FERAL PESTS PROGRAM

PROJECT 11

METHODS OF BROADSCALE CONTROL OF FERAL CATS IN WA

Annual Report January 1996

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SUMMARY

The results presented in this document are for Phase 2 of an ongoing four year project. This project has two major components. The first of these components involves research into baiting effectiveness for broadscale control of feral cats (Scope Items 1 and 2).

Previous research had indicated that kangaroo meat sausages were the most preferred/acceptable bait medium tested. It was originally anticipated that a series of baiting effectiveness trials, using this bait type, would be conducted during the year. However, torrential rainfall in potential study areas in the arid zone restricted accessability and limited research to one site. In this study, the baiting effectiveness of kangaroo meat sausages, surface coated with "digest", was examined at a baiting intensity of 10 baits/km^2.

The level of baiting effectiveness achieved in this trial (53%) was lower than that reported for the comparable trial in November 1994 (78%). A number of environmental factors were likely to have reduced bait acceptability rather than an aversion to the bait itself. We are confident that kangaroo meat sausages provide the best medium for baiting feral cats, particularly if baiting occurs under more favourable environmental conditions. Based on the results from the two preliminary baiting effectiveness trials conducted to-date, a number of recommendations are proposed for planned experimental and operational cat control programs in Western Australia.

The second component of the the project involves development of methodology to census cat density (Scope item 3). Previous research examining bait preferences suggested that cyanide baits with suitable attractants would provide a simple and effective technique to sample cat populations and generate an index of cat abundance. A lure, different from the broadscale bait, is required to census cat populations pre- and post-baiting to ensure results are not confounded due to bait type bias.

Pen trials (Part A) were conducted to provide information on lure pastes to surface coat cyanide capsules. Results of these trials showed a significant preference for fish and liver

pastes that contained 10% of "like" organ/viscera digests. These digests provide the protein hydrolyzates and phosphate nucleotides which enhance the flavour/aroma of the lure medium. The addition (at 1% w/w) of the aromatic properties of fenugreek further enhanced the acceptability of lure mediums containing digest substances.

At the completion of the pen trials described in Part A, several brief field trips were undertaken to examine lure acceptance in feral populations. A number of cats were collected along cyanide transects however, it was apparent that some individuals, although attracted to the bait stations, were not interested in the lures offered. Previous work examining bait preference had indicated that cats readily took solid mediums (eg. sausage type baits) which raised a concern about the physical nature of the cyanide paste/slurry lure.

To provide a preliminary examination of these concerns in the field, a small scale cyanide transect was conducted. At each bait station, animals were offered a choice of capsules coated in the fish paste/slurry or mulies (pilchards) surface coated with fish digest, into which a cyanide capsule was inserted. All animals collected along the transect selected the mulie cyanide lure. This result suggested that the physical form of lures may influence cats' acceptance of the cyanide bait. To further investigate the significance of the physical form of the lure and additional flavour enhancers, a second series of pen trials (Part B) was conducted.

Modifying the physical form of the cyanide lure resulted in a distinct preference for the fish over the fish paste. There was also a distinct preference for the fish lures over the liver sausages. Acceptability of the fish lure was further enhanced by coating the surface with a fish digest containing fenugreek and the flavour enhancer MSG. Cats show a marked aversion to lures that contained aniseed oil.

The marked preference shown by cats for mulies, surface coated with digest and additives, indicates that this lure type will be the most successful lure medium for cyanide baits. Field tests of this lure, to census feral cat populations, will be undertaken in the near future.

BAITING EFFECTIVENESS TRIAL

Introduction

A baiting effectiveness trial was conducted in May 1995 as a follow-up to the two previous trials documented (Algar and Friend 1995). Previous research (*Op cit.*) had indicated that kangaroo meat sausages were the most preferred/acceptable bait medium tested in pen and field trials. The aim of the current study was to provide preliminary data on the effectiveness of this bait type.

This report documents the design and results from this baiting effectiveness trial and provides recommendations for future experimental and operational programs.

Materials and Methods

Study Site

The baiting trials were conducted on the Nullarbor in East Naretha Paddock (30^0 54' 10s South, 124^0 52' 54s East), Kanandah Station. The area lies within the Eucla Botanical District, Nyanga Plain and is described as a lightly wooded succulent steppe (Beard 1975). Myall (*Acacia sowdenii*) was the commonest tree species in the open woodland areas, with scattered Sheoak (*Casuarina cristata*) and Rosewood (*Heterodendrum oleaefolium*). There were areas of open bluebush (*Kochia sedifolia*) plain and more extensive perennial grassland areas of *Stipa nitida* and *Danthonia caespitosa* (see Plate 1). Depressions or `dongas' were also present in the area. Large areas of the site were dominated by the introduced Ward's weed (*Carrichtera annua*).

The study was conducted on an area of approximately 90 km^2. The boundaries of the study area were provided by fencelines of adjoining paddocks and the Transline road in the south.

Plate 1. Vegetation typical of the study area.

Bait Type

Kangaroo meat steaks were minced and the mixture used to fill plastic sausage skins. The sausages were approximately 5 cm x 2 cm and weighed approximately 30 g. They were placed on drying racks and sun-dried to approximately 20 g, firming the plastic skin.

To enhance the flavour and acceptability of the bait, chicken "digest" was surface coated (5% w/w) onto the sausages and allowed to set. Fenugreek seeds were ground and added to the "digest" (1% w/w), prior to it being surface coated.

Biomarker

It was not possible to use toxic baits in this study because of the threat to station working dogs. Results of the previous baiting effectiveness trial (Algar and Friend 1995) suggested that tetracycline-HCl labelled baits may have been toxic, especially if multiple baits had been consumed.

To avoid problems associated with tetracycline in bait uptake studies, an alternative biomarker was sought. Iophenoxic acid (a-ethyl-3-hydroxy-2,4,6-tri-iodobenzenepropanoic acid) has been used in bait acceptance studies as a serum marker and labelled a number of carnivorous species (Larson *et al.* 1981; Baer *et al.* 1985; Knowlton *et al.* 1987; Hadidian *et al.* 1989; Eason *et al.* 1994).

A biomarker trial (Algar 1995) indicated that 10 mg of iophenoxic acid (IPA) inserted into a pocket cut in the sausage would successfully label feral cats in bait uptake trials. This methodology was adopted in the current baiting effectiveness trial.

Direct measurement of IPA in the blood samples was conducted by the Chemistry Centre (Perth, W.A.), as described in Jones (1994).

Baiting Regime

To enable comparison with the previous trials a baiting intensity of 10 baits per km^2 was selected.

To facilitate the bait trial, 10 transects were plotted through the study area (see Figure 1). The transects were approximately 1 km apart, running in a north - south direction. A GPS navigation system was used to plot and navigate the transects across the paddock.

To mimic an aerial baiting campaign and measure bait removal over time, all baits were placed on the transects. Individual baits were located at 100 m intervals. A central core area 50 km^2 (10 km along transects T1 to T5 respectively) was used to monitor bait removal daily. Five buffer transects surrounding the core area, and the distances to the fencelines along the core transects were also baited to provide total bait coverage of the paddock. Bait removal along the buffer transects was only recorded at day 3 (see below).

Bait preference trials had indicated that a visual attractant was important in stimulating bait uptake. Pink flagging tape that could flap or move in the wind, anchored to a chaining arrow had proved successful in earlier trials. In this trial, the same visual attractant was used and positioned adjacent to the bait (see Plate 2).

Animal Removal

Cats were shot, using 0.22 and 0.222 calibre rifles. All animals were shot at night using a 100 watt halogen spotlight to see eye-shine. To maximise the area covered, a zig-zag pattern was driven, across country, between transects. The location of each kill was plotted, using a GPS navigation system. All cats were collected within two weeks of the bait lay to ensure integrity of the biomarker. A further five cats were shot as biomarker controls. These animals were collected some 20 km distant from the study area.

A number of foxes were also collected from within the study area to determine their level of bait uptake.

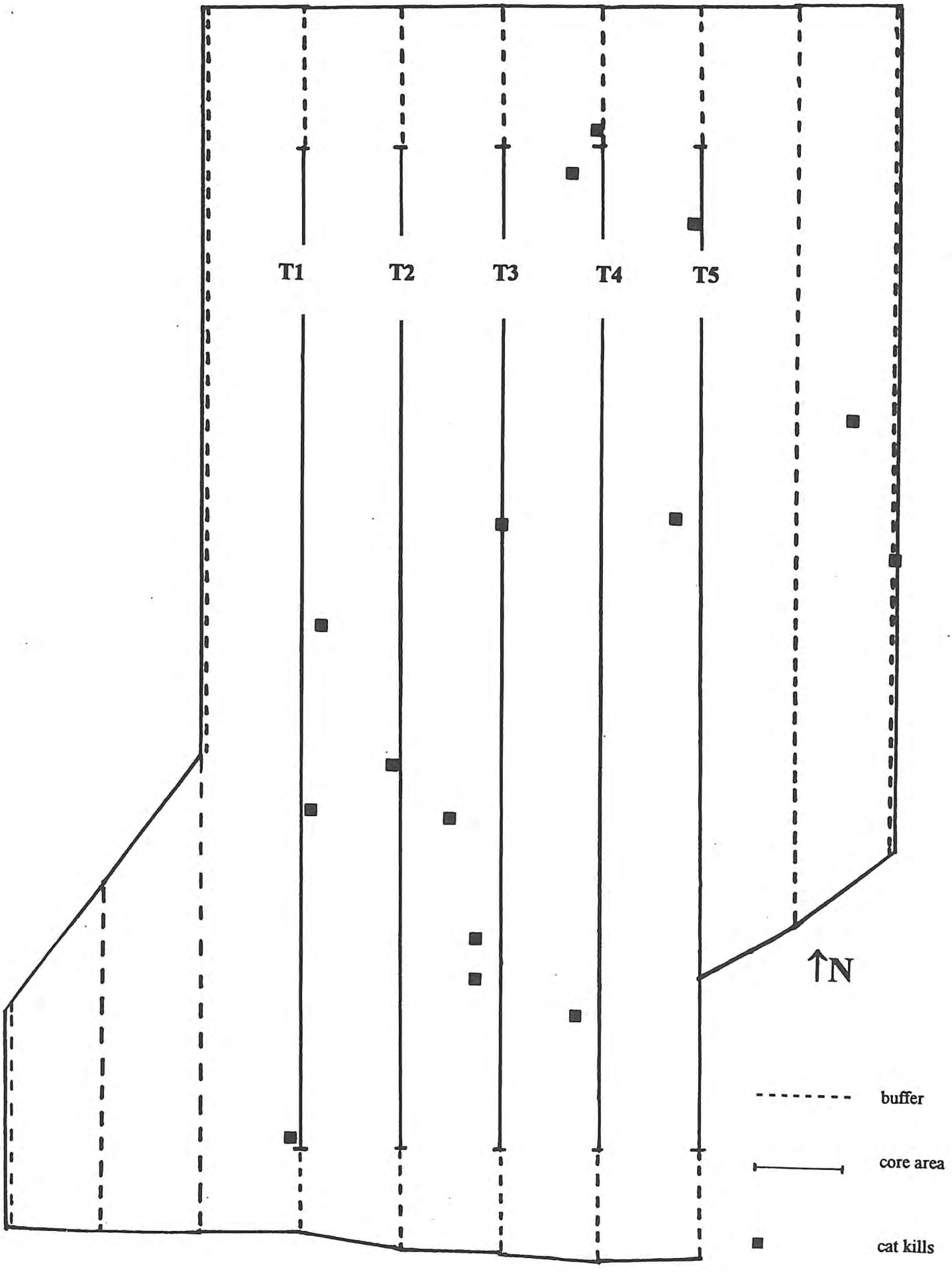

Figure 1 - Map of Study Area

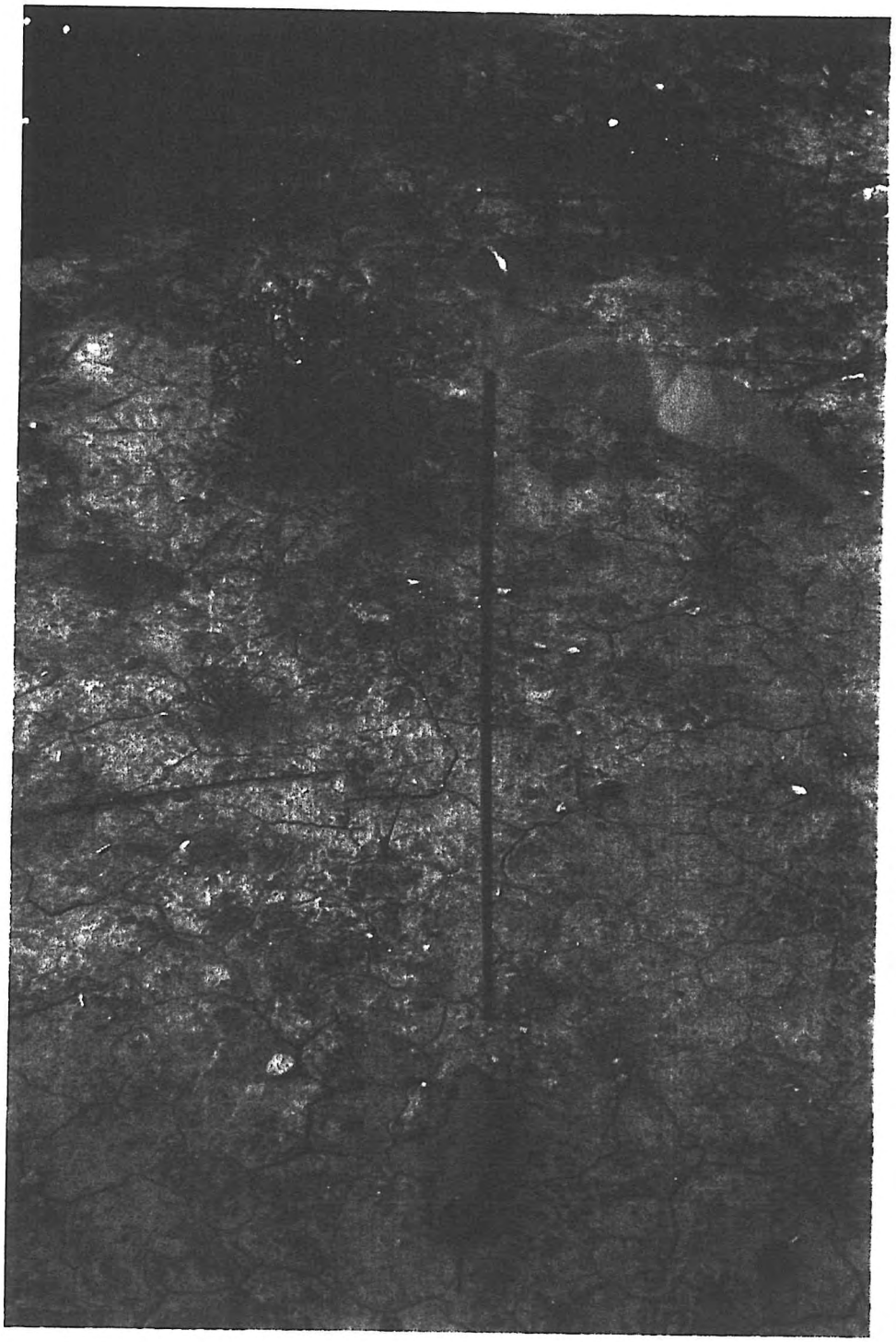

Plate 2. Kangaroo meat sausage bait, surface coated with digest, and adjacent visual attractant.

Population Biology

Cats collected were sexed and weighed. Blood was collected for IPA and viral antibody assay. Placental scars were used to determine the number of breeding females within the collected population and their litter size.

Dietary Analysis

Stomach contents were collected for dietary investigations. Stomachs were removed from the cats and the contents placed in plastic jars containing 70% alcohol as a temporary preservative. Stomach contents were divided into the groups:- mammal; bird; reptile; and invertebrate. Presence or absence of these categories was recorded for each cat stomach. Percentage frequency for each category was calculated as the number of stomachs containing species of the category, divided by the total number of stomachs, and converted to a percentage. Mammals and reptiles were identified to species level where possible. The mammals were identified according to hair structure, as described in Brunner and Coman (1974).

Results

Bait Uptake

Flooding as a result of `Cyclone Bobby' and subsequent storms had resulted in a flush of vegetation growth in the area that carpeted the paddock. The baits were laid following advice from the Bureau of Meteorology that fine weather conditions would prevail for the subsequent five days. Unfortunately rain fell periodically over the following days and in fact over the majority of the field trip (see Plate 3). As the weather conditions and carpet vegetation prevented tracks being observed, no attempt was made to monitor the species responsible for bait removal, at each bait location.

Baits were monitored daily in the core area. By day 3 the majority of baits that remained had become infested with maggots underneath because the damp conditions had softened the dried sausage skin and allowed penetration by flies. Once the meat was rancid, the likelihood of bait

Plate 3. Rain and surface water that occurred post-baiting.

consumption by cats was negligible and thus the study was terminated on day 3. Bait removal data are presented in Table 1 and summarized, across transects, in Table 2.

Table 1. Daily removal of kangaroo meat baits for individual transects. n = 100/transect

Transect	Day 1	Day 2	Day 3	Remaining
T1	6	13	17	65
T2	16	24	35	26
T3	18	46	34	3
T4	3	71	22	5
T5	30	5	9	57

Table 2. Summary of cumulative percentage of bait removal (mean ± s.d.) across transects. n = 100%

Day 1	Day 2	Day 3
14.6 ± 10.7	46.4 ± 22.3	69.8 ± 28.8

A total of 440 baits was laid along the buffer transects. Of these 64.5% had been removed by day 3.

Biomarker Presence

A total of 15 cats was shot in the baiting effectiveness study site and a further 4 cats were shot but could not be retrieved. The cats were shot over a five night period; spotlighting for a

further three nights failed to locate any further animals. The locations of the cats killed and collected are shown in Fig. 1.

Analysis of the blood samples for IPA indicated that eight cats, 53% of the population, had consumed at least one bait. There was no relationship between the likelihood of cats being labelled and distance from the core transects. Of the 12 foxes collected, 83% had consumed at least one bait.

Population Biology

Of the 20 cats collected in this trial (15 baiting effectiveness + 5 controls) 4 were male and 16 female. The weight (g) of cats collected (mean $\pm$ s.d.) was 4625 $\pm$ 189 for males and 3381 $\pm$ 505 for females. As with cats collected the previous November, none of the females had produced young, in fact cats had not produced young since the previous autumn. It is generally thought that feral cats breed in the spring and autumn. No reason for the lack of breeding in spring (1994) and autumn (1995) can be established.

Dietary Analysis

The contents of the 20 stomachs collected were identified. Percentage frequency of the diet categories: mammal; reptile; bird and invertebrate are presented in Table 3.

Table 3. Percentage frequency of occurrence of the diet categories

Diet category	% frequency of occurrence
Mammal	50
Reptile	20
Bird	30
Invertebrate	70

Rabbit was the only species in the mammal category as was grasshopper in the invertebrate category. In comparison to previous stomach collections from Kanandah (Algar and Friend 1995), where mammals dominated the diet, in this study grasshoppers were the major dietary item. Following the cyclonic rains and flush of vegetation growth, grasshoppers were extremely abundant and thus `easy' prey for the cat population.

Discussion

The level of baiting effectiveness achieved in the current trial (53%) was lower than that reported for the comparable trial in November 1994 (78%). There are a number of interacting factors likely to have affected bait uptake by cats. The inclement weather conditions immediately post-baiting would have reduced bait viability and acceptability to cats. The density of vegetation would also have reduced bait visibility. The availability of other food items, particularly grasshoppers, may have reduced cat activity and the distances travelled in search of prey. Thus either the likelihood of finding baits was reduced, or animals may not have been hungry when the baits were located because of stomach fill.

Baiting effectiveness for foxes was also lower in this trial (83%), compared with 97% in November 1994.

The abundance of crows seen in the study area was primarily responsible for the removal of many of the baits. The use of a visual attractant for cats also allowed crows to locate the baits. During the course of daily monitoring bait removal, crows were observed flying along the transects or at various bait stations.

Recommendations

- Based on the results from the two preliminary baiting effectiveness trials conducted to-date, a number of recommendations are proposed for planned experimental and operational cat control programs in Western Australia. These recommendations are listed below:-

- To maximise baiting effectiveness, control programs should be targeted when weather conditions will be dry for the duration of the exercise. Dry conditions are essential to maintain the integrity, viability and acceptability of the bait. This factor is more critical for cat control than for foxes as the baits are surface coated with attractants to enhance bait uptake. Also rancidity of the bait medium will significantly reduce the likelihood of cats consuming the bait.

- No baiting program is likely to achieve total eradication of cats. However, if an abundance of other, `easy' prey is available, baiting effectiveness using any bait type is likely to be significantly reduced. Any reduction in food resource availability will improve this baiting efficiency and thus, bait uptake by cats can be expected to improve.

- The visual attractant to accompany baits in aerial baiting campaigns has not been thoroughly researched at this stage. Thus, to optimise the availability of quality baits over time and maximise the likelihood of cats finding baits when they are hungry, a baiting intensity of 30 baits/km^2 is recommended. The baiting program should be conducted in three stages of 10 baits/km^2 each. Baits should be laid at 3-4 day intervals. Baiting in this manner will also limit the impact of crows on bait availability.

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LURES FOR CYANIDE BAIT STATIONS
(PART A)

Introduction

Methods to census feral cat populations have been limited to trapping, track counts and spotlighting. These methods are either labour intensive and/or have inherent biases. Recently, a technique using cyanide poison to examine bait uptake, in cafeteria trials, (Algar and Sinagra in press) suggested that, with suitable attractants, cyanide bait stations may provide a simple and effective technique to sample cat populations. The technique also has the potential to generate an index of cat density, similar to that used in fox studies (Algar and Kinnear 1992; Algar *et al.* in prep.).

The cyanide baiting methodology enables retrieval of cats at individual bait stations. The technique also permits the measurement of a number of biological parameters relevant to control strategies. Cats retrieved on cyanide transects can provide data on reproductive status and fecundity, population age structure, diet and also the incidence of disease in a cat population.

This report presents the results of preliminary pen trials to assess cats' preferences for various lures that may be used to surface coat cyanide capsules. Preferred lures will then be tested in the field to complement the pen trials. Field trials will ensure that the results obtained from pen trials, using urban cats, are not biased because of previous domestic feeding history.

Method

Study Animals

Permission was granted to conduct the pen trials at the Perth Cat Haven. Fortunately this provided an opportunity to work with essentially semi-feral cats rather than the domestic cats

in catteries. Results of the lure acceptability trials may therefore be less biased than originally anticipated. Cats in the Haven were housed in individual enclosures.

Study Design

A series of small-scale trials was conducted to provide information on lure medium preferences and then whether preferences could be enhanced with the addition of different levels of "digest" substances (the end products of organ/viscera autolysis). Two further trials were then undertaken to test whether the inclusion of the aromatic herb fenugreek (*Trigonella foenum-graecum* L.) further improved lure acceptability, as was found in previous bait acceptability trials (Algar 1995).

In the series of cafeteria trials, individual cats were offered a choice of the various lure/additive combinations described below (see Table 1). A minimum of 20 cats was used in each trial. Approximately 4.0g of each lure type was offered to individual cats. Lure preference was assessed on the basis of the lure type first selected and consumed by an individual. Consumption of additional lures was also recorded in order.

The lures were offered at the normal feeding time. Lures were only offered once to any individual cat to avoid any learned behaviour that may have confounded the test and also to simulate cyanide bait delivery in the field.

Lures

During the course of previous fox research studies, using cyanide baits, a number of lures were tested, of these liver and fish were also found to be acceptable to feral cats. Liver and fish products are the main ingredients in most commercial cat foods. As such, these two substances formed the basis for lure mediums in the current trials. Liver was blended into a paste and the fish paste composed of sardines blended in their packing oil. In the first series of trials several "digests", in various ratios, were added to these lure mediums (described below, see Table 1).

Lure pH

Nutritional literature suggests that cats are very sensitive to the pH of their food. The pH of the various lure types in this trial was measured using a TPS LC80A pH meter. The pH of a number of commercial cat foods was also measured as a comparison with lure types.

Statistical Analysis

Simple descriptive statistics (Chi^2 tests) were used to analyse the data.

Results

When cats were offered the lure types, those which showed interest initially sniffed or licked each lure and then selected their choice (see Plates 4 and 5). A number of individuals consumed more than one lure type. The order of preference was also recorded. Thus, the experimental design can truly be said to offer a choice. Several cats from each trial were also offered a "second helping" and all, without exception, ate the lures in the same initial order further emphasising an experimental design of choice.

Those cats which did not consume a lure were generally shy and remained in their sleeping boxes. Stress of recent capture and their new surroundings most likely accounted for their behaviour and therefore the percentage uptake of lures by cats was not accurately reflected.

Trial 1

A total of 46 cats was offered a choice of the lure types in Trial 1, of which 21 consumed at least one type. Analysis of cats' first preferences for the various lures, indicated significant differences in their choice ($Chi^2 = 63.0$, 3df., $P<0.001$). Every cat that consumed a lure, selected liver paste (100%) as its first choice. The addition of chicken digest to the liver had a marked negative effect on the consumption of the lure. Lure acceptance data, for trial 1, are presented in Table 2.

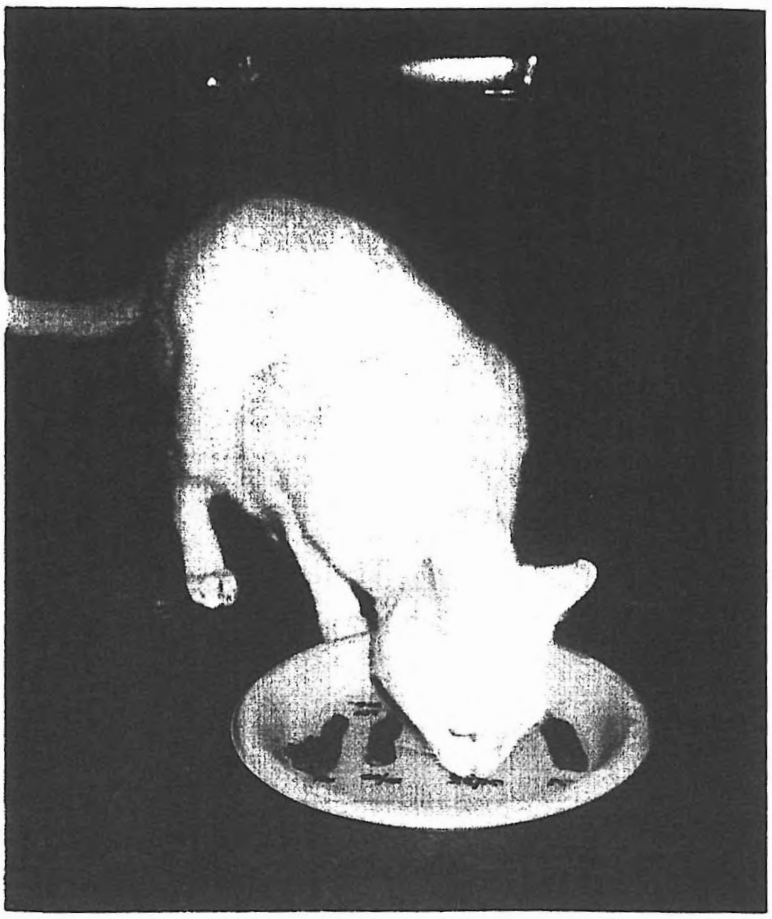

Plate 4. Cat offered the various lure types in Trial 2.

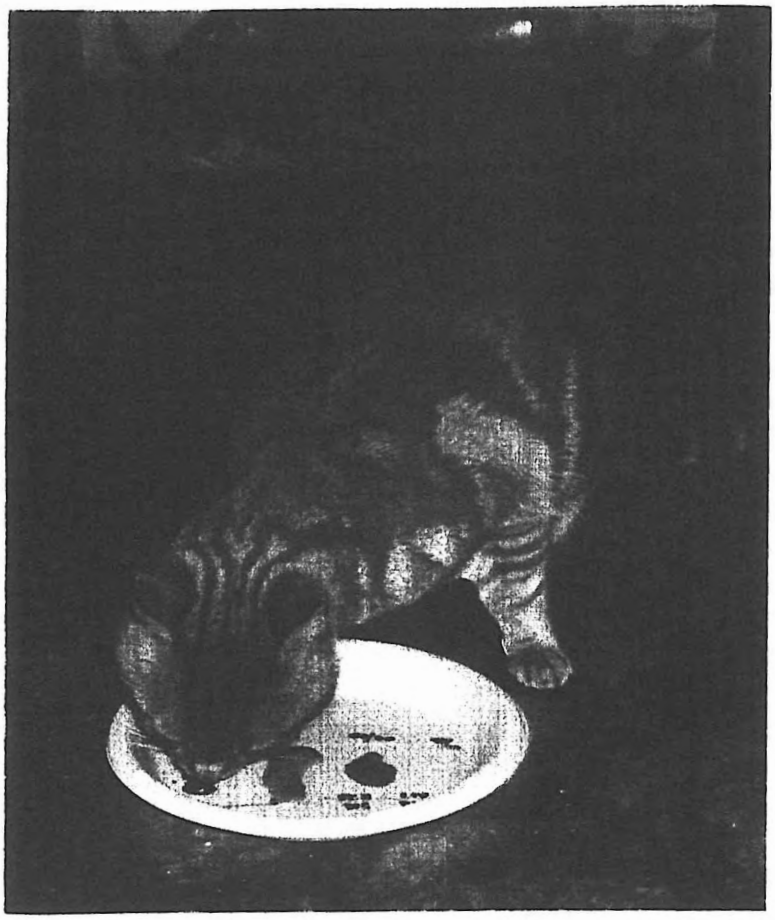

Plate 5. Cat offered the various lure types in Trial 4.

Table 2. Trial 1 Lure acceptance data. Number of cats consuming liver paste/chicken digest lure combinations.

(%) chicken digest in lure

Lure preference	Lure type			
	Lv p	Chck d	Lv p /Chck d	Lv p/Chck d
	(0)	(100)	(10)	(50)
1st	21	-	-	-
2nd	-	3	2	3
3rd	-	-	1	-
4th	-	-	1	-

Lv p = liver paste, Chck d = chicken digest

Trial 2

A total of 45 cats was offered a choice of the lure types in Trial 2, of these 23 consumed at least one lure type. Analysis of the cats' preferences for the various lures indicated a significant difference in their first choice ($Chi^2 = 4.65$, 3df., $P<0.2$). The addition of 10% w/w liver digest to liver paste was the most preferred lure combination. Lure acceptance data, for trial 2, are presented in Table 3.

Table 3. Trial 2 Lure acceptance data. Number of cats consuming liver paste/digest lure combinations.

(%) liver digest in lure

Lure preference	Lure type			
	Lv p	Lv d	Lv p/Lv d	Lv p/Lv d
	(0)	(100)	(10)	(50)
1st	5	5	10	3
2nd	2	1	4	7
3rd	2	1	2	6
4th	4	3	2	-

Lv p = liver paste, Lv d = liver digest

Trial 3

A total of 44 cats was offered a choice of lure types in Trial 3, of these 34 consumed at least one lure. Analysis of the cats' preferences for the four lures indicated a significant difference in their first choice ($Chi^2 = 4.03$, 3df., $P<0.25$). Addition of 10% w/w of fish digest to fish paste was the most preferred lure combination. Lure acceptance data, for trial 3, are presented in Table 4.

Table 4. Trial 3 Lure acceptance data. Number of cats consuming fish paste/digest lure combinations.

(%) fish digest in lure

Lure preference	Lure type			
	Fsh p	Fsh d	Fsh p/Fsh d	Fsh p/ Fsh d
	(0)	(100)	(10)	(50)
1st	9	6	13	6
2nd	11	2	8	7
3rd	9	3	7	8
4th	2	11	2	4

Fsh p = fish paste, and Fsh d = fish digest

Trial 4

A total of 29 cats was offered a choice of the most preferred liver paste/digest lure, fish paste/digest lure and chicken digest. Of these animals, 21 cats consumed at least one lure type. There was a significant difference in the preference for the lure types ($Chi^2 = 14.0$, 2df., $P<0.001$). The fish paste/digest lure was the most preferred, followed by the liver equivalent. All cats refused the chicken digest. Lure acceptance data, for trial 4, are presented in Table 5.

Table 5. Trial 4 Lure acceptance data. Number of cats consuming lure types. (%) digest in lure

Lure preference	Lure type		
	Liv p/Liv d	Fsh p/Fsh d	Chck d
	(10)	(10)	(100)
1st	7	14	-
2nd	8	8	-
3rd	-	-	-

Liv p = liver paste, Liv d = liver digest, Fsh p = fish paste and Fsh d = fish digest

Trial 5

A total of 26 cats was offered the various lure combinations, of these 23 consumed one or more lures. There was a significant difference in the cats' first choice of lure types (Chi^2 = 6.74, 3df., $P<0.10$). The fish paste/digest lure with the fenugreek additive was the most preferred lure. Pooling the data for the lures with and without fenugreek indicates that uptake is significantly enhanced with the addition of fenugreek {(1st preference $Chi^2 = 3.52$, 1df., $P<0.10$), (1st + 2nd preference $Chi^2 = 3.93$, 1df., $P<0.05$)}. Lure acceptance data, for trial 5, are presented in Table 6.

Table 6. Trial 5 Lure acceptance data. Number of cats consuming lure types. (%) digest in lure

Lure pref.	Lure type Liv p/Liv d	Liv p/Liv d	Fsh p/Fsh d	Fsh p/Fsh d
	(10)	(10) + fenu	(10)	(10) + fenu
1st	3	5	4	11
2nd	3	8	5	4
3rd	3	4	8	3
4th	10	-	5	3

Liv p = liver paste, Liv d = liver digest, Fsh p = fish paste, Fsh d = fish digest and fenu = fenugreek.

Trial 6

Fifteen animals were offered the three levels of fengreek in the fish paste/digest lure, all of which consumed a lure type. The majority of these cats only ate one lure type and as such, only first preferences are presented (see Table 7). There was a significant difference in the cats' first choice of fenugreek addition ($Chi^2 = 19.6$, 2df., $P<0.001$). Fenugreek included at 1% w/w in the digest was the most preferred lure type.

Table 7. Trial 6 Lure acceptance data. Number of cats consuming lure types.

1% w/w fen	5% w/w fen	10% w/w fen
13	-	2

Lure pH

The pH readings for the various lure types are presented in Table 8.

Table 8. Lure pH

Lure	pH
Liver paste	6.2
Chicken digest	3.0
Liver/chicken digest (10)	4.9
Liver/chicken digest (50)	3.9
Liver digest	3.5
Liver/liver digest (10)	5.9
Liver/liver digest (50)	5.1
Fish paste	6.1
Fish digest	3.8
Fish/fish digest (10)	5.9
Fish/fish Digest (50)	5.6

The pH of six commercial cat foods (mean $\pm$ s.d.) was 6.2 ± 0.3.

Discussion

The pen trials, described in this document, were designed to provide information on lure options to surface coat cyanide capsules, that could be employed in censusing feral cat populations. During earlier pen and field trials, examining bait preferences (Friend and Algar 1994; Algar and Sinagra in press), we have found that adding chicken digest to the surface of baits dramatically improved bait uptake. We have also successfully collected cats along cyanide transects, using chicken digest as a lure. However, chicken digest is a pet food additive only and used at 5% w/w enhances the flavour/aroma of foods. As such, chicken digest used alone is probably not an ideal cyanide bait lure.

Results of the above pen trials suggest a number of lures more suitable than chicken digest to coat cyanide baits. Despite limited sample sizes, there was a distinct ranking for the various lures offered. There was a significant preference for liver and fish pastes that contained 10% of "like" organ/viscera digests. These digests provide the protein hydrolyzates and phosphate nucleotides that enhance the flavour/aroma of the lure medium. However, cats are very sensitive to pH of their food and the addition of further digest makes the lure too acidic. The pH readings of the preferred lures are within the range of those found in commercial cat food.

The addition (at 1% w/w) of the aromatic properties of fenugreek further enhanced the acceptability of lure mediums containing digest substances.

Cat preference for the above lure types will now be examined in the field.

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LURES FOR CYANIDE BAIT STATIONS
(PART B)

Introduction

At the completion of the pen trials described in Part A, several brief field trips were undertaken to examine lure acceptance in feral populations. A total of 16 individuals was killed along cyanide transects but it was apparent that a number of cats, although attracted to the bait stations, were not interested in the lures offered. Previous work examining bait preference (Algar and Sinagra in press) had indicated that cats readily took solid mediums (eg. sausage type baits) which raised a concern about the physical nature of the cyanide paste/slurry lure. Literature on cat nutrition (MacDonald and Rogers 1984; Rainbird 1988; Bradshaw 1992) suggests that the cat is very sensitive to the physical form of its food, more so than the dog and many other mammals.

To provide a preliminary examination of these concerns in the field, a trial 20 km cyanide transect was conducted. At each bait station, animals were offered a choice of capsules coated in the fish paste/slurry and mulies (pilchards) surface coated with fish digest, into which was inserted a cyanide capsule. Five animals were collected along the transect, all of which selected the mulie cyanide lure. This result suggested that the physical form of lures may influence cats' acceptance of the cyanide bait. It is also of interest that the contents of the majority of commercial cat foods are chunky in consistency rather than paste/slurries. Another factor of importance in designing a lure for cyanide capsules is that the aromatic and flavour enhancing properties of the digest mixture is surface coated onto the bait medium, rather than blended into the paste.

To further investigate the importance of the physical form of the lure a second series of pen trials was conducted. The results of these trials are documented in this report.

Method

Study Animals

Pen trials were conducted at the Perth Cat Haven.

Study Design

A series of trials was conducted to provide information on preference for physical form of fish and liver lure mediums. Two other trials were conducted to assess whether lure uptake could be improved with the addition of the flavour enhancer mono sodium glutamate (MSG) and the aromatic properties of aniseed oil. MSG is widely used in pet food as a flavour enhancer and there is considerable myth and folklore regarding cats' response to aniseed oil.

The methodology adopted in these trials was the same as described in Part A. Individual cats were offered a choice of two lure types, in a series of cafeteria trials described below (see Table 1). A minimum of 20 cats was used in each trial. Lure preference was recorded as the lure type first selected and consumed by an individual; consumption of the second lure was not recorded.

Lures

IQF (Individual Quick Frozen) mulies were used in preference to sardines, as fish lures, in these trials. Mulies are an ideal size to accommodate a cyanide capsule. The fish paste consisted of blended mulies.

Liver sausages were made by mincing liver and the mixture used to fill organic sausage skins. The sausages were approximately 5cm x 2cm. The liver paste consisted of blended liver.

Fish and liver digests, with 1% w/w fenugreek, were surface coated on the mulies and liver sausages and added at 10% w/w to the respective pastes.

In the trials assessing preference for MSG and aniseed oil, both additives were incorporated into the fish digest at 1% w/w and surface coated onto mulies.

In all trials the lures offered were of approximately equal size to reduce the likelihood of any bias associated with weight/mass differences.

Table 1. Description of trial series and lure types

Trial No.	Lure type		
1	mulie + digest	v	fish paste + digest
2	liver sausage + digest	v	liver paste + digest
3	mulie	v	mulie + digest
4	mulie + digest	v	liver sausage + digest
5	mulie + digest (MSG)	v	mulie + digest
6	mulie + digest (aniseed)	v	mulie + digest

Statistical Analysis

Simple descriptive statistics (Chi^2 tests) were used to analyse the data.

Results

When cats were offered the lure types they initially sniffed or licked each lure and then selected their choice (see Plates 6 and 7).

Trial 1

A total of 29 cats was offered a choice of the lure types in Trial 1, of which 26 consumed at least one lure. Analysis of cats' preferences for the two lures indicated a significant difference in their choice ($Chi^2 = 9.9$, 1df., $P<0.01$). Cats preferred the mulie + digest over the fish paste + digest. Lure acceptance data for trial 1, are presented in Table 2.

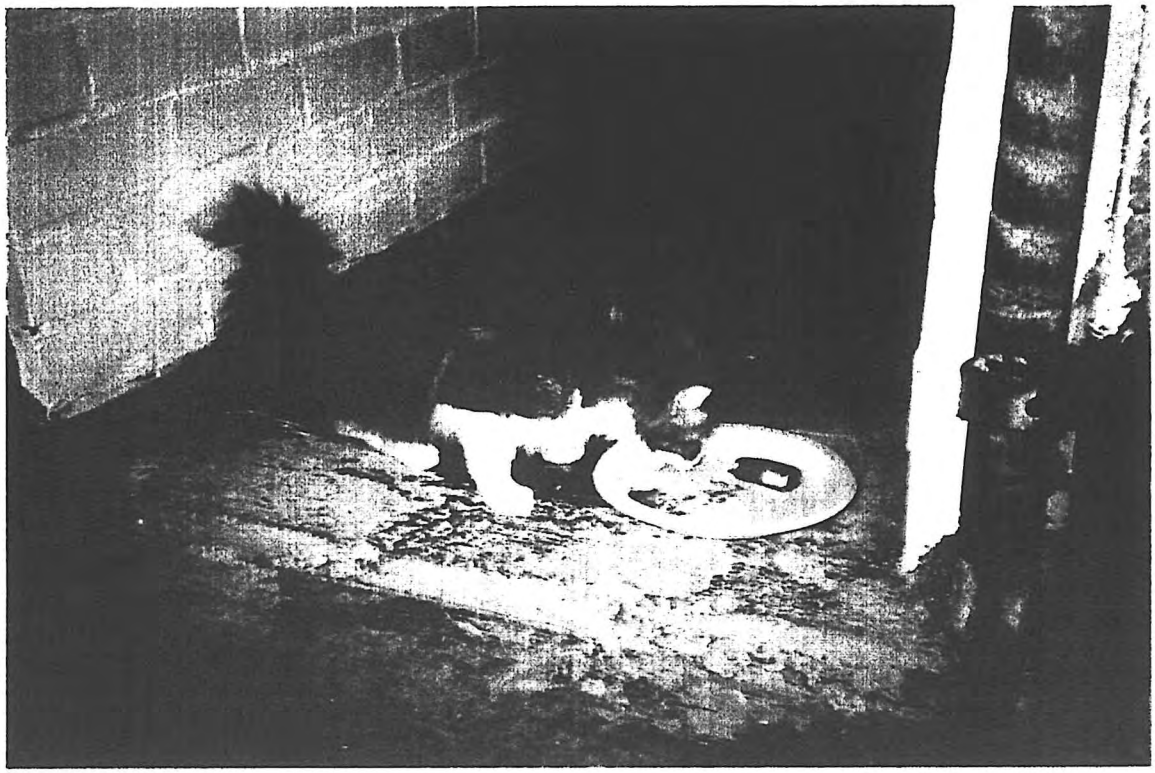

Plate 6. Cat offered the two lure types in Trial 5.

Plate 7. Cat offered the two lure types in Trial 6.

Table 2. Trial 1 Lure acceptance data. Number of cats consuming mulie + digest versus fish paste + digest.

Lure type	
Mulie + digest	**Fish paste + digest**
21	5

Trial 2

A total of 42 cats was offered a choice of the lure types in Trial 2, and of these 20 consumed one lure type. Analysis of the cats' preferences for the various lures indicated no significant difference in their choice between liver sausages + digest and liver paste + digest ($Chi^2 = 0.2$, 1df., $P>0.50$). Lure acceptance data for trial 2 are presented in Table 3.

Table 3. Trial 2 Lure acceptance data. Number of cats consuming liver sausage + digest versus liver paste + digest lure combinations.

Lure type	
Liver sausage + digest	**Liver paste + digest**
11	9

Trial 3

A total of 30 cats was offered a choice of lure types in Trial 3 and of these 27 consumed one lure. Analysis of the cats' preferences for the two lures indicated a significant difference in their choice ($Chi^2 = 8.3$, 1df., $P<0.0.01$). Surface coating of the fish digest to the mulie was the most preferred lure combination. Lure acceptance data for trial 3 are presented in Table 4.

Table 4. Trial 3 Lure acceptance data. Number of cats consuming mulie + digest versus mulie alone.

Lure type	
Mulie + digest	**Mulie**
21	6

Trial 4

A total of 36 cats was offered a choice of the mulie + digest lure and the liver sausage + digest lure. Of these animals, 28 cats consumed at least one lure type. There was a significant difference in the preference for the lure types ($Chi^2 = 17.3$, 1df., $P<0.001$). The mulie + digest lure was preferred to the liver sausage. Lure acceptance data, for trial 4, are presented in Table 5.

Table 5. Trial 4 Lure acceptance data. Number of cats consuming lure types.

Lure type	
Mulie + digest	**Liver sausage + digest**
25	3

Trial 5

A total of 25 cats was offered the two lure combinations, and of these 21 consumed one or more lures. There was a significant difference in the cats' choice of lure types ($Chi^2 = 5.8$, 1df., P<0.0.02). The addition of MSG to the lure was the most preferred choice. Lure acceptance data for trial 5 are presented in Table 6.

Table 6. Trial 5 Lure acceptance data. Number of cats consuming lure types.

Lure type	
Mulie + digest + MSG	**Mulie + digest**
16	5

Trial 6

A total of 32 animals was offered a choice of the lure types in Trial 6, of which 28 consumed one lure. Analysis of cats' preferences for the two lures, indicated a significant difference in their choice ($Chi^2 = 28.0$, 1df., P<0.001). Every cat selected the lure that did not contain aniseed oil. The addition of aniseed oil to a lure has a marked negative effect on its consumption. Lure acceptance data for trial 6 are presented in Table 7.

Table 7. Trial 6 Lure acceptance data. Number of cats consuming the two lure types

Lure type	
Mulie + digest + aniseed oil	**Mulie + digest**
0	28

Discussion

Modifying the physical form of the cyanide lure resulted in a distinct preference for the fish over the fish paste, whereas there was no difference in selection between liver sausage or liver paste. However, the number of animals required to test preferences showed that consumption of the liver lures was poor in contrast to the fish lures. This result was further emphasised when a distinct preference was shown for mulies over the liver sausages. Preference for fish based lures over liver lures was also documented in Part A lure trials. Similarly, all cats collected in field trials of lure preferences, even those in the arid zone, were killed on fish lures.

Acceptability of the mulie lure was further enhanced by coating the surface with a fish digest containing fenugreek and the flavour enhancer MSG. Cats however, show a marked aversion to lures that contained aniseed oil. Talin (thaumatin protein), another strong flavour enhancer used in pet food, will be tested for lure enhancement when it becomes available.

The marked preference shown by cats for mulies, surface coated with digest and additives, over other lure types indicates that this is the most appropriate lure option for cyanide baits. Cyanide capsules can be easily inserted into the fish and anchored to the ground. Field tests of this lure, to census feral cat populations, will be undertaken in the near future. Results of these field trials will be documented in a subsequent report.

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