

Monitoring of small mammal populations in the Brindabella Ranges after fire

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Abstract. We live-trapped small mammals in the Brindabella Ranges west of Canberra, Australian Capital Territory from April 2009 until October 2011 to assess population recovery after an intense and widespread fire that occurred across the region in 2003. Three native mammals (agile antechinus, *Antechinus agilis*; dusky antechinus, *Antechinus swainsonii*; bush rat, *Rattus fuscipes*) were encountered. Trapping records and spool-and-line movement patterns suggested a strong association of these small mammals with moist gully vegetation that had survived the fire.

Additional keywords: *Antechinus*, Brindabellas, Elliott, *Rattus*, road-crossing.

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Introduction

In 2003 a bushfire burnt much of the Brindabella Ranges. The impact of this fire on small mammal populations was largely unknown. In order to assess this impact a short-term small-mammal trapping project was conducted. This work builds on previous research on small mammals in the mountains of the Australian Capital Territory, some of which was very brief and not in a post-fire context (Woolley 1966; Stewart 1979a, 1979b; Dickman 1982, 1983, 1986; Lawrence 1986; Mayo 1987; Mayo *et al.* 1987; Osborne and Preece 1987; especially Site 1: Lintermans 1988). Here we present trapping data over three consecutive years from a single site for three small mammal species. We also present data on survival and movements, including road crossing.

Methods

Study area

Trapping was conducted along a 1200-m section of New Chums Road, a short (<3 km) management-only access track within Namadgi National Park (35°23'14.17"S, 148°49'58.36"E) (Fig. 1a). The vegetation is classified as 'Southern Escarpment Wet Sclerophyll Forest' (Keith 2004). Mean annual rainfall is ~1140 mm per year. A wildfire occurred in 2003 across large parts of the Australian Capital Territory, burning much of the site. In November 2007 the road was cleared of dense post-fire regeneration to allow vehicle access for managers and researchers only. Since then only the northern half of the road has regularly been kept clear of vegetation.

Trapping and handling

Live-trapping was conducted approximately every two months from April 2009 until October 2011 (excluding winter months to avoid trap deaths due to exposure), resulting in nine trapping sessions (Table 1). We used Elliott folding box traps (100 × 90 × 330 mm, Elliott Scientific Equipment, Upwey, Victoria), baited with a mixture of rolled oats and peanut butter. A wad of non-absorbent Dacron cotton-wool was added to each trap for warmth and each trap was placed inside a thin clear plastic bag for protection from the weather.

Trapping effort varied (both in number of traps and number of nights) between sessions. Fig. 1b shows the typical trapping configuration centred on the gully through which ran an intermittent stream and which comprised a denser and moister habitat than the surrounding forest. The maximum number of traps set per night for any trip was 64 (44 traps in the roadside vegetation and 20 traps in the gully) (Table 1).

Captured animals were transferred from the trap to a cloth bag in which they were weighed. A passive integrated transponder (PIT) tag (11 mm ISP microchip, Allflex Australia) was inserted under the skin between the shoulder blades. The PIT tag number was then scanned using an Allflex Compact Reader. At first capture, and at subsequent recaptures between trips, measurements of head–body length, tail length, ear length and hind foot length were taken using a clear plastic 300-mm ruler. Males and females were assessed for age and breeding condition. Males were classified as adults if their testes were scrotal. Females were assessed as adults if their vaginas were perforate or if their teats showed evidence of lactation. Adult females

Table 1. Summary of trapping

'Date' is the first night of trapping for that session. Numbers listed in 'New captures' and 'Recaptures' represent males, females and unrecorded. Rf, *Rattus fuscipes*; Aa, *Antechinus agilis*; As, *Antechinus swainsonii*

Session	Date	Traps (n)	New captures			Between-trip recaptures			Within-trip recaptures			Total
			Rf	Aa	As	Rf	Aa	As	Rf	Aa	As	
1 ^A	19.iv.2009	64	5,2,0	3,4,1	0,2,0	0	0	0	0	0	0	17
2	14.xi.2009	128	2,1,0	0,4,0	0,0,0	1,1,0	0,0,0	0,0,0	1,1,0	0,0,0	0,0,0	11
3 ^A	17.i.2010	42	0,2,1	1,2,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	6
4	27.iii.2010	128	3,5,0	7,3,0	1,0,0	0,2,0	0,0,0	1,0,0	0,3,0	1,0,0	0,0,0	26
5 ^A	23.x.2010	50	4,3,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	7
6	7.i.2011	50	4,7,1	1,0,0	0,0,0	1,1,0	0,0,0	0,0,0	1,1,0	0,0,0	0,0,0	17
7	26.ii.2011	128	7,5,0	7,8,2	0,0,0	0,0,0	0,0,0	0,0,0	2,0,0	3,1,0	0,0,0	35
8	8.iv.2011	72	1,1,0	1,1,0	1,0,0	3,2,0	1,1,0	0,0,0	2,1,0	0,0,0	0,0,0	15
9	21.x.2011	72	0,0,10	0,1,0	0,0,0	5,0,0	0,0,0	0,0,0	1,0,0	0,0,0	0,0,0	17
Total		734	26,26,12	20,23,3	2,2,0	10,6,0	1,1,0	1,0,0	7,6,0	4,1,0	0,0,0	151

^AOne night of trapping only, hence no within-trip recaptures.

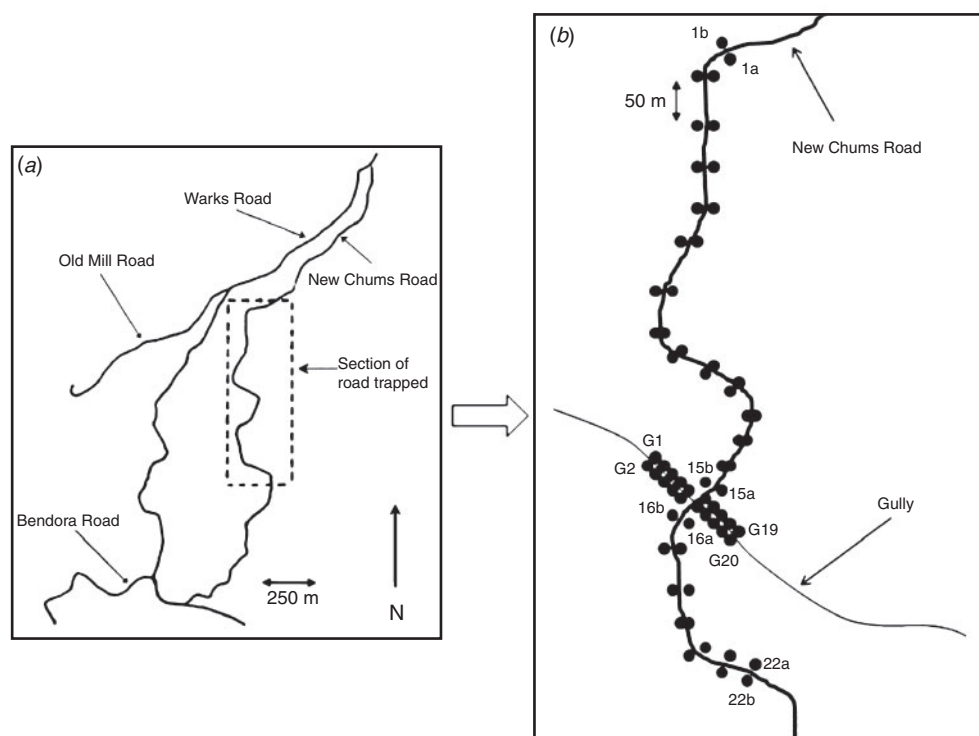


Fig. 1. Location map showing New Chums Road (a) and detail of New Chums Road showing trap locations (black dots) (b). Gully trap locations not to scale.

were also assessed for pregnancy via palpation. Within-trip recaptures were not measured but PIT tag number and trap location were recorded. Occasionally it was not possible to record measurements (e.g. due to damaged tails). All animals were released at point of capture.

Movements as revealed by trapping

Trap location data from recaptures were used to estimate an average distance moved between captures for each species. As traps were set along the edge of this winding road and evidence for road-crossing was found only in and around the gully that contained an under-road pipe (see Results below), movement

measurements from recapture events that occurred along the road were taken as a path along the roadside, rather than as a straight line that crossed a bend in the road. Measurements from gully to roadside recaptures (or vice versa) from the same side of the road were taken as a straight line. Measurements were taken using the measuring tool in Google Earth™ and known GPS locations.

Results and discussion

Trapping results

Overall trap success was 20.6%. There were 114 individual animals, with 18 within-trip recaptures and 19 between-trip

recaptures (Table 1). There were 64 captures of *Rattus fuscipes*, 46 *Antechinus agilis*, and 4 *Antechinus swainsonii*. No feral small mammal species were observed or trapped during this study. Average adult measurements are presented in Table 2.

A majority of the *R. fuscipes* captures were from the gully (58 of 93 captures; 62.3% of captures), with the remainder captured from the roadside vegetation. In comparison, 83% (44 of 53) of captures for *A. agilis* were from the roadside vegetation and only 17% were from the gully. All of these gully captures were within 10 m of the road (i.e. the first two pairs of traps on either side of the road). All captures of *A. swainsonii* (5 of 5), including one recapture, were from the gully.

The 2003 bush fires did not appear to cause the local extinction of any of these species. The small mammals identified during this study were typical for the location and consistent with previous studies listed above. This study commenced approximately six years after the fire, which was widespread and intense, destroying most of the vegetation and leaving only

small pockets of unburnt refugia in the moister gullies. It is likely that animals survived the fire in these refugia and recolonised the surrounding areas when conditions became favourable, which is consistent with other studies that have investigated the effects of fire on small mammal populations (Leonard 1972; Heislors 1974; Recher *et al.* 1974; Catling 1991).

The relatively low number of captures of *A. swainsonii* could be due to several factors. Most of the trapping effort was focussed on the roadside vegetation, which is not preferred habitat for this species (Leonard 1970; Hall and Lee 1982). It is also possible that these animals are still in a post-fire recovery stage as they are known to recover slowly after fires (Catling 1991).

Recaptures

There were five within-trip recaptures of *A. agilis* and all occurred in the same habitat type (either roadside or gully).

Table 2. Summary of adult measurements

Measurements include those taken from initial capture as well as first recapture between trips. Numbers in parentheses are standard deviations followed by number of records

	<i>Rattus fuscipes</i>		<i>Antechinus agilis</i>		<i>Antechinus swainsonii</i>	
	Male	Female	Male	Female	Male	Female
Body weight (g)	144.4 (9.6, <i>n</i> = 10)	125.9 (19.7, <i>n</i> = 15)	22.2 (2.9, <i>n</i> = 17)	21.5 (1.4, <i>n</i> = 4)	62.5 (21.9, <i>n</i> = 2)	53.0 (<i>n</i> = 1)
Head-body length (mm)	174.7 (10.1, <i>n</i> = 9)	153 (12.6, <i>n</i> = 10)	85.0 (5.0, <i>n</i> = 12)	87.8 (4.6, <i>n</i> = 6)	125.0 (<i>n</i> = 1)	120.0 (<i>n</i> = 1)
Tail length (mm)	156.8 (19.3, <i>n</i> = 9)	154 (5.8, <i>n</i> = 10)	82.2 (4.3, <i>n</i> = 13)	82.0 (2.4, <i>n</i> = 6)	103.5 (12.0, <i>n</i> = 2)	89.0 (<i>n</i> = 1)
Hind foot length (mm)	32.1 (1.6, <i>n</i> = 10)	31.4 (1.7, <i>n</i> = 10)	15.5 (2.2, <i>n</i> = 13)	15.8 (0.8, <i>n</i> = 6)	22.0 (2.8, <i>n</i> = 2)	19.0 (<i>n</i> = 1)
Ear length (mm)	21.2 (1.2, <i>n</i> = 10)	21.6 (4.6, <i>n</i> = 10)	14.1 (2.4, <i>n</i> = 13)	14.3 (2.8, <i>n</i> = 6)	14.0 (1.4, <i>n</i> = 2)	16.0 (<i>n</i> = 1)

Table 3. Animal movements as revealed by trapping

Capture locations include Session number followed by trap number and location. 'G' indicates a gully trap, 'a' an eastern roadside trap, and 'b' a western roadside trap

Species and Tag #	Sex	Initial capture location	Within-trip capture location	Between-trip capture location	Average distance moved (m)	Total distance covered (m)
<i>A. agilis</i>						
3500	M	7-13a	7-13a	—	0	0
5311	M	7-G11	7-G10	8-15a	10	10
3651	M	7-5a	7-5a	—	0	0
2310	M	4-6a	4-6a	—	0	0
1217	F	7-17a	7-16a	8-15a	45	45
<i>A. swainsonii</i>						
4585	F	1-G14	—	4-G1	40	40
<i>R. fuscipes</i>						
1569	M	7-G13	9-G7	9-G11, 8-G15	8	25
8640	M	7-G18	8-G15, 8-G20	9-G20, 8-G20	8	25
6951	M	7-G16	8-15a, 7-G17	8-G14, 9-G15	10	40
9301	M	7-G15	7-G13	9-G10	10	20
9250	M	5-14a	6-G4	6-G11	52	105
3705	M	1-16a	2-G20	2-G20	25	25
6571	M	7-G1	—	9-G7	15	15
8341	F	1-3a	—	2-5a	95	95
4524	F	5-8a	8-9a, 6-9a	8-8a, 6-8a	35	105
6819	F	4-19a	4-21a	—	60	60
2705	F	3-G20	4-G19	4-G20	2	2
2904	F	3-G19	4-G17	4-G17	5	5
5828	F	2-G1	2-G10	—	20	20

There were two between-trip recaptures (separated by six weeks), both involving traps around the road/gully intersection (Table 3).

There were 14 within-trip recapture events (8 males, 6 females) of 11 individual *R. fuscipes* (6 males, 5 females). Of these, only one (#6951) was recaptured in a different habitat (gully to roadside trap closest to gully). There were 15 between-trip recapture events (10 males, 5 females) of 11 individuals (7 males, 4 females). Of these, only two, both male, were caught in a habitat different from their original capture – both were initially captured in roadside vegetation and subsequently recaptured in the gully.

Between-trip recapture data for *R. fuscipes* using first and last capture dates did not reveal any animals surviving more than 12 months. The maximum interval between recaptures was 34 weeks. Although limited, these data are comparable to those presented by Carron (1985) and Stewart (1979b).

There were no within-trip recaptures of *A. swainsonii*. There was one between-trip recapture of a female, with an interval of 49 weeks. All captures of *A. swainsonii* occurred in the gully habitat.

Movements as revealed by trapping

Movement data, combining within- and between-trip recaptures are presented in Table 3. The 'average distance moved' figure is derived from successive captures. The average distance moved by *A. agilis* was 27.5 m (s.d. = 24.7 m, $n = 2$). One of these (#5311) showed evidence of two road-crossing events involving the gully area.

Only one *A. swainsonii* was recaptured, giving a movement length of ~40 m. Both of these capture events occurred in the gully on either side of the road, also revealing a road-crossing event.

Thirteen *R. fuscipes* provided movement data via trapping. The average movement distance between successive recaptures for males was 18 m (s.d. = 16 m, $n = 7$) and for females 36 m (s.d. = 35.8 m, $n = 6$). The average total distance travelled was 36 m (s.d. = 31 m, $n = 7$) for males and 48 m (s.d. = 45.5 m, $n = 6$) for females. Three individuals (animals #1569, #9301 and #9250, all in the gully) provided evidence for road-crossing.

Estimates of home range and movements for small mammals are problematic (Stickel 1954; Wood 1970; Statham 1982). Trapping for this study was not conducted using a grid pattern, trapping sessions were irregularly timed using varying numbers of traps, traps were set with varying gaps in between and trapping alongside a winding road made straight-line measurements difficult. Therefore we have not presented formal estimates of home range length. Instead, we present average distances moved between successive captures and total distance moved. These figures for *R. fuscipes* are lower than those presented in other studies but our data obviously suffer from a low number of recaptures. Barnett *et al.* (1978) in northern New South Wales showed that male *R. fuscipes* moved an average of 95 m between successive captures, and females moved 42 m. Leonard (1972) found that males from the Daylesford area in the non-breeding season had a restricted movement range of ~40 m but in the breeding season this expanded to an average of ~115 m between successive captures.

There were too few recaptures of *A. agilis* to give any reliable estimates of movement range. The figures given in Table 3 are consistent with two studies close to New Chums Road. Woolley (1966) gives movement data for female *A. agilis* of 50 yards (45 m) and 200 yards (182 m) and Dickman (1983) gives figures of 50 m for males and 37 m for females.

Trapping results showed that several animals crossed from one side of the road to the other. All of these road-crossing events occurred where the road passes through a gully containing a drainage pipe. During the study the creek in the gully was dry, possibly allowing for easy passage. There was no direct evidence that these animals used the pipe to cross from one side to the other but it was possible and may warrant further investigation.

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