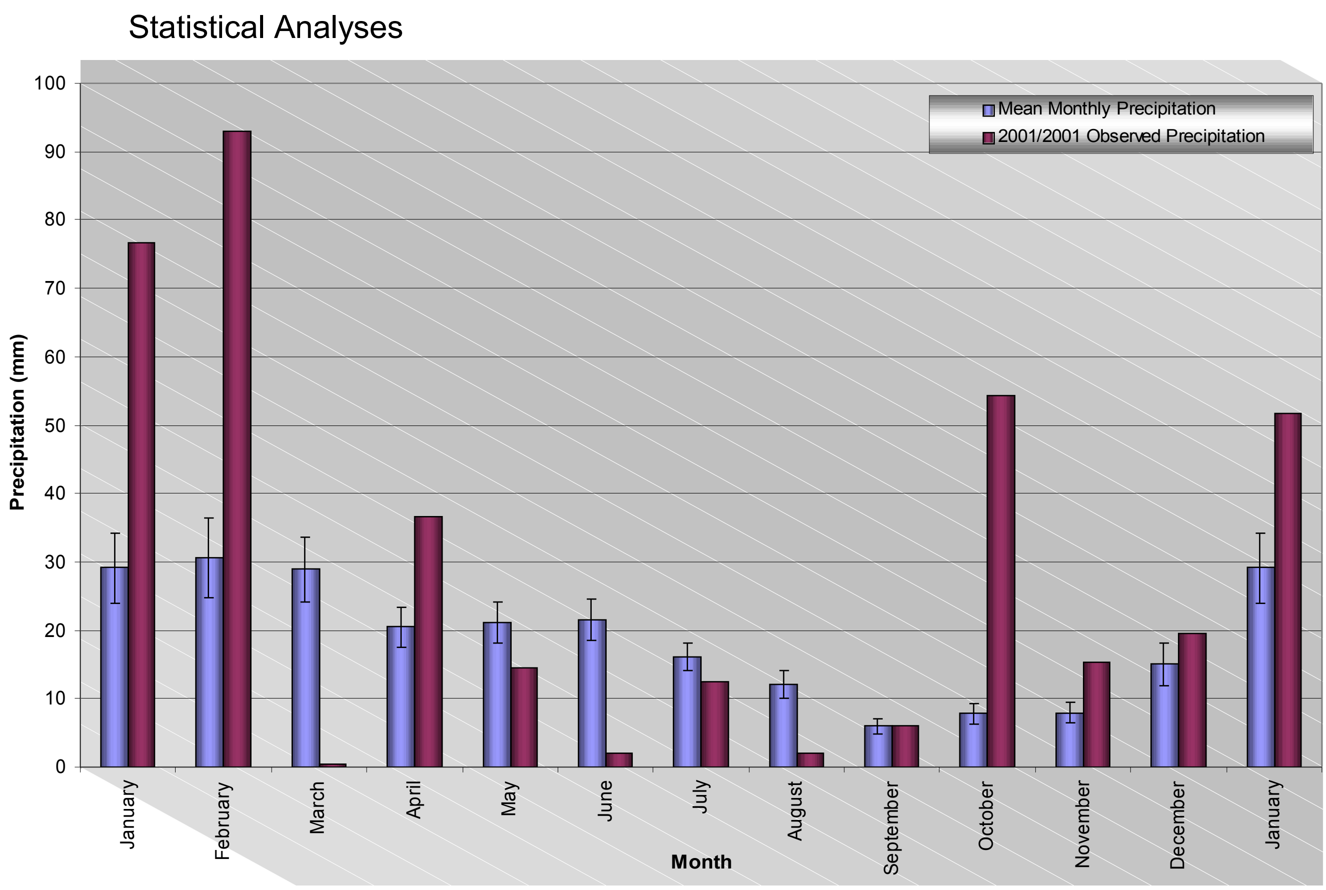


Figure 6. Mean monthly precipitation and observed precipitation for the study area



Regression analyses and significance tests for the relationship between observed rainfall and the measured abundance of rabbits and small mammals are presented in Table 5. These analyses indicate that there was no significant linear relationship between the observed rainfall and rabbit abundance or the observed rainfall and small mammal abundance.

Table 5. Univariate regression analysis and significance tests for the relationship between observed rainfall and the measured abundance of rabbits and small mammals

Relationship	Pearson Product Moment Correlation Coefficient	*F* statistic	*F* level of significance
Observed rainfall v measured rabbit abundance	-0.02813	0.008709	0.927326
Previous month's observed rainfall v measured rabbit abundance	-0.39683	1.869098	0.201522
Observed rainfall v measured small mammal abundance	0.05601	0.034616	0.855789
Previous month's observed rainfall v measured small mammal abundance	-0.33555	1.268769	0.286302

Regression analysis and significance tests for the relationship between imposed and measured environmental variables on bait acceptance by feral cats are presented in Table 6. These analyses indicate that no significant linear relationship exists between the observed rainfall or the previous month's observed rainfall and bait acceptance by feral cats. No significant linear relationship exists between the measured abundance of rabbits or mammals and bait acceptance. However there is a significant linear relationship between the number of sampling periods undertaken and bait acceptance. The cats present accepted baits more readily as more sampling exercises were undertaken. There is also a significant linear relationship between bait acceptance and the mean distance travelled by those cats observed. The greater the mean distance travelled by cats the greater the proportion of cats that accepted baits.

Table 6. Univariate regression analysis and significance tests for the relationship between imposed and measured environmental variables on bait acceptance by feral cats

Measured variable	Pearson Product Moment Correlation Coefficient (r)	*F* statistic	*F* level of significance
Rainfall	-0.4143	2.279266	0.1592913
Previous Month's rainfall	-0.51125	3.538733	0.0893542
Rabbit Abundance	0.189249	0.4086	0.5357652
Small mammal abundance	0.109141	0.132609	0.722645
Number of sampling periods	0.681272	9.527435	0.010348
Mean distance travelled by cats	0.813512	21.52532	0.000717

Regression analysis and significance test for the relationship between the mean distance travelled by cats observed and the number of sampling periods undertaken is presented in Table 7. This analysis indicates that there was also a significant linear relationship between the mean distance travelled by cats observed and the number of sampling periods undertaken. The more sampling periods undertaken, the greater the distances travelled.

Table 7. Univariate regression analysis and significance test for the relationship between the mean distance travelled by cats observed and the number of sampling periods undertaken

	Pearson Product Moment Correlation Coefficient (r)	*F* statistic	*F* level of significance
Number of sampling periods undertaken	0.72715	12.34201	0.004857

Discussion

Bait acceptance by feral cats across the study period was high, but increased and became more consistent from mid autumn onwards (83 – 100% over the period May 2001-January 2002). There was no significant relationship between bait uptake by cats and season/rainfall or prey abundance. The annual rainfall recorded during the study period was greater than the long-term average, however the majority of this rain fell during the summer months with follow-up rainfall in autumn and winter being well below the long-term monthly averages. Rainfall effectiveness rather than average rainfall is the major influence on vegetation growth. Although rainfall is the most important factor influencing the growth of vegetation, temperature plays an important part in limiting its effectiveness by reducing soil moisture during the hot summer months. A pattern of predominantly winter plant growth occurs across the north-eastern Goldfields with effective summer rains being a rare event (Gilligan 1994). Below average autumn and winter rainfall has occurred for at least two years (monthly rainfall data were not available for 1999) in the area. Low rainfall during these seasons may have been inadequate to promote plant growth, which in turn restricted population increases in rabbit and other small mammal species.

In a previous investigation of bait consumption by cats at Peron Peninsula (Algar *et al*. in press), a significant relationship between bait uptake and seasonal environmental factors affecting rabbit abundance was observed. In this earlier study, factors affecting bait uptake were examined over the period from late spring through autumn. It was found that as rabbit abundance declined from 70% presence in late spring to 20% presence in late summer/early autumn, bait uptake by cats increased. The most common rodent on the peninsula *Notomys alexis* was also very abundant at this time with a trap success of 38% being recorded (‘Project Eden’, unpub. data). In comparison with prey availability recorded at Peron Peninsula, rabbit and small mammal abundance at Wanjarri was extremely low throughout the year.

Cats generally exhibit apostatic food selection (preferential consumption of commonly occurring or familiar food items), however they are adept at selecting rarer food items to maintain nutritional balance (Church *et al*. 1996, Bradshaw *et al.* 2000). The preferential predation of certain taxa or food items has also been discussed in relation to energetic balance. The hypothesis is that in addition to maintenance of nutritional balance, preferential predation of certain species or food types is also governed by the balance between the input required to successfully predate a particular species or locate a food item and the energetic benefit gained by consuming that particular item (Kitchener 1991). As suggested by Church *et al*. (1996), cats will accept novel or uncommon food items when there is a nutritional (and/or energetic) advantage but will be apostatic in food selection if the pre-existing prey is common and nutritionally adequate. Therefore novel food items, such as baits, will be readily accepted if the common prey items are nutritionally deficient or energetically expensive to procure (eg low abundance).

There is some evidence from this study that the increase in bait uptake observed was due to the habituation of cats to the non-toxic baits. As the number of sampling periods increased, both the number of baits consumed and the on-track distances travelled by individual cats increased. Individuals may have travelled increased distances, actively searching for baits. The bait medium once initially consumed by individual cats may have been recognised as an energy-rich and highly palatable food source. On subsequent occasions when baits were encountered, a greater amount of time may have been spent actively searching for these food items and the number of baits consumed increased. On-track distances travelled were highest in July, August and September, however this period coincides with the breeding season. Day length controls the oestrous cycle in cats, increasing day length or long days will induce oestrous in cats, or decrease the length of the anoestrous period (Scott and Lloyd–Jacobs 1959). During the breeding season male home ranges increase and overlap to a greater degree. Male cats tend to roam over a large area to compete for receptive females as they are encountered.

Cat control programs conducted on pastoral leases adjacent to Wanjarri Nature Reserve provided the opportunity to examine whether or not bait uptake at specific times by bait 'naive' cats was similar to that recorded on the reserve. On-track deployment of biomarked baits, followed by trapping programs, was conducted at Yakabindie Station in October 2001 (Onus *et al*. 2002) and Barwidgee Station in January 2002 (Fuller *et al*. unpub. data). The percentage of the sample population that consumed baits during these two exercises was 67% (n=18) and 71% (n=21) respectively. In comparison, bait uptake by cats at Wanjarri was higher at 83% and 100% during these respective periods. These two figures are not directly comparable as the trapping programs involved destructive sampling and the sampling of animals that used the transects over a period of days, rather than a single night. Removing animals through trapping may have led to 'new' animals moving on to the transects as ranges were vacated. Sampling over a period of days may have included animals that do not regularly use the transects and therefore may never have encountered baits. The only real comparison is to examine naïve cats, using identical methodology. However it does indicate that effective control of cats is feasible at these locations and that examination of pre-feeding is warranted.

Pre-feeding to increase trap success and/or control efficiency has been used extensively on a wide variety of species. Results from this study suggest that pre-feeding feral cats with non-toxic baits may be worth examining.

In conclusion, bait uptake by feral cats at this site was consistently high throughout the year. To maximise the effectiveness of baiting campaigns it is suggested that the optimum time to conduct these programs is late autumn/winter. At this time, rainfall which will cause degradation of baits is less likely to occur than during the summer months, and the abundance of all prey types, in particular predator-vulnerable young mammalian prey and also reptiles, is at its lowest. The consistently high bait acceptance observed here extends the possibility of predator control to the arid zone. As cats are controlled in target areas, it will be possible to return native animals to their former habitats, allowing fauna recovery programs to proceed that were previously obstructed by predation by feral cats (Short *et al.* 1992; Christensen and Burrows 1994; Gibson *et al.* 1994).

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