Survey protocol for Butler's dunnart *Sminthopsis butleri*.

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Introduction

Until recently there have been very few records of captures of Butler's dunnart. In a review of its status, Woinarski *et al*. (1996) collated all then known information, and this comprised only six individuals: with the exception of three individuals recorded from the north Kimberley in 1965-66, all records have been from the Tiwi Islands. Subsequent very substantial fauna survey effort in the early 2000s (notably Woinarski *et al*. (2003), which reported on a survey comprising >35,000 trapnights on the Tiwi Islands), added only a small number of records. All recent (post the 1996 review) records have been from the Tiwi Islands. The species is listed as "Vulnerable" under national and NT legislation and as "Fauna that is rare or is likely to become extinct" in Western Australia.

Following publication of the recovery plan for this species in 2004 (Woinarski 2004), recovery actions were partly funded by an NHT program in mid 2006. This project aimed to explore a range of sampling techniques, establish a monitoring program, identify habitat requirements and derive conservation advice (in part related to the development of plantation forestry). Results from this project provide the first substantial data on detection, trap efficacy and abundance for this species.

Initial trapping indicated that Butler's dunnarts are notably trap-shy and use of deep pitfall traps was clearly and significantly (χ^2=7.0, p<0.05; Table 1) superior to using standard 20L pitfall traps or Elliott live-small-mammal traps (with a broad range of baits). The protocol developed below produced 34 captures of 28 individuals, from 10 of 40 sites and a total of 5470 pitfall trap-nights, covering a variety of habitat types on the both Melville and Bathurst Islands. The protocol has been adopted by the Tiwi Land Council and Great Southern Pty. Ltd. in their pre-clearing surveys for the species on Melville Island.

Table 1. Total numbers of captures of Butler's dunnarts using three trapping methods, across all trapping sessions and sites. (Data from Ward & Hill, *unpublished*.)

trap type	total trapping effort	no. captures of Butler's dunnarts
standard pits	350 pitnights	0
deep pits	5470 pitnights	34
Elliott traps	1500 trapnights	0

Prime habitat for Butler's dunnarts is tall open eucalypt forest, typically of *Eucalyptus miniata, E. tetrodonta* and or *Corymbia nesophila*, but they are also found in lower abundances in woodlands with other eucalypt species and

they have been recorded from melaleuca woodland and low scrub areas. They occur on both lateritic rocky slopes and sandy flats (Fig. 1), and in the latter habitats can co-occur with red-cheeked dunnarts *Sminthopsis virginniae*.

a.

b.

Figure 1. Prime habitat of Butler's dunnarts on the Tiwi Islands is tall eucalypt forest dominated by *Eucalyptus miniata, E. tetrodonta* and or *Corymbia nesophila*; a. on flat sandy soils, or b. on lateritic rocky slopes.

The Protocol

Trap layout

Pitfalls are set in lines of 10, approximately 10m apart, with a 100m long x 30cm high drift fence along the length of the line, across the top of all the pits (see Fig.2a). Two lines are set within 50-100m of one another at each site. The deep pitfalls used in the above study were 28cm diameter and 60cm deep, constructed from two types of 20L white plastic buckets differing in taper (Fig 2b & c), such that one wedged in the other, with the bottom cut out of the top one.

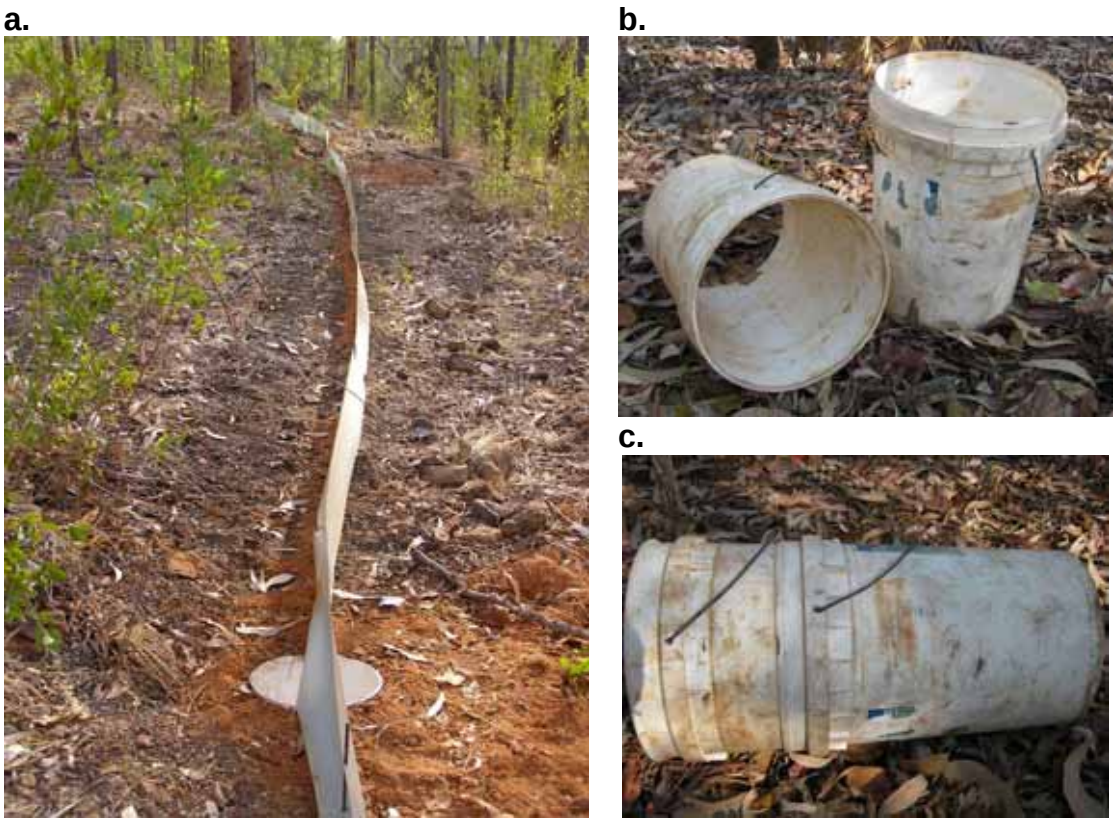


Figure 2. Pitfall trapping for Butler's dunnarts on the Tiwi Islands; a. a line a ten pitfalls with a 100m fence; b. two 20L bucket types, differing in taper, the top one with the bottom cut out; c. deep buckets made from the two buckets types.

Detectability and trapping effort

An aim of wildlife survey is to detect species that are present. This is not always straightforward, as species vary substantially in conspicuousness, trappability and abundance. Increasingly sophisticated statistical methods are available for assessing detectability, and hence calculating the minimum sampling effort required to be reasonably sure of reporting the species if it is in fact present (MacKenzie & Kendall 2002; MacKenzie *et al*. 2002, 2006; MacKenzie & Royle 2005). To date, the dunnart data don't allow for robust calculation of detectability, partly because the data themselves are too few and partly because of considerable variation in trapping success across and within habitats.

However, the data do provide some insight. Butler's dunnarts were captured in 14 of 44 trapping sessions (some sites were trapped multiple times). Up to 5 individuals were caught within a session, but recaptures were generally rare. Most new captures occurred on the second night of trapping (Fig. 3a), but new captures occurred up to the fifth night. All captures on later nights were recaptures. In nine trapping sessions (64% of sessions where Butler's dunnarts were detected) dunnarts were caught within the first two nights of trapping, but in four sessions (29%) they were not detected until the fourth night (Fig. 3c). Based on this pattern of captures, surveys to establish the distribution of Butler's dunnarts should trap for at least four nights. Surveys to estimate population sizes in an area or in different habitats (therefore dependent on recaptures) should run for longer.

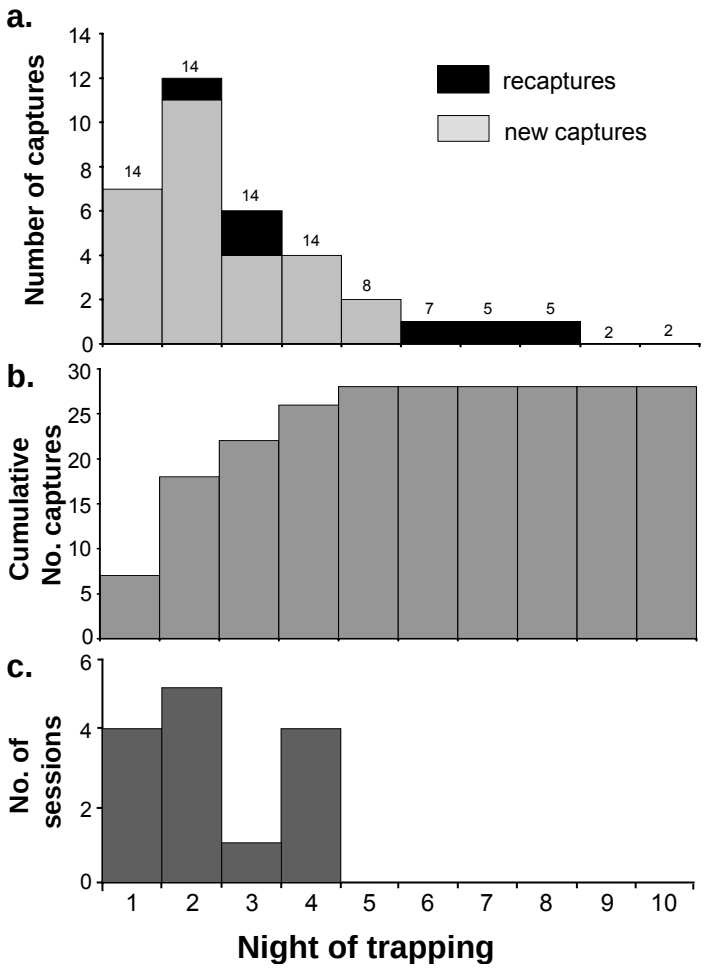


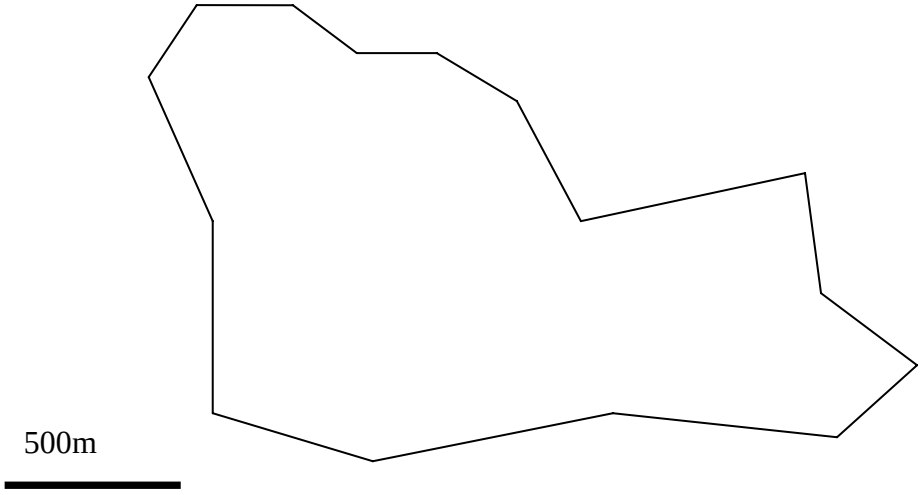
Figure 3. Patterns of trapping of Butler's dunnarts across trap-nights. Data are combined from all sessions of trapping in which Butler's dunnart were captured (28 individuals from 14 sessions across 10 different sites). a. numbers of new captures and recaptures on each night of trapping. Numbers above the bars indicate the numbers of sessions with at least that number of trap-nights; b. cumulative number of individuals captured as nights of trapping increased, c. number of trapping sessions (n=14) where the first capture occurred on that night of trapping. (Data from Ward & Hill, *unpublished*.)

Capture rates for Butler's dunnarts are low, even using these protocols. From all the trapping sessions, the mean capture rate was 0.6 captures per 100 deep-pitfall trap nights, varying from zero to four. If just the 14 sessions in

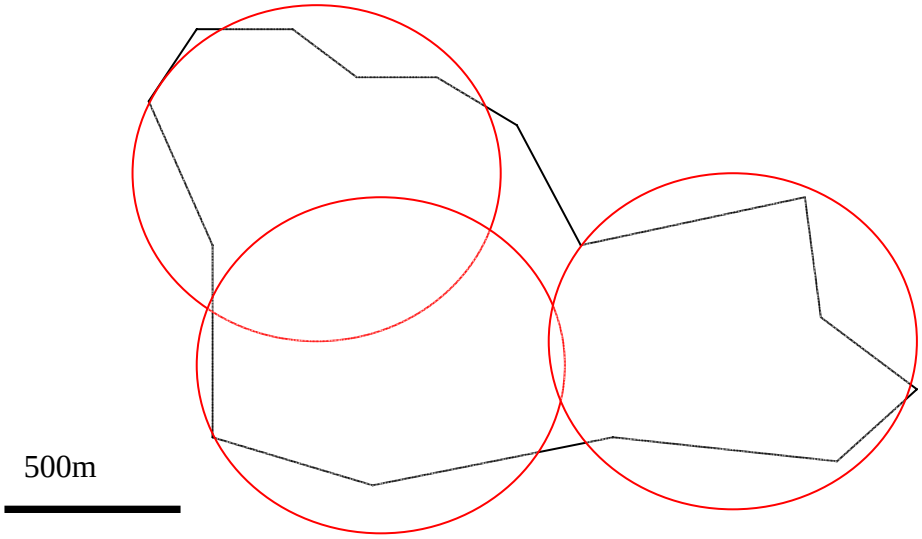
which dunnarts were captured are considered, the mean (±standard deviation) capture rate was 1.46 ± 0.86 captures per 100 deep-pitfall trap-nights. The large standard deviation indicates that the capture rate is very variable. We failed to detect dunnarts in some sessions at sites where the species was later caught, so detectability of the species is low and lack of captures when using this protocol should not be used to indicate absence of the species from an area of potential habitat.

Survey area and intensity.
There is limited information available to estimate home range size for individual dunnarts, and hence the dispersion required for trap arrangements and the spatial adequacy of sampling. One radio-tracked individual used a 1.4ha area over a 5-day period, and based on limited data from other dunnart species, individual dunnarts probably range over several hundred metres per night, and home range is probably of the order of 2-100 ha. This spatial requirement is partly reflected in the forestry approval conditional requirement on Melville Island to retain 500 m around all known Butler's dunnart locations. It is feasible to use this radius to guide appropriate levels of sampling intensity in areas proposed for forestry development, based on the premise that this sampling should (be required to) provide a reasonable assessment of whether or not the dunnart occurs in an area proposed for clearing.

For example, if the black outline below represents an area proposed for clearing, then the dunnart sampling should provide a reasonably comprehensive measure of spatial sampling adequacy.



Such adequacy can be done by selecting the central point of a trapping grid and drawing 500m radii around it (i.e. the buffer distance stipulated in the approval condition, and equivalent to an area of 78.5 ha). In the figure below, three such trapping locations would be needed to provide a reasonably comprehensive (albeit not complete) assessment of the proposed clearing area. As a nominal working rule, >90% of the proposed clearing area should be included within 500m radiuses around trapping grids.


500m

Permits

All native terrestrial vertebrates in the Northern Territory are protected and a permit is required to trap them (*Territory Parks and Wildlife Conservation Act 2006*). Permits are issued by the Permits Office of the Department of Natural Resources, Environment, The Arts and Sport, and the application form for a permit to undertake scientific research can be downloaded from our department's website http://www.nt.gov.au/nreta/wildlife/permits/ A requirement of the permit is that details of all species captured are listed in an annual report.

References

Woinarski, J.C.Z. (2004). *National multi-species Recovery Plan for the Carpentarian Antechinus* Pseudantechinus mimulus*, Butler's Dunnart* Sminthopsis butleri *and Northern Hopping-mouse* Notomys aquilo*, 2004-2008*. (NT Department of Infrastructure Planning and Environment: Darwin.) http://www.environment.gov.au/biodiversity/threatened/publications/recovery/p-mimulus-s-butleri-n-aquilo/index.html

Woinarski, J.C.Z., Woolley, P.A. and Van Dyck, S. (1996). The distribution of the dunnart *Sminthopsis butleri*. *Australian Mammalogy* **19**, 27-29.

Woinarski, J., Brennan, K., Hempel, C., Armstrong, M., Milne, D., and Chatto, R. (2003). *Biodiversity conservation on the Tiwi islands, Northern Territory. Part 2. Fauna*. 127 pp. (Department of Infrastructure Planning and Environment: Darwin.)