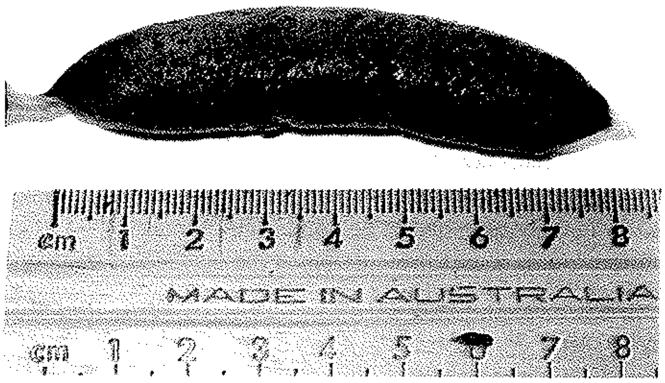
A summary of the research undertaken to identify non-target risks in the use of the feral cat bait *Eradicat*, and encapsulation of the toxin.



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Feral Cat Baits and Non-target Species

A comprehensive and carefully designed series of cafeteria pen trials with stray cats and subsequent field trials with feral cats have been conducted in an endeavour to develop a bait medium that was attractive to feral cats, capable of carrying a toxin, relatively easily and cheaply manufactured and could be deployed aerially over broadscale areas (Friend and Algar 1993; 1994a and b; 1995; Algar and Sinagra 1995; 1996 a, b and c). Initially, a number of bait media, representing a broad choice in physical form and type, were examined for acceptability. A range of flavour enhancers was then added to the most preferred bait medium to assess whether acceptability could be further improved. These initial trials indicated the suitability of kangaroo meat as a bait medium and early trials conducted in the Gibson Desert (Burrows *et al.* 2003; Algar and Burrows 2004) using a prototype bait consisting of a 30-40 g, fresh kangaroo meat chunk confirmed bait acceptance by feral cats. Using kangaroo meat chunks as baits however presented a number of problems in bait manufacture and field application: -

a). provision of standard sized kangaroo meat chunks precluded automation of bait production as the baits could only be cut manually;
b). manual production of baits was labour intensive and resulted in considerable wastage of meat;
c). dosing the baits with the toxin had to be performed manually;
d). it was difficult to provide a uniform coating of the surface of baits with flavour enhancers and in the presence of rain the coating would wash off;
e). the coating made it extremely difficult to avoid baits clumping together when deploying them in the field;
f). finally, the lean kangaroo meat would dry quickly in the sun, even during the cooler months, and become too hard within a short time to be acceptable to feral cats.

To overcome these problems, the use of a kangaroo meat sausage was assessed as a suitable alternative to the kangaroo meat chunk. These investigations culminated in the development and patenting of a novel feral cat bait that is proving highly effective in experimental and operational baiting programs to control feral cats (see Review, Algar and Burrows 2004). Paralleling this has been the development of an automated bait manufacturing process including the incorporation of a toxin (1080). These baits are now routinely manufactured at the CALM Bait Factory in Harvey. The bait is similar to a chipolata sausage in appearance, approximately 20 g wet-weight, dried to 15 g, blanched (that is, placed in boiling water for one minute) and then frozen. This bait is composed of 70 % kangaroo meat mince, 20 % chicken fat and 10 % digest and flavour enhancers (Patent No. AU13682/01). Toxic feral cat baits are dosed at 4.5 mg of sodium monofluoroacetate (compound 1080) per bait. The toxin is injected as a solution into the bait medium. Prior to laying, feral cat baits are 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 feral cat baits are sprayed, during the sweating process, 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 ant attack and the deterrent to bait acceptance from the physical presence of ants on and around the bait medium.

In conjunction with developing a new bait medium, it was essential that a comprehensive assessment of the potential risk of the feral cat bait to non-target species be undertaken and devise methods to reduce exposure to the toxin where possible. The risk assessment is in part required to gain Australian Pesticides and Veterinary Medicines Authority (APVMA) registration of the bait as well as to ensure the protection of native fauna. This research is described below.

Bait Acceptance Trials by Non-target Species

Background

A desktop evaluation was conducted to assess the likely risk to non-target species. Species risk assessment was based on several factors: - their degree of tolerance to the toxin and their known food preferences suggesting that they were likely to consume a bait. Bird and reptile species are much less susceptible than mammals to 1080 (McIlroy 1984; McIlroy *et al*. 1985: Calver *et al*. 1989a). In addition to this tolerance to the toxin, on-track baiting programs, conducted throughout the year, have indicated only several bird and reptile species have shown any significant interest in the baits (Algar *et al*. 2002: Algar *et al*. in press). These trials have indicated that Corvids, Emus (*Dromaius novaehollandiae*), Varanids and Bobtail Skinks (*Tiliqua rugosa*) are the principal non-target species responsible for bait removal. The 1080 tolerance of three of these species is categorized as extremely tolerant (King 1990) with LD_{50}s (mg/kg), described later, of 102, 50 and 500-800 for Emus, Sand Monitors (*Varanus gouldii*) and Bobtail Skinks respectively. The 1080 tolerance for Corvids is described as moderate with a LD_{50} of 12.8mg/kg for the Little Crow (*Corvus bennetti*) (Anon. 2002).

It is possible that the impact of non-target uptake, during the above studies, was amplified by a certain level of learnt behaviour. That is, bait placement on the various transects allowed association between transect alignment and/or vehicular activity and the presence of a highly palatable food source. Vehicular activity, in itself, often creates a focus of activity for carrion-eaters as (particularly when drags are used) it regularly results in the death of invertebrates, slower-moving Agamids and Skinks, as well as fossorial reptiles. The method of bait distribution (a) and timing of baiting campaigns (b) are also likely to significantly reduce bird and reptile consumption of baits.

a) Bait deployment in most baiting campaigns is conducted from an aircraft over broad-scale areas rather than along vehicle tracks thereby reducing the visibility and thus accessibility of baits to birds.

b) Baiting campaigns are generally conducted at times when reptiles are less active and therefore less likely to find and consume baits. Research into bait uptake by feral cats has indicated a temporal variability in bait consumption in areas influenced by Mediterranean climatic regimes (Algar and Angus 2000; Algar *et al*. in press). This variability is correlated with the availability of prey (particularly where rabbits are the primary prey), which is a function of season/rainfall. In these areas, the optimum baiting period occurs in the drier autumn/early winter before the onset of winter rains when young, predator-vulnerable prey are not present. 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, it has been observed that the time and intensity of rainfall events determines the abundance of many prey species, particularly mammals and birds (e.g., see Morton 1990). Research conducted in the arid zone has suggested that the optimum time to conduct baiting programs and maximize their effectiveness is under cool, dry conditions in winter (Algar *et al*. 2002a). At this time rainfall, which will cause degradation of feral cat baits is less likely to occur than during the summer months, and the abundance and activity of all prey types, in particular predator-vulnerable young mammalian prey and reptiles, is at its lowest and bait degradation due to rainfall, ants and to hot, dry weather, is significantly reduced.

The combination of factors associated with degree of tolerance to 1080 and baiting methodologies would indicate that bird and reptile species are highly unlikely to be at risk from feral cat baiting programs. This is not the case for mammals, as the sensitivity to 1080 for many species tends to be much higher than for birds and reptiles. The degree to which 1080 tolerance has developed within native mammal populations is in the order of herbivorous > omnivorous > carnivorous species (Twigg and King 1991). The level of tolerance of different populations within a species may also vary depending on the degree of exposure to the toxin during the course of their evolution and to the extent of their current and previous exposure (Op cit.).

The risk assessment investigation has broadly defined a range of species potentially at risk from operational baiting campaigns with the focus on mammal species. Native mammal species whose known food preferences suggest that they may consume a bait are presented in Table 1. The species list is taken from Western Australian Museum Mammals Checklist (last updated 14th December 2001) and includes several listed herbivores (gray shaded). Weight ranges are taken from Strahan (1983) and Menkhorst and Knight (2001). Approximate Lethal Dose$_{50}$ 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 Calver *et al.* (1989b) [A]; King (1990)[B]; Martin and Twigg (2002)[C]; Martin *et al*. (2002) [D]; Anon. (2002) [E] and Twigg *et al*. (2003)[F]. Approximate Lethal Dose (ALD) the dose which causes 10% of deaths are provided, in parenthesis, where known from the above references. LD_{50} data are greater than the ALD by a factor of less than or equal to 1.5 in approximately 80% of species (McIlroy 1981; 1984; Calver *et al*. 1989b). 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.

Table 1. Species potentially at risk from feral cat baits

Family Dasyuridae		**Body Weight (g)**	**Approximate LD_{50} and ALD values (mg/kg)**
Chuditch	*Dasyurus geoffroui*	700-2000	7.1[F]
Northern Quoll	*D. hallucatus*	300-1000	7.1 [F]
Ampurta	*Dasycercus hilleri*		
Mulgara	*D. cristicauda*	60-170	4.9 [F], (3.27) [F]
Yellow-footed Antechinus (Mardo)	*Antechinus flavipes leucogaster*	20-75	11 .8[E]
Dibbler	*Parantechinus apicalis*	40-100	35.3 [F], (23.5) [F]
Red-tailed Phascogale	*Phascogale calura*	38-70	16.5 [F], (14.1)[D]
Northern brush-tailed Phascogale	*P. tapoatafa pirata*	110-310	
Southern brush-tailed Phascogale	*P. tapoatafa tapoatafa*	110-310	7.3 [F], (4.84) [F]
Kaluta	*Dasykaluta rosamonda*	20-40	
Kultarr	*Antechinomys laniger*	20-30	
Wongai Ningaui	*Ningaui ridei*	6-13	(3)[A]
Pilbara Ningaui	*N. timealeyi*	2-10	(12) [A]
Mallee Ningaui	*N. yvonneae*	4-10	(3) [A]
Long-tailed Planigale	*Planigale ingrami*	4-6	

Family Dasyuridae (cont)		**Body Weight (g)**	**Approximate LD_{50} and ALD values (mg/kg)**
Common Planigale	*P. maculata*	6-12	(4) [A]
Fat-tailed Pseudantechinus	*Pseudantechinus macdonnellensis*	20-45	
Nimbing Pseudantechinus	*P. ningbing*	15-33	
Rory's Pseudantechinus	*P. roryi*		
Woolley's Pseudantechinus	*P. woolleyae*	18-43	
Butler's Dunnart	*Sminthopsis butleri*	10-20	
Lesser Hairy-footed Dunnart	*S. youngsoni*	9-14	
Stripe-faced Dunnart	*S. macroura*	15-25	
Little Long-tailed Dunnart	*S. dolichura*	10-20	(8) [A]
Gilbert's Dunnart	*S. gilberti*	14-25	
White-tailed Dunnart	*S. granulipes*	18-35	11.9 [E], (>7.9) [D]
Grey-bellied Dunnart	*S. griseoventor*	15-25	4.2 [F], (2.82) [F]
Hairy-footed Dunnart	*S. hirtipes*	13-19	(7) [B]
Ooldea Dunnart	*S. ooldea*	10-18	(1-5) [A]
Long-tailed Dunnart	*S. longicaudata*	15-20	
Sandhill Dunnart	*S. psammophila*	26-40	
Red-cheeked Dunnart	*S. virginiae*	18-75	
Fat-tailed Dunnart	*S. crassicaudata*	10-20	(3) [A]
Family Peramelidae			
Golden Bandicoot	*I. auratus*	250-650	8.4 [E]
Northern Brown Bandicoot	*I. macrourua*	500-3000	
Southern Brown Bandicoot	*I. obesulus*	400-1500	18.8 [E], (14.1) [D]
Western Barred Bandicoot	*Perameles bougainville*	170-285	8.5 [E]
Family Thylacomyidae			
Bilby	*Macrotis lagotis*	800-2500	14.1 [E]
Family Phalangeridae			
Common Brush-tailed Possum	*Trichosurus vulpecula vulpecula*	1400-5000	118 [E], (92) [D]
Northern Brush-tailed Possum	*T. arnhemensis*	1100-2000	0.5 [B]
Family Burramyidae			
Western Pygmy Possum	*Cercartetus concinnus*	8-18	10 [B]
Family Potoroidae			
Burrowing Bettong	*Bettongia lesueur*	900-1600	13.8 [E]
Woylie	*B. penicillata*	1000-1600	115 [E], (106) [D]
Gilbert's Potoroo	*Potorous gilberti*	785-965	
Spectacled Hare Wallaby	*Lagorchestes conspicillatus*	1600-4500	5 [B]
Mala	*L. hirsutus*	800-2000	35.3 [E]
Quokka	*Setonix brachyurus*	2500-4.200	37.6 [E]
Family Muridae			
Forrest`s Mouse	*Leggadina forresti*	15-25	
Short-tailed Mouse	*Leggadina lakedownensis*	15-25	(4) [A]
Grassland Melomys	*Melomys burtoni* (Ramsay, 1887)	30-120	

Family Muridae		Body Weight (g)	Approximate LD_{50} and ALD values (mg/kg)
Black-footed Tree Rat	*Mesembriomys gouldi*	430-880	
Golden-backed Tree Rat	*M. macrurus*	200-330	
Water Rat	*Hydromys chrysogaster*	400-1200	
Bush Rat	*R. fuscipes*	50-225	17-43[F] (27.6)[D]
Long-haired Rat	*R. villosissimus*	60-280	1.3[F]
Common Rock Rat	*Zyzomys argurus*	30-75	14.9[F], (9.96)[F]
Mitchell's Hopping Mouse	*Notomys mitchelli*	40-60	14-51[F], (34)[F]
Spinifex Hopping Mouse	*N. alexis*	27-45	
Sandy Inland Mouse	*Pseudomys hermannsbergensis*	9-17	38.5[E]
Pebble Mound Mouse	*P. chapmani*	8-17	
Desert Mouse	*P. desertor*	13-30	
Kimberley Mouse	*P. laborifex*	9-17	
Shark Bay Mouse	*P. fieldi*	30-50	5.9[F], (3.95)[F]
Heath Rat	*P. shortridgei*	55-90	50.9[F], (33.96)[F]
Western Chestnut Mouse	*P. nanus*	25-50	9.5-14.5[F], (6.8)[C]
Western Mouse	*P. occidentalis*	30-55	50.9[F], (21-34)[F]
Delicate Mouse	*P. delicatulus*	6-12	
Bolam's Mouse	*P. bolami*	10-21	1[B]
Plains Rat	*P. australis*	40-75	
Ash-grey Mouse	*P. albocinerus*	15-40	32-50.9[F], 21.3-34.0[F]

Assessment of the potential risk to these species is being undertaken in field and captivity trials.

Bait consumption by non-target species in the field under natural conditions of climate and alternative food resources is being conducted where possible. Initial field trial of non-target bait consumption were conducted concurrently with the assessment of baiting efficacy on feral cat populations at differing levels of baiting density, using non-toxic biomarker baits (see below). These trials provided information on bait consumption by individuals in the field and thus the possible impact of an operational baiting program on species populations at various baiting intensities.

Following these earlier large-scale trials on the entire suite of native species present, additional field research has been undertaken on certain species with restricted ranges. The distribution pattern of baits deployed from a plane has been mapped to enable simulation by hand placement of baits on the ground. It is now possible to replicate bait distribution of an aerial baiting program over a specific fauna-trapping site. This permits non-target bait uptake studies to be conducted as part of other fauna programs to allow maximization of species and individuals assessed at minimum cost.

To complement the field trials, a more rigorous assessment of the amount of bait consumed by a number of non-target species has been examined in a series of captivity trials. Feral cats will consume the entire bait however; most non-target species have a much lower body weight and may be unable to eat the entire bait. The biomarking of individual animals in the field, in part, indicates potential risk to baiting programs, as its presence is qualitative rather than quantitative. The presence of the biomarker does not indicate the quantity of the bait consumed and therefore whether a lethal dose would have been acquired if the bait was toxic. Laboratory examination of bait consumption adds further to the information on theoretical risk from baiting for individual species (eg. Calver *et al*. 1989a and b). In addition, captivity trials have been used to evaluate bait consumption by species not readily available in the field.

Evaluation of bait consumption by non-target species listed in Table 1 in both field and laboratory trials is ongoing. Extension of feral cat baiting programs to strategic areas outside their current limited locations, where the focus of non-target research has been to-date, (eg. extending baiting campaigns into the Pilbara and Kimberley) will require assessment of bait consumption by a different group of species not yet tested. Toxic baiting will only be permitted at any of these sites following approval being granted under the 'Risk Assessment' guidelines of the State and Federal statutory regulations for the "Code of Practice on the Use and Management of 1080". Further laboratory trials are to be conducted opportunistically as new species become available or additional animals, of certain species assessed to-date, are collected and tested to increase sample size and rigour of the trials. Trials of bait consumption by non-target species conducted to-date have been compiled and are summarized in the following report.

Methodology

To-date, field studies of bait consumption using rhodamine B labelled non-toxic baits, have been undertaken for the Hairy-footed Dunnart (*Sminthopsis hirtipes*), Lesser Hairy-footed Dunnart (*S. youngsoni*), Wongai Ningaui (*Ningaui ridei*), Mulgara (*Dasycercus cristicauda*), Red-tailed Phascogale (*Phascogale calura*), Spinifex Hopping Mouse (*Notomys alexis*), Sandy Inland Mouse (*Pseudomys hermannsbergensis*) and Desert Mouse (*P. desertor*).

Examination of bait consumption in captivity has been undertaken on a number of species: - the Spinifex Hopping Mouse; Mulgara; Chuditch (*Dasyurus geoffroii*); Dibbler (*Parantechinus apicalis*); Common Rock-rat (*Zyzomys argurus*) and Central Rock-rat (*Z. pedunculatus*); Southern Brown Bandicoot (*Isoodon obesulus*); Gilbert's Potoroo (*Potorous gilberti*); Golden-backed Tree-rat (*Mesembriomys macrurus*), Bilby (*Macrotis lagotis*); Kultarr (*Antechinomys laniger*); Long-tailed Dunnart (*S. longicaudata*) and Stripe-faced Dunnart (*S. macroura*).

The adult body weight and sensitivity to 1080 for the various species listed above is presented in Table 2. The data, description of terminology and references were presented earlier for Table 1.

Table 2. The range in adult weight, the approximate lethal dose (ALD) and the amount of 1080 required for an ALD based on the minimum and maximum adult weights for the species used in the bait acceptability trials

Species	**Adult wt range (g)**	**ALD (mg 1080 kg^{-1})**	**Range of 1080 required for ALD (mg)**
Chuditch	705-2075	4.7	3.31-9.75
Mulgara	60-170	3.27	0.19-0.55
Dibbler	40-100	23.50	0.94-2.35
Red-tailed Phascogale	38-70	14.10	0.54-0.99
Kultarr	20-30	Unknown	Unknown
Wongai Ningaui	6-13	3	0.02-0.04
Long-tailed Dunnart	15-20	Unknown	Unknown
Stripe-faced Dunnart	15-25	Unknown	Unknown
Hairy-footed Dunnart	13-19	7	0.09-0.13
Lesser Hairy-footed Dunnart	9-14	Unknown	Unknown
Southern Brown Bandicoot	400-1600	14.10	5.64-22.56
Bilby	800-2500	9.4	7.52-23.5
Gilbert's Potoroo	785-965	Unknown	Unknown
Golden-backed Tree-rat	207-330	Unknown	Unknown
Central Rock-rat	50-80	Unknown	Unknown
Common Rock-rat	30 -75	9.96	0.30-0.75
Spinifex Hopping Mouse	27-45	Unknown	Unknown
Desert Mouse	13-30	Unknown	Unknown
Sandy Inland Mouse	9-17	25.7	0.23-0.44

<u>Field Trials</u>

Study Sites

Two field trials of bait acceptance by non-target species were conducted during the course of investigating bait acceptance by feral cats at differing baiting intensities. The first of these was undertaken in the Gibson Desert Nature Reserve (GDNR), located in the interior of Western Australia, at 24.5^{o} S to 25.5^{o} S, 124.7^{o} E to 126.3^{o} E. The second trial was conducted at Mt Keith pastoral lease (27^{0}10' S, 120^{0}45' E) to the north of Wanjarri Nature Reserve, in the north-eastern goldfields region. The pastoral lease was owned and managed by WMC Resources Ltd at the time, for the grazing of sheep and more recently of cattle.

A field trial targeting bait consumption by Mulgara was conducted at Plutonic Gold Mine (Barrick Gold of Australia) situated within the boundaries of the Three Rivers and Marymia Pastoral Stations in the Peak Hill goldfields area of the Gascoyne Basin (25^{0}20'S, 119^{0}27'E). The field trial targeting bait acceptance by the Red-tailed Phascogale was conducted at Tutanning Nature Reserve (32^{0} 32'S, 117^{0} 19').

Baits and Bait placement

Non-toxic feral cat baits containing the biomarker Rhodamine B (RB) at a dose rate of 30 mg per bait, were used in the field trials. All baits were deployed at least two weeks prior to the commencement of the trapping program. RB is a systemic marker, which enables detection of bait consumption by cats (Fisher *et al*. 1999) and a number of non-target species (Fisher 1998). When RB is consumed, the compound causes short-term staining of body tissues, digestive and faecal material with which it comes in contact. Certain metabolites of RB are absorbed by the body and are incorporated into the structure of growing hair. A band is produced by the dye in whiskers (mystacial vibrissae) that appears fluorescent orange under ultraviolet light (Fisher 1995). It is thought that RB enters a growing hair by passive diffusion from the blood stream and is then tightly bound into the protein structure of the hair shaft (Fisher 1995). During processing of captured animals, four to six Vibrissae were plucked from either side of the animal's muzzle using forceps and placed in labelled zip-lock bags for laboratory analysis of the presence/absence of RB (see Plate 1). Vibrissae were examined under a Zeiss fluorescence microscope for the presence of metabolites of RB. The excitation filter used was 510 nm. Analysis for the presence of RB in the mystacial vibrissae is described in Fisher *et al*. (1999).

Plate 1. Vibrissae being removed from a Mulgara for examination of the presence of RB

The first field trial, conducted in the GDNR, examined bait acceptance at two baiting densities in July 2001. Two densities of non-toxic bait distribution, 100 baits km^{-2} and 50 baits km^{-2}, were trialed with each treatment being approximately 350 km^{2} in area and in similar habitats. These baiting intensities were selected following the success of feral cat baiting programs on Hermite and Faure Islands (Algar *et al*. 2001; Algar *et al*. 2002b) using high baiting levels compared with the variable responses achieved in the earlier trials in the GDNR at lower baiting intensities. Baits were distributed from an aircraft with special navigation and bait delivery system to ensure accuracy in the location and density of baits delivered (Angus *et al*. 2002a). In the second field trial, non-toxic feral cat baits containing the biomarker RB, were deployed from an aircraft using the AGNAV navigation system described previously (Angus *et al.* 2002a). A nominal 50 baits km^{-2} was deployed over the Mt Keith treatment area, of approximately 400 km^{2} in extent. Baits were distributed in May 2002.

Bits at Plutonic Gold Mine and Tutanning Nature Reserve were ground-laid at a rate of 50 baits km^{-2} throughout the areas to be trapped. Fifty baits km^{-2} is the optimum baiting intensity currently prescribed for feral cat baiting.

Fauna Collection

The GDNR bait uptake trial sampled fauna using grids of pitfall and medium Elliott box traps of dimensions (9x9x32 cm), baited with Universal bait (a mixture of peanut butter, rolled oats and sardines) at two sites in each treatment (Angus *et al*. 2002a). Baits were deliberately delivered close (<130 m) to the non-target trap sites. Bait uptake by non-target fauna at Mt Keith involved sampling the fauna using grids of pitfall and medium Elliott box traps at 16 sites (Angus *et al*. 2002b). The field trials targeting Mulgara and Red-tailed Phascogales employed grids of medium Elliot box traps (see Algar *et al*. 2003; Algar *et al*. 2004)

<u>*Laboratory Trials*</u>

Examination of bait consumption in captivity by: - Mulgara; Chuditch; Dibbler; Common Rock-rat; Central Rock-rat; Golden-backed Tree-rat and Bilby were conducted on captive-bred animals from the Perth Zoo, where the trials were undertaken. All zoo animals were housed individually except the Golden-backed Tree-rats and Bilbies, which were housed as pairs. Laboratory trials with the Spinifex Hopping Mouse were conducted on animals provided by the Caversham Wildlife Park. These animals were transported to the Wildlife Research Centre, Woodvale for the trials. Bait consumption by the Southern Brown Bandicoot was assessed using seven animals that were being processed for translocation. These animals were housed outside at the Wildlife Research Centre, in individual cyclone wire enclosures measuring 3x5x2 m and provided with shelter from the weather and for sleeping. Bait consumption by the Red-tailed Phascogale in the laboratory was assessed using six animals captured at Tutanning Nature Reserve and transported to the Wildlife Research Centre, for the trials. These animals were captured in addition to those individuals from the above sites in an area outside the RB baited zones. Bait acceptance trials with Gilbert's Potoroos were conducted on animals at the captive breeding facility at Two People Bay Nature Reserve. The Kultarr and Long-tailed Dunnart were trapped at Lorna Glen Station and transported to the Wildlife Research Centre, for the trials. The Stripe-faced Dunnarts were captured during a Pilbara survey and transported to the Wildlife Research Centre, for the trials.

All animals were housed individually in cages or terraria suitable for their body size, they were provided with shelter and maintained at a temperature of approximately 23 ^{0}C. Standard maintenance rations and water were provided each species in excess of their daily requirements.

Two test protocols were used to determine the acceptability of the baits to non-target animals: non-toxic baits were offered in the presence of (Trial A) (eg. Plate 2), and in the absence of (Trial B), alternative food (Calver *et al.* 1989a; Martin *et al*. 2002). Trial B represents the worst-case scenario (WCS), which may be encountered during feral cat control programs when food is scarce, and where animals have been habituated to the bait material. The trials were conducted over two four-day periods. During the first trial period (Trial A) each animal was offered its normal ration of food and a non-toxic feral cat bait. Baits and any uneaten food were collected and removed from the cages the following morning. Baits were examined for signs of consumption, gnawing, damage or disturbance and weighed. Control baits were placed on top of the cages to enable adjustment of weight loss due to dehydration. Fresh baits were offered each night rather than the repeated use of the same bait. The daily consumption of the standard ration offered to each individual was not quantified; however, the standard ration remaining each day was examined to ensure that all test animals were feeding 'normally', as indicated by the presence of seed husks or the consumption/absence of food items. A record of 'normal' feeding was kept for each individual. Animals were also weighed before and after each trial to ensure that they had maintained condition. The second trial period (Trial B) conducted over a four-day period, examined bait consumption in the presence of alternative foods on days 1 and 3 (habituation) and in the absence of alternative foods on days 2 and 4. Measurement of bait consumption and the use of dehydration controls were as for Trial A. Bait acceptance trials in the absence of alternative food were not conducted with Gilbert’s Potoroos because of their critically endangered status.

The mean daily bait consumption was calculated for individuals of each species for both Trials A and B (except Gilbert’s Potoroo, see above). Although it was not possible to determine the amount of bait consumed by individuals housed in pairs, the mean daily bait consumption for the two Golden-backed Tree-rats and two Bilbies was calculated for the pair and divided by two. The ratio of 'potentially ingested' 1080 to the amount of 1080 actually needed for an ALD dose was then calculated using the known body weights of the largest and smallest adult individuals for each species (see Table 2). The daily bait consumption by each species was used in these calculations. These data were then used to provide a 'theoretical risk assessment' for each species.

Plate 2. Laboratory trials of bait consumption (Trial A) by Stripe-faced Dunnarts

Results

Field Bait Acceptance Trials

A summary of non-target fauna captures from the field trial conducted in the GDNR is presented in Table 3. The only taxon represented at all sites was Wongai Ningaui, with most taxa represented at two or three sites. None of the non-target species sampled during this trial was marked by RB. If any individual did consume bait material, the amount consumed was insufficient to produce a detectable marking by RB. The distance between the mid-point of the nearest bait drop and the edge of the fauna sampling grids varied. This distance may have been greater than that normally traversed by some individuals sampled, however no bait drop was more than 130 m distant from the nearest sampling grid and baits were delivered directly overhead at two of the sites. Based on published home range data (e.g. Strahan 1995; see Moro and Morris, 2000) many of the individuals sampled would have potentially encountered baits. It is significant however, that three small mammal species were sampled from sites that had directly received a high concentration of baits and that none showed any sign of having consumed bait material.

Table 3. Non-target fauna captures (source Angus *et al*. 2002a)

Taxon	Baiting Intensity	
	50 baits km^{-2}	**100 baits km^{-2}**
Wongai Ningaui	8	3
Lesser Hairy-footed Dunnart	-	1
Spinifex Hopping Mouse	3	-
Desert Mouse	-	2
Sandy Inland Mouse	3	-

A summary of non-target fauna captures from the field trial conducted at Mt Keith is presented in Table 4. As with the previous trial, none of the non-target species sampled during this trial was marked by RB.

Table 4. Non-target fauna captures (source Angus *et al*. 2002b)

Taxon	No. Individuals
Wongai Ningaui	16
Spinifex Hopping Mouse	3
Sandy Inland Mouse	5
Hairy-footed Dunnart	1

A total of 11 Mulgara, 72 Desert Mice, 10 Sandy Inland Mice and 11 Spinifex Hopping Mice were captured at Plutonic Gold Mine. Consumption of any bait material was recorded for only four of these animals, with the presence of RB being located in the mystacial vibrissae of four Spinifex Hopping Mice. A total of 31 individual Red-tailed Phascogales were captured at Tutanning Nature Reserve, 15 (48 %) animals had consumed enough bait material to be labelled with the biomarker. Of the individuals labelled, four were male and 11 were female.

Laboratory Bait Acceptance Trials

Bait consumption by the various species during the laboratory trials is presented in Table 5. These trials indicated that the three rat species did not consume or attempt to consume (based upon the absence of tooth marks on the baits), any bait material even when no alternative food was available (worst-case scenario, Trial B). The other rodent species, the Spinifex Hopping Mouse, consumed a minimal amount of the bait, and this increased slightly when alternative food was absent. Gilbert's Potoroos also did not consume or attempt to consume any bait material.

In contrast, the larger four-dasyurid species ingested at least some bait material. However, there was considerable variation in individual bait consumption on a daily basis and also between individuals of the same species, and hence in the amount of 1080 potentially ingested. In the absence of alternative food, the amount of bait consumed by Chuditch, Mulgara and Dibbler increased. The amount of bait consumed by Red-tailed Phascogales decreased or remained the same in the absence of alternative food. The trials with the smaller dasyurids (< 30 g) indicated either no or negligible bait consumption.

The Southern Brown Bandicoots and Bilbies consumed most of the bait material offered, and in the absence of alternative food, the entire bait was consumed.

Table 5. Species' bait consumption in laboratory trials. Trial A (in the presence of alternative food) and Trial B (in the absence of alternative food). Figures in parentheses indicate number of individual animals that consumed some bait material

Species	Sample size	Trial A bait consumption (g) (mean ± s.e.)	Trial B bait consumption (g) (mean ± s.e.)
Chuditch	2	Entire bait (2/2)	Entire bait (2/2)
Mulgara	3	2.0 ± 1.5 (2/3)	2.8 ± 1.2 (3/3)
Dibbler	21	2.5 ± 0.6 (19/21)	3.3 ± 0.8 (17/21)
Red-tailed Phascogale	6	5.1 + 0.7 (6/6)	3.8 + 0.6 (6/6)
Kultarr	2	0	-
Long-tailed Dunnart	1	0	-
Stripe-faced Dunnart	2	Trace (1/2)	Trace (1/2)
Southern Brown Bandicoot	7	9.8 ± 1.3 (7/7)	Entire bait (7/7)
Bilby	2	11.8 ± 0.8 (2/2)	Entire bait (2/2)
Gilbert's Potoroo	5	0 (5/5)	-
Spinifex Hopping Mouse	6	0.1 ± 0.1 (2/6)	0.8 ± 0.3 (4/6)
Common Rock-rat	5	0	0
Central Rock-rat	5	0	0
Golden-backed Tree-rat	2	0	0

The amount of 1080 that might have been theoretically ingested by each species had the baits been toxic is presented in Table 6. These calculations are based on a 15.0 g bait, containing 4.5 mg of 1080.

Table 6. The amount of 1080 that might have been theoretically ingested by each species had the baits been toxic; calculations are based on a 15.0 g bait, containing 4.5 mg of 1080.

Species	Trial A toxin consumed (mg) (mean ± s.e.)	Trial B toxin consumed (mg) (mean ± s.e.)
Chuditch	4.50 (entire bait)	4.50 (entire bait)
Mulgara	0.61 ± 0.44	0.82 ± 0.35
Dibbler	0.76 ± 0.17	0.99 ± 0.23
Red-tailed Phascogale	1.5 ± 0.2	1.2 ± 0.2
Kultarr	0	-
Long-tailed Dunnart	0	-
Stripe-faced Dunnart	0	0
Southern Brown Bandicoot	2.9 ± 0.4	4.5
Bilby	3.5 ± 0.2	4.5
Gilbert's Potoroo	0	-
Spinifex Hopping Mouse	0.10 ± 0.04	0.24 ± 0.10
Common Rock-rat	0	0
Central Rock-rat	0	0
Golden-backed Tree-rat	0	0

Discussion

The theoretical risks posed by feral cat baiting programs to the range of non-target species evaluated thus far, are described below. The theoretical risk is determined by the amount of toxin ingested (species sample mean) compared to the range of toxin values required for an ALD for adult animals (see Table 2). The actual field risk potentially faced by individuals of any non-target species will depend on their weight relative to adult size and the rate and extent that baits are encountered. The location and/or uniformity of distribution of toxin within the bait medium is also of significance where baits are only partially consumed.

Comparison of probable toxin ingested and the range of 1080 values required for an ALD suggests that the Chuditch is potentially at risk from feral cat baiting programs. It is also likely that individual animals will consume more than one bait and thus increasing the risk. Laboratory trials suggested that the Mulgara is also at risk from feral cat poisoning campaigns and in the absence of alternative food, these trials indicated that bait consumption increases and therefore so does the potential risk from baiting. Although Mulgara were observed to consume bait material in the laboratory trials, bait consumption, with a larger sample size, during the field trials did not occur. These field trials were also conducted in late autumn when prey resources were likely to be scarce. Bait consumption by the Dibbler suggests that this species is not theoretically at risk from feral cat baiting programs. Bait consumption trials in the field will be useful to gain a more thorough understanding of the risk to this species from feral cat baiting programs. Data from both field and laboratory trials indicated that the Red-tailed Phascogale readily consumes the feral cat bait. Laboratory trials indicated variability in the amount of bait material ingested and the degree of consumption generally declined as the trials progressed. Despite this, the data suggest that the Red-tailed Phascogale is theoretically at risk from feral cat baiting programs.

Field and laboratory trials indicated either no or negligible bait consumption by the smaller dasyurids (< 30 g), which suggests, despite small sample sizes, that this group of species is unlikely to be at risk from feral cat baiting programs.

The high range of 1080 values required for an ALD for both Southern Brown Bandicoots and Bilbies suggest that these two species are unlikely to be at risk from feral cat baiting programs unless individuals consume more than one bait. The laboratory trials suggest that multiple bait consumption is only likely to occur when alternative food is absent. Gilbert's Potoroos and did not consume or attempt to consume any bait material. Thus, it is highly unlikely that this species would face any direct risk from feral cat baiting programs.

The three rat species (Common Rock-rat, Central Rock-rat and Golden-backed Tree-rat) did not consume or attempt to consume any bait material. Thus, it is highly unlikely that these species would face any direct risk from feral cat baiting programs. The only rodent to consume bait material was the Spinifex Hopping Mouse. Field trials indicated that some Spinifex Hopping Mice consume baits however; laboratory trials suggest that this species is unlikely to consume enough bait material to pose a risk. Although no ALD values are available for this species, the amount of toxin ingested compared to the range of toxin values required for an ALD (0.92-1.53 mg) for Mitchell's Hopping Mouse (*Notomys mitchelli*), taken from Twigg *et al*. (2003), a closely related species suggests this species is not at risk from feral cat baiting programs.

The above trials, of necessity, have been conducted at the individual level for the various species and have shown that there is considerable variation in individual bait consumption on a daily basis and also between individuals of the same species, and hence in the amount of 1080 potentially ingested. However, the risk posed to a species and the benefits accruing from reduced cat predation following feral cat baiting campaigns should be assessed finally at the population level.

In addition to these ongoing field and laboratory trials, methods such as encapsulation of the toxin (described in the next Section), are being investigated to reduce the level of toxin exposure toxin to non-target species populations, which will significantly reduce the potential risk from baiting.

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Encapsulation of the Toxin

Background

A toxicant compound, Felid Specific Toxin (FST), that exploits some unique physiological characteristics of cats, is being developed by the Department of Primary Industries Research in Victoria (PIR [Vic]) as a selective lethal agent for bait delivery. The identification of this toxin creates the potential for significant improvement in the ability to control feral cats where the use of 1080 may pose a problem. A collaborative research program between CALM, PIR (VIC) and Department of Environment and Heritage is developing the toxin/bait combination.

The chemical nature of the toxin requires that it must be incorporated into a hard shell capsule to be effective. Encapsulation of the toxin may also increase target specificity of the toxin by reducing exposure to the majority of potential bait consuming, non-target mammal species because these species are significantly smaller than feral cats and have different dentition. The carnassial teeth in cats are highly specialized adapted to cutting and shearing. The loss of grinding pre-molars and reduced chewing efficiency leads to their propensity to swallow relatively larger portions of food and inert material such as bone. The potential of cats to ingest larger particles (eg. tablets or capsules containing toxin) relative to most non-target species has the potential to reduce exposure of many non-target mammals to bait toxicants and thereby decrease the risk of baiting to non-target species. The inclusion of toxic tablets in baits could be a practical vehicle for toxins that would be ingested by feral cats yet rejected by smaller mammals.

Colleagues at DPI have determined that a capsule (4.7 mm diam.) is the maximum particle size reliably accepted by cats, within the feral cat bait medium (Marks *et al*. in press). They have recently tested the ability of several eastern states non-target species to ingest capsules manually implanted in a bait. Plains rats (*Pseudomys australis*), northern quolls (*Dasyurus hallucatus*), eastern barred-bandicoots (*Perameles gunnii*) and fat-tailed dunnarts (*Sminthopsis crassicaudata*) have being examined in the laboratory for their ability to ingest pellets. Field assessment of pellet ingestion has also being conducted on populations of bush rats (*Rattus fuscipes*) and swamp rats (*R. lutreolus*). Results from these programs have indicated that all the species listed rejected the pellet in baits (Op. cit.).

CALM researchers have focused attention on developing the technology to enable automatic insertion of spherical capsules into the baits during bait manufacture. This has recently been accomplished at CALM's Bait Factory at Harvey and provides a significant breakthrough to the bait-toxin delivery system. Discussion of the automated capsule insertion mechanism is provided in Appendix 1. With the development of the capsule insertion methodology it was then possible to assess capsule acceptance/rejection by species potentially at risk from feral cat baiting programs and thereby offer a further measure of target specificity. Research was also conducted to provide the necessary verification of capsule acceptance by cats.

Methodology

Feral cat baits, containing non-toxic capsules, were offered to a broad-range of non-target species. Acceptance/rejection of the bait medium and total daily consumption of bait material formed the basis for assessing the risk to these species from baiting, using a non-encapsulated toxin. Acceptance/rejection of the capsule would indicate whether or not encapsulating the toxin is useful in reducing/eliminating this potential risk to these species, from baiting for feral cat control. Bait consumption and capsule acceptance/rejection are being assessed both in field trials and when the opportunity arises, in captivity in the laboratory.

<u>*Native Species*</u>

Field Trials

Preliminary trials have shown that a number of species that consume feral cat baits will also accept these non-toxic baits if they are included, in addition to the standard lure used, in routine cage trapping programs. Thus it is possible to improve efficiency of testing by examining bait acceptance and also the consumption/rejection of a capsule in a bait by a number of species in the field simultaneously.

A 4.7 mm diameter ball bearing (substitute capsule) was automatically implanted in each non-toxic feral cat bait during manufacture. Implantation of each bait was verified using a metal detecting device. The baits were placed in wire cage traps, (60x20x20 cm) with treadle plates, in addition to the standard lure (a peanut paste/rolled oat mixture). The following morning, cage traps were inspected for captures; individual animals were recorded as well as the degree of bait consumption and whether the capsule had been consumed. Capsule rejection was confirmed by locating the ball bearing using a metal detecting device. Where an individual animal was captured more than once during a trapping period, capsule acceptance/rejection was recorded for that individual as the worst-case-scenario (ie. capsule acceptance was listed if it occurred on at least one occasional but the capsule was rejected on other days). To-date, trapping programs have principally focused on areas where Chuditch (*Dasyurus geoffroii*), the species potentially most likely to consume both bait and capsule, are present. Trapping programs have been conducted at State Forest Blocks (Noggerup, Catterick, Batalling and Wellington Mill) near Collie.

In addition to these field trials, colleagues from the Department of Sustainable Environment (M. Johnston and M. Lindemann) conducted a further trial at Dryandra Woodland on a range of native species.

Laboratory Trials

Trials examining acceptance of capsules by species in captivity are being undertaken opportunistically as species become available. The trials are conducted at the completion of the bait acceptance research (Trial B), described earlier. Individual animals are housed as before. The capsule acceptance trials are conducted over one, one-day period. During the trial each animal is offered a non-toxic feral cat bait in place of its normal ration. Each bait contains the substitute capsule automatically implanted during manufacture. Any bait material present is collected and removed from the cages the following morning. The degree of bait consumption and whether the capsule has been consumed is recorded. Capsule rejection is confirmed by locating the ball bearing using a metal detecting device.

Assessment of capsule acceptance/rejection by the Red-tailed Phascogale (*Phascogale calura*), Southern Brown Bandicoot (*Isoodon obesulus*), Kultarr (*Antechinomys laniger*), Long-tailed Dunnart (*Sminthopsis longicaudata*) and Stripe-faced Dunnart (*S. macroura*) has been undertaken in laboratory trials. Southern Brown Bandicoots were also captured at Tutanning Nature Reserve while conducting the field risk assessment for the Red-tailed Phascogale (described in the previous Section "Bait Acceptance Trials by Non-target Species"**).**

<u>*Feral Cats*</u>

Trials to verify capsule consumption by feral cats have been completed; these trials were conducted on animals trapped at rural rubbish tips. Wire cage traps, described above, were used to trap the cats. The traps were baited with several fresh mulies (pilchards) and the feral cat bait containing the substitute capsule. Trapped cats were shot, the sex and weight for each individual was recorded and their stomachs examined for the presence of the capsule.

To determine whether the age of the animal influenced capsule acceptance, the weight of animals was used to arbitrarily divide the sampled population into three broad age groups (kittens, sub-adults and adults). The weight/age classes for females were 0-1.0 kg for kittens, 1.1-2.0 kg for sub-adults and 2.1+ kg for adults; males were 0-1.0 kg for kittens, 1.1-2.5 kg for sub-adults and 2.6+ kg for adults.

Results

Native Species

The field trials resulted in the capture of (29) Chuditch, (14) Brushtail Possum (*Trichosurus vulpecula*), (4) Southern Brush-tailed Phascogale (*Phascogale tapoatafa tapoatafa*), (22) Woylie (*Bettongia penicillata*), and (7) Southern Brown Bandicoot. A further (11) Southern Brown Bandicoots were available from a translocation program, (6) Red-tailed Phascogales were available from the '*Risk Assessment*' for translocation and (2) Kultarr, (1) Long-tailed Dunnart and (2) Stripe-faced Dunnarts were opportunistically available for these experiments. Trials conducted at Dryandra Woodland provided data for (57) Boodie (*Bettongia lesueur*), (15) Bilby and (5) Western Barred Bandicoot (*Perameles bougainville*). Data collected on bait consumption and capsule acceptance/rejection by individual animals where, bait consumption was observed, by the various native species trapped in the field trials and those assessed in laboratory trials are summarised in Tables 1 and 2. In several instances, the captured animal moved the trap as it tried to escape, if the ball bearing could not be positively identified as being consumed and it was not found at the site, its fate was described as unknown.

The trials with the smaller dasyurids (Kultarr, Long-tailed Dunnart and Stripe-faced Dunnarts) indicated either no or negligible bait consumption and no contact with the capsule.

Table 1. Bait consumption and capsule acceptance/rejection by individual animals of the various native species trapped in the field trials and those assessed in laboratory trials. The number of individuals that consumed or did not consume bait material are given. Those individuals that consumed bait material are then divided into groups according to whether they accepted/consumed the capsule (A), whether the capsule was rejected (R) or whether the fate of the capsule was unknown (U)

Species																							
Chuditch				**Bt Possum**				**S Bt Phascogale**				**Woylie**				**SB Bandicoot**				**Rt Phascogale**			
Bait consumption				Bait consumption				Bait consumption				Bait consumption				Bait consumption				Bait consumption			
Yes			No	Yes			No	Yes			No	Yes			No	Yes			No	Yes			No
24			5	7			7	1			4	17			5	18			0	6			0
Capsule				Capsule				Capsule				Capsule				Capsule				Capsule			
A	R	U		A	R	U		A	R	U		A	R	U		A	R	U		A	R	U	
6	14	4		1	3	3		0	1	0		0	14	3		1	17	0		0	6	0	

Table 2. Bait consumption and capsule acceptance/rejection by individual animals of the various native species trapped at Dryandra Woodland. The number of individuals that consumed or did not consume bait material are given. Those individuals that consumed bait material are then divided into groups according to whether they accepted/consumed the capsule (A), whether the capsule was rejected (R) or whether the fate of the capsule was unknown (U)

Species		
Boodie	**Bilby**	**Western Barred Bandicoot**
Bait consumption	Bait consumption	Bait consumption

Yes			No	Yes			No	Yes			No
53			4	11			4	0			5
Capsule				Capsule				Capsule			-
A	R	U		A	R	U		A	R	U	
0	52	1		0	10	1					

Bait consumption and capsule ingestion (including non bait take, but excluding capsules of unknown fate) are presented as percentages for the sampled populations of each species in Tables 3 and 4.

Table 3. Bait consumption and capsule ingestion (including non bait take, but excluding capsules of unknown fate) are presented as percentages for the sampled populations of each species. Sample sizes are indicated in parentheses

Species	**Chuditch** (29)	**Bt Possum** (14)	**S Bt Phascogale** (5)	**Woylie** (22)	**SB Bandicoot** (18)	**Rt Phascogale** (6)
Bait consumption (%)	83	50	20	77	100	100
Capsule ingestion (%)	24	9	0	0	6	0

Table 4. Bait consumption and capsule ingestion (including non bait take, but excluding capsules of unknown fate) are presented as percentages for the sampled populations of each species. Sample sizes are indicated in parentheses

Species	**Boodie** (56)	**Bilby** (14)	**Western Barred Bandicoot** (5)
Bait consumption (%)	95	79	0
Capsule ingestion (%)	0	0	0

Feral Cats

A total of 78 feral cats consumed the bait while trapped; a further 6 individuals had not eaten the bait during the capture period. The 78 bait-consuming animals comprised 35 males and 43 females. Seventy-eight percent (61/78) of these animals also consumed the capsule. The distribution of capsule acceptance/rejection across the various age classes for both sexes is presented in Table 5.

Table 5. The distribution of capsule acceptance/rejection across the various age classes for both sexes

Male						**Female**					
Kitten		**Sub-adult**		**Adult**		**Kitten**		**Sub-adult**		**Adult**	
Accept	Reject	Accept	Reject	Accept	Reject	Accept	Reject	Accept	Reject	Accept	Reject
-	-	12	2	16	5	1	2	9	3	23	5

There was no significant difference (Z=0.35, P>0.05) in capsule acceptance between males and females, with 80 % of males and 78 % of females ingesting the capsules. Apart from the kitten age class, which was not adequately sampled, pooling data for both sexes indicated no significant difference (Z=0.12, P>0.5) in capsule acceptance between sub-adults (81 %) and adult (80 %) feral cats.

Discussion

The data for bait consumption and capsule ingestion are preliminary for native species, as increased sample sizes are required for species so far examined and more species need to be assessed. However, results to-date suggest that the feral cat bait medium is readily consumed by a number of non-target species. Some of these species would potentially be at risk from 1080 feral cat baiting programs if the toxin was non-encapsulated, particularly if multiple baits were consumed (eg. Chuditch). Data from this study suggest that encapsulating the toxin would be useful in reducing the potential risk from baiting to this species and essentially eliminating the risk to others (eg. Woylie and Southern Brown Bandicoot). It is also likely that the potential risk to species such as the Chuditch and Brushtail Possum has been overstated. The unknown fate of a number of capsules, due to trap disturbance, was most probably capsule rejection and lost during movement. Proposed further studies, to increase sample size, will anchor traps in position to overcome this problem.

As found by our colleagues at DPI, cats readily accept the capsule within the bait medium. Eighty percent of the sampled population ingested the substitute capsule. Although the number of kittens sampled was very small, rejection of the capsule was high. As the optimum timing of baiting programs is late autumn – winter (Algar and Angus 2000; Algar *et al*. 2002; Algar and Burrows 2004), when kittens are not in the population (Kitchener 1991; Jones and Coman 1982) baiting efficacy would not be affected.

Incorporation of a toxin, whether it be 1080 or FST, into a hard shell capsule will increase target specificity of the toxin by reducing exposure to the majority of potential bait consuming, non-target mammal species. The inclusion of toxic capsules in the feral cat bait medium will provide a practical delivery vehicle for toxins that would be readily ingested by feral cats yet rejected by smaller mammals. Design and development of the capsule is now being conducted by an industrial group, specializing in this field, in a collaborative program with the existing partners.

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