

PRELIMINARY ASSESSMENT OF A SAUSAGE BAIT FOR FOX CONTROL (STAGE 2)

by

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(November 1998)

This is the second in a series of internal Department of Conservation and Land Management reports prepared for the Executive Director (Dr. Syd Shea). This report will be forwarded to Dr. Shea following comments from the people listed below and the drafting of recommendations for further action. Following modifications to this manuscript, a paper will be submitted to CALMScience for publication.

cc Roger Armstrong
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Executive Summary

The cost of standard fox baits, supplied to CALM is increasing. These standard baits are manually cut from kangaroo meat and are labour intensive to produce. An alternative to the standard bait type is the production of a sausage bait. The cost of producing sausage baits is significantly less than that of the standard bait because manufacture is less labour intensive as the system is automated, wastage is minimal, and the baits are also easier to handle and store. To reduce bait costs and therefore to provide a more cost-effective control strategy for foxes a preliminary trial was conducted to assess the acceptability of a prototype sausage bait to foxes.

In this earlier bait trial it was found that foxes readily take the prototype sausage bait. Chuditch in pen trials were also observed to consume the prototype sausage bait. No trials have been conducted offering standard fox baits alone to Chuditch.

The objective of this series of trials was to assess whether there was any significant difference in the consumption, by Chuditch, of standard fox baits and the prototype sausage bait when offered to captive animals. A field trial, using non-toxic, biomarked prototype sausage baits, was then conducted to determine potential bait consumption by Chuditch, Woylies, Southern Brown Bandicoots and Common Brushtail Possums, the main non-target species likely to consume baits during broad-scale standard fox baiting programs.

Results of the pen trials indicated that Chuditch consumed a greater amount of the standard fox bait than that of the prototype sausage bait.

The field trial indicated that the consumption of sausage meat baits by native non-target species such as the Woylie, Bandicoot and Brushtail Possum was likely to be negligible or at worst very low. These species are not considered at risk from standard 1080 fox baiting programs because of their tolerances to the toxin and their relatively small home ranges, which limit access to the number of baits and prevent a lethal dose being acquired. Negligible bait consumption by these species would also have little impact in reducing bait availability to foxes.

Results of the pen trials indicate that Chuditch are capable of and will consume the prototype sausage bait. The field trial suggests that although the observed sausage bait consumption may be very low (3%), there may be as much as 15% of the Chuditch population, due to the small sample size, which may consume at least one bait.

There is sufficient evidence to demonstrate that the existing fox bait and baiting regime provides a net benefit to much of the native fauna within the south west forests, including the Chuditch. However, there have been no analogous field trials of the existing standard fox bait on non-target native species to compare with the prototype sausage bait. Consequently it is not possible to directly relate the results of this trial with the performance experienced to date using the current fox control methods and materials. Some indirect evidence may, however, allow some comparative speculation. The artificial pen trials on captive Chuditch provide some preliminary evidence that the existing bait type is slightly more attractive or consumable than the sausage bait. Therefore, one may infer that the net benefit to Chuditch should not be any less than has been observed on the standard bait, assuming there are no differences in the two baits with respect to their performance in controlling fox numbers.

The work on the prototype sausage bait has led to the design and development of a series of new bait medium types (R. Armstrong pers. comm). A coordinated approach needs to be adopted for further bait assessment, which must include the development and implementation of a detailed research plan, conforming to registration standards. Such a plan must include acceptability of bait types to foxes, a baiting efficiency trial to compare the best option against the standard fox bait and also a toxin longevity trial. A series of trials must also be conducted to assess non-target impact across seasons. To maximise the efficiency and resource availability of the program, it is essential that this research be integrated with existing fauna-monitoring programs.

Preliminary assessment of a sausage bait for fox control: non-target trials

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Introduction

The cost of standard fox baits, supplied to CALM is increasing. These standard baits are manually cut from kangaroo meat and are labour intensive to produce. An alternative to the standard bait type is the production of a sausage bait. The cost of producing sausage baits is significantly less than that of the standard bait because manufacture is less labour intensive as the system is automated, wastage is minimal, and the baits are also easier to handle and store. To reduce bait costs and therefore to provide a more cost-effective control strategy for foxes a preliminary trial was conducted to assess the acceptability of a prototype sausage bait to foxes (Algar and Liddleow 1998).

In this earlier bait trial it was found that foxes readily take the prototype sausage bait. Chuditch (*Dasyurus geoffroyi*) in pen trials were also observed to consume the prototype sausage bait. No trials have been conducted offering standard fox baits alone to Chuditch.

The objective of this second series of trials was to assess whether there was any significant difference in the consumption, by Chuditch, of standard fox baits and the prototype sausage bait when offered to captive animals. A field trial, using non-toxic, biomarked prototype sausage baits, was then conducted to determine potential bait consumption by Chuditch, Woylies (*Bettongia penicillata*), Southern Brown Bandicoots (*Isodon obesulus*) and Common Brushtail Possums (*Trichosurus vulpecula*), the main non-target species likely to consume baits during broad-scale standard fox baiting programs.

This document reports the findings of these trials.

Materials and Methods

Bait Manufacture

Standard fox baits are cut from kangaroo meat (120 g wet-weight) and then dried to 40% of their original weight. Standard, non-toxic fox baits were supplied by Agriculture Western Australia (Ag WA) for trials.

Kangaroo mince was used to manufacture sausage baits. The baits were approximately 100 g wet-weight and encased in non-smoked 32 mm natural sausage skins. Individual baits were approximately 120 mm in length and 32 mm in diameter. A binding agent (5%) and water (10%) was added to the mince.

The baits were then taken to the Ag. WA bait factory (Forrestfield) to dry. The drying regime used was slightly different from that used in the initial trial (Algar and Liddelow 1998) in order to speed the drying process and further reduce bait dry-weight. The baits were not placed in pre-dryers at an ambient temperature for 24 h but rather placed in the dehydration room under fan-forced conditions at a temperature of 40⁰ C for 72 h. The baits were then bagged and frozen in preparation for the pen and field trials. A sample of baits was weighed daily to provide information on the degree of bait dryness.

Pen Trials

A pen trial was conducted at Perth Zoo on captive Chuditch to examine potential differences in their consumption of standard fox baits and prototype sausage baits. Ten individually penned animals were used in the experiment. Day 1, five animals were offered fox baits and the remaining five animals were offered sausage baits. Day 2, those offered fox baits on day 1 were offered sausage baits and those animals offered sausage baits on day 1 were offered fox baits. The weight of food offered was the same as that normally provided in daily feeding regimes, approximately 100 g dry-weight for females and approximately 150 g dry-weight for the males. The baits were placed in the enclosures late in the afternoon and the weight of residue recorded the following morning. No other food item was available during the course of the trial.

Field Trial

The field trial was undertaken, in April and May 1998, at the Kingston, Winnejump and Warrup State Forest Blocks. The program was conducted in conjunction with the routine 'Project Kingston' fauna trapping by the CALMScience Forest Ecology Research Team. The study area contains good population sizes of most of the non-target native species of medium sized mammals currently expected in the jarrah forest and considered likely to consume toxic sausage baits. Western Ringtail Possums, Brushtail Possums, Brushtailed Phascogales, Woylies and Bandicoots are not considered at risk from 1080 fox baiting programs, using baits containing 4.5 mg 1080/bait at a baiting intensity of one bait/20 ha. Although the estimated tolerances to 1080 by Western Ringtail Possums is relatively low (LD50 = 2 mg/kg????????????), their specialist folivorous diet and highly arboreal habit greatly limits the chances of this species being vulnerable to 1080 poisoning using meat baits. The higher approximate tolerances to the toxin by the other medium sized mammals (King 1990) and their relatively small home ranges (Table 1), which limit access to the number of baits, would prevent these species from acquiring a lethal dose. Nevertheless, it was important to ascertain whether these species would consume baits, in a field trial, as bait consumption would reduce bait availability to foxes. Given the large home ranges of Chuditch, this species may also potentially intercept sufficient baits

to acquire a lethal dose. Consequently the field trial also aimed to measure the potential negative impact of a toxic form of the prototype sausage bait to Chuditch.

The Brushtailed Phascogale may potentially be at risk if it were to eat greater than 40% of a meat bait (if a 100g animal has a LD₅₀ of 17.5 and the bait has 4.5mg of 1080). *Are they physically capable of eating the baits?*

Dave we need to think carefully about this.....

– perhaps we should include the phasco pen trials in this paper.

Table 1. Species' 1080 tolerances, body weights and home range sizes

Species	1080 tolerance LD ₅₀ (mg/kg)	Body weight (kg)	Home range size (ha)
Brushtail Possum	125	1.5-4.5	2.4-5.9 ^{1,2}
Woylie	100	1.1-1.6	20-40 ^{3,4}
Bandicoot	20	0.4-1.6	< 7 ⁵
Brushtail Phascogale	?	0.1-0.2	4-5 ⁶
Chuditch	7.5	0.8-1.3	300-1500 ⁷
Western Ringtail Possum	2?	0.7-1.2	<9 ⁸

^{1,2} (Green 1984; Inions 1985)

^{3,4} (Sampson 1971; Christensen 1980)

⁵ (Braithwaite 1983)

⁶ (Cuttle 1991)

⁷ (Serena and Soderquist 1989)

⁸ (Wayne pers obs)

The dried non-toxic sausage baits were injected with the biomarker Rhodamine B (30mg/bait). Rhodamine B has proven a very successful label for a number of species including Cats, Foxes, Chuditch, Possums, and Bandicoots (Fisher *et al.* in press). Approximately 320 km² of State Forest, within 10 km of trapping sites was, included in the aerial deployment of Rhodamine B labelled baits at the standard fox baiting regime of 5 baits/km². The fauna-trapping program commenced 12 days after the bait drop and ran for three weeks.

The trapping methodology used was similar to a standard 'Project Kingston' survey (Morris *et al.* in review). A number of additional measures were taken to maximise the number of Chuditch caught, these were, doubling the trapping effort on the road transects, use of an experimental Chuditch bait (Wayne *et al.* in prep.) and trapping on the roads continued for an extra third week.

Captured individuals of each medium sized mammal species were randomly sampled at a rate to ensure that at least 60 individuals of each species would be collected. The rates of random sampling were determined on the basis of anticipated species capture rates calculated from previous 'Project Kingston' trapping data. All Chuditch caught were sampled given that the trap success of this species was anticipated to be less than 60 individuals. All sampled individuals were sedated using isoflourine vapour and four to five vibrissae per animal were removed to determine the presence/absence of the biomarker. After full recovery from the anaesthetic, animals were released at their site of capture. Analysis of the vibrissae was conducted as described in (Fisher *et al.* in press) and indicated which individuals of the various species consumed baits and also the proportion of the populations at risk from baiting.

Results

Bait Preparation

The drying conditions and reductions in bait weight are presented in Table 2.

Table 2. The drying regime and average bait weight

Drying regime	Average Bait Weight (g)
Day 0. Wet-weight	100
Day 1. Dehydration 40 ⁰ C	53
Day 2. Dehydration 40 ⁰ C	42
Day 3. Dehydration 40 ⁰ C	34

Pen Trial

The results of the pen trial conducted at Perth Zoo are presented in Tables 3 and 4.

Table 3. Consumption of non-toxic standard fox baits and prototype sausage baits by individual captive Chuditch

Animal No.	Sex	Bait type	Bait weight offered (g)	Bait residue (g)	% consumed
B01	M	Sausage	146	0	100
B02	M	"	140	33	76
B03	F	"	105	40	62
B04	F	"	115	55	52
B05	F	"	107	45	58
B06	F	Fox bait	96	17	82
B07	M	"	151	0	100

B08	F	“	100	31	69
B48	F	“	104	27	74
B49	M	“	135	28	79
B01	M	Fox bait	152	0	100
B02	M	“	130	0	100
B03	F	“	105	62	41
B04	F	“	102	25	75
B05	F	“	102	0	100
B06	F	Sausage	99	46	54
B07	M	“	139	86	38
B08	F	“	105	40	62
B48	F	“	114	0	100
B49	M	“	149	72	52

Table 4. Group consumption of standard fox baits and prototype sausage baits by captive Chuditch

Bait type	Day	Animal	% consumption
Sausage	1	All	69
Sausage	2	All	61
Fox bait	1	All	81
Fox bait	2	All	83
Sausage	Both	All	65
Fox bait	Both	All	82
Sausage	Both	M	67
Sausage	Both	F	65
Fox bait	Both	M	95
Fox bait	Both	F	74

Field Trial

The number of individuals sampled from each species of medium sized mammal and the results of the vibrissae analysis are given in Table 5.

Table 5. The number of individuals sampled (n), the number of individuals within these samples found to consume a sausage bait (X), and the proportion of the species population (N) which may potentially consume at least one sausage bait at the 95% Confidence Interval (C.I.)

Species	Sample size (n)	Sex ratio (m:f)	Weight range (g)	Mean Weight (g)	Rhodamine positive (X)	P, % N consuming at least 1 bait (95% C.I.)
Chuditch	34	31: 3	500-2000	1397	1	0.07-14.9
Bandicoot	61	40:21	550-1900	1314	0	0.00- 5.9
Possum	86	53:33	900-2000	1540	1	0.03- 6.4
Woylie	90	60:30	500-1570	1281	0	0.00- 4.0

Of the animals sampled, the vibrissae of only two individuals (one Chuditch and one Brushtail Possum) contained the Rhodamine B biomarker. The Chuditch was a male (C2; ear tags M7238/M7239) caught at road trap NB8 and the Brushtail Possum was a female (BTP 16; ear tags M5768/M4313) caught at road trap SR23. The degree of biomarker present in the vibrissae suggested that both these animals had only partially consumed one bait each.

On the basis of the sample size (n) and the observed incidence of bait consumption (X), the proportion of individuals (p) consuming sausage baits in a binomial population was calculated (pp100-101, Ostle and Mensing 1975) for the Chuditch to be less than 15% (95% C.I.). Similarly, less than 7% of the Brushtail Possum population within the greater Kingston area is expected to have consumed at least one sausage bait. The 95% confidence interval for sausage bait consumption by the Bandicoot and Woylie populations is less than 6% and 4% respectively.

No Brush-tailed Phascogales or Western Ringtail Possums were caught during the three-week trapping program.

Discussion

The field trial indicated that the consumption of sausage meat baits by native non-target species such as the Woylie, Bandicoot and Brushtail Possum was likely to be negligible or very low (e.g. less than 7% for Brushtail Possums). As such, these species would have little impact in reducing bait availability to foxes. When considering the potential risk of a toxic (1080) fox bait on these non-target native species, it is important to take into account aspects of the species' behaviour, biology and physiology. These factors should include home range, dietary habits, physical ability to eat the bait, probability of intercepting all baits within the individual's range before any other animal, and the species' tolerance levels to 1080. Taking these factors into consideration it is highly unlikely under existing baiting densities that a Woylie, Bandicoot or Possum would be physically capable of eating enough baits to receive a lethal dose of 1080.

Results of the pen trials indicate that Chuditch are capable of and will consume the prototype sausage bait. The field trial suggests that although the observed sausage bait consumption may be very low (3%), there may be as much as 15% of the Chuditch population which may consume at least one bait. The small sample size of Chuditch is the reason for the large 95% confidence interval. The large home ranges, relatively low densities of Chuditch, and the efficiency of current survey techniques are the main causes for the small sample size.

Trap success rates for Chuditch during the field trial were significantly greater than those previously recorded for the Kingston area (Morris *et al.* in review). This was largely due to the use of the experimental Chuditch lure aimed to increase Chuditch captures by reducing the interception of traps by the extremely populous Woylie (Wayne *et al.* in prep.). The highly male biased

ratio (31:3) of Chuditch is most likely related to the timing of trapping with breeding (females would have been establishing adequate maternity dens), however, it indicates that there may be considerably more individuals in the landscape than is currently being caught. Any future field trials of this nature will need to use efficient capture techniques to obtain adequate sample sizes in order to more accurately measure the potential bait consumption and impact for Chuditch.

There is sufficient evidence to demonstrate that the existing fox bait and baiting regime provides a net benefit to much of the native fauna (within the Critical Weight Range; Burbidge and McKenzie 1989) within the south west forests, including the Chuditch (Morris *et al.* 1995). However, there have been no analogous field trials of the existing standard fox bait on non-target native species to compare with the prototype sausage bait. Consequently it is not possible to directly relate the results of this trial with the performance experienced to date using the current fox control methods and materials. Some indirect evidence may, however, allow some comparative speculation. The artificial pen trials on captive Chuditch provide some preliminary evidence that the existing bait type is slightly more attractive or consumable than the sausage bait. Therefore, one may infer that the net benefit to Chuditch should not be any less than has been observed on the standard bait, assuming there are no differences in the two baits with respect to their performance in controlling fox numbers. Nevertheless, the dangers of extrapolating the results from captive pen trials to field behaviour should be emphasised.

The work on the prototype sausage bait has led to the design and development of a series of new bait medium types (R. Armstrong pers. comm). A coordinated approach needs to be adopted for further bait assessment, which must include the development and implementation of a detailed research plan, conforming to registration standards. Such a plan must include acceptability of bait types to foxes, a baiting efficiency trial to compare the best option against the standard fox bait and also a toxin longevity trial. A series of trials must also be conducted to assess non-target impact across seasons. To maximise the efficiency and resource availability of the program, it is essential that this research be integrated with existing fauna-monitoring programs.

Acknowledgements

We gratefully acknowledge the help of M. Lowthe and A. Eastman from the Ag WA Bait Factory and for the use of the drying facility. We would like to thank M. Bradley and his staff from the Perth Zoo for allowing us to use the captive Chuditch colony in the bait consumption trial. For the veterinary assistance provided by the staff of Animal Health at the Perth Zoo and the Manjimup Veterinary Clinic, and the trapping assistance provided by the Manjimup District and Southern Forests Regional staff and the numerous volunteers, we are deeply thankful for their invaluable contribution. We are also thankful to M. Williams for his statistical support.

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Species	1080 tolerance Ld₅₀ (mg/kg)	Body weight (kg)	Home range size (ha)
Reptiles			
Bobtailed Lizard	500-800		
Sand Goanna	50		
Rosenberg's Goanna	200-300		
Birds			
Emu	102		
Wedge-tailed Eagle	9.5		
Mammals			
Western Ringtail Possum	2		
Western Pygmy Possum	10		
Red-tailed Phascogale	17.5		
Quokka	10, 40		
Tammar Wallaby	2, 5		
Western Brush Wallaby	5-10		
Western Grey Kangaroo	20		
Ash-Grey Mouse	Highly variable		
Western Mouse	25 (ALD)		
Heath Rat	25 (ALD)		
Bush Rat	Highly variable		
Water Rat	?		