Mammals and Birds of the Mount Napier State Park

P.R. Bird

Abstract

This paper reports observations made over twenty years (1974-95) in Mt. Napier State Park, an area of newer volcanics dominated by Manna Gum *Eucalyptus viminalis*, Blackwood *Acacia melanoxylon*, Austral Bracken *Pteridium esculentum* and Common Tussock Grass *Poa labillardieri*.

The Dusky Antechinus *Antechinus swainsoniii* and Bush Rat *Rattus fuscipes* were the most common small native mammals captured. The Brown Antechinus *A. agilis* and Swamp Rat *Rattus lutreolus* were less common. A Brush-tailed Phascogale *Phascogale tapoatafa* and Sugar Glider *Petaurus breviceps* were seen in the forest.

The most common bats caught were Chocolate Wattled Bat (*Chalinolobus morio*), Lesser Long-eared Bat *Nyctophilus geoffroyi* and Little Forest Bat *Vespadelus vulturnus*. The least common bats were Gould's Wattled Bat *C. gouldii*, Gould's Long-eared Bat *N. gouldi*, Large Forest Bat *Vespadelus darlingtoni* and Southern Forest Bat *Vespadelus regulus*. Common Bent-wing Bats *Miniopterus schreibersii* also roost in the Byaduk Caves.

Significant bird records were Rose Robin *Petroica rosea*, Satin Flycatcher *Myiagra cyanoleuca*, Black Falcon *Falco subniger* and Grey Goshawk *Falco hypoleucos*.

[A version of this paper was published in *The Victorian Naturalist* **114** (2) 1997, 52-66].

Introduction

The Mt. Napier State Park lies 13 km south of Hamilton in south west Victoria (Fig. 1). The park occupies some 3,000 ha of volcanic landscape of comparatively recent origin. The dominant feature of the landscape is a scoria cone named Mt. Napier in 1838 by Major Thomas Mitchell. In May 1841, G.A. Robinson camped at a village of the powerful Tappoc Conedeet clan at "the great swamp" (now the drained Buckley Swamp), before they were dispossessed of the country, and learned that their name for the cone nearby was Tappoc (Presland 1977). The volcano erupted at least 7,300 years ago* (Gill and Elmore 1973), covering about 9,000 ha of the extensive but thin sheet of Pliocene basalt, which overlies Cainozoic marine sediments. Willis (1963) provides notes on the history and vegetation of the former small Mt. Napier Reserve. The geological features of the surrounding area and the Byaduk lava caves are described by Gill and Elmore (1974) and Ollier and Brown (1964), respectively.

The soils of the area are fertile but mostly stony and most of the area outside the park has, with great difficulty, been used for agriculture. Crown land was sold in the area through to the 1960s. The remainder, including a Forest Reserve in the northern sector, was locally regarded as "wasteland". Scoria was mined at Menzel's Pit. Much of the land in the southern and western sectors was leased for grazing up until at least 1980. There is no surface water on the newer basalt within the park.

State Park status was recommended by the Land Conservation Council in 1982 and proclaimed in 1987. A draft plan for management was released in 1993. [* a new dating is ~ 30,000 years]

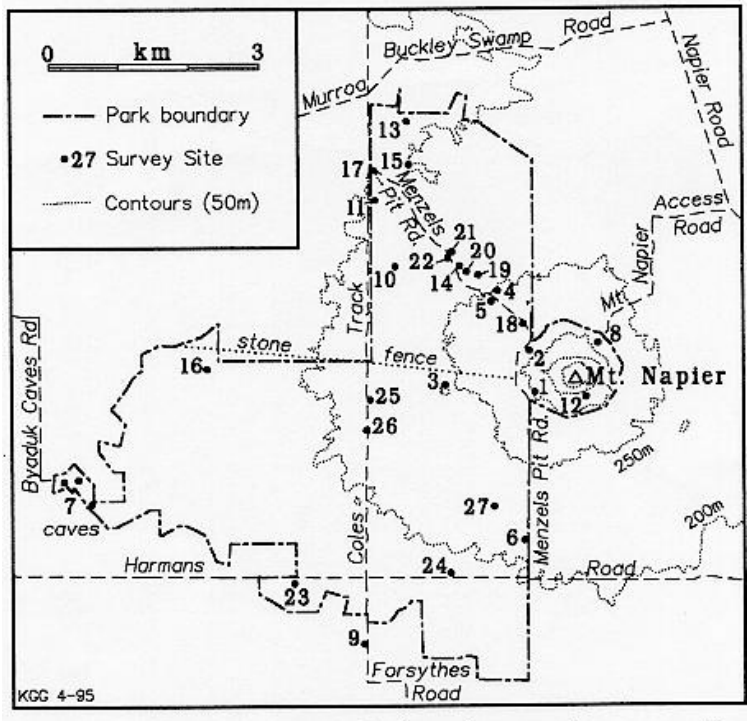

Figure 1: Mt. Napier State Park and mammal survey sites

The vegetation varies from grassy woodland to tall open forest. Manna Gum *Eucalyptus viminalis* is the sole eucalypt and the dominant tree species. Blackwood *Acacia melanoxylon*, Cherry Ballart *Exocarpos cupressiformis* and Tree Everlasting *Ozothamnus ferrugineus* are the major understorey trees. Apart from the Byaduk Caves on the Harman's Valley lava flow, Black Wattle *Acacia mearnsii* is restricted mainly to the margins of the new lava and in a few "islands" where the older basalt soils were not covered. Swamp Gum *Eucalyptus ovata* is only found on freehold land just off the newer basalt. Shrubs such as Sweet Bursaria *Bursaria spinosa*, Kangaroo Apple *Solanum laciniatum* are widespread, while Sticky Boobialla *Myoporum viscosum*, Western Golden-tip *Goodia medicaginea* and Shiny Cassinia *Cassinia longifolia* are less common.

An aerial photograph from 1948 shows no trees on the summit and few on the mid and upper slopes of the Mount, consistent with the disastrous Jan. 1944 fires which swept the district. Willis (1963) commented on the fire-damaged vegetation on the Mount. The forest has been regularly burned by graziers and arsonists. Lightning has not been a factor here. Severe fires in Nov. 1965, Easter 1972, Sep. 1977, Oct. 1975, Dec. 1980 and Oct. 1987 were noted in Department files or by the local press. Smaller fires in Sep. 1994 and May 1996 were also "deliberately lit" (Anon. 1994, 1996).

Fires have severely modified the vegetation. Blackwoods are common and widespread in the park but mature specimens are rare because few manage to survive beyond one or two fire cycles. The northern flank of the Mount is the only area in the park that has not been burned since 1972 and Blackwoods there stand some chance of achieving old age. Here the trees also appear to have suppressed the undergrowth.

Fires kill all young trees in areas of tall, thick bracken growing on deep brown soil near the lava "barriers", and damage mature Manna Gums. Blackwoods and young Manna Gums struggle in this deep-soil zone that should otherwise provide the best growth. The park managers have not taken adequate account of ecological factors here and an ill-advised prescribed burn in April 1993 near Murroa Corner scorched foliage to 10 m height and killed most of the young trees, severely degrading the tourist route to the Mount.

Austral Bracken *Pteridium esculentum* is the dominant groundcover species in most areas of the park. The presence of long stone fences throughout the forest, now in parts so dense with Austral Bracken as to scarcely admit passage, shows that this was not always so. Bruni (GA Browne) confirms this in an article written in 1903 ... "*many years ago the brackens began to spread throughout the stony country and in a short time they completely covered the surface, to the great detriment of the pasture... the stony rises used of old to fatten cattle splendidly*". Much of the forest, too, had been changed since it was held under squatting license... "*in the stony country surrounding Mt. Napier, as elsewhere, the timber has been cleared away 'til it is almost a plain and the once heavily wooded mount has become a bald hill*". Mitchell had cleared the summit of trees in 1836 (Mitchell 1838); nearly 150 years later the Hamilton Field Naturalists began to replant it with trees grown from seed collected at the base of the Mount. The dominance of Austral Bracken in the park is probably due to the increased frequency of fire, together with the impact of grazing by rabbits and livestock on other species.

Common Tussock Grass *Poa labillardieri* is conspicuous on the stony barriers and the slopes of the mount. Bidgee Widgee *Acaena anserinifolium* is also widespread. Variable Groundsel *Senecio lautus*, Small-leaved Clematis *Clematis microphylla*, Austral Storks-bill *Pelargonium australe*, Bluebells *Wahlenbergia* spp. and Ivy-leaf Violet *Viola hederacea* are conspicuous groundcover species, providing a showy display in the summer.

The total number of native vascular species recorded for the area, including the Byaduk caves (Beauglehole and Learmonth 1957) and the former Mt. Napier Reserve (Willis 1963), is only 176 species (records of Beauglehole (1984) and a few recent additions by Elmore and Bird). There are a further 102 alien species.

This report provides an assessment of the mammal and bird species living in the forest area, which has been isolated from other forest areas for over 100 years due to the clearing of the surrounding plain for farms. No surveys of this area have been previously made, although Emison *et al.* (1978) surveyed a similar area 25 km further south (the former Stones State Faunal Reserve and Mt. Eccles National Park).

Methods

The observations recorded in this paper have been made sporadically between 1974 and 1995. The survey sites are described in Table 1 and their location indicated in Figure 1. Several mammal survey methods were used, under permits from the former Fisheries and Wildlife Division, Ministry of Conservation Victoria:

1. Live trapping

(a) Cage traps – 10 traps (45 x 15 x 12.5 cm) were made from wire mesh (1.25 x 1.25 cm) and 10 cylindrical traps (30 x 9 cm diameter) were made from wire mesh (2.5 x 2.5 mm); the large cage traps did not retain mice or very small *Antechinus*. Twenty small and 10 large Elliott aluminium traps were also employed after 1979. Traps were baited with a mixture of honey, peanut butter and rolled oats. The traps were set on the ground, except for one period (Site 13) when 10 mesh traps were set 5 m up trees for three nights. Traps were checked each morning and, when they were to be left for more than one day, occasionally in the late afternoon. Captured mammals were put in a small bag and weighed on a Salter 250 g spring balance to the nearest gram. The animals were then measured with respect to head-body length, tail length, length of hind foot (excluding nail), length of ear from the notch, foreclaw and hindclaw (*Antechinus* spp. only). A vernier calliper and graduated ruler were used. One specimen of each species was retained and lodged either with the former Fisheries and Wildlife Division or the former National Museum of Victoria (NMV) for reference. Other animals were released at the site of capture, after clipping a toenail to enable a recaptured animal to be identified.

(b) Pit traps – 4 pit traps (a 20 L drum sunk, with great difficulty, just below the level of the stoney ground) were set at approximately 5 m spacing at each of Site 1 (grassland) and Site 17 (bracken dominated understorey) and a 20 x 0.3 m polythene barrier was erected across the centre of the drums. The lines were monitored daily from 1-5 Jan. 1979.

(c) Bat traps – 2 collapsible harp traps were constructed along the lines of that described by Tidemann and Woodside (1978), except that the frame was made from wood rather than aluminium. Cords were slung over convenient vantage points (usually branches) and the frame was lifted into position from hooks attached to the top corners. Sites were chosen where a trap could cover a substantial part of a flight path through the trees or entrance to a lava tunnel. The traps were set at dusk and checked early in the morning. Most bats were weighed, length of ear and forearm recorded and colour of fur noted to aid identification (Hall and Richards 1979). The first male of each species was retained and lodged with the NMV for reference; all other bats were released at the site of capture. Pregnant females bearing single or twin foetuses were noted.

2. Predator scat analysis

Scats, presumably from Red Foxes *Vulpes vulpes*, were collected along the tracks in the forest and at the Byaduk Caves. The scats were prepared as described by Brunner *et al.* (1975) and examined microscopically by Hans Brunner, Keith Turnbull Research Institute, Frankston.

Bone material was also collected from the soil or rock floors of caves in the forest at The Bridge (Oct. 1973), SW of Mt. Napier (June 1977), and Brown's Cave at the Byaduk Caves (June 1977) and identified by Joan Dixon, Curator of Mammals (NMV).

3. Hair sampling tubes

Twenty hair-sampling tubes were constructed according to the design of Suckling (1978). Bait was smeared on the inside centre of the tubes which were then nailed to tree trunks 2-4 m from the ground. The tubes were sampled for 2 weeks in July 1978.

4. Nest boxes

Ten wooden boxes (five were 30 x 10 x 10 cm and five were 40 x 15 x 15 cm) were tied to trees 4-5 m from the ground. The small boxes had entry holes of 40 mm diameter and the larger boxes 60 mm diameter, which were situated towards the top of the box. Each had a detachable lid to allow inspection inside. The boxes were installed in January 1980 and inspected in Feb, April and Oct. 1980, April and July 1981. Four were destroyed by fire in Dec. 1980.

5. Daylight and spotlight observation

Sightings of birds and mammals in daylight were recorded while carrying out survey methods 1-4 above. Spotlight observations of mammals and nocturnal birds were made on twelve occasions from a vehicle and on foot.

6. Survey of historical literature

Changes in flora and mammalian fauna over time were assessed by reference to historical literature (*e.g.* Bruni 1903, Mitchell 1838, Presland 1977 and 1980, WW 1916), including the local press, recollections of adjoining landholders and sub-fossil records for the Byaduk Caves (Wakefield 1964).

Table 1. **Mammal survey sites in the Mt. Napier State Park (see Figure 1)**

1. Mt. Napier Reserve, SW corner, on Menzel's Pit Rd, 2.7 km N from Harman's Rd; Manna Gum and Blackwood woodland with tussocks. Burned Easter 1972 and in Sep 1977.
2. Mt. Napier Reserve, NW corner, 0.3 km S from Menzel's Pit; small cone with lava blocks, logs, bracken, tussocks and Blackwood. Burned in 1972 and in 1977.
3. Elmore's Cone with lava bridge and collapsed tunnel, 0.25 km S of the E-W stone fence from a point 1 km W from the junction of that fence with Menzel's Pit Rd; tall open forest with tall bracken and tussocks. Burned in Nov 1965 and early 1970s.
4. Scoria cone 0.1 km E of Menzel's Pit Rd from a point 0.7 km N of Menzels Pit; grassy Manna Gum woodland with a few logs. Burned in 1972.
5. Barrier and crater W of Menzel's Pit Rd, opposite Site 4; tussocks and old trees on barrier, dense bracken in crater. Burned in 1972 and on 28 Sep 1977.
6. Barrier edge, W side of Menzel's Pit Rd, 0.5 km N from Harman's Rd; dense bracken and scattered Manna Gums. Burned in the early 1970s and late 1970s.
7. Byaduk Caves (Harman's 1 and 2, Bridge, Brown's and Church caves); dense bracken, other ferns, Shiny Cassinia and a few Blackwoods.
8. Mt. Napier Reserve, NE corner; dense tussocks, Variable Groundsel, bracken, young open forest of Blackwood and Manna Gums. Burned in 1972.
9. Forsythe's Rd, 1 km S of Harman's Rd; barrier with logs, Manna Gums, bracken and a grassy clearing with Black Wattles. Burned in the early 1970s.
10. Barrier edge, 0.5 km E of Cole's Tk from a point 2.5 km from Murroa Corner; Sticky Boobialla, Sweet Bursaria, bracken and logs. Burned in 1972 and in 1975.
11. Along Cole's Tk, 1-2 km from Murroa Corner; old open forest of Manna Gum, Blackwood, Tree Everlasting, tussocks and bracken. Parts burned in Oct 1975.
12. Mt. Napier Reserve; moist gully on the SE flank, tall open forest of Manna Gum, with Mother Shield-fern, bracken and tussocks. Burned in 1972.
13. Open forest near a barrier, 0.5 km E of Menzel's Pit Rd from a point 0.5 km from Murroa Corner; Manna Gums and dense bracken. Burned in 1972 and 31 Dec 1980.
14. Menzel's Pit Rd, 3 km from Murroa Corner; lava pile, bracken and tussocks on the E side of the track. Burned in 1972.
15. Open forest near a barrier, 0.5 km E of Menzel's Pit Rd from a point 1 km S from Murroa Corner; tall Manna Gums and dense bracken. Burned in 1972.
16. Edge of barrier 0.7 km S of the stone fence at the "Old Ruin", E of Byaduk Caves; tall open forest of Manna Gum, with tussocks and bracken. Burned in 1972.
17. Between the junction of Cole's Tk and Menzel's Pit Rd; open Manna Gum forest adjoining a grassy, bracken-clad barrier. Burned in 1972.
18. Menzel's Pit, 4.5 km along Menzel's Pit Rd from Murroa Corner; scoria boulders amidst Kangaroo Apple, bracken and Manna Gums. Burned in 1972 and 1975.
19. A patch of Manna Gum, bracken and Bidgee Widgee not burned Sep 1977; 0.2 km E of a quarried cone on Menzel's Pit Rd from a point 3.3 km from Murroa Corner.
20. A 1 ha patch of rocks and logs in a stony basin not burned in Sep 1977; 0.1 km E of Menzel's Pit Rd from a point 3 km from Murroa Corner.
21. Several small patches of tall, old Manna Gums amidst stony ridges not burned in Sep 1977; just E of Menzel's Pit Rd, from a point 2.75 km from Murroa Corner.
22. Small patch (0.2 ha) of dense bracken and tussocks unburned in Oct 1975; W of Menzel's Pit Rd opposite Site 21, adjacent to a barrier.
23. A ridge of lava with sparse Manna Gums and moderately tall bracken, not burned in 1975; 0.1 km S of Harman's Rd from a point 0.4 km E of the edge of the lava field.
24. Patch of jumbled lava, tussocks and old Manna Gums, not burned in Sep 1977; N side of Harman's Rd, 1.1 km W of junction of Harman's Rd and Menzel's Pit Rd.
25. Woodland along E side of Cole's Tk, 0.5 km S from the E-W stone fence; tall bracken running on to sparsely clad ridges. Burned in 1965 and in 1975.

26. Open forest along W side of Cole's Tk, 1.0 km S from the E-W stone fence; rough lava with large Manna Gums, deep bracken and tussocks. Burned in 1965 and in 1975.
27. Hill in forest 0.5 km W of Menzel's Pit Rd, from a point 1 km N of Harman's Rd.

Results

The mammals captured in cages and Elliott traps within the forest are shown in Table 2. Overall, there were 246 captures (including 11 recaptures) in 1538 trap-nights (16% success). The total for natives was 162 captures (11% success). Some unexpected captures were four skinks (*Sphenomorphus* sp.) and, when several traps were set in trees, two White-throated Treecreepers and a Brown Thornbill

Table 2. Number and species of mammal captured in the Mt. Napier forest
number of animals recaptured indicated in brackets ( )

Site	No. of trap nights	Dusky Antechinus	Brown Antechinus	Bush Rat	Swamp Rat	Black Rat	House Mouse
1	108	-	-	-	-	-	1
2	55	6	1	2	-	-	1
3	120	1	-	-	2	2	22
4	50	-	-	-	-	-	14
5	123	6	1	25(6)	-	-	4
6	80	9(2)	-	-	2	1	3
7	36	1	-	-	-	6	1
8	50	-	-	-	5	2	5
9	68	6	-	-	-	-	1
10	18	4	-	-	-	1	-
11	122	3	-	2	-	-	3
12	60	2	-	1	2	-	1
13	194	3	14	13(1)	-	-	5
14	56	1	-	1	-	-	-
15	46	5	-	3(1)	2	-	-
16	60	5	-	4	-	-	3
17	82	-	2	-	1	-	5
18	28	2	-	8	-	-	1
19	12	3	-	-	-	-	-
20	8	1	-	-	-	-	-
21	16	1	-	1	-	-	-
22	16	-	-	2(1)	-	-	-
23	20	-	1	1	-	-	-
24	20	-	-	-	-	-	2
25	30	-	-	-	-	-	-
26	60	7	-	-	-	-	-
Total	1538	66(2)	19	63(9)	14	12	72

Two species of *Antechinus* and two native *Rattus* species were found, together with two species of introduced rodent. The Dusky Antechinus *Antechinus swainsonii*, 64 individuals, and Bush Rat *R. fuscipes*, 55 individuals, were the most common small native mammals captured in the Park. The Brown Antechinus *A. agilis* occurred irregularly, in time and space. The percentage of males in the captured Dusky Antechinus, Brown Antechinus, Bush Rat and Swamp Rat *R. lutreolus* was 58, 37, 50 and 57%, respectively.

Trapping was usually directed to areas that had not been recently burned, sometimes islands of unburned vegetation. However, there were a few occasions when burned areas were targeted. Three Bush Rats were caught in Oct. 1977, below the rim of a lava flow burned 10 days earlier. In March 1978, no rats were caught in this area of vigorous Austral Bracken regrowth but one animal was trapped amidst Common Tussock Grass in a nearby copse of Blackwood. In April 1976, no animals were caught at Site 11 on patches which had been burned for fuel reduction in Oct. 1975, but three animals were caught in the unburnt sections.

The earliest evidence of breeding in the Dusky Antechinus was July; one female was found on the 31 July 1976 with 8 young attached to teats. Since the offspring were 1-1.5 cm in length, perhaps they were born two weeks earlier. The three smallest independent animals were trapped in mid-October and

weighed 12, 15 and 18 g. Lactating females were found as late as 2 November. Only one Brown Antechinus was found to be lactating; this female was caught on 22 October. The smallest animals, four females each weighing 16 g, were caught in April.

Seven species of bats were captured in the harp traps and data for body mass and forearm length is presented in Table 3. Of the 33 trap nights, made over 10 different periods of 1-7 days between April 1979 and Jan. 1987, 134 bats were captured. Most bats were caught in the months Nov. to Jan. In Nov. of 1979 and 1986, most of the females were pregnant. Both of the female Little Forest Bats captured had a single young; 26 of the 28 female Chocolate Wattled Bats captured had twins and two had single young; all nine of the female Lesser Long-eared Bats and both female Gould's Long-eared Bats had twins.

Table 3. Numbers and species of bats captured within the Mt. Napier forest
The data for mass and forearm include mean, standard deviation (sd) and number of observations (n)

Species		No. trapped	Mass (g) mean ± sd (n)	Forearm (mm) mean ± sd (n)	Forearm range (mm)
Gould's Wattled Bat	*Chalinolobus gouldii*	1	-	48.0	
Chocolate Wattled	*Chalinolobus morio*	70	10.5 ± 1.2	38.5 ± 1.0 (61)	36.4-41.0
Lesser Long-eared	*Nyctophilus geoffroyi*	32	8.6 ± 1.7 (14)	37.5 ± 1.2 (20)	36.0-39.0
Gould's Long-eared	*Nyctophilus gouldi*	5	10.6 ± 1.1 (5)	41.5 ± 1.4 (5)	40.0-43.0
Large Forest Bat	*Vespadelus*	3	7.0 ± 0 (3)	34.3 ± 0.6 (3)	34.0-35.0
Little Forest Bat	*Vespadelus vulturnus*	22	4.5 ± 1.3 (4)	28.8 ± 0.9 (16)	26.6-30.0
Southern Forest Bat	*Vespadelus regulus*	1	6.0	31.6	

When this survey began the *Vespadelus* (formerly *Eptesicus*) group had not been differentiated and it is possible that some bats recorded then as *V. vulturnus* (Little Forest Bat) may have been *V. regulus* (Southern Forest Bat), because both species are similar in appearance (Hall and Richards 1979) and the range of forearm and other measurements overlap. Kitchener *et al.* (1987) give a range of 26.3-32.8 mm for *V. vulturnus* and 28.0-34.4 mm for *V. regulus*. In particular, one bat recorded in 1987 as a Little Forest Bat has been ascribed in Table 3 as a Southern Forest Bat. The bat was lodged with NMV but cannot be located. However, from notes on the specimen – male, forearm 31.6 mm, body 41 mm, tail 35 mm, tragus 6 mm, ear 11 mm, colour and characteristic penis shape (Kitchener *et al.* 1987) – it was probably *V. regulus*.

Seven mammal species were detected by predator scat analysis (Table 4). Many of the scats collected in April and May of 1978 consisted almost entirely of insect remnants (mainly crickets and moths). Two samples collected from caves were from owl or kestrel pellets of recent origin.

Table 4. Species of mammal detected within the Mt. Napier forest area by analysis of fox scats collected along tracks from June-Aug 1977 & April-June 1978.

The data shows the number of scat samples containing a particular species.

Site No.	No. of samples	Bush Rat	Brown Antechinus	Echidna	Brushtail Possum	Sheep	Rabbit	House Mouse
7	29	1	-	1	-	-	26	6
6-18	24	-	-	-	2	-	24	-
23-24	15	-	-	2	2	-	14	-
17-18	41#	2	4	2	6	4	34	-
Total	109	3	4	5	10	4	98	6

one scat with Common Brushtail Possum fur had a lead shotgun pellet; another contained Crimson Rosella feathers

Other bone samples of uncertain age were also collected from the lava caves (Table 6) and might best be described as sub-fossil.

No mammals were captured in pit traps and none were detected using hair sampling tubes, but hairs of Common Brushtail Possum were found in two tubes that had been disturbed.

Table 6. Mammal species identified from surface bone deposits in lava caves in the forest (Sites 3 & 27) and the Byaduk Caves (Site 7).

Species		The Bridge	Hill SW of Mt. Napier	Brown's Cave (1977)
Yellow-footed	*Antechinus flavipes*	#*	#	
Dusky Antechinus	*Antechinus swainsonii*	*		
Dog	*Canis familiaris*	*		
Kangaroo	*Macropus* spp.	*		
Broad-toothed Rat	*Mastocomys fuscus*	*	*	
Rabbit	*Oryctolagus cuniculus*	†		
Swamp Rat	*Rattus lutreolus*		#	
Black Rat	*Rattus rattus*	*	*	
Bush Rat	*Rattus fuscipes*			§
Common Brushtail	*Trichosurus vulpecula*	*		

* jawbones of indeterminate age; # limb fragments of indeterminate age; † fresh skull of a young rabbit;
§ fresh samples of regurgitated pellets from owl or kestrel contained jawbones of young Bush Rats and at least 100 jawbones of scincid lizards.

Five native and five alien mammal species not detected by other means were seen by spotlight or during the day (Table 5). Only one Eastern Grey Kangaroo and no Black Wallabies were seen before 1986, despite 19 hours of spotlighting and conducting the entire cage trapping, scat collection and most of the bat survey work in that period. Only one Echidna was seen, despite plentiful evidence of digging and appearancxe of quills in fox scats.

Birds recorded in the survey area are shown in Table 7, where an indication of the habitat distribution of the birds – forest, grassland, temporarily flooded areas or aerial nomads – is given. Species seen only once are also marked.

Body measurements (mean, range and standard deviation) for captured *Antechinus* and native *Rattus* species are presented in the Appendix (Table 8) in order to characterise these populations. The effect of body mass (a surrogate for age) on the proportions of some body components is examined from the relationships between body mass and various linear body measurements (Table 9).

Discussion

The most common bat captured was the Chocolate Wattled Bat. Most of the bats captured in harp traps placed across the entrances to the small caves in the forest in Nov. 1986 were females and most were heavily pregnant, with most of the Chocolate Wattled Bats carrying twins. Similar numbers of this species were found at this site in Dec. 1980, but none were obviously pregnant. Since pregnant females were noted in Nov. 1979 it seems probable that in 1980 all had given birth by late December. This is not invariable because in Jan. 1986 one of five females was still carrying a single foetus.

Since most bats of all species, except Gould's Wattled Bat and Southern Forest Bat, were caught entering or leaving the small caves it seems likely that some were roosting in the cracks and crevices in the lava walls and ceiling. One bat, species unknown, was observed during the day deep in such a crack. Bat droppings were also present on the floor of the forest caves but, since about 1985, feral goats have camped in these areas and have obliterated these signs and the presence of sub-fossil bones.

The least common bats caught were Gould's Wattled Bat, Gould's Long-eared Bat, Large Forest Bat and Southern Forest Bat. This apparent difference in abundance may be an artefact of the trapping method or positioning of traps. Few Large Forest Bats were found, although that species was the dominant *Vespadelus* identified at Mt. Eccles NP in a survey conducted in April 1983 (unpublished data). The forearm length for that group was 35-36 mm. The bats captured at Mt. Eccles were Lesser Long-eared Bat (4), Gould's Long-eared Bat (1), Chocolate Wattled Bat (23), Large Forest Bat (4) and Little Forest Bat (1).

Common Bent-wing Bats *Miniopterus schreibersii* use the Byaduk Caves at infrequent intervals, but the major wintering or maternity caves appear to be Lake Gillear and Naracoorte Caves (Smith 1965).

Bats were observed in the Byaduk Caves (Harman's, Fern and Church Cave) in Oct. 1973 and similar numbers (perhaps a hundred or two) still occasionally roost in the latter two caves. Elmore (pers. comm.) believes that cooking fires in at least four of the caves in the 1970s disrupted the bat population. I have not seen any bats in Harman's Cave in recent years; this is the most accessible cave and subject to the greatest disturbance from tourists. Visitor usage of Church Cave and Fern Cave is less intense and they have a higher ceiling. Large deposits of guano exist in Harman's, Bridge, Church and Fern Caves.

The predator scat analysis did not reveal species not found by live-trapping or observation. It was hoped that the presence of species such as the Southern Brown Bandicoot *Isoodon obesulus*, Feathertail Glider *Acrobates pygmaeus*, Eastern Pygmy Possum *Cercartetus nanus*, Common Ringtail Possum *Pseudocheirus peregrinus*, Fat-tailed Dunnart *Sminthopsis crassicaudata* and Yellow-footed Antechinus *Antechinus flavipes*) may have been revealed in this way.

Curiously, the scat analysis showed the presence of Brown Antechinus but not the Dusky Antechinus, which was trapped more regularly and frequently (64 *v.* 19 individuals). Since only 3 scats contained Bush Rat fur, but this species was also common in the forest (63 individuals), it is possible that this was due to the difficulty a fox would have in successfully hunting these species in their dense bracken habitat. In contrast, Brown Antechinus were trapped in more open habitat where a fox might operate more easily. Rabbits *Oryctolagus cuniculus* formed the major part of the fox diet and these, too, are usually seen on the more open areas and along tracks in the more dense areas. Rabbits are a major pest in this Park, although numbers recorded during the survey (Table 5) were not high.

Swamp Rats were trapped sporadically in low numbers (14 individuals) but were not detected in the scat analysis. It is not uncommon in ungrazed, untrampled areas on farms in the region. The species is often regarded as a nuisance because of its habit of invading vegetable gardens and chewing the roots of young trees. At "Lanark", near Branxholme, I concluded that it was responsible for the loss of most of the Hickory Wattle *A. falciformis* planted in a woodlot. Other acacias, including Blackwood, did not appear to be affected, but suckering in this species could result from Swamp Rat activity.

The body measurements for captured *Antechinus* species indicated that animals of greater body mass had significantly shorter tails and ears, as a proportion of head-body length. This was not the case for the native *Rattus* species. For the Brown Antechinus, a large male (40 g) would have a tail length about 90% of head-body, compared with 98% for males of average mass (28 g). Published papers on *Antechinus* (*e.g.* Wakefield and Warneke 1963 and 1967) and field guides give mean values which can be misleading as an aid to identification of specimens which are much smaller or larger than average.

The Yellow-footed Antechinus is usually much larger than the Brown Antechinus but large individuals of Brown Antechinus can sometimes be confused with the former. Since small individuals of Yellow-footed Antechinus probably also have proportionately shorter tails, as found here for Brown Antechinus and Dusky Antechinus, then one should be able to confidently differentiate between similar sized individuals of Yellow-footed Antechinus and Brown Antechinus on the basis of this character and the colour of fur on the feet and flanks.

The Broad-toothed Rat *Mastacomys fuscus* and the Yellow-footed Antechinus were not detected here by any survey method, but were identified from jawbones and other bones collected from lava caves at The Bridge (site 3) and from a lava cave on a small hill 0.7 km NW of site 6 (Table 6). The discoloured bones were collected from the soil surface but no attempt was made to determine an age for the material. These species were also represented in sub-fossil bone deposits collected in the Byaduk Caves by Wakefield (1964). These species – and others recorded by Wakefield, including Eastern Pygmy Possum, Feathertail Glider, Fat-tailed Dunnart, Southern Brown Bandicoot, White-footed Dunnart *Sminthopsis leucopus*, Squirrel Glider *Petaurus norfolcensis*, Eastern Barred Bandicoot *Perameles gunnii* and Red-necked Wallaby *Macropus rufogriseus* – are present today in other areas of Victoria but apparently not now in the Mt. Napier State Park.

Animals were probably taken by predators into the Byaduk Caves from the surrounding plains of older basalt which, from the observations of Robinson in 1841 (see Presland 1977 and 1980), were "*thinly wooded and well grassed*", with "*banksia*" (Silver Banksia), "*eucalyptus*" (Swamp gum and

Manna Gum), "*lightwood*" (Blackwood), "*cherry*" (Cherry Ballart) and "*wattle*" (Black Wattle). These species, with Sweet Bursaria and Drooping She-oak *Allocasuarina verticillata*, occur as remnants today. Drooping She-oak survives on Mt. Eccles but not in the Mt. Napier State Park. Robinson observed that Silver Banksia *Banksia marginata* was an abundant species on the basalt plains and Bruni (1903) observed that the country approaching the stony rises "*was originally covered with a dense growth of honeysuckles, of which scarcely one remains*". A remnant exists at Yatchaw, and in 1972 an old banksia log was found in the Bridge Cave (Lionel Elmore, pers. comm.). When that woodland disappeared, so did the dependant animal species. The animals present in the sub-fossil record of the Byaduk Caves did not necessarily reside in the forest area of the newer volcanics.

The Fat-tailed Dunnart occurs nearby on the basalt plains. In June 1978 an individual was caught by a cat near Strathkellar and in 1983 I found a road-kill on the Mt. Napier Rd 10 km from Hamilton. These animals are occasionally found in freshly dug post holes or more often under posts left lying in the paddock. Three such instances have been reported to me since 1985, the most recent near Buckley Swamp in Sep 1996. Laurie Kirkwood (pers. comm.) recalls seeing this species about 40 years ago "*in the stones*" on a farm just south of Mt. Napier.

Kirkwood also recalls at that time catching "*rat kangaroos*" in rabbit traps. He described the animals as "*about 12 inches tall*" and that they "*hopped like little kangaroos when released*". In 1975, the late Mrs Elmore saw an animal of this description when it crossed Cole Track, about 500 m south of the E-W stone fence (Lionel Elmore, pers. comm.). He had disturbed it while walking from the car into the bush. Presumably the animals were Long-nosed Potoroo *Potorous tridactylus*, a species recorded by Wakefield (1964) in bone deposits at Mt. Eccles, but apparently not now present there or at Mt. Napier. Frequent fires may have contributed to this loss. The baiting of rabbits with carrots impregnated with sodium fluoroacetate (`1080') may also have been a major cause because this species is more sensitive to 1080 than the Rabbit (McIlroy 1982).

Until recent years the Eastern Barred Bandicoot also occurred on the basalt plains near the park, although Kirkwood could not recall seeing the species in or near "the stones". The nearest occurrence of the Red-necked Wallaby, Southern Brown Bandicoot and Yellow-footed Antechinus is the Grampians (Gariwerd) National Park. I collected a road-kill of the Long-nosed Bandicoot near Mt. Abrupt in June 1975 and captured Yellow-footed Antechinus in the Dundas Range in June 1979. The nearest record of the Feather-tailed Glider is the Wannon Falls Reserve, where a domestic cat captured an individual in June 1977 (Rob Rutter, pers. comm.).

A rare species that could frequent the park is the Tiger Quoll *Dasyurus maculatus*. It has been recorded in the Mt. Eccles and Heywood area (Emison *et al.* 1978, Menkhorst and Beardsell 1982) and it possibly also occurs at Mt. Napier. Reports by farmers of strange animals seen travelling over cleared land near the park appear from time to time, although not recently. Such reports include that of Alan Lewis of Gazette (Anon. 1973a) and Brien Falkenberg of Byaduk (Anon. 1973b). Some of the reported features suggest that the animals were Tiger Quolls, *viz.* large head in proportion to the body, massive lower jaw, rounded ears, excellent jumper, steady and relentless gait, tapered body, length 30 inches, height 18 inches (Falkenberg); red-brown colour, large head in relation to the body, dog-like muzzle, long tail carried straight behind (Lewis). At about that time Margaret Rundell also saw a Tiger Quoll on a farm at North Byaduk (Anon. 1997); her photograph shows the spots on back and tail.

The absence of recent reported sightings of Tiger Quoll in the vicinity of Mt. Napier or Mt. Eccles, or elsewhere in the region, indicates that the species is either very rare or may no longer survive in the area. Its decline is associated with routine baiting of rabbits and foxes with 1080 poison, to which the Tiger Quoll is also susceptible (McIlroy 1981). McIlroy estimated that poison baits containing 3.22 g of 1080 (0.014 mg per g of meat) might cause 45% mortality in Tiger Quolls and 100% mortality in Dingoes. The current vermin control measures in both Parks need to be reassessed with regard to their impact on threatened carnivores such as the Tiger Quoll and the Brush-tailed Phascogale *Phascogale tapoatafa*. The latter species is probably highly at risk because other small dasyurids such as the Brown Antechinus and Dusky Antechinus are very susceptible, largely because of their small size (McIlroy 1981).

The most significant mammal found in the forest was that of a Brush-tailed Phascogale. One was

seen on a cold night in May 1977 on Menzel's Pit Rd near the junction with Coles Track. It left the track and I followed, with the aid of a portable spotlight. By chance I noticed the animal head down in the fork of a tree that contained no hollows, some 5 m from the ground. After a minute or so it shuffled down the tree, head first and flattened against the smooth bark, until it was about 1.5 m from the ground. It backed up the vertical trunk a little way and then edged down again. I marvelled how it maintained its hold and later I could not discern on the bark any mark of its 5 mm needle-tipped claws. The animal then leaped to the ground and disappeared amongst the bracken and stone. It was presumably nesting in the hollow of a tree. At this time many of the largest old trees in the forest were found in this area (1 km from farmland) but were cut down in Jan 1981, following a fire. Ironically, the major damage to the forest was done by fire fighters who used the opportunity to conduct a training exercise.

A cat-killed Brush-tailed Phascogale from a farm at Buckley Swamp, near the Park, was given to Laurie Kirkwood (and seen by me) in September 1989. The species may be more common than indicated from surveys, but the population must be considered vulnerable.

Spotlight observations revealed many Common Brushtail Possums but no Common Ringtail Possums. The apparent absence of the latter species is surprising because it is not uncommon on the basaltic plains in the region. For example, it occurs at "Lanark" (John and Cicely Fenton's property), at Laurie Kirkwood's farm at North Byaduk, and at Kelvin Rodgers property 5 km east of Hamilton. Fenton and Kirkwood have *Cupressus macrocarpa* hedges, exotic trees or dense native shrubberies. Rodgers has Swamp Gum with Hedge Wattle *A. paradoxa* and Sweet Bursaria.

Common Ringtail Possums will use hollows in branches or trunks where understorey species are unsuitable for their nests (Thomson and Owen 1963). I have observed this species using hollows in River Red Gums *E. camaldulensis* at the Dundas Ranges and there appears to be no shortage of similar nesting hollows in Manna Gums in the Mt. Napier forest. The absence of Common Ringtail Possums in the Mt. Napier forest indicates that the vegetation is not adequate as a food source.

While the Manna Gum forest would appear to suit the Koala *Phascolarctos cinereus*, and several introductions from Phillip Island have been made over the years, including 42 by the National Parks Service in 1981, the population has generally been very low. Severe fires may have contributed to this state, since Elmore (pers. comm.) observed that a colony south of the Mount was wiped out in the fire of Feb. 1972. The current situation is quite healthy, since a "koala count" by Friends of Eccles and Napier in Aug. 1994 along a 7 km loop of tracks in the NE section of the park (Sites 13-17-18-13) revealed 12 adults and one juvenile.

The presence of Sugar Gliders *Petaurus breviceps*, or possibly of Feathertail Gliders, was indicated in Oct. 1980 when a large quantity of dried gum leaves were found coiled in 2 nest boxes. There were no leaves present when the boxes were inspected in Feb. or April 1980. The nests were probably made during the winter because most of the leaves had faded to brown, although a few still had green pigment. No further activity was detected in April or July 1981 in five boxes which survived a fire in Dec. 1980.

A Sugar Glider was observed on a moonlit night in mid Oct. 1994, in an area with tall Manna Gums, both dead and alive. Nearby were a few Black Wattles which are rare on the new volcanic soils. A half hour after sunset a glider landed with a thump near a small sap seep on a tree, some 5 m from the ground. The animal soon ascended to the treetop and glided away. The Yellow-bellied Glider *Petaurus australis* occurs in similar vegetation at Mt. Eccles National Park, along with Sugar Gliders, but neither it nor trees with bark gouged by the animals have been seen in the Mt. Napier forest. An injured juvenile from Mt. Eccles was cared for by Kay Aldridge at her Hamilton wildlife shelter in 1995-96.

Kangaroos once abounded in the area, as evident from a report (W.W. 1916) by the then 76-year-old Mr Andrew Kerr of Pierrepoint, that in the early days "*7,000 'roos were shot at Mt. Napier station in one winter ... every man had 7 or 8 'roo dogs ... 3 pence per head was obtained ... since the skins had come of value the poor 'roo had altogether disappeared*". At the unveiling of a monument at Mt. Napier in 1933 (Anon. 1933) "*mementoes of the last kangaroo on Mt Napier Estate*" were exhibited. "*The teeth and toes were later mounted in gold, inscribed and given to M. McGenniskin and R. Nagorcka*"!

Whether or not that population of Eastern Grey Kangaroo *Macropus giganteus* was exterminated by the enthusiastic locals is uncertain. Rex Wedding (pers. comm.), an adjoining landowner, does not recall seeing any kangaroos or signs of them in the 1960s. They have retained a precarious presence in the area, perhaps through recolonisation from the Grampians (Gariwerd) NP or Mt. Eccles. They are capable of travelling long distances across farmland; sightings and night-time collisions with cars occur occasionally. The increase in numbers seen since 1986 may indicate that fewer are being shot since the land was declared a State Park.

The Black Wallaby *Wallabia bicolor* has been sighted occasionally in the forest (Bird 1992) and most recently in Feb. 1995. That individual was seen briefly on a seldom-used forest track before it vanished into dense bracken. It is possible that this wary species has existed for many years here, unrecognised. However, the species may be a recent addition to the fauna because it was first reported for the Grampians in 1979 and is now common there and also occurs elsewhere in SW Victoria (Bird 1992). This species is susceptible to 1080 poisoning (McIlroy 1982) and the annual rabbit control program probably also limits the wallaby population in the targeted areas.

Cashmere Goats escaped from a farm adjacent to the park and have been prominent in the forest since the mid 1980s. They have denuded most of the prominent rocky areas in the forest and frequent a few of the Byaduk Caves. Ferns have virtually disappeared from the worst affected areas. Six goats were seen browsing in the open woodland; they gained access to the foliage of young Blackwoods by standing on their back legs and then bearing the sapling down between their front legs. Comprehensive action is required to eradicate this destructive pest.

The list of birds for the park (112 species, including 4 introduced species) is restricted by the lack of water and the lack of diversity in the flora. For example, the paucity of flowering species restricts the number of honeyeater species. There is no permanent surface water in the park and therefore no crakes, rails or waders. Eastern Grey Kangaroos and some birds use the permanent water of Murroa Pool near the NE edge which was formed by a tongue of lava blocking a small stream. Seventeen of the birds listed in Table 7 are found only on the narrow margins of the park, mostly during the late winter and spring when some of those areas are temporarily flooded. These species occur at other times on and near Murroa Pool and some, like the Maned Duck *Chenonetta jubata* and Australian Shelduck *Tadorna tadornoides*, were observed to nest at least 500 m inside the forest.

Significant bird records in the park include single sightings of Rose Robin *Petroica rosea* in Oct. 1994, Satin Flycatcher *Myiagra cyanoleuca* in Dec. 1980, Black Falcon *Falco subniger* in March 1990 and Grey Goshawk *Falco hypoleucos* in Dec. 1979. The Goshawk was seen on the ground eating a freshly killed rabbit at the Byaduk caves. A pair of Peregrine Falcons *Falco peregrinus* hold a breeding territory in the area. Masked Woodswallows *Artamus personatus* and White-browed Woodswallows *A. superciliosus* were seen only on one occasion. The Woodswallows were in 3 flocks of several thousand birds, mostly White-browed Woodswallows, over a warm, still weekend in Oct. 1994. The forest was alive with the tumult of their flight, colour and song. Birds seen on only a few occasions include Bassian Thrush *Zoothera lunulata*, Crested Shrike-tit *Falcunculus frontatus*, Eastern Yellow Robin *Eopsaltria georgiana*, Brown Treecreeper *Climacteris picumnus*, Barn Owl *Tyto alba*, Tawny Frogmouth *Podargus strigoides* and White-winged Triller *Lalage tricolor*. Blue-winged Parrots *Neophema chrysotoma* and Sacred Kingfishers *Todirhampus sancta* have been observed a little more frequently in the forest.

Acknowledgments

Naturalist Lionel Elmore, who died recently, was instrumental in arousing my interest in the geology and history of this area and in initiating the study of its fauna. He had an enormous enthusiasm for the volcanic plains and hills and guided me to the significant features of this rough and then largely neglected terrain. Helpful advice and assistance from Bob Warneke and Hans Brunner (Department of Conservation and Natural Resources) and Joan Dixon and Linda Huxley (National Museum of Victoria) is gratefully acknowledged. I am indebted also to Ken Grimes for drafting the map of the Mt. Napier State Park and to John Cayley for advice on statistical matters. Lastly, special thanks to my daughter Rebecca who, when a little girl, accompanied me on many cold and often wet hours in the field.

References

Anon. (1933). *Hamilton Spectator* (5 September).

Anon. (1973a). Farmer saw a strange animal. *Hamilton Spectator* (11 August).

Anon. (1973b). Mystery animal seen at Byaduk. *Hamilton Spectator* (20 September).

Anon. (1994). Lack of fire report concern to rangers. *Hamilton Spectator* (27 September).

Anon. (1996). Mt Napier fire investigation is continuing. *Hamilton Spectator* (30 May).

Anon. (1997). Is the Quoll on comeback trail? *Hamilton Spectator* (25 January).

Beauglehole, C & Learmonth, NF (1957). The Byaduk caves. *The Victorian Naturalist* **73**: 204-210.

Beauglehole, AC (1984). The distribution and conservation of vascular plants in south west Victoria. Publ. Western Victorian Field Naturalists Clubs Association, Portland.

Bird, PR (1992). Expansion of the range of the Black Wallaby in western Victoria. *The Victorian Naturalist* **109**: 89-91.

Bruni (1903). The Hamilton District. The Australasian, 25 April issue.

Brunner, H Lloyd, JW and Coman BJ (1975). Fox scat analysis in a forest park in south-eastern Australia. *Australian Wildlife Research* **2**: 147-54.

Brunner H and Wallis LR (1986). Roles of predator scat analysis in Australian mammal research. *The Victorian Naturalist* **103**: 79-87.

Emison WB, Porter JW, Norris KC and Apps GJ (1978). Survey of the vertebrate fauna in the Grampians-Edenhope area of south western Victoria. *Mem. Natn. Mus. Vic.* **39**: 281-363.

Gill ED and Elmore LKM (1973). Radiocarbon dating of Mount Napier eruption,western Victoria, Australia. *The Victorian Naturalist* **90**: 304-306.

Gill ED and Elmore LKM (1974). Importance of the Mount Napier volcanic complex near Hamilton, Victoria, Australia. *The Victorian Naturalist* **91**: 167-174.

Hall LS and Richards GC (1979). Bats of eastern Australia. *Queensland Museum Booklet* No. 12.

Kitchener DJ Jones B and Caputi N (1987). Revision of Australian *Eptesicus* (Microchiroptera: Vespertilionidae). Rec. West. Aust. Mus. **13** (4): 427-500.

Menkhorst PW and Beardsell CM (1982). Mammals of south western Victoria from the Little Desert to the coast. *Proc. R. Soc. Vict.* **94**: 221-247.

McIlroy JC (1981). The sensitivity of Australian animals to 1080 poison. II. Marsupial eutherian carnivores. *Australian Wildlife Research* **8**: 385-99.

McIlroy JC (1982). The sensitivity of Australian animals to 1080 poison. III. Marsupial eutherian herbivores. *Australian Wildlife Research* **9**: 487-503.

Mitchell TL (1838). Three expeditions into the interior of eastern Australia. **2**: 245-252.

Ollier CD and Brown MC (1964). The Byaduk lava caves. *The Victorian Naturalist* **80**: 279-290.

Presland G (1977). Journals of George Augustus Robinson, March-May 1841. Records of the Victorian Archaeological Survey, No. 6.

Presland G (1980). Journals of George Augustus Robinson, May-August 1841. Records of the Victorian Archaeological Survey, No. 11.

Smith E Hamilton (1965) The distribution of cave dwelling bats in Victoria. *The Victorian Naturalist* **82**: 132-

Suckling GC (1978). A hair sampling tube for the detection of small mammals in trees. *Australian Wildlife Research.* **5**: 249-52.

Thomson JA and Owen WH (1963). The Ringtail Possum in south-eastern Australia. *Australian Natural History* **14**: 145-148.

Tidemann CR and Woodside DP (1978). A collapsible bat trap and a comparison of results obtained with the trap and with mist nets. *Australian Wildlife Research* **5**: 355-362.

WW(1916). `Disjecta Membra' (5/8/1916).

Wakefield NA (1964). Mammal sub-fossils from basalt caves in south western Victoria. *The Victorian Naturalist* **80**: 274-278.

Wakefield NA and Warneke RM (1963). Some revision in *Antechinus* (Marsupialia) 1. *The Victorian Naturalist* **80**: 194-219.

Wakefield NA and Warneke RM (1967). Some revision in *Antechinus* (Marsupialia) 2. *The Victorian Naturalist* **84**: 69-99.

Willis JH (1963). Notes on the history and vegetation of Mount Napier. *The Victorian Naturalist* **80**: 162-168.

Table 5. Number and species of mammal observed by spotlight at night or during daylight hours within the Mt. Napier forest area

Site No.[§]	No. of surveys Spotlight[*]	Day[#]	Common Brushtail Possum	Eastern Grey Kangaroo	Black Wallaby	Sugar Glider	Brush-tailed Phascogale	Echidna	Koala	Rabbit	Hare	Goat	Cat	Fox
4	-	4	-	-	-	-	-	-	1[‡]	-	-	-	-	-
17-18	7(11.5)	30	52	-	-	-	1	1	-	21	-	-	3	-
13-17-18	1(3)	2	20	7	-	-	-	-	3	8	-	-	-	-
6-9	1(0.5)	10	1	-	-	-	-	-	-	-	-	-	-	-
17-26-9	1(2)	6	9	1	-	-	-	-	-	11	-	-	-	-
7	1(2)	20	-	-	-	-	-	-	-	10	-	-	6	1
13	2(3)	24	26	18	1	1	-	-	2	16	1	-	-	1
1-2-8	-	40	-	7	-	-	-	-	-	-	-	-	-	-
3	-	15	-	23	-	-	-	-	-	2	-	3	1	1
11	-	15	-	1	-	-	-	-	-	4	-	-	1	-
6-18	-	10	-	1	1[†]	-	-	-	-	-	-	-	-	-
6-27	-	2	-	3	1	-	-	-	2	1	-	6	-	1
Total	13(22)	178	108	61	3	1	1	1	8	73	1	9	11	4

§ see Figure 1 for routes indicated – *e.g.* 6-18 indicates a section of Menzel's Pit Rd. Route 13-17-18 is a "circular" walk with one side following a fire track along part of the eastern boundary and the other mainly following Menzel's Pit Rd.

* duration of survey (hours) indicated in brackets

\# this column records the approximate number of visits made to the particular site for many purposes

† observation in Jan. 1987 by Laurie Kirkwood from North Byaduk of a small dark wallaby along track near site No. 6.

‡ observed in Oct. 1973 by Lionel Elmore

Table 7. Birds seen in Mt. Napier forest (F), in grassland margins (G), in temporarily flooded edges near Murroa Corner (W), or aerial nomads (A

Species	Location
Hoary-headed Grebe	W
Australasian Grebe	W
Little Pied Cormorant	W
Pacific Heron	W
White-faced Heron	W
Nankeen Night Heron	F#(E)
Australian White Ibis	W
Straw-necked Ibis	W
Yellow-billed Spoonbill	W
Black Swan	W
Australian Shelduck	F,W
Pacific Black Duck	W
Grey Teal	W
Maned Duck	F,W
Musk Duck	W
Black-shouldered Kite	G
Whistling Kite	F#
Brown Goshawk	F
Collared Sparrowhawk	F
Grey Goshawk	G#
Wedge-tailed Eagle	F
Little Eagle	F
Swamp Harrier	G
Black Falcon	G#
Peregrine Falcon	F
Australian Hobby	F
Brown Falcon	G
Australian Kestrel	G
Stubble Quail	F
Brown Quail	F
Purple Swamphen	W
Eurasian Coot	W
Brolga	G#
Masked Lapwing	G
Common Bronzewing	F
Yellow-tailed Black-cockatoo	F
Galah	F
Long-billed Corella	F
Sulphur-crested Cockatoo	F
Musk Lorikeet	F
Purple-crowned Lorikeet	F
Crimson Rosella	F
Eastern Rosella	F
Red-rumped Parrot	G
Blue-winged Parrot	F,G
Pallid Cuckoo	F
Fan-tailed Cuckoo	F
Horsfield's Bronze-cuckoo	F
Shining Bronze-cuckoo	F
Southern Boobook	F
Barn Owl	F
Tawny Frogmouth	F
White-throated Needletail	A
Fork-tailed Swift	A
Laughing Kookaburra	F
Sacred Kingfisher	F

Species	Location
Eurasian Skylark	G
Welcome Swallow	G,F
Tree Martin	G,F
Fairy Martin	G,F
Australasian Pipit	G
Black-faced Cuckoo-shrike	G,F
White-winged Triller	F
Bassian (Ground) Thrush	F
Common Blackbird	F
Rose Robin	F#
Flame Robin	G,F
Scarlet Robin	F
Eastern Yellow Robin	F
Jacky Winter	F
Crested Shrike-tit	F
Golden Whistler	F
Rufous Whistler	F
Grey Shrike-thrush	F
Satin Flycatcher	F#
Restless Flycatcher	F
Grey Fantail	F
Willie Wagtail	F
Brown Songlark	G
Superb Fairy-wren	F
White-browed Scrubwren	F
Striated Fieldwren	F
Brown Thornbill	F
Yellow-rumped Thornbill	G,F
Striated Thornbill	F
Varied Sittella	F
White-throated Treecreeper	F
Brown Treecreeper	F
Red Wattlebird	F
Noisy Miner	F#
Yellow-faced Honeyeater	F
White-eared Honeyeater	F
White-plumed Honeyeater	F
Brown-headed Honeyeater	F
White-naped Honeyeater	F
New Holland Honeyeater	F
White-fronted Chat	G
Spotted Pardalote	F
Striated Pardalote	F
Silvereye	F
European Goldfinch	G
Red-browed Firetail	F
Common Starling	G
Australian Magpie-lark	G,F
Dusky Woodswallow	F
Masked Woodswallow	F(A)
White-browed Woodswallow	F(A)
Grey Butcherbird	F#(E)
Australian Magpie	G,F
Grey Currawong	F
Australian (Forest?) Raven	G,F
Little Raven	G,F

(#) single observation;

(A) nomadic flocks of thousands of White-browed Woodswallows and some Masked Woodswallows seen in and over the forest in October 1994;

(E) Grey Butcherbird recorded by L.K.M. Elmore near Murroa corner in 1970.

APPENDIX

Body measurements and proportions for *Antechinus* and *Rattus* species at Mt. Napier State Park.

Body measurements for captured *Antechinus* and native *Rattus* species were made to characterise these local populations. These data are presented in Table 8. Age affects the size of the body and some body components and may alter the proportion of tail length to head-body length, although the extent of such effects are not given in field guides. Small animals are often caught but data is only available for "average" size animals of each species. Relationships between body mass and various body measurements are presented in Table 9, so that it is possible to deduce what effect a change in body mass has on a particular component.

The data were analysed by regression, with sex included as a variable in the linear regression model. A common line was fitted where there was no significant additional precision gained by fitting separate lines for each sex (different intercepts and slope, different intercept and same slope, or same intercept and different slope). In 2 instances, *pes* length for *A.swainsonii* and R. *fuscipes*, there was a significant difference between males and females in intercept but not slope.

For *A. agilis* there were two instances, *pes* length and ear length, where an apparently significant effect of sex was ignored because inspection of the data showed that this was a result of a small range in the data for females, giving a contrary negative slope. In these instances the values for *pes* were 0.26 for males *v.* –0.03 for females (r^2 0.63) and for ear length the values were 0.19 for males *v.* –0.09 for females (r^2 0.43). In another case (ear length for *A. swainsonii*) it was apparent that if the 4 small animals (3 female) less than 20 g were not included in the set then there was no relationship between ear length and body mass. If these animals were included then the intercepts and regression slopes for males and females were 14.9 *v.* 12.0 and –0.01 *v.* 0.06, respectively ($P < 0.05$, r^2 0.22).

While a curvilinear relationship between body mass and linear measurements might be expected, these were only significant ($P < 0.05$) in *A. swainsonii*, for which there was a wider range in body mass. A quadratic relationship, $y = a + bx + cx^2$, was significant for head-body, ear and *pes*. For these components, the coefficients a, b and c were 59, 1.32 and –0.0068; 11.1, 0.131 and –0.00115; 14.5, 0.131 and –0.00079, respectively. Except for the very small animals, there was little advantage in using the quadratic equation.

For the native *Rattus* species there were no significant effect of change in body mass on tail length as a proportion of head-body length, or of ear length. However, these properties were significantly affected in the *Antechinus* species, particularly with Brown Antechinus *A. agilis*. These calculations of regression slope (b) can be used to enable comparisons to be made between animals of widely differing body mass. Looking at *A. agilis* in Table 8, it may be deduced that the tail length as a proportion of head-body, is 6.6% less for animals that are 10 g heavier. The latter animals also have about 15 mm greater length of head-body. For animals differing by 21 g, the range found in the survey, the expected difference would be 14% and 31 mm, respectively. With Dusky Antechinus *A. swainsonii*, it is expected that one of the smallest animals caught (18 g) would have foreclaws 0.4 mm shorter than the largest caught (86 g), and that the tail length as a proportion of head-body would be 13% less.

The mean data here for *A. swainsonii* and *A. agilis* may be compared with that of Wakefield and Warneke (1963 and 1967). For *A. swainsonii*, their data for head-body length and tail length (as % head-body) for preserved specimens of males *v.* females were 123 mm and 80% *v.* 116 mm and 77%, respectively. For *A. agilis*, their data was 97 mm and 97% *v.* 91 mm and 92%, respectively. My data for tail length (as % head-body) for *A. swainsonii* and *A. agilis* were 83% and 85% (males *v.* females) and 98% and 105% (males *v.* females), respectively. The agreement is surprisingly close, given the difficulties in measuring head-body length of live and very muscular *Antechinus* species, the probability that the mean mass of Wakefield and Warneke's animals differed from those collected here, and the possibility of regional differences in such characters.

It may be difficult to differentiate in the field between large *A. agilis* and small Yellow-footed Antechinus *A. flavipes* (not found in this survey), particularly because the pelage colour may appear

rather similar. Wakefield and Warneke (1967) have shown that the latter species is usually a larger animal. My data indicates that a large Brown Antechinus male (40 g) would have a tail length some 90% of head-body length compared with 98% for males of average mass (28 g). Either value is rather larger than the mean value of 81% found by Wakefield and Warneke (1967) for the Yellow-footed Antechinus, or 82% that I measured for one individual of mass 42 g found dead on Eddie Coxon's farm at Nareen in 1979.

Since small individuals of Yellow-footed Antechinus probably also have proportionately shorter tails, as found here for Brown Antechinus and Dusky Antechinus, then one should be able to confidently differentiate between similar sized individuals of Yellow-footed Antechinus and Brown Antechinus on the basis of this character and the colour of fur on the feet and flanks

The Bush Rat, Swamp Rat, Brown Antechinus and Dusky Antechinus are shown in the 4 photos below.

The Yellow-footed Phascogale and Fat-tailed Dunnart are shown in the bottom 2 photographs.

Table 8. Body measurements of captured *Antechinus* and native *Rattus* species

Species	Body component						
	Mass (g)	Head-body (mm)	Tail (%HB)	Ear (mm)	Pes (mm)	Fore claw (mm)	Hind claw (mm)
Antechinus swainsonii							
Males Mean[#]	55.1	109[6]	83[-1.9]	14.6[0]	19.3[0.3]	3.8[0.06]	2.9[0.07]
SD	18.1	13.2	8.8	0.9	1.2	0.34	0.31
Range	18-86	80-143	64-100	13-16	16-22	2.8-4.6	2-3.5
N	37	37	37	35	36	37	37
Female Mean	32.4	95[6]	85[-1.9]	14.0[0]	17.4[0.3]	3.6	2.6
SD	9.2	10.5	8.3	1.1	1.1	0.34	0.40
Range	12-45	72-110	70-100	13-16	15-19	3-4.1	2-3.3
N	27	26	26	25	23	26	26
Antechinus agilis							
Males Mean	28	95[15]	98[-6.6]	16.4[0.8]	17.9[0.2]	2.0[0.14]	2.1[0.11]
SD	4.4	9.4	5.4	1.3	1.3	0.22	0.25
Range	21-35	80-110	91-106	15-19	16-20	1.7-2.5	2-2.7
N	7	7	7	7	7	7	7
Female Mean	18	81[15]	105[-6.6]	15.6[0.8]	15.8[0.2]	1.8[0.14]	1.9[0.11]
SD	2.6	4.0	4.5	0.6	0.6	0.26	0.21
Range	16-25	75-87	100-113	15-17	15-17	1.5-2.2	1.5-2.3
N	12	12	12	12	12	12	12
Rattus fuscipes							
Males Mean	93	145[3.2]	95[0]	20.0[0]	29.1[0.3]		
SD	17.2	8.0	4.9	1.2	1.2		
Range	58-130	125-159	87-108	18-23	27-31		
N	28	24	24	24	24		
Female Mean	80	141[3.2]	94[0]	20.2[0]	27.8[0.3]		
SD	13.4	7.7	5.4	1.2	1.0		
Range	55-100	126-154	77-102	18-22	26-29		
N	27	26	26	24	25		
Rattus lutreolus							
Males Mean	137	161[5]	70[0]	17.7[0]	30.2[0.7]		
SD	16.7	9.5	6.8	1.2	0.8		
Range	123-166	145-170	60-79	16-19	29-31		
N	8	7	7	6	6		
Female Mean	113	152.5	63[0]	18.9[0]	28.8[0.7]		
SD	44.5	36.6	9.2	0.3	4.0		
Range	30-154	100-180	56-76	18-19	22-32		
N	6	4	4	4	5		

#value in brackets [ ] is the predicted change in the mean body measurement for a 10 g increase in body mass – see regression slope in Table 9.

Table 9. Linear relationships (y = a + bx) between body mass (x) and various body measurements (y) of 4 native mammalian species from the Mt. Napier forest

Species	Regression coefficients	Body component					
		Head-body (mm)	Tail	Ear	*Pes*	Fore claw	Hind claw
Antechinus swainsonii	a	74	92	14.5	‡	3.4	2.4
	b	0.64	-0.19	0.00	0.034	0.006	0.007
	r.s.d.	7.1	7.9	0.88	1.04	0.35	0.34
	r^2	0.75	0.17	0.00	0.51	0.11	0.14
	N	63	63	56	59	63	63
	P < 0.05	*	*	ns§	*	*	*
Antechinus agilis	a	54	117	14.2	12.5	1.6	1.8
	b	1.47	-0.66	0.077	0.19	0.014	0.011
	r.s.d.	3.3	4.2	0.9	0.8	0.27	0.24
	r^2	0.88	0.48	0.22	0.69	0.09	0.07
	N	19	19	19	19	19	19
	P < 0.05	*	*	*	*	ns	ns
Rattus fuscipes	a	115	95	19.8	¶		
	b	0.32	0.009	0.004	0.033		
	r.s.d.	6.0	5.2	1.2	1.00		
	r^2	0.44	0.001	0.003	0.41		
	N	50	50	48	49		
	P < 0.05	*	ns	ns	*		
Rattus lutreolus	a	91	65	20.6	20.8		
	b	0.52	0.02	-0.02	0.071		
	r.s.d.	11.6	8.6	1.1	1.0		
	r^2	0.75	0.007	0.08	0.87		
	N	11	11	10	11		
	P < 0.05	*	ns	ns	*		

r.s.d residual standard deviation
r correlation coeficient
* regression is statistically significant
ns regression is not statistically significant

data for males and females were combined, except where indicated
‡ intercept (a) differed significantly for males (17.4) *v.* females (16.3)
¶ intercept (a) differed significantly for males (26.0) *v.* females (25.2)
§ omitting animals less than 20 g