Field trial to compare baiting efficacy of *Eradicat*® and *Curiosity*® baits

D. Algar, N. Hamilton, M. Onus and S. Hilmer (Science Division, Woodvale)
S. Comer, C. Tiller, L. Bell and J. Pinder (South Coast Region, Albany)
E. Adams and S. Butler (South Coast Region, Esperance)

Plate 1. Feral cat walking across a monitoring plot at Cape Arid National Park with a predated Southern Brown Bandicoot

INTRODUCTION

Baiting is recognised as the most effective method for controlling feral cats (Short *et al*. 1997; EA. 1999; Algar *et al*. 2002; Algar and Burrows 2004; Algar *et al*. 2007; Algar and Brazell 2008) when there is no risk posed to non-target species. The preferred feral cat bait medium (Algar *et al*. 2007) is similar to a chipolata sausage in appearance — it is approximately 20 g wet-weight, dried to 15 g, blanched and then frozen. The bait is composed of 70 % kangaroo meat mince, 20 % chicken fat and 10 % digest and flavour enhancers that are highly attractive to feral cats (Patent No. AU 781829) (see detailed description in Algar and Burrows 2004).

There are two poison bait products intended for the management of feral cat populations in Australia. When the above bait medium (pH 5-6) is dosed with sodium monofluoroacetate (compound 1080), the bait product is known as *Eradicat*®. When the above bait medium is buffered with sodium bicarbonate to pH neutral-alkaline and dosed with para-aminopropiophenone (PAPP) it is known as *Curiosity*®. *Eradicat* and *Curiosity* are registered trademarks of the Western Australian and Commonwealth governments respectively.

A collaborative project between the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC), the Department of Sustainability and Environment (DSE) and the Department of Environment and Conservation (DEC) has been developing the *Curiosity*® bait product. The project involves bringing together the buffered feral cat bait medium and an encapsulated pellet known as the 'Hard Shell Delivery Vehicle' (HSDV), which contains the toxicant PAPP. The use of the acid-soluble HSDV, in a buffered bait, ensures that the toxin does not disperse throughout the bait but releases in the cat's stomach where it quickly overwhelms the cat's physiological processes (Johnston *et al*. in press). This method of delivering the toxicant also plays a key role in reducing the potential exposure of non-target species. When feeding, feral cats simply shear food items into manageable portions and swallow those portions whole. Thus, they will reliably swallow a pellet that is implanted into a bait. Conversely, most wildlife species process food items more thoroughly in the mouth. This means most animals other than cats tend to reject the HSDV as they eat whereas it is reliably consumed by feral cats (Marks *et al*. 2006; Hetherington *et al*. 2007; Forster 2009;

Johnston unpub. data). Direct injection of PAPP toxin into the bait (i.e. without the pellet delivery device) is not appropriate because it would significantly increase the amount of toxin required and hence significantly increase the risk of non-target poisoning. The pellet delivery device contains about 78 mg of PAPP toxin in pellet form (Johnston *et al*. in press).

A number of cafeteria pen trials have been conducted to test for differences in acceptability of the two bait mediums. These pen trials were conducted at the Perth Cat Haven that provided an opportunity to work with essentially semi-feral cats rather than domestic cats in catteries. Cats in the Haven were housed in individual cages. The cats were offered a choice of the two non-toxic bait mediums. The baits were randomly placed, approximately 20 cm apart. Bait preference was assessed by the medium first selected and consumed by an individual. The baits were offered at the normal time of feeding. All available cats were offered the bait mediums and those which showed interest, initially sniffed each bait type and then selected their choice thus; the experimental design offered a bait choice. Baits were only offered once to any individual cat to avoid any learned behaviour that may have confounded the trial and also to simulate toxic bait delivery in the field. Those cats that did not consume a bait were generally shy and remained in their sleeping boxes. Stress of recent capture and their new surroundings most likely accounted for their behaviour. A number of individuals consumed more than one bait type and the order of preference was also recorded.

A total of 43 cats consumed at least one bait. Analysis of cats' preferences for the two bait mediums, indicated a significant difference in their choice for bait mediums (Chi^2 = 31.8, 1df, P<0.001) with 40 of the cats consuming *Eradicat*® first. The *Eradicat*® bait was the most preferred while the *Curiosity*® bait was the least preferred. However, in 40% of the occasions when the *Eradicat*® bait was consumed first, cats then also chose to eat the *Curiosity*® bait. To test whether this difference is real or an artefact common to cafeteria trials, a trial is required under normal field conditions where bait consumption is assessed in the absence of choice.

The objective of this trial was to compare the efficacy of *Eradicat*® and *Curiosity*® baits in the field to see whether there was any significant difference in baiting efficacy between the two bait types during an operational baiting campaign.

METHODOLOGY

Study area

The trial was conducted in Cape Arid National Park (CANP) and in the adjoining Nuytsland Nature Reserve (NNR). This broad area is located on the south coast of Western Australia (see Figure 1) at 33º 47’ 21”S, 123º 24’ 47”E (CANP centroid) and 33º 45’ 0”S, 123º 41’ 24”E (NNR centroid). The area of conservation estate and baiting cells are described below and provided in Table 1.

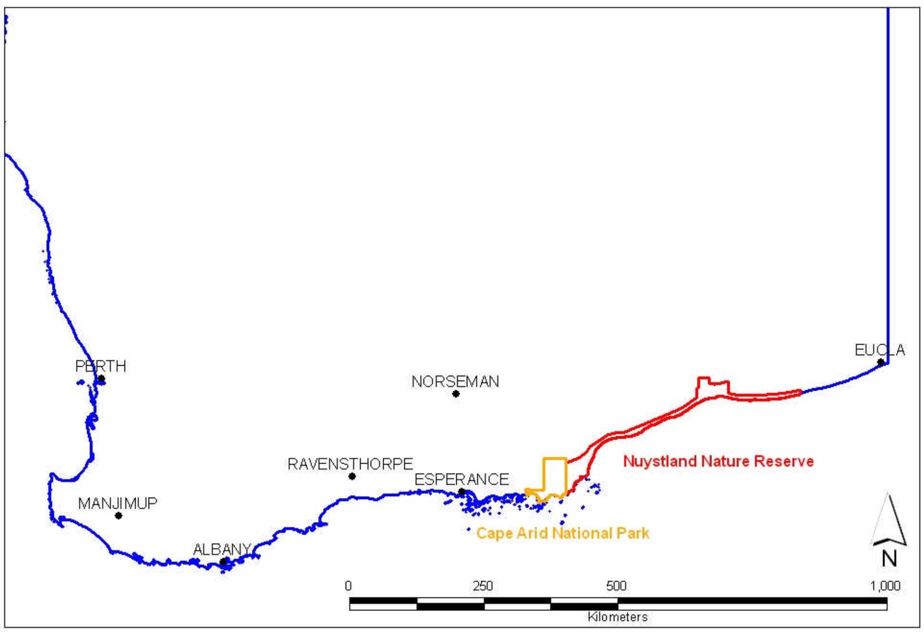

Figure 1. Location of Cape Arid National Park and Nuytsland Nature Reserve

CANP Park experiences a typical Mediterranean climate, with pronounced winter rainfall and frequently long dry summers with years of high summer rainfall associated with trough movement and thunderstorm activity. Average annual rainfall for CANP (Bureau of Meteorology Station 009879) is 596 mm.

Vegetation of the study area is largely *Eucalyptus incrassata* and *E. tetragona* mallee-heath with large patches of proteaceous shrublands. Water courses are dominated by *E.*

occidentalis woodlands, and smaller incursions of *E. redunca* mallee scrub occur in the vicinity of Thomas River.

Table 1. Location and size of baited cells

National Park/Nature Reserve	Area (km^2)	*Eradicat*® baiting cell (km^2)	*Curiosity*® baiting cell (km^2)	% National Park/Nature Reserve baited
CANP	2,781	973	259	44
NNR	6,079	227	-	4
Total	**8,860**	**1,200**	**259**	**16**

This location was selected for the following reasons:-

- This location has not been baited for feral cats in the past and surveys have indicted an abundant feral cat population (Comer and Tiller unpub. data);
- There are no non-target species at risk from the proposed baiting program. A complete mammal, reptile and bird species list present in CANP/NNR is provided in Appendix 1;
- The program will assist in the research and recovery efforts for the Critically Endangered Western Ground Parrot (*Pezoporus* [*wallicus*] *flaviventris*). The South Coast Threatened Birds Recovery Team identified feral cat predation as likely to be the primary key threatening process for the survival of the species (Comer *et al*. 2010);
- Financial support for the overarching program has been provided by DEC's Nature Conservation Service Special Projects funds, DSEWPaC, South Coast NRM and the State NRM funds directed through the department. DEC has also provided considerable 'in-kind' support through Regional, District, and Science Division resources.

CANP/NNR was divided into two study areas. The larger area (1,200 km^2) was baited with *Eradicat*® baits as financial resources were limited and these baits are currently less expensive and easier to manufacture in large volumes. The smaller area (259 km^2) was baited with *Curiosity*® baits. The two sites were selected to provide an area of sufficient size to allow enough cats to be trapped (see below) and their activity to be monitored pre- and post-baiting. The trapping locations and monitoring transects are sufficiently distant from the other baiting application, such that mortality of animals can only be ascribed to the one bait type. The study areas are shown in Figure 2.

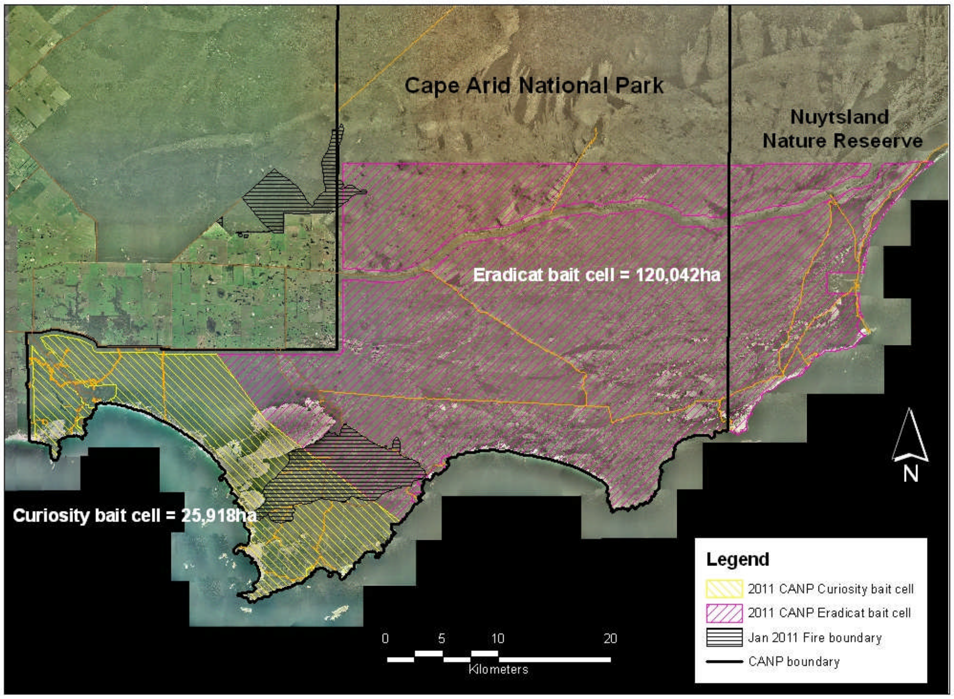

Figure 2. CANP and adjacent NNR baiting cells, *Curiosity*® versus *Eradicat*® bait trial

Cat trapping and radio-collaring

Feral cats were trapped several weeks prior to the baiting program, at locations around the track network, in both study areas (see Figure 3 for trap locations). The trapping technique involved the use of padded leg-hold traps Victor 'Soft Catch'® traps No. 3 (Woodstream Corp., Lititz, Pa.; U.S.A.) with a mixture of cat faeces/urine and a olfactory lure (Cat-astrophic, Outfoxed, Victoria) as the attractant. Trap sets were parallel to the track along the verge at 0.5 km intervals. Open-ended trap sets were employed with two traps positioned lengthwise (adjoining springs touching) and vegetation/sticks used as a barrier along the trap sides. The dates of commissioning and decommissioning traps are provided in Table 2.

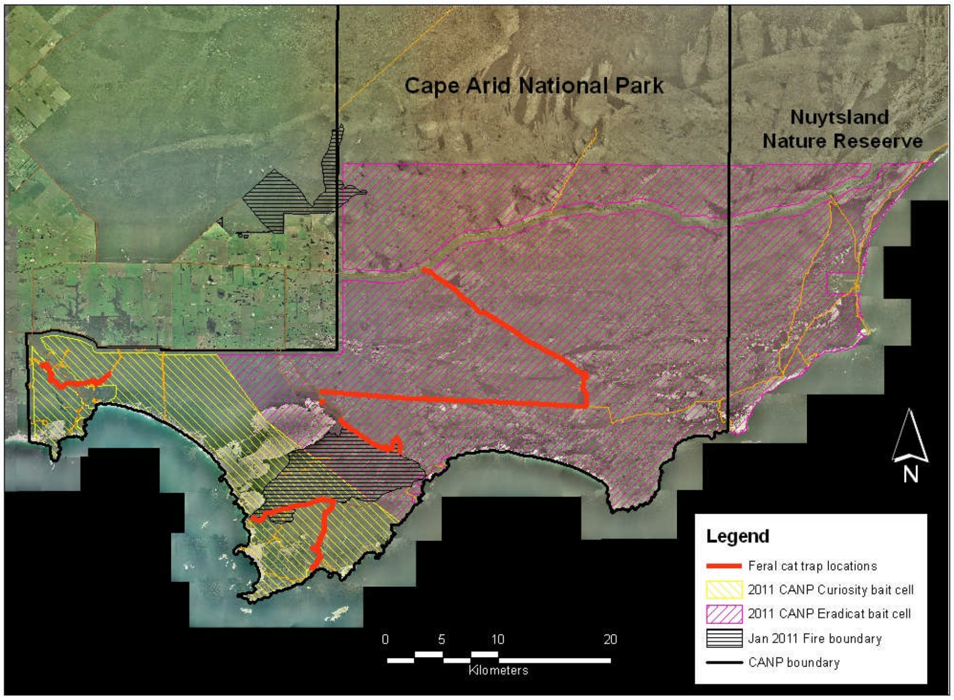

Figure 3. Location of feral cat trap sites in CANP during 2011

Table 2. Dates of commissioning and decommissioning traps

Trap No.	Commissioned	Decommissioned	No. trap nights
TT 1-40	15/2	24/2	360
TT 41-42	16/2	24/2	16
TT 43-48	20/2	24/2	24
P 49-53, P 79-86	20/2	24/2, *P 83	51
P 54-66, P 72-78	21/2	24/2	60
P 67-71	22/2	24/2	10
TR 1-19	15/2	21/2	114
GAB 1-12	15/2	21/2	72
GAB 13-31	16/2	21/2	95
GAB 32-34	20/2	21/2	3
PC 1-17	22/2	24/2, *PC 16	33
TOTAL			**838**

*both traps retrieved 21/2 because of non-target activity

Trapped cats were sedated with an intramuscular injection 4 mg/kg Zoletil 100® (Virbac, Milperra; Australia). All animals captured were sexed and weighed and coat colour recorded; a broad estimation of age (as either kitten, juvenile or adult) was registered using weight as a proxy for age. A VHF radio-telemetry collar with mortality signal (Sirtrack Ltd, New Zealand) was fitted to trapped cats. Cats were released at the site of capture.

Baiting program

To optimise baiting efficacy, it is essential that the baiting campaign was conducted prior to the onset of late autumn/winter rainfall, which long-term weather records suggested began in April/May (Bureau of Meteorology). A dedicated baiting aircraft deployed the baits at previously designated bait drop points. The baiting aircraft flew at a nominal speed of 130 kt and 500 ft (Above Ground Level) and a GPS point is recorded on the flight plan each time bait leaves the aircraft. The bombardier releases a bag of 50 baits into each 1 km map grid, along flight transects 1 km apart (see Figures 4a and b), to achieve an application rate of 50 baits km^{-2}. The ground spread of 50 baits is approximately 250 x 150 m (D. Algar, unpub. data). Under this regime, a total of 60,000 *Eradicat*® baits and 12,950 *Curiosity*® baits were deployed.

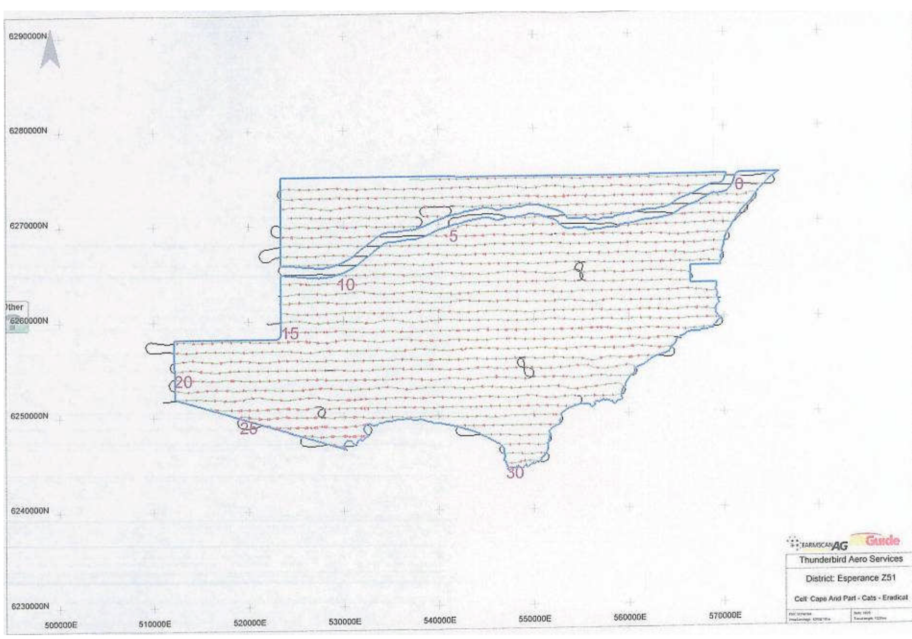

Figure 4a. Bait drop locations in the *Eradicat*® cell

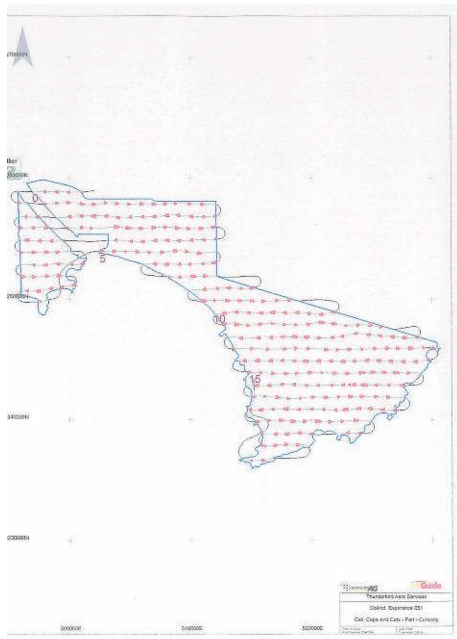

Figure 4b. Bait drop locations in the *Curiosity*® cell

Surveys of cat activity

Two independent methods were used to monitor baiting efficacy. Baiting efficacy was firstly determined from the percentage of radio-collared cats found dead following the baiting program. The second method involved surveys of cat activity at sand plots to derive indices of activity. The difference in indices pre- and post-baiting was then used as a measure of baiting efficacy.

A track survey transect was established along the Thomas River track in the *Curiosity* baited site and along the Pasley track in the *Eradicat* baited zone. The Thomas River transect was 10.0 km in length and in the larger *Eradicat* baited zone, Pasley transect was 15 km long. These two transects provided a broad coverage of the entire area and an efficient and representative sampling of the population using the surrounding habitat. As multiple indexing assessments were to be made through time on the same area, then the same locations were used (Engeman *et al*. 2002).

The Thomas River and Pasley transects comprised 20 and 30 permanently marked sand pads respectively located at 0.5 km intervals (see Figure 5). Each sand pad was constructed from a 1 m patch of sand that covered the width of the road/track; either end of the sand pad was blocked by vegetation that forced animals to walk across the pad. Two types of plots, passive and active plots, were employed to monitor animal presence/absence. Passive plots have no attracting lure and detect animals during the normal course of their movements. These plots often generate sample sizes that are too low to adequately monitor population changes (Fleming *et al*. 2001). The active plots contained a lure to attract animals to the plot and thereby increase the likelihood of detecting animals particularly at low density.

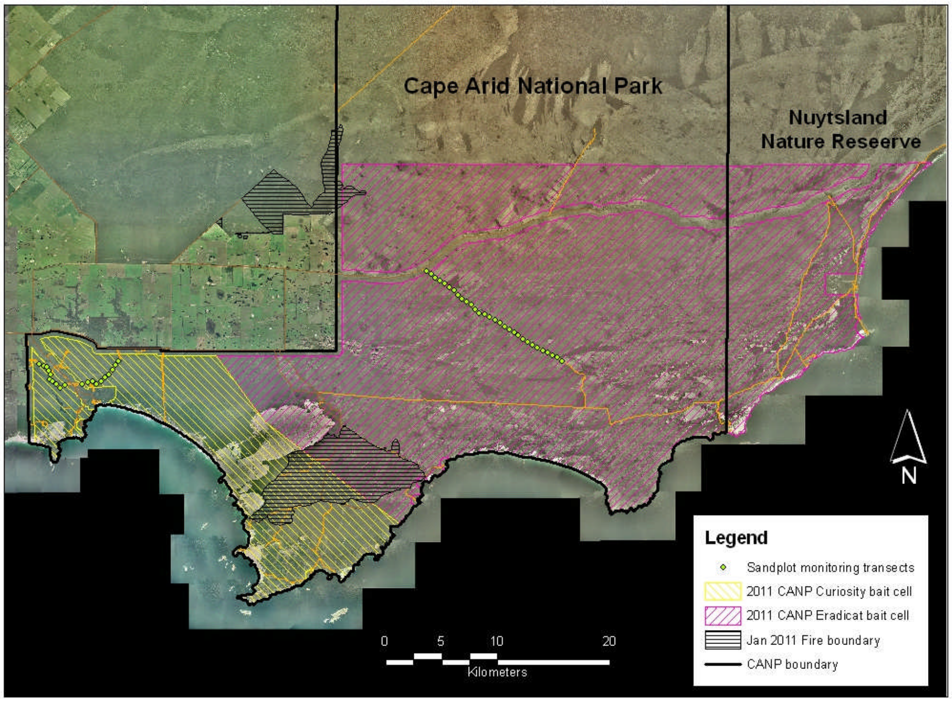

Figure 5. Location of sand plot monitoring transects in CANP

To limit potential short comings of using either plot method, a combination of both plot types was employed. The passive plots were located at the 0.5 km sand pads and the active plots were placed at the 1.0 km sand pads. At the active plots an audio lure (Felid Attracting Phonic, Westcare Industries, Western Australia) was used to attract cats to the sand plots during the two survey periods. The audio lures were removed outside the survey periods.

Each plot was observed for the presence or absence of tracks, as it is not possible to determine the number of intrusions by individual animals onto the plot. Each day, the plots were swept to clear evidence of previous activity. Cat activity at the sand plots was recorded over five nights during two survey periods; these were not consecutive nights because of interruption by rain.

Calculation of indices and analyses

Because individuals typically cannot be identified on the basis of track characteristics, it is customary to ignore the number of detections and simply record whether an animal was detected at the station (Ray and Zielinski 2008). The presence/absence data are more robust to statistical analysis than the total number of detections recorded at a station or multiple-station sample units. Thus in this case, sand plot stations have an index of usage expressed as the mean number of positive plots per night. The 'Plot Activity Index' (PAI) is formed by calculating an overall mean from the daily means (Engeman *et al*. 1998; Engeman 2005). The VARCOMP procedure within the SAS statistical software package produced the variance component estimates.

The efficacy of individual baiting programs for both feral cats and foxes was then assessed by comparing these indices immediately prior to and following individual baiting programs. Data were analysed for significant differences using a 'z'-test Elzinga *et al*. 2001).

RESULTS

Cat trapping and radio-collaring

Twenty-one cats were trapped comprising 12 male and nine females (Table 3). Eleven of these animals were trapped within the *Curiosity*® baiting cell and ten within the *Eradicat*® baiting cell. The location of cat captures is provided in Figure 6. Bodyweight (mean ± s.e.) for males was 4.5 ± 0.2 kg and 3.0 ± 0.1 kg for females. Nineteen radio-collars were available; ten cats were collared in the *Curiosity*® baiting cell, the eleventh cat died in a trap, cause unknown. Nine cats were collared in the *Eradicat*® baiting cell, the tenth cat was released without a collar following processing. All cats appeared to be in excellent body condition and searches for ectoparasites proved negative.

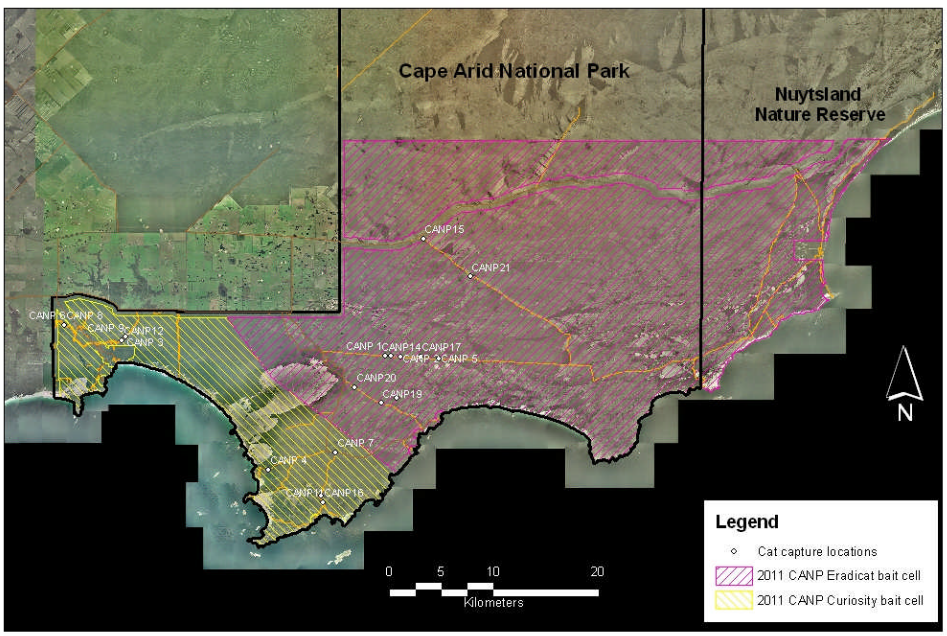

Figure 6. Location of cat captures

Table 3. Capture records of trapped cats

Date	Sample No	Trap No	Sex (M/F)	Weight (kg)	Coat colour	Age	Radio-collar frequency (Mg Htz)
16/2/2011	CANP 1	TT 13	M	4.6	Tabby	Adult	151.5470
16/2/2011	CANP 2	TT 16	F	3.2	Tabby	Adult	151.3480
16/2/2011	CANP 3	TR 18	M	3.9	Tabby	Adult	151.0482
16/2/2011	CANP 4	G 03	F	2.6	Tabby	Sub-adult	151.5292
17/2/2011	CANP 5	TT 28	F	3.3	Tabby	Adult	151.0097
17/2/2011	CANP 6	TR 01	M	4.8	Tabby	Adult	151.4887
17/2/2011	CANP 7	G 17	M	5.2	Tabby	Adult	151.4666
18/2/2011	CANP 8	TR 01	M	3.6	Tabby	Adult	151.0281
18/2/2011	CANP 9	TR 18	F	2.8	Tabby	Adult	151.5087
18/2/2011	CANP10	G 27	M	4.5	Tabby	Adult	151.4480
20/2/2011	CANP11	G 29	M	5.0	Tabby	Adult	151.3893
20/2/2011	CANP12	TR 17	F	2.8	Tabby	Adult	151.3084
20/2/2011	CANP13	TR 18	M	6.0	Tabby	Adult	Died in trap
21/2/2011	CANP14	TT 14	M	4.5	Tabby	Adult	151.3272
21/2/2011	CANP15	P 01	M	4.2	Tabby	Adult	151.0662
21/2/2011	CANP16	G 29	M	4.5	Black	Adult	151.0880
23/2/2011	CANP17	TT 19	F	2.9	Tabby	Adult	151.4093
23/2/2011	CANP18	PC 15	F	2.9	Tabby	Adult	151.4268
23/2/2011	CANP19	PC 10	F	3.4	Tabby	Adult	151.3673
24/2/2011	CANP20	PC 04	M	2.6	Tabby	Sub-adult	151.5885
24/2/2011	CANP21	P 12	F	2.9	Tabby	Adult	No collar

Baits, baiting program and impact

The production of *Eradicat®* baits was completed in November 2010 at the DEC Harvey bait factory and consisted of 60,000 toxic baits for CANP. A further 13,000 *Curiosity®* baits were produced in Victoria by Scientec Research Pty Ltd for the trial comparison between the effectiveness of each bait type. All toxic baits contained Rhodamine B to facilitate the non-target uptake trials.

Eradicat® baits and *Curiosity®* baits were sweated on 18 March. The two flights required to deliver all *Curiosity®* baits were conducted on 20 March. Prior to baiting, the plane was experiencing problems with the GPS program (i.e. not identifying exclusion zones for the cell). On 21 March, rain and low cloud was experienced at CANP during the first bait flight. This reached the Esperance airstrip and delayed the second flight by several hours, in total, only three flights were completed this day. The final two flights to complete delivery of *Eradicat®* baits to CANP were conducted on 22 March. Rainfall (2.0

mm) was recorded on the 20 March and 0.2 mm on 21 March, no rainfall was recorded over the following five days.

The status of radio-collared cats was assessed three weeks after the baiting program and is presented in Table 4. Two of the ten radio-collared cats in the *Curiosity*® bait cell and two of the eight found radio-collared cats in the *Eradicat*® bait cell are presumed to have died from baiting.

Table 4. The status of radio-collared cats following the aerial baiting program

Bait cell	Sample No.	Status
Curiosity®	CANP 3	Alive
"	CANP 4	Dead
"	CANP 6	Alive
"	CANP 7	Alive
"	CANP 8	Alive
"	CANP 9	Alive
"	CANP10	Alive
"	CANP11	Alive
"	CANP12	Alive
"	CANP16	*Not found initially, later found dead
Eradicat®	CANP 1	Alive
"	CANP 2	Alive
"	CANP 5	Alive
"	CANP14	Dead
"	CANP15	Alive
"	CANP17	Dead
"	CANP18	Alive
"	CANP19	Alive
"	CANP20	**Not found
"	CANP21 (no collar)	Unknown

*Mortality date to be checked to confirm death due to baiting

**Radio-collar presumed to have malfunctioned

The activity indices for cats, foxes and varanids before and after baiting are presented in Table 5. The only major impact of the baiting program was on cat activity indices in the *Eradicat*® baiting cell where a significant reduction in activity was recorded ($z = 3.391$, $P<0.001$). Interestingly, cat activity indices increased in the *Curiosity*® baiting cell following baiting although this was not significant ($z = -1.152$, $P=0.125$).

Table 5. Activity indices (mean ± s.e.)

Species	Site	PAI (pooled across active and passive plots)		
		Pre-bait	**Post-bait**	**Significance**
Cat	*Curiosity*®	0.080 ± 0.027	0.140 ± 0.045	z = -1.152, *P*=0.125
	Eradicat®	0.180 ± 0.043	0.027 ± 0.013	z = 3.391, *P*<0.001
Fox	*Curiosity*®	0.010 ± 0.010	0.010 ± 0.010	z = 0.000, *P*=0.500
	Eradicat®	0.007 ± 0.007	0.000 ± 0.000	z = 0.999, *P*=0.159
Varanid	*Curiosity*®	0.020 ± 0.020	0.010 ± 0.010	z = 0.447, *P*=0.372
	Eradicat®	0.053 ± 0.020	0.007 ± 0.006	z = 0.554, *P*=0.290

DISCUSSION

Results from this trial are inconclusive with regard to differences in field acceptability of *Eradicat*® and *Curiosity*® baits. Mortality of radio-collared cats in both baiting cells was low at 25% and 20% in *Eradicat*® and *Curiosity*® zones respectively. Despite this, cat activity indices indicated that baiting had a significant impact in the *Eradicat*® cell with a decline in cat activity following baiting. Conversely, although not significant, cat activity increased in the *Curiosity*® cell post-baiting. The relocation of the sand plot survey transect in the *Curiosity*® bait cell because of fire, see below, was not ideal because of its proximity to the unbaited boundary but limited access prevented placement elsewhere. As a consequence, cats at either end of this transect probably had less opportunity to encounter baits, particularly in the short-term following deployment.

To be able to make valid statistical comparisons of cat activity index scores, it is better to have data from a number of transects across the site, rather than a single continuous circuit. In this way, potential variability in activity across the site is accounted for. When using multiple transects to generate an activity index it is necessary to separate the transects by sufficient distance such that the probability of a single animal being recorded on more than one transect in any single survey period is minimized and therefore the transects are independent sampling units. Unfortunately, a fire within the study area several weeks prior to the commencement of this trial (see Figure 2) with subsequent re-alignment of the baiting cells and the lack of track access across the entire study area precluded the use of multiple transect use. As such, comparison of activity scores pre- and post-baiting within and between baiting cells should be made with caution.

Poor bait uptake by cats in either cell, in comparison with previous trials, was most likely a result of reduced bait attractiveness/palatability. Both feral cat bait types require preparation by thawing and sweating prior to deployment in the field. To have sufficient baits prepared to suit the timing of flights necessitates that many baits are prepared the day prior to delivery. However, poor weather conditions (i.e. wind > 25 kts, rain and low cloud) or issues with the plane or equipment can delay bait delivery which may require storage of prepared baits for a number of days. When this occurs, sweated baits are stored in the Western Shield Bait Truck, which contains a sealed refrigeration unit on the tray. Over a period of a number of days, the lack of air movement in this refrigeration unit can cause mould to develop on the surface of the baits and/or rancidity to commence. In this trial, the longest period between sweating and bait delivery for some baits was four days (the final flights of *Eradicat*® to CANP).

The problem with deploying baits that are developing mould and/or rancidity is exacerbated when baits reach the ground. The dense vegetation and cool and damp conditions produce a micro-climate that increases the rate of bait decay. Decaying baits are not attractive/palatable to cats and bait uptake is significantly reduced. Bait longevity in the field is also compromised and thus quality bait availability over time is condensed.

To improve baiting efficacy in the more temperate regions it is recommended that: -

- An efficient artificial method to sweat baits in the field is developed. Reliance on environmental conditions to sweat baits is likely to result in poor quality baits being distributed;
- A test for bait stability/longevity is undertaken in all future trials to gain some measure of bait availability over time;
- Trials to assess baiting efficiency during late summer are conducted. Despite the prey resource likely to be more abundant during these warmer months, bait integrity and longevity will be improved and therefore potentially bait uptake.

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Appendix 1

Definitions

Sensitivity to 1080

Approximate Lethal Dose50 data (LD_{50}) where LD_{50} is the amount of toxin theoretically required to kill 50% of test animals are standardized to mg pure 1080 kg^{-1}, have been taken from Anon. (2002)[A], Twigg *et al*. (2003)[B] and Martin *et al*. (2002)[C]. Approximate Lethal Dose (ALD) the dose which causes 10% of deaths are provided, in parenthesis, where known from the above references. ALD_{50} data are greater than the ALD by a factor of less than or equal to 1.5 in approximately 80% of species. LD_{50} and ALD data are taken from the most recent source and referenced to the above authors by superscript, rather than from the original work. Where data for different populations differ, they are presented as a range, if unknown, they are left blank. Only data from Western Australian populations have been cited.

Sensitivity to PAPP

Sensitivity of Australian vertebrates included in this analysis was obtained from available literature or from personal comments from past and present researchers investigating this toxicant (eg. IA CRC). Additionally Savarie *et al*. (1983) undertook PAPP studies on several North American species that also exist in Australia. Data for these species is also shown. There is large variation in sensitivity to PAPP both intra and inter genus. As a result no extrapolation of sensitivity levels was made between species that had been tested and those that had not, except to note that similar species had been tested.

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MAMMALS

Common Name	Scientific name	Size (g)	1080 Sensitivity (mg/kg)	PAPP Sensitivity (mg/kg)	Potential for bait consumption	Potential for pellet consumption	Reason for risk assessment / Risk mitigation
Western Grey Kangaroo	*Macropus fuliginosus*	54000		Unknown	No	No	Herbivorous
Gould's Wattled Bat	*Chalinolobus gouldii*	16		Unknown	No	No	Insectivorous
Southern Brown Bandicoot subsp fusciventer	*Isoodon obesulus fusciventer*	1000	18.8 [A], (14.1) [C]	6 CRC	Yes	No	Baits consumed in pen trials *WA Non-target bait acceptance study (Algar 2006)*. 100% pellet rejection *Hetherington et al. (2007)*
Bush Rat	*Rattus fuscipes*	225	17-43 [B] (27.6) [C]	696 CRC	Yes	Limited	Baits consumed in RB trials. 14% animals had low RB exposure on encapsulated RB trials. *Marks et al 2006.* 1 animal tested Nil pellets consumed. *WA ball bearing data-1*
Grey-bellied Dunnart subsp griseoventer	*Sminthopsis griseoventer griseoventer*	25	4.2 [B], (2.82) [B]	Unknown	Yes	No	Too small
Honey-possum	*Tarsipes rostratus*	10		Unknown	No	No	Specialist feeder on pollen and nectar

BIRDS

Common Name	Scientific name	Length (cm)	1080 Sensitivity (mg/kg)	PAPP Sensitivity (mg/kg)	Potential for bait consumption	Potential for pellet consumption	Reason for risk assessment / Risk mitigation
Inland Thornbill	*Acanthiza apicalis*	11.5		unknown	No	No	Too small

Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	13		unknown	No	No	Too small
Rufous Fieldwren Subsp campestris	*Calamanthus campestris campestris*	13		unknown	No	No	Too small
Shy Heathwren	*Hylacola cautus*	14		unknown	No	No	Too small
Redthroat	*Pyrrholaemus brunneus*	11.5		unknown	No	No	Too small
White-browed Scrubwren	*Sericornis frontalis*	13		unknown	No	No	Too small
Weebill	*Smicrornis brevirostris*	9		unknown	No	No	Too small
Brown Goshawk	*Accipiter fasciatus*	50		unknown	No	No	Live prey only
Wedge-tailed Eagle	*Aquila audax*	101	9.1[A]	unknown	No	No	Live prey and carrion, unlikely to recognise bait as food (Algar et al. 2007) only
Swamp Harrier	*Circus approximans*	61		unknown	No	No	Live prey only
Spotted Harrier	*Circus assimilis*	61		unknown	No	No	Live prey only
Black-shouldered Kite	*Elanus axillaris*	38		unknown	No	No	Live prey only
Little Eagle	*Hieraaetus morphnoides*	55		unknown	No	No	Live prey only
Square-tailed Kite	*Lophoictinia isura*	56		unknown	No	No	Live prey only
White-bellied Sea-eagle	*Haliaeetus leucogaster*	90		unknown	No	No	Live prey only
Osprey	*Pandion haliaetus*	65		unknown	No	No	Live prey only
Australian Owlet-nightjar	*Aegotheles cristatus*	24		Unknown	No	No	insectivorous
Sacred Kingfisher	*Todiramphus sanctus*	23		Unknown	No	No	Live prey only
Chestnut Teal	*Anas castanea*	48		Unknown	No	No	Water filter feeder
Grey Teal	*Anas gracilis*	67		Unknown	No	No	Water filter feeder
Australasian Shoveler	*Anas rhynchotis*	53		Unknown	No	No	Water filter feeder
Pacific Black Duck	*Anas superciliosa*	60	11.8[A]	Unknown	No	No	Water filter feeder
Musk Duck	*Biziura lobata*	72		Unknown	No	No	Water filter feeder
Cape Barren Goose	*Cereopsis novaehollandiae*	90		Unknown	No	No	Water filter feeder
Australian Wood/Maned Duck	*Chenonetta jubata*	30	11.8[A]	Unknown	No	No	Water filter feeder
Black Swan	*Cygnus atratus*	140		Unknown	Unlikely	Unlikely	Water filter feeder. Don't bait near watercourses / lakes

Pink-eared Duck	*Malacorhynchus membranaceus*	45	Unknown	No	No	Unlikely to recognise bait as a food source
Australian Shelduck	*Tadorna tadornoides*	74	Unknown	No	No	Water filter feeder / grain
Australasian Darter	*Anhinga novaehollandiae*	94	Unknown	Unlikely	Unlikely	Feeds on fish and crustaceans. Unlikely to recognise bait as food. Don't bait near waterways
Fork-tailed Swift	*Apus pacificus*	19	Unknown	No	No	Insectivorous
Great Egret	*Ardea alba*	100	Unknown	Possible	Possible	May recognise the bait as a food source
White-necked Heron	*Ardea pacifica*	106	Unknown	Possible	Possible	May recognise the bait as a food source
White-faced Heron	*Egretta novaehollandiae*	70	Unknown	Possible	Possible	May recognise the bait as a food source
Nankeen Night Heron	*Nycticorax caledonicus*	64	Unknown	Possible	Possible	May recognise the bait as a food source
Dusky Woodswallow	*Artamus cyanopterus*	18	Unknown	No	No	Insect / nectar feeders
Pied Butcherbird	*Cracticus nigrogularis*	36	Unknown	Possible	Possible	Carrion eaters
Australian Magpie	*Cracticus tibicen*	44	Unknown	Possible	Possible	Carrion eaters
Grey Butcherbird	*Cracticus torquatus*	30	Unknown	Possible	Possible	Carrion eaters
Grey Currawong	*Strepera versicolor*	50	Unknown	Possible	Possible	Carrion eaters

Short-billed Black-cockatoo	*Calyptorhynchus latirostris*	60		Unknown	Unlikely	Unlikely	Feeds on seeds fruit and occasional invertebrates. Unlikely to recognise bait as food source
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	36		Unknown	Unlikely	unlikely	Unlikely to recognise bait as a food source
White-winged Triller	*Lalage sueurii*	18.5		Unknown	Unlikely	unlikely	Too small. Unlikely to recognise bait as a food source
Spotted Nightjar	*Eurostopodus argus*	33		Unknown	No	No	Aerial insectivore.
Emu	*Dromaius novaehollandiae*	200	102.0[A]	Unknown	Possible	Possible	Eats some carrion. May see bait as food source (Algar et al. 2007), PAPP tolerance (Johnston unpub. data)
Red-capped Plover	*Charadrius ruficapillus*	16		Unknown	No	No	Too small
Hooded Dotterel/Hooded Plover	*Thinornis rubricollis*	23		Unknown	Possible	Possible	Includes invertebrates and small animals in diet. May recognise bait as food
Red-kneed Dotterel	*Erythrogonys cinctus*	19		Unknown	No	No	Too small
Banded Lapwing	*Vanellus tricolor*	28		Unknown	Possible	Possible	Includes invertebrates and small animals in diet. May recognise bait as food
Rufous Treecreeper	*Climacteris rufa*	17.5		Unknown	No	No	Insectivore. Too small
Crested Pigeon	*Ocyphaps lophotes*	34	23.5[A]	Unknown	No	No	Granivore
Common Bronzewing	*Phaps chalcoptera*	36	37.6[A]	Unknown	No	No	Granivore

Brush Bronzewing	*Phaps elegans*	31		Unknown	No	No	Granivore
Little Crow	*Corvus bennetti*	48	12.8[A]	Unknown	Yes	Unlikely	Omnivorous carrion eater. May reject pellet if similar to *C. coronoides*
Australian Raven	*Corvus coronoides*	52		129 *CRC* ***	Yes	Unlikely	Pellet rejected 37/40 Pellet consumed 3/40. *(Johnston unpub. data)*
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	27		Unknown	Possible	Possible	Predominant insectivore but may take small vertebrates.
Pallid Cuckoo	*Cacomantis pallidus*	33		Unknown	Possible	Possible	Predominant insectivore but may take small vertebrates.
Horsfield's Bronze-cuckoo	*Chalcites basalis*	17		Unknown	Possible	Possible	Predominant insectivore but may take small vertebrates.
Shining Bronze-cuckoo	*Chalcites lucidus*	18		Unknown	No	No	Too small
Black-eared Cuckoo	*Chalcites osculans*	21		Unknown	No	No	Too small
Wandering Albatross	*Diomedea exulans*	135		Unknown	No	No	Eats at and from the sea. Don't bait on shoreline
Yellow-nosed Albatross	*Thalassarche chlororhynchos*	82		Unknown	No	No	Eats at and from the sea. Don't bait on shoreline
Red-eared Firetail	*Stagonopleura oculata*	13		Unknown	No	No	Too small
Zebra Finch	*Taeniopygia guttata*	10		Unknown	No	No	Too small
Brown Falcon	*Falco berigora*	50	30.1[A]	Unknown	Unlikely	Unlikely	Unlikely to recognise bait as a food source

Nankeen Kestrel/Australian Kestrel	*Falco cenchroides*	35		Unknown	Unlikely	Unlikely	Unlikely to recognise bait as a food source
Australian Hobby	*Falco longipennis*	35		Unknown	Unlikely	Unlikely	Unlikely to recognise bait as a food source
Sooty Oystercatcher	*Haematopus fuliginosus*	52		Unknown	No	No	Unlikely to recognise bait as a food source. Feeds on shoreline. Don't bait shoreline
Pied Oystercatcher	*Haematopus longirostris*	51		Unknown	No	No	Unlikely to recognise bait as a food source. Feeds on shoreline. Don't bait shoreline
White-backed Swallow	*Cheramoeca leucosterna*	15		Unknown	No	No	Aerial insectivore.
Welcome Swallow	*Hirundo neoxena*	15		Unknown	No	No	Aerial insectivore.
Tree Martin	*Petrochelidon nigricans*	14		Unknown	No	No	Aerial insectivore.
Crested Tern	*Thalasseus bergii*	48		Unknown	possible	Possible	May recognise bait as a food source
Caspian Tern	*Hydroprogne caspia*	55		Unknown	possible	Possible	May recognise bait as a food source
Kelp Gull	*Larus dominicanus*	60		Unknown	possible	Possible	May recognise bait as a food source
Pacific Gull	*Larus pacificus*	66		Unknown	possible	Possible	May recognise bait as a food source
Silver Gull	*Chroicocephalus novaehollandiae*	43		Unknown	possible	Possible	May recognise bait as a food source
Blue-breasted Fairy-wren	*Malurus pulcherrimus*	15		Unknown	No	No	too small
Southern Emu-wren	*Stipiturus malachurus*	19		Unknown	No	No	too small
Rufous Songlark	*Cincloramphus mathewsi*	17		Unknown	No	No	too small
Malleefowl	*Leipoa ocellata*	61	94.0^{A}	Unknown	Possible	Possible	Ground forager. May see bait as a food source

Western Spinebill	*Acanthorhynchus superciliosus*	15	Unknown	No	No	Frugivore, Nectivore
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	26	Unknown	No	No	Frugivore, Nectivore
Red Wattlebird	*Anthochaera carunculata*	36	Unknown	No	No	Frugivore, Nectivore
Western Wattlebird	*Anthochaera lunulata*	31	Unknown	No	No	Frugivore, Nectivore
White-fronted Chat	*Epthianura albifrons*	13	Unknown	No	No	Frugivore, Nectivore
Purple-gaped Honeyeater	*Lichenostomus cratitius*	19	Unknown	No	No	Frugivore, Nectivore
White-eared Honeyeater	*Lichenostomus leucotis*	22	Unknown	No	No	Frugivore, Nectivore
Yellow-plumed Honeyeater	*Lichenostomus ornatus*	16	Unknown	No	No	Frugivore, Nectivore
Singing Honeyeater	*Lichenostomus virescens*	22	Unknown	No	No	Frugivore, Nectivore
Brown Honeyeater	*Lichmera indistincta*	15	Unknown	No	No	Frugivore, Nectivore
Yellow-throated Miner	*Manorina flavigula*	27.5	Unknown	No	No	Frugivore, Nectivore
Brown-headed Honeyeater	*Melithreptus brevirostris*	14	Unknown	No	No	Frugivore, Nectivore
White-naped Honeyeater	*Melithreptus lunatus*	15	Unknown	No	No	Frugivore, Nectivore
White-cheeked Honeyeater	*Phylidonyris niger*	18	Unknown	No	No	Frugivore, Nectivore
New Holland Honeyeater	*Phylidonyris novaehollandiae*	18	Unknown	No	No	Frugivore, Nectivore
White-fronted Honeyeater	*Purnella albifrons*	18	Unknown	No	No	Frugivore, Nectivore
Tawny-crowned Honeyeater	*Gliciphila melanops*	17	Unknown	No	No	Frugivore, Nectivore
Rainbow Bee-eater	*Merops ornatus*	28	Unknown	No	No	Insectivore
Magpie-lark	*Grallina cyanoleuca*	30	Unknown	Possible	Possible	May recognise bait as a food source
Restless Flycatcher	*Myiagra inquieta*	21	Unknown	No	No	Too small
Australian Pipit/Richard's Pipit/Groundlark	*Anthus novaeseelandiae*	19	Unknown	No	No	Too small
Varied Sittella	*Daphoenositta chrysoptera*	12.5	Unknown	No	No	Too small
Australian Bustard	*Ardeotis australis*	150	Unknown	Yes	Yes	May recognise bait as a food source
Grey Shrike-thrush	*Colluricincla harmonica*	26	Unknown	Possible	Possible	May recognise bait as a food source
Crested Bellbird	*Oreoica gutturalis*	23	Unknown	Possible, but unlikely due to size	Possible, but unlikely due to size	May recognise bait as a food source
Golden Whistler	*Pachycephala pectoralis*	18.5	Unknown	No	No	Predominantly insectivorous
Spotted Pardalote	*Pardalotus punctatus*	10	Unknown	No	No	Too small

Striated Pardalote	*Pardalotus striatus*	11.5	Unknown	No	No	Too small
Australian Pelican	*Pelecanus conspicillatus*	190	Unknown	Possible	Possible	May recognise bait as a food source. Don't bait near water bodies
Southern Scrub-robin	*Drymodes brunneopygia*	23	Unknown	No	No	Too small
Eastern Yellow Robin	*Eopsaltria australis*	16	Unknown	No	No	Too small
Jacky Winter	*Microeca fascinans*	14	Unknown	No	No	Too small
Hooded Robin	*Melanodryas cucullata*	17	Unknown	No	No	Too small
Red-capped Robin	*Petroica goodenovii*	12	Unknown	No	No	Too small
Scarlet Robin/Pacific Robin	*Petroica multicolor*	14	Unknown	No	No	Too small
Great Cormorant	*Phalacrocorax carbo*	92	Unknown	Unlikely	Unlikely	Predominant fish eater. Don't bait near waterways
Black-faced Cormorant	*Phalacrocorax fuscescens*	70	Unknown	Unlikely	Unlikely	Predominant fish eater. Don't bait near waterways
Pied Cormorant	*Phalacrocorax varius*	80	Unknown	Unlikely	Unlikely	Predominant fish eater. Don't bait near waterways
Little Pied Cormorant	*Microcarbo melanoleucos*	64	Unknown	Unlikely	Unlikely	Predominant fish eater. Don't bait near waterways
Brown Quail	*Coturnix ypsilophora*	22	Unknown	No	No	Too small
Tawny Frogmouth	*Podargus strigoides*	50	Unknown	No	No	Unlikely to recognise the bait as a food source
Great Crested Grebe	*Podiceps cristatus*	61	Unknown	No	No	Feeds on fish and tadpoles. Don't bait near water
Hoary-headed Grebe	*Poliocephalus poliocephalus*	30	Unknown	No	No	Feeds on fish and tadpoles. Don't bait near water

Australasian Grebe	*Tachybaptus novaehollandiae*	26		Unknown	No	No	Feeds on fish and tadpoles. Don't bait near water
White-browed Babbler	*Pomatostomus superciliosus*	22		Unknown	Possible	Possible	Ground feeder - invertebrates spiders reptiles. May recognise bait as a food
Cape Petrel	*Daption capense*	40		Unknown	No	No	Feeds at sea. Don't bait on shoreline
Great-winged Petrel	*Pterodroma macroptera*	43		Unknown	No	No	Feeds at sea. Don't bait on shoreline
Soft-plumaged Petrel	*Pterodroma mollis*	36		Unknown	No	No	Feeds at sea. Don't bait on shoreline
Western or Australian Ringneck	*Barnardius zonarius*	37	10.8[A]	Unknown	No	No	Granivorous
Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*	17		Unknown	No	No	Granivorous
Budgerigar	*Melopsittacus undulatus*	20		Unknown	No	No	Granivorous
Elegant Parrot	*Neophema elegans*	24		Unknown	No	No	Granivorous
Rock Parrot	*Neophema petrophila*	23		Unknown	No	No	Granivorous
Scarlet-chested Parrot	*Neophema splendida*	22		Unknown	No	No	Granivorous
Ground Parrot Subsp flaviventris	*Pezoporus wallicus flaviventris*	32		Unknown	No	No	Granivorous
Mulga Parrot	*Psephotus varius*	31		Unknown	No	No	Granivorous
Regent Parrot	*Polytelis anthopeplus*	41	11.8[A]	Unknown	No	No	Granivorous
Chestnut-backed Quail-thrush	*Cinclosoma castanotum*	24		Unknown	No	No	Insectivore
Eurasian Coot	*Fulica atra*	38		Unknown	Unlikely	Unlikely	Water bird. Don't bait near watercourses
Purple Swamphen	*Porphyrio porphyrio*	48		Unknown	Unlikely	Unlikely	Water bird. Don't bait near watercourses
Australian Spotted Crake	*Porzana fluminea*	23		Unknown	Unlikely	Unlikely	Water bird. Don't bait near watercourses
Spotless Crake	*Porzana tabuensis*	21		Unknown	Unlikely	Unlikely	Water bird. Don't bait near watercourses
Banded Stilt	*Cladorhynchus leucocephalus*	45		Unknown	Unlikely	Unlikely	Predominantly water feeders. Don't bait near water bodies.

Black-winged Stilt	*Himantopus himantopus*	38	Unknown	Unlikely	Unlikely	Predominantly water feeders. Don't bait near water bodies.
Red-necked Avocet	*Recurvirostra novaehollandiae*	48	Unknown	Unlikely	Unlikely	Predominantly water feeders. Don't bait near water bodies.
Grey or New Zealand Fantail	*Rhipidura fuliginosa*	17	Unknown	No	No	Aerial insectivore
Willie Wagtail	*Rhipidura leucophrys*	22	Unknown	No	No	Aerial insectivore
Red-necked Stint	*Calidris ruficollis*	16	Unknown	Unlikely	Unlikely	Predominantly beach / mudflat feeders. Don't bait near water bodies or beaches
Sanderling	*Calidris alba*	21	Unknown	Unlikely	Unlikely	Predominantly beach / mudflat feeders. Don't bait near water bodies or beaches
Sharp-tailed Sandpiper	*Calidris acuminata*	21	Unknown	Unlikely	Unlikely	Predominantly beach / mudflat feeders. Don't bait near water bodies or beaches
Bar-tailed Godwit	*Limosa lapponica*	46	Unknown	Unlikely	Unlikely	Predominantly beach / mudflat feeders. Don't bait near water bodies or beaches
Eastern Curlew	*Numenius madagascariensis*	65	Unknown	Unlikely	Unlikely	Predominantly beach / mudflat feeders. Don't bait near water bodies or beaches

Whimbrel	*Numenius phaeopus*	43		Unknown	Unlikely	Unlikely	Predominantly beach / mudflat feeders. Don't bait near water bodies or beaches
Grey-tailed Tattler	*Tringa brevipes*	27		Unknown	Unlikely	Unlikely	Predominantly beach / mudflat feeders. Don't bait near water bodies or beaches
Common Greenshank	*Tringa nebularia*	34		Unknown	Unlikely	Unlikely	Predominantly beach / mudflat feeders. Don't bait near water bodies or beaches
Common Sandpiper	*Actitis hypoleucos*	22		Unknown	Unlikely	Unlikely	Predominantly beach / mudflat feeders. Don't bait near water bodies or beaches
Little Penguin	*Eudyptula minor*	45		Unknown	No	No	Feeds at sea. Don't bait on shoreline
Southern Boobook / Morepork	*Ninox novaeseelandiae*	36		Unknown	Unlikely	Unlikely	May not recognise bait as a food source
Silvereye	*Zosterops lateralis*	12.5		Unknown	No	No	insectivore. Frugivore
Painted Button-quail	*Turnix varius*	19		Unknown	No	No	Too small
Little Button-quail	*Turnix velox*	14		Unknown	No	No	Too small
Barn Owl	*Tyto alba*	40	21.8[A]	Unknown	Unlikely	Unlikely	Unlikely to recognise bait as a food source

REPTILES

NAMES VARIOUS	Scientific name	Length (cm)	1080 Sensitivity (mg/kg)	PAPP Sensitivity (mg/kg)	Potential for bait consumption	Potential for pellet consumption	Reason for risk / Risk mitigiation
Ornate Dragon	*Ctenophorus ornatus*	8		Unknown	No	No	Too small
Claypan Dragon	*Ctenophorus salinarum*	7		Unknown	No	No	Too small
Bardick	*Echiopsis curta*	60 total		Unknown	Unlikely	Unlikely	May not recognise bait as food
Dugite Subsp affinis	*Pseudonaja affinis affinis*	150 total		Unknown	Unlikely	Unlikely	May not recognise bait as food
Western Crowned Snake	*Drysdalia coronata*	40 total		Unknown	Unlikely	Unlikely	May not recognise bait as food
Marbled Gecko	*Christinus marmoratus*	7		Unknown	No	No	Too small
Bynoe's Gecko	*Heteronotia binoei*	5		Unknown	No	No	Too small
Three-lined Knob-tail	*Nephrurus levis*	8		Unknown	No	No	Too small
Thick-tailed Gecko	*Underwoodisaurus milii*	8		Unknown	No	No	Too small
Marble-faced Delma	*Delma australis*	8		Unknown	No	No	Too small
Western Three-lined Skink	*Acritoscincus trilineata*	6		Unknown	No	No	Too small
Cryptoblepharus pulcher Subsp clarus	*Cryptoblepharus pulcher clarus*	Unknown					
Common South-west Ctenotus	*Ctenotus labillardieri*	6		Unknown	No	No	Too small
Barred Wedgesnout Ctenotus	*Ctenotus schomburgkii*	4.5		Unknown	No	No	Too small
King's Skink	*Egernia kingii*	20		Unknown	No	No	Too small
Southern Sand-skink	*Egernia multiscutata*	8		Unknown	No	No	Too small
South-western Crevice-skink	*Egernia napoleonis*	12		Unknown	No	No	Too small
Lowlands Earless Skink Subsp peronii	*Hemiergis peronii peronii*	5.5		Unknown	No	No	Too small
Southern Slider	*Lerista dorsalis*	6.5		Unknown	No	No	Too small
South-western Slider Subsp intermedia	*Lerista microtis intermedia*	5		Unknown	No	No	Too small
Shrubland Morethia Skink	*Morethia obscura*	4.5		Unknown	No	No	Too small

Bobtail Skink Subsp rugosa	*Tiliqua rugosa rugosa*	25	800.0A	Unknown	Yes	Possible	Carion eater. Likely to view baits as food source. Lay baits during cooler months when not active
Southern Blind Snake	*Ramphotyphlops australis*	50 total		Unknown	No	No	Termite / Ant eater. Unlikely to identify bait as food
Heath Monitor / Rosenberg's Monitor	*Varanus rosenbergi*	100 total	235.0A	3 *CRC*	Yes	Possible	Carnivore. Ground feeding. May perceive bait as food. Bait in cooler months when less active. Highly tolerant to 1080