FERAL PESTS PROGRAM

PROJECT 11

METHODS OF BROADSCALE CAT CONTROL, AND FOX CONTROL AT A NUMBAT RE-INTRODUCTION SITE.

Progress Report
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Responsible institution: Department of Conservation and Land Management, Western Australia.
Chief Investigator: Dr. J. A. Friend
Scientific Officer: Dr. D. Algar

INTRODUCTION

Following a request from Feral Pests Program personnel, this project was formulated as a combination of two project proposals submitted for funding by the Department of Conservation and Land Management. The scope of the overall project is as follows

1. To develop methods to trap and radio-collar feral cats at a site in a Western Australia.

Dependent on the success of (1.):

2. To establish a radio-collared group of approximately 20 cats at a field site for baiting trials.

3. To run a trial baiting using 1080 fox baits to measure the percentage kill on a radio-collared group of feral cats in the wild.

4. If an unacceptably low bait take is indicated in the trials of fox baits, to run a baiting trial using another bait type currently being developed to measure the percentage kill on a radio-collared feral cat population.

5. To reduce fox numbers by aerial baiting with 1080 in an area of Karroun Hill Nature Reserve in which numbats are being re-introduced. The area, of approximately 40 000ha, will be baited twice during 1993.

6. To monitor the effectiveness of the fox control at Karroun Hill NR using cyanide transects.

7. To monitor the numbat colony at Karroun Hill and determine sources of mortality (allocated to raptor, fox, cat, or other) in 1993 for comparison with previous years.

This report will deal with Scope Items 1 to 4 under Section A and Scope Items 5 to 7 in Section B.

SECTION A: METHODS OF BROADSCALE CAT CONTROL

Background and Justification

Despite the lack of data, feral cats are widely acknowledged as a serious threat to populations of small to medium-sized vertebrates in Australia. Cats are opportunistic predators, feeding on a wide range of prey species (Coman and Brunner 1972; Jones and Coman 1981). They are highly fecund, producing two or more litters a year and highly adaptable to a range of harsh environments (eg lack of water requirement). The feral cat threat is particularly serious on islands and in the semi-arid and arid regions.

Predation by cats was most probably the cause of the extinction of spectacled hare-wallabies (*Lagorchestes conspicillatus*) and golden bandicoots (*Isoodon auratus*) on the Monte Bello Islands (Serventy and Marshall 1964) and the South Australian brush-tailed bettong (*Bettongia penicillata*) from St Francis Island (Delroy *et al.* 1986). Predation by feral cats may therefore seriously affect the continued survival of many native species persisting at low population densities. This has been highlighted during recent re-introduction programs of numbats (*Myrmecobius fasciatus*) at Karroun Hill NR and boodies (*B. lesueur*) and golden bandicoots at the Gibson Desert NR. Despite aerial baiting of these reserves, cat predation has significantly affected the survival of the re-introduced species (J.A. Friend, unpublished; N. Burrows, unpublished).

Other factors such as displacement by cats of native carnivorous species (e.g. quolls) may reduce the viability of certain species populations. Cats are also the primary hosts and reservoirs for the protozoan parasite causing toxoplasmosis. Marsupial species have been shown to be highly susceptible to toxoplasmosis and rarely survive its effects (Dubey 1986, cited in a review by Cross 1990).

There are three options available for feral cat control:-

1/. Poisoning with 1080 baits is the first option. The efficacy of a baiting campaign is determined by the proportion of cats killed in the population. No baiting campaign is likely to achieve total eradication. The important question is whether the control measure has sufficiently reduced cat density to permit native species to maintain viable populations.

2/. Following baiting in small scale areas or islands further reductions in cat numbers may be achieved using trapping and hunting. These techniques are labour intensive and can only be justified in areas of limited size or where total eradication is warranted (eg islands).

3/. If the above conventional control techniques do not achieve the required level of cat population reduction, it may be necessary to implement some form of biological control. Examination of biological control techniques is beyond the scope of this research program. It will, however, be beneficial to future research on possible biocontrol strategies if data relevant to number of demographic parameters are collected during the current program.

Aim

Control methods for feral cats have not been extensively researched in Australia. When cat control has been implemented it has generally relied on using standard fox baiting procedures, or on trapping. In Western Australia, routine fox-baiting procedures consist of aerial baiting (5 to 10 baits/km^2) or ground baiting (up to 20 baits/km^2) campaigns using dried meat baits. The recommended baits are cut from kangaroo meat (120g wet-weight), injected with 4.5 mg of 1080, and then dried to 40% of their original weight. There are however, no data on the effect of fox-baiting on cats. There is circumstantial evidence that despite susceptibility to 1080 poison, cats are not as vulnerable as foxes to existing baiting campaigns (Christensen and Burrows in prep.). Trapping is an extremely labour-intensive option and can only be practicably used to remove cats from small and strategically important sites.

There is an urgent need to develop and implement effective and economic feral cat control methods. This should be done by establishing the effectiveness of current fox-baiting procedure in killing cats and if this low, by testing a more acceptable bait type. At the outset of the program, the intention was to use in the second trial a cat bait already developed in New Zealand. Certain risks are associated with this approach, however. It is possible that the bait might prove to be less palatable to feral cats living in arid and semi-arid parts of Australia than to feral cats in New Zealand. It was decided that a bait type should be selected through palatability trials on captive cats and on feral cats in the wild before expensive field baiting trials are commenced.

The primary objectives to be addressed by this program are therefore as follows:-

a) To determine relative bait palatability and attractiveness to cats by conducting pen trials. Currently there are five commercial 1080 bait types that can be tested as a preferred bait choice. A number of additives that cause an ingestion response will also be investigated to improve bait uptake. Preliminary work on bait acceptability by Dredge (1993) indicated that some of these additives improve bait uptake in cats living on refuse tips in Tasmania. All these trials will be conducted using non-toxic baits.

b) To determine relative bait palatability and attractiveness to cats by testing in the field to complement the pen trials. Field trials, although on a smaller sample size, will provide a check on results obtained from pen trials using urban cats, in case these are biased because of previous domestic feeding history.

c) To determine the level of baiting effectiveness achieved in field trials using standard 1080 meat baits and the preferred bait choice from the pen trials. Baiting effectiveness will be determined by the proportion of the cat population killed.

Study Design

a) The pen trials are to be conducted in local catteries. Cats are to be housed in individual enclosures and will be offered a choice of the five commercially available, non-toxic bait mediums. Bait preference, that is the bait medium first selected and

consumed by an individual, will be assessed on a minimum of 100 individual animals. The bait mediums will be offered at the normal time of feeding. Baits will only be offered once to any individual cat to avoid any learned behaviour that may confound the test and also to mimic toxic bait delivery in the field.

Additives that cause an ingestion response will then be investigated to ascertain whether bait uptake can be enhanced. A number of additives will be incorporated into the most preferred bait medium from the initial pen trial. The bait with additives will then be tested in the same manner as the initial pen trial to see whether bait uptake is improved. Depending on the results of this trial a further study of additive combinations may then be conducted to examine whether bait uptake can be further improved.

b) Bait preference trials will then be run in the field. This will provide a check on the results from pen trials in case there was bias due to the cats' previous domestic feeding history. It will be necessary to test the bait types across a range of geographic zones as bait preference may differ according to habitat. Feral cats in Western Australia may be considered a threat to native species in three broad geographic zones:- coastal; semi-arid and arid regions. Four areas, that cover the above geographic ranges, have been selected as possible study sites. Final site selection will be based on a reconnaissance of feral cat abundance (presence/absence of cat tracks along standard transects).

It is also essential to recognise that bait preference may vary according to environmental conditions. In good seasons, when live prey is abundant, bait uptake may be significantly lower than in poor seasons. Examination of bait uptake during a good season will therefore provide a more conclusive test of bait acceptability. Over the last three years, high rainfall in the semi-arid and arid zones in Western Australia has led to successive good seasons and thus an opportunity to undertake the most appropriate bait uptake tests.

Several baits and additives will be selected on the basis of performance in pen trials and used in tests on feral cat populations in the field.
Cats will be offered a choice of bait/additive types at each bait station. Sodium cyanide gel will be incorporated into the baits to ensure retrieval of individuals following bait uptake. Standard cyanide baiting procedures will be adopted for this investigation (Algar and Kinnear 1992). Baits will be laid along individual transects for one night only to minimise field time yet maximising the area covered by the number of transects baited. The study is designed to maximise feral cat sample size, as a minimum of 20 cats is required from each site. Bait preference will then be assessed on the basis of kill numbers for the different bait options.

Results of the bait preference trials will also be invaluable in developing a number of techniques essential to control programs:-

1/. Development of lures to improve trap success as a control option. Trap type should be standardised by only using the `Victor Soft-Catch' design. It would appear that many people experience difficulty in setting `humane treadle snares'.

2/. Development of an index for measuring cat abundance as this will be used to measure effectiveness of operational programs and the rate of re-invasion. Two options are available, the scent station method and cyanide bait stations, where a suitable attractant would be useful. The scent station method is used extensively in America as a measure of carnivore abundance. CPUE (Catch Per Unit Effort), an index of density generated from the use of cyanide bait stations, may also be used to measure cat abundance if a suitable attractant/lure to cover the cyanide capsules can be found. This method has an added benefit in that it provides a valuable tool for sampling populations. Cyanide kills provide information on demographic parameters relevant to control strategies such as age and sex structure, fecundity and the incidence of disease.

3/. The field trials described will also highlight any potential problems of ants being attracted to synthetic baits, which may influence bait uptake.

c) The effectiveness of standard fox baits and the preferred cat bait from the above trials will then be field tested in two distinctly different geographic zones for the reasons given previously. The field studies will be conducted in areas where cat densities are relatively high to remove low sample bias. Two sites in each study area, separated by a buffer zone, will be selected where cats will be trapped. Radio-collars will be fitted to the captured cats to enable monitoring of post-baiting activity and retrieval of dead animals. The efficiency of the control program will be determined by the proportion of dead radio-tagged cats retrieved after baiting. A cross-over design will be employed in the testing of baiting effectiveness. Site 1 will be initially baited with bait A and Site 2 with bait B. Following retrieval of dead, radio-tagged cats, the baiting regimes will then be reversed. This design will provide a comprehensive evaluation of baiting effectiveness and remove any site biases that may confound treatment effect.

Progress to date

Employment of the scientific officer commenced on 1 July 1993. Work to date has involved literature review, detailed study design, procurement of commercially available cat baits, negotiations with cattery owners on facilities for pen trials and examination of potential field sites for bait preference trials and baiting effectiveness trials.

Procurement of bait materials

The five commercially available bait types are as follows:

Standard W.A. fox baits
"Fox-off" meatmeal bait(Applied Biotechnologies)
"Puss-off" fishmeal bait (Applied Biotechnologies)
Extruded kangaroo meat fox bait (NSW)
NZ fishmeal based bait (Department of Conservation, NZ)

These baits have all been obtained, with the exception of the New Zealand cat baits. The NZ baits are based on fishmeal, and the consignment being sent over to us in September was impounded by Australian quarantine service (AQIS), through measures

being taken in connection with the introduction of a Japanese starfish into Tasmanian waters. It is expected that these baits will be released before the end of November.

Sites for bait preference pen trials

Negotiations with owners of cat-holding facilities have resulted in permission to conduct trials in a cattery and in the Cat Welfare Society's Cat Haven. These trials will be run as soon as the NZ baits are received.

Examination of field sites

Cat densities have been assessed at the following sites

Coastal	1. Quobba Station, near Carnarvon
	2. Edel Land, Shark Bay
	3. Peron Peninsula, Shark Bay
Semi-arid	
	4. Karroun Hill NR, eastern Wheatbelt
	5. Kanandah Station, Nullarbor
Arid	
	6. Wanjarrie NR near Wiluna

At this stage, sites 3-6 have been selected as the sites or the bait preference trials, to be run at the conclusion of the pen trials.

References

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SECTION B: FOX CONTROL AT A NUMBAT RE-INTRODUCTION SITE

Introduction

This project was designed to provide further data on the threat posed by feral cats to attempts to re-introduce numbats to semi-arid areas. Specifically, it involves continuation of the monitoring of re-introduced numbats at Karroun Hill Nature Reserve to determine sources of mortality under a regime of fox control using aerial baiting with standard fox baits containing 1080.

The re-introduction of numbats to Karroun Hill has been in progress since 1986. Between 5 and 20 individuals have been released there each year since October 1986 and their progress monitored by radio-tracking. Dingo control by aerial baiting with 1080 meat baits was being carried out already, so no additional fox control was attempted initially. In the first two years, predation by foxes was recorded, so some fox control by baiting from the few tracks was implemented. Predation by foxes continued, so aerial baiting was introduced in 1990-1991. During those years, predation by foxes decreased, but predation by cats became a factor.

The significance of cat predation in numbat populations is difficult to quantify. During the 10-year study of numbats at Dryandra and during re-introduction projects at Boyagin NR and Karroun Hill NR, cause of death of radio-collared numbats has been recorded (Figure 1). Only at Karroun Hill as cat predation been definitely identified as a cause of death, albeit at relatively low incidence. The large "unidentified predator" component at Karroun Hill in Figure 1 almost certainly includes some cat kills, and further work is now in progress to attempt to identify the responsible predator from marks left on plastic collar bands.

Methods

Fox control (scope item 5)

Research in the south-west of Western Australia has shown that aerial baiting using dried meat baits containing 4.5 mg of 1080 distributed at a density of 6 baits per km^2 is sufficient to kill over 90% of the resident foxes (CALM 1990) The times of year for most effective fox baiting are in September/October, before juvenile dispersal, and in March, to kill immigrant juveniles. Additional baiting during summer provides further protection as young foxes invade vacant habitat. Baiting in winter may be less effective as rain reduces the toxicity of the baits.

The baited area is shown in the map in Figure2. The baiting route flown follows 20 north-south lines 20 km in length separated by 1 km. The plane is kept on course by the use of a GPS unit. Baits are dropped at intervals of approximately 130 m (about every 2-3 seconds). 3000 baits are distributed over the 40 000 ha area in this manner, giving a rate of 7.5 baits per km^2.

Effectiveness of fox control (scope item 6)

Death of foxes by 1080 poisoning is not instantaneous, and poisoned individuals can move well away from the point of bait uptake before dying. The cyanide transect method was developed to provide an index of fox density (Algar and Kinnear 1992). This technique was used in the current project to assess the density of foxes remaining on the numbat release site and its surrounds after baiting.

A carcase (sheep, kangaroo etc) is dragged along the track where the cyanide line is to be laid, to provide a scent trail. Wax capsules containing 5gm of powdered sodium cyanide mixed with an anti-caking agent are attached by wire traces to metal plates of 10 cm diameter buried 10 cm deep in the track in the scent trail. These cyanide capsules are laid along the track at 200 m intervals, two at a site, and covered with one of two bait materials: condensed milk and icing sugar on one capsule and an ox liver and blood homogenate on the other. These capsules are laid as late as possible before dark and are checked and removed at dawn the following day to minimise risk to diurnal non-target animals. Foxes taking the baits are generally killed within a few metres of the bait station. Tracks of animals investigating the baits can be seen in the sand or soft soil at the bait station. An impression can then be gained of the activity of animals that have not taken baits.

The effectiveness of the aerial baiting in removing foxes from the numbat release site was measured by the use of cyanide transects run on 17-18 November 1993. This allowed six weeks for bait uptake by resident foxes in the study area. Three cyanide transects each 5 km in length were laid in this way along tracks within the baited area at Karroun Hill. Transects of 15 km total length (cyanide baits laid at 200m intervals) were thus run on both nights.

Numbat monitoring (scope item 7)

All numbats released at Karroun Hill are fitted with radio-collars. These collars contain two-stage transmitters (AVM P2-1V or Biotrack TW-2) powered by a 1.5V Hg675 mercury cell, giving a life of 4-6 months and a ground-ground range of 500-1000 m. An aircraft (Cessna 172 or 182) fitted with a side-looking Yagi antenna on each wing, giving a sideways range of 3-5 km, is used to locate dispersing numbats and to check for other transmitters not located in ground searches. The release site is visited each 6-8 weeks and the numbats are located on the ground. Their survival or mortality is noted and if possible the animals are caught, weighed, measured, condition and breeding status noted, transmitter battery replaced if necessary.

Results

Fox control (scope item 5)

The first baiting was carried out on 6 October 1993. The area of 40 000 ha (shown in Figure 2) surrounding the release site at Karroun Hill was baited at a rate of 7.5 baits per km^2.

Effectiveness of fox control (scope item 6)

No foxes were killed on the transects, and no sign of foxes, cats or dingoes was seen on the tracks where cyanide transects were laid. The tracks of one cat were seen, however, in the numbat release area on a track where no transect had been laid.

Numbat monitoring (scope item 7)

In December 1992, five numbats were translocated from Dryandra to Karroun Hill NR. At that time there were three radio-collared adults already present, and four young born at Karroun Hill had been fitted with radio-collars in October 1992. On 1 January 1993, therefore, there was a possible maximum of 12 radio-collared numbats living on the reserve.

A new female carrying four young was captured at Karroun Hill on 26 June 1993. Three of her young and three young of another female were fitted with radio-collars on 27 October 1993.

Figure 3 shows the number of radio-collared numbats known to be alive at Karroun Hill during 1993. Table 1 shows the fate of the live numbat/functioning radio-collar units that ceased during 1993. The largest group were those animals whose signals were lost. This highlights an apparent problem with the transmitters that were being used until early 1993. An unprecedented rate of loss of signal was experienced during 1992 and 1993 and consequently another manufacturer is now being used to provide transmitters for this study. It is likely that some of the numbats whose signals were lost are still alive.

Table 1. Fate of live numbat/functioning transmitter units at Karroun Hill between 1 January and 3 November 1993. Twelve units were intact at 1 January 1993.

Fate	Number
Signal lost	6
Unidentified predator	2
Raptor	1
Total	9

The "unidentified predators" responsible for two of the three recorded deaths could have been either birds or mammals. The plastic-covered collars retain some marks and scratches and an attempt is now being made to obtain more specific information on the identity of the predators responsible for these deaths, by presenting similar collars to cats foxes and raptors in captivity.

Discussion

The baiting carried out at Karroun Hill NR in October presented no problems of logistics. It was also shown to be very effective, possibly in combination with other baiting being carried out, in removing foxes from the area. The low occurrence of cats recorded in the area is also of interest. Although the track system in the reserve is very sparse, a greater presence of cats might be anticipated, given the experiences of workers in other areas (Shark Bay, Gibson Desert, Tanami Desert) who recorded an increase in cat numbers following fox baiting. Fox control has been carried out on this project at various intensities since 1988, and it might be expected that if a strong response were going to occur, it might have begun by now.

Work proposed for 1994 will focus again on close monitoring of the re-introduced numbat population. The next baiting is proposed for February-March, and a small group of numbats will be released in December to supplement the group of nine currently radio-collared in the reserve.

References

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Figure 1. Percentage frequency of causes of death within numbat populations studied.

UP	Unidentified predator
RA	Raptor
FO	Fox
CA	Cat
PY	Carpet python
BU	Burnt in fire
RK	Road kill
CC	Caught by collar
DU	Dead, unexplained

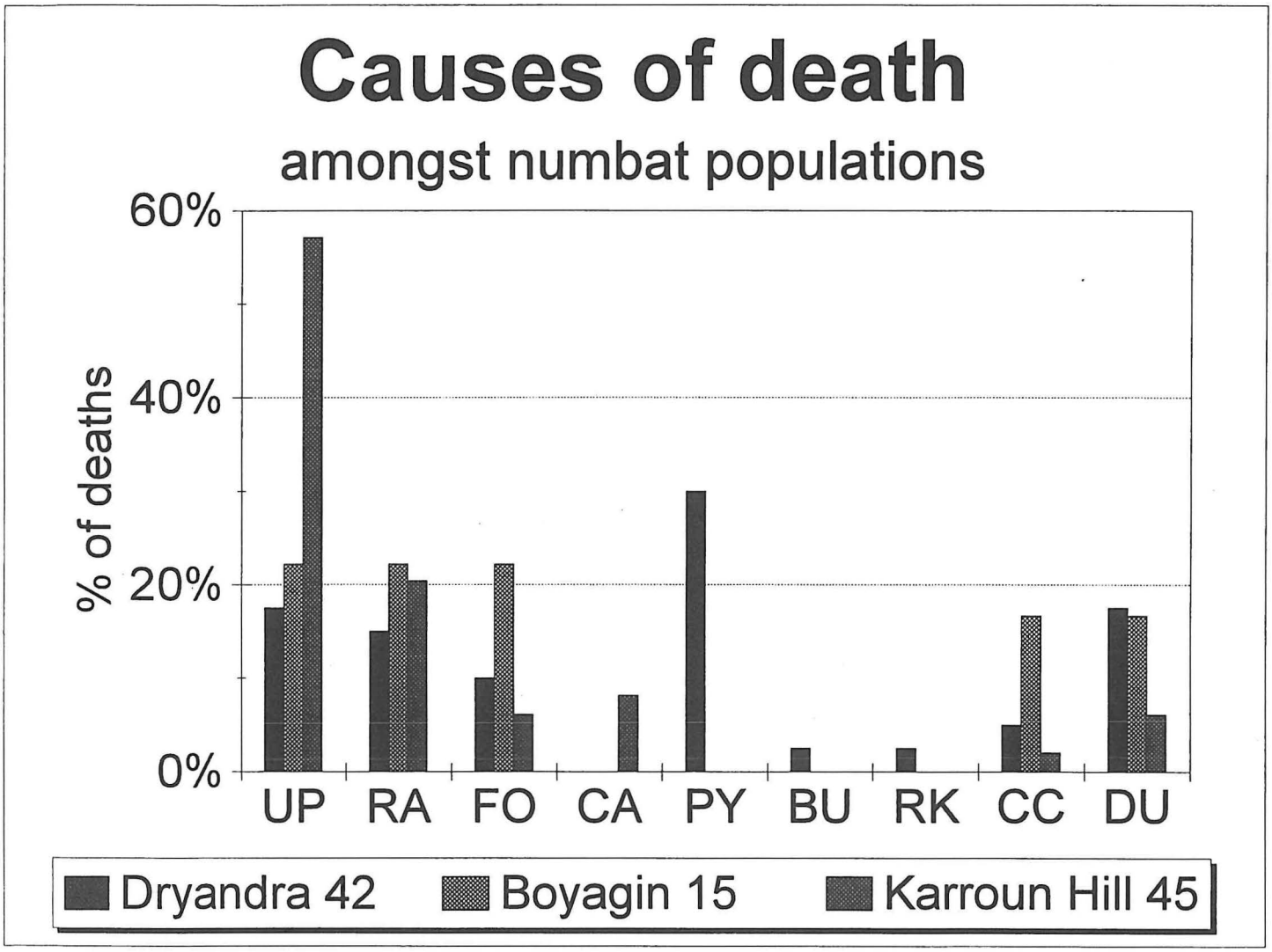

Causes of death
amongst numbat populations
60%
40%
20%
0%
% of deaths
UP
RA
FO
CA
PY
BU
RK
CC
DU
Dryandra 42
Boyagin 15
Karroun Hill 45

Figure 2. Map of Karroun Hill Nature Reserve showing baited area.

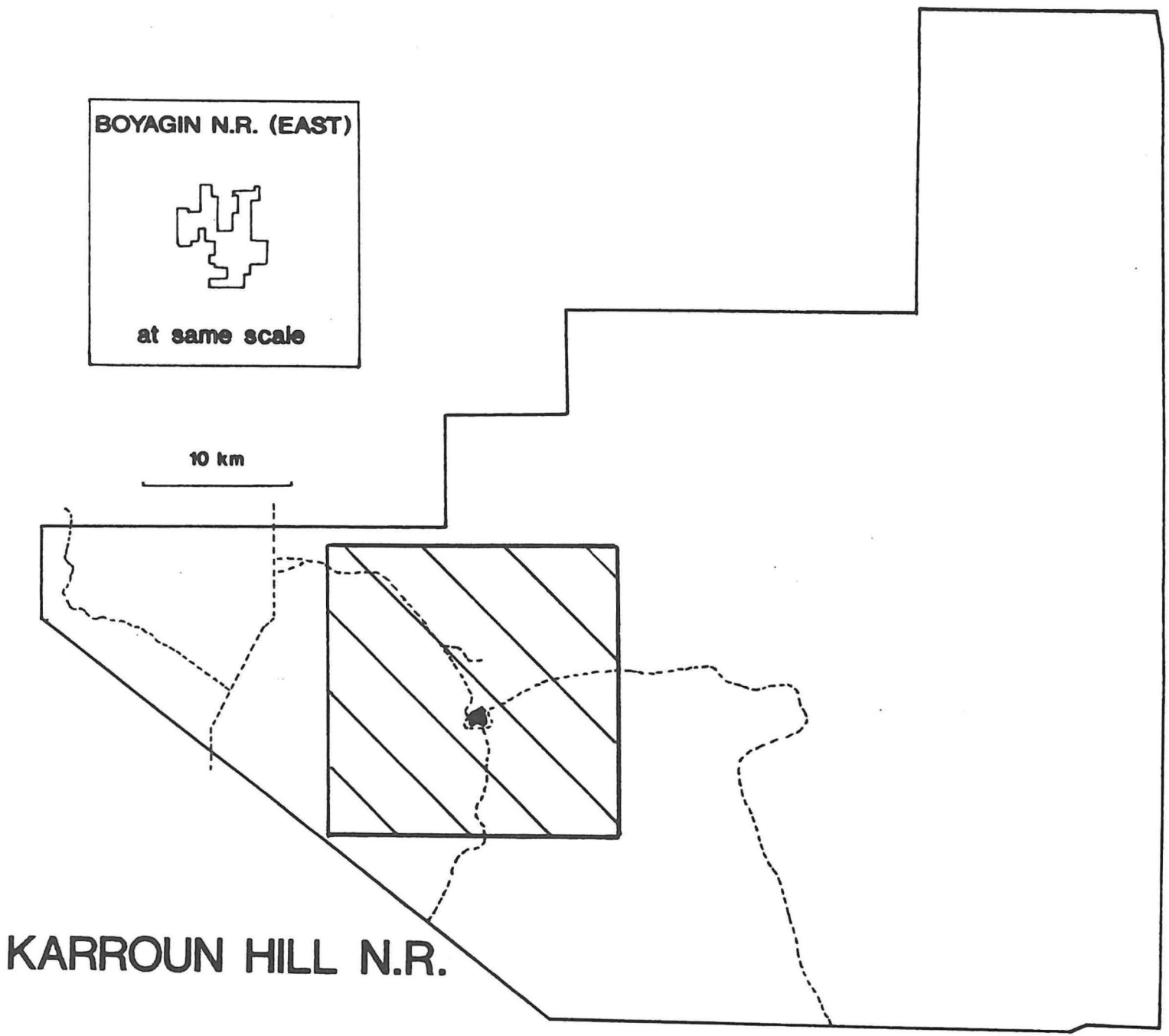
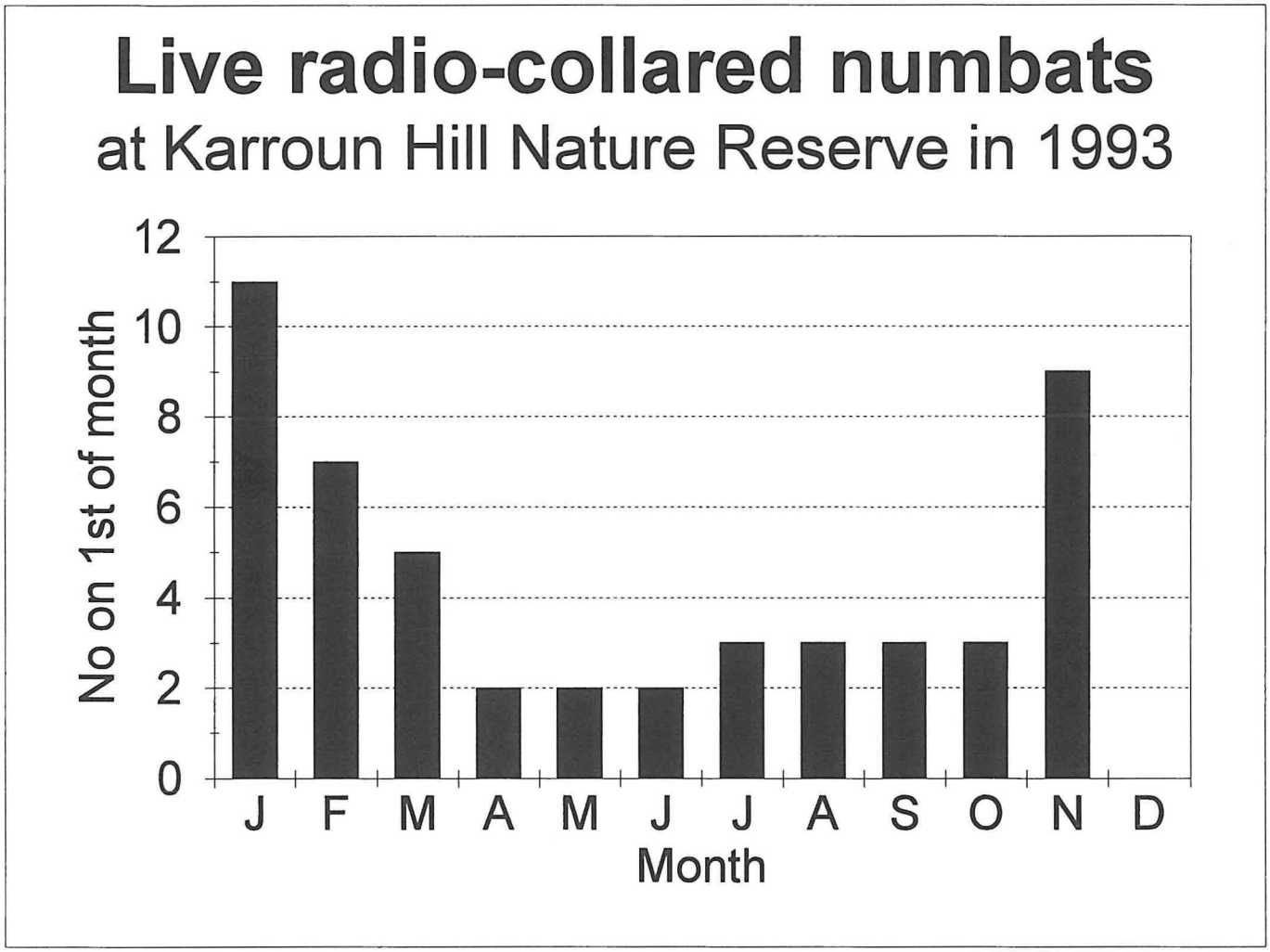

BOYAGIN N.R. (EAST)
at same scale
10 km
KARROUN HILL N.R.

Figure 3. Number of live radio-collared numbats at Karroun Hill at the beginning of each month. No data yet for 1 December.


Live radio-collared numbats
at Karroun Hill Nature Reserve in 1993
No on 1st of month
0
2
4
6
8
10
12
J
F
M
A
M
J
J
A
S
O
N
D
Month