The Victorian Naturalist

Vol. 106, No. 1 January/February 1989

Published by the FIELD NATURALISTS CLUB OF VICTORIA

Registered by Australia Post. Publication No. V.B.P. 1268

$3·50

GENERAL MEETINGS (Second Monday)

The February, March and April General Meetings will be held at the Royal Society Hall, 9 Victoria Street, Melbourne at 8pm.

Monday, 6th March.

"Malaysia through the Eyes of a Conservationist." Graeme Love (President, FNCV).

Monday, 10th April.

"Birds and People." Mrs E. McCulloch.

FNCV EXCURSIONS (First Sunday)

Saturday, 11th-Monday,13th March. Victorian Field Naturalists Clubs Association annual get-together at Bellarine Peninsula. Hosted by Geelong Field Naturalists Club. Predominantly a coastal weekend with a variety of habitats – seashore, rock shelf, mangroves, freshwater lake, etc. A Marine Biology cruise in conjunction with Marine Studies Centre for those who would like it at about $15 extra.The cruise includes 5 hours on Port Phillip and Swan Bays, with a beach and rock shore walk, Botany and bird life at Edwards Point, and seeing Ocean Grove Reserve. Snorkling with seals is an optional possibility. Other activities will be arranged for those wishing to stay on shore. Accommodation: Uniting Church Youth Camp at Ocean Grove. Meals, bed, mattress and pillow supplied. Other bedding will be needed. Cost depends on number of people going on coach, but total cost should be about $130. Please book as soon as possible with Marie Allender. $40 deposit.

Sunday, 2nd April. Tourourrong & Winneke Reservoirs, Kinglake area. Bus leaves Batman Ave. 9.30am. $14.

GROUP MEETINGS

The February, March and April Group meetings (other than Day Group) will be held at the Astronomers Residence, Birdwood Ave., South Yarra (150 metres nearer the Shrine than the Herbarium) at 8 pm.

Botany Group – Second Thursday

Thursday, 9th March. "From the Kimberley to the Cooper – a Contrast." Win Bennet.

Thursday, 13th April. "An Overview of the Vegetation of the Mallee." David Cheal.

Thursday, May 11th. "R.C.A. Roadside Reserves": Graeme Stone.

Thursday, June 8th. "Trees, Toadstools, Puff Balls and Potoroos": Tom May.

Geology Group – First Wednesday.

Wednesday, 1st March. "Transform Faults: Alpine Fault System, New Zealand." Zofia Bartoszewicz (Geologist).

Wednesday, 5th April. "Earthquakes." Gary Gibson (Seismology Research Centre, Bundoora).

Day Group – Third Thursday

Thursday, 16th March. Banksia Park, Heidelberg. Catch the 10.56 am train at Flinders St. To Heidelberg station, where the No. 291 bus leaves for Box Hill via Banksia Park. Leader: Marge Wilson 836 3521.

Thursday, 20th April. Queens Park, Moonee Ponds. Catch the 11.10 am Flinders St. train to Moonee Ponds station. Leader: Andy Blackburn 379 8960.

Microscopical Group – Third Wednesday

Wednesday, 15th March. The right lighting to view an object. Bright field, top lighting, dark ground, Phase contrast, modulation contrast, Rheinberg illumination. Types of lamps used.

Wednesday, 19th April. Making insect mounts – dry mounts, balsam mounts, opaque mounts. Display of insect slides.

Fauna Survey Group – First Tuesday

Tuesday, 7th February.

Tuesday, 7th March.

Tuesday, 4th April.

The Victorian Naturalist

Volume 106, Number 1

January/February, 1989
ISSN 0042-5184

Editor: Russell Thomson.

Cover Illustration: The Eastern Quoll *Dasyurus viverrinus* (see page 4).
Photo: Donald F. Thomson

Mammals of Victoria from the Collection and Notes of Donald F. Thomson

By Joan M. Dixon and Linda Huxley*

Introduction

Donald Fergusson Thomson is a well-known figure in Australian anthropology. It is not so well known that he was also deeply involved in aspects of the natural sciences. His interest and work in some aspects of this field is detailed by Dixon and Huxley (1985).

Born in 1900 of musician parents who came to Melbourne from London, at an early age he developed a strong interest in natural history. Even at the age of ten he kept a natural history diary, and he continued writing, documenting his travels and the animals he saw or collected throughout his life. His early formal education was broken because of ill-health, and a trip to England when he was twelve. He then spent a year attending the School of Horticulture at Burnley, before a rekindled interest in formal education resulted in his father sending him to Scotch College. There he was noted for his interest in natural history, and received a prize at a school speech night for 'Photographic Contributions to the Scotch Collegian.' His school nickname was 'Kanga' after one of his pets.

Thomson declined a scholarship to study veterinary science at the University of Melbourne and instead funded his way in zoology and botany there by doing such manual tasks as carrying material for road gangs, breaking stones and cutting firewood.

Impatient by nature, Thomson approached the recently retired Professor of Biology, Sir Baldwin Spencer, also well known for his anthropological work, during his undergraduate years to try to get on a British Museum (Natural History) sponsored expedition. He was dissuaded from this, and Spencer promised to help him join an expedition after his graduation.

Having graduated, he planned on a field career making collections. Polar regions attracted him but he felt that there would be limitations unless he developed further skills. Photography was his choice, and he is still widely recognized for his achievements in that field.

During his working period as a cadet at the 'Herald' he had his sights set on an expedition to remote areas. He developed his journalistic skills there, and had a continuing association with the 'Herald' over many years, establishing contacts with the public, and extending his knowledge of Victoria's mammals.

Having applied for fieldwork to the newly established Australian National Research Council's committee on anthropological research, he was informed by Professor Radcliffe-Brown, holder of the first chair in Anthropology at the University of Sydney that while funds were available, he required some training. Thomson enrolled in the new one-year diploma course there and also carried out some demonstrating in zoology. Radcliffe-Brown supported his application, which was successful, and he travelled to northern Australia to work among the Cape York Aboriginals in April 1928. In May 1929 he made a second trip to Cape York and then joined the staff of the Walter and Eliza Hall Institute for Research in Pathology and Medicine in Melbourne. For two years he worked there on the development of an antivenene for tiger snake bites. In 1932 he joined the University of Melbourne as a Research Fellow attached to the Department of Anatomy, under Professor F. Wood Jones, a figure who had considerable influence on his

*J. M. Dixon and L. Huxley Department of Mammalogy, Museum of Victoria, 328 Swanston St., Melbourne, 3000.

style and presentation of mammalogy in his field work and notes. In the same year he was financed on his third and final trip to Cape York as a Bartlett scholar.

On completion of his Doctorate of Science in 1934, Thomson switched interest from the natural to the social sciences, although his interest in botany and zoology did not wane during his visits to Arnhem Land in 1935, 1936-7 and 1941-3, and to the Great Sandy Desert between 1957-65. His publications during later years reflect the changing emphasis in his work.

In 1938, Thomson travelled to England to take up a fellowship at Christ College, Cambridge. He travelled to the United States in 1939 at the invitation of the Rockefeller Foundation, and when war broke out, he returned to Australia to enlist in the RAAF. He was posted to the Solomon Islands to investigate flying boat bases, and to set up the preliminaries of a coast-watching scheme. Recalled to Victoria in 1940, he commenced planning and organizing the Special Reconnaissance Unit of Arnhem Land Aboriginals to defend the eastern flank of Darwin. In 1943 he was posted to Dutch New Guinea, and during this period sustained severe injuries and subsequently diabetes. In 1945 he was awarded an O.B.E. for his work in New Guinea. Details of his activities during this period were collated by Nicholas Peterson as 'Donald Thomson in Arnhem Land' (Thomson, 1983).

In typical manner, Thomson refused to let physical disability hinder his work. He was offered a lectureship in anthropology at Cambridge University, but declined this to return to the University of Melbourne and anthropology studies there. He published widely and was awarded a doctorate in anthropology at Cambridge University in 1950, as well as receiving numerous other awards. Between 1957 and 1965 he made three expeditions into the Great Sandy Desert where he placed emphasis on aboriginal material culture and economic life. His detailed observations and documentation attained the same high level of achievement as those of his earlier Cape York and Arnhem Land work. He recorded his anthropological work in arid Australia at this period in 'Bindibu Country' (Thomson, 1975).

Thomson often brought mammals from northern Australia to his Eltham home where he kept them in captivity, observing and documenting their activities. This type of behavioural information was not generally in vogue among mammalogists at the time, and it pre-empted many of the studies of native mammals which have been made in recent years. Not well known is that he also had a great interest in Victorian mammals and devoted much time to studying them.

Methods

Thomson acquired much of the Victorian collection from country people, rather than by personal collecting. As a nature writer over many years for the 'Herald' and 'Sun', he obtained considerable data and many specimens from his readers. Several of the Victorian species which he received and subsequently reared and observed at Eltham are not known now in their former haunts, and one species is apparently extinct in Victoria. Some of his observations are incredibly detailed and where necessary we have reduced his notes without detracting from his intended meaning.

We have divided the text into sections dealing with the three groups of mammals; monotremes, marsupials and placentals. Each species entry is preceded by its scientific and vernacular name, followed by a table of the collected Thomson data on individual animals from his card records. As each animal discussed is represented by an actual specimen, a number has been allocated by the Museum, DTC . . ., followed by Thomson's field number. This is to enable any investigator to trace individual specimens. Following Thomson's data, we have entered Thomson's detailed notes and provided up-to-date comments for each species.

An analysis of faeces of *Perameles nasuta* and *Dasyurus viverrinus* is presented in Table 1. Latitudes and longitudes are provided for Thomson's localities

in Appendix I. Some distribution maps, are included and wherever possible we have included Thomson's original photos. The material and its basic documentation are held in the Museum of Victoria under specific loan conditions from the University of Melbourne.

Species List of Donald Thomson's Collection of Victorian Mammals

MONOTREMATA

Ornithorhynchus anatinus	Platypus

MARSUPIALIA

DASYURIDAE

Antechinus flavipes	Yellow-footed Antechinus
Antechinus stuartii	Brown Antechinus
Antechinus swainsonii	Dusky Antechinus
Phascogale tapoatafa	Brush-tailed Phascogale
Dasyurus maculatus	Tiger Quoll
Dasyurus viverrinus	Eastern Quoll
Sminthopsis crassicaudata	Fat-tailed Dunnart

PERAMELIDAE

Perameles nasuta	Long-nosed Bandicoot

PHALANGERIDAE

Trichosurus vulpecula	Common Brushtail Possum

BURRAMYIDAE

Acrobates pygmaeus	Feathertail Glider

PETAURIDAE

Petaurus australis	Yellow-bellied Glider
Petaurus breviceps	Sugar Glider
Pseudocheirus peregrinus	Common Ringtail Possum
Petauroides volans	Greater Glider

MACROPODIDAE

Bettongia gaimardi	Tasmanian Bettong
Wallabia bicolor	Swamp Wallaby

VOMBATIDAE

Vombatus ursinus	Common Wombat

RODENTIA

MURIDAE

Rattus fuscipes	Bush Rat
Rattus rattus	Black Rat
Hydromys chrysogaster	Water-rat

CHIROPTERA

VESPERTILIONIDAE

Nyctophilus geoffroyi	Lesser Long-eared Bat
Chalinolobus gouldii	Gould's Wattled Bat

MOLOSSIDAE

Mormopterus planiceps	Little Mastiff-bat

EMBALLONURIDAE

Taphozous flaviventris	Yellow-bellied Sheathtail Bat

CARNIVORA

FELIDAE

Felis catus	Feral Cat

Species Accounts of Donald Thomson's Collection of Victorian Mammals

MONOTREMATA

ORNITHORYNCHIDAE

Ornithorhynchus anatinus (Shaw, 1799)
Platypus
DTC 1 207 Vic., River Yarra, Eltham. 1931
SKULL. Specimen brought in dead and decomposed.

Comments
The platypus is not uncommon in the rivers and streams of Victoria and it is still likely to occur in the Eltham area.

MARSUPIALIA

DASYURIDAE

Antechinus flavipes (Waterhouse, 1838)
Yellow-footed Antechinus
DTC 60 410 Vic., Mooralla via Cavendish 25 May 1946, SPIRIT.

Notes
DTC 60 410 Adult specimen received from Allen Thomson, 'Wyndon', Mooralla via Cavendish, who captured it while rabbitting. He states that the animals are living in rabbit burrows. The fur was tinged with rusty or cinnamon and the specimen was damaged.

Comments
This species is common in much of Victoria's bushland west of the Dividing Range. It has been confused often with the smaller *A. stuartii* from which it can usually be distinguished by the yellow colouration of its feet and rump. These differences were pointed out by Wakefield and Warneke (1963). It is still likely to occur in the area noted by Thomson.

Antechinus stuartii Macleay, 1841
Brown Antechinus
DTC 59 221 Vic, Belgrave. 1931, SPIRIT
DTC 62 421 Vic., Upper Ferntree Gully. 20 Dec. 1958, SPIRIT.
Collected by W. Hosmer.

Comments
This is one of the most common small mammals of Victoria, found over a wide range of habitats,

often occurring in the same areas as *A. swainsonii* and *A. flavipes*. It is likely to occur still in the areas indicated by Thomson.

Antechinus swainsonii (Waterhouse, 1840)
Dusky Antechinus
DTC 61 414 Vic., Avonsleigh via Emerald.
26 Aug. 1947, SPIRIT
Received from N. McCance.
DTC 63 — Vic., Upper Ferntree Gully.
March 1953, SPIRIT

Comments
Abundant in densely vegetated wetter areas of Victoria, this species is still likely to occur in Thomson's sites.

Phascogale tapoatafa (Meyer, 1793)
Brush-tailed Phascogale
DTC 21 203 Vic., Whittlesea
12 July 1930, SKIN & SKULL, male.
DTC 46 393 Vic., Eltham.
1944, SPIRIT, male.
***DTC 47 401** Vic., Swan Bay near Queenscliff.
6 May 1945, SPIRIT, male.
DTC 48 402 Vic., Brisbane Hill, Hamilton.
30 June 1945, SPIRIT, female.
DTC 49 403 Vic., Swan Bay near Queenscliff.
9 Sept. 1945, POUCH AREA & FOUR EMBRYOS IN SPIRIT, female.
DTC 50 417 Vic., Swan Bay, Queenscliff.
17 Nov. 1947, SPIRIT, female.
DTC 51 418 Vic., Beechworth.
21 June 1948, SPIRIT, male.
DTC 52 419 Vic., Ocean Grove via Queenscliff.
29 April 1958, SPIRIT, male.
DTC 53 420 Vic., Ocean Grove via Queenscliff.
4 June 1958, SPIRIT, female.
DTC 54 422 Vic., Ocean Grove via Queenscliff.
15 July 1958, SPIRIT, female.
DTC 55 426 Vic., Ocean Grove via Queenscliff.
February 1959, SPIRIT, male.

Notes
DTC 21 203 Head (occipit to nose) 59 mm. Ears naked, rhinarium naked and flesh coloured. Vibrissae well developed; mysticial well developed, black in colour and very long, up to 50 mm. Supraorbital long, hairs sparse, to 24 m; genal well developed and long, to 32 mm. Submental sparse, short, light in colour, to 6 mm, interramal short and sparse; calcaneal absent; anconeal and ulnar-carpal short.
DTC 46 393 Brought in by Mrs. Gibson's cat at Sweeneys Lake, Eltham.
DTC 47 401 On Friday, 4 May 1945 Mr. Trevena, who had written to me some time ago about the fact that *Phascogale pencillata* [= *P. tapoatafa*] was numerous at Swan Bay, near Queenscliff, where he has a fishing cottage, telephoned today to say that a neighbour, McDonald, had captured two alive in an outhouse.

Trevena says that he has a fishing shack at Swan Bay and that these animals are numerous there and are a nuisance in the house. They often found the animals in the house, and could not find out how they got there, but they did find that the mice, which had been a nuisance, disappeared.

Trevena says that the Phascogales live in the house and make nests in drawers, cupboards and even in beds and that they destroyed a mattress. They make their nests of rags, paper, feathers or any such material. The two animals he brought me today were a pair – male and female – and Trevena says he believes they habitually live in pairs. They have often seen them with young – generally eight in number. He says that the animals have been so numerous at Swan Bay that they regard them as a nuisance because of the damage they do in the house and the noise they make on the roof.

Trevena says that McDonald traps them on the roof and has skinned many – catching them in rabbit traps baited with meat. He says that McDonald skins all his rabbits in one place, and that the offal probably attracts them.

The two animals travelled well. The brush on the tail was I think, much longer than in Cape York specimens. The hairs were about 1" long, intensely black, and generally erected – giving the tail the 'bottle brush' appearance from which it has derived one of its names – 'bottle brush squirrel'.

It is a fine, virile little hunter. Its whole attitude is one of tense alertness and restless activity. During the evening, the male was restlessly exploring the cage, active and interested, rather than distressed.

It drummed or stamped rapidly with its two front feet when it saw me – as if in challenge, and kept up this stamping with its two forefeet simultaneously for minutes on end.

Pouch area in female not developed or conspicuous but both animals well and perfect. Dark stripe on the head conspicuous, also the stance – the forepart of the body well up on the forelegs, the latter part of the body 'crouched' or flattened, the nose pointed, the head conspicuously flattened, the dark mid-dorsal line on the head conspicuous. Most of

* Female mentioned in notes not located, but discussed in letters from Mr. Trevena. It seems that Thomson may have included both under the one number 401.

the time the tail was carried behind at ground level, slightly arched, the long hairs erect in all directions. General appearance very alert and squirrel-like.

If the animal is hunting alone and sees or hears me, it starts to stamp. If it is suspicious it also starts to stamp with its fore feet, keeping this up for some seconds, even for a minute or two as if to 'draw' me into revealing my whereabouts.

7 May 1945. Animals asleep together in an open shallow nest in straw this morning, oblivious even to food, a sparrow, put in beside them. But by evening it had gone.

Ate also pieces of raw meat given in absence of birds and insects, as well as meal worms, of which they are particularly fond.

They often sleep lying on their sides curled up with their noses circled up close to their hind feet and tail curled under body.

9 May 1945. Noticed that the female was torpid and sluggish, apparently with cold and had lost her alert attitude. Apparently these animals need a warm nest and a great deal of the right kind of food, especially in winter. The male was warm and much more active and alert. The note of alarm is a low rasping hiss – a note, that is, between a rasp and a hiss.

Gave the Phascogales cockchafer grubs, which they took readily, as they did meal worms, and three sparrows; later a fourth added.

I put the cage containing the pair of Phascogales close enough to the fire to warm the sleeping box and later the animals became more lively. It was evening, however, before they became fully active and I could hear them eating the four sparrows. It appears that the activity of these animals is low in the early morning and most intense at night. The body temperature appears to be much lower during the inactive, sluggish morning period.

Tonight I put a single Bogong moth into the cage. A moment later, one of the animals approached stealthily and then pounced on it. It ate the moth greedily, holding it in its hands. The whole insect, body first and then the wings, was eaten. A second moth was dropped into the cage from above, a few minutes later. A Phascogale came out and snatched it, taking it away in its mouth, out of sight under the sleeping box. Evidently its mate attempted to take the insect for there was a short scuffle and a 'tss' sound, followed by the characteristic harsh rasping hiss that this animal makes when alarmed, annoyed or disturbed.

One of the animals eagerly searched for meal worms dropped into its sleeping box, becoming 'tense' and alert and darting its head about in eager search for the larvae. They are especially eager for insects and became wildly alert the moment their meal worms or the moths were dropped into their cage.

On the night following that on which these notes were written, the Bogong moths were out in great numbers, and the Phascogales took all that I gave them – 40 or 50 a night – eagerly, unlike bats and most other insectivorous animals, eating wings and all. They would dart out even into parts of the cage where bright electric light was shining, and snatch up the moths, using both their teeth and forepaws to hold them. The rapid chewing of the insect could be heard immediately afterwards. Also the low scolding note – a rasping hiss, sustained at first, then rising with anger, as they squabbled over the insects.

I was formerly under the impression that the bristles of the tail brush were only erected in moments of excitement but whenever the animals are active the hairs appear to stand up on the 'bottle brush' tail. The movements are jerky and the animals have a habit of flattening themselves against limbs and trunks of trees in a gecko-lizard like way. The head, already rather flat in form, is laid close to the trunk and the animal crouches low as if it had no legs. It dodges quickly behind a limb or tree, placing this between itself and the observer with such speed, skill, and ease to escape detection.

22 May 1945. Animals very noisy and appeared to be mating tonight. Staccato rasping cry or hissing unlike the normal hissing cry heard at other times, apparently made by the female, who appeared to protest and resist violently. These animals always sleep together and do not appear to be solitary.

They search eagerly for meal worms dropped into their cage, hunting by 'smell' at least as much as by sight.

23 May 1945. These animals appear to be mating again tonight although less intensely than last night. Heard a call note tonight for the first time – a short clucking or 'kissing' sound apparently made by the male, but with a slightly metallic click – very like the sound of two glass marbles being knocked together. Apparently this sound is a kind of mating call or serenade of the male to the female. When I made the sound in imitation – with the tongue behind teeth on roof of mouth – one of the animals (apparently the male) became very excited and came right up and clung to the wire as closely as he could.

As I made the sound he stamped with his front feet, almost every time, so keenly interested was he that he would leave the sheltered part of his cage and come right out in the open, to listen, very keen and alert, his tail bristles standing right out.

24 May 1945. Early in the morning and after daybreak the Phascogales were still active and were apparently still mating. This has taken place only over the past two days.

Two heads of fowls put in this morning and the brains were eaten out. They are especially fond of the brains of birds and other game. Both animals, male and female, always sleep together.

19 June 1945. The two Phascogales are still thriving and have been very noisy for some time. On 22 May I noted the fact that these animals appeared to be mating and they were certainly copulating this morning (19 June) so that if the female has not been impregnated before this, the period of gestation may be determined. There is a continual rasping hissing cry and the kissing 'tuk tuk tuk' note from the cage at night even up till daylight in the morning. This morning they were seen in coitus in the nest.

The female appears to be more timid and retiring, and if one is away and only one in the nest, it has proved almost invariably, to be the female that remained.

This morning I examined the pouch area of the female. It showed very little development and was distinguished only as a slight depression with yellowish hairs. No enlargement of mammary tissue can yet be noticed.

30 June 1945. Examined pouch area of female today. The pouch area, distinguished by its pale yellowish hair has grown more extensive and the mammae, not seen before, are now visible as tiny pink spots. It appears probable that the female is pregnant and that the young will be born in a few weeks.

The animals are much less noisy, and less of the hissing and kissing sounds are heard than when they were actively mating. It is always the female that is more shy and retiring than the male, which is an active predatory forager.

Although they would probably bite severely if wrongly handled, these animals cower or flatten themselves out when one's hand approaches them and never attempt to snap at one's hand.

9 July 1945. Very active but less noisy than a short time ago, though the male appears still to mate or at least to worry the female with his attentions.

10 July 1945. The female's pouch is still empty, though the pouch area appears to be developing as if she will produce young.

16 July 1945. If birds and other game are put into the cage during the day these animals come out of the sleeping quarters for the kill. Both animals still sleeping together – the female still much the shyer and less bold of the pair.

Examined the pouch again tonight. The pouch has increased much in size and the mammary tissue has increased. The nipple area seen as bright pink pin-points in the centre of the depression, now well defined, that forms the pouch. Surrounding this central depression of the pouch is a lot of mammary tissue, now strongly developed. It appears fairly certain that the female will soon produce young.

18 July 1945. Yesterday I put the body of a female native cat in the Phascogales' cage. It had been run over and the manus, pes and pouch area removed. They appeared to be very much afraid of it and not only would not eat it, but seemed reluctant to leave their nesting box.

This morning I was dismayed to find the male dead in the sleeping box.

During the past few days the animals have carried up the feathers and especially wings, of birds, with feathers attached and lined the sleeping box – or at least have carried these feathers and feathery ends to the corner of the sleeping box and slept on them. The result is a deep cosy sleeping hollow in the far corner in which the female lies closely curled up on her side most of the time. The time for the birth of her young is probably close, and this transfer of feathers may be to keep her warm and to prepare for the birth of the young.

Pouch now quite deep and well defined and teats can be seen easily on close examination.

[Notes end after this discussion. Thomson does not explain what happened to the female or the further development of the pouch. It is possible that a section of the notes is missing].

DTC 48 402 Sent by Miss M.E. Fraser, who says that a number have been brought in. Apical tuft 45 mm.

DTC 49 403 Collected by J.P. McDonald.

DTC 50 417 3 specimens sent by Mr. McDonald. Adult female received with two large (half grown) young.

DTC 51 418 Specimen received (dead) from Leslie Goldsworthy, Reids Creek Roadside, via Beechworth, who said that it had fallen into cream which it was eating and added that it had been making a lot of noise in the house lately.

DTC 52 419 Collected by Mr. Grimwade (very large specimen).

November 1947. During November Mr. McDonald of Queenscliff telephoned to say that he had a pair of Phascogales for me. He calls them squirrels. They were eventually sent up and proved to be a female with two grown young still suckling, but long out of the pouch. The female is very shy, but from the beginning both she and the two young took food, consisting of living mice, very freely.

Apparently the two young, although very nearly adult, are still timid and appear to be reluctant or even afraid to kill mice for themselves. But the female kills freely, and I have watched her at close quarters after liberating a number of mice in the cage, at evening.

The female, ears erect, forepart of body raised high and hindquarters flattened, so that she appeared to be crouching, tail with hairs bristling, attacked mice, seizing them by the snout, a little too far forward to crush the skull or to kill instantly. She held the struggling mouse lashing from side to side, in her jaws, crosswise, and if it struggled hard, she held the animal in her hands and even between her feet, lying on her side to get free one of her two pairs of limbs simultaneously. In this position, the animal gripped lightly between her jaws, she lay, just holding on, until her quarry was dead. She appeared to kill for her offspring as well as for herself.

One of the mice appeared to bite her on the head one evening in December but she just hung on and showed no signs. In the morning I was sorry to find that she was dead. The real reason for her death is obscure unless she was injured by the rodent.

The two young, both females, have thrived without the mother. However, when I put mice, even immature female specimens into the cage, they seem too timid to kill them and I found one at least of the mice sharing the nest with the Phascogales. But when I killed the mice they have taken them readily.

12 February 1948. These two animals are very well and very active. They still eat two or three mice each night and sometimes come out in daytime and feed. They are not as strictly nocturnal as some of the other animals. They still make a bed of heaps of cotton wool or debris and sleep in a nest on or under this.

20 May 1948. The two young female Phascogales are now apparently adult and thriving. They have eaten on the average about two fat (laboratory) mice each night until recently, when I have cut these down considerably, for two reasons: They were getting too fat and the mice limited in number. They will eat dozens of large meal worms instead of mice, however, and I am now feeding only one mouse each night until the deposit of fat on the tail, which has been very marked, is reduced a good deal.

Today I heard one of them resort to the same tactics as the specimen from Cape York that we brought down in 1929 used. I had put one in the new cage first and she had hidden under the cotton wool I gave them to make a warm bed. The second took some time to settle when I released her in the new and larger cage. She could not find the other female. She explored the cage, she stamped with her hind feet on the wooden floor of the cage making a noise like a rabbit or kangaroo, apparently a kind of note of enquiry rather than of distress or anger which is shown by a rasping, grating, hissing sound.

Both females are now readily killing even adult laboratory mice, although at first they seemed to be afraid actually to kill them for themselves.

DTC 53 420 Collected by W. Hosmer.

DTC 54 422 Female from Ocean Grove.

6 May 1958 at night, Mr. Grimwade telephoned to say that he had just captured another Phascogale in one of our traps.

7 May 1958. Wood Jones (1923-5) says of this species that it appears never to have had a popular name, but in Victoria at least it is known to the few who do know it as the Tuan. In the last stronghold I have met with, it is really plentiful. From Swan Bay to Ocean Grove, it was commonly called squirrel, no doubt from its habit of carrying its conspicuous black bristling tail high and fluffed out like a bottle brush, when it is excited.

At Swan Bay these animals were really numerous and slept in fishermen's cottages and in the roofs of houses where they appear to have cosy homes.

In recent weeks we have had reports of the presence of this species at Swan Bay and especially at Ocean Grove in fair numbers. When Bill Hosmer went down to try to secure living specimens he met Mr. Fred Grimwade of Ocean Grove, who told him that it was present in such numbers in and about his house and was so troublesome that he had shot a number. Bill left a trap with him and he secured a very fine, very large male, but unfortunately it was dead when Bill went down to get it, after a few hours of capture.

On 6 May (Tuesday) at night, Mr. Grimwade telephoned to say that he had just captured another Phascogale in one of our traps. He told me that the animal had been living in a nest in the roof of his workshop over the bench, and that he was leaving the nest undisturbed for me to examine.

We received the animal soon after midday – a fine adult female in very good condition. She was feeling the effects of cold from exposure on the trip for about 18 hours but showed improvement when kept near a heater, and in the evening I took her home to Eltham and put her in the cage specially made for these animals before I left for the Bindibu expedition. I gave the animal a quantity of wool skirting to make a bed and put six white mice into the cage. She killed all the mice and ate the heads of five and part of the head of the sixth before morning. During the following day she ate the head and fore part of the body of the sixth. She slept most of the time, night as well as day, with her head tucked under her body and her black brush tail curled over her head.

Tonight (*8th May*) the third night after capture, she was alert and active and her tail was like a bottle brush.

These animals appear to make very snug nests and to lie closely in them except when they are actively engaged in hunting. Removed from the nest or when their way of life is disturbed and they are rendered inactive or deprived of shelter and warmth for sleeping, they appear to be quickly overcome by cold and in this seem to show a reptilian character in common with many other of this and allied genera. Well fed and with warm dry sleeping quarters, they thrive, but they must have a dark, secluded sleeping place free from disturbance.

In view of many and conflicting accounts that are published about this animal, I am hoping to get some opinions that should be of interest from people who know it well about Swan Bay and Ocean Grove. So far all that they have volunteered to me in the past has been the fact that this animal is a nuisance in and about their houses and that it is destructive to clothing and bedding material, which it uses to make nests in the roofs of these buildings. Nobody has mentioned its predatory habits, but most of those I have spoken to have been fishermen and not keepers of poultry. These people do, however, even wage war on this rare and interesting active, vivacious little animal.

2 June 1958. The Tuan female is rarely seen in the open in her cage. She has no young in her pouch and no pouch development. She is certainly thriving here under the conditions in which she is living. A few days ago I gave her 14 mice (house mice) freshly killed when I cleaned the feed room out and she has eaten all these greedily.

I feel that they must be one of the chief lures that bring this otherwise timid and rarely seen animal to take up its abode in civilization, as it has done at Swan Bay and the Queenscliff – Ocean Grove regions.

10 June 1958. About a week ago (4/6/58) Hosmer returned from Ocean Grove with another *P. tapoatafa* which I put in with the first – not without some misgivings because it was also a female. It seemed to be in good condition but it was not as active and alert as the other. Today it was dead in the sleeping box without any sign of injuries or marks of any kind. Of three (3) trapped recently, the first, a male, died before Hosmer could go down to collect it and the third (female) has also died. The other seems to have settled down very well and to be thriving.

The living female is being fed on white mice put into her cage alive and fed on barley while they are there. She does not now kill all that are put in as she did at first, but tolerates living mice in the sleeping quarters and even in the wool lined box in which she sleeps.

2 August 1958. Have examined the pouch of the living female *P. tapoatafa* several times, but it has shown little sign of development and I assumed that she has passed the normal gestation period and was not pregnant. But today I examined the pouch again and found that it was full of pouch embryos – naked and very small – at least six (6) in number and possibly eight. (I counted six (6) without disturbing the animal that I held in my hand.)

I have picked this little animal up many times and also the male, (they are, of course, in separate cages) and they have never attempted to bite when handled. I do not think that they actually make a nest so much as accumulate a great pile of wood, strips of bark (and in the houses, particularly in the house of F. Grimwade at Ocean Grove) newspaper in a hollow or recess, and simply burrow under this to sleep. In the nest at Grimwade's the animal slept under warm debris forming a nest against a wall of the house which probably got some sun. A male Phascogale slept over Grimwade's tool shed in a recess in a rafter filled with wool, bark and paper. We do not know whether the male and female share a nest at any time of the year but

at present, evidently not, for the females would now have young and evidently they live in nests apart from the male. The male captured by Hosmer in the nest as it slept (by hand) is a fine active animal and fed freely on white mice even the day it was captured and put into the big cage (converted aviary) on the verandah at home. This animal also spends most of its time in its sleeping box like the female – possibly these animals only move about actively to hunt and so when well fed, lie low.

2 August – Saturday. Examined the female *P. tapoatafa* – the first time I have inspected her closely for some time. She had small young, about the size of the nail of one's little finger. **DTC 55 426** *28 February 1959.* One Phascogale, the first female captured, is still alive and very well and active, but both females, although they had young in the pouch, failed to rear them. I feel now that this could have been avoided by much more careful feeding instead of depending on the mice, put in the cages in numbers, alive, which the mothers had to catch and kill themselves. If readily available food had been put out, I think the result could have been different.

On *Wednesday 26 February*, Mr. Fred Grimwade telephoned from Ocean Grove to tell me that he had captured (last night) a fine big male Phascogale. On Friday I put it with the female. Later I found the two animals close together under cover and apparently the female has accepted the male. I hope that they will mate and produce young, which this time I may rear.

The male, recently captured – about 6 weeks or 2 months ago – is virile, active and strong. By far the most lively and active of these animals – in fact, of any animal that I have seen. It moves with such extreme rapidity in the large aviary in which it lives that I often cannot follow its movement at all and certainly would have no chance of preventing its escape if the door was open.

This animal often 'stamps' its hind feet on the floor of its cage at night, when hunting. This appears to be a ruse for attracting the attention of prey, or of enemies (if indeed so rapacious a carnivore has enemies) and so reveal their presence, but this can at present only be conjecture.

On *22 May 1959* the single male Phascogale was very active and gets around his cage at night with incredible speed. The only sound I heard from him at night is the stamping with his hind feet – a tapping – used evidently to 'sound' out the situation when he is uncertain if the 'coast is clear'.

The male is the only specimen of this marsupial of the many that I have handled, that used its teeth, and it bit a coat I was wearing and clamped its teeth shut on the fabric, so that it had to be levered off.

It crouches very flat on the floor of its cage and this characteristic is shown in its every pose – especially when it is intently listening – its hind end – from the middle of the back appearing to be cut away as it spreads out. It is unbelievably alert and rapid in its movements. In the ordinary way, no sound at all is uttered by this vivacious little predator. But one of the two males we have does stamp its hind feet when it comes out at night.

11 February 1960. Received letter from Fred Grimwade.

It is interesting to know that these animals are back in his house again after a barren period when he reported that he was seeing and hearing nothing of them.

		Measurements				
Museum No.	Orig. No.	Total Length	Tail	Auricle	Manus	Pes
DTC 21	203	406	211	36	26.5	41
DTC 42	401	378	180	36	25	41
DTC 48	402	429	206	32	28.5	42
DTC 54	422	370	200	32	26	38
DTC 55	426	450	—	—	26	43

Comments

This species has not been recorded recently on the Bellarine Peninsula, although it is not uncommon in some parts of inland Victoria. Thomson's comments on the breeding and other behaviour of captive animals, as well as his notes on the increase and decrease of coastal populations, depending on food availability, are significant. The only studies on the species in recent years were made by Cuttle (1982) whose records did not include any material from the Bellarine Peninsula. (Map 1).

Dasyurus maculatus (Kerr, 1792) Tiger Quoll
DTC 76 415 Vic., Gelantipy.
27 Aug. 1947, SPIRIT, male.
Collected by Mrs. Hodge in milk can.

Comments

In this period, tiger cats were considered rare in Victoria. Thomson entered into a great deal of correspondence in quest of the species, and reported the findings in his Nature Diary in 'The Herald' Melbourne. Mammal surveys conducted over the past twenty years have shown

that this species occurs in parts of the Otway Ranges and other parts of Western Victoria, as well as in the Snowy River region. (Map 1).

Dasyurus viverrinus (Shaw, 1800) Eastern Quoll
DTC 17 210 Vic., Darcbin.
Aug. 1931, SKULL, male.
DTC 18 240 Vic., Alvic near Colac.
1934, SKULL, female.
DTC 19 243 Vic, Alvie near Colac.
1934, SKIN & SKULL, male.
DTC 20 244 Vic., Alvie near Colac.
1934, SKIN & SKULL, male.
DTC 44 400 Vic., Merri Ck., Heidelberg Road, near Clifton Hill.
17 July 1945, SPIRIT manus pes auricle and POUCH AREA WITH 3 EMBRYOS, female.
DTC 45 411 (Presumably Victoria.)
12 Aug. 1945, SPIRIT, male.
DTC 77 224 Vic., Alvie near Colac.
Dec. 1931, SPIRIT, male.
DTC 78 225 Vic., Alvie near Colac.
Dec. 1931, SPIRIT, male.
DTC 86 — (Presumably Victoria.)
18 Aug. 1934. SPIRIT, POUCH, YOUNG.
DTC 87 — (Presumably Victoria).
6 July 1934, SPIRIT, EMBRYO
— — **238** Victoria
1934, SPECIMEN MISSING, female.

Notes (Plate 1.)
DTC 17 210 Animal taken in rabbit trap and sent to the Melbourne Zoological Gardens where it died.
DTC 44 400 Specimen found dead on Heidelberg Road.
DTC 77 224 Killed March 1932.
DTC 78 225 In captivity until March 1932. One of a series taken in basalt country in December 1931. (Plate 2).
DTC 86 — Two young dropped from pouch and found dead on 18 August, 1934.
DTC 87 — Young from pouch.
— — Faeces samples from three animals from Vic., Alvie, near Colac. 7 July 1931, Sept. 1934 (Table 1).

		Measurements				
Museum No.	Orig. No.	Total Length	Tail	Auricle	Manus	Pes
DTC 19	243	493	196	46	35	59
DTC 20	244	531	221	51	37	63

Comments
Specimens were collected in the basalt country near Lake Corangamite in 1931 by David Fleay (Fleay, 1932). The Thomson collection from Alvie is an important series as the specimens are undoubtedly the only material records in existence from the area. The species has not been recorded in Victoria in recent years, although a colony was known at Studley Park, Kew until the late 1940s. A zoo specimen from the Museum of Victoria with locality 'Port Melbourne' was collected in 1948. A 1958 Alvie record reported by Warneke (pers. comm. R.

Plate 1 The Eastern Quoll *Dasyurus viverrinus* caught by flashlight in its lair among basalt rocks.
Photo D.F. Thomson

Plate 2 Eastern Quoll haunt, Alvie, Victoria July 1934. Photo: D.F. Thomson

Table 1. Scat Analysis

Sample 1. No. 228, 5 Feb. 1934 Healesville; Sample 2. 7-8 Dec. 1931 Alvie, near Colac; Sample 3. Sept. 1934 Alvie; Sample 4. 1934 Alvie.

	Species			
	Perameles nasuta	*Dasyurus viverrinus*		
Sample	1	2	3	4
No. of scats	3	17	10	8
Wt. of scats (g)	3.6	41.3	35.5	29.5
Grooming hairs	+		+	+
Rabbit hairs (*Oryctolagus cuniculus*)		+	+	+
Blue Wren feathers (*Malurus cyaneus*)			+	
Bone fragments		+	+	+
Insects: Fam. Blaberidae				
Laxta sp.			+	
Fam. Carabidae		2+spp.	1+sp.	
Fam. Scarabaeidae	1+sp.	2+spp.		2+spp.
Fam. Tenebrionidae	1+sp.	1+sp.	1+sp.	1+sp.
Plants: *Acacia* seeds	+			
Dicot. seed unidentified			+	
Sedge seeds, Cyperaceae				
Paspalum sp.	+			
**Pinus* needle, leaf (part)	+			+
**Cedrus* or *Picea* needle	+			
Bursaria spinosa			+	+
Oxalis sp. seed			+	
Hymenanthera dentata (leaf fragment)				+
Arctotheca calendula (capeweed, seeds)			+	

* May be nesting materials.

M. Warneke) cannot be authenticated. The Thomson photographs of the habitat of this species at Alvie are of historical and zoological significance. (Map 1).

Map 1 Localities of Thomson's specimens of
Phascogale tapoatafa (●)
Dasyurus maculatus ( )
Dasyurus viverrinus (○)
Sminthopsis crassicaudata (△)
Perameles nasuta (▲)

Sminthopsis crassicaudata (Gould, 1844)
Fat-tailed Dunnart
DTC 22 206 Vic., Werribee Plains.
1931, SKULL, male.
DTC 23 406 Vic., Numurkah.
28 Jan. 1946, SKIN, SKULL & SPIRIT TONGUE, female.
DTC 24 227 Vic., Deer Park, basalt plains country. Sept. 1931, SKULL.
DTC 25 405a Vic., Numurkah.
28 Jan. 1946, SPIRIT JUV., male.
DTC 26 405b Vic., Numurkah.
28 Jan. 1946, SPIRIT JUV., male.
DTC 27 405c Vic., Numurkah.
28 Jan. 1946, SPIRIT JUV., female.
DTC 28 405d Vic., Numurkah.
28 Jan. 1946, SPIRIT JUV., female.
DTC 29 405e Vic., Numurkah.
28 Jan. 1946, SPIRIT JUV., female.
DTC 30 405f Vic., Numurkah.
28 Jan. 1946, SPIRIT JUV., female.
DTC 64 356 Vic., Numurkah.
27 June 1945, SPIRIT, female.
DTC 65 215 Vic., Werribee Plains.
1930, SPIRIT, female.
DTC 66 216 Vic., Werribee Plains.
1931, SPIRIT, male.
DTC 67 408 Vic., Laverton.
Aug. 1945, SPIRIT, female.
DTC 68 408a Vic., Laverton.
Aug. 1945, SPIRIT, male.
DTC 69 408b Vic., Laverton.
Aug. 1945, SPIRIT, female.
DTC 70 408c Vic., Laverton.
Aug. 1945, SPIRIT, female.
DTC 71 408d Vic., Laverton.
Aug. 1945, SPIRIT, female.
DTC 72 408e Vic., Laverton.
Aug. 1945, SPIRIT, female.
DTC 73 408f Vic., Laverton.
Aug. 1945, SPIRIT, female.
— **201** Vic., Werribee Plains near Laverton.
30 Aug. 1930, SPECIMEN MISSING, female.
— **401** Vic., Laverton.
20 Sept. 1945, SPECIMEN MISSING.
— **423** Vic., Laverton.
19 Sept. 1958, SPECIMEN MISSING, female.

Notes
DTC 22 206 Adult male about 12-14 months from pouch.
Laverton, Vic. 1930-1931.
DTC 23 406 Adult female with six young received from A.S. Marshall. Six young are [DTC 25-30] 405a-405f.
On 27th January (1946) I received a letter from A.S. Marshall, Numurkah. This is interesting as showing not only the distribution, but also the breeding range, of this species. Thus while we were getting females with pouch young in late winter, near Laverton, and again in September, this female with young about one-third grown was secured in late January.

The female and six (6) young arrived safely. The female was much lighter in colour and had shorter fur than the specimens collected on the Werribee Plains near Melbourne, which had a distinct dark tinge to the fur.

28 January, 1946. Female and her six well-grown young all active and thriving. They eat and relish meal worm larvae, beetles, moths and almost any other insect. Snails, as noted by Marshall when sending this brood, they do not appear to eat, but they relish small birds, stripping the flesh clean from the bones, and they eat small lizards. But it is insects which form their staple diet.

The usual note of excitement or alarm is a loud rasping chirruping cry, and this note is issued when the young fight for possession of insects.

Like the other family of this species which I kept recently, and also like *Phascogale*

tapoatafa these little animals are very susceptible to the cold, and often if handled early in the morning or when there was a sudden rapid drop in temperature, they are curiously helpless. They open their mouths wide and utter a sharp chirruping cry.

If these animals are subject to this chilling during life under natural conditions, it is certain that mortality must be very high and that they could be overcome by enemies.

DTC 24 227 Disgorged by a tiger snake *Notechis scutatus* after capture.

DTC 25-30, 405a-405f Six young in various stages of growth. These were received with a female on 28 January, 1946, and thrived for some time. The first died on 22 March and the last early in May.

DTC 65 215 Captured 1930 with mother. Died 1931.

DTC 67 408 Female with six young, DTC 68-73, 408a-408f.

Notes August-September, 1945

Despite its wide distribution, very little detailed information appears to have been recorded about this species. It is still (1945) not uncommon on the Werribee Plains as close to Melbourne as Laverton, and on three separate visits of a couple of hours' duration specimens were secured.

The first visit to the area was made in August when a female with at least six young, already well grown and too large to be accommodated in the pouch, was captured. Unfortunately she escaped the same day before any examination had been made.

On 10th September a nest containing eight (8) fat-tailed pouched mice, about half grown, was found. Seven of these were females and only one a male.

Subsequently, on 20th September, another visit was made and two more specimens captured. One was a male about half grown, the other a large and fully adult female which proved to have at least four very minute young in her pouch. They were then only about 2 or 3 mm in length, and looked rather like masses of pink jelly. So, of a total of eleven specimens captured, nine were females and only two males. This bears out the statement made by Wood Jones (1923-5) that 'The females appear to vastly outnumber the males, or else to fall more easy victims to cats and traps.' However, as eight of the specimens mentioned above were captured together in one nest and obviously belonged to one litter, it appears that the males are much less numerous than the females. Of this litter seven were females and only one a male.

All the specimens captured were found under stones or old iron scattered about the plains. Flat stones which were not lying too close to, or embedded under the earth, appeared to be the most favoured spots. The first female with the young each about half an inch long was found in a nest. The family of seven was also found in a nest, but the two later specimens, the adult female and the young male, were each found solitary and without nests.

The nests were generally built in depressions, fairly deep, in the ground under rocks or iron.

Measurements of a typical nest made on 10th September are:

401 Maximum length 4 inches
Maximum breadth 3 inches
Maximum inside height 1½ inches.

Nest situated in a deep depression 3 inches wide by 2 inches deep. The nest was well made and domed, the upper part or 'roof' not quite complete when the stone was rolled away. There was a more definite side entrance than I had seen in other specimens. The nest was placed under a big boulder and had a run or tunnel seven inches in length, leading to it. It was in good repair but not in use.

20 September 1945. A number of nests were observed, generally under stones, on the surface of the ground, not in burrows. Remains of beetles, such as the elytrae, were generally abundant.

Nest constructed of grass, rootlets and fibre, with some sheep's wool or feathers added. In each case it was in a cup-like hollow under a rock or sheet of iron, either carefully selected or excavated by the animal. The material forming the bottom of the nest consisted of short pieces of grass or herbage. Very snug and warm and affording good shelter from the bitter winds of the plains.

These animals are not very fast and when disturbed are generally so confused that they are easily captured. They depend rather on escaping into crannies among stones, or into grass where they hide, than on the speed of their movements.

Wood Jones (1923-5) says that the breeding season is in June and July. This must be variable in Victoria, for apart from the female captured in August, which escaped on 10th September, the eight half-grown specimens must obviously have been born in the winter, and the female

captured as late as 20 September had very small naked young in her pouch. At this stage it should be noted that the pouch was quite adequate for the young and that it was then well-developed, and the young so completely concealed inside it that they could only be seen with difficulty, by causing the pouch to open. There are at least four and they are contained within this structure.

It is not possible to make a more detailed examination without serious risk of losing the young. In any case it seems definite that the breeding season is variable and extends over a number of months. In other specimens where the young have been bigger, the mammary tissue becomes so enlarged that the pouch seems to be turned inside out. The young then hang from the nipples and are not protected by the pouch at all. The pouch therefore serves only in the initial stages of development, when it certainly does protect the very frail and delicate embryos during the vulnerable stage of their growth, immediately after brith and transfer to the pouch.

The nest containing the eight young, a little less than half grown, was placed under a stone. There was no sign of any adult, nor would there have been room in the nest, which the eight animals filled completely. They proved to be independent and feed readily in captivity.

These animals are chiefly insectivorous, eating beetles, moths and their larvae, grubs, etc. They will also eat meat, cake etc. In captivity they eat mealworms greedily, but will also take cake made with eggs, and finely chopped meat, raw or cooked. When afraid, they open their mouths wide and show their teeth in an attempt to intimidate, but will bite if handled, although not capable of inflicting any real injury.

When two animals seize the same prey, or when one wishes to take some tit-bit from another, it will seize the desired object and a struggle ensues in which little damage appears to be done. The usual note when afraid or disturbed is a loud rasping hiss made with the mouth wide open. Unless alarmed, they appear to be silent.

The ears are carried always erect, and this, with the sharp ponted nose, gives the face an alert and rather fox like appearance. In none of the specimens just captured is the tail encrassated - all are short and in no way distended.

23 September 1945. At the present time I have in captivity an adult female with at least four very small naked young in her pouch. This animal is a large and fully grown specimen. She was alone when captured and not in a nest. She was very timid and tried hard to escape, but after three days is settling down and has made her nest in the centre of a piece of cotton wool.

Adults appear to be solitary. Specimens in one nest either adult female with young, or partially grown family of young, just getting independence. They make a harsh rasping hiss when alarmed and have a habit of opening and holding mouth agape in a gesture of silent intimidation.

Like many other marsupials, the little animals grow very cold when inactive or in a cold room, and are then so helpless that they are either incapable of movement or very limited in movement. They open their mouths wide to show their teeth, but are powerless to run away and quite defenceless. Within half an hour, if warmed, they become normally active and will feed. Their fur is very fine and felt-like in texture.

A mature specimen, (again a female) was received a few weeks ago (DTC 64 356).

The area in which these animals have been found, is on the Werribee Plains near Aircraft Siding (Laverton). Here, despite the inroads of civilisation, they live under stones scattered about the blacksoil plains, or in boulders in the stone walls, and even under iron, timber or debris of old rubbish dumps and abandoned dwellings. In this area, caterpillars of many kinds and beetles were seen to be especially numerous, and this and the old basalt country probably account for the numbers of these animals.

The colony of *Sminthopsis crassicaudata* captured on 10 September and the young male taken a few days later are all thriving.

Today, 26 September, I noticed that the tails of all these animals appear to be increasing in size so that this supports the belief that they are thriving. Their coats have lost their ruffled rough appearance and they are becoming sleek and velvety in appearance. All eight sleep together, six females and two males.

At first all the young thrived, but soon they became sick, ataxic, passed yellow faeces and died one by one during October.

A series of these young has been preserved in spirit.

— **201** Head 28 mm. Taken by J. Sades in basalt country, but injured in capture. She had 8 young about half grown, not attached to teats but said

to have been clinging to fur of mother's back by teeth. On 1 September five of the young were well and in good condition, being fed on bread, milk, egg, etc.

The tail of this female, 201, was greatly reduced, no doubt owing to rearing of 8 large young.

30th September 1945. Notes on adult female with young in pouch, captured 20th September, 1945.

This animal has settled down well after being very restless and timid, and now feeds freely. The female has adopted a corner of the small cage in which she is kept, sitting on what was an old nest taken on the Werribee Plains, over which there is a covering of a sheet of cotton wool. Just as *Acrobates* object to wool or flannel, these animals like it.

In view of the habitat and mode of life of these animals it is probably that small lizards and birds (taken at night) are eaten quite frequently in addition to the chief diet of insects.

1st October 1945. The female *Sminthopsis* ate the small frog which she appeared to reject yesterday and which I killed. She again ate the skin, skeleton etc. and left only the lower parts of the two hind feet.

Female escaped with young, early in October. — **423** Collected by Wm. Hosmer. Found beneath rock on open field.

Measurements

Museum No.	Orig. No.	Sex	Total Length	Tail	Auricle	Manus	Pes
DTC 23	406	female	129	46	20	8	14
DTC 64	356	female	125	45	29	9	14
—	201	female	140	44	19	8.5	14.5

Comments

This species was not investigated in detail until relatively recently when S.R. Morton studied various aspects of its ecology and life history and published his findings (Morton, 1978). Thomson's early notes on its nesting behaviour, breeding and feeding habits are biologically significant as well as providing historical interest. (Map 1).

PERAMELIDAE

Perameles nasuta Geoffroy, 1804

Long-nosed Bandicoot

DTC 16 234 Vic., Sorrento.
31 March 1934, SKULL RIGHT PES.

DTC 38 228a Vic., Healesville.
3 Feb. 1934, SPIRIT JUV., male.

DTC 43 228b Vic., Healesville.
3 Feb. 1934, SPIRIT JUV., male.

DTC 39 212 Vic., Mooroolbark near Lilydale.
1932, SPIRIT, female.

DTC 40 212a Vic., Mooroolbark near Lilydale.
1932, SPIRIT, POUCH, YOUNG, female.

DTC 41 212b Vic., Mooroolbark near Lilydale.
1932, SPIRIT, POUCH, YOUNG, male.

DTC 42 212c Vic., Mooroolbark near Lilydale.
1932, SPIRIT, POUCH, YOUNG, male.

DTC 79 233 Vic., Rye.
3 April 1934, SPIRIT, male.

Notes

DTC 16 234 Dead and mutilated animal found, second specimen DTC 79 233 also found dead.

DTC 38 228a & 43 228b Female disturbed from nest and captured. Three young in pouch, one very badly damaged and discarded, a second injured and replaced in pouch after capture on 3rd April 1934. Next morning this and the young that had remained in the pouch throughout both dead. Nest made from coarse grasses, of domed shape constructed in heavy grass under shade of a tree and placed in a shallow depression in the ground.

Burrows with forefeet in trying to escape. Sought refuge in a hollow stump when chased by dogs. Makes a loud snuffling sound when

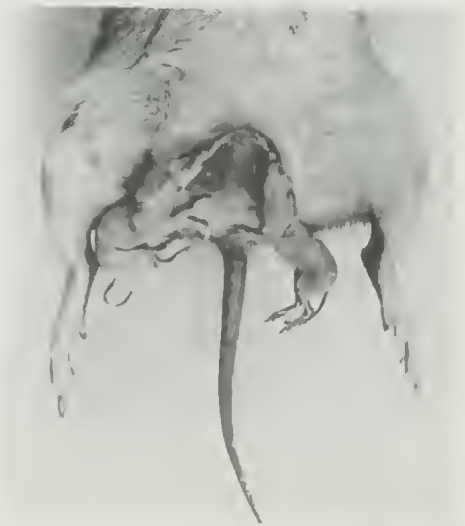


Plate 3 The Long-nosed Bandicoot, *Perameles nasuta* DTC 39, Ventral surface showing pouch and pouch young. Photo: D.F. Thomson

The Field Naturalists Club of Victoria

NATIONAL HERBARIUM Birdwood Avenue, South Yarra, 3141

CALENDAR OF EVENTS, FEBRUARY - JUNE 1989

FEBRUARY

Wed 1 **Geology Group.** Members' Night. Videos on Geology of Australia.

Sun 5 **General Excursion.** Sherbrook Forest.

Tue 7 **Fauna Survey Group.** "The Ecology of Australian Fur Seals." Bob Warneke.

Thu 9 **Botany Group.** "Alpine Plants and their Habitats." Hilary Weatherhead with Andy Blackburn, Ilma Dunn & Ian Morrison.

Sat 11 **Fauna Survey Excursion.** Leadbeaters Possum – Upper Yarra. Leader: Ray Gibson 874 4408 (AH).

Mon 13 **General Meeting.** "Kakadu is on the Way to Arnhem Land." Mr J. Montgomery.

Wed 15 **Microscopical Group.** Microscopes of all sorts and sizes.

Thu 16 **Day Group.** Blackrock to Ricketts Point. Leader: Dan McInnes 211 2427.

Sat 18 - Sun 19 **Fauna Survey Excursion.** Water Rats – Werribee.

Fri 24 **Hawthorn Juniors Meeting.** Talk by Malcolm Turner on his exotic holiday.

Sat 25 **Botany Excursion.** Lake Mountain.

Mon 27 **Council.**

MARCH

Wed 1 **Geology Group.** "Transform Faults: Alpine Fault System, New Zealand." Zofia Bartoszewicz.

Mon 6 **General Meeting.** "Malaysia through the Eyes of a Conservationist." Graeme Love.

Tue 7 **Fauna Survey Group.** "Travels with a Marine Biochemist: Auckland to Zamboanga, Stopping All Stations." Dr John Baldwin.

Thu 9 **Botany Group.** "From the Kimberley to the Cooper: a Contrast." Win Bennet.

Sun 11 - Mon 13 **General Excursion.** Vic. Field Naturalists Clubs Association annual get-together, Bellarine Peninsular.

Sun 11 - Mon 13 **Fauna Survey Excursion.** Inverleigh Common.

Wed 15 **Microscopical Group.** Lighting.

Thu 16 **Day Group.** Banksia Park, Heidelberg. Leader: Marge Wilson 836 3521.

Fri 17 **Hawthorn Juniors Meeting.** Information night on Easter camp.

Sat 18 **Fauna Survey Excursion.** Leadbeaters Possum Survey – Upper Yarra. Leader: Ray Gibson 874 4408 (AH).

Mon 20 **Council.**

Fri 24 - Tue 28 **Fauna Survey Excursion.**

APRIL

Sun 2 **General Excursion.** Toorourrong & Winneke Reservoirs, Kinglake area.

Tue 4 **Fauna Survey Group.**

Wed 5 **Geology Group.** "Earthquakes." Gary Gibson.

Mon 10 **General Meeting.** "Birds & People." Mrs E. McCulloch.

Thu 13 **Botany Group.** "An Overview of the Vegetation of the Mallee." David Cheal.

Sat 15 - Sun 16 **Fauna Survey Excursion.** Water Rats – Werribee.

Wed 19 **Microscopical Group.** Making insect mounts; display of insect slides.

Thu 20 **Day Group.** Queens Park, Moonee Ponds. Leader: Andy Blackburn.

Sat 22 **Botany Excursion.** Tall Forest on the Ada River (Noojee area). Leader from the Latrobe Valley FNC.

Mon 24 **Council.**

Fri 28 **Hawthorn Juniors Meeting.** Eastern Barred Bandicoot.

Sat 29 **Fauna Survey Excursion.** Leadbeaters Possum survey – Upper Yarra. Leader: Ray Gibson 874 4408 (AH).

MAY

Tue 2 **Fauna Survey Group.**
Wed 3 **Geology Group.** "ATraveller in China." Mr J. Mitchell.
Sun 7 **Geology/General Excursion.** Led by Geology Group.
Mon 8 **Annual General Meeting.** President's Address.
Thu 11 **Botany Group.** "RCA Roadside Reserves." Graeme Stone.
Sat 13 **Fauna Survey Excursion.** Leadbeaters Possum survey – Upper Yarra. Leader: Ray Gibson 874 4408 (AH).
Wed 17 **Microscopical Group.** Diatoms – collecting & mounting; display of slides; history of some famous diatom mounters.
Thu 18 **Day Group.** Altona via Westgate Bridge. Leader: Ian Gillespie 578 1879.
Fri 26 **Hawthorn Juniors Meeting.** Bird Smuggling.
Sat 27 **Botany Excursion.** Mornington Peninsular. Leader: Tom Sault.
Mon 29 **Council.**

JUNE

Sun 4 **General Excursion.** Fungi.
Mon 5 **General Meeting.** "V.F.T. – Environmental Effects?" Eric Quinlan.
Tue 6 **Fauna Survey Group.** Members' Night.
Wed 7 **Geology Group.** "Speleology (Caving)." Mr M. McBain.
Thu 8 **Botany Group.** "Trees, Toadstools, Puffballs & Potoroos." Tom May.
Sat 10 - Mon 12 **Fauna Survey Excursion.**
Thu 15 **Day Group.** Bundoora Park & Museum. Leader: Dan McInnes 211 2427.
Wed 21 **Microscopical Group.** Crystals – suitable crystals; making slides; polarised light; display of slides.
Fri 23 **Hawthorn Juniors Meeting.** Aboriginal Food.
Sat 24 **Botany Excursion.** Fungi – Beenak area. Leader: Tom May.
Mon 26 **Council.**

For more details of events, see current *Victorian Naturalist.*

CONTACTS

President – Graeme Love 697 5109 (BH).
Vice President – Sheila Houghton 551 2708 (AH).
General Excursions & Information – Marie Allender 527 2749.
Day Group – Dan McInnes 211 2427.
Botany Group – Margaret Potter 29 2779.
Geology Group – Helen Bartoszewicz 311 5106 (AH).
Fauna Survey Group – Julian Grusovin 211 4997.
Microscopical Group – Elsie Graham 469 2509.
Hawthorn Junior F.N.C. – Gerard Marantelli 388 1260.

MEETING TIMES & VENUES

* General meetings start at 8 pm, and for February, March and April are at the Royal Society Hall, 9 Victoria St., Melbourne.

* All other meetings, except Day Group and Hawthorn Juniors, also start at 8 pm, and for February, March and April, are at the Astronomer's Residence, Birdwood Ave., Sth Yarra.

* From May onwards, all meetings except Day Group and Hawthorn Juniors are at the Herbarium Hall, Birdwood Ave., Sth. Yarra.

* Hawthorn Junior F.N.C. meets at 7.30 pm at the Balwyn Primary School Hall, cnr. Balwyn & Whitehorse Rds., Balwyn. Other details of their meetings and excursions are subject to confirmation.

Supplement to *The Victorian Naturalist* Jan-Feb 1989

investigating anything or loud note like a cracked tin whistle when alarmed. Female secured alive and uninjured. Her pes and manus look very white when she moves about – in striking contrast with her dark grizzled brown hair. Faeces of this female preserved. (Table 1).
DTC 39 212 Mammae 8. (Plate 3).
DTC 40-42 212a-212c Pouch young of DTC 39 212.
DTC 79 233 Found dead on road – having been killed by motor car. These animals are still numerous in grassy tussocky country along coast, their cracked tin whistle calls of alarm or annoyance often heard at night. They come to scavenge about temporary camps, at night, and eat scraps, fat, meat, etc. Move in short, rapid rushes then stand quite still, so are often hard to see or to follow.

		Measurements				
Museum No.	Orig. No.	Total Length	Tail	Auricle	Manus	Pes
DTC 39	212	508	147	50	36	69
DTC 79	233	545	154	59	39	73

Comments
Although this species is not uncommon throughout much of Victoria, in habitats which range from the coast to wooded gullies of the North-east, there are no known records from the Mornington Peninsula, nor have any reports of its occurrence at Rye or Sorrento reached the Museum. (Map 1).

PHALANGERIDAE
Trichosurus vulpecula (Kerr, 1792)
Common Brushtail Possum
DTC 5 209 Vic. Eltham.
1931, SKULL.

Comments
This species is one of Victoria's most common marsupials found in both urban and bushland areas.

BURRAMYIDAE
Acrobates pygmaeus (Shaw, 1793)
Feathertail Glider
DTC 14 204 Vic., Ferntree Gully.
25 July 1930, SKIN, male.
DTC 33 398 Vic., Erica, Gippsland.
9 May 1945, SPIRIT, female.
DTC 34 399 Vic., Erica, Gippsland.
12 May 1945, SPIRIT, female.
DTC 35 409 Vic., Erica, Gippsland.
9 May 1945, SPIRIT, male.
DTC 36 413 Vic., Romsey, Monument Creek, via Woodend.
20 Aug., 1943, SPIRIT, male.
DTC 37 416 Vic., Erica.
16 Sept. 1947, SPIRIT & 4 YOUNG, female.

Notes
DTC 14 204 Apparently rare or little known in district, inquiries failed to bring any others and it was the first the finder, a local resident, had ever seen there. Head 25mm, Tongue 23 mm, Wt. 13.0 g.
DTC 33 398 (See DTC 35). Three specimens sent from Erica after a forest fire, one male and two females. This female died soon after arrival.
DTC 34 399 (See DTC 35). The male and female have settled down in captivity and are under observation.
DTC 35 409 Male collected 9 May 1945, died 24 May 1946. Captured at Erica in May 1945 by Dyer, a Forest Officer, with 2 females. One of these three specimens, a female (DTC 33), died soon after arrival, the second female (DTC 34) thrived for some months and then died.

12th May 1945. I received a 'phone call from a man to say that he had brought down the *Acrobates* from Erica. They arrived alive in a tin, this time with some material in it, but both were weak and chilled from the night in the tin and from the ordeal of capture and travel. The first specimen was a male, the last two females. Both these animals lapped water and honey with their long pink tongues, fairly eagerly after their arrival, but one died during the afternoon. I had not been able to induce the first specimen (the male) to eat, and it seemed perpetually cold and I expected it to die. I put it, with the female, in a cage with a wire-gauze front and made them a warm nest of leaves inside a hollow *Pandanus* log. In the evening I found that both were very active and seemed well. During the night they ate a full teaspoonful of (unrefined) honey and were very active when I saw them at intervals. In the morning they were active again at daylight but went into the hollow and settled snugly for the day.

Heard one of these animals utter a low twittering bird-like note this evening when in its sleeping log.

Although only newly captured, these animals do not appear to object to being handled, but clung to my hands, so that I had great difficulty in putting them down once I picked them up.

It appears as if these animals are susceptible to the cold except when very active, or in the snug nest, inside a hollow limb. In the morning they are often (but not invariably) so chilled that they are almost immobilised, like a reptile. At these times they are closed up in a tight ball but later 'thaw' out and become fully active and normal.

16th May 1945. The two Pygmy Phalangers have now quite settled down. They spend almost all their time asleep in a hollow branch filled with the warm leafy bracts of maize and I have only seen them out for brief periods in the last two or three days. They are not as easy to handle but are more at home and 'self-contained' now. They are warm and no longer inert. Their fur is clean and dry. They appear to be taking honey and two or three nights ago, ate a Bogong moth, except for the wings which were clipped off. These animals dislike being disturbed, and wake at once and return to the hollow limb if this occurs. If they are out when I flash the electric light on in the room, they go in at once. Much more nimble and alert now.

17th May 1945. Both animals active early in the evening but when light switched on, they again retired to their nest.

21st May 1945. Rarely see these animals now except when I turn on the light suddenly in the early morning (before daylight), and generally find them actively running about the cage – their tails carried out behind them. All day and while the light is on at night, I do not see them. They have taken a number of beetles lately, leaving only the elytrae, but live mostly on honey.

Yesterday *20th May*, when it was bitterly, penetratingly cold in the house, I examined one in the hollow sleeping log and found it absolutely inert – apparently scarcely able to move – and rolled in a tight ball, its tail coiled over its body too – just as I found it about 10 days ago when it first arrived, inert and just like an animal disturbed when hibernating. I have warmed the cage each night by the fire and kept it as warm as possible. When the animals are active it does not appear to matter how cold it is, but they get very cold in the hollow tree they sleep in and become completely immobilised. They appear to recover from and not to be affected in any way as a result of this cold – which only overtakes them when they are inactive. As long as they are able to move about freely, the cold does not appear to worry them.

Have put many mealworms into the cage, but have not seen any evidence that they have eaten them (though they have eaten beetles). These little animals are very silent.

Tonight, *24th May* the female bit my finger as I handled her.

Examined the female today. Her pouch is still empty but appears to be enlarged a little. It is now quite conspicuous, rather deep and lined with long pale yellowish hairs.

Today I heard again the sound I recorded before, and the only sound I have heard these little animals utter – a low twittering like the twittering of young mice, coming from within their sleeping hollow.

30th September 1945. Both animals thriving. In captivity they are feeding chiefly on brown sugar and honey, but they eat insects eagerly and apparently search for them. When possible I have given them mealworms, and though at first they did not appear to eat these larvae they now do. Generally the mealworms are killed to prevent their escape before the *Acrobates* come out to forage.

They are much less troubled now when the electric light is switched on. At first they fled to cover, but now they are scarcely troubled by it at all, and are generally less timid than when first captured.

DTC 36 413 Collected by E. Collins.

DTC 37 416 Adult female with 4 young, a, b, c, d, spirit. Collected 16th September 1947, by Mr. Ryan.

Manus, pes and auricle figured.

Measurements

Museum No.	Orig. No.	Total Length	Tail	Auricle	Manus	Pes
DTC 14	204	146	71	11	9.5	13.5
DTC 35	409	138	66	11.5	11	14

Comments

Although this species is widely distributed in eastern Australia, few specimens are collected in surveys or seen by the public. Only limited behavioural studies have been undertaken on *A. pygmaeus* (Fleming and Frey, 1984; Russell, 1980).

PETAURIDAE

Petaurus australis Shaw, 1791

Yellow-bellied Glider

DTC 9 203 Vic., Toorloo Arm, Lake Tyers. 31 March 1934, SKIN & SKULL, female.

DTC 10 231 Vic., Toorloo Arm, Lake Tyers. 1 April 1934, SKIN & SKULL, male.

DTC 11 232 Vic., Toorloo Arm, Lake Tyers. 1 March 1934, SKIN, SKULL & SPIRIT, male.

Notes
DTC 9 203 Mammae 2. Manus and pes figured.
DTC 10 231 Iris dark brown.

Measurements						
Museum No.	Orig. No.	Total Length	Tail	Auricle	Manus	Pes
DTC 9	203	704	438	65	36	46
DTC 10	231	720	460	59	37	43
DTC 11	232	666	401	64	34	45

Comments
One of the rarer members of the Petauridae known from the forests of temperate to sub-tropical eastern Australia, it is still likely to occur in the Thomson localities. Little research has been carried out on the species, but Henry and Craig (1984) have provided some information on its breeding behaviour and feeding habits.

Petaurus breviceps Waterhouse, 1839
Sugar Glider
DTC 8 205 Vic., Healesville.
10 Aug. 1930, SKIN & SKULL, male.
Died in captivity. Total length 363 mm, Tail 193 mm, Auricle 29 m, Head 47 mm, Pes 30 mm, Tongue 32 mm, Iris dark brown.

Comments
This is still a common species in Victoria and in South-eastern Australia. It often thrives in strips and patches or corridors of forest remaining on cleared agricultural land. A review of recent work is presented by Henry and Suckling (1984).

Pseudocheirus peregrinus (Boddaert, 1785)
Common Ringtail Possum
DTC 6 226 Southern Victoria.
1931, SKULL.
DTC 7 208 Southern Victoria.
1931, SKULL.
DTC 31 218 Southern Victoria.
1931, SPIRIT JUV., male.
DTC 32 430 Vic., Upper Ferntree Gully.
12 Sept. 1958, SPIRIT JUV., female.
DTC 74 217a Vic., Belgrave.
1931, SPIRIT JUV., male.
DTC 75 217b Vic., Belgrave.
1931, SPIRIT JUV., female.

Notes
DTC 32 430 Collected by W. Hosmer.
DTC 74-75 217a-217b Naked pouch young from the same pouch.

Comments
This is one of Victoria's most common species of possum. Having adapted its lifestyle to survive in close association with human habitation, it is still likely to be found in the Thomson localities.

Petauroides volans (Kerr, 1792)
Greater Glider
DTC 12 229 Vic., Toorloo Arm, Gippsland Lakes.
31 March 1934, SKIN & SKULL, male.
DTC 13 — Vic., Mooroolbark (Plate 4).
Dec. 1931, SKULL JUV.

Notes
DTC 12 229 Iris dark brown.

Measurements						
Museum No.	Orig. No.	Total Length	Tail	Auricle	Manus	Pes
DTC 12	229	903	495	48	43	50

Comments
This is an inhabitant of eucalypt-dominated habitats, from low open coastal forests to the tall forests of the ranges, and low woodland west of the Dividing Range. As a result of urban development it is now unlikely to be a common inhabitant in the Mooroolbark area.

Plate 4 The Greater Glider *Petauroides volans* Mooroolbark, Victoria 1932.
Photo: D.F. Thomson

MACROPODIDAE

Bettongia gaimardi Desmarest, 1822
Tasmanian Bettong
510 197 Victoria.
1931, SKULL & VERTEBRAE.
(In a box labelled as *Pseudocheirus laniginosus.* No other data available.)

Comments
The Tasmanian Bettong has not been recorded from mainland Australia since the early years of this century. It is unfortunate that this specimen has no precise locality information, and there is always the possibility that it was confused with another species, not of Victorian origin.

Wallabia bicolor (Desmarest, 1804)
Swamp Wallaby
DTC 2 219 Vic., Belgrave.
1931, SKULL, SCAPULAE & VERTEBRAE.
DTC 3 241 Vic., Flinders.
Oct 1934, SKULL, female.
DTC 4 431 Vic., near Lang Lang.
1957, SPIRIT HEAD, MANUS & PES.

Notes
DTC 2 219 Skeleton found in creek bed in Dandenong Ranges, near Tragellas bog, Belgrave.
DTC 3 241 Mammae 4.
DTC 4 431 Found dead on road, head and limbs only retained.

		Measurements				
Museum No.	Orig. No.	Total Length	Tail	Auricle	Manus	Pes
DTC 3	241	1380	630	89	49	202

Comments
This distinctive wallaby is found throughout many of the wetter areas of Victoria.

VOMBATIDAE

Vombatus ursinus (Shaw, 1800)
Common Wombat
DTC 15 — Victoria.
1931, SKULL & SKELETON.

Comments
Wombats are still common over much of Victoria, although they have receded from the south-west of the State.

RODENTIA

MURIDAE

Rattus fuscipes (Waterhouse, 1839)
Bush Rat
DTC 56 213 Vic., Otway Ranges.
Dec. 1931, SPIRIT, male.

Comments
This is the most common and widespread of Victoria's native rodents, and is a well-recognised inhabitant of the Otway Ranges.

Rattus rattus (Linnaeus, 1758)
Black Rat
DTC 57 246 Vic., Eltham.
March 1935, SPIRIT, female.
— — Vic., 'Worlingworth', Eltham.
7 June 1943, NO SPECIMEN.

Notes
DTC 57 246 Numerous in neighbourhood of river, largely fruit and vegetable feeder. Active in trees. Ears very prominent in life. Clean, healthy, attractive animal.
— — For some time large numbers of Bogong moths have appeared at night and often beat against the windows in great numbers. I captured about 100 in a few minutes a few nights ago. Last night, 6th June, I noticed a rat coming up to the window outside (it had no blind or shutter) and snatching moths which were fluttering against the window.

It came along the sill, stealthily, its head appeared for a moment. It would snatch a moth in its forepaws and then run off, taking one moth only each trip and not waiting to eat it on the sill but retreating to the end of the window which was covered with ivy. It looked more like a *Phascogale* than a domestic *Rattus* when hunting the moths. Have also noticed this rat climbing nimbly on the branches of trees along the Yarra, where it was disturbed from an old discarded nest in a tree.

Comments
This common species of urban and agricultural areas is often mistaken for a native rat. Its climbing habits are well recognised; and it often makes itself at home in orchards or gardens where food is reasonably plentiful.

Hydromys chrysogaster Geoffroy, 1804
Water-rat
DTC 58 358 Vic., River Yarra at junction of Diamond Creek, Eltham.
April 1945, SPIRIT, female.
— **412** Vic., Mafeking.
14 June 1947, SPECIMEN MISSING.
Skull sent by Miss Cook.

Comments
Thomson's Eltham property was obviously a haven for many mammal species, including the water-rat. This species is still found extensively in coastal and inland waterways of Victoria, and is still a likely inhabitant of the Eltham area.

CHIROPTERA

VESPERTILIONIDAE

Nyctophilus geoffroyi Leach, 1821
Lesser Long-eared Bat
DTC 84 239 Vic., Eltham.
Died 30 July 1934, SPIRIT, female.
DTC 85 242 Vic., Eltham.
Died 7 Nov. 1934, SPIRIT, female.

Notes
DTC 84-85 239-242 In captivity for several months.

8th April 1934. Captured bat drank water from spoon but refused mealworms, ate moths but generally discarded wings.

12th April 1934. Caught second bat but terrified. Ate live dragon fly. Only wings discarded.

17th April 1934. Both eating mealworms on floor of cage, they walk on the feet and on digit one.

25th April 1934. The two long-eared bats which have been very inactive for some time were both extremely alert and active tonight, although it was clear and cold. It is the first night for days when there has not been rain and a dull overcast sky and tonight, although cold, the sky outside is clear and starry. Are the bats sensitive even to atmospheric change – would they have been in a state of hibernation or near-hibernation in the recent days of terrific storm, being unable to fly and to get food. Now tonight would they be able to get out and feed and therefore be active? There may be nothing in this but it seems suggestive that both are so unusually alert and active tonight and flying in their cage. They ate all last night's mealworms and tonight I have given them a very large number.

6th May 1934. Both bats still well and active, feeding each night. They eat large quantities of mealworms and are thriving. When asleep, their ears are usually folded or partially folded, the mechanism being the folds or wrinkles in the posterior margin of the ear; the ear may be noted in all positions, from erect when they are very long and directed forwards; half-erect, or folded.

Map 2 Localities of Thomson's specimens of
Nyctophilus geoffroyi ( )
Chalinolobus gouldii (○)
Mormopterus planiceps (△)
Taphozous flaviventris (●)

June 1934. Both bats are alive and well. They always sleep together in the daytime, the ventral surface of one close and opposed to the dorsal surface of the other. They feed each night and are not active as a rule early in the evening but towards early morning – often more active after daybreak. Generally clinging together on roof or side wall of the wire house.

8 June 1934. After a long succession of dry weather with increasingly cold nights in which there has been frost, and after which these bats have not been active early in the evening, rain fell today. The temperature is still low. A large number of Bogong moths appeared tonight – as they do when there is rain in Autumn and early Winter. I took a number in to the bats at 7.15 p.m. found them unusually active, alert and noisy – inclined to run about their cage, even to fly about, uttering frequently their shrill *Malurus*-like (wren) alarm notes in spite of this low temperature. Is it humidity that makes them active or are they sensitive to change in atmospheric conditions of which we know nothing? No heating is in the room in which they have been kept at all today, or on past days.

4th July 1934. Bats still active. When settled down in the morning, *5th July*, each tried hard to get under the other – to be the one that was underneath. Both hang head downward. When aroused the mouth opens, they emit a shrill squeak and at the same time rapidly move ears that vibrate the whole time.

24th July 1934. A few days ago, I brought the bats into the University, they are now feeding as well as at home. This morning one of them was on the floor of the cage so chilled as to

appear almost dead. I warmed them by the radiator and both were feeding within a short time.

25th July 1934. The bat that was so inert with the cold yesterday morning shows no signs of discomfort today. Both were hanging together – one above the other – the ventral surface of one appeared to be the dorsal surface of the other head downwards as usual. They feed freely in the daytime if hungry.

27th July 1934. During the night, one of the bats made its escape in the library in which I am working; it was missing on *28th July* but on *29th July* I noticed it on the floor of the room behind a great book trolley that I could not move. In the morning *30th July* it was lying on the linoleum floor of the room. It was unable to fly and when I tried to pick it up it flew around the room – although it can have had no food for two or three nights. Today *30th July*, both bats were active and fed freely – still on mealworms. They feed frequently now during the day – picking up their own mealworms, and then scampering (the word that seems to describe their gait) about the floor of the cage. The sound of their chewing is very loud – a quick crisp crunching sound that can be heard some distance away.

7th November 1934. Bat found dead in cage.

Comments

This small species of bat is relatively common throughout Victoria, but few studies have been made on its behaviour in captivity. Ryan (1961) in an unpublished M. Sc. thesis of (University of Melbourne), studied numerous aspects of its general biology and activity in captivity. (Map 2).

Chalinolobus gouldii (Gray, 1841)
Gould's Wattled Bat
DTC 83 237 Vic., Eltham.
6 April 1934, SPIRIT, female.
Captured alive 6th April 1934, died 14th April, 1934. The little animal which was living with long-eared bats was shy at first but seemed to feed later. I was, however, mistaken and it died after 8 days, apparently without feeding at all.

Comments

Widespread throughout Victoria, this colonial, insectivorous species has not been subjected to extensive live studies, apart from recent work by the present authors (in press). It is still likely to be common in the Eltham area. (Map 2).

MOLOSSIDAE

Mormopterus planiceps (Peters, 1866)
Little Mastiff-bat
DTC 82 222 Vic., Eltham.
2 Dec. 1933, SPIRIT, male.
Found dead on road in early morning – apparently killed and partly eaten by an owl or other bird of prey.

Comments

This small, colonial bat is common over much of Victoria, and is likely to occur in the Eltham area now. (Map 2).

EMBALLONURIDAE

Taphozous flaviventris Peters, 1867
Yellow-bellied Sheathtail Bat
DTC 81 235 Vic., Tempy, Mallee.
March 1934, SPIRIT, female.
Bat sent to Zoological Gardens and given to Professor Wood Jones.

Apparently injured in capture. It was sluggish, never attempted to fly and refused to feed on mealworms. It uttered a single metallic insect-like note.

Comments

This is the first record of this rare and little known species from the Mallee. It has been recorded from several areas in Victoria, but is seldom collected because it is such a high, fast flier. There is only one other known Mallee record of the species, a 1956 specimen from Mildura. No prior information exists on the behaviour of *T. flaviventris*. (Map 2).

CARNIVORA

FELIDAE

Felis catus Linnaeus, 1758
Feral Cat
[Notes from *7th June 1943*, probably at Eltham, Victoria.]

On the night of *6th June*, I set two traps for rabbits on the wall above the house among gumtrees. On the morning of *7th June*, there was a dead rabbit in one of them, its neck and thoracic part eaten (but not its head or hind quarters). The throat had been torn open and the intestines and all viscera and anterior part of the body nearly as far as the kidneys eaten. The rabbit was lying on the grass with some grass, mould, moss, leaves etc. scratched over it. I thought it looked like the work of a domestic cat but was not sure – certainly not the work of a dog. I left the rabbit there and set a ring of five traps around it and caught a

very large black male cat, which had apparently returned to its kill of the previous night.

All these wild and semi-wild cats are extremely fat; there is a great deal of fat in all the tissues and the mesenteric fat is very abundant.

Comments

This species is well entrenched in the Australian bush, and even forty years ago was well recognised as a predator.

Acknowledgements

Thanks are extended to the following people for their assistance with the project:– Mrs D. Thomson for her encouragement and help; Miss J. Wiseman, Human Studies Division of the Museum of Victoria, for invaluable advice; Misses M. Elden, J. Nanson, L. Gibson, and M. Barrett (volunteers) and Lisa Guiliani for typing the manuscript; the Museum Photography Department; K. Walker Department of Entomology, Museum of Victoria, H. Brunner Consultant, and N. Walsh Royal Botanic Gardens and National Herbarium for assistance in scat analysis.

REFERENCES

Cuttle, P. (1982). Life history strategy of the dasyurid marsupial *Phascogale tapoatafa*. pp.13-22. In: *Carnivorous Marsupials* Ed. M. Archer. Surrey Beatty, Sydney.

Dixon, J.M. and Huxley, L.M. (1985). *Donald Thomson's Mammals and Fishes of Northern Australia.* Thomas Nelson, Melbourne.

Fleay, D. (1932). The rare dasyures (native cats). *Victorian Nat.* 49: 63-8.

Fleming, M.R. and Frey, H. (1984). Aspects of the natural history of Feathertail Gliders (*Acrobates pygmaeus*) in Victoria. pp. 403-8. In: *Possums and Gliders* Eds. A. Smith and I. Hume. Surrey Beatty, Sydney.

Henry, S.R. and Craig, S.A. (1984). Diet ranging behaviour and social organisation of the Yellow-bellied Glider in Victoria. pp. 331-41. In: *Possums and Gliders* Eds. A. Smith and I. Hume. Surrey Beatty, Sydney.

Henry, S.R. and Suckling, G. (1984). A review of the ecology of the Sugar Glider (*Petaurus breviceps*). pp. 355-58. In: *Possums and Gliders*. Eds. A. Smith and I. Hume. Surrey Beatty, Sydney.

Morton, S.R. (1978). An ecological study of *Sminthopsis crassicaudata* (Marsupialis: Dasyuridae). *Aust. Wildl. Res.* 5: 151-211.

Russell, R. (1980). Spotlight on Possums. University of Queensland Press: St. Lucia, Queensland.

Ryan, R.M. (1961). Life history and ecology of the Australian lesser long-eared bat *Nyctophilus geoffroyi* Leach (M.Sc.) unpublished thesis, The University of Melbourne.

Thomson, D.F. (1975). *Bindibu Country.* Thomson Nelson, Melbourne.

Thomson, D.F. (1983). *Donald Thomson in Arnhem Land.* Compiled and introduced by Nicolas Peterson. Currey O'Neill, Melbourne.

Wakefield, N.A. and Warneke, R.M. (1963). Some revision in *Antechinus* (Marsupialia) - 2. *Victorian Nat.* 84: 69-99.

Wood Jones, F. (1923-5). *The Mammals of South Australia.* South Australian Government Printer, Adelaide.

Appendix 1. Latitudes and Longitudes of Thomson localities.

Alvie	38°15′S	143°31′E
Avonsleigh	37°55′S	145°28′E
Beechworth	36°22′S	146°42′E
Belgrave	37°55′S	145°21′E
Clifton Hill	37°47′S	145°00′E
Darebin	37°47′S	145°02′E
Deer Park	37°47′S	144°46′E
Eltham	37°43′S	145°09′E
Erica	37°59′S	146°23′E
Ferntree Gully	37°53′S	145°18′E
Flinders	38°29′S	145°02′E
Gelantipy	37°13′S	148°16′E
Hamilton	37°45′S	142°02′E
Healesville	37°39′S	145°32′E
Lang Lang	38°16′S	145°34′E
Laverton	37°52′S	144°46′E
Mafeking	37°23′S	142°35′E
Mooralla	37°24′S	142°07′E
Mooroolbark	37°47′S	145°19′E
Numurkah	36°06′S	145°26′E
Ocean Grove	38°16′S	144°31′E
Otway Ranges	38°27′S	143°58′E
Romsey	37°21′S	144°45′E
Rye	38°23′S	144°50′E
Sorrento	38°20′S	144°45′E
Swan Bay	38°14′S	144°39′E
Tempy	35°21′S	142°26′E
Toorloo Arm	37°51′S	148°04′E
Upper Ferntree Gully	37°54′S	145°18′E
Werribee	37°55′S	144°40′E
Whittlesea	37°31′S	145°07′E

Notes on Skin Irritation When Rearing *Euproctis baliolalis (Tussock Moths)*

By P. S. and I. M. Coupar*

Fig. 1. Mature larva of *Euproctis baliolalis.*

The larvae of *E. baliolalis* are typical of the family Lymantriidae (Tussock moths). The body is covered with short, dense hairs of reddish-brown and white with prominent dorsal tussocks of dark hair (Figure 1.).

We first collected larvae of *Euproctis baliolalis* in February 1986 at Jells Park, Wheelers Hill, Victoria. Jells Park is one of the Dandenong Valley Metropolitan Parks where there has been extensive planting of young Eucalyptus trees. These types of localities are rewarding for insect collecting, especially moth larvae which can be seen at eye level relishing the tender new growth of the Eucalyptus seedlings.

*143, Brackenbury Street,
Warrandyte, Victoria, 3113.

On this particular day four larvae of *E. baliolalis* were found resting on the slender branches of a young Eucalyptus tree, the species of which could not be identified from its juvenile or intermediate leaves. However the larvae readily accepted the leaves of Red Stringbark *(Eucalyptus macrorhyncha)* which were kept fresh in water in a narrow necked bottle and placed in a flywire cage. The larvae reached 40 mm in length before pupating. All four pupated in a finely woven white cocoon spun amongst the Eucalyptus leaves.

The first larva pupated on 25-2-86.
Tachinid fly emerged on 14-3-86.
The second larva pupated on 8-3-86.
Female moth emerged on 4-4-86.
The third larva pupated on 12-3-86.
Tachinid fly emerged on 6-4-86.
The fourth larva pupated on 15-3-86.

Fig. 2. Skin reaction to the cocoon of *Euproctis baliolalis.*

Examination of the pupa from the fourth larva showed that it had dessicated. After one of us (P.C.) handled its woven cocoon and then accidently touched the face and neck an intense stinging sensation and a subsequent rash occurred. To be certain that it was the cocoon of *E. baliolalis* that had caused this reaction the cocoon was rubbed on a small patch of skin on the arm. In a few minutes the area became itchy, then red with many raised areas of oedema (Figure 2.).

One substance that can cause skin reactions of this type is histamine, a simple organic base present for instance in nettle and some insect stings. To test the possibility that the cocoon contained histamine the antihistamine drug mepyramine was applied to the affected area in the form of Antisan Cream. However, the area of itching and redness spread as far as the cream had been applied. Mepyramine in Antisan Cream is formulated in an oil-in-water emulsion (Martindale, 1982) so it seems that the irritant present in the cocoon is not histamine and is water soluble.

In early April 1987 another larva of the same species was found resting on a branch of a Silver-leaved Stringbark *(Eucalyptus cinerea)* in Ringwood, Victoria.

Once again the larva could be handled without suffering any skin irritation. It fed well for two months and then ceased feeding and started to wander around the cage. At this stage handling the larva produced the same skin irritation as handling the cocoon the year before. It was another five days before the larva stopped wandering and started to pupate in the corner of the cage. Pupation lasted all winter and in early October an adult moth emerged.

Obviously sensitivity to urticating larval hairs varies from person to person. It is quite possible that during all its larval stages the hairs of *E. baliolalis* may cause irritation to sensitive skins but according to Common (1960) the larval hairs of *E. baliolalis* are harmless, unlike *E. edwardsi*

(Mistletoe browntail moth) the larval hairs of which are notorious for causing severe skin irritation (McQuillan & Forrest, 1985). We have handled well over one hundred different species of moth larvae and although a few have caused a slight skin irritation, we have never had such a strong reaction as that received from *E. baliolalis.*

Skin irritants such as cantharidin which is derived from the Spanish blister beetle *(Cantharis vesicatoria)* have limited use in medicine as counter irritants in the treatment of rheumatism (Martindale, 1982). Research into the active ingredient from the cocoon of *E. baliolalis* may help to reveal more about the nature of inflammation and in so doing could even advance the development of more efficient anti-inflammatory drugs.

REFERENCES

Common, I. F. B. (1960). *Lepidoptera In : The Insects of Australia.* Melbourne University Press.

Martindale, (1982). The Extra Pharmacopoeia. Reynolds, J. S. F. (ed). The Pharmaceutical Press, London.

McQuillan, P. B. & Forrest, J. A. (1985). Common moths of the Adelaide Region. South Australian Museum.

Obituary: Wilson Roy Wheeler

Roy Wheeler died on 25th September 1988, after a long illness. He made a major contribution to the popularising of birds and birdwatching in Australia, and while doing so he served for many years on committees of a number of organizations. He published widely in journals and newsletters.

He was elected an Honorary Life Member of the Bird Observers Club (as it then was) in 1975, having been at various times its President, Secretary and Treasurer from 1951 to 1971.

An active member of the Gould League, he joined its Council in 1950 and was elected Vice-President in 1956.

He was President of the Royal Australasian Ornithologists Union for 1964 and 1965, and was elected a Fellow in 1970.

As a result of his long dedication to birds he was awarded the Australian Natural History Medallion in 1965.

One of the awards he was particularly proud of was the M.B.E. awarded in the 1969 New Year's Honours List.

Perhaps his most lasting contribution was the way he introduced so many beginners to the joy of birds, patiently leading walks month after month, year after year. Apart from everything else, for this alone he will be remembered with gratitude by the many who profited from his extensive knowledge, so cheerfully passed on.

Ellen M. McCulloch

Naturalist Review

By P. W. Menkhorst

A Guide to the Bats of South Australia

By Terence B. Reardon and Stanley C. Flavel

South Australian Museum in association with the Field Naturalists' Society of South Australia, Adelaide, 1987. 85pp.

Available from the Bookshop, South Australian Museum, North Terrace, Adelaide, SA, 5000 for $10-95 plus $1-50 postage.

The authors of this book had two aims: to provide a practical reference for those involved in the study of bats, and to provide an informative and readable text for anyone interested in learning about bats. To successfully blend both these aims is a difficult and uncommon achievement. I am pleased to report that this book has succeeded.

The book is divided into two parts. The first is aimed principally at people newly interested in bats. It gives background information about the study of bats including the state of Australian bat taxonomy and nomenclature, habitats utilized by bats, their diets, life history strategies and orientation. Then follows a brief description of the main techniques used to capture, measure and identify bats.

The second part occupies over half the book and consists of an identification key and species accounts. The identification key is clearly layed out and extremely well illustrated with clear line drawings showing diagnostic features. Even the difficult genus *Eptesicus* is well handled and the electron micrographs of the glans penis should help considerably in the identification of males. For females one has to rely on body measurements and pelage colour or, in the case of *E. baverstocki*, it may be necessary to examine the skull or have protein analyses conducted.

Each species is then considered in some detail under the headings Description, Distribution and Status, Habitat and Habits, and Notes. Understandably, the emphasis is very much on morphological description and identification. Only brief statements are provided about distribution and status, and habitat and habits. However, these always accurately reflect the rather poor state of knowledge about the ecology of each species. The distribution maps are large and clear. The provision of point localities which distinguish between museum specimen records and sight records is particularly useful.

I am sure that anyone interested in Australian bats will find this guide a most useful compendium. Naturalists seeking an introduction to bat biology, field methods and identification will be satisfied by the refreshing lack of jargon, clear instructive drawings and fine photographic portraits. All bat workers will benefit from the accurate species accounts and identification keys. Further, since most Australian bats have extensive distributions and occur in several States, the book will be of interest to bat workers throughout Australia.

P.W. MENKHORST

Naturalist Note

Distribution of *Asterolasia phebalioides*, A Victorian Endemic, on Kangaroo Island, South Australia

By B. M. Overton*, M. W. McKelvey* and D. S. Overton*

Asterolasia phebalioides was discovered growing on Kangaroo Island on 3 November 1985, on the Playford Highway, within roadside vegetation, outside the boundary of Flinders Chase National Park, lat. 35° 48′ long 136° 48′.

Viable specimens were received by D. J. E. Whibley, South Australian Botanic Garden and State Herbarium and was determined by P. G. Wilson, West Australian Herbarium, Department of Agriculture, Western Australia.

Prior to the discovery of this colony on Kangaroo Island, the species was considered to be a Victorian endemic, specific to the Little Desert National Park and the Grampians National Park.

Field surveys conducted between October 1986 and December 1987 indicate that the Kangaroo Island colony is isolated and extensive, with scattered individuals being located 2 km along roadside vegetation, and inland at least 2 km into Flinders Chase National Park.

A long-term survey has been undertaken to study the disjunct populations, taxanomic attributes, soil requirements and habitat. The data from this long term survey will be published when it has been fully analysed.

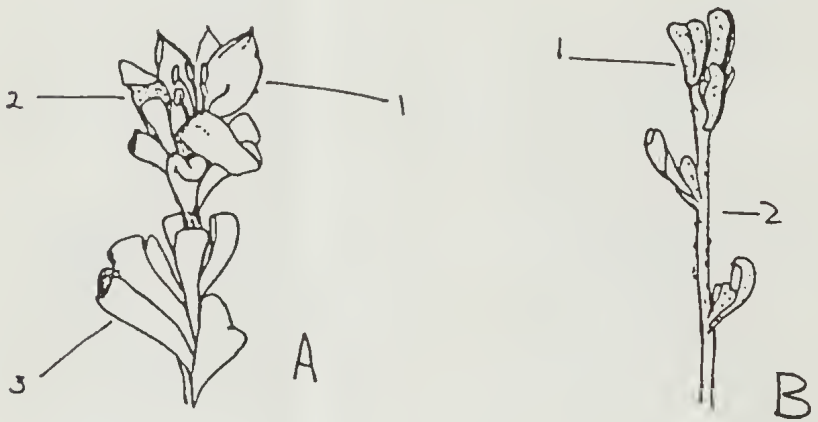


Figure 1: Austerolasia phebalioides, the downy star bush; pressed specimens drawn 21 June 1988 by Beverley Overton.

A Individual from Kangaroo Island colony (x25) collected 13 October 1986. 1 – golden yellow, 5 petals. 2 – bronzy-gold short tomentose. 3 – leaves (cuneate, apex retuse, clustered. Shortly tomentose both surfaces, mature leaves blackened).

B New growth, collected from Little Desert National Park, Victoria, 25 March 1987. 1 – lower surface; 2 – branchlet. 10 filaments, yellow; anther yellow – orange dusted with light cream to golden yellow pollen; Pistil solitary, central carpel 5 segments. Leaves nearly sessile, clustered, often crowded, lamina cuneate, apex retuse, lower surface densely stellate tomentose, midrib often prominent, grey to yellowish green, often blackening with age.

* B. M. Overton, M. W. McKelvey, D. S. Overton, 1 Nepean Avenue, Kingscote, Kangaroo Island, 5223.

The Correspondence of Ferdinand von Mueller.

An international collaborative project has been launched earlier this year, the object of which is to prepare for publication a definitive edition of the surviving correspondence of the noted Australian botanist, explorer and director of Melbourne's famed Botanic Garden, Ferdinand von Mueller.

Born in Rostock in the German grand-duchy of Mecklenburh-Schwerin in 1825, Mueller grew up in the then Danish duchy of Schleswig, where he trained as a pharmacist, then obtained his Ph.D. in botany from the University of Kiel. He emigrated to South Australia in 1847, then moved to Melbourne during 1852, where he was appointed Victoria's first Government Botanist in 1853, a position he held for 43 years until his death in 1896. He was honoured and decorated by the monarchs of many countries and elected an honorary member of numerous scientific societies around the world.

Mueller was, without question, Australia's leading scientist in the 19th century, being 'largely responsible for the international recognition given to Australian scientific endeavour' (Australian Dictionary of Biography) and a major contributor to science in his day. He was also a prolific letter-writer, claiming more than once to have been writing over 3000 letters in a year and towards the end of his life 5-6000 letters annually. He corresponded with leading scientists in all parts of the world, with naturalists and collectors from all walks of life, with government officials, with men of influence and with ordinary citizens of colonial Australia.

Mueller was closely associated with the Field Naturalist Club of Victoria from its inception and was joint patron of the club with Professor McCoy from May 1886 to his death in October 1896. Many of his botanical papers were published in the early volumes of the **Victorian Naturalist.**

His official letter copy-books and inward correspondence files were wantonly destroyed over fifty years ago. However, in recent times several thousand surviving letters have been located and brought under control. There are undoubtedly thousands of others scattered in libraries, archives and private hands, all over the world.

These letters now constitute a precious historical and scientific resource. In their present scattered state, however, they are little known and even less used. Yet they represent the basis of most Australian taxonomic botany and so remain of fundamental importance to present-day science. They are also potentially of great significance to the Australian historian for the light they shed on the social and scientific institutions of 19th century Victoria and, indeed, the other Australian colonies; the role of the large German immigrant community in Australian colonial life; the nature of colonial public administration; the exploration of northern and central Australia; the scientific study of the Australian flora and the natural enviroment more generally; the place of science in colonial society; the relationship of individual colonial scientists to the national and international communities of their day; and many other major themes of Australian colonial history.

The proposed edition will include the full text of all letters to or from Mueller that can be located, appropriately illustrated, annotated and indexed. The publisher will be Melbourne University Press in conjunction with the National Herbarium of Victoria.

An editorial consortium has been established comprising Professor Arthur M. Lucas (King's College London), Mrs Doris M. Sinkora (National Herbarium of Victoria) and Professor Johannes H. Voigt (Universitat Stuttgart), under the direction of Professor Rod W. Home (University of Melbourne). An Advisory Board has been established to bring further, wide-ranging expertise – scientific, archival, literary, historical – to bear on the project.

Funds to enable the project to get under way have come from the Australian Research Grants Scheme, the University of Melbourne, The Victorian Department of Conservation, Forests and Lands, and the R.E. Ross Trust. Additional funding is being sought to see it continued.

The editors are now appealing for help in locating letters to or from Mueller, or any other items of Muelleriana. Any readers who know of such materials are asked to bring them to the attention of the project. Please contact Ms Sara Maroske, Research Assistant to the project, c/- National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria 3141 (tel. (03) 650 9424).

Field Naturalists Club Victoria
Club Activities

General meeting 10th October 1988

The President presented an Honorary Membership Certificate to Tom E. George, in recognition of his 40 years' membership of the club. Noel Schleiger, on behalf of Tom George, outlined his activities in the field of natural history.

The speaker for the evening was Dr Tom Rich of the Museum of Victoria, who spoke on 'Dinosaurs in Victoria'. Dr Rich said that Australia had very few discovered skeletal remains of dinosaurs, only 4 sites compared with an estimated of between 1,000 - 10,000 in the Americas and between 100 - 1,000 in Europe. A methodical search along the Victorian coast over a period of years had revealed 'Dinosaur Cove' in the Southern Otways, and with the aid of slides Dr Rich described the work being done at this site, and the hazards experienced in a coastal situation.

Exhibits: Under microscopes: transverse sections of sea-urchin spines; transverse section of single large spine of a sea-urchin found in Fiji; a row of sea-urchin spine sections. (Dan McInnes) Fossilised wood from the APM quarry at Bacchus Marsh. (Graeme Love) Jack Douglas presented a copy of the second edition of '**Geology of Victoria**' to the Club library.

Nature notes: Marie Allender reported seeing duck orchids in flower on the excursion to the Brisbane Ranges on 2 October, rather early. Dan McInnes reported that the weed which had previously choked Albert Park Lake seemed to be growing again, and asked whether the weed control programme had eased off.

General meeting 14th November 1988.

The President welcomed a number of visitors including Jean Galbraith and members of the Latrobe Valley FNC. The Australian Natural History Medallion was presented to John Dell, of the Western Australian Museum, by Tony Lee, Associate Professor of Zoology at Monash University.

John Dell spoke on 'Faunal surveys in arid and tropical Western Australia', and with the aid of some excellent slides gave an interesting talk on the work being done in the Western Australian Wheatbelt, the Eastern Goldfields region, and the Kimberleys to assess the distribution and status of fauna in these areas. He stressed the vital importance of the availability of comprehensive data in making decisions about the creation of conservation reserves. After numerous questions Julian Grusovin proposed a vote of thanks to John Dell.

The meeting was preceded by a buffet dinner at the Royal Society, which was attended by about 25 people.

Exhibits: Part of a dinosaur bone. (Norm Stanford) Radiolaria, under microscope, with illustrations of the specimens taken during the Challenger Expedition. (Dan McInnes)

Nature notes: Julian Grusovin reported finding a marbled gecko in his letterbox at Chadstone. Sheila Houghton had observed galahs enjoying the sudden downpour that morning in the reserve next to her home in Dingley.

General meeting 13th December 1988

Mary Doery spoke on 'A field naturalist in Iceland', illustrating her talk with many slides showing the position of Iceland on the edge of the Arctic Circle, its geological features, the vegetation of the island, its buildings, and in particular the bird-life. She mentioned that since the "forests" of Iceland grow only a few centimetres high, the introduction of exotic trees as wind-breaks in some parts of the island is a matter of some concern to conservationists. There is no natural timber on the island, and as a result no fences. The President announced that there were to be two new co-editors of **The Victorian Naturalist**, Tim Offer and Robyn Watson, who were present at the meeting. He thanked Russell Thomson for the work he had done in editing **The Victorian Naturalist.** Norm and Helen Stanford have resigned their positions as Secretary and Assistant Treasurer/Book Sales Officer respectively. Graeme thanked them for their assistance to the club, and called for offers to fill these positions.

The president circulated a paper on the future of the FNCV, and its role in present day conditions. Julian Grusovin distributed details about having the club recognised as a Scientific Research Institute, and the setting up of a Trust Fund. He explained that this would enable the Club to receive sponsorship and donations which would be tax deductible, and facilitate the undertaking of major surveys and

expeditions, such as the Club had carried out earlier in its history. The necessary amendments to the Articles of Association were being drawn up, and would be presented to the members of the Club at an extraordinary meeting early in 1989.

Exhibits: Slime mould from her lawn, which had reappeared due to the wet weather. This was exhibited under a 1902 microscope. (Margaret Potter).

Nature notes: Tom Sault said he had seen a seagull in Flinders Street, with no feet. It managed to balance and walk quite satisfactorily on the stumps to its legs.

Club News: Who's Doing What?

Congratulations to Club member Ellen Lyndon who was awarded the O.A.M. in the Australia Day honours list!

The President and a number of Council and Club members attended the opening of the extension to the Herbarium and the Visitor Centre by the Governor-General, Sir Ninian Stephen, on 20th November 1988, which was followed by a lunch on the Western Lawn.

Margaret Potter attended a one-day session on 'Mallee Environmental Education' organised by the Museum of Victoria and the Royal Society of Victoria on 19th October. The Club has sent in a submission on the L.C.C. proposed recommendations for the Mallee area.

On 15th December Graeme Love met the Minister for Conservation, Forests and Lands, Kay Setches, to discuss conservation issues and the position and role of the Club.

Graeme Love was interviewed by Dr David Hill on 3AW on 3rd December. The Botany Group held its annual general meeting on 8th December. Officers elected for 1989 are: President: Margaret Potter; Vice-President: Joan Harry; Hon. Secretary: Win Bennett; Ass. Hon Secretary: Dorothy Mahler. Programme Committee consists of Cicily Falkingham, Marie Allender, John Eichler, Peter Carwardine, Hilary Weatherhead, and the office-bearers.

There are currently three vacancies on Council. Anyone interested in participating in the administration of the Club should contact the Hon. Secretary, Ron Pearson, or the President. Council meetings are normally held on the last Monday of the month at 7.30 pm. Yvonne Gray, Hon. Treasurer, has given notice that she will not be standing for office again in May. We would like to hear from anyone willing to undertake this job.

We need a Club Reporter!

Any items for this column will be gratefully received. Let us know what you are doing. (Address: 30 Golf Links Crescent, Dingley 3172).

Sheila Houghton.

Thank You.

To all those members who so promptly posted a copy of The Victorian Naturalist. Vol 103 No. 2, in response to my appeal. The gap is now well filled.

D.E. McInnes

(Sales Officer. The Victorian Naturalist)

INSTRUCTIONS TO AUTHORS

The Victorian Naturalist invites contributions of original papers relating to Australian natural history, particularly of Victoria. All papers are assessed by an independent referee before publication.

Short contributions of natural history observations are also invited for use as "Naturalist Notes". These contributions may be edited, or excerpts published, at the Editors' discretion. Such notes are not normally refereed, and may be submitted more informally.

All contributions are to be written in concise, simple English.

For cost reasons, authors of original papers submitted for publication are requested to conform with the following guidelines. Any author who has difficulty in complying with these guidelines, or has queries concerning manuscripts, should consult the Editors before submitting a manuscript.

Submission of Manuscripts

Manuscripts should be sent to The Editorial Committee, Victorian Naturalist, F.N.C.V., C/- The National Herbarium of Victoria, Birdwood Ave., South Yarra, 3141.

Two typewritten copies of the manuscript should be submitted. Authors are advised to retain a further copy.

Format

Text should be fully revised, typed double spaced on one side of the paper only, with a wide margin, pages numbered consecutively, and should conform in style to recent issues of the *Victorian Nat.*

Author's name and address or institution should appear beneath the title. Underline only those words to be italicised in the text i.e. genus and species names, and titles of periodicals and books. All measurements should be expressed in the metric system (SI units).

References should be cited in the text as Brown (1981) or (Brown, 1981). Footnotes must be avoided. Acknowledgements should be grouped at the end of the paper before References.

References should be listed alphabetically by author's surname at the end of the paper. All references should be cited in the text. Abbreviations of titles of periodicals should conform with those in *A World List of Scientific Periodicals* (4th ed., Butterworth). Refer to recent issues of the *Victorian Nat.* for the formatting of references.

Tables and Figures

Tables should only be used for essential data needed to show important points in the text. They should be numbered consecutively, referred to in order in the text, and designed to fit within the print area of 115 x 180 mm. Each table must have an explanatory caption.

Figures may be in the form of drawings or photographs. They should be identified on the back with the author's name and the figure number. The top should be indicated and the magnification by scale where appropriate. Compass directions must be indicated where necessary. All figures should be referred to in the text and numbered consecutively (Fig. 1, Fig. 2 etc.).

Figures should be carefully prepared and should be submitted ready for publication. Each should have a short caption. Maximum size is 115 x 180 mm; single column width is 55 mm. Figures are preferably submitted at actual size. Lettering on Figures should be done by the author; care is needed to ensure that all letters are legible after reduction.

Line drawings should be made in black ink.

Photographs should only be used where essential due to the high cost of printing plates. They should preferably be unmounted, glossy black & white prints, showing good detail and moderate contrast.

Proof and Reprints

Galley proofs will be sent to the author, who should correct and return them as soon as possible. Only the minimum of corrections should be made.

Multiple copies of articles can be prepared for the author only at the time of printing. These will be in the form of print run-ons and priced as follows for each multiple of 50 copies:

1-2 pp	3-4 pp	5-6 pp	7-8 pp	9-10 pp	11-12 pp	13-14 pp
$28	$35	$45	$55	$65	$75	$85

Orders for these 'reprints' must be made at the time authors return their corrected proofs to the editor.

Taxonomic Papers

Papers describing new taxa will not be accepted for publication unless the primary type material is deposited in a recognised public museum or herbarium.

It is suggested that in other more general papers where taxonomy is discussed, voucher material be lodged in a public collection, and the repository details cited in the text.

Special Note for Authors Using Wordprocessors

Many word processors and microcomputer floppy disks can now be transcribed directly to our printer's typesetting equipment, saving the effort and cost of rekeying.

Authors of papers which have been typed on a wordprocessor should tell the editor (at the time the paper is first submitted), what type of machine and wordprocessing software was used. Note that printed copy must still be submitted.

Queries can be directed to the editors.

GROUP EXCURSIONS

All FNCV members and visitors are invited to attend any Group Excursions.

Botany Group – Fourth Saturday

Saturday, 25th February. Lake Mountain. Alpine Plants.

Saturday, 25th March. No excursion (Easter)

Saturday, 22nd April. Tall forest on the Ada River, Noojee area. Leader from the Latrobe Valley FNC.

Saturday, 27th May. Mornington Peninsula. Leader: Tom Sault.

Saturday, 24th June. Fungi, Beenak area. Leader: Tom May.

Fauna Survey Group

Saturday, 11th February. Leadbeaters Possum – Upper Yarra.

Saturday, 18th – Sunday, 19th February. Water Rats – Werribee.

HAWTHORN JUNIOR FIELD NATURALISTS CLUB

Meetings – 7.30pm at the Balwyn Primary School Hall, cnr. Balwyn & Whitehorse Rds., Balwyn. (Topics and speakers subject to confirmation.)

Friday, 24th February. Talk by Malcolm Turner on his exotic holiday.

Friday, 17th March. Information night on Easter camp.

Wanted
Subscription Secretary

The Club requires a Subscription Secretary. Duties include the collection of subscriptions, banking of money, and maintenance of records for members and subscribers to The Victorian Naturalist. Attendance at monthly General Meetings to collect subscriptions will be required. Salary $1500p.a. For further details contact the Secretary, Ron Pearson (584 7443) or the President.

Low Cost Natural History Reading.

Back volumes of **The Victorian Naturalist.**

VOLS 76 to 90

these volumes contain 335 to 380 pages in 12 monthly parts.

PRICE $6.00 per volume

Order and pick up at any GENERAL OR GROUP meeting.

Postage in Victoria if required

One or Two volumes $3.70 Three to Six volumes $4.15

D.E.McInnes, 129 Waverley Road, East Malvern 3145

(Sales Officer The Victorian Naturalist)

Field Naturalists Club of Victoria

In which is incorporated the Microscopical Society of Victoria

Established 1880

Registered Office: FNCV, c/- National Herbarium, Birdwood Avenue, South Yarra, 3141.

OBJECTS: To stimulate interest in natural history and to preserve and protect Australian fauna and flora.
Members include beginners as well as experienced naturalists.

Patron

His Excellency, The Rev Dr John Davis McCaughey, The Governor of Victoria.

Key Office-Bearers 1988-1989

President: Mr. GRAEME LOVE, P.O. Box 2018, St. Kilda West, 3182 (697 5109 B.H.)

Vice President: Mrs. SHEILA HOUGHTON, FNCV, National Herbarium, Birdwood Avenue, South Yarra, 3141 (551 2708)

Hon. Secretary: Mr. RON PEARSON, 23 Avenza St., Mentone, 3194 (584 7443)

Hon. Treasurer: Ms YVONNE GRAY, 46 Albany Cres., Surrey Hills, 3127 (890 1488 A.H.)

Subscription-Secretary: Vacant.

Editors: ROBYN WATSON and TIM OFFER, FNCV, c/- National Herbarium, Birdwood Avenue, South Yarra, 3141.

Librarian: Mrs. SHEILA HOUGHTON, FNCV, c/- National Herbarium, Birdwood Avenue, South Yarra, 3141 (551 2708 A.H.)

Excursion Secretary: Miss MARIE ALLENDER, 19 Hawthorn Avenue, Caulfield, 3161 (527 2749)

Club Reporter: Vacant.

Conservation Co-ordinator: Mr. GRAEME GILLESPIE, c/- Arthur Rylah Institute, 123 Brown Street, Heidelberg, 3084 (450 8652 B.H.).

Sales Officer (Books): Vacant.

Sales Officer (Victorian Naturalist only): Mr. D. E. McINNES, 129 Waverley Road, East Malvern, 3145 (211 2427)

Programme Secretary: Vacant.

Group Secretaries

Botany: Miss MARGARET POTTER, 1/249 Highfield Road, Burwood, 3125 (29 2779).

Day Group: Mr. D. E. McINNES, 129 Waverley Road, East Malvern, 3145 (211 2427)

Geology: Miss HELEN BARTOSZEWICZ, 16 Euroa Avenue, Nth. Sunshine, 3020 (311 5106 A.H.)

Fauna Survey: Mr. JULIAN GRUSOVIN, 1 Warriner Court, East Oakleigh, 3166. (543 8627).

Microscopical: Mrs. ELSIE GRAHAM, 147 Broadway, Reservoir, 3073 (469 2509)

MEMBERSHIP

Membership of the F.N.C.V. is open to any person interested in natural history. The *Victorian Naturalist* is distributed free to all members, the club's reference and lending library is available and other activities are indicated in reports set out in the several preceding pages of this magazine.

Subscription rates for 1988

Metropolitan Members (03 area code)	$25.00
Joint Metropolitan Members	$27.00
Country/Interstate/Retired Members	$23.00
Joint Country/Interstate/Retired Members	$25.00
Student (full-time)	$18.00
Junior (under 18; no Victorian Naturalist)	$5.00
Subscription to Victorian Naturalist	$23.00
Overseas Subscription to Victorian Naturalist	$30.00
Affiliated Clubs	$25.00
Subscriber Clubs	$23.00
Individual Journals	$3.50
Late Fee (Renewing Members), after end of March	$2.00

JENKIN BUXTON PRINTERS PTY. LTD. 1-13 ABBOTSFORD ST. WEST MELBOURNE 328-4774

The Victorian Naturalist

Vol. 106, No. 2 March / April 1989

Published by the FIELD NATURALISTS CLUB OF VICTORIA

Registered by Australia Post. Publication No. V.B.P. 1268

$3.50

FNCV DIARY

GENERAL MEETINGS (Second Monday)

General Meetings will be held at the Royal Society Hall, 9 Victoria Street, Melbourne at 8 pm until further notice.

Monday, 8th May
Annual General Meeting and President's Address.

Monday, 5th June
"V.F.T. - Environmental Effects?" Eric Quinlan.

FNCV NEW MEMBERS Jan-Feb 1989

Metropolitan

Mrs. Margaret Watton, East Brighton.

Simon Blomberg, Wantirna South.

Ms A. Tanino, East Reservoir.

Craig Lighton, Macleod.

Dr. Eleanor McDonald, Ivanhoe.

Joint Metropolitan

Judge Leo S. and Mrs. Deidre E. Lazarus, Armadale.

Alex and Vida Martin, Surrey Hills.

Country

Michael Sturmfels, Derrinallum.

Barbara M. Dullard, Hamilton.

FNCV EXCURSIONS (First Sunday)

Sunday, 7th May The General Excursion will combine with the Geology Group in an excursion led by the Geology Group to Lancefield. Meet at 10 am in the main street of Romsey. Excursion includes visits to Melbourne Hill (Volcano!!) and Cobaw Mt. Lunch at Lancefield. Transport will be up to participants but those seeking/offering a lift should contact Marie Allender or Graeme Love.

Sunday, 4th June Fungi excursion to be led by Tom May. The place will depend on local conditions for fungi, but will possibly be in the Toolangi district. A coach will leave Batman Ave. at 9.30 am. Fare $15. Bring a picnic lunch.

GROUP MEETINGS

Group Meetings (other than Day Group) will be held at the Astronomers Residence, Birdwood Ave., South Yarra (150 metres nearer the Shrine than the Herbarium) at 8 pm until further notice.

Botany Group (Second Thursday)

Thursday, 11th May. "RCA Roadside Reserves." Graeme Stone.

Thursday, 8th June. "Trees, Toadstools, Puffballs and Potoroos." Tom May.

Geology Group (First Wednesday)

Wednesday, 3rd May. "A Traveller in China." John Mitchell.

Wednesday, 7th June. "Speleology (Caving)." Mr. M. McBain.

Day Group (Third Thursday)

Thursday, 20th April. Queens Park, Moonee Ponds. Catch the 11.10 am Flinders St. train to Moonee Ponds station. Leader: Andy Blackburn 379 8960.

Thursday, 18th May. Altona: Cherry Lake via Westgate Bridge. Catch bus no 232 at the SW corner of Queen St. and Bourke St. at 10.30 am. Leader: Ian Gillespie 578 1879.

Thursday, 15th June. Bundoora Park & Museum. Catch tram no 86 in Bourke St. (tram leaves Spencer St. at 10.30 am) and alight at stop no 61. Leader: Dan McInnes 211 2427.

Microscopical Group (Third Wednesday)

Wednesday, 17th May. Diatoms – collecting & mounting; display of slides; history of some famous diatom mounters.

Wednesday, 21st June. Crystals: suitable crystals; making slides; polarised light; display of slides.

Fauna Survey Group (First Tuesday)

Tuesday, 2nd May.

Tuesday, 6th June. Members' Night.

HAWTHORN JUNIOR FIELD NATURALISTS CLUB

Meetings - 7.30 pm at the Balwyn Primary School Hall, cnr. Balwyn & Whitehorse Rds., Balwyn.

Friday, 28th April. Eastern Barred Bandicoot.

Friday, 26th May.

Friday, 23rd June. Aboriginal Food.

Excursions

Sunday, 7th May. Eastern Barred Bandicoots – Greenvale.

Sunday, 4th June.

(Topics speakers and excursion venues for Hawthorn Juniors subject to confirmation.)

(Continued on inside back cover)

The Victorian Naturalist

Volume 106, Number 2 March/April, 1989

Editors: Robyn Watson and Tim Offor.

ISSN 0042-5184

Cover photo: Snowgums, *Eucalyptus pauciflora*, at Mt. Bogong, Vic.
(see article by J. E. Williams page 45)
Photo: Richard Weston

From the editors

This issue has been patiently waiting for the Auditors Report which is why it is a little late. As this is only an annual delay we expect to be back on schedule for the May/June issue.

We would like to introduce a "Letters page" to the Vic. Nat. so that you will have a forum to comment on topics covered by the Vic. Nat. and bring news of interest to our readers. We have started off with a letter on "Platypus sightings in Melbourne" (see below). We suggest letters should be 500 words or less and marked "for publication". Short letters will be most welcome.

The Vic. Nat. publishes two types of articles - refereed scientific papers and Naturalist Notes. We would like to increase contributions to the Naturalist Notes so if you have made some interesting observations put them in writing.

Finally, we would like to thank Russell Thomson, the outgoing editor, who has spent many hours of hard work putting together the Vic. Nat. over the last five years.

Robyn Watson and Tim Offor

Platypus Sightings In Melbourne

It was with great interest that I read the recent article 'Platypus in Melbourne' (Vic. Nat. **104** Sept./Oct.). I thought that readers may be interested to know of other occurrences and observations of platypus from the Melbourne surburbs.

In Spring of 1981 I observed a platypus for up to five minutes on the Maribyrnong River at Braybrook (Melway Map 27, C9) whilst seated fishing for mullet. The platypus appeared some 50 m upstream of where I was seated and proceeded to swim downstream towards me, diving regularly. When it was before me it swam to the opposite bank whereupon it left the water and disappeared amongst the riparian vegetation. Please note that this section of the river is estuarine with Solomons Ford (Melway Map 27 B8) being the upper limit of the Maribyrnong estuary.

I have also had reports of platypus from the Plenty River near Bundoora (Gerrard Closs, community representative, Plenty river advisory committee).

Small numbers of platypus (3?) have in the past been introduced to the La Trobe University campus wildlife reserve. These are believed to have been obtained from trout farmers near Melbourne who view these animals as pests. Platypus can cause serious losses (100's) of trout fingerlings when they find their way into hatchery sheds.

In the Spring to 1986 I received a report of an unconfirmed sighting of a platypus in La Trobe University's Cresswell Forest Wildlife Reserve. This reserve in Bundoora has only one very small dam, situated on a tributary of Salt Creek (which joins the Yarra River in Heidelberg). To my knowledge there have not been any re-introductions of platypus into this reserve.

George C. Paras
Deputy Ranger,
La Trobe University,
Bundoora, Victoria, 3083.

We would be interested to hear about any other unusual sightings of native wildlife in the Melbourne suburbs (Eds).

RENEW YOUR SUBSCRIPTIONS!

Subscriptions were due on 1 January. If you have not paid for 1989 please post your subscription as soon as possible to the Subscription Secretary, FNCV, National Herbarium, Birdwood Avenue, South Yarra 3141. Current Subscription rates can be found on the back cover.

The Value of Faecal Pellets for Ascertaining the Presence of *Mastacomys fuscus* (Rodentia, Muridae) in Field Surveys.

By D. C. D. Happold*

Abstract

The rate of disintegration of faecal pellets from *Mastacomys fuscus* and *Rattus fuscipes*, exposed to natural climatic conditions, was measured. Pellets of *M. fuscus*, especially those produced in winter, lasted for at least four years, whereas those from *R. fuscipes* disintegrated within one year. The presence of rodent faecal pellets in alpine and subalpine habitats may be used to indicate habitats of *M. fuscus*, but does not provide any indication on abundance or whether the species is still present.

Introduction

Faecal pellets are frequently used as an indirect method for determining the presence of a species in the field. Although this method is useful for secretive and nocturnal species, it does not indicate how many individuals are present, or whether they are still present. Faecal pellets are sometimes difficult to identify because of the similarity of pellets from different species, and because pellet structure may vary greatly within a species. In spite of these disadvantages, the presence of faecal pellets is often a quick and easy way to know that individuals of a species are, or have been, at a specified locality.

Two species of small indigenous rodents, the Australian Bush-rat *Rattus fuscipes* (Waterhouse) and the Broad-toothed Rat *Mastacomys fuscus* Thomas, occur widely in the alpine and subalpine regions of Australia (Calaby and Wimbush 1961; Dixon 1971; Happold 1983; Ride 1970; Seebeck 1971; Wallis, Brunner and Menkhorst 1982; Watts and Aslin 1981). It is generally considered that *R. fuscipes* is relatively common and widespread, and *M. fuscus* is uncommon although it may be fairly common in optimal localities (Happold 1983; Watts and Aslin 1981). Faecal pellets are not uncommon in runways, under boulders and on steep grassy slopes in these regions. However, in order to know whether these pellets come from *R. fuscipes*, *M. fuscus*, or both, a clear method for distinguishing them is necessary. This paper considers several questions regarding these faecal pellets. Are they from one species, or both species? Do pellets indicate present occurrence, or habitation several years ago? How long do faecal pellets last when exposed to the elements? Can they be used as a reliable field survey method?.

*Department of Zoology, Australian National University, Canberra, ACT 2600

Methods.

Fresh undamaged faecal pellets were collected from Elliott live-traps during routine sampling near Smiggin Holes, Kosciusko National Park (D. C. D. Happold, unpubl.) in April 1983. Twenty of these "summer" pellets from *M. fuscus* were arranged in two parallel lines on the surface of compacted soil in a plant pot. The surface of the soil was about 2 cm below the rim of the pot so that the pellets would be exposed to air, rain, wind, and snow. Similarly, 20 pellets from *R. fuscipes* were arranged in a separate pot. There were eight replicates for each species (ie. 8 pots and 160 pellets for each species). In addition, 150 white hardened "winter" pellets from *M. fuscus*, produced during a previous winter, were collected and divided into three groups of 50. Each group was placed on soil in a pot in the same way as for the fresh summer pellets. The pots, 19 in all, were numbered, placed on the ground, and secured under chicken netting in the study area. The number of pellets which were intact and visible was counted at irregular intervals during the following four summers.

Results.

The consistency and composition of fresh pellets is related to diet. *Mastacomys fuscus* is almost exclusively a grass-eating herbivore (Carron 1985), and has rather an inefficient digestive system (D. C. D. Happold, unpubl.); therefore, its fresh faecal pellets are green, fibrous, and composed of small fragments of undigested grass cuticle and fibre. In contrast, *R. fuscipes* is more omnivorous (Carron 1985); its faecal pellets are dark-brown or black, fudge-like in consistency, homogeneous in structure, and lacking in any obvious grass fragments. These different characteristics determine the rate at which the pellets of the two species disintegrate in the field.

Figure 1 shows the percentage of summer pellets which were visible during four summers. By the first summer, most of the pellets had been displaced from their original rows; some were partly buried, others were near the inner rim of the pot. Small clumps of grass and herbs colonised some of the pots. By the fourth summer, five pots were totally covered by grass so that the earth (and any remaining pellets) were invisible. The pellets of *R. fuscipes* disintegrated quickly; by the beginning of the second summer, only 9% were visible, and they had all disappeared within one calendar year. During the course of the year, all pellets remained dark-brown or brown, and none became bleached. In contrast, pellets of *M. fuscus* disintegrated much more slowly; 19% were visible after one calendar year, and 7% were still visible after exposure to three winters and two full summers. However, none were visible after four calendar years. These pellets gradually lost their green colour, and became increasingly pale and bleached with increasing exposure. Even when dry and bleached, they retained their shape and their fibrous hay-like consistency. The rate of disintegration of winter pellets, which were already hard, dry and pale from exposure to at least one winter, was slower than the summer pellets; 10% were still visible after exposure to at least five winters and four summers (Fig. 1).

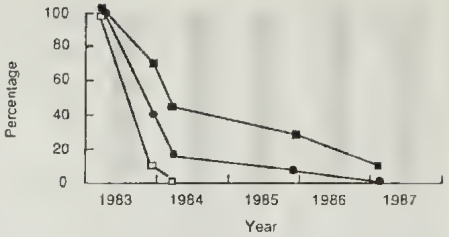


Fig. 1. The numbers of intact faecal pellets (expressed as percentages) of *Mastacomys fuscus* and *Rattus fuscipes* in relation to length of exposure. ■ = *Mastacomys fuscus* winter pellets, • = *Mastacomys fuscus* summer pellets; □ = *Rattus fuscipes*. Stippled areas = winter snow covers ground.

Discussion.

Faecal pellets of *M. fuscus* survived for up to five years. In contrast, the faecal pellets of *R. fuscipes* did not last for more than a few months, and none lasted for more than a year. The pellets of *R. fuscipes* remained dark and difficult to see; those of *M. fuscus* became pale and easier to see as time progressed. Thus the pale, hard, fibrous rodent pellets observed in alpine and subalpine regions are those of *M. fuscus*, and not from *R. fuscipes*.

It is not possible to ascertain when pellets of *M. fuscus* have been deposited; the date could vary from one to five years previously. The presence of pellets does not necessarily indicate present occurrence. Pellets produced under the snow in winter are more likely to survive because they are quickly frozen before being wetted or trampled upon, and therefore the presence of large numbers of pale pellets is indicative of a preferred winter habitat. *Mastacomys fuscus* produce 200-400 pellets each day (D. C. D. Happold, unpubl.), and consequently the few pellets which are visible in the summer represent only a small proportion of those produced by a single individual, yet alone a group of individuals, during a whole winter. Most pellets, whether deposited in summer or winter, disintegrate or become invisible very

quickly, and only a few, produced at a suitable site and time, remain.

Thus pellets only indicate that an individual, or several individuals, of *M. fuscus* utilised the habitat at some time in the last 1-5 years. Nevertheless, the presence of pellets indicates where live-trapping may be worthwhile. Finding fresh pellets, and live-trapping of individuals, is the only definitive method of ascertaining whether *M. fuscus* is currently living in a habitat.

Acknowledgements.

This study was undertaken as part of a long-term project on small mammals in the alpine and subalpine regions of Australia. I thank the National Parks and Wildlife Service of New South Wales for permission to work on small mammals, and the staff of Kosciusko National Park for their assistance. I am grateful to the Australian National University and the Australian Research Grants Scheme (D17815275) for financial support for this project.

REFERENCES.

Calaby, J. H. and Wimbush, D. J. (1961) Observations on the Broad-toothed Rat, *Mastacomys fuscus* Thomas. *CSIRO Wildl. Res. 9:* 123-133.

Carron, P. L. (1985) *The ecology of three species of small mammals in subalpine habitat.* Unpublished PhD thesis, Australian National University.

Dixon, J. M. (1971) The Broad-toothed Rat *Mastacomys fuscus* Thomas from the Falls Creek Area, Bogong High Plains, Victoria. *Victorian Nat. 88:* 198-200.

Happold, D. C. D. (1983) *Mastacomys fuscus.* In *Complete Book of Australian Mammals* (Ed. R. Strahan). Angus and Robertson, Sydney. p. 423.

Ride, W. D. L. (1970) *A Guide to the native Mammals of Australia.* Oxford University Press, Melbourne. 249 pp.

Seebeck, J. H. (1971) Distribution and habitat of the Broadtoothed Rat, *Mastacomys fuscus* Thomas (Rodentia, Muridae) in Victoria) *Victorian Nat. 88:* 310-323.

Wallis, R.L., Brunner, H., and Menkhorst, P.W. (1982) Victorian studies on the Broad-toothed Rat (*Mastacomys fuscus* Thomas). *Victorian Nat. 99:* 12-20.

Watts, C. H. S. and Aslin, H. J. (1981) *The Rodents of Australia.* Angus and Robertson, Sydney. 321 pp.

A New Locality for the Eastern Underground Orchid, *Rhizanthella slateri*

T.J. Annable*

The orchid genus *Rhizanthella* is endemic to Australia and comprises two species, *R. gardneri*, which is known from a number of sites in S.W. Western Australia and *R. slateri* which is now known from six confirmed sites in eastern Australia. One of the most remarkable characteristics of this genus is that almost the entire life cycle is spent underground.

The western underground orchid *R. gardneri* has been studied extensively (George 1980, Dixon and Pate 1984, Warcup 1985). The eastern underground orchid *R. slateri* has not yet been studied in detail, largely because of its extreme rarity. Until the discovery described below only one site with an extant plant was known. The species was first discovered by Edwin Slater in 1931 and the six confirmed sites range from Springwood in the south to Lamington National Park in the North.

On 9th October, 1988 the author was out bushwalking in Heaton State Forest near Newcastle with several friends when one of them, Roger Ward, rolled over a large cut log and noticed several unusual purple coloured flowers at ground level, partially covered by leaf litter. Three of the six flower heads were broken in turning the log and of these two were taken for identification, photography and later preservation in 70% alcohol. The species was identified from the key to the Orchidaceae in Morley and Toelken, (1983) and confirmed from Jones, (1988). This

*Science Department, Avondale College, Box 19, Cooranbong, N.S.W. 2265.

last reference includes a photograph and diagram with the description.

Each flower head consists of about 25-35 flowers arranged in a flat spiral or capitulum and is something like a glistening purple dandelion in appearance. The flower head is surrounded by fleshy bracts and is supported by a thick vertical whitish fleshy stem also covered in fleshy bracts. The stems grow from a horizontal subterranean rhizome which has no roots, only fine hairs. The plant has no chlorophyll and is saprophytic.

Observations on the progress of the flowers indicate that flowering occurs from early September to November. The flower has an unusual 'chemical' scent which probably attracts pollinating insects. Of the three remaining flower heads one died without producing any fruit. The second flower head produced a single fruit which developed rapidly but died off leaving no apparent seed. The third flower which may have been the only one not disturbed by the original log turning, has continued to progress very slowly towards producing a full head of fruits.

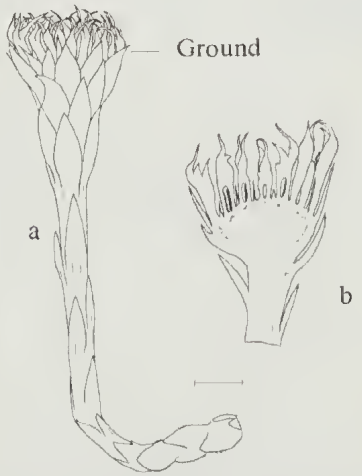


Fig. 1a. Entire flowering stem and piece of horizontal rhizome. Note arrangement of bracts and relation of plant to ground level (GL). **b.** Vertical section through flower head, bracts are found both surrounding the capitulum and between individual florets.
Scale: 10 mm.

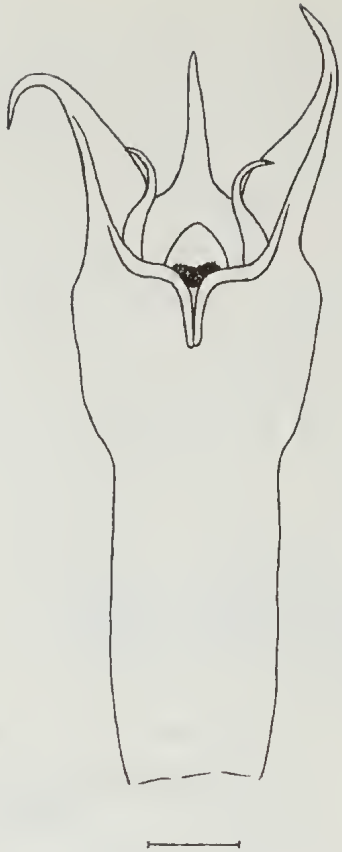


Fig. 2. Individual floret showing petal arrangement and hairy labellum. Scale: 2 mm.

It remains to be seen whether viable seeds will be produced and what fungal and other plant association is involved in the biology of this rare orchid.

References

Dixon, K.W. (1985). The Underground Orchids of Australia – An Appraisal. *Orchadian* **8**: 75-9.

George, A.S. (1980). *Rhizanthella gardneri*. R. Rogers – The Underground Orchid of Western Australia. *American Orchid Society Bulletin* **49**: 631-46.

Jones, D.L. (1988). *Native Orchids of Australia*. (Reed: Sydney.)

Morley, B.D. and Toelken, H.R. (1983). *Flowering Plants in Australia*. (Rigby: Adelaide).

Warcup, J.H. (1980). The Mycorrhizal Relationships of Australian Orchids. *New Phytologist*. **87**: 371-82.

The Ecotone Dynamics of Snow Gum on Continental Australia – Some Preliminary Comments and Observations

J.E. Williams*

Introduction

Eucalyptus pauciflora Sieb. ex Spreng. or snow gum has one of the widest geographic ranges of any eucalypt. Within this range it exhibits many ecotypes which has led to some confusion in the taxonomy of the species for example subspecies *niphophila* (Green, 1969). At higher altitudes on continental south-eastern Australia it is the dominant tree and forms the tree-line. At the same time, it also borders frost hollows in shallow valleys or other areas where cold-air accumulation is prevalent (Harwood, 1976). Disjunct lowland populations of snow gum also occur from near sea level to about 700 m in elevation in Victoria and isolated localities in South Australia and New South Wales (Boland *et al.*, 1984; Williams and Ladiges, 1985).

Most published research on the highland populations of snow gum have tended to concentrate on the ecology of populations at or near the tree-line (e.g. Costin, 1968; Slatyer and Morrow, 1977; Slatyer, 1978; Wimbush and Costin, 1979; Barlow, 1986). There are many reasons for this. One, for example, was the general debate concerning whether the observed tree-line was, in fact, determined climatically or not. Compared to areas overseas, the elevation of the alpine tree-line on continental Australia at about 1800 m above sea level seems low. However, when one considers the mean temperature of the warmest month for the alpine region overall, a clearer and more universal pattern emerges. Irrespective of the hemisphere or the species of tree, tree-lines typically approximate the 10°C (mean) isotherm for the warmest month. The alpine tree-line in south-east Australia follows this pattern but occurs at a relatively lower elevation due to the latitude of the region and its proximity to the coast. Each degree increase in latitude equates with about a 110 m decrease in elevation of the tree-line (Costin, 1968) and this decrease is compounded further by the moderating effect on summer temperatures in the highlands by the nearby sea.

The alpine tree-line is not always clear-cut; a gradual transition from tree to shrub forms sometimes occurs. This has led to difficulties in intepretation when comparisons of tree-line structure have been attempted between regions and continents. In general, however, the now widely used terminology of Wardle (1974), which subdivides the tree-line into timber-line and tree limit, has minimised this potential problem.

*Ecosystem Dynamics Group, Research School of Biological Sciences, The Australian National University, PO Box 475, Canberra City, ACT 2601.

Studies on Ecotone Dynamics

At a relatively coarse scale, climatic conditions below the 10°C mean isotherm for the warmest month must severely limit the growth and survival of trees and/or reduce their competitive ability with respect to smaller plants, particularly grasses. At a finer level of resolution, however, it is clear that a variety of environmental factors may influence the spatial and temporal position and patterning of the tree-line. Further, it is possible that the currently observed position of the tree-line need not represent its ecological limit but may be the artifact of stochastic events, such as extreme fire and drought, in the past.

Experimental work conducted recently by Ferrar *et al.* (1988) on the dynamics of the tree-line in the Kosciusko region has shed some light on this situation. Their data indicated that, given certain micro-site conditions, snow gum can regenerate from seed and survive to reproductive maturity in situations up to 200 m above

the extant tree-line. The micro-site conditions required were simply the availability of sufficient viable seed and some disturbance of the ground cover to reduce competition from surrounding plants. Fire is one of several types of disturbance that may fulfil the latter condition. However, the probability of the concurrent availability of viable seed upslope from its source of dispersal appears to be relatively low (Cremer, 1977) but could be affected by the frequency of strong winds.

The tree-line on continental Australia represents, in effect, the upper ecotone boundary of the highland populations of *E. pauciflora*. Here the over-riding determinants limiting its upper distribution appear relatively well studied. In contrast, the factors determining the lower ecotone boundary of the highland populations of snow gum, prior to my current research, had not been investigated systematically. Study of the dynamics of this ecotone is of interest as it could highlight general mechanisms which may account for the disjunct distribution of snow gum across the landscape. For example, Williams and Ladiges (1985) hypothesised that the geographic range of snow gum was reduced by the spread of competitively superior species of eucalypts that were better adapted to the warmer climatic conditions of the current interglacial phase. Thus, given this, is there any evidence to suggest that the current position of the lower ecotone of the highland populations of snow gum is influenced by competitive interactions with other species of eucalypts? Further, what does this suggest about the dynamics of this ecotone with respect to future environmental change (e.g. climate change) or the potential viability of discrete populations through time? This knowledge has direct relevance for nature conservation and may afford some insight into the processes affecting other forest types.

My research concerns the sub-alpine forests of the Brindabella Range on the western border of the Australian Capital Territory. In this region snow gum is the dominant tree above about 1200 m, forming pure stands above about 1600 m. At its lower ecotone, snow gum can be replaced downslope by any of several eucalypts but typically *E. delegatensis* R. Baker, in sheltered gullies, and *E. dives* Schauer on ridges and slopes (Talsma 1983). At the same time, *E. dalrympleana* Maiden is present in low frequency in all of these forests (below 1600 m). The width of the ecotone between snow gum and its replacement species can be relatively narrow. In the case of the broad-leaved peppermint *E. dives* it may be less than about 30 m in elevation suggesting that at least some factors influencing replacement impact over a relatively short distance.

My work on this lower ecotone has tested a variety of hypotheses that may account for the observed replacement of snow gum downslope. Detailed mapping of the spatial arrangement and the number of individuals of snow gum and the broad-leaved peppermint across their shared ecotone suggests that conditions become unfavourable for both species towards the ecotone. Individuals of *E. dives* near and in the ecotone appear less healthy and more susceptible to disease, suggesting their upper limit is related to physiological and mechanical constraints. Other work (Williams, in review) suggests that an earlier hypothesis by Burdon and Chilvers (1974) implicating herbivory as an important factor in the replacement of snow gum downslope is unlikely to be true. Some increase in herbivory on the leaves of snow gum is observed approaching the ecotone but this, in isolation, appears unlikely to be a critical factor effecting replacement (Williams, in review).

Using seedling transplants, grown from seed collected from adult trees within the ecotone, it has been shown that seedlings of snow gum can survive and grow below the current position of the ecotone, within the peppermint forest. Preliminary results from assays of soil samples taken across the ecotone indicate that soils upslope

from the ecotone are higher in organic carbon and useable calcium and magnesium than those in the peppermint forest below. This information is currently being assessed in relation to that obtained from survival and growth experiments on seedlings of both snow gum and the peppermint, conducted in the field and glasshouse. These and other sources of data suggest that several factors (e.g. soil, temperature) are interacting near and within this ecotone to bring about the replacement of snow gum by the broad-leaved peppermint. In general, however, it appears that the peppermint cannot extend its range further upslope because of unfavourable abiotic factors, particularly climate parameters. In contrast, the current lower boundary of snow gum appears, in a sense, to be determined by competition. Snow gum exhibits a slower rate of growth than the peppermint. This may, amongst other things, be related to genetic characteristics. The overall effect is that snow gum is excluded from areas where the peppermint can grow. Thus, my preliminary observations appear to be generally consistent with the hypothesis of Williams and Ladiges (1985).

Conclusion

While detailed investigations of the dynamics of the lower boundary of snow gum are yet to be conducted more widely, some general patterns from this research appear evident and worthy of comment. On a broad scale, the downslope replacement of the highland populations of snow gum appears to occur within a relatively narrow range of elevations across a variety of landscapes on continental Australia. This infers an important role for certain climatic parameters correlated to a gradient in altitude. A detailed bioclimatic envelope for snow gum is currently being compiled but from the limited data available these climatic parameters may be related more to where eucalypt species other than *E. pauciflora* can grow rather than where *E. pauciflora* itself can grow. On the surface, it would seem that the genotypes of snow gum (or its 'forms') that were favoured by selective forces during the most recent glacial episode now restrict its opportunity for a natural expansion in range beyond climatically extreme environments (Williams, 1989). At the same time, the specialised ability of snow gum to occupy these extreme environments offers considerable potential for its use by mankind, particularly in such environments overseas. This useage is developing but should be more prevalent and economically productive once the greater complement of genetic resources of snow gum is better known.

References

Barlow, B. (1986). *Flora and Fauna of Alpine Australasia – Ages and Origins* (CSIRO and ASBS.)

Boland, D.J., Brooker, M.I.H., Chippendale, G.M., Hall, N., Hyland, B.P.M., Johnston, R.D., Kleinig, D.A. and Turner, J.D. (1984). *Forest Trees of Australia*. (Thomas Nelson and CSIRO.)

Burdon, J.J. and Chilvers, G.A. (1974). Leaf parasites on altitudinal populations of *Eucalyptus pauciflora*. *Aust. J. Bot.* **22**: 265-9.

Costin, A.B. (1968). Alpine ecosystems of the Australasian Region. In W.H. Osburn and H.E. Wright (eds) *Arctic and Alpine Environments* (Indiana University Press: Bloomington.) pp 55-87.

Cremer, K.W. (1977). Distance of seed dispersal in eucalypts estimated from seed weights. *Aust. For. Res.* **7**: 225-8.

Ferrar, P.J., Cochrane, P.M. and Slatyer, R.O. (1988). Factors influencing germination and establishment of *Eucalyptus pauciflora* near the alpine tree line. *Tree Physiol.* **4**:27-43.

Green, J.W. (1969). Taxonomic problems associated with continuous variation in *Eucalyptus pauciflora* (snow gum) (Myrtaceae). *Taxon* **18**: 269-76.

Harwood, C.E. (1976). Ecological studies of timberline phenomena. Ph.D Thesis, The Australian National University.

Slatyer, R.O. (1978). Altitudinal variation in the photosynthetic characteristics of snow gum, *Eucalyptus pauciflora* Sieb. ex Spreng. 7. Relationships between gradients of field temperature and photosynthetic temperature optima in the Snowy Mountains area. *Aust. J. Bot.* **26**: 111-21.

Slatyer, R.O. and Morrow, P.A. (1977). Altitudinal variation in the photosynthetic characteristics of snow gum, *Eucalyptus pauciflora* Sieb. ex Spreng. 1. Seasonal changes under field conditions in the Snowy Mountains area of south-eastern Australia. *Aust. J. Bot.* **25**: 1-20.

Talsma, T. (1983). Soils of the Cotter Catchment Area, A.C.T.: Distribution, chemical and physical properties. *Aust. J. Soil Res.* 21: 241-55.
Wardle, P. (1974). Alpine timberlines. In J.D. Ives and R.G. Barry (eds.) *Arctic and Alpine Environments* (Methuen: London,) pp 370-402.
Williams, J.E. (1989). The greenhouse effect and vegetation dynamics - lessons from snow gum. *Ascent* 14 (in press).
Williams, J.E. (in review). The importance of herbivory in the population dynamics of three subalpine eucalypts in the Brindabella Range, south-east Australia. (submitted to *Aust. J. Ecol.*).
Williams, J. and Ladiges, P.Y. (1985). Morphological Variation in Victorian, lowland populations of *Eucalyptus pauciflora* Sieb. ex Spreng. *Proc. R. Soc. Vict.* 97: 31-48.
Wimbush, D.J. and Costin, A.B. (1979). Trends in vegetation at Kosciusko. 1. Grazing trials in the subalpine zone, 1957-1971. *Aust. J. Bot.* 27: 741-787.

Report of F.N.C.V. Fungal Excursions: 1986-1988

Tom May*

A number of new and interesting species have been recorded on recent Club fungal excursions. These are discussed below, along with lists of other species found. It is hoped that such lists will add to an understanding of the distribution and ecology of the species and also serve to highlight the incomplete knowledge of many groups.

The names

The naming of Australian fungi can be difficult, and this difficulty must be recognised when compiling and interpreting records if these records are to be of any value. The first problem is the correct application of the available names. The modern taxonomy of fungi requires a knowledge of the microscopic characters of the fruiting body. This information is lacking for many of the species which have already been described from Australia and therefore the status of these species is often uncertain. Secondly, a huge number of species are yet to be formally named. This problem is especially acute in the larger agaric genera such as *Cortinarius, Russula* and *Inocybe*, where there may well be up to 10 times as many species present as have already been named.

There are indeed a number of species, such as *Amanita muscaria* or *Mycena interrupta*, which are so distinctive that they can be named on the basis of readily recognisable field characters. However, the correct identification of most species must be based on a thorough examination of the macroscopic and microscopic characters of the fruiting body. Therefore, it should be stressed that many of the names used below should be regarded as 'field-names', used in the sense of Australian authors, and that they may well refer to a complex of closely related species or be the best fit from the European literature. An asterisk alongside a name indicates that specimens were collected and examined microscopically and the details checked against the appropriate literature. A number of species are recorded in the form '*Marasmius* sp. (=*Collybia elegans*)': this indicates that the species *Collybia elegans* belongs in *Marasmius* but that a valid new combination in *Marasmius* has not been made. Distinctive species which appear to be undescribed are denoted 'sp. *A*, sp. *B*' etc.

The lack of names and the continual changes to existing names can be daunting but there is a positive side to the incomplete knowledge of our fungi. Not having names to readily apply to many of the species encountered forces one to look closer at the structures of the fungus in order to characterise it.

Descriptions and illustrations of many of the species mentioned can be found in Cleland (1976), Cole *et al.* (1984), Fuhrer (1985), Griffiths (1985), Macdonald and Westerman (1979), Willis (1963) and Young (1982).

* Department of Botany and Zoology, Monash University, Clayton, Victoria 3168.

Excursion of the Botany Group to Fernshaw and Dom Dom, 24th May 1986

Heavy morning rain fortunately abated and allowed a good look at the fungal flora in the vicinity of Fernshaw and in the pine plantation at Dom Dom saddle. An excellent sample of the higher fungi typically found in the wetter mountain forests was found, with over 60 different types being recorded. The agaric species from this excursion are described systematically in order to provide an introduction to some of the major genera.

Agarics: *Mycena*

Mycena is a good starting genus for anyone wishing to become familiar with the commoner genera of agarics. Species of *Mycena* are present at most localities during the fungus season, and invariably so in the wetter forests.

The distinctive characters of *Mycena* are: the typically convex or bell-shaped cap borne on a thin, relatively fragile stipe which lacks a ring, and the white spore print. The photographs in Fuhrer (1985) and Grgurinovic and Holland (1983) provide an excellent introduction to the genus. The field key in the latter work is helpful for identification and also includes short descriptions of some newly named species.

Once the general appearance has been recognised then other white-spored genera may be distinguished by reference to *Mycena* (see below). Similarly, amongst the coloured-spored genera, most *Mycena*-like agarics with black spores will belong in *Panaeolus* and *Psathyrella*, those with pink spores are members of the subgenus *Nolanea* of *Entoloma* and many species in *Galerina* and *Conocybe* (with brown spores) resemble *Mycena* in stature.

On the excursion *Mycena* was the most common genus, both in the number of fruiting bodies and in the number of species. Many of the *Eucalyptus regnans* butts were dotted with caps, often extending way up the trunk. The following species were distinguished: *M. interrupta* (the impressive blue colour of the cap makes identification easy, and always exciting), *M. epipterygia* (bright yellow, glutinous cap and cucumber odour), *M. sanguinolenta* (dark red juice appears when the stipe is broken), *M. viscidocruenta* (small, viscid and bright red; not seen on the day but has been frequently collected in the area), *M. subcapillaris* (collective name for any tiny, white *Mycena*), *M. austrororida* (=*M. rorida* of some authors: decurrent gills and a very glutinous stem), *M. subgalericulata* (used for any of what are doubtless a number of species which have greyish brown to brown caps, growing on trees and stumps), *M. erythromyces* (pinkish purple caps and red edges to the decurrent gills readily distinguish this species; see Grgurinovic and Holland, 1983, pl.7), *M. pura* (more lilac than the previous species and with adnate gills, common in pine plantations and eucalypt forest; *M. vinacea* is another name that has been applied to pink to vinaceous species of *Mycena*; the names for this group need to be revised), *M. austrofilopes* (very tall stem with greyish brown cap) and *M. hispida* (similar to the preceding; differing in the more distant gills and the lack of a greyish bloom to the cap; this species seems to be the cause of the numerous tangled threads (rhizomorphs) which were often massed amongst the leaf litter; *M. austrofilopes* and *M. hispida* have previously been known collectively as *M. pullata*). **Mycena* sp. *A* (fig. 1) is a distinctive species which appears to be undescribed. It is very small, only 8 mm high, but was quite obvious on a large rotting log by virtue of the vivid red cap colour. It is rather like a red version of *M. interrupta*. The gills are edged in red and the stipe covered by red scales. The gill edges, cap and stem are found to be covered with microscopic, club shaped cystidia (modified sterile cells) whose surfaces bear many

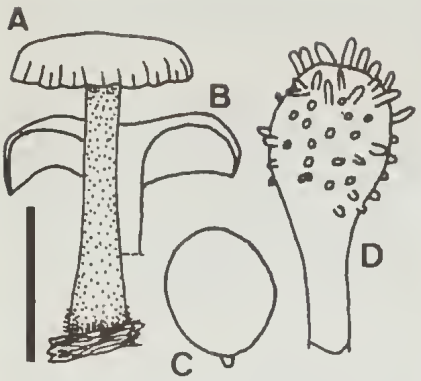


Fig. 1. *Mycena* sp. A: fruiting body, B; cross section of fruiting body, C; spore, D; cheilocystidium. Scale bar = 4 mm for A; 3 mm for B; 10 µm for C; 20 µm for D.

peg like protruberances. These type of cystidia are commonly found in *Mycena* and related genera, and differences in their shape and size are often used to aid in the separation of species.

Other white-spored agarics

Collybia is similar to *Mycena*, being best distinguished in the field by the thicker stem, especially at the base, and the flatter cap. Along with the mycenas on the tree butts were colonies of *Collybia eucalyptorum* (cap pale yellowish brown, stem darker red-brown and gills white). On the ground was a species with a red-brown cap and stem, and white gills; this is close to the European *C. butyracea*, and was common in both eucalypt forest and under pines. A third collybia differed in having strong yellow tints to the gills.

Two species which have been placed in *Collybia* in the past are *Oudemansiella radicata* (rooting shank) and *Flammulina velutipes* (velvet foot). Some very tall specimens of *O. radicata* were seen under the pines at Dom Dom, and a typical cluster of *F. velutipes* grew half way up a dead tree.

Marasmius has the same thin stem as *Mycena*, but the fruiting bodies are able to rehydrate after drying. This character is well shown by the fairy ring mushroom, *M. oreades*, which is common in suburban lawns. The forest species can also be distinguished from *Mycena* by the much tougher stems which are usually darker below (to black) and often very thin, resembling horse hairs. The following species were seen: *Marasmius* sp. (= *Collybia elegans*: aptly named for the lovely tones of peach-red or apricot of the cap, the stem base is dark reddish brown), *M. crinis-equi* (the horse-hair mushroom), *Marasmius* sp. *A* (similar to *Mycena epipterygia* in the yellow colour of the stipe, but the apex is white and the surface dry) and *Marasmius* sp. *B* (a dark stem and strong purple tint to the cap centre).

Amongst moss was the orange-capped *Gerronema fibula* (sometimes placed in *Omphalina* or *Mycena*), looking much like a tiny *Mycena* but with strongly decurrent gills. Under a lens the stem can be seen to be covered with minute hairs (caulocystidia).

Two white-spored species with short stems attached to the side of the cap (ping-pong bat shaped) were *Panellus stypticus* and *Dictyopanus pusillus* (= *Polyporus rhipidium*). The first has gills, the second pores, but the fruiting bodies are similar in texture and microscopic characters. Some authors even place both in the same genus. This is a radical change from their original position in different families (Agaricaceae and Polyporaceae)!

Laccaria is not immediately recognised as being white-spored since the gills are coloured pink to vinaceous, but the spores form a white bloom on the mature gills. The name generally given to collections of this genus from Australia is *L. laccata*, however, there are at least nine species present in Victoria, and it is doubtful if any is the true *L. laccata*. Two types could be distinguished on the day, **L. lateritia* with brick-red gills (basidia two-spored) and **Laccaria* sp. *B*, very similar except for the paler pink gills (basidia four-spored).

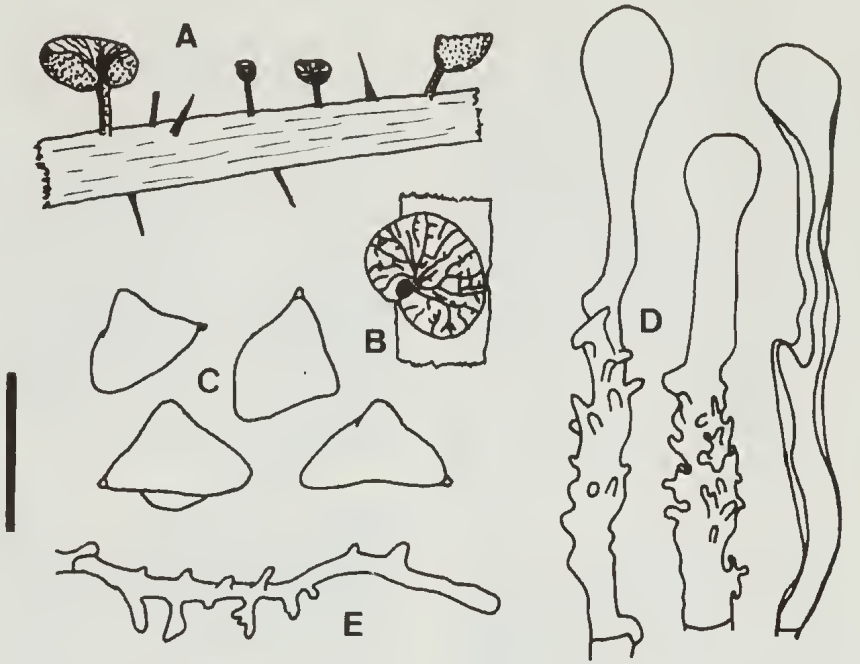


Fig. 2. *Tetrapyrgos olivaceonigra*: A; fruiting bodies on *Rubus* sp., B; fruiting body showing gills, C; spores, D; cheilocystidia, E; terminal element of pileopellis. Scale bar = 10 mm for A, B; 10 µm for C, D; 20 µm for E.

**Tetrapyrgos olivaceonigra* (fig. 2) is a species whose various names are as unusual as its appearance. It was described from New Zealand as *Pterospora olivaceonigra* by Horak (1983), and later transferred to *Tetrapyrgos* for nomenclatural reasons. If the generic delimitations of Singer (1986) are accepted it would belong in *Campanella*. The cap is connected to the apex of the short stem at one side and eventually points away from the substrate. The cap and stem are tinted bluish green with finely pruinose surfaces. The gills are shallow and often forked and interconnected. The microscopic characters are equally bizarre, the spores being triangular, much like a pastie with a bulge on one side, and the cheilocystidia having medial finger-like protruberances and capitate apices.

Agarics with coloured spores

Hypholoma has purple-brown spores and often grows in clumps on rotten wood (some authors use the alternative name *Naematoloma*). Three species were common in the area: *H. fasciculare* (sulphur tuft; bright yellowish to brown cap and greenish yellow gills), *Hypholoma* sp. *A* (orange-red cap and brilliant orange gills; this has not been named but could well be called apricot tuft, it differs from *H. sublateritium* (brick tuft), which was not seen on the day, in the orange rather than red tones and the much brighter gill colour) and *Hypholoma* sp. *B* (dark reddish brown cap with a belt of pale fibres around the margin; this also has not been named but there is a painting of this species by H. T. Tisdall in the National Herbarium, Melbourne, so it could be referred to as Tisdall's hypholoma).

Rather similar in general appearance to the hypholomas was the tufted *Psathyrella* sp. (= *Psilocybe echinata*), in the young stage recognised by the covering of curved scales to the cap. These scales disappear with age and the mature plant can look quite different. The fragile consistency and black spores place the species in *Psathyrella* rather than *Psilocybe*. Some authors use the name *Psathyrella pygmaea* for this species. Another *Psathyrella* was seen along the edges of the track, with a long slender stem, looking much like a black-spored *Mycena*.

A true *Psilocybe* was also growing along the track sides; **P. eucalypta* has a honey to straw coloured cap which stains blue upon handling. It is related to *P. subaeruginosa*, differing in microscopic characters.

**Tubaria rufofulva* was seen growing in clumps on rotting wood. The cap and stem are a beautiful rich reddish brown colour. This species was described from South Australia as *Pholiota rufofulva* (Cleland, 1976). *T. rufofulva* has not previously been recorded from Victoria, although what is almost certainly the same species is described as *Cortinarius sanguineus* by Willis (1963) and Macdonald and Westerman (1979). *T. rufofulva* is distinguished from the true *C. sanguineus* (a close relative of which does occur in Victoria) by the spore print being darker brown and the spores smooth, the occurrence on wood, the presence of a distinct ring on the stem (at least initially), the rough cap surface and the watery consistency of the flesh.

**Melanophyllum echinatum* has only been recorded previously from Western Australia (Hilton, 1982). It is common in the wetter forests of Victoria, but can be easily overlooked. The cap is greyish brown, finely granular in texture (the surface is made up of spherical cells) and initially the margin has a membranous fringe. The gills are a distinctive rich reddish brown and the stem is reddish brown. The spore print is green and the spores are finely punctate which is a unique combination of spore characters amongst the agarics. There is a good illustration in Griffiths (1985; p. 31).

Other agarics

Other agarics, with variously coloured spores, were *Clitocybe clitocybioides, Coprinus micaceus, Crepidotus applanatus, C. variabilis, Entoloma (Leptonia) formosum, Gymnopilus pampeanus, Lactarius subdulcis* and unidentified species of *Cortinarius, Inocybe, Paxillus, Pluteus* and *Russula*. Growing under pines were *Amanita muscaria, Lactarius deliciosus, Suillus granulatus, S. lakei* (dry cap with red scales) and *Tricholoma terreum*.

Non agarics

Jelly fungi observed were the white *Tremella fuciformis*, the yellow buttons of *Heterotextus pezizaeformis*, some species of *Calocera*, and *Naematelia encephala*, this last species growing on fallen pine wood, and with a much firmer texture than the similar looking *Tremella*.

A species growing as groups of hard red spheres on wood was *Nectria cinnabarina*, a relative of the larger *Daldinia*.

Two of the puffball group were *Scleroderma* sp. and *Zelleromyces australiensis*. Although of similar appearance to the typical puffballs, **Z. australiensis* (see Beaton *et al.*, 1984) is actually more closely related to the agarics. The internal structure is like a convoluted honeycomb with very small spaces, rather than the powdery mass seen in *Scleroderma*. The microscopic characters are very similar to those of *Russula* or *Lactarius*; the texture of the fruiting body is even remarkably similar to the brittle flesh of these agarics.

Other non-agarics noted were *Ascocoryne sarcoides, Clavicorona pyxidata, Discinella terrestris, Podoserpula pusio* (= *Craterellus multiplex*; delicately pink hued, stepped caps), *Stereum illudens, Trametes versicolor* and *Tyromyces caesius* (white, staining blue).

Excursion to Powelltown Area, 1st June, 1986

On the excursion to the Powelltown area a week later, fungi were equally numerous. Additional agarics to those noted on the preceeding excursion were: *Crepidotus eucalyptorum, Gymnopilus* sp. (= *Flammula eucalyptorum*), *Hygrocybe conica, H. miniata, Lacrymaria asperospora, Mycena viscidocruenta, Panellus* sp. (unnamed, but this grey gilled species is well illustrated in Cole *et al.,* 1984: pl.5), *Pholiota* sp. (= *F. californica* var. *communis*; numerous on the ground and on tree stumps), *Resupinatus* sp. (= *Pleurotus cinerascens*; black cap without stipe, texture gelatinous), *Russula foetens* (odour of bitter almonds) and *Schizophyllum commune.*

Additional non-agarics were *Aleuria aurantia* (orange-peel fungus), *Boletus* sp. (similar to the European *B. erythropus*; with rich red stipe and pores), *Clavulinopsis amoena* (bright yellow), *Daldinia concentrica* (King Alfred's cakes), *Grifola* sp. and *Sphaerobolus stellatus.*

Excursion of Botany Group to Kinglake Area, 23rd May, 1987

The first locality visited was a fairly open dry selerophyll forest east of the junction of the Yarra Glen-Yea Rd and the Kinglake-Healesville Rd. Larger fungi were plentiful, with the commonest genera, in terms of numbers of individuals, being *Russula* and *Cortinarius.*

A most interesting find was **Dictyolus cinnamoneus*, an agaric described by Cleland (1976). The fruiting body is excentrieally attached to wood, and is initially spoon-shaped becoming semi-infundibuliform as the sides of the cap curl outwards. The cap and stem are brownish orange with finely tomentose surfaces; the gills are decurrent, thin and pale pinkish orange; the odour is strongly farinaceous; the spore print is white; the spores are cylindrical, smooth and non-amyloid. A good illustration of mature fruiting bodies is to be found in Cole *et al.* (1984: plate 2, as *Clitopilus* sp.). This species does not belong in *Dictyolus* or *Clitopilus* but is likely to be the type of a new genus, or at least a new seetion of *Hohenbuehelia*, sinee all the mieroseopie characters place it near *Hohenbuehelia*, but it laeks the metuloids typical of that genus.

Other speeies of agarics noted were: *Cantharellus cibarius* var. *australiensis, Collybia butyracea, Cortinarius austroalbidus* (= *C. albidus*), *C. ochraceus,* **Cortinarius* sp. *A* (cap red-brown, umbonate, covered with appressed squamules composed of bundles of fine white fibrils; gills ochraceous; stipe white, fibrillose, lacking a ring; cortina present initially), **Cortinarius* (subgen. *Dermocybe*) sp. *B* (related to *Cortinarius clelandii* (= *C. subcinnamoneus*), with distinetive darker bands on the stipe below the collapsed cortina, **Cystolepiota* sp. *A* (cap pale brown, with a fine, brown, furfuraceous covering; gills white, free; stipe buff above, pale reddish brown below; initially the fragile veil connects the eap margin to the stipe, on rupturing the veil forms an appendieulate margin to the eap; this species is rather like a white-gilled counterpart of *Melanophyllum echinatum*), *Dictyopanus pusillus, Entoloma formosum, Gymnopilus* sp. (= *Flammula eucalyptorum*), *Gymnopilus* sp. (= *F. excentrica*), *Lactarius subdulcis, Mycena epipterygia, M. subgalericulata,* **Mycena* sp. *B* (cap grey-brown, centrally depressed; gills decurrent; stipe viscid), **Mycena* sp. *C* (cap dark black-brown with eoncentrie zones; gill edges dark), *Oudemansiella radicata, Russula foetens, R. mariae, R. purpureoflava* and *Stropharia semiglobata.*

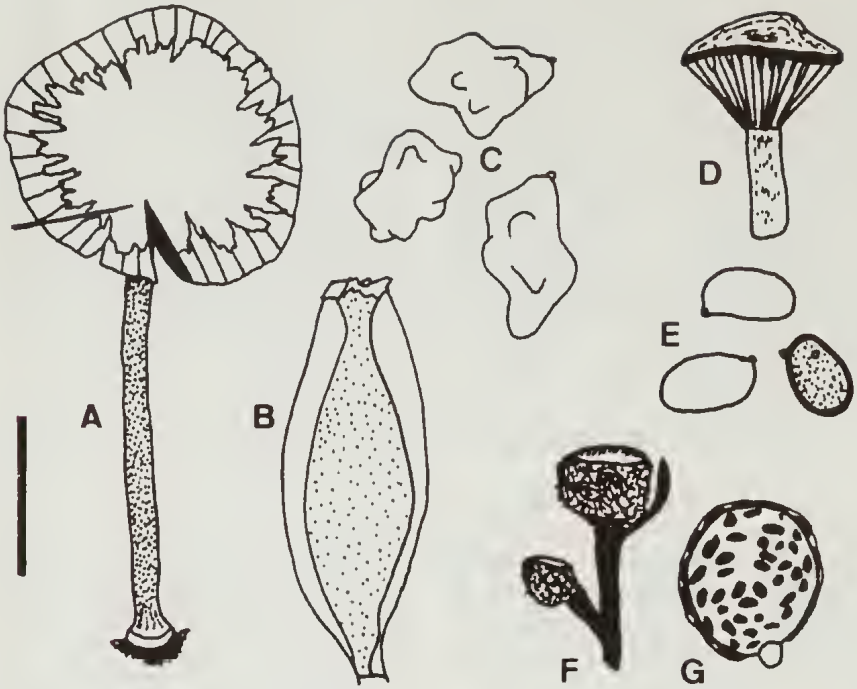


Fig. 3. *Astrosporina scissa*: A; fruiting body; B; cheilocystidium, C; spores, *Hygrophoropsis umbriceps*: D; fruiting body, E; spores, *Chromocyphella muscicola*: F; fruiting bodies, G; spore. Scale bar = 20 mm for A, D; 10 μm for C, E, G; 20 μm for B; 3 mm for F.

Non-agarics were less common with the following species being seen: *Clavulina rugosa, Discinella terrestris, Phellodon niger, Ramaria ochraceosalmonicolor* and several other species of *Ramaria*.

Jehosaphat Valley

We then proceeded to Jehosaphat Valley. The moister conditions here allow a greater development of wood inhabiting fungi. Some of the hand-rails along the track were covered with fruiting bodies exemplifying most of the major fungal families. In a small area could be seen such diverse forms as the smooth patches or brackets of the Thelephoraceae, the spiny or toothed patches of the Hydnaceae, the pored brackets of the Polyporaceae, the gelatinous finger or brain-like fruiting bodies of the Tremellaceae and the familiar mushrooms of the Agaricaceae. Fungi were also abundant along the tracks and three species not previous recorded from Victoria were found: *Astrosporina scissa, Hygrophoropsis umbriceps* and *Chromocyphella muscicola* (fig. 3).

**Astrosporina scissa*: cap yellow-brown, surface splitting radially at the margin; gills grey; stipe pruinose over entire length, base bulbous; flesh of the stipe base with a pink tint; odour not distinctive; spores nodulose; cystidia broad, metuloid with very thick walls. This species was described from New Zealand by Horak (1977) who uses *Astrosporina* for the species of *Inocybe* with nodulose spores; the use of *Inocybe* in a broad sense seems preferable. *A. scissa* occurs commonly in wetter

habitats in Victoria, both under *Nothofagus cunninghamii* and in *Eucalyptus* forest.

**Hygrophoropsis umbriceps*: cap dark brown tomentose-squamulose over yellow-brown ground colour; gills forked, pinkish cream; stipe brown, squamulose; flesh soft; spores ovoid, dextrinoid, wall slightly thickened; terminal elements of cap surface with brown, intracellular pigment; clamp connections present. *Hygrophoropsis* is a relative of *Paxillus*, distinguished by the white rather than brown spore print. Although only a single, small specimen was collected and a spore print not obtained, the characters observed are in close agreement with those of *H. umbriceps* as described by McNabb (1969) and Horak (1979).

**Chromocyphella muscicola*: a keen eyed member of the party spotted this tiny cup shaped species growing on moss. The fruiting body resembles that of a discomycete but the spores are borne on basidia. The interior of the cup is the fruiting surface and is dusted with the brown spores. The spores are subglobose, yellow-brown and verrucose. The only previous Australian record of this species is from Tasmania (Berkeley, 1860: as *Cyphella muscigena*), although other records of muscicolous cyphellas may well refer to *Chromocyphella muscicola*.

There were many lyrebird scratchings along the track side amongst which had been uncovered hypogean fungi including **Zelleromyces australiensis*, **Z. striatus*, **Cystangium sessille* and **Hymenogaster nanus*. These species are all puffball-like relatives of agarics and are important food items for many native mammals (e.g. potoroos and bandicoots), it would be of interest to know if they are also eaten by the lyrebirds. Another hypogean fungus, with spores produced in asci rather than on basidia, was **Peziza whitei*. This species forms hollow, deeply convoluted spherical fruiting bodies which grow half buried beneath leaf litter.

The following agarics were found along the track: **Clitocybe clitocybioides* (cap infundibuliform, light pinkish-brown; gills decurrent; odour farinaceous; microscopically very distinctive by virtue of the numerous inflated cells in the cap tissue), *Collybia butyracea, C. eucalyptorum, Coprinus* sp. (resembling *C. plicatilis* but with an ashy, friable covering to the cap), *Crepidotus variabilis, Descolea recedens* (= *Pholiota recedens*; distinguished by the well developed ring which is striate on the upper surface), *Dictyopanus pusillus, Galerina unicolor* (cap honey-brown, hygrophanous, resembling a mycena in stature but with brown spore print and a ring), *Hygrocybe ceracea*, **Laccaria* sp. *E* (pale gills, 2-spored basidia), *Lactarius piperatus, Marasmius equicrinis, Marasmius* sp. *A, Melanotus hepatochrous* (= *Crepidotus subhaustellaris*; with the habit of a *Crepidotus* but a darker, purple-brown spore print), *Mycena epipterygia, M. erythromyces, M. hispida* (with numerous white rhizomorphs, some of which terminated in a minute cap), *M. sanguinolenta, M. subcapillaris, M. viscidocruenta*, **Mycena* sp. *D* (growing on wood; initially with a black, convex cap which is covered with small white speckles - this species could be called the nargun's mycena from the imaginary resemblance to the sparkle from the eyes of the nargun as it peers from its cave), *Panellus stypticus, Paxillus muelleri* (= *P. infundibuliformis*), **Pluteus atromarginatus, Psathyrella* sp. (= *Psilocybe echinata*) and **Russula foetens*.

Non-agarics included: *Calocera guepinioides, Chlorosplenium aeruginosum, Clavariadelphus junceus, Clavulina rugosa, Clavulinopsis amoena, C. corallinorosacea, Dasyscyphus pteridophilus, Heterotextus pezizaeformis, Hypoxylon ruhiginosum, Leotia lubrica, Mycoacia subceracea, Polyporus picipes, Pseudohydnum gelatinosum, Ramaria ochraceosalmonicolor, R. sinapicolor, Stereum illudens* and *Tremella fuciformis*.

Excursion of the Botany Group to Dom Dom and Acheron Way, 28th May 1988

As in 1986 the early part of autumn was comparatively dry followed by recent heavy rain. We were again fortunate that the rain abated – at least for the morning. It was interesting to revisit the pine plantation at Dom Dom saddle and see much the same species as in 1986. Under the pines were *Amanita muscaria, Lactarius deliciosus, Suillus granulatus, *S. lakei* (under Douglas fir) and *Tricholoma terreum*. An additional species was **Chalciporus piperatus*, a relatively small bolete with red-brown cap, stipe and pores. A distinctive species of *Calocera* was growing colonially on wood; the cylindrical fruiting bodies with awl-like tips were a beautiful pale yellowish pink, paler at the base, up to 3.5 cm high. Other agarics under the pines, but not strictly associated with pine, were *Collybia butyracea, Melanophyllum echinatum* and *Mycena pura*. From a dead tree near the pines sprouted *Flammulina velutipes*; the base of the same tree was surrounded by *Coprinus micaceus* – just as in 1986.

From the pine plantation we walked along the Dom Dom Rd. into eucalypt forest. Here, and in the grassy area outside the pines, were found: *Bolbitius vitellinus, Campanella* sp. (= *Tetrapyrgos olivaceonigra), Campanella* sp. (unlike *T. olivaceonigra* this species does not have stipe and is pure white), *Clitopilus subfrumentaceus* (large pink – brown caps with stipe off-centre), *Collybia butyracea, Cortinarius rotundisporus, Cortinarius vinaceolamellatus* (cap viscid, pale yellow with brown blotches centrally, stipe pale with darker fibrils, gills pale grey-brown with distinct lilac tint), *Crepidotus variabilis, Dictyopanus pusillus, Entoloma formosum, Laccaria lateritia, Laccaria* sp. *B, Leucoagaricus* sp. (cap 6 cm diam., dark reddish brown centrally with vinaceous brown fibrils extending to edge; gills white, free; ring persistant, upward pointing: with the appearance of a white-spored *Agaricus*, the fibrillose rather than squamulose cap surface also serves to distinguish this species from other 'lepiotas'; this and the next two species would have been placed in *Lepiota* in the past, but that genus is now split into a number of genera including also *Cystolepiota* and *Cystoderma*), *Leucocoprinus* sp. (delicate white fruiting bodies with free gills and a ring, the cap has fine, grey scales centrally and the margin is plicate), *Macrolepiota* aff. *gracilenta, Marasmius* sp. (= *Collybia elegans*), *Melanotus hepatochrous, Mycena austrofilopes, M. hispida, M. sanguinolenta, Mycena* sp. D, **Mycena* sp. *E* (greenish grey cap, stipe with minute darker dots; tougher in texture than many mycenas), *Oudemansiella radicata, Paxillus muelleri, Paxillus* sp. *A* (cap pale yellow with brown scales centrally), *Phlebopus portentosus* (= *Phaeogyroporus portentosus*: only the massive stem was found, no doubt the result of attack by a mycophobe), *Phylloporus rhodoxanthus, Psilocybe eucalypta, Schizophyllum commune, Stropharia* sp. *A* (growing on the ground; cap viscid, dark brown; gills greyish; stipe pale yellow, 14 cm long).

Two members of the bolete family were: **Boletus mollis* (slimy bun-shaped cap on a slender stipe, pores pink, very soft; probably belongs in *Fistulinella*) and another species with the form and texture of *B. mollis* but with yellow pores. Non-agarics included *Clavulina cristata, Ramaria fumigata* and *R. ochraceosalmonicolor.*

Hypogean fungi were a gain found among lyrebird scratchings: *Thaxterogaster levisporus* at Dom Dom and *Chamonixia mucosa* and *Podohydnangium australe* at the Acheron Way.

On the tree under which we had parked our car was an agaric described by Willis

(continued page 57)

(1963), under *Omphalia kewensis*, as a diminutive species 'whose cylindrical, flat-topped caps stand out on rigid, horny stems like bracket lights from a wall. The prevailing hue is pale dull yellow, with darker striations and umbilicus'. This description allowed immediate identification of the tiny fruiting bodies of the species now known as **Marasmius cylindraceocampanulatus*.

Acheron Way

We then proceeded to the Acheron Way to a stand of *Nothofagus cunninghamii* growing alongside a branch of the Acheron River. Under the closed canopy of the beech trees, in the gloomy light, surrounded by tree ferns and a multitude of bryophytes and up to our ankles in mud it was easy to imagine a time when much of the ancient continent of Gondwana was covered by forests of Southern Beech. When Gondwana split up to become South America, New Zealand, Australia and the other southern continents the *Nothofagus* remained but, especially in Australia, became restricted to small pockets in cooler, high rainfall areas. There are many fungi which are assocated with *Nothofagus* and which today can be found only in the southern hemisphere countries which once made up Gondwana. Species of *Cyttaria* (the beech oranges) are a well known example of such fungi. We did not see any *Cyttaria gunnii*, a species usually fruiting in spring, but a number of interesting species were found some of which are only known from under *Nothofagus*.

The highlight was a rare and spectacular green species of *Hygrocybe* (= *Gliophorus graminicolor*). Green is a colour which for those studying plants other than fungi is rather mundane but there are exceptionally few green agarics. **G. graminicolor* was first collected from under *Nothofagus* in New Zealand and placed in *Gliophorus* due to the thick glutinous layer covering the cap and stipe, it belongs in *Hygrocybe* when that genus is used in a broader sense. The cap and stipe are a beautiful grass-green; the gills are pale, adnate with a decurrent tooth and with a clear gelatinous line along the edge.

Other agarics associated with *Nothofagus* included: **Cuphocybe* sp. *A* (similar to a *Cortinarius* but has a covering of small felty scales on the viscid cap), **Laccaria inasonii* (when young it is more mycenoid in stature than most *Laccaria*, when mature the buff caps contrast with the pale pink stipe; the gills are exceptionally pale greyish pink for a *Laccaria*), *Mycena* sp. *F* (allied to *M. sanguinolenta* but with a more brilliant red colouration, like a large *M. viscidocruenta*; gills with red edges, stipe with red juice when broken), **Panellus longinquus* (excentrically attached, rubbery fruiting bodies with a pink, viscid cap), *Paxillus* sp. *C* (rich yellow, infundibuliform cap with a relatively thin stipe), **Porpoloma* sp. *A* (large fruiting bodies similar to those of *Tricholoma* but the gills are rather thick and bright yellow and the spores are amyloid; the cap is plane with reddish brown radial fibrils; the stipe is pale yellow above grading to brown below and there is no ring).

Other species noted were *Armillaria novaezelandiae* (pink gills; illustrated in Macdonald and Westerman (1979), as *A. mellea*), *Collybia butyracea, Cortinarius* sp. (cap vinaceous brown; gills amethyst; stem 13 cm high, with amethyst tint at apex, pallid below), *cortinarius* sp. (cap blue grey, translucent-striate; gills grey; stipe apex bluish purple), *Crepidotus applanatus, C. eucalyptorum, Lactarius subdulcis, Lepiota haemorrhagica, Marasmius* sp. (= *Collybia elegans*), *Mycena epipterygia, M. erythromyces, M. interrupta, Mycena* sp. *E, Russula xerampelina, Schizophyllum commune, Stropharia semiglobata* and *Tubaria rufofulva*. Under a solitary pine near the road were *Amanita muscaria* and *Lactarius deliciosus*. Non-agarics included *Bisporella citrina, Discinella terrestris, Heterotextus peziziformis* and *Hydnum repandum*.

Details of Voucher Collections

The following collections of species mentioned above which are newly recorded from Victoria or otherwise of interest have been deposited at VPRI (Herbarium, Plant Research Institute, Burnley). Some collections are from sites other than those visited during the forays. *Astrosporina scissa* Horak (B414), *Chromocyphella muscicola* (Fr.) Donk (B412), *Clitocybe clitocybioides*) Cooke and Massee) Peg. (B426), *Cortinarius* sp. *A* (B406), *Cortinarius* sp. *B* (B411), *Cystolepiota* sp. *A* (B407), *Cuphocybe* sp. *A* (M83-24), *Dictyolus cinnamoneus* Clel. (B410), *Gliophorus gramminicolor* Horak (B475), *Hygrophoropsis umbriceps* (Cooke) McNabb (B417), *Marasmius cylindraceo-campanulatus* Hennings (B470), *Melanophyllum echinatum* (Roth: Fr.) Sing. (M18), *Mycena* sp. *A* (B268), *Mycena* sp. *B* (B405), *Mycena* sp. *C* (B425), *Mycena* sp. *D* (M337), *Mycena* sp. *E* (M520), *Panellus longinquus* (Berk.) Sing. (B371), *Pluteus atromarginatus* (Konrad) Kühner (M553), *Porpoloma* sp. *A* (B477), *Tetrapyrgos olivaceonigra* (Horak) Horak (B269), *Tubaria rufofulva* (Clel.) Reid and Horak (B350).

Acknowledgements

I would like to thank Katrina Geering, Dugal Wallace and Sibely and John May for helpful comments. Bruce Fuhrer aided considerably in discussing the identifications of many species. I would also like to thank the foray participants whose keen observation and persistence in the face of unfavourable weather enabled many of the species described above to be collected.

References

Beaton, G., Pegler, D.N. and Young, T.W.K. (1984). Gasteroid Basidiomycotina of Victoria State, Australia 2. Russulales. *Kew Bull.* **39**: 669-698.

Berkeley, M.J. (1860). Fungi, in Hooker, J.D., *Flora Tasmaniae*. II, pp 241-282. (Lovell Reeve: London).

Cleland, J.B. (1976). *Toadstools and mushrooms and other larger fungi of South Australia. Parts I and II. 1934-1935.* (Reprint) (Government Printer: South Australia).

Cole, F.M., Holland, A.A. and Fuhrer, B.A. (1984). *A field guide to the common genera of gilled fungi in Australia.* Revised edition. (Inkata Press: Melbourne.)

Fuhrer, B. (1985). *A field companion to Australian fungi.* (The Five Mile Press: Hawthorn.)

Grgurinovic, C.A. and Holland, A.A. (1983). A field identification key of some Victorian species of the genus *Mycena*. *Vict. Nat.* **99**: 102-107.

Griffiths, K. (1985). *A field guide to the larger fungi of the Darling Scarp of South West Western Australia.* Published by the author.

Horak, E. (1977). Fungi agaricini Novaezelandiae. VI. *Inocybe* (Fr.) Fr. and *Astrosporina* Schroeter. *New Zealand J. Bot.* **15**: 713-747.

Horak, E. (1979). Paxilloid Agaricales in Australasia. *Sydowia* **32**: 154-166.

Horak, E. (1983). Neufunde und Bemerkungen zu einem emendierten Gattungskonzept von *Pterospora* Metrod (Agaricales). *Sydowia* **36**: 125-138.

Macdonald, R. and Westerman, J. (1979). *Fungi of south-eastern Australia.* (Thomas Nelson: West Melbourne.)

McNabb, R.F.R. (1969). The Paxillaceae of New Zealand. *New Zealand J. Bot.* **7**: 349-362.

Singer, R. (1986). *The Agaricales in modern taxonomy.* (4th ed.). (Koeltz Scientific Books: Koenigstein.)

Willis, J.H. (1963). *Victorian toadstools and mushrooms.* (3rd ed.). Field Naturalists Club of Victoria.

Young, A.M. (1982). *Common Australian Fungi.* (New South Wales University Press: Kensington.)

Native Orchids of Australia

By David L. Jones

Published by Reed Books (1988), pp 656, r.r.p. $69.95 (hardcover)

Orchids make up a group of plants which have attracted enthusiastic attention from botanists, field naturalists and horticulturalists alike. As David Jones reminds us in the first page of his book, the name *orchis* itself dates back to Theophrastus in the third century B.C. The main attraction of this family of plants lies in the flowers which are keenly sought by field enthusiasts and growers. The enjoyment of a walk in the bush is always heightened by the discovery of an orchid in flower, and, for the grower, the challenge of success is irresistible (but, alas, many fail). Our fascination with orchids is almost exclusively aesthetic and some of the more outstanding and easily grown species form the basis of a lucrative international trade in cut flowers.

So widespread is the interest in orchids that books describing and depicting details of their structure and beauty in drawing or photograph, appear perhaps more frequently than they do for any other group of flowering plants. The cults of orchid growing, orchid photography, orchid watching and recording, ensure a continuing, if uncritical, market for orchid books. David Jones' 'Native Orchids of Australia' is the most recent of at least eight* Australian, regional or State orchid books published since 1980!

'Native Orchids of Australia' is an authoritative and attractive book written by a highly qualified and experienced orchid enthusiast. It contains over 650 pages of information and description; the only book to deal comprehensively with all Australian orchids since Nicholls' 'Orchids of Australia' published in 1969. It is a landmark reference book for the Australian orchid flora.

The book is divided into three sections. The first deals with the nature of orchids, their structure, biology and cultivation. Naturally, David Jones emphasises the features of orchids which are important in their description and identification; leaf shape and form, inflorescence type and details of floral structure. These are accompanied by clear and simple drawings. Chapter 3, entitled 'The Biology of Native Orchids', concentrates on pollination biology, a subject of special interest to Mr Jones, while other aspects such as the saprophytic life-style of some and the essential mycorrhizal association of most, are treated more briefly. No mention is made at all of the ecology of epiphytes, the water relations of orchids, or the range of photosynthetic systems adopted by orchids, but these are botanical research topics of less interest to the orchid enthusiast. The section finishes with chapters on the cultivation and propagation of native orchids.

Sections two and three deal respectively with terrestrial and epiphytic orchids, some 700 species in 110 genera – five hundred pages of species descriptions, drawings and photographs. Each species is named with its authority, the specific epithet is explained and a common name given where appropriate, the flowering period is also given. Then follows a formal description, the state distribution, some notes of interest, the taxonomic relationships, and some advice on appropriate cultural conditions. The high quality colour photographs, drawings and text provide the reader with a thorough and up-to-date description of all Australian orchids; it is thus a major contribution as a reference text for the whole orchid family. It is the foundation on which future developments and research into Australian orchids will be based and as such I recommend it for all serious students of orchids. (In some respects it is ahead of its time since a Supplement of

twenty pages lists and describes some new species and combinations which will be published in the "Catalogue of Australian Orchidaceae" being prepared by Mark Clements of the Australian National Botanic Gardens). It is also an attractive book which will be used by field botanists, naturalists and orchid growers wishing to know more about our orchids and their identification. It is a book which successfully covers the spectrum of interest in orchids and I recommend it strongly.

I have three comments which arise from my perusal of this book, the first concerns the order in which the genera are presented, the second the need for identification keys, and the final one deals with the concept of species as understood by orchid enthusiasts. In his preface David Jones says:-

> "Significant genera have been dealt with in separate chapters and in a few cases small genera have been gathered together to form a chapter. These genera may or may not be related."

Such a policy has resulted, for instance, in the inclusion of *Apostasia* with genera such as *Malaxis* and *Phaius*, one of the most primitive with some of the more advanced genera. I understand that there is no general agreement on the evolution and systematics of orchids, but even a brief discussion of the problem of orchid systematics would have helped the reader to understand the approach and added significantly to the impact of the book.

A serious omission for those less familiar with the Australian orchid flora, is the absence of keys for identification. This is a problem with Nicholls and more recent orchid books and forces one to the often frustrating task of thumbing through pages of drawings and photographs to compare a specimen with the specific example given in the book. There is little excuse for this omission since the basis of a workable key for the orchids is now available in Morley and Toelken (1983).

Finally, I must say something about the species concept as indicated in the text of this book. Field naturalists will know that there are broadly two groups of botanists, those known as "Lumpers" who generally accept a degree of variability within a species as representing population differentiation below the level of species, and those known as "Splitters" who recognise such variation as warranting specific recognition. I should declare my hand at the outset by indicating that I tend to accept the approach of the Lumpers. It is also true that the more we study and understand a group of plants the greater emphasis we tend to give to the differences we see between groups. The economically important families of plants like the Poaceae, the Rosaceae and the Apiaceae have many more genera and species than do those of little economic importance. So it is with the Orchidaceae, and we are always more impressed with the fine differences between individuals and groups than we are with the similarities.

I will illustrate my concern with a consideration of the species *Dendrobium speciosum* Sm. as presented in the book. In the body of the text (p. 487) the following note appears:-

> "Being such a widespread species, *D. speciosum* is extremely variable. Five varieties having fairly distant geographical ranges have been described. It should be noted that confusing intermediate forms may occur where these ranges overlap."

I have no problem with this statement when I consider the geographic range of this orchid from eastern Victoria along the eastern border of the continent to Cape York. Our own work on *D. speciosum* suggests that the pattern of variability represents more closely a cline of variation through a climatic continuum from temperate to tropical. Samples at given locations along this cline are bound to show up genetically based differences, but the presence of intermediate forms clearly indicates geographic (climatic) variation

within a single species. The problem emerges in the Supplement where he and Mark Clements provide individual specific names for all these five varieties of *D. speciosum*. This splitting of the species seems to me to be unwarranted and unhelpful, making biological disjunctions where they do not exist and concentrating on the minor differences between the groups rather than the common features (including cross fertility) which link them. My message is – orchid enthusiasts, take note of the characters which unite a species rather than the small features which may subdivide them. If flower colour, or depth of the floral tube are important specific determinants, why then isn't the pink heath (*Epacris impressa*) a different species from the white? Is my point made?

Not withstanding any of the above, I want to congratulate David Jones and Reed Australia on the publication of such a thorough and beautiful book. It is one that I have bought and will cherish and use in my study and enjoyment of Australian orchids. I recommend it most strongly for professional botanists, growers of orchids and all those with an interest in the bush and our native plants. It will be a handsome addition to our collective libraries and reference works.

Malcolm Calder,
Reader in Botany,
University of Melbourne.

References

Morley, B.D. and Toelken, H.R. (1983). *Flowering Plants in Australia.* (Rigby: Adelaide.)

* A list of these books may be obtained from the editors.

Books Received

Review copies of these books have been received by the FNCV. Books mentioned here may be reviewed in later issues.

Associations Between Insects and Plants
Dr Timothy New. New South Wales University Press, 113 pp., r.r.p. $19.95 (soft cover).

This is number four in the Australian Institute of Biology's series entitled "Australian Studies in Biology". The topics covered by this book include the feeding habits of insects, causes of insect pest outbreaks, longterm development of insect plant relationships and the roles of insect herbivores.

The Wombat
Barbara Triggs (1988). New South Wales University Press, 141 pp, r.r.p. $14.95 (soft cover).
and

The Lyrebird – A Natural History
Pauline Reilly (1988). New South Wales University Press, 92 pp, r.r.p. $14.95 (soft cover).

Two new books in the "Australian Natural History Series". This series of books aims to "make accessible accurate scientific information, complemented by high quality illustrations, on a wide variety of Australian animals". Other books to follow in this series include The Goanna, The Crocodile, The Possum, The Kangaroo, The Emu, and The Cockatoo.

A Guide to plants in Little Desert and Mt Arapiles Area
F. J. C. Rogers. Published by the author. 31 pp, (soft cover).

A colour guide in magazine format with 216 photographs of the flora. 1032 species are listed. A useful starting point for naturalists as there is no other species list for this designated area.

FIELD NATURALISTS CLUB OF VICTORIA
Report by Council

The members of the Council submit herewith balance sheet as at 31 December 1987, and statement of income and expenditure for the year ended on that date, and report as follows:-

1. The names of the members of the Executive Council in office at the date of this report are as follows:-
   Mr. G. Love
   Mr. R. Pearson
   Miss Y. Gray
   Dr. J. Douglas
   Mrs. S. Houghton
   Miss M. Allender
   Mrs. H. Stanford
   Mr. G. Gillespie
   Mr. M. McBain
   Mr. J. Grusovin
2. The principal activities and objects of the Club are to stimulate interest in natural history and to preserve and protect Australian Fauna and Flora. No significant change in the nature of those activities occurred during that period.
3. The net Surplus of the Club for the year ended 31 December 1988 was $697 (1987 Deficit $1,696) in the General Account. In addition surpluses were earned in the following Funds -
   Building Fund
   Publications Fund
   Excursion Fund
   Special Funds
4. The Club is prohibited from paying a dividend by its Memorandum and Articles of Association; consequently no dividend is recommended and no dividends have been paid.
5. The review of operations for the year:-
   The Club's groups met regularly throughout the year. The Botany, Day, Geology and Mammal Survey Groups arranged day trips and extended excursions. The Australian Natural History Medallion was administered and awarded to Mr. John Dell, a biologist in the department of biogeography and ecology at the West Australian Museum.
6. No significant changes in the state of affairs of the Club occurred during the financial year ended 31 December 1988.
7. No matters or circumstances have arisen since the end of the financial year which significantly affected or may significantly affect the operations of the Club, the results of those operations, or the state of affairs of the Club in financial years subsequent to the financial year ended 31 December 1988.
8. The likely developments in the operations of the Club and the expected results of those operations in financial years subsequent to the financial year ended 31 December 1988 are unlikely to have any significanct effect on the financial results in future years.
9. Information on Members of the Council:
   Graeme Love - President
   Occupation - Public Servant
   Council Member since - 1985
   Ron Pearson - Secretary
   Occupation - Retired
   Council Member since - 1987
   Yvonne Gray - Treasurer
   Occupation - Accountant
   Council Member since - 1986
   Jack Douglas - Member of Council
   Occupation - Geologist
   Council Member since - 1986
   Sheila Houghton - Member of Council
   Occupation - Librarian
   Council Member since - 1981
   Marie Allender - Member of Council
   Occupation - Retired
   Council Member since - 1956
   Helen Stanford - Member of Council
   Occupation - Homemaker
   Council Member since - 1983
   Graeme Gillespie - Member of Council
   Occupation - Zoologist
   Council Member since - 1988
   Michael McBain - Member of Council
   Occupation - Company Director
   Council Member since - 1987
   Julian Grusovin - Member of Council
   Occupation Laboratory Technician
   Council Member since - 1987
10. Since the end of the previous financial year no member of the Council has received or become entitled to receive any benefit by reason of a contract made by the Club with him or with a firm of which he is a member or with a company in which he has substantial financial interest.

SIGNED at MELBOURNE this 12th day of April 1989 in accordance with a resolution of the Council.

G. Love, President
Y. Gray, Treasurer

FIELD NATURALISTS CLUB OF VICTORIA
STATEMENT OF INCOME & EXPENDITURE – YEAR ENDED 31 DECEMBER 1988

INCOME

	1988 $	1987 $
Subscriptions Received		
Arrears	—	128
Current	16,140	17,038
Supporting	559	355
	16,699	17,521
Sales of "Victorian Naturalist"	383	140
Advertisements	—	40
	383	180
Interest Received		
Library Fund	15	15
Bank Account	161	160
Commonwealth Bonds	1,475	1,475
Bonds – M Wright Legacy	767	767
Bonds – C M Walker Legacy	147	148
Deposit	—	608
Life Membership Fund	40	78
Natural History Medallion Fund	—	296
	2,605	3,547
Sundry Income	1,459	60
Profit on Book Sales	1,022	1,125
Microscope	50	—
Profit on Sale of Fixed Assets	2,269	—
	4,800	1,185
Deficit for year	—	1,696
	24,487	24,129

EXPENDITURE

	1988 $	1987 $
Victorian Naturalist		
Printing, Illustrating & Despatch	17,142	16,851
Less Grants		
Treasury	(1,500)	(1,500)
	15,642	15,351
Working Expenses		
Postage & Telephone	463	504
Printing & Stationery	1,454	315
Bookkeeping & Typing	1,510	1,500
Rent	1,210	885
Herbarium Affiliation Fees, Subscriptions & Donations	468	296
Auditor's Remuneration (Note 4)	265	240
Insurance	315	325
General Expenses	877	961
Natural History Medallion Expenses	53	2,141
Kinglake Expenses – Rates	511	486
	7,126	7,653
Club Improvement Account – Transfer of Profit on Books Sales	$1,022	1,125
Surplus for year	697	—
	1,719	1,125
	24,487	24,129

FIELD NATURALISTS CLUB OF VICTORIA
BALANCE SHEET AS AT 31 DECEMBER 1988

	Notes	1988 $	1987 $
Current Assets			
Cash	5	33,976	18,454
Receivables	6	213	168
Inventories	7	1,206	1,351
Total Current Assets		35,395	19,973
Non-current Assets			
Property, Plant and Equipment	8	9,541	10,042
Investments	9	156,430	140,968
Total Non-current Assets		165,971	151,010
Total Assets		201,366	170,983
Current Liabilities			
Creditors and Borrowings	10	18,499	4,765
Total Liabilities		18,499	4,765
Net Assets		182,867	166,218
Shareholders' Equity			
Share Capital		—	—
Accumulated Funds	11	182,867	166,218
Total Shareholders' Equity		182,867	166,218

FIELD NATURALISTS CLUB OF VICTORIA
NOTES TO AND FORMING PART OF THE ACCOUNTS
YEAR ENDED 31 DECEMBER 1988

1. **Statement of Accounting Policies**

The accounts have been prepared in accordance with the accounting standards issued by the Australian Accounting bodies and with the disclosure requirements of the Companies (Victoria) Code, Schedule 7 as in operation on 30th September, 1987. The accounts have also been prepared on the basis of historical costs and do not take into account changing money values or, except where stated, current valuations of non-current assets. The accounting policies have been consistently applied, unless otherwise stated.

The following is a summary of the significant accounting policies adopted by the Club in the preparation of the accounts:-

(a) **Investments**

Investments are valued either at cost less amounts written off for permanent diminution in the value of Investments or, at directors' valuation. Dividends and interest are brought to account when received.

(b) **Fixed Assets**

Fixed assets are valued at cost or valuation. No provision has been made for depreciation of the Library as in the opinion of Council its value greatly exceeds the value shown in the books of account.

(c) **Income Tax**

The Club is not liable to pay income tax.

(d) **Inventories**

Inventories are valued at the lower of cost and net realisable value.

(e) **Club Improvement Account**

Profit on Sale of books is capitalised to club improvement account to reflect realised capital profit.

		1988 $	1987 $
2.	**Operating Profit** has been determined after:		
	(a) Charging as Expense –		
	Depreciation of Plant & Equipment	NIL	NIL
	Rental Expense on Operating Leases	1,210	885
	(b) Crediting as Income –		
	Interest Received from Other Persons	2,920	15,784
	Profit on Sale of Non-Current Assets	—	56
	(c) Recognising Operating Revenue –		
	Membership Subscriptions	16,699	17,521
	Interest	16,748	15,784
	Proceeds on Disposal of Non-Current Assets	2,770	56
3.	**Remuneration of Councillors**		
	No remuneration was received by the councillors from the Club for the year ended 31 December 1988	NIL	NIL
4.	**Auditors' Remuneration**		
	Amount received or due and receivable by the auditors for:–		
	Auditing the Accounts	265	240
	Other Services	—	—
5.	Cash		
	Cash at Bank	13,779	8,454
	Cash at Bank – Bicentennial Grant	10,197	—
	Australian Savings Bonds at cost	10,000	10,000
		33,976	18,454
6.	**Receivables**		
	Sundry Debtors	213	168
7.	**Inventories**		
	Badges and Sundries	85	95
	Books for Sale	331	481
	Victorian Naturalist Subject Index	790	775
		1,206	1,351
8.	**Property, Plant & Equipment**		
	Freehold Property		
	Kinglake (gift of Harold C. Frahm)	—	—
	Maryborough, Cosslick Reserve, at cost	213	213
		213	213
	Library, Furniture & Equipment		
	At cost	9,328	9,829
	Less Accumulated Depreciation	—	—
		9,328	9,829
		9,541	10,042

	1988 $	1987 $
9. Investments		
General Fund		
Australian Savings Bonds at cost	8,300	8,300
Esanda Ltd – Debentures at cost	8,000	9,000
ANZ Savings Bank – Deposit	5,472	4,672
Statewide Building Society – Deposit	2,443	1,313
	24,215	23,285
Building Fund		
Australian Savings Bonds at cost	3,100	3,100
Esanda Ltd – Debentures at cost	5,900	8,500
ANZ Banking Group Ltd	3,591	2,310
Statewide Building Society – Deposit	2,773	—
	15,364	13,910
Publications Fund		
Australian Savings Bonds at cost	45,380	45,380
Esanda Ltd – Debentures at cost	5,000	9,500
Telecom – Bonds at cost	1,500	3,500
ANZ Savings Bank – Deposit	10,804	9,900
ANZ Banking Group Ltd	12,248	3,632
Book Stocks at cost	6,084	6,419
Statewide Building Society – Deposit	6,916	—
	87,932	78,331
Excursion Fund		
Australian Savings Bonds at cost	1,000	1,000
ANZ Savings Bank – Deposit	10,826	9,826
Cash at Bank	29,052	14,616
Sundry Creditors	(11,959)	—
	28,919	25,442
TOTAL INVESTMENTS	156,430	140,968
10. Creditors and Borrowings		
Subscriptions received in advance	3,578	1,905
Sundry Creditors	2,533	2,706
M A Ingram Trust Grant in Hand	154	154
Treasury Grants in Hand	2,037	—
Bicentennial Grant in Hand	10,197	—
	18,499	4,765
11. Accumulated Funds		
General Fund		
Balance 1 January	13,156	14,852
Net Surplus (Deficit) for year	697	(1,696)
BALANCE at 31 December 1988	13,853	13,156
Specific Funds		
Building Funds		
Balance at 1 January	13,910	12,309
Net Surplus for year	1,454	1,601
BALANCE at 31 December 1988	15,364	13,910
Publications Fund		
Balance at 1 January	78,331	71,272
Net Surplus for year	9,601	7,059
BALANCE at 31 December 1988	87,932	78,331

	1988 $	1987 $
Excursion Fund		
Balance at 1 January	25,442	22,378
Net Surplus for year	3,477	3,064
BALANCE at 31 December 1988	28,919	25,442
Club Improvement Account		
Balance at 1 January	13,888	12,763
Net Surplus for year	1,021	1,125
BALANCE at 31 December 1988	14,909	13,888
Kinglake Project Fund		
Balance at 1 January	1,313	657
Net Surplus for year	165	656
BALANCE at 31 December 1988	1,478	1,313
Sundry Bequests & Legacies		
Balance at 1 January	20,178	20,446
Net Surplus (Deficit) for year	234	(268)
BALANCE at 31 December 1988	20,412	20,178
TOTAL SPECIFIC FUNDS	169,014	153,062
TOTAL ACCUMULATED FUNDS	182,867	166,218

FIELD NATURALISTS CLUB OF VICTORIA
STATEMENT OF SOURCES AND APPLICATIONS OF FUNDS
YEAR ENDED 31 DECEMBER 1988

	1988 $	1987 $
SOURCES OF FUNDS		
Funds from Operations (Note 1)		
Inflows of funds from operations	40,586	37,951
Less Outflows of funds from operations	26,206	26,410
	14,380	11,541
Reduction in Assets		
Current Assets		
Cash	—	4,435
Inventories	145	738
	145	5,173
Non-current Assets		
Proceeds on disposal of Non-Current Assets	2,770	—
Other Assets		
Other Investments	—	4,686
Increase in Liabilities		
Creditors & Borrowings	13,734	—
	31,029	21,400
APPLICATIONS OF FUNDS		
Increase in Assets		
Current Assets		
Cash	15,522	3,403
Receivables	45	168
	15,567	3,571

	1988 $	1987 $
Other Assets		
Investments	15,462	10,405
Reduction in Liabilities		
Creditors & Borrowings	—	7,424
	31,029	21,400
NOTE 1:		
Funds from Operations	14,380	11,541
Less – Interest & Other Items Credited direct to Special Funds	15,952	13,237
Add – Profit on disposal of Non-Current Assets	2,269	—
NET OPERATING SURPLUS/(DEFICIT)	697	(1,696)
BUILDING FUND		
Balance of Fund at 31 December 1987	13,910	12,309
Interest on Investments and Bank Account	1,454	1,601
Balance of Fund at 31 December 1988	15,364	13,910
PUBLICATIONS FUND		
Balance of Fund at 31 December 1987	78,331	71,272
Interest on Investments and Bank Account	9,393	8,337
Sundry	33	39
Surplus for the year from –		
Fossil Book	175	89
Printing Booklet Natural History Medallion	—	(1,406)
Balance of Fund at 31 December 1988	87,932	78,331
CLUB IMPROVEMENT ACCOUNT		
Balance of Account at 31 December 1987	13,888	12,763
Book Sales Account Profit	1,021	1,125
Balance of Account at 31 December 1988	14,909	13,888
EXCURSION FUND		
Balance of Fund at 31 December 1987	25,442	22,378
Interest on Investments and Bank Account	3,389	2,029
Surplus on Tours	88	1,035
Balance of Fund at 31 December 1988	28,919	25,442

AUDITOR'S REPORT TO THE MEMBERS OF FIELD NATURALISTS CLUB OF VICTORIA

We report that we have audited the accounts of the FIELD NATURALISTS CLUB OF VICTORIA in accordance with Australian Auditing Standards.

In our opinion the accompanying accounts, being the Balance Sheet, Statement of Income and Expenditure, Notes to Accounts, Statement of Source and Application of Funds and Statement by Members of the Council, are properly drawn up in accordance with the provisions of the Companies (Victoria) Code 1981 and so as to give a true and fair view of:–

(i) the state of affairs of the company at 31 December 1988 and of the results of the club for the year ended on that date;

(ii) the other matters required by Section 269 of that Code to be dealt with in the accounts;

and are in accordance with Australian Accounting Standards and applicable approved accounting standards.

DANBY BLAND PROVAN & CO.
Chartered Accountants

R. W. FRANKLAND
Partner

MELBOURNE
April 1989

FIELD NATURALISTS CLUB OF VICTORIA
STATEMENT BY MEMBERS OF COUNCIL

In the opinion of the members of the Council:-

1. (a) The accompanying Income & Expenditure Account is drawn up so as to give a true and fair view of the results of the company for the financial year ended 31 December 1988.
   (b) The accompanying Balance Sheet is drawn up so as to give a true and fair view of the state of affairs of the company as at the end of that financial year.
   (c) At the date of this statement, there are reasonable grounds to believe that the company will be able to pay its debts as and when they fall due.
2. The accompanying Accounts have been made out in accordance with Australian Accounting Standards and applicable approved accounting standards.

This statement is made in accordance with a resolution of the Members of Council.

SIGNED at MELBOURNE this 12th day of April 1989.

G. Love, President
Y. Gray, Treasurer

Club News: Who's Doing What?

Arthur Theiss attended a Bryological Workshop in Hobart from 3-10 December 1988, which he found very rewarding, seeing at least a dozen species which were new to him, including two previously unrecorded for Australia. (A report on the workshop appears elsewhere in this issue).

Gary Richardson, of the FNCV Microscopical Group, Graeme Love FNCV President, Marion van Gameren, representing the Friends of the Botanic Gardens, and Ian Clarke, from the Herbarium, met on 16 January 1989 to consider the joint purchase of major scientific equipment for use in the field, e.g. video cameras, for which Government funding may be available.

Details of items suitable for this column should be sent to me, in writing, please! (Address: 30 Golf Links Crescent, Dingley, 3172)

Sheila Houghton

Australia Day Honours

Ellen Lyndon

As briefly reported in our last issue, Ellen was awarded the OAM in the Australia Day Honours List, for services to conservation and local history. Ellen has been a member of the FNCV since 1943, and as our "correspondent from Leongatha" has contributed many articles and observations to the *Victorian Naturalist*. As her award suggests she has been vigilant in conservation matters, and not only field naturalists in Gippsland, but also in a wider area, have benefitted from her wide knowledge of natural history. Congratulations!

S.H.

Dr Gretna Weste

Congratulations to Dr Weste who was awarded an AM, a Member of the Order of Australia, for her significant contribution to science. Dr Weste has conducted extensive long-term research on the fungal pathogen *Phytophthora cinnamomi* and its serious impact on native vegetation. Prior to her research virtually nothing was known about this pathogen which can cause extensive dieback in certain vegetation communities, such as in the Grampians, Wilsons Promontory and the Brisbane Ranges. Dr Weste is an active member of the FNCV and contributor to the *Victorian Naturalist*.

Eds

NOMINATIONS OF FNCV COUNCIL MEMBERS AND OFFICE BEARERS

The FNCV Annual General Meeting will be held on Monday, 8th May, 1989 and nominations are required for Council Members and other office bearers. Council consists of the President, Vice President, Immediate Past President and ten other members. The following offices are open for nomination: President, Vice President, Secretary, Treasurer, Editor, Librarian, Excursion Secretary, Programme Secretary, Conservation Co-ordinator, Club Reporter and Book Sales Officer.

With the exception of the President, Vice President and Immediate Past President, office bearers are not automatically members of Council, though the Secretary and Treasurer are required to attend Council meetings, which are held on the last Monday of the month at the Herbarium.

If you nominate a person for a partieular office, and that person is willing to be a member of Council, an additional nomination to this effect is required. Council is the governing body of your Club. Think now of the people you would like to form this body, and ask them if they will aceept nomination.

The Club is entitled to nominate two representatives to the Conservation Council of Victoria. It also appoints nominees to a number of other bodies around Melbourne. If you would like to undertake any of these jobs, or know of members who would, please let the Secretary know.

Ron Pearson
Hon. Secretary

FNCV Push For 'Approved Research Institute' Status

The Council of the FNCV has applied to the Australian Taxation Office to be granted the status of an Approved Research Institute (ARI). If this status is granted the Club will be able to accept gifts for which the donor is entitled to a tax-deduction. Such donations however, must only be used for, and applied to the purposes of scientific research.

Any donations currently received by the Club are not tax-deductible to the donor.

It is expected that ARI status will benefit the current program of field-based research, and financially underpin future research efforts.

In order to satisfy the requirements of the tax legislation and its administration the Club is required to safeguard the proper and legitimate expenditure of research funds. A minimum step in this direction is the establishment of a Research Committee which will oversee the conduct and standard of research and the proper expenditure of funds. Council has already established this body.

The exact formal structure of the ARI is currently under negotiation. The Taxation Office wants the Club to establish a separate company whose sole function would be to conduct researeh. This new subsidiary company would be the ARI. Council is reluctant to accept this position and has a counter-proposal making the Club itself the ARI whilst ensuring the independence of the Research Committee and integrity of the Research Fund by creating new empowering clauses in the Clubs Articles of Association.

The proposed additions to the Articles of Association creates a framework for the administration and funding of research by:

1. Making various provisions for a Research Committee.
2. Establishing a Scientific Research Trust Fund.

If the Taxation Offiee accepts Councils proposals the new Articles will be put to the Club for approval at the Annual General Meeting to be held in May.

Copies of the proposed Articles will be circulated at the General Meeting prior to the AGM. Further information can be obtained from Julian Grusovin (A.H.) 543 8627.

GROUP EXCURSIONS

All FNCV members and visitors are invited to attend any Group Excursions.

Botany Group (Fourth Saturday)

Saturday, 22nd April. Tall forest on the Ada River, Noojee area. Leader from the Latrobe Valley FNC.

Saturday, 27th May. Mornington Peninsular. Leader: Tom Sault.

Saturday, 24th June. Fungi, Beenak area. Leader: Tom May.

Fauna Survey Group

Saturday, 29th April. Leadbeaters Possum survey – Upper Yarra. Leader: Ray Gibson 874 4408 (AH).

Saturday, 13th May. Leadbeaters Possum survey – Upper Yarra. Leader: Ray Gibson 874 4408 (AH).

Saturday, 10th – Monday, 12th June.

URGENT POSITIONS VACANT

A quick glance at the back cover will reveal that we currently have four positions vacant. Each of these positions involves helping the Field Naturalists for a few hours each month. No experience is necessary so take the opportunity to get involved in the club. The **Club Reporter** keeps up to date with FNCV activities and general meetings and writes a small column for the Vic. Nat. every two months. The **Book Sales Officer** looks after book sales at general meetings. A keen person in this position would provide a very useful service to members as well as generating useful income for the club. The **Programme Secretary** organises and looks after speakers for the general meetings. The **Diary Co-ordinator** liases with group leaders to gather the information for the diary section of the Vic. Nat.

The Hon. Treasurer and the Hon. Secretary will not be standing for office again at the May AGM. Please contact Graeme Love or Sheila Houghton if you are interested in any of these very important positions.

Northeast Study Area Report

by A.C. Beauglehole

Available from:
A.C. and H.M. Beauglehole
3 Beverley Street
PORTLAND Vic. 3305

– for $10 per copy including postage.

Donations

Our thanks to the following people who included donations with their subscriptions: A.E. Perry, R.M. Warneke, D.J. Mahler, W.J.L. McCully, E. Turnbull, I.D. Philips, J.L. Miller, G. Blackburn, P.& A. Daniell, E. & H. Brentnall, A.K. Sheldon, R. & I. Barker, G.K. Paterson, W.R. Beauglehole, E.P. & O.G. Brewster, R. Williamson, R.M. & M. Bland, Dr B.J. Smith, J. Eichler, W.S. Osborne, A.J. & E.H. Farnworth, Dr S. Henry, E.M. Thompson.

Dr Charles Stanford Sutton

We have received a request for information about Dr Sutton from Professor John Pearn, who is writing a book on Australian native plants which have been named after medical practitioners. Dr Sutton was a member of the Club from 1900-1950. He was President in 1915-1916, Hon. Librarian from 1924-1943, and a member of the Plant Names Committee from Aug 1907 – June 1943. He lived in Rathdowne St Carlton, Vic. and later at 63 Toorak Road, South Camberwell. If anyone can supply further biographical details, or a photograph (which would be carefully copied and returned), please contact me, either c/- National Herbarium, or at 30 Golf Links Crescent, Dingley 3172. (Ph. 551 2708) S.H.

Field Naturalists Club of Victoria

In which is incorporated the Microscopical Society of Victoria

Established 1880

Registered Office: FNCV, c/- National Herbarium, Birdwood Avenue, South Yarra, 3141.

OBJECTS: To stimulate interest in natural history and to preserve and protect Australian fauna and flora.
Members include beginners as well as experienced naturalists.

Patron

His Excellency, The Rev Dr John Davis McCaughey, The Governor of Victoria.

Key Office-Bearers 1988-1989

President: Mr. GRAEME LOVE, P.O. Box 2018, St. Kilda West, 3182 (697 5109 B.H.)

Vice President: Mrs. SHEILA HOUGHTON, FNCV, National Herbarium, Birdwood Avenue, South Yarra, 3141 (551 2708)

Hon. Secretary: Mr. RON PEARSON, 23 Avenza St., Mentone, 3194 (584 7443)

Hon. Treasurer: Ms YVONNE GRAY, 46 Albany Cres., Surrey Hills, 3127 (890 1488 A.H.)

Subscription-Secretary: Ms DIANNE CHAMBERS, FNCV, c/- National Herbarium, Birdwood Avenue, South Yarra, 3141 (387 5146).

Editors: ROBYN WATSON and TIM OFFOR, FNCV, c/- National Herbarium, Birdwood Avenue, South Yarra, 3141 (387 5146).

Librarian: Mrs. SHEILA HOUGHTON, FNCV, c/- National Herbarium, Birdwood Avenue, South Yarra, 3141 (551 2708 A.H.)

Excursion Secretary: Miss MARIE ALLENDER, 19 Hawthorn Avenue, Caulfield, 3161 (527 2749)

Club Reporter: Vacant.

Conservation Co-ordinator: Mr. GRAEME GILLESPIE, c/- Arthur Rylah Institute, 123 Brown Street, Heidelberg, 3084 (450 8652 B.H.).

Sales Officer (Books): Vacant.

Sales Officer (Victorian Naturalist only): Mr. D. E. McINNES, 129 Waverley Road, East Malvern, 3145 (211 2427)

Programme Secretary: Vacant.

Diary Co-ordinator: Vacant.

Group Secretaries

Botany: Miss MARGARET POTTER, 1/249 Highfield Road, Burwood, 3125 (29 2779).

Day Group: Mr. D. E. McINNES, 129 Waverley Road, East Malvern, 3145 (211 2427)

Geology: Miss HELEN BARTOSZEWICZ, 16 Euroa Avenue, Nth. Sunshine, 3020 (311 5106 A.H.)

Fauna Survey: Mr. JULIAN GRUSOVIN, 1 Warriner Court, East Oakleigh, 3166. (543 8627).

Microscopical: Mrs. ELSIE GRAHAM, 147 Broadway, Reservoir, 3073 (469 2509)

MEMBERSHIP

Membership of the F.N.C.V. is open to any person interested in natural history. The *Victorian Naturalist* is distributed free to all members, the club's reference and lending library is available and other activities are indicated in reports set out in the several preceding pages of this magazine.

Subscription rates for 1988

Metropolitan Members (03 area code)	$25.00
Joint Metropolitan Members	$27.00
Country/Interstate/Retired Members	$23.00
Joint Country/Interstate/Retired Members	$25.00
Student (full-time)	$18.00
Junior (under 18; no Victorian Naturalist)	$5.00
Subscription to Victorian Naturalist	$23.00
Overseas Subscription to Victorian Naturalist	$30.00
Affiliated Clubs	$25.00
Subscriber Clubs	$23.00
Individual Journals	$3.50
Late Fee (Renewing Members), after end of March	$2.00

JENKIN BUXTON PRINTERS PTY. LTD. 1-13 ABBOTSFORD ST WEST MELBOURNE 328-4774

The Victorian Naturalist

l. 106, No. 3 May/June 1989

ublished by the FIELD NATURALISTS CLUB OF VICTORIA

egistered by Australia Post. Publication No. V.B.P. 1268

$3.50

FNCV DIARY

GENERAL MEETINGS (Second Monday)

General Meetings will be held at the Royal Society Hall, 9 Victoria Street Melbourne, until further notice. Meetings commence at 8.00 pm.

Monday, 10th July
"National Heritage Act" Mr Simon Molesworth.

Monday, 14th August
"Flora and Fauna Guarantee Act" Mr Phillip Sutton.

Monday, 11th September
"Talks by Group Members".

FNCV EXCURSIONS (First Sunday)

Sunday, 2nd July Planetarium. Meet at the Planetarium near the ticket box at 1.30 pm for the 2.00 pm session as these shows are popular. There are good displays in the museum for members able to go in the morning and if the weather is pleasant possibly have lunch in the Carlton (Exhibition) Gardens.

Sunday, 6th August Botanic Gardens. Meet outside the Herbarium at 11.30 am. Bring a picnic lunch.

Sunday, 3rd September Serendip and the You Yangs. Serendip is not normally open on Sundays but the ranger has offered to take us around, so a good attendance would be appreciated. The coach will leave Batman Avenue at 9.30 am, bring lunch.

Monday, 2nd to Friday, 6th October Little Desert. A coach has been chartered for this excursion, and accommodation twin share in bunk rooms with breakfast and dinner has been booked. Lunches are available but were not booked as some members like to provide their own. The coach will leave Melbourne at 9.30 am, bring a picnic lunch. The cost of this excursion is $250 and a deposit of $50 should be sent to Marie Allender 19 Hawthorn Avenue Caulfield North, 3161 when booking. Please book as soon as possible as numbers are limited.

PRELIMINARY NOTICE

Thursday, 4th to Tuesday, 9th January 1990. Mount Buffalo. Accommodation has been booked at the Chalet for this period. There is a camping ground at Lake Catani for members wishing to camp and campers should make their own bookings. Those desiring accommodation at the Chalet book with Marie Allender.

Note: I did not stand for re-elections this year and Mrs Joan Harry was elected as Excursion Secretary at the A.G.M., however the excursions for the rest of the year were arranged before the election so Joan would like me to continue taking bookings for current excursions. I have enjoyed my time as Excursion Secretary and would like to thank members for their support and friendship and I hope Joan will find the position as pleasant as I have.

Marie Allender

GROUP MEETINGS

Group Meetings (other than Day Group) will be held at the Astronomers Residence, Birdwood Ave., South Yarra (150 metres nearer the Shrine than the Herbarium) at 8 pm until further notice. Any member or visitor invited to all meetings.

Fauna Survey (First Tuesday)

Tuesday, 4th July. "Forest Owls." Paul Peake.

Tuesday, 1st August. "Wader Studies in Australia." Clive Minten.

Geology Group (First Wednesday)

Wednesday, 5th July.

Wednesday, 2nd August.

Botany Group (Second Thursday)

Thursday, 13th July. Member's night.

Thursday, 10th August. "Restoration Efforts at Latrobe University Wildlife Reserves." George Paras.

Microscopical Group (Third Wednesday)

Wednesday, 19th July. Collecting and Mounting Diatoms. Practical demonstration by Kevin Blaze. Meet at Plant Science Lab. Burnley Agricultural College, Swan St Burnley at 8.00 pm.

Wednesday, 16th August. Projection with the Microscope. Members can use their own microscopes. Drawing of objects under the microscope.

(continued inside back cover)

The Victorian Naturalist

Volume 106, Number 3 May / June, 1989

Editors: Tim Offor and Robyn Watson.

ISSN 0042-5184

Cover photo: Baby Carpet Snake
Photo: William Farrugia

Mammals Between Lysterfield and Cardinia Reservoir in the Shire of Sherbrooke

By Robert L. Wallis*

Introduction

Lysterfield Lake Park and the Dandenong Ranges National Park constitute two large tracts of bushland in Melbourne's outer eastern suburbs within the Shire of Sherbrooke. The land linking these Parks could be important for wildlife, and managers of these remaining patches of bush should bear in mind its conservation significance. Nearby, the Melbourne and Metropolitan Board of Works manages large areas of native vegetation around Cardinia Reservoir and Aura Vale Lake, and these sites could also provide valuable habitat for native fauna.

This note reports on mammal surveys conducted over five years in three sites near Wellington Road (Fig. 1).

Study Sites

Site 1 was surveyed in 1984. It consists of about 5 ha of private land about 1 km north-east of the northern-most edge of Lysterfield Lake Park. The site is grazed by cattle and is covered mainly by open forest dominated by peppermints (*Eucalyptus radiata* and *E. dives)* with some *E. viminalis* and *E. rubida* in the moist gullies. The vegetation has been described by O'Neill (1984).

Site 2 consists of 112 ha of uncleared bushland along Courtneys Road, about 0.5 km north of Wellington Road, and is managed by the Department of Conservation, Forests and Lands. It includes the 25 ha Ash Reserve which is well known for its orchids. In 1984 this site was razed by the Ash Wednesday fires. Three vegetation associations have been described for Site 2 by Pergl (1986), one dominated by *E. cephalocarpa* and *E. ovata,* another by *E. ovata* and *E. obliqua,*and a third by *E. cypellocarpa* and *E. ovata.* The mammals in Site 2 were surveyed in 1986 by Brooke (1986).

*Department of Science, Victoria College – Rusden Campus, Clayton, Vic. 3168

Aura Vale Lake Park (Site 3) is about 40 km from Melbourne. The vegetation of the section to the north of the lake, the 15 ha "North Shore", has been described by Fisher (1988) who recognized six vegetation communities. During 1988 mammals were surveyed in the North Shore and the adjoining Bob's Park (which is intensively used for recreation). The most common eucalypt species at Aura Vale are *E. cephalocarpa, E. obliqua* and *E. ovata.* Many parts of the Park have a thick understorey of *Leptospermum juniperinum, Acacia mucronata* and *A. myrtifolia. Stipa muelleri* is a common ground cover species.

The techniques used in this survey were live trapping, direct observation, spotlighting, predator scat analysis and identification of indirect signs. Both Elliott folding aluminium and wire mesh cage traps were used and were baited with a mixture of rolled oats, honey and peanut butter. Traps were set near dusk and cleared soon after dawn. They were usually placed in pairs, at 25 m intervals. Trapping was carried out during August and September of 1984 at site 1, October to December of 1986 at site 2 and during August of 1988 at site 3. The number of trap nights were 400 at site 1, 410 at site 2 and 243 at site 3. Spotlighting was carried out for 12, 14 and nine hours respectively by walking along tracks and along clearings. Indirect signs such as diggings, scratchings, burrows and scats were identified using Triggs (1984), and 70 PVC hair tubes (Suckling, 1978) were set in trees at site 3. Collections of 45 fox and dog scats were made between 1986 and 1988 at site 2, five raptor pellets and three fox scats in 1984 from site 1 and 29 fox, dog and cat scats from site 3 in 1988. All were sterilized and the mammalian prey remains identified using techniques described in Brunner and Wallis (1986).

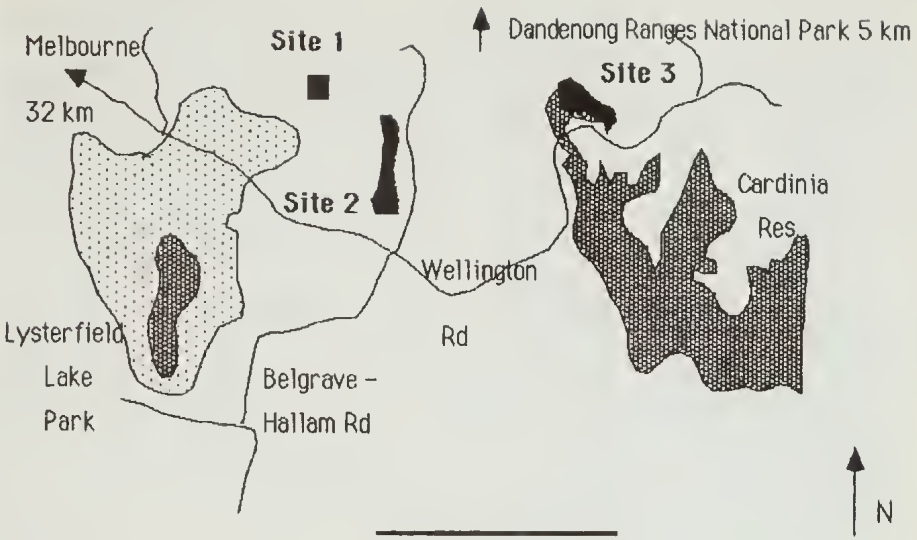


Fig. 1. Location of the study sites.

Results and Discussion

The survey shows (Tables 1 and 2) at least 13 native species live in parts of the corridor. The swamp rat (*Rattus lutreolus*) has not been previously reported in the immediate vicinity of the study sites. At Aura Vale Lake Park this species (and the other native rat *R. fuscipes*) were most commonly found in pockets of a vegetation association dominated by *E. cephalocarpa* and a dense understorey of *Leptospermum* and *Acacia* species with abundant sedges and native grasses. Strahan (1983) notes that several years regrowth after fire is necessary before a habitat can again support a breeding population of *R. lutreolus*. At this site, swamp rats were also the most common prey item in predator scats. Thus fire and introduced predators (especially foxes) may have to be limited at Aura Vale Park to ensure the survival of the swamp rat. Ash Reserve (site 2) also has a high population of swamp rats. The Reserve has been burnt every three or four years over the last twenty years and was severely burnt in the Ash Wednesday fires of 1983 (Brooke, 1986). Future burning regimes should take into account the habitat requirements and locations of populations of native small mammals, especially *Rattus lutreolus*.

Seebeck (1977 p. 170) has previously commented on mammals in suburban Melbourne by noting that several mammal species which "are abundant elsewhere, such as the dasyurid marsupials *Antechinus stuartii* and *A. swainsonii*, and the native rats *Rattus fuscipes* and *R. lutreolus* – have, in fact, disappeared without record from the suburban sprawl". Although Seebeck's study area was quite a bit closer to Melbourne, rapid urbanization has particularly affected the Lysterfield area over the last decade. The presence of three of the above species, *R. fuscipes, R. lutreolus* and *A. stuartii* in the study sites is thus encouraging. Thus the patches of remnant bushland between the larger parks such as Dandenong Ranges National Park and Lysterfield Lake Park could be of conservation value.

Table 1. Mammals surveyed at the three sites: 1 – private land near Lysterfield, 2 – Courtneys Road, 3 – Aura Vale Lake Park.

Mammals	Site 1	Site 2	Site 3
Trapping			
Number of traps nights	400	410	243
Rattus fuscipes	73	5	4
R. lutreolus		60	9
*Mus musculus**	29	5	2
Antechinus stuartii	2	5	1
*R. rattus**	1		
Spotlighting			
Number of hours	12	14	9
Pseudocheirus peregrinus	26	11	2
Trichosurus vulpecula	9	1	
Petaurus breviceps	8		
*Oryctolagus cuniculus**	4		
Other Methods			
Tachyglossus aculeatus	+	+	+
Ornithorhynchus anatinus	+		
*Mus musculus**			+
*Vulpes vulpes**	+	+	+
*Canis familiaris**	+	+	+
Nyctophylus geoffroyi	+		
Antechinus stuartii	+		
Isoodon obesulus	+		
Trichosurus vulpecula		+	+
Pseudocheirus peregrinus	+	+	+
Wallabia bicolor	+	+	+
Macropus giganteus	+		+

[*Denotes introduced species]. [+Indicates presence detected]

Table 2. Mammalian prey remains identified from five eagle pellets and three fox scats from site 1, 45 fox scats from site 2 and 29 fox, dog and cat scats from site 3.

Mammals	Site 1	Site 2	Site 3
Oryctolagus cuniculus	8	24	2
*Vulpes vulpes**		12	8
Rattus lutreolus		9	6
Pseudocheirus peregrinus	4	4	5
Antechinus stuartii	1	4	
R. fuscipes		2	1
Bos taurus			2
Homo sapiens			2
Trichosurus vulpecula	1		
Rattus sp.			1
*Canis familiaris**			1
*Felis catus**			1

[* Likely grooming hairs.]

Acknowledgements

I would like to thank the Victoria College (Rusden campus) students who participated in these projects: Phil O'Neill, Felicity Brooke, Garique Pergl and the 1988 second year Environmental Studies class. I would also like the thank Peter Menkhorst (Wildlife Management Branch, Department of Conservation, Forests and Lands) for his constructive comments on the manuscript and for providing data from the Atlas of Victorian Wildlife. Financial assistance towards some of this work was provided by the M. A. Ingram Trust, the Melbourne and Metropolitan Board of Works and the Department of Science, Victoria College (Rusden campus).

References

Brooke, F. (1986). A mammal and bird survey of Ash Reserve and adjacent lands, South Belgrave. Biology Research Project (unpublished), Victoria College – Rusden Campus, Department of Science.

Brunner, H. and Wallis, R.L., (1986). Roles of predator scat analysis in Australian mammal research. *Victorian Nat.* **103**: 79-87.

O'Neill, P. (1984). A mammal survey of property adjoining Lysterfield Park. Biology Research Project (unpublished), Victoria College – Rusden Campus, Department of Science.

Pergl, G. (1986). A study of Courtneys Rd, South Belgrave. Biology Research Project (unpublished), Victoria College – Rusden Campus, Department of Science.

Seebeck, J.H. (1977). Mammals in the Melbourne metropolitan area. *Victorian Nat.* **94**: 165-171.

Strahan, R. (1983). *Complete Book of Australian Mammals.* (Angus and Robertson: Sydney).

Suckling, G.C. (1978). A hair sampling tube for detection of small mammals in trees. *Aust. Wildl. Res.* **5**: 249-252.

Triggs, B. (1984). *Mammal Tracks and Signs: A Field Guide for South-eastern Australia* (Oxford University Press: Melbourne).

Reptiles of the Northern Section of Kinglake National Park

Michael F. Braby*

Abstract

Fifteen species of reptiles were recorded from within the northern section of Kinglake National Park during an intensive survey between September 1983 and February 1984. Two species, *Egernia whitii* and *Chelodina longicollis*, are new additions and bring the present list of reptiles recorded for Kinglake National Park to twenty-one species. Pitfall traps were used as the primary method for sampling the reptilian fauna, although nearly half (47%) of the species recorded were made by direct observations only. The species-list for the northern section is possibly incomplete and further studies may add a number of species to the present list.

*Montmorency Field Naturalists Club
C/- 21 Cromwell Street, Vic. 3095.
Present Address: Department of Zoology,
James Cook University, Qld, 4811.

Introduction

Kinglake National Park is situated approximately 65 km north-east of Melbourne, Victoria, on the slopes of the Great Dividing Range, and at present is comprised of three major regions or sections viz: western, southern and northern. The northern section, which consists of an area of about 5,400 hectares, was acquired by the National Parks Service (now within the Department of Conservation, Forests and Lands) in 1980. The occurrence and distribution of the reptilian fauna has been well documented for the southern and western sections (Hutchinson, 1979), however, there have been no systematic studies in the northern section. The aim of the present study was therefore to establish which reptile species occur within the boundaries of the northern section, and to compare this fauna with that of the two other sections of the park.

Physical features of the study area

The northern section (Fig. 1) supports a range of open-forest types which occur on strongly dissected and hilly terrain that descends northwards from the Kinglake plateau of the Great Divide. Elevation varies from about 620 m at Andrews Hill (the highest point in the park) to below 300 m at Island Creek and Captains Creek. Sedimentary rocks of Silurian and lower Devonian age underlie much of the area; the steeper slopes typically comprise shallow, stony soils while the more gentle slopes and valleys are characterised by heavy clay soils (Land Conservation Council, 1973). Average annual rainfall varies from more than 1200 mm on the Kinglake plateau, an area adjacent to the southern boundaries of the northern section and which is largely cleared for agriculture, to about 1000 mm in the northern most extremities of the park (Land Conservation Council, 1973). The area is principally drained by three major creek systems; Captains Creek, Island Creek and Boggy Creek, all of which are tributaries of the Yea River.

Methods

Reptiles were recorded within the park by captures in pitfall traps and by direct (incidental) observations made by the author and members of the Montmorency Field Naturalists Club during 1983 and 1984. Pitfall traps, comprising six traplines with a total of 67 pits (Table 1), were installed in two different areas within the park (Fig. 1). Three traplines were positioned in the south-east region of the park in the vicinity of Stringybark Track and Andrews Hill West Track near Eucalyptus Road. The other three traplines were positioned in the north-east region of the park in the vicinity of Burgan Track and Candlebark Track near Captain Creek Road. A total of twelve trapping weekends were held at irregular intervals between September 1983 and February 1984.

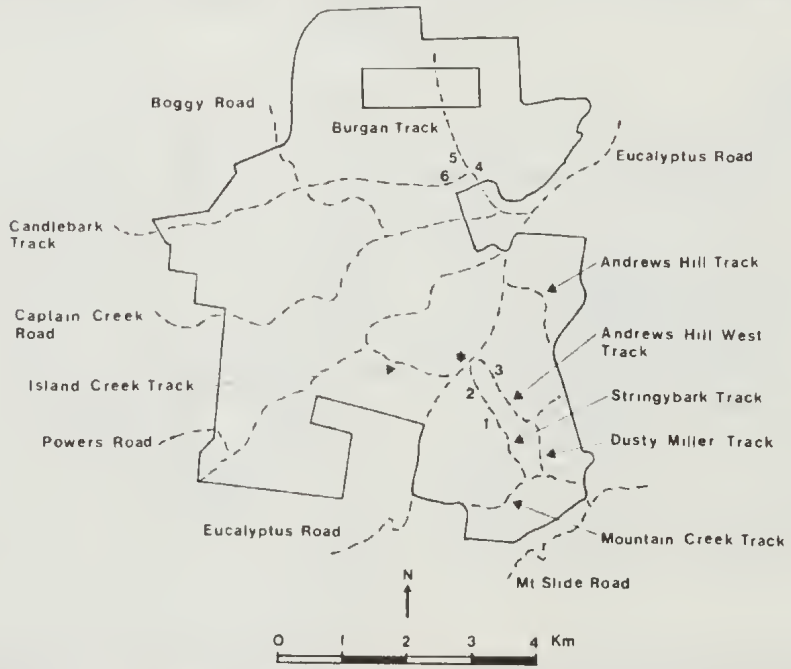


Fig. 1. Location of trapline sites 1 to 6 within the northern section of Kinglake National Park. Major roads and tracks are shown, together with Island Creek Picnic Area (*).

The Field Naturalists Club of Victoria

CALENDAR OF EVENTS, JULY - DECEMBER 1989

JULY

Sun 2 **General Excursion.** Planetarium, National Museum.

Tue 4 **Fauna Survey Group.** "Forest Owls". Paul Peake.

Wed 5 **Geology Group.**

Mon 10 **General Meeting.** "National Heritage Act". Mr. Simon Molesworth.

Thur 13 **Botany Group.** Members Night.

Sat 15 – Sun 16 **Fauna Survey Excursion.** Anglesea.

Wed 19 **Microscopical Group.** Collecting and Mounting Diatoms. K. Blaze. Meeting at Burnley Agriculture College, Burnley.

Thur 20 **Day Group.** Alexandra Gardens and National Gallery. Leader: Joan Miller 836 2681.

Sat 22 **Botany Excursion.** Operation Revegetation Nursery of the Knox Environment Society, Knoxfield. Leader: Andrew Paget.

Fri 28 **Hawthorn Juniors Meeting.** "Plant Identification".

AUGUST

Tue 1 **Fauna Survey Group.** "Wader Studies in Australia". Clive Minten.

Wed 2 **Geology Group.**

Sun 6 **General Excursion.** Botanic Gardens. Meet at Herbarium at 11.30 a.m.

Thur 10 **Botany Group.** "Restoration Efforts at Latrobe University Wildlife Reserves". George Paras.

Mon 14 **General Meeting.** "Flora and Fauna Guarantee Act". Mr. Phillip Sutton.

Wed 16 **Microscopical Group.** Projection with the Microscope. Drawing of objects under the microscope.

Thur 17 **Day Group.** Geelong by train. 10.00 a.m. Geelong train at Spencer Street. Leader: Marge Wilson 836 3521.

Fri 25 **Hawthorn Juniors.** Club Birthday Night.

Sat 26 **Botany Excursion.** Latrobe University Wildlife Reserves (Gresswell Forest). Leader: George Paras.

Sat 26 - Sun 27 **Fauna Survey Excursion.** Water-rat Studies.

SEPTEMBER

Sun 3 **General Excursion.** Serendip and the You Yangs.

Tue 5 **Fauna Survey Group.** "Brush-tailed Rock Wallabies". Bert Lobart.

Wed 6 **Geology Group.**

Sat 9 – Sun 10 **Fauna Survey Excursion.** Strathbogies.

Mon 11 **General Meeting.** Talks by Group Members.

Thur 14 **Botany Group.** "Botanical Exploration of the Port Phillip Bay Area". Dr. Sophie Ducker.

Wed 20 **Microscopical Group.** Pond Life Collecting. Pond Life under the Microscope.

Thur 21 **Day Group.** Walk. East Malvern to Alamein Station. Leader: Dan McInnes 211 2427.

Fri 22 **Hawthorn Juniors.** "Fungi".

Sat 23 **Botany Excursion.** Brisbane Ranges. Leader: Norman Plever.

Thur 28 – 30 **Fauna Survey Excursion.** Nooramunga Islands Survey.

OCTOBER

Mon 2 – Fri 6 **General Excursion to Little Desert.**

Tue 3 **Fauna Survey Group.** To be announced.

Wed 4 **Geology Group.**

Mon 9 **General Meeting.** "Antarctica" Talk by member of the Australian Conservation Foundation.

Thur 12 **Botany Group.**

Sat 14 – Sun 15 **Fauna Survey Excursion.** Water-rat Studies.

Wed 18 **Microscopical Group.** "Fun with Fungi and Microscopes". Mary Coll.

Thur 19 **Day Group.** Organ Pipes National Park. Leader: Dan McInnes 211 2427.

Fri 27 **Hawthorn Juniors.** "Alpine Wildlife and Plants".

Sat 28 **Botany Excursion.** Tynong North to Gembrook. Leader: Hilary Weatherhead.

Tue 31 **Fauna Survey Group.** Conservation and Ecology of Mallee Fowl. Joe Benshemesh.

NOVEMBER

Wed 1 **Geology Group.**

Sat 4 – Tue 7 **Fauna Survey Excursion.** Hairy-nosed Wombat Survey at Deniliquin.

Sun 5 **General Excursion.** Lerderderg Gorge.

Thurs 9 **Botany Group.** "Conservation of Basalt Plain Grassland Flora". Keith McDougall.

Wed 15 **Microscopical Group.** The Video Camera and the Microscope. New Tapes.

Thur 16 **Day Group.** The Melbourne General Cemetery. Historical Graves. Leader: Andy Blackburn 379 8960.

Fri 24 **Hawthorn Juniors.** "Bats".

Sat 25 **Botany Excursion.** Basalt Plains Flora Remnants. Leader: Keith McDougall.

DECEMBER

Sun 3 **General Excursion.** Nepean State Park.

Tue 5 **Fauna Survey Group.** Members Night.

Wed 6 **Geology Group.** Social Night and Supper.

Sat 9 – Sun 10 **Fauna Survey Excursion.** Water-rat Studies.

Thur 14 **Botany Group.** Annual Meeting and Members Night.

Microscopical Group. No meeting in December.

Day Group. No meeting in December.

Hawthorn Juniors. No meeting in December.

Dec 26 – Jan 2 **Fauna Survey Excursion.** Nooramunga Survey. (Snake and Sunday Islands).

JANUARY 1990

Thur 4 – Tues 9 **General Excursion to Mt. Buffalo.**

CONTACTS

President – Graeme Love 697 5109 (BH).
Vice President – Sheila Houghton 551 2708 (AH).
General Excursions and Information – Marie Allender 527 2749.
Day Group – Dan McInnes 211 2427
Botany Group – Margaret Potter 29 2779
Geology Group – Graeme Love 697 5109 (BH)
Fauna Survey Group – Julian Grusovin 211 4997
Microscopical Group – Elsie Graham 469 2509
Hawthorn Junior Field Naturalists Club – Jonathorn Stevenson 830 5886 or Rohan Clarke 725 8923

MEETING TIMES AND VENUES

* General meetings start at 8.00 p.m., at the Royal Society Hall, 9 Victoria Street, Melbourne until Herbarium Hall is available.

* All other meetings, except Day Group and Hawthorn Juniors also start at 8.00 p.m. at the Astronomers Residence, Birdwood Avenue, South Yarra. (Between the Shrine and the Herbarium Hall).

* Hawthorn Juniors F.N.C. meets at 7.30 p.m. at the Balwyn Primary School Hall, cnr. Balwyn and Whitehorse Roads, Balwyn. Details of their excursions when arranged can be obtained by telephoning contacts as above.

Each trapline consisted of a series of pits, with each pit spaced approximately 4m apart, and a drift-fence. Metal tins (ice-cream containers, approx. 30 cm × 23 cm diam.) were used as pits and 20 cm wide strips of black nylon mesh (household fly-wire) were used for drift-fences. The pits were sunk into the soil so that the rim was level with the ground and each pit was secured with a lid to prevent accidental entry of animals during non-trapping periods. The drift-fences were stretched over each pit, sunk about 5 cm into the soil and rose to about 15 cm above the ground, and were held upright by solid metal stakes (40 cm × 8 mm diam.) using fuse-wire and by smaller fence-wire stakes.

Nomenclature for reptiles follows that of Robertson (In prep.).

Description of trapline sites

The habitat and vegetation are detailed below for each trapline. Nomenclature of flora follows Forbes and Ross (1988).

Trapline No. 1

Site is on a gentle moist slope of a southern aspect, adjacent to O'Connor Weir. Vegetation is an open-forest of *Eucalyptus obliqua* and *E. radiata* with some *E. cypellocarpa*. Understory consists of a dense cover of *Bedfordia arborescens* with *Pteridium esculentum, Goodenia ovata, Olearia lirata, Acacia verticillata, Coprosma quadrifida, Spyridium parvifolium* and *Cyathea australis*, and some *Pimelea axiflora, Acacia mucronata, Pomaderris aspera* and *Pultenaea daphnoides*.

Table 1. Location, number of pits and length of each trapline.

Trapline No.	Location	No. of Pits	Length (m)
1	Stringybark Track (O'Connor Weir)	9	31
2	Stringybark Track	9	35
3	Andrews Hill West Track	13	62
4	Burgan Track	9	29
5	Burgan Track	11	46
6	Candlebark Track	16	78
Total		67	281

Trapline No. 2

Site is relatively flat, heathy and open due to recent controlled burning. Vegetation is an open-forest of *Eucalyptus obliqua* and *E. radiata*. Understorey is fairly open, with a sparse cover of *Kunzea ericoides* and a dense ground cover of *Hakea sericea, Acacia mucronata, A. verticillata, A. ulicifolia, Goodenia ovata, Spyridium parvifolium, Pteridium esculentum, Xanthorrhoea minor* and *Amperea xiphoclada* and some *Acacia myrtifolia* and *Cyathea australis*.

Trapline No. 3

Site is located on a gentle west-facing slope in peppermint-heath forest. Vegetation is an open-forest of *Eucalyptus obliqua* and *E. dives* with some *E. radiata*. Understorey consists of a dense cover of *Banksia spinulosa* and *Hakea sericea* with a more open ground cover of *Xanthorrhoea minor, Acacia mucronata, A. ulicifolia* and some *Epacris impressa, Baeckea ramosissima, Amperea xiphoclada, Correa reflexa, Monotoca scoparia* and *Platylobium formosum*.

Trapline No. 4

Site is located on a gentle west-facing slope adjacent to a moist fern gully. Vegetation is a tall open-forest of *Eucalyptus obliqua* with some *E. radiata* and *E. ovata*. Understorey is very open with a sparse cover of *Acacia melanoxylon* and a dense ground cover of *Lomandra longifolia* and *Pteridium esculentum* with *Coprosma quadrifida* and some *Olearia lirata, Cassinia aculeata, A. verticillata, Epacris impressa* and *Blechnum nudum*.

Trapline No. 5

Site is relatively flat and floristically poor, possibly due to past habitat disturbance through timber removal. Vegetation is an open-forest of *Eucalyptus radiata* and *E. obliqua*. Understorey is open, consisting of a sparse cover of *Kunzea ericoides* with a dense ground cover of *Pteridium esculentum*, and some *Epacris impressa, Pultenaea gunii* and *Acacia verticillata*.

Trapline No. 6

Site is on a slope with a northern aspect near a ridge. Vegetation is an open-forest of *Eucalyptus dives*. Understorey is very open with a sparse cover of *Kunzea ericoides* and a more open ground cover of *Epacris impressa, Monotoca scoparia* and some *Acrotriche serrulata* and *Tetratheca ciliata*.

Results

The survey resulted in a total of fifteen species of reptiles being recorded from within the boundaries of the northern section of Kinglake National Park (Table 2). The species recorded represent five families: Chelidae, Agamidae, Scincidae, Varanidae and Elapidae with the lizard family Scincidae comprising the greatest number of species. The number of reptiles captured in pitfall traps for each trapline are summarised in Table 3, in which a total of 70 captures representing six different species was achieved. Although trapline sampling times (TST) varied considerably, the number of different reptile species recorded at each trapline were similar, with four species captured (or recorded) at traplines 2, 3, 4, and 6, and three species at traplines 1 and 5 (Table 3).

The most common reptiles encountered during the survey were three species of skinks; *Sphenomorphus tympanum, Lampropholis guichenoti* and *Leiolopisma coventryi*, all of which were captured in relatively high numbers by pitfall traps (Table 3). *S. tympanum* and *L. guichenoti*, in particular, were recorded in all areas of the park that were visited during the survey. *S. tympanum* was invariably associated with fallen logs, while both *L. guichenoti* and *Leiolopisma coventryi* tended to inhabit the litter layer. *S. tympanum* was also recorded, but not captured, at Trapline No. 1.

The skink *Nannoscincus maccoyi* was recorded in comparatively lower numbers, with seven individuals captured by pitfall traps. One specimen was observed, but not captured, at Trapline No. 1, and another specimen was also recorded on Powers Road, approximately 500 m from within the park boundary.

Five lizard species: *Egernia whitii, E. saxatilis, Pseudemoia spenceri, Amphibolurus muricatus* and *Lampropholis mustelina* were recorded in very low numbers. Two specimens of *E. whitii* (NMV, D57305) were recorded near

Table 2. Checklist of reptiles recorded from Kinglake National Park and their occurrence within the northern and southern and western sections. + Recorded from section, – Not recorded from section.

Species	Northern Section	Southern & Western sections**
Family: Chelidae		
**Chelodina longicollis* (Shaw) Long-necked Tortoise	+	–
Family: Scincidae		
Egernia saxatilis Cogger Black Rock Skink	+	+
**E. whitii* (Lacepede) White's Skink	+	–
Nannoscincus maccoyi (Lucas & Frost) McCoy's Skink	+	+
Lampropholis delicata (De Vis) Delicate Skink	–	+
L. guichenoti (Dumeril & Bibron) Garden Skink	+	+
L. mustelina (O'Shaughnessy) Weasel Skink	+	+
Leiolopisma coventryi Rawlinson Coventry's Skink	+	+
L. entrecasteauxii (Dumeril & Bibron) Grass Skink	–	+
L. duperreyi (Gray) Three-lined Skink	–	+
Pseudemonia spenceri (Lucas & Frost) Spencer's Skink	+	+
Sphenomorphus tympanum (Lonnberg & Anderson) Southern Water Skink - CTF	+	+
Tiliqua nigrolutea (Quoy & Gaimard). Blotched Blue-tongued Lizard	+	+
T. scincoides (Shaw) Common Blue-tongued Lizard	–	+

Andrews Hill West Track, near Trapline No. 3, and a small population was located near Burgan Track in a area which is presently outside the park boundary. *E. saxatilis* was recorded from three areas, with individuals sighted (some captured by hand) near Andrews Hill Track (northern end), Burgan Track (near Trapline No. 5), and Mountain Creek Track (eastern end). All specimens encountered were associated with fallen logs. One specimen of *Pseudemoia spenceri* was sighted near Andrews Hill Track, near Andrews Hill, and a small population (NMV, D57360) was located amongst a fallen tree near Mountain Creek Track (eastern end). A single specimen of the agamid *Amphibolurus muricatus* was captured at Trapline No. 6 and a further specimen was sighted near Burgan Track. *Lampropholis mustelina* was recorded from several areas, with single specimens sighted at both Island Creek Picnic Area and near Mt. Slide Road (near Mountain Creek), while two individuals were captured by pitfall traps. All specimens were encountered in cool, moist microhabitats.

Two species, *Amphibolurus diemensis* and *Austrelaps superbus*, were recorded by single observations. One specimen of *A. diemensis* was found on Andrews Hill West Track, near Andrews Hill, while two specimens of *A. superbus* were sighted together on Stringybark Track near Eucalyptus Road.

The skink *Tiliqua nigrolutea* and the elapid *Notechis scutatus* were both recorded as road kills. A single specimen of *T. nigrolutea* was found on Eucalyptus Road, approximately 1 km south of Captain Creek Road, and single specimen of *N. scutatus* was also found on Eucalyptus Road near Island Creek Picnic Area.

Two species, *Chelodina longicollis* and *Varanus varius*, were not encountered during the survey, but both have been

Table 2. Cont.

Family: Agamidae		
Amphibolurus diemensis (Gray) Mountain Dragon	+	+
A. muricatus (Shaw) Jacky Lizard	+	+
Family: Varanidae		
Varanus varius (Shaw) Lace Monitor	+	+
Family: Elapidae		
Austrelaps superbus (Gunther) Copperhead Snake - LF	+	+
Notechis scutatus (Peters) Eastern Tiger Snake	+	+
Cryptophis nigrescens (Gunther) Eastern Small-eyed Snake		+
Dysdalia coronoides (Gunther) White-lipped Snake	–	+
Total	15	19

* New records to park
** Data from Hutchinson

Table 3. Numbers of reptile species captured by pitfall traps. Trapline sampling times are for diurnal hours only.

Species	Trapline Number						Total
	1	2	3	4	5	6	
Amphibolurus muricatus						1	1
Nannoscincus maccoyi	+	1	4	1		1	7
Lampropholis guichenoti		7	3		10	12	32
L. mustelina			1	1			2
Leiolopisma coventryi	2	2	12	1	1		18
Sphenomorphus tympanum	+	1		1	4	4	10
Total Numbers	2	11	20	4	15	18	70
Total Species	3	4	4	4	3	4	6
Trapline Sampling Time (TST) (hrs)	168	236	230	120	247	257	
Total Trapline Sampling Time (TST x No. pits) (hrs)	1512	2124	2990	1080	2717	4112	14535

+ Species recorded at trapline site but not captured in pitfall traps.

recorded from within the northern section. A small population of *C. longicollis* was apparently introduced into the park (Island Creek) by rangers (P. O'Connor, pers. comm.), while positive sightings of *V. varius* have been reported by rangers from the Andrews Hill area in the south-eastern end of the park (D. Munday, pers. comm).

Discussion

The reptile fauna recorded as occurring in the northern section of Kinglake National Park compares favourably with the total of nineteen species listed by Hutchinson (1979) for the southern and western sections of the park. Two species, *Chelodina longicollis* (introduced by rangers) and *Egernia whitii* are not listed for the southern and western sections and represent new additions, bringing the present list of reptiles recorded for Kinglake National Park to twenty-one species (Table 2).

As few observations and captures were made during the relatively short survey period the list of fifteen species recorded for the northern section is possibly incomplete, and further studies and research may reveal a number of species not reported here. For instance, six species not currently listed for the northern section are known to occur in Kinglake National Park (Table 2), and a further seven species are recorded from areas adjacent to the park (Hutchinson, 1979). Several regions within the northern section, particularly the south-west, west, north-west and central areas, were not examined in this study and it is therefore likely that some of these species may well occur within these sections of the park.

Pitfall trapping is generally regarded to be a convenient and efficient method of sampling the reptilian fauna (eg. Cockburn *et al.*, 1979; Mather, 1979; Menkhorst, 1982). In addition to obtaining a measure of species diversity for particular sites, the method allows quantitative comparisons to be made between faunal assemblages of different habitats, and to gain information on the status and habitat dependence of certain species. In the present study, however, meaningful comparisons between trapline sites and associated plant communities are not possible due to low captures of both reptile species and numbers. With the exception of perhaps *Lampropholis guichenoti* and *Leiolopisma coventryi*, it is difficult to assess measures of relative abundance for most species, and how such numbers may vary between habitats, from the comparatively low capture data (Table 3). Consequently, further work is needed to determine the status and habitat dependence for most species occurring in the northern section.

Hutchinson (1979) noted that *L. guichenoti* and *L. coventryi* tended to frequent different habitats such that the two species show only limited overlap. Although these two small, common skinks were often sampled together it was found that, where captures were relatively high, only one species predominated, suggesting some habitat partitioning. For example, in the dense (shady) understorey at Trapline No. 3 captures of *L. coventryi* greatly exceed those of *L. guichenoti,* while the reverse occurred at traplines 2, 5 and 6 where *L. guichenoti* was prevalent in the more open (sunnier) sites.

The limited success achieved by use of pitfall traps in this study is also revealed by the fact that of the reptile species captured, all were also recorded by incidental sightings. Furthermore, only six species (40%), of the total of fifteen recorded during the survey, were sampled by pitfall traps, and seven species (47%) were recorded by direct observations only. These findings perhaps suggest limited usefulness of this sampling technique, at least in areas such as Kinglake. The low capture success, however, may be largely attributed to the trapping regime employed. Short trapping periods (eg. weekends) were held at irregular intervals over the six month survey period, rather than sampling by the more conventional method of trapping intensively over longer

(eg. weeks). The latter technique allows for variation in weather, by increasing the chances of sampling during favourable (hot and sunny) conditions, and is highly preferable where traplines deteriorate with time. During the course of the present study regular disturbances to drift-fences by large animals (wombats, swamp wallabies) were experienced in which the traplines rapidly declined in condition, rendering them less likely to capture animals as the survey progressed.

More significantly, the nature of the Kinglake climate of relatively low temperatures and overcast conditions may have been responsible for the comparatively low capture rates (Table 4). Cool and warm conditions, which prevailed for over two-thirds (69.2%) of the total sampling period during the survey, led to very few captures (19 in total or 27.1%) compared with hot conditions (51 captures or 72.9%). Similarly, days with less than fifty percent sunshine, which accounted for over half (58.4%) of the total sampling time, resulted in slightly fewer captures (26 in total or 37.1%) than days with fifty percent or more sunshine (44 captures or 62.9%). These observations indicate that weather had a strong influence on capture success and hence reptile activity.

Acknowledgements

I wish to thank Dr. Mark Hutchinson (La Trobe University) for comments on the manuscript, and Mr. Peter Robertson (Department of Conservation, Forests and Lands) for assistance and advice. The author also thanks Mr. Cam Beardsell (Department of Conservation, Forests and Lands) for assistance with plant identifications, and is particularly grateful to members of the Montmorency Field Naturalists Club for their assistance and involvement with the project. Ms. Carmel Conboy kindly typed the manuscript. Reptiles were trapped in the park under Permit Number 84-84 and collected under Research Permit No. 856/24.

References

Cockburn, A., Fleming, M. and Wainer, J. (1979). The comparative effectiveness of drift fence pitfall trapping and conventional cage trapping of vertebrates in the Big Desert, north-western Victoria. *Victorian Nat.* **96**: 92-95.

Forbes, S. J. and Ross, J. H. (1988). *A census of the vascular plants of Victoria.* (National Herbarium of Victoria).

Huchinson, M. N. (1979). The reptiles of Kinglake National Park. *Victorian Nat.* **96**: 124-134.

Land Conservation Council of Victoria (1973). Report on the Melbourne study area.

Mather, P. B. (1979). An examination of the reptile fauna of Wyperfeld National Park using pitfall trapping. *Victorian Nat.* **96**: 98-101.

Menkhorst, P. W. (1982). Pitfall trapping of reptiles in the Big Desert, Victoria. *Victorian Nat.* **99**: 66-70.

Robertson, P. (In prep.). List of Victorian amphibians and reptiles. ARI Technical Report.

Table 4. Total numbers of reptiles captured by pitfall traps in relation to daily maximum temperature and percentage daily sunshine. Three arbitrary temperature ranges are given each with two different levels of daily sunshine.

Maximum Daily Temperature	Daily Sunshine	No. Reptiles Captured	Total Trapline Sampling Time hrs.	%
Cool (15-19°C)	$< 50\%$	0	1596	11.0
Cool (15-19°C)	$> 50\%$	4	462	3.2
Warm (20-24°C)	$< 50\%$	12	6328	43.5
Warm (20-24°C)	$> 50\%$	3	1672	11.5
Hot (25-29°C)	$< 50\%$	14	566	3.9
Hot (25-29°C)	$> 50\%$	37	3911	26.9
Total		70	14535	100.0

A Stalked Jellyfish (Stauromedusae), Found at Black Rock, Port Phillip Bay. A First Recording in Australia.

D. E. McInnes

For a number of years I have been interested in observing microscopic marine life and for this purpose have arranged a series of four litre ice cream containers as marine aquariums. The lids of the containers, cut to fit, serve as shelves which are resting on margarine tubs. On the shelves are placed a number of petri dishes. Well aerated sea water is kept 20 mm above the top of the petri dishes (McInnes 1982).

To make an observation, all that is necessary is to lift out the petri dish, place it in a larger petri dish and place this on the stage of the microscope (any water spilt goes into the larger dish instead of onto the microscope). I make my first observations with a low power stereoscopic microscope. If higher powers are needed, the depth of the water in the small petri dish is reduced to 5 mm and the outside carefully dried. The dish can then be placed on the stage of a binocular microscope and observed at higher magnifications. Using a 40x water immersion objective that can be dipped straight into the petri dish, magnifications of 400x or even 800x are possible.

This set up has enabled me to see hydroids producing their medusae, the life story of strange foraminifera, protozoans of all shapes and colours (one a bright pink), polycheate worms of all sorts, mollusc eggs hatching into veligers, the blood stream in sea squirts, a marine amoeba packed full of cubic crystals, in fact a fascinating picture of marine microscopic life at any time.

Back in February 1982, while exploring one of the petri dishes, I found something new to me. At first I thought it was just a loose tentacle of the "walking jellyfish", the medusa of the hydroid *Eleutheria* (Bishop 1972). Figure 1 shows what was seen. The total length was only 0.5 mm so without a microscope it would never have been seen. Closer observation showed

Fig. 1. Early stage of stalked jellyfish found in the petri dishes, elbow starting to form (bar = 0.25 mm).

that it had attached itself to the glass by a disc at one end, and was swaying from side to side. There were 3 tentacles and what looked like a rounded bud that might later become a fourth tentacle. Each tentacle had a round knob of stinging capsules and the stem of the tentacle had an elbow with a flattened bump at the elbow. What could it be?

A few days later I found a specimen the same length (0.5 mm) with four tentacles at the same stage of development (fig. 2). Dr. Dick Hamond, a marine biologist, saw the specimens and suggested that they may be the young of a jellyfish, possibly a member of the genus *Lucernaria*. This genus belongs to the group of jellyfish that have a stalk with an adhesive base which

attaches to the stems of seaweed and the jellyfish hang downward.

During March I saw many similar specimens in the petri dishes. All specimens were the same length but the number of tentacles varied. Some had one tentacle, others had 3 or 4, and one specimen each of 5 and 6 tentacles. I then found a specimen with 8 tentacles. This specimen was longer (1.5 mm) and is shown in figure 3, (note the elbows).

This organism demonstrates a rapid bending movement of the body when prey such as small shrimp swim past. The movement is similar to the action of the freshwater hydra. If a small shrimp came into contact with the tentacles of the jellyfish, the stinging capsules at the end of the tentacle shot out their barbed threads and captured the shrimp. The tentacles then drew the prey to the mouth in the centre of the tentacles where it was engulfed, ready for digestion.

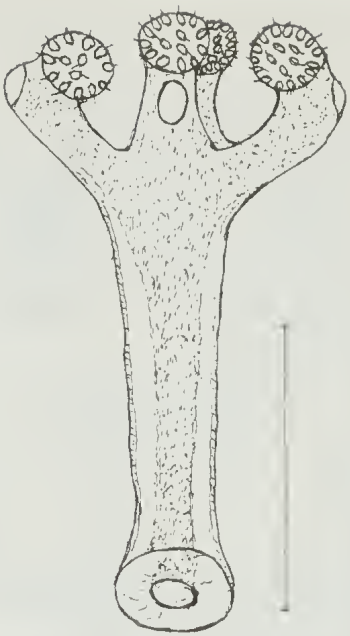


Fig. 2. Later stage of stalked jellyfish (bar = 0.25 mm).

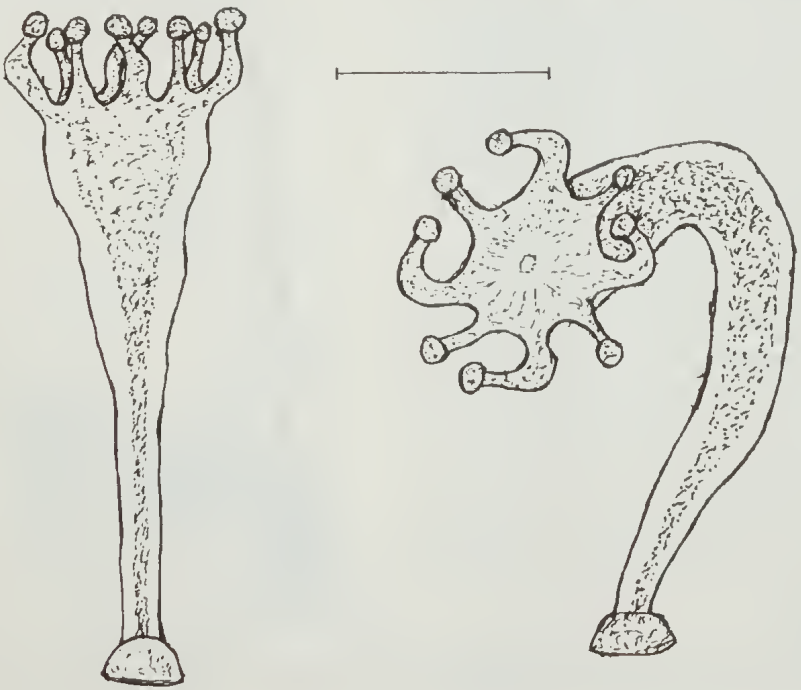


Fig. 3. Later stage with eight tentacles all showing the elbowed shape (bar = 0.5 mm).

A search for information about *Lucernaria* showed many forms of stalked jellyfish but none seemed to fit the pattern of the specimens found at Black Rock. A specimen was exhibited at a meeting of the Field Naturalists Club of Victoria in May 1984 under the heading "A stalked jellyfish from the family Lucernaridae". Later, an illustration of *Stenoscyphus inabai* from Japan in 'The Medusae of the World' by P. L. Kramp just seemed to fit the details of the Black Rock specimens. Could it be the same species?

The higher jellyfish or Scyphozoa generally have a sessile polyp stage when immature which is followed by a free-swimming medusa stage when mature. However, there is one order, the Stauromedusae, in which the members are not free-swimming when mature but stay attached to some substrate by a stalk. The Stauromedusae are generally considered to live in deep or colder waters.

In the book 'Marine Invertebrates of Southern Australia' a chapter on Cnidaria by Dr. R. V. Southcott (1982) contains the statement that "no Stauromedusae are known to occur in southern Australian waters." This made me wonder about the identity of the Black Rock specimens and I wrote to Dr Southcott to ask if he was interested in any specimen that I could send him. Dr. Southcott replied expressing interest in any specimens that could be sent to him. Dr. Southcott later sent me a copy of the article by K. Kishinouye (1902) which describes a new genus in the Stauromedusae, *Stenoscyphus inabai* (fig. 4). The illustrations and description of this species fitted perfectly with the specimens found at Black Rock.

Encouraged by Dr. Southcott's interest I began a series of notes on specimens of *Stenoscyphus* found at Black Rock and sent these and the specimens to Dr. Southcott who has sent them on to the Adelaide Museum.

The description of *Stenocyphus* gave a maximum length of 25 mm and this gave me some idea of what I may find. And where and how did I find them? Well – I have only found them on the brown seaweed *Cystophora exspansa* which grows just below the low tide level (the sublittorial zone). It is seasonal in growth and

Fig. 4. Illustration of *Stenoscyphus inabai* by K. Kishinouye (1902). Journal of the College of Science, Japan.

disappears completely in late December and January. I collect three buckets of the seaweed and sea water and then examine every part of the seaweed at home under a low power stereo microscope. This takes 2 or 3 days and if I'm lucky I may find 1 or 2 specimens of the stalked jellyfish. The colour of *Stenoscyphus* matches the brown colour of the seaweed and it is only the movement of the animal that allows it to be detected.

Most of the *S. inabai* found on the *Cystophora* are from 4 to 9 mm in length. A change in the form and number of tentacles takes place with time. The eight elbowed tentacles seen in the early stage (fig. 3) change drastically. The sphere of stinging capsules (nematocysts) gradually becoming absorbed into the bump at the elbow which becomes an adhesive circle (the anchor) situated on the outer side of the bell edge (exumbrellar surface) (fig. 5).

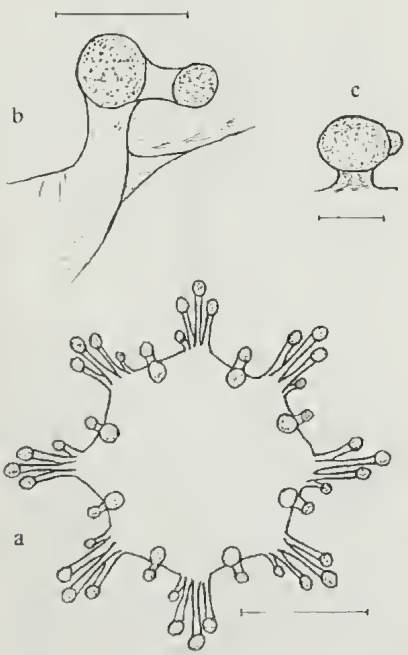


Fig. 5a. Sketch of outer side of bell (with stalk omitted) showing position of the elbowed tentacles and the secondary tentacles. (bar = 0.5 mm). **b.** The shrinking of the sphere of stinging capsules into the adhesive anchor (bar = 0.25 mm). **c.** The elbowed tentacle nearly reduced to the round adhesive anchor (bar = 0.25 mm).

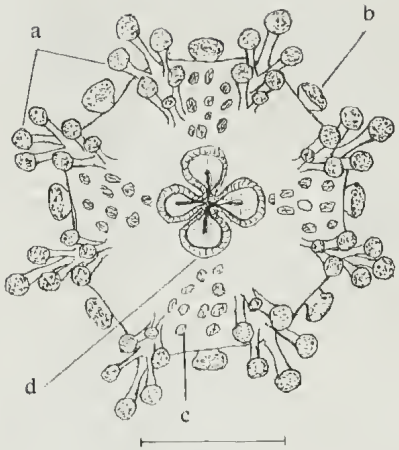


Fig. 6. A view of the subumbrellar or inner side of the bell in an everted position showing a) Secondary tentacles, b) Anchors, c) Nematocyst clusters and d) Four-lobed mouth (bar = 1.0 mm).

Inside the edge of the bell (the subumbrellar surface), between the anchors, there develops a clump of stalked tentacles called 'secondary tentacles'. Each tentacle has a rounded knob of stinging capsules. The number of tentacles increases with the age of the medusa e.g. 4 mm medusa had groups of 3 secondary tentacles, 6 mm medusa had groups of 6 tentacles and 9 mm medusa had 8 tentacles. The largest medusa I have found was 23 mm long and there were 11 tentacles in the groups but Kishinouye (1902) writes of 25 tentacles in groups. Between the groups of secondary tentacles, embedded in the subumbrellar surface are groups of nematocysts and in the centre of the bell is the four-lobed mouth (fig. 6) which will expand to swallow a shrimp as long as the bell is wide.

At an F.N.C.V. meeting in August 1986 a couple of medusae were shown under the microscope but this time as *Stenocyphus inabai* and as a possible first record for Australia.

Experiments were made to keep the medusae alive in jars. Small shrimps *(Chiltonia subtenuis?)* were placed in the jars as food for the medusa and some green sea lettuce *(Ulva)* or a fragment of the brown seaweed *(Cystophora)* as food for the shrimps. The ideal shrimp size seemed to be the width of the bell of the medusa or smaller because they could be caught and swallowed by the medusa. Although several shrimps were kept in each jar no more than one outer skin was found ejected per day.

The water was changed each day due to the large amount of excreta from the shrimps. The reaction to the presence of the shrimps seemed at most times sluggish. Even when a shrimp bumped into the tentacles and became attached, the medusa was very slow to bring other tentacles to grasp the shrimp and very often just let the shrimp struggle away. Large shrimps had a tendency to chew at the stalk of the medusa and twice killed specimens. Sometimes the bell of the medusa will remain party closed and at other times the bell may be wide open, even partly everted with the mouth almost turned inside out (fig. 6).

During September I was lucky to find an 18 mm medusa apparently quite mature as it had the double lines of gonad cells along the stalk (fig. 7). Although the medusa was quite active, the stalk when it bent over, flattened like a flat bicycle tube. In younger medusae the stalk always remains a firm round tube whereas in other large medusae found (22 and 23 mm long) the stalks tend to flatten.

The 18 mm medusa had 10 secondary tentacles in the groups. Hoping it might release the gonads if mature, the medusa was placed in a jar with shrimps as food. One day at 5 pm the medusa slowly ejected dozens of minute spheres. At 7 pm there were hundreds of spheres on the bottom of the dish. They were round and granular in appearance and measured 0.04 mm in diameter. I moved the medusa and the shrimps out of the jar so that the eggs? (or gametes) could be observed during development. The next day more eggs? were ejected and some were placed in different dishes.

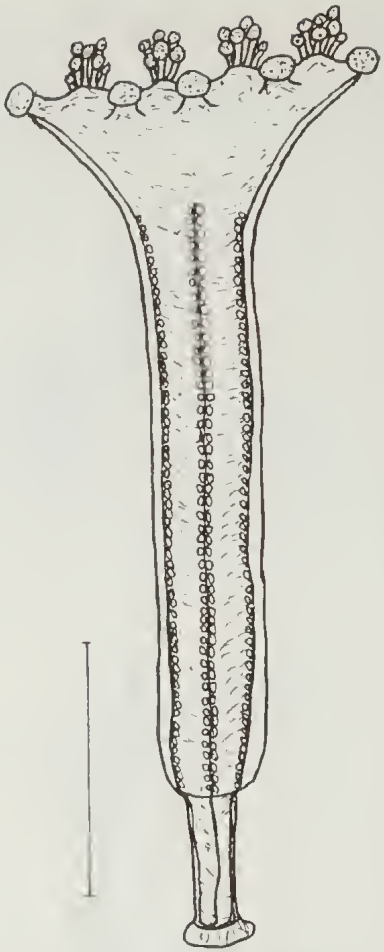


Fig. 7. The mature stalked Jellyfish with the double lines of gonad sacs is very likely *Stenoscyphus inabai*, usually found in Japanese waters (bar = 5.0 mm).

One odd aspect was that all the area around the tentacles was blown up and quite thick between the inner and outer layers of the bell but this returned next day to its normal thin layer. Another oddity was the ejection with the eggs? of what seemed to be nematode worms but examination with higher powers of the microscope showed the "worms" to be fine filaments 0.9 mm long and 0.07 mm wide

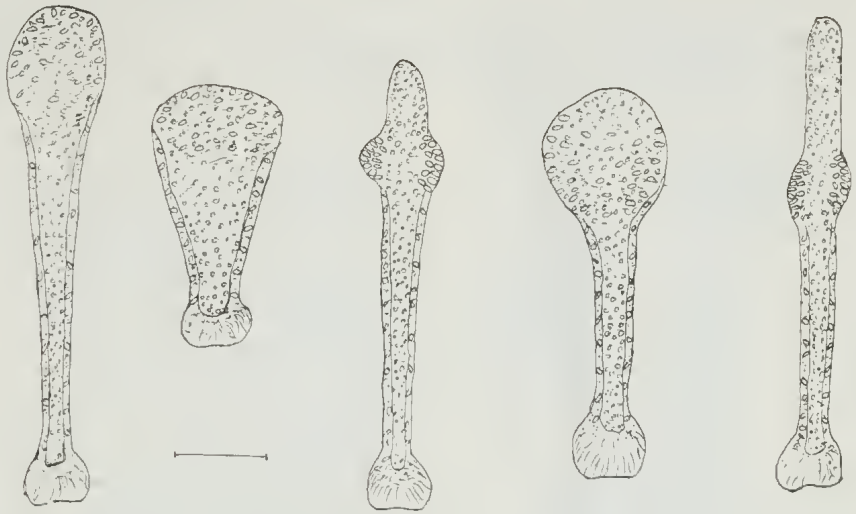


Fig. 8. Early stage. Various shapes of one medusa during a period of 2 hours (bar = 0.1 mm).

and covered on one side with fine cilia. The cilia could be seen beating vigorously. Apparently the filaments are gastral filaments of the medusa that break free at maturity.

I thought the medusa might now disintegrate and be lost so I put it into formalin to send to Dr. Southcott.

Observation of the eggs? continued each day to note any development but in every dish the story was the same, the number of eggs? became less and less each day, examination with high powers revealed the answer, a tiny ciliate had 5 eggs? inside it and even an amoeba only 0.06 mm long and 0.03 mm wide was engulfing the eggs? which were as wide as the amoeba. As there were dozens of ciliates and amoebae no wonder the eggs? disappeared.

None of the eggs? that escaped the predators showed any sign of development, just a slow breakdown of the outer skin and the granular contents. Perhaps the eggs? were not fertile, perhaps it is necessary to have medusae to shed their gonads and cause fertilization.

The hatching of the eggs? into the first stage is a gap in my observation of the life cycle of *Stenoscyphus* but some very early stages were seen in the petri dishes and these are shown in Figs 8, 9 and 10. The smallest stage is only 0.17 mm in length not much bigger than the eggs? at 0.04 mm in diameter.

At Black Rock it seems that the minute forms appear around February to April, in July to August middle sized medusae can be seen, then from September to early December the fully mature medusae with their gonad sacs are about. This life cycle seems to follow the life cycle of the brown seaweed *Cystophora exspansa* that disappears in late December and January.

This raises the question: how is the medusa or rather in what form is the species carried through the period of no seaweed? Are some eggs? in a dormant cyst during this time? An interesting question for someone to find the answer.

The stalked jellyfish has been found at Black Rock and perhaps this article may encourage others to look carefully among the brown seaweeds to see where else they occur.

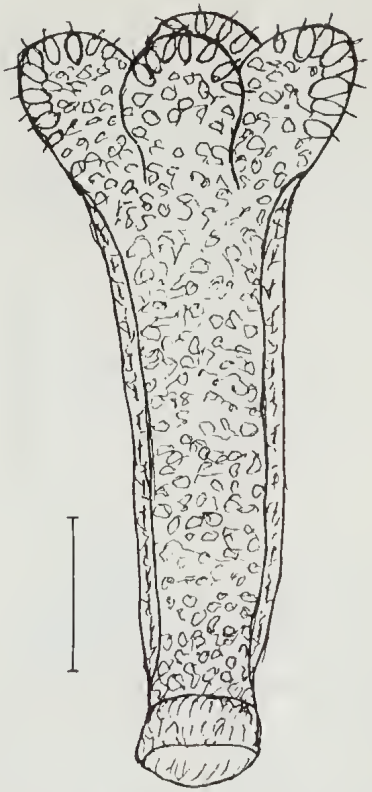


Fig. 9. Early stage. Elbow stage not yet developed (bar = 0.05 mm).

Fig. 10. Earliest stage found. Stinging cell spheres just starting to form (bar = 0.05 mm).

References

Bishop, H.H. (1972). The ambulatory medusa or walking bud of *Clavatella prolifera*. *Vic. Nat.* **89**: 16-9.

Kishinouye, K. (1902). Some new Scyphomedusae of Japan. *Journal of the College of Science, Imperial University Tokyo*, Japan. **17**: 2.

McInnes, D.E. (1982). Some observations on Hydroids at Black Rock. *Vic. Nat.* **99**: 159-63.

Southcott, R.V. (1982). *Marine Invertebrates of Southern Australia. Part I.* Pages 115-159.

Uchida, T. (1929). Studies on the Stauromedusae. Japan. *Journal of Zoology.* **2**: 103-113.

Marine Life Diving Guide

The FNCV is publishing a field guide to the marine life off Wilsons Promontory. This book, the result of intensive underwater research by authors Margaret O'Toole and Malcolm Turner, is designed to assist snorkellers and scuba divers to identify the plants and animals likely to be encountered in the Marine Parks surrounding Wilsons Promontory. It contains not only photographs and text to enable identification but also describes the best places to dive and gives hints on safety, underwater photography, equipment and the logistics of a diving expedition. The guide will also be applicable to other waters off south-eastern Australia and should be welcomed by shore-bound beachcombers as well. It will be the first publication of its kind in Australia. The guide, which will be produced with funds from the Australian Bicentennial Authority, should be available in early 1989.

New Host Records for Adults of Some Fungus-feeding Beetles (Coleoptera) from New South Wales and Queensland, Australia

Trevor J. Hawkeswood*

Abstract

New fungal hosts from the Basidiomycetes (Polyporaceae) are recorded for some fungus-feeding beetles from New South Wales and Queensland, Australia. *Zopherosis georgei* White (Zopheridae) and *Byrsax macleayi* Pascoe (Tenebrionidae) are recorded from the cosmopolitan fungus, *Ganoderma applanatum* (Fries) Karsten (Polyporaceae). Two species of *Scaphidium*, *S. exornatum* (Oberthur) and *S. punctipenne* Macleay (Scaphidiidae) are recorded feeding on two unidentified species of *Poria* (Polyporaceae), while *Cis victoriensis* Blackburn (Cisidae) feeds and breeds in *Polystictus cinnabarinus* (Jacq. ex Fr.) Cooke (Polyporaceae).

Zopheridae

Zopherosis georgei White

The Zopheridae is a small family of beetles which occurs in North and South America, Africa, south-east Asia and Australia. *Zopherosis georgei* is the only species of the family in Australia, where it appears to be confined to the montane rainforests of north-eastern New South Wales. The beetle is dark brown to dull brownish-black in colour, very heavily and strongly sclerotized and the dorsal surface of the body is ornamented with deep pits and prominent tubercles of various sizes and shapes. Males are similar in gross morphology and size to the females; the body length of the adult beetle varies only slightly from 25-30 mm. The sides of the prothorax are distinctive in that they have deep channels for the reception of the antennae. Nothing previously has been recorded on the biology of *Z. georgei* and the early life stages are unknown.

* 49 Venner Road, Annerley, 4103, Queensland, Australia.

On 21 November 1987 (at about 1430 hrs) the author and his wife observed 3 specimens of *Z. georgei* feeding on the fresh fruiting bodies of *Ganoderma applanatum* (Fries) Karsten (Polyporaceae) at Mt. Warning, north-eastern New South Wales (ca. 28°30'S, 153°30'E). The fungi were growing on the rotting, standing trunk of a large coachwood *Ceratopetalum apetalum* D. Don (Cunoniaceae), a large rainforest tree of coastal central and north-eastern New South Wales and south-eastern Queensland. Over 30 fruiting bodies were counted on the tree trunk which was about 6 m in height. The three beetles occupied separate fungi between 0.8 and 3.2m above ground level. Two of the specimens were captured and photographed on the underside of a fungus and later released. When first encountered, the beetles were feeding on the white portion of the fungus containing the spores and spore tissues from a position underneath the fungus. They rested against the tree trunk where their cryptic coloration provided them with excellent camouflage. Only when feeding on the white portion of the fruiting bodies could these cryptically coloured beetles be observed, and it is interesting to note that the colour and texture of the beetles matches precisely that of the dark brown, gnarled, rough, upper main portion of the fungus. It is possible *Z. georgei* also breeds in the fruiting bodies but since most of the fungi that were able to be examined were fresh, no evidence of larval infestations were found. Their cryptic coloration may be one factor why this beetle has often been overlooked by collectors but more importantly, it could be its limited distribution and apparent rarity. This is the first published fungal host record for *Z. georgei*.

Tenebrionidae

Byrsax macleayi Pascoe

The genus *Byrsax* Pascoe is represented in Australia by at least 4 species, confined to New South Wales and Queensland (Carter, 1926). Since *B. macleayi* (the type species) was described by Pascoe (1866) there has been nothing published on its biology and habits.

During 1 July 1982 I observed several various-sized holes in the crown of a dead, badly worn bracket fungus (later identified as *Ganoderma applanatum* (Fries) Karsten, Polyporaceae) on a fallen log at the margin of rain-forest near a road in the Bunya Mountains, about 220 km north-west of Brisbane, Queensland (ca 26°52'S, 151°50'E). Breaking the fungus in several places exposed channels and piles of small, rounded faecal pellets. A group of *B. macleayi* (one male and five females) were clustered together in a large cavity near one edge of the fungus close to its point of attachment to the fallen log. Portions of exoskeleton from a teneral female as well as the remains of one larva heavily infected with white fungus, were found in another chamber. The beetles became active upon exposure to sunlight and produced a very strong, nauseating odour when handled. Other trees infected with living *G. applanatum* were examined in the rainforest but no further *B. macleayi* were found. The beetle may breed only in dead basidiocarps, since all living fungi showed no attack. Several other dead *Ganoderma* were found but although bore holes were evident on the crowns of the fungal bodies, they did not contain beetles. The adults obtained from the initial fungus were kept alive for 2-3 months in the laboratory before succumbing.

On 28 September 1983 three adult beetles were observed feeding on the white under-surface of a fresh *G. applanatum* near ground level on a large rainforest fig tree (*Ficus* sp., Moraceae) near Mt. Glorious, south-eastern Queensland (27°25'S, 152°50'E). There was no evidence of the beetles having bred in the fresh fungi, which were common on many areas of the lower trunk. When approached, two beetles ceased feeding and fell to the ground below. Such behaviour appears to act as an escape mechanism, while the strong odour is evidently a defence mechanism.

Byrsax macleayi is poorly represented in Australian museum collections and appears to be rarely observed in the field. The cryptic coloration of the adult which matches the colour of the fungus, and the secretive habits of the species have probably led to the beetle often being overlooked. This is the first published record of an Australian tenebrionid known to feed and live in the fruiting bodies of *G. applanatum*. The fungus beetle, *Episcaphula rufolineata* Wilson (Erotylidae) is also known to feed on young basidiocarps of this fungus (Hawkeswood, 1986) while *Z. georgei* White (Zopheridae) (related to the Tenebrionidae) is also known to feed upon this fungus (see above). These three species of beetle are presently the only Australian beetles recorded in the literature which utilize *G. applanatum,* a fungus which is widespread in tropical, subtropical and temperate regions of the world.

Scaphidiidae

Scaphidium exornatum (Oberthur)

On 11 September 1983 several adult *S. exornatum* were observed feeding on the fresh basidiocarp of a pale brown *Poria* species (Polyporaceae) growing on a moist rainforest log, at Mt. Glorious, about 30 km west of Brisbane, Queensland. This is the first published host record for this rare species which is restricted to the rainforests of Queensland and New South Wales (Hawkeswood, 1987).

Scaphidium punctipenne Macleay

On 12 October 1985 two adult *S. punctipenne* were observed feeding on fungal filaments and small fruiting bodies of a white *Poria* species (Polyporaceae) growing on a rotten *Eucalyptus* log in a residential garden in Brisbane, Queensland. This is the first published host record for the species.

Ciidae

Cis vistoriensis Blackburn

On 2 November 1982 I observed large numbers of this beetle feeding and breeding in the dead, weathered, basidiocarps of *Polystictus cinnabarinus* (Jacq. ex Fr.) Cooke (Polyporaceae) growing on a fallen log of a *Casuarina* species (Casuarinaceae) on the Griffith University campus, Brisbane, Queensland. Several adults were also collected on 25 August 1986 in dead *P. cinnabarinus* on a dead branch of the narrow-leafed ironbark, *Eucalyptus crebra* F, Muell., at Rungli Downs, via Helidon, Queensland. This is the first published larval and adult host record for the species, which is widespread in eastern Australia.

Aknowledgements

I would like to thank Dr J.F. Lawrence of Canberra for the identification of *Cis victoriensis.*

References

Carter, H.J. (1926). A check list of the Australian Tenebrionidae. *Aust. Zool.,* **4:** 117-163.

Hawkeswood, T.J. (1986). Notes on two species of Australian fungus beetles (Coleoptera: Erotylidae). *Coleopterists Bulletin,* **40:** 27-28.

Hawkeswood, T.J. (1987). *Beetles of Australia.* - VIII + 248S. Sydney. (Angus and Robertson).

Pascoe, F.P. (1866). Notices of new or little known genera and species of Coleoptera. Part V. *J. Ent.,* **2:** 443-493.

Books Received

Review copies of these books have been received by the FNCV. Books mentioned here may be reviewed in later issues.

Plants of the Arid Shrublands of Western Australia

A.A. Mitchell and D.G. Wilcox. University of Western Australia Press, 325 pp, r.r.p. $28.00 (soft cover).

This book is primarily aimed at pastoralists and rangeland managers. The first twenty or so pages are devoted to a general discussion on a range of topics important to land managers. These include soil assessment, stocking rate and rainfall. The bulk of the book is devoted to description and illustration of some of the major plant species of the region. 136 plant species are dealt with in detail. Two good quality colour plates are provided for each. The appearance of each species is described and notes on habitat, distribution, forage value and indicator value are provided.

Butterfly conservation

T.R. New. Entomological Society of Victoria, 50 pp, r.r.p. $4.00 (soft cover). Available from the author (Department of Zoology, La Trobe University, Bundoora, Victoria, 3083.)

A useful booklet providing background information on butterfly conservation. Topics covered include butterfly biology, causes of decline in butterfly numbers, approaches to conservation and, of particular interest to Melbournians, the Eltham copper.

Australian Trees – Their Care and Repair

Phillip Hadlington and Judith Johnston. (1988) New South Wales University Press, 186 pp, r.r.p. $14.95 (soft cover), $24.95 (cased).

Topics covered include the tree and its environment, insect pests and their control, some common tree diseases, tree repair. Well illustrated in both colour and black and white.

Australia's Reptiles. *A guide to the terrestrial reptiles of Australia.*

By Stephen Wilson and David Knowles

Published by Collins Australia (1988), 447 pp., r.r.p. $70.00 (Hardcover).

This book is clearly the result of years of work by two very able photographer-naturalists, presenting colour photographs of practically all (over 95% by the authors' reckoning) of Australia's lizards and non-marine snakes. Accompanying the photographs is a separate text entry for *all* of the species decribed until early 1988, making it particularly up-to-date in this respect. The photographs are presented six to a page in a block of plates in the middle of the book, each photo being accompanied by a small distribution map.

The text consists of an introductory section which includes a guide to the headings used in the individual species entries and a brief introduction to Australian habitats, the latter illustrated by an attractive series of colour photographs. The remainder of the text is taken up by the individual species entries, arranged alphabetically within families. Each species entry includes a *Description,* emphasizing readily observed colour and pattern characteristics, *Preferred Habitat,* generally a brief section which includes a verbal description of the geographic distribution, *Microhabitat,* which indicates where the species shelters when inactive, and *Comments,* used to present information on reproduction and other ecological data. For each family there is an introduction to its general characteristics, in some cases including a few well executed diagrams of anatomical features useful in identifying family members (e.g. gekkonid toes, scincid head shields). The book concludes with a comprehensive bibliography, subdivided into general works on families and references dealing with particular genera.

The authors' principal aim has been to present in colour as many species as possible and to provide a photographic atlas of Australia's lizards and snakes. In doing so they have relied no only on their own slide libraries but have, where necessary, used photographs provided by a long list of helpful contributors. The result is impressive. Certainly, to someone with an interest in Australia's reptiles, the first riffle through the plates is a feast for the eye. The quality of the reproductions is generally good, although the photos on pages 231 and 233 of the review copy suffer from some misalignment of the colour printing. I feel the authors have succeeded in their primary aim, and few readers will fail to be impressed by the beauty and diversity of our terrestrial reptile fauna. For those with a more specialized interest, it is exciting to see so many species depicted for the first time, showing the living colours which are so often lost in preserved museum specimens.

The photographs are both the major strength and major weakness of this book. The strength, the beauty and breadth of the coverage has already been discussed. The weakness is related to the attempt by the authors to make this not only an atlas but also an identification guide. The photographs are the primary tool for identification, but attractive as they are, the illustrations are not sufficient in many cases. The size of the photos (79 x 53 mm) means that they are so small that many taxonomically important details are not visible, although much of the available space on each page of plates is wasted (page size 195 x 280 mm). Larger sized prints would have provided more assistance for making identifications, while still fitting 6 to a page. The white background areas are used to place the distribution maps, but the convenience of having the maps beside the photo is, to me at least, negated by the small illustration size. In spite of the number of illustrations, they are still too few to adequately cover the variation characteristic of many species. This is significant since the descriptive text avoids mention of many technically im-

portant anatomical features, and provides no keys. Even without these additions, the usefulness of the photos for identification puposes could have been greatly enhanced if similar species were grouped together. For speciose genera such as *Ctenophorus, Ctenotus, Lerista,* and many others, where complexes of similar species make identification difficult, these photographs will give only slight assistance.

By way of compensation, a strength of the text is the ecological information. This is mostly anecdotal and limited in detail, as is to be expected of a fauna only just beginning to be investigated. However, as far as I can judge the information is accurate and gives important additional data bearing on identification which is not available in the standard reference for the Australian fauna, Cogger's *Reptiles and Amphibians of Australia.*

A problem with the state of Australian herpetology at present is its great nomenclatural instability, due to new species descriptions and higher taxon revisions that are being produced at a rapid rate. Probably the most exasperating aspect of this taxonomic activity for the non-systematist is the lack of a consensus on many taxonomic matters between the two most influential centres in the Australian herpetological community, namely the Australian Musem and the Western Australian Museum, as perusal of the guides issued from these institutions (respectively Cogger 1986 and Storr *et al.* 1981, 1983, 1986) shows. Given this, plus the recent anarchic taxonomic meddlings of two amateur herpetologists, the classification adopted in the book is a very good compromise, based on a combination of Cogger's and Storr's classifications.

Finally I should mention two minor irritations that strike me concerning this book. The first is its title; it is certainly misleading and one can imagine the disappointment of turtle and crocodile enthusiasts as they rush to examine a new Australian herpetological work, only to discover that their favourite animals didn't get a guernsey. Even the subtitle does not make amends, since for at least some ecologists, terrestrial (as opposed to marine) faunas include fresh water species. In any case, it can be argued that some taxa included in the book (e.g. *Acrochordus*) are less terrestrial than others (e.g. *Chelodina* or *Crocodylus*) which have been excluded. Secondly there is the price. Seventy dollars is a significant outlay and will certainly discourage the casual buyer who might well enjoy the book, as well as making its purchase by more committed natural historians a fairly painful exercise. Aspects of the book's production, such as the small size of the photographs, their placement together as a central block, and the rather ordinary quality of the text paper all detract from its overall impact, and appear to be cost-saving measures. Apparently they did not succeed.

In summary, this is a well illustrated book which shows the beauty and diversity of Australia's lizards and snakes, a group of animals which has not had the sympathetic feeling from the Australian public that many other components of our fauna have enjoyed. It should make an important contribution to dispelling this negative image. As a primary identification guide I feel it is less successful, although in concert with Cogger's more technically complete descriptions, the photos and ecological notes in *Australia's Reptiles* will be very usefull to a wide variety of readers.

References

Cogger, H. G. (1986). *Reptiles and Amphibians of Australia* (Rev. & exp. ed.). (A.H. & A.W. Reed: Sydney).

Storr, G. M., Smith, L. A. and Johnstone, R. E. (1981). *Lizards of Western Australia. I. Skinks.* (Univ. W.A. Press and W.A. Museum: Perth).

Storr, G. M., Smith, L. A. and Johnstone, R. E. (1983). *Lizards of Western Australia. II Dragons and Monitors.* (Univ. W.A. Press and W.A. Museum: Perth).

Storr, G.M., Smith, L. A. and Johnstone, R. E. (1986). *Snakes of Western Australia.* (Univ. W.A. Press and W.A. Museum: Perth).

Mark Hutchinson,
School of Biological Sciences,
La Trobe Unversity,
Bundoora Vic. 3083.

The VFT

Is it on the right track?

by Bob Miller*

It seems like a futuristic fantasy – a train trip between Melbourne and Sydney in a mere three hours at breathtaking speeds of up to 350 kilometres an hour. The proponents of the Very Fast Train (VFT) project, however, are very serious about the idea – serious enough to fund a $18 million feasibility study.

They estimate the project will cost $6 billion, take five years to complete and will operate as many as 90 high speed train trips a day between the capitals. Other such projects are also being considered elsewhere in Australia.

The VFT proposal has significant transport implications for south eastern Australia and will have considerable social, economic and environmental impacts. The proposed route travels through suburban housing and bushland areas, rural farmlands, national parks and wilderness.

A project of this scale and complexity raises a number of major questions.

Does Australia need high speed train services?

What are the advantages and disadvantages for urban, regional and rural areas?

Is the environmental impact acceptable?

Finally, should such an operation be publicly or privately owned?

Origins

The original proposal for a three hour VFT service between Sydney and Melbourne, at a fare of around $100, came from the Commonwealth Scientific and Industrial Research Organisation (CSIRO). Their research has focussed upon a proposed route from Sydney passing through Goulburn, Canberra, Cooma and Bombala in NSW, and then travelling through Orbost, Bairnsdale, Traralgon, Warragul, Dandenong and finally Melbourne in Victoria.

The proposed maximum speed of 350 km/h would make Australia's VFT nearly 100 kph faster than the world's current fastest scheduled rail service, the French TGV. While it is technologically feasible to operate a VFT at such speed, there are nonetheless some significant technical issues yet to be resolved.

The Australian Government has indicated that it will not fund the project. This means that the VFT is wholly backed by private capital, through a consortium which includes the Japanese construction/finance company Kumagai Gumi, and Australian corporate giants Elders IXL, TNT and BHP. The interest of the these companies in the proposal can be readily understood through their interests in construction, real estate, transport and steel.

Melbourne-Sydney link needs better services

Rail transport between Sydney and Melbourne has long been hampered by a history of state rivalries. As late as the 1960s there were still different rail gauges in each state. Historically then, the possibility of travel between the two capital cities without needing to change trains is a relatively recent innovation.

During the 1970s, serious consideration was given to electrification of the route although it has not proceeded. Since the introduction of 160 km/h XPT rail services in NSW a proposal to operate these trains through to Melbourne has been developed, but has yet to be implemented. Such a service would reduce the rail journey to some nine hours.

*Bob Miller is the President of the Society for Social Responsibility in Engineering. A more detailed discussion paper on the implications of the Very Fast Train is available for $10 from SSRE, PO Box N84, Grosvenor Street, Sydney, 2000.

Existing rail passenger services between Sydney and Melbourne are clearly inadequate. The rapid increase in interstate bus services over recent years shows consumer dissatisfaction with rail transport in terms of service, frequency, travel time and fares. Despite rail's distinct advantages over other modes of transport in terms of energy efficiency and accident safety it seems that reduced travel times are still the key for rail to improve its public support and become more competitive.

There is a case then for higher speed trains in Australia, but the questions remain – how fast, and, at what cost?

VFT – the environmental costs

The VFT route, as currently proposed, poses serious environmental problems. Of great concern to conservation groups is the plan to run the alignment through forest areas of East Gippsland, close to newly proclaimed National Parks. Areas in the immediate vicinity, such as the magnificent Errinundra Plateau and the Rodger River Wilderness, could face significant adverse environmental consequences. Conservationists argue that the combined impact of high noise levels, restricted wildlife movement, and threats from erosion and siltation will severely diminish the value of wilderness areas along the route.

The noise impact generated by 90 high speed trains a day travelling at 350 km/h would be substantial. It has been likened to that of a jet aircraft at close range with audible levels being registered as far as 5 kms from the railway line.

Restrictions on wildlife

Wildlife movements will be restricted by the fencing required to enclose the rail corridor, in order to reduce fire hazards, maintain access and prevent accidents. Without full details of the VFT proposal being available, it is difficult at this stage to ascertain the extent of this problem. A complete wildlife study of sensitive areas would be necessary to reveal the extent of disruption to bird and animal movements. Underpasses and tunnels would allow some wildlife movement. It is far from clear how adequate this would be.

Although erosion and siltation problems during construction can be controlled to some extent, the movement of large quantities of 'cut and fill' and tunnelling material would inevitably cause some pollution, especially during heavy rains.

Noise - the major urban issue

Noise will also be a major environmental issue along urban sections of the route. The critical factor here is speed at which the train will run. Here we can learn from over-seas experience, particularly the Japanese.

During the 1970s and early 1980s the Japanese National Railways spared no expense to overcome high noise emissions from their 250 km/h Shinkensen train. A

The proposed route

variety of different track structures and noise absorption methods were used on a test track north of Tokyo in an attempt to meet the Government's mandatory noise emission limits. Despite these efforts the best result could not meet the requirements. Consequently the Shinkensen was forced to operate at lower speeds and houses adjacent to the railway must be fitted with double glazed windows.

VFT consortium underestimates noise problem

It would appear that the VFT consortium has seriously under-estimated the significance and cost of noise emissions. A detailed study is obviously required. Overseas experience indicates that substantially lower speeds will be necessary before the noise can come down to acceptable levels. This may mean speeds under 200 km/h, therefore ruling out a three hour travel time from Sydney to Melbourne. In view of this the very basis of the VFT proposal, as it presently stands, needs fundamental reassessment and full consideration given to the alternatives.

The reassessment must take place now. If these issues are only considered after the route has been selected and millions of dollars spent on preliminary work then they will inevitably be portrayed as not being important enough to halt a project in which so much has been invested.

Noise level considerations should be an integral part of 'route selection' criteria, not merely an afterthought in a subsequent Environmental Impact Statement. They should be built into the criteria for determining appropriate routes and speeds. Unfortunately, the limited data available at present only highlights the uncertainty about how low these limits should be, and the difficulty in achieving them. Table 1 shows the variation in levels which operate internationally.

The benefits

The VFT's major benefit is reduced travel time. Its prime objective and major selling point is the three hour travel time from city centre to city centre. This compares very favourably to the 13 hour rail or road journey and is aimed at matching the overall time taken to travel by air.

Reduced air (and motor vehicle) travel between Sydney and Melbourne resulting from a VFT service could bring some environmental benefits. Of particular interest are the possible reductions in air traffic which could relieve the strain upon the major airports. This is particularly important to Sydney residents because of the problems associated with Kingsford Smith Airport. Here, take off and landing operations are predominantly over residential areas and problems of noise and exhaust pollution are increasing, along

Table 1

ACCEPTABLE NOISE EMISSION LIMITS

Country	Sound Pressure Level (dBA) At 25 metres
France	
TGV @ 200kph	97
West Germany	
Proposed Limit - New rail lines	90
Australia (NSW)	
Government Limit - New rail lines	80
Japan	
Government Limit - New rail lines	75

with infringements of the night time curfew. The greater accident risk caused by increasing air traffic congestion only heightens residents' concerns.

Reduced jet fuel consumption

The possibility of the VFT reducing air traffic problems is attractive. However, a word of caution. Any spare capacity resulting at Sydney airport may well be absorbed by increases in international tourism. Furthermore, reduction in air traffic could well delay a decision to commence Sydney's second airport, which would have both positive and negative aspects. Of significance, however, given Australia's limited oil reserves, is the quite large reduction in jet fuel consumption likely with fewer flights between Sydney and Melbourne.

Less significant, though also potenially important, is the possible reduction of motor vehicle traffic on the Hume Highway, the main road link between the two cities. A decline here, although small, could reduce vehicle accident levels, fuel consumption and air pollution.

Given that the VFT would be propelled by 25 KV AC electric power, the abundant generation capacity in NSW and Victoria, based on local coal supplies, means that the project has significant energy advantages.

Finally, the shift from air and road transport to electrified rail in such a heavily used travel route could bring a major net reduction in air pollution and energy consumption, reducing in a small but meaningful way Australia's contribution to the 'Greenhouse Effect'.

Social and economic impacts

The effect the VFT could have on regional and local communities is far from clear, but a number of issues need widespread discussion.

Reduced travel times could lead to the creation of a new class of "commuter suburbs" as far as 300 kms away from Sydney and Melbourne. This would cause major changes to the socio-economic make-up of the local comunities. Only the affluent would be able to afford costs of perhaps $50 a day to commute to the city centre from these new satellite suburbs.

Communities could also be literally divided by the VFT corridor which, for safety reasons, would be fully fenced and allow only limited access across the route. This is a seemingly irresolvable problem.

Cooma, and the Snowy Mountains area, could expect significant increases in visitor numbers. A VFT could increase use of these areas by skiers and other visitors, who might otherwise be discouraged by the long travel times. The capacity of the Kosciusko National Park to absorb more tourists is a major issue in itself and warrants further investigation.

Government assistance

While the project is being advocated as a private business venture it would still require considerable Government assistance. Although it is unlikely that Government would provide significant funding, there are other areas of assistance which would be crucial.

These include:

- legislation by the Victorian, NSW and Federal governments to allow the resumption of private land along the route as well as giving the consortium free use of existing rail corridors,
- relocation of roads and other public utilities along the route and design/construction of road bridges,
- possible payments to the consortium by way of subsidies to allow pensioners and other existing transport concession holders to travel on the VFT. If this were to eventuate it is highly likely that existing interstate rail services between Melbourne and Sydney would become obsolete.

Protecting public interest

Such Government assistance would be of great value to the consortium. The question then arises, what will the Government, and hence taxpayers, receive in return? Clearly, there is a strong

argument for public equity based on the level of assistance provided and the need to ensure that the public interest is maintained in the future. The potential for the VFT to develop into a quasi monopoly for a large section of the Sydney-Melbourne transport market, possibly resulting in unacceptable pricing and other practices, cannot be under-estimated.

Government will also be involved in considering the social, economic and environmental impact of such projects. A range of Government requirements will have to be met by the proponents of any high speed railway before the necessary legislation is considered by the NSW, Victorian and Federal Governments. Before Government can assess such projects full consideration of alternatives is essential.

Alternatives

A number of alternatives exist which could substantially improve rail services between Sydney and Melbourne and allow a significant reduction in travel time. While the VFT aims to win a major share of the market by matching the total travel time involved in air travel, it is also conceivable that a lesser reduction in travel time could still bring a desirable result. Alternatives for such options exist, which involve substantially less initial investment and lower environmental costs, including:

- a high speed diesel train service like the XPT,
- electrification and realignment of the existing rail line,
- new rail routes.

Other routes

The VFT proposal, thus far, has essentially been limited to consideration of only one route. Other routes are quite feasible to achieve the desirable objective of linking Sydney, Canberra and Melbourne. For example, investigation has shown that a new route including Sydney, Canberra, Wagga and Albury is clearly an option with two distinct advantages over the current VFT proposal.

Firstly, such a route can use the existing railway from Sydney to Goulburn and also from Wagga to Melbourne. This would greatly reduce the upfront capital expenditure to 25% of that required by the VFT.

Secondly, such a route achieves a major advantage in avoiding sensitive national park and wilderness areas, such as in East Gippsland. It would be restricted to a 3 kilometre limit from potential nature reserves such as the Brindabella Range, west of Canberra.

While not all potential problems would be solved by this route it does demonstrate that alternatives exist which warrant full investigation.

National Inquiry needed

The current VFT proposal now undergoing a feasibility study is essentially limited to considering only one route and one form of technology. Given the major implications of the project for south-east Australia this is totally inadequate. This is not to imply that it is the fault of the proponents, as approaches were made to Government. It does, however, reflect poorly on the advice given to the Government during the early consideration of the proposal.

The time has come when the VFT project must be taken seriously. A full public inquiry is essential if the real needs and options for major improvements to interstate land transport are to achieve maximum benefits for the community with the least financial, social and environmental costs.

A Federally commissioned inquiry, with state involvement, to consider all of the issues is essential. The inquiry should be open to the public and involve a wide ranging socio-economic-environmental study with consideration of the various technologies available. The development of route selection and speed criteria to be applied when considering the options would form a central part of the inquiry.

This article was originally published in the October 1988 edition of HABITAT. It is reproduced here with the permission of the publishers, the Australian Conservation Foundation.

An Overview of the Vegetation of the Mallee

Report of a talk given by David Cheal to the Botany Group

David Cheal is a botanist with the Department of Conservation, Forests and Lands working on flora and fauna surveys. His talk was very relevant in view of the current moves to have more of this area included in National Parks.

In a recent survey conducted by department staff, 32 or 33 different plant communities were distinguished – which will be a surprise to many people who think of "the mallee" as a very homogeneous area. The word "mallee" itself can be confusing as it can refer to (a) a type of eucalypt (b) a vegetation type or (c) an area.

In the mallee there are parallel lines of sand dunes, following the old shore lines. Most of the area has not been cleared for farming in the accepted sense, but there has been de facto clearing by stock and rabbits. The area varies greatly in fertility. The chenopod – *Eucalyptus gracilis-Eucalyptus oleosa* community is on the most fertile soil. The shallow sand mallee is less fertile, as the sand has been blown out, while the deep sand mallee is very infertile – *Eucalyptus incrassata* and *Triodia sp.* are found here. The very deepest dunes of the Big Desert are acid and deficient in almost every nutrient except sulphates.

There are the heathlands where mallee eucalypts are dominant, the clay areas, the gypseous dunes, saline areas, savannah mallee and savannah woodland, old flood terraces on the Murray, the alluvial plain scrubland, the blackbox wetland, the blackbox – chenopod woodland.

Of the 32 or 33 plant communities, eleven make up less than 1% of the public land. Every area has its own special plants.

Some of the communities and/or their plants are threatened with extinction e.g. *Melaleuca helmaturorum* (the salt paperbark) as the level of the ground water is rising.

Grazing has destroyed many areas, lack of periodic flooding others. But the most threatened community is the pine-buloke woodland – in fact it is about to disappear. It could only regenerate with the ideal conditions that may occur only once or twice a century. Of the area originally covered with pine-buloke vegetation 33% is now grassland, 54% is severely degraded, 12% still exists but there is no regeneration and only 1% is actually regenerating.

Reasons for the necessity for positive action in this area emerged very strongly from the talk.

The Ada Tree

Recently it has been my privilege to visit the Ada Tree, one of a group of giant mountain ash *(Eucalyptus regnans)* near the Ada River. It is currently the tallest known tree in Victoria, and stands 70.33 metres tall. Some idea of its size can be gauged by the fact that eighteen people have stood finger-tip to finger-tip at its base. With the passage of time very old mountain ash have their tops blown out and the Ada Tree has already lost some of its branches.

Part of the interest in this area is because it has never been logged and cannot have been burnt for many centuries. There are very large sassafras (*Atherosperma moschatum*) near Island creek which must also be of great age.

The area around the Ada Tree will never be logged, it has been set aside by the Department of Conservation, Forests and Lands (CF&L) and can be visited by driving north along the Ada River road which joins the Powelltown-Noojee road. The Society for Protecting the Ada Tree has done a wonderful job with the assistance of CF&L in making easy but unobtrusive forest tracks through to the viewing platform and have erected two foot bridges over Island Creek.

Hilary Weatherhead
43 Beaconsfield Road Emerald, Vic. 3782.

Report of F.N.C.V. Botany Group Excursion to see Grasses at Laverton and in the Long Forest Mallee on Saturday 26 November 1988.

Led by David Albrecht and Neville Walsh.

This November we have been very fortunate in having Dr. Suzanne Duigan's excellent talk on the structure of grasses on 10 November followed by the excursion led by David Albrecht and Neville Walsh on which we could use our knowledge of grass structures to work through identification keys and so name the species we found.

Our excursion started as we stepped into a grassland area of the western volcanic plains off Doherty's Road, Laverton. The western volcanic plains were originally dominated by *Themeda*. The area we visited had approximately 30 grasses present, about 20 of which were native, according to our leaders. Neville gave us all copies of keys he is working on for the grass section of the Flora of Victoria. This was a good opportunity to trial some of these keys. David started us off on two samples of *Avena*, a genus with spikelets which were easy to see. With help from the leaders we keyed out *Avena barbata* and *Avena sterilis*. We then went on to investigate a number of other grasses. We found that careful measurements of the length of paleas and spikelets were vital in identifying grasses. We looked at hairs and teeth on paleas and we looked at the long strong awns of the spear grasses to see how many times and at what angles they were bent. With each new grass we tackled David and Neville patiently helped us to work through the keys, coming out with interesting and invaluable comments about each new species we met.

The grasses we studied at Laverton were:

Avena barbata	Bearded oat.
Avena sterilis	Wild oat
Amphibromus nervosus	Swamp wallaby-grass. Florets stick out above the glumes. Grows in wet spots on basalt.
Panicum Prolutum	Rigid panic. Usually grows near water. A example of a grass where the whole inflorescence falls off then each whole spikelet falls off. One of the "Tumbleweeds"
Dichelachne crinita	Long-hair plume-grass. A dense panicle with many spikelets.
Danthonia duttoniana	Brown-back wallaby-grass. In *Danthonia* the florets fall out and the base of the awn curls when dry and screws the seed into the ground like a brace and bit. This species is found typically on wet, heavy soil. It has a shining golden-brown lemma
Stipa bigeniculata	A spear-grass with a twice-bent awn and a hairy lemma. Grows in damp places.
Stipa curticoma	
Agropyron scabrus	Common wheat grass (belongs to the same group as wheat). Spikelets sessile. Widespread over a large area including the alps, the coastal areas and the basalt plains.
Themeda triandra	Kangaroo grass. This grass has a spathe-like bract which subtends a cluster of 7 spikelets only one of which is bisexual, and awned. The surrounding ones are male, or have no anthers or ovaries. It is important to recognise the awned and fertile spikelet which forms the seed when collecting seed for regeneration purposes. It is also

important to remember that *Themeda* seeds have a long dormancy period, at least 6 months.

Nassella trichotoma Serrated tussocks, a noxious weed from Southern America.

After our wonderful learning experience at Laverton, 8 of the 12 people present were able to go on to the Long Forest Mallee area near Lake Merrimu. After lunch we walked through a typical mallee area, very different from our earlier location. The "special finds" of the afternoon were two species of spear-grass.

Stipa elegantissima Feather spear-grass. This has glabrous culms, which are often branched. The panicle branches are plumose with long hairs. This grass is widespread throughout the Victorian mallee.

Stipa breviglumis Cane spear-grass. The first piece was found by David and Ilma Dunn. This species is rare and localised in Victoria so we were very lucky to see it. It is a cane-like grass to 1 metre high, with a dense, many-flowered inflorescence.

We also found *Danthonia setacea*, a wallaby-grass smaller than the commonly found *Danthonia caespitosa*, and the naturalised species *Ehrharta erecta* – Panic veldt grass.

In all, we had a most interesting and informative day, due in no small measure to patience, knowledge and help of David and Neville.

Sibely J. May

Australasian Bryological Workshop
Hobart, Tasmania
3 to 10 December 1988

On a long weekend in September 1983, 26 New Zealand botanists and amateurs with a special interest in mosses and liverworts held a "Bryological Foray". It proved a great success, and the New Zealanders have since made this an annual event of up to five days and have renamed it a Bryological Workshop.

This year a similar workshop was held in Hobart. It was organised by Dr Rod Seppelt of the Antarctic Division and Mr Paddy Dalton of the University of Tasmania. Eleven of the thirty-one participants came from NZ, and one each from Argentina, the USA and India. For those (most) of us who so elected, the Youth Hostel provided accommodation and full board.

There were three full day excursions: To the Hartz Mountains, to Mt Field National Park, and to the Tasman Peninsula. The other days we spent half in the field and half at the University, where dissecting and compound microscopes were available to all. The places visited included a wide variety of habitats with different moss and liverwort communities.

There were discussions, talks and slide shows. One session was devoted to the format and presentation of material in the moss and liverwort volumes of the Flora of Australia. Several of the people preparing them were present, and the meeting's views are sure to be considered.

The planning and running of the Workshop were flawless. The weather was pleasant but for one cold wet windy hour on Mt Wellington. Two species new to Australia were recognised in the field, more may turn up in the collections. There was a great spirit of harmony in the group, the professionals as usual being most helpful and encouraging to us amateurs.

Arthur W. Thies

F.N.C.V. Botany Group – Annual Report for 1988

Another interesting year was enjoyed by the Group. Meeting in the Astronomer's residence has caused some difficulties – even an attendance of 30-35 makes the room very crowded, displays are difficult and we miss having the library available. However, invited speakers have been very co-operative in fitting into the limited space.

Speakers for the evening meetings were:

Feb. 11 John Reid. Food plants of butterflies and moths.
Mar. 10 Hazel Blackney. Speaking of Hakeas.
Apr. 14 Pat Carolan. Trees and their environment.
May 12 Tom May. Fungi.
June 9 Hilary Weatherhead. Kashmir – in search of flowers.
July 14 Member's night.
Aug. 11 Garrique Pergl. Some problems for the conservation of the flora and fauna of the Courtney's Road Reserve, South Belgrave.
Sept. 8 Margaret Corrick. Problems with pea flowers.
Oct. 13 George and Thelma Spice. Orchids.
Nov. 10 Suzanne Duigan. Grasses.
Dec. AGM and Member's night.

Excursions were to the Mullum Mullum Creek area to study the food plants of butterflies and moths (Feb.), to the Alex Wilkie Reserve and Ricketts Point (March), to the Dandenongs for eucalypts (April), to the Dom Dom area for fungi (May), to the butterfly house at the zoo (June), to the Royal Botanic Gardens, Cranbourne annexe (July), to Courtneys Road Reserve (Aug.), to the Common and Fourth Hill, Warrandyte (Sept.), to the Kilmore, Mangalore, Avenal area (Oct.) and to Laverton North for grasses (Nov.).

We thank the many people who have given their experience, time and energy to the smooth running of the Botany Group during 1988.

W.H. Bennet (Hon. Sec.)

F.N.C.V. Library Report 1988-89

The library report for this year is necessarily brief because our library has been in storage for the whole of the period. We continue to receive periodicals, a selection of which has been displayed at General meetings. Forty-one books have been added to stock, including further volumes from Madge Lester's collection, and donations from Dr Elizabeth Turner and others. Notable among the additions are *Zoological catalogue of Australia, v.5: Mammalia;* Douglas and Ferguson: *Geology of Victoria. 2nd ed;* Auld and Meed: *Weeds*; and papers from the 3rd I.O.P. Conference, 1988.

A collection of nearly 3000 slides was left to us by Madge Lester. Ron Pearson sorted and listed these, an effort which is much appreciated.

The Club also received the microscopical slide collection of Paul Genery, donated by his widow, Mrs Peg Genery.

The Club has been able to assist in the international project to produce a definitive edition of Ferdinand von Mueller's correspondence.

We have received more enquiries about former members of the Club and people connected with it, and continuing work on the archives has made the answering of these enqiries more satisfactory. We were unable to shed any light on the fate of the

specimen of *Ooperipatus insignis* which formed the subject of a note by Charles Barrett (*Vic. Nat.* v. 55 p. 11 1938), about which we received an enquiry from the Royal Society of Tasmania. A search of Club correspondence around this period failed to reveal the identity of Barrett's correspondent, and *Peripatus* did not, it seems, appear at any Club meeting.

When the Herbarium extension is finished it is expected that the library will be accommodated in the Astronomer's Residence. This may produce problems of accessibility at all meetings, and it is something which Council will have to consider. It is not possible to say at the moment what decisions will be made, but I would be glad to hear from anyone who would be interested in being library assistant at Group meetings.

Sheila Houghton
Hon. Librarian

F.N.C.V. Day Group Annual Report for 1988

Chairman	Joan Miller
Vice Chairman	Marge Wilson
Secretary	Dan McInnes

The 1988 program of excursions arranged by the Day Group again relied only on public transport which members find is sufficient and convenient.

Many places around Melbourne are worth a visit and the Day Group invites members and their friends to join in a social outing. A typical outing is to meet at 11.30 am at the place we visit, then we have a picnic lunch, after a short meeting to discuss the next outing and any other item, the leader for the day usually gives some history or information about the area or place we are to see.

The excursion ends about 3.00 pm which gives all members time to get well on their way home before the rush period begins.

All details of the excursions are listed in the issues of *The Victorian Naturalist* prior to the date of the excursion.

Interesting places visited during 1988 are shown below.

Month	*Excursion*	*Leader*
Feb.	Garden City and West Gate Park	Dan McInnes
Mar.	Ferntree Gully National Park	Marge Wilson
April	Flagstaff Gardens and Historical Society of Victoria	Betty Gillespie
May	Rockebear Park and Northcote Pottery	Joan Miller
June	Fitzroy Gardens and Meteorological Center	Andy Blackburn
July	Outer Circle Railway Line and the Urban Forest	Dan McInnes
August	National Gallery Garden and walk along north side of Yarra River	Joan Miller and Dan McInnes
Sept	Woodlands Park and Napier Park Essendon	Andy Blackburn
Oct.	100 Acres Park Orchards	Betty Gillespie
Nov.	The Lilydale Museum	Andy Blackburn

The average attendance was 11 with the highest of 15 at the Flagstaff Garden and the Historical Society of Victoria.

Dan McInnes (Sec.)

F.N.C.V. Microscopical Group Annual Report 1988 – 1989.

The Group is under the Leadership of Mr Urwin Bates, monthly meetings average 18 members.

New members – Bonnie and Jim Watson, Denis Philipatos, Ray Overton, Mr Waldron, Rosemary & Clinton Hale.

The Group received donations of microscopical slides from Mrs Peggy Genery and Mr Cliff Nance.

Mr D. McInnes has compiled a catalogue of the slides in the Genery and Nance collections.

Mr Cliff Nance, the oldest member of the group, celebrated his 90th birthday on the 15th July 1988.

Our President Mr Graeme Love and his wife were warmly received by the members of the Group in April. Mr Love told the group he was impressed with the high standard of the lecture, large range of microscopes and prepared slides on display.

Lectures and Speakers for the year 1988-1989.

Mr. U. Bates	Design and Care of Modern Microscope.
Mrs J. Calder	Histology of Plants.
Mr. A. Cleghorn	Making and Staining slides of Bacteria.
Mr. J. Dawes	Display of old microscopes.
Mr. J. Fong	Representative from Wild Leitz (Australia) gave us an interesting talk about methods of lighting objects for examination under the microscope.
Mr. C. Hale	The Preparation of material to show the Chromosones.
Mr. D. McInnes	Pond Life. Rock Sections.
Dr. E. Peters	Photography through the microscope.
M. G. Richardson	Microscopic Life on the video.
Members Night	January 1989.
Members Night	March 1989.

Mrs Elsie Graham.

FNCV – Geology Group Annual Report for 1988

Is time really going that fast; here it is April 1989 and I've only just found time to write this report. What a year – it isn't often that a speaker when apologising for not turning up, explains than an earthquake stopped him (It did for Gary Gibson).

It has been good to see average attendances still holding at 19/20. The highlight for the year could well have been "Chris Pooles' Impact Theory (1978) revisited". Not because of numbers but here for the first time, I believe, a speaker's (in this case, though, posthumously) new theory was reviewed in the light of new evidence. Important for the group, along with a number of members (namely Jack Douglas and Norm Plever) your Chairman had the privilege to be present at the 3rd IOP Conference in August, at Melbourne University.

Elsewhere the year did really present both scope and variety, I feel sure, for members. How many do we remember; Clay Resources of the Ballarat Region, the Solar Energy Council, Catastrophes and extinctions, plus from members; Meteor Craters Slide night, Plate tectonics and Australia, Gold and the Pacific Rim, and Norm Plever's Daylesford "Graptolites" followed by an excellent excursion to the area. We even found time to pay a visit to the "block" at Kinglake (early in the year).

To our regular participatory stalwarts thank you once again, and let us hope 1989 can be even better.

Graeme Love (Chair.)

Club News: Who's Doing What?

Ian Faithfull has resigned as one of the Club's representatives on the Conservation Council of Victoria, because he has left Melbourne. Council appointed Tim Offor to replace him.

We have received a letter from Colin Lewis, an Honorary member, concerning the gift of a copper billycan to the Club. This was by a country member from Wonthaggi, Jim Glover, an artist and coppersmith, 'in appreciation of the comradeship he had enjoyed during the Club's Australia Day excursion to Cape Patterson' in 1950, during the Presidency of Colin Lewis. No account of this excursion appears to have been published in the *Victorian Naturalist*, but Alf Baker, who was the leader, reported the gift at the May General meeting that year. The billycan stands about 12 inches high, and its lid has an embossed border featuring the Club's correa badge. A photograph of it appeared in the *Victorian Naturalist* (v. 95 p. 166, 1978) and it was last displayed at the May General meeting in 1986, as part of an address on some aspects of the Club's history.

The M.M.B.W. Braeside Metropolitan Park was officially opened on 2 April. Ron Pearson, who is a member of the Advisory Committee for the Park, and Sheila Houghton attended. Visitors were able to inspect the Visitors' Centre, explore the heathland area, barbecue or purchase refreshments, and during the afternoon were entertained by a variety of cultural groups performing their national songs and dances. The large crowd justified the claim that Braeside is intended to be a people's park, and it seems it will be well-used in the future.

A letter from another Honorary member, Eulalie Brewster, informs us that at the time that she was elected to the Club, as an Associate member, girls had to wait until they were eighteen before being elected, though boys could achieve this at sixteen. We are to note that this discrimination no longer remains, everyone under eighteen is a junior member, and full membership is available over that age. Eulalie got round the technicality by attending meetings with her mother, Mrs Eulalie Bennett, who was a member from 1918 until her death in 1984.

Any items for this column will be gratefully received. Let us know what you are doing. (Address: 30 Golf Links Crescent, Dingley 3172) Sheila Houghton

---

General Meeting 13th February 1989

It was a hot and steamy night, very appropriate for a talk on the Northern Territory. Jim Montgomery's tour of discovery took us through Litchfield and Kakadu National Parks and Arnhem Land. He outlined the problems land managers in the Top End face when determining appropriate fire regimes, balancing flora and fauna conservation with social issues. An increase in fire frequency is changing the vegetation structure and floristic composition of the forests, leading to domination by plants such as acacias and spear grass. The flora and fauna were beautifully illustrated, particularly in the almost pristine Arnhem Land.

Exhibits

Two beautiful brass microscopes more than a hundred years old were on display.

Wolffia australis, the smallest flowering plant in the world, was brought in by Dan McInnes who found it at Cherry Lake, Altona.

Nature notes

Hillary Weatherhead told us about a rare *Mutinus* species of fungus previously undescribed for Victoria that was found on a fungal excursion to Sherbrooke Forest.

A sugar glider was recently sighted in Ringwood.

Friends Of The Gould League

NATURAL HISTORY LEADERSHIP PROGRAM 1989

Are you interested in finding out more about plants, animals and the environment? Would you like to have fun and forage with the experts? Why not inquire about F.O.G.L.'s Natural History Leadership Program? Consisting of monthly evening sessions and field trips on alternate months, this exciting program offers information and "hands-on" experiences covering a range of topics.

Program

Wednesday Evening Sessions	Topic	Field Trip
15.2.1989	Rockpools	18.2.1989
*16.3.1989	Weeds	18.3.1989
19.4.1989	Bush Birds	
17.5.1989	Fungi	20.5.1989
21.6.1989	Ferns	
19.7.1989	Pondlife	22.7.1989
16.8.1989	Nocturnal Life	
20.9.1989	Orchids	23.9.1989
18.10.1989	Waterbirds	
15.11.1989	Butterflies/Moths	18.11.1989

*Thursday evening session

Speakers
Specialist speakers will be responsible for each session

Cost
$35.00 (complete 10 month program)
$5.00 (individual topics)
Note: Children under 14 years must be supervised by an adult.

Further Details/Application Forms
Sheryl Richards,
Gould League of Victoria, P.O. Box 446, Prahran, 3181
Telephone (03) 51 1493

Day Group (Third Thursday)

Thursday, 20th July. Alexandra Gardens and National Gallery. Meet at the station end of Princes Bridge at 11.30 am. Leader: Joan Miller. 836 2681.

Thursday, 17th August. Geelong by train. Catch the 10.00 am Geelong train at Spencer St Station. Leader: Marge Wilson 836 3521.

GROUP EXCURSIONS

All FNCV members and vistors are invited to attend any Group Excursion.

Fauna Survey Group

June 10th-12th. (Q. B. weekend) Hairy-nosed Wombat Survey at Deniliquin N.S.W.

June 24th-25th. Water-rat studies at Werribee.

July 15th-16th. Anglesea.

August 26th-27th. Water-rat studies.

Botany Group (Fourth Saturday)

Saturday, 22nd July. Operation Revegetation Nursery of the Knox Environment Society, Stock Garden of Bushland Flora and the Mealy Stringybark Woodland recently preserved in Knoxfield. Leader: Andrew Paget.

Saturday, 26th Aug. Latrobe University Wildlife Reserves (Cresswell Forest, etc.) Leader: Andrew Paget.

HAWTHORN JUNIOR FIELD NATURALISTS CLUB.

Meetings are on the last Friday in the month at 7.30 pm at the Balwyn Primary School Hall, cnr of Balwyn & Whitehorse Rds. Balwyn.

Friday, 28th July. Plant Identification.

Friday, 25th August. Club Birthday. Special Night.

For information on Club excursions or meetings contact the President: Jonathon Stevenson Ph. 830 5886 or the Program Officer: Rohan Clarke Ph. 725 8923.

FNCV NEW MEMBERS March-April 1989

Metropolitan

James Todd, North Melbourne.
Matthew Yacopetti, South Yarra.
Ms Francesca Folk-Scolaro, Brunswick.
Henry L. Simpson, Gardenvale.
Jeffrey Jeanes, Bayswater.
Mr L. Maas, North Balwyn.
Dr S. Read, Kew.

Joint Metropolitan

Mrs E. Salkin, Mount Waverly.
Mrs Myf Macfarlane, Watsonia.
Dr Dianne Simmons, Christmas Hills.
Mrs Heather McKenzie, North Balwyn.

Country

D. C. Robinson, Buronga.

Donations

Our thanks to the following members who included donations with their subscriptions: D.N. Gunn, Mrs F.J. Pontt, Mrs Peg Flattely, Mary Doery, Jean Zirkler, Claire Taylor, Audrey Pittard, John Whinray, Dr & Mrs J.G. Douglas, Fred and Diana Bienvenu, Karl Kleineeke, Enid McCarthy

Attention! 1988 Index

Due to an error on the part of the editors the 1988 index did not appear in the centre pages as usual. Additional loose copies are available free of charge from the Editors, FNCV, C/- National Herbarium, Birdwood Avenue, South Yarra, 3141.

Field Naturalists Club of Victoria

In which is incorporated the Microscopical Society of Victoria

Established 1880

Registered Office: FNCV, c/- National Herbarium, Birdwood Avenue, South Yarra, 3141.

OBJECTIVES: To stimulate interest in natural history and to preserve and protect Australian fauna and flora.
Members include beginners as well as experienced naturalists.

Patron

His Excellency, The Rev Dr John Davis McCaughey, The Governor of Victoria.

Key Office-Bearers 1988-1989

President: Mr. GRAEME LOVE, P.O. Box 2018, St. Kilda West, 3182 (697 5109 B.H.)

Vice President: Mrs. SHEILA HOUGHTON, FNCV, National Herbarium, Birdwood Avenue, South Yarra, 3141 (551 2708)

Hon. Secretary: 23 Avenza St., Mentone, 3194 (584 7443)

Hon. Treasurer: Vacant

Subscription-Secretary: Ms DIANNE CHAMBERS, FNCV, c/- National Herbarium, Birdwood Avenue, South Yarra, 3141 (344 5068 B.H.).

Editors: ROBYN WATSON and TIM OFFOR, FNCV, c/- National Herbarium, Birdwood Avenue, South Yarra, 3141 (387 5146).

Librarian: Mrs. SHEILA HOUGHTON, FNCV, c/- National Herbarium, Birdwood Avenue, South Yarra, 3141 (551 2708 A.H.)

Excursion Secretary: Miss MARIE ALLENDER, 19 Hawthorn Avenue, Caulfield, 3161 (527 2749)

Club Reporter: Vacant.

Conservation Co-ordinator: Vacant

Sales Officer (Books): Vacant.

Sales Officer (Victorian Naturalist only): Mr. D. E. McINNES, 129 Waverley Road, East Malvern, 3145 (211 2427)

Programme Secretary: Vacant.

Publicity Officer: Vacant.

Group Secretaries

Botany: Miss MARGARET POTTER, 1/249 Highfield Road, Burwood, 3125 (889 2779).

Day Group: Mr. D. E. McINNES, 129 Waverley Road, East Malvern, 3145 (211 2427)

Geology: Miss HELEN BARTOSZEWICZ, 16 Euroa Avenue, Nth. Sunshine, 3020 (311 5106 A.H.)

Fauna Survey: Mr. JULIAN GRUSOVIN, 1 Warriner Court, East Oakleigh, 3166. (543 8627).

Microscopical: Mrs. ELSIE GRAHAM, 147 Broadway, Reservoir, 3073 (469 2509)

MEMBERSHIP

Membership of the F.N.C.V. is open to any person interested in natural history. The *Victorian Naturalist* is distributed free to all members, the club's reference and lending library is available and other activities are indicated in reports set out in the several preceding pages of this magazine.

Subscription rates for 1989

Metropolitan Members (03 area code)	$25.00
Joint Metropolitan Members	$27.00
Country/Interstate/Retired Members	$23.00
Joint Country/Interstate/Retired Members	$25.00
Student (full-time)	$18.00
Junior (under 18; no Victorian Naturalist)	$5.00
Subscription to Victorian Naturalist	$23.00
Overseas Subscription to Victorian Naturalist	$30.00
Affiliated Clubs	$25.00
Subscriber Clubs	$23.00
Individual Journals	$3.50
Late Fee (Renewing Members), after end of March	$2.00

JENKIN BUXTON PRINTERS PTY. LTD. 1-13 ABBOTSFORD ST WEST MELBOURNE 328-4774

The Victorian Naturalist

Vol. 106, No. 4 July / August 1989

Published by the FIELD NATURALISTS CLUB OF VICTORIA

Registered by Australia Post. Publication No. V.B.P. 1268

$3.50

FNCV DIARY

GENERAL MEETINGS (Second Monday)

General Meetings will he held at the Royal Society Hall, 9 Victoria Street, Melbourne, until further notice. Meetings commence at 8.00 pm.

Monday, 14th August
"Flora and Fauna Guarantee Act" Mr Phillp Sutton.

Monday, 11th Septemher
"Talks by Group Members".

Monday, 9th Octoher
Slide show on Antarctica. Oz Ertok from the Australian Conservation Foundation.

FNCV NEW MEMBERS May-June 1989

Peter Bennett, Greensborough.
Barry Harrison, Kew.
Jane Marks, Richmond.
Stephen Read, Parkville.

FNCV EXCURSIONS (First Sunday)

Sunday, 3rd September Serendip and the You Yangs. Serendip is not normally open on Sundays but the Ranger has offered to take us around, so a good attendance would be appreciated. The coach will leave Batman Avenue at 9.30 am, bring lunch. Fare $14.

Sunday, 1st October Working bee and barbecue at Kinglake Property. See page 164 of this issue for details.

Monday, 2nd to Friday 6th Octoher Little Desert. A coach has been chartered for this excursion, and accommodation twin-share in bunk rooms with breakfast and dinner has been booked. Lunches are available but were not booked as some members like to provide their own. The coach will leave Melbourne at 9.30 am, bring a picnic lunch. The cost of this excursion is $250 and a deposit of $50 should be sent to Marie Allender, 19 Hawthorn Avenue, Caulfield North 3161 when booking. *(Later Note)* The coach may not be able to pick up in Flinders Street and there will probably be a pick up at Caulfield Railway Station at 9.15 am then at McKenzies depot in Barkers Road and at a point to be arranged for other members. Balance of payment should be sent to Marie Allender by the 1st September. *At present* there is a waiting list so check before sending money.

Sunday, 5th November Lerderderg Gorge. Details next issue.

Sunday, 3rd December Nepean State Park. Details next issue.

Thursday 4th to Tuesday 9th January Mt. Buffalo. Accommodation only has been booked at the Chalet at $425 private facilities, $345 standard, this covers all meals. Members not travelling by car can take the train to Wangaratta, the coach to the Chalet. Members with 60+ tickets should be able to get a concession on the train. Bookings with $100 deposit should be sent to Marie Allender as soon as possible, stating type of accommodation preferred, rooms booked are a mixture so it may not be possible to give members their first preference. There is a camping ground at Lake Catani and anyone wishing to camp should make their own bookings.
Note: As mentioned last month Marie Allender (527 2749) will continue to take bookings on behalf of Joan Harry for excursions previously arranged.

GROUP EXCURSIONS

All FNCV members and visitors are invited to attend any Group Excursion.

Fauna Survey Group

Sat 9th – Sun. 10th September Strathbogies. Training in Fauna Survey Skills.

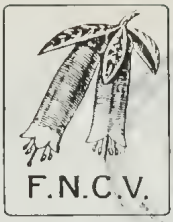
Thur 28th – 30th September Nooramunga Islands Survey.

Sat 14th – Sun 15th Octoher Werribee M.M.B.W. Water Rat Studies.

Botany Group

Sat 23rd September Brisbane Ranges. Leader Norman Plever.

Sat 28th October Tynong North to Gembrook. Variety of Vegetation Associations. Leader Hilary Weatherhead.



The Victorian Naturalist

Volume 106, Number 4 July / August, 1989

Editors: Robyn Watson and Tim Offor.

ISSN 0042-5184

Cover photo: The fungus *Gerronema postii* fruiting amongst liverwort (*Marchantia*) and moss (*Funaria*) (see article by T. May and B. Fuhrer on p. 133). Photo: Bruce Fuhrer

From the Editors

You may have noticed that over the last couple of issues there have been a few changes in *The Victorian Naturalist*. Articles are appearing under new headings and we have changed the style to make it easier to read. In order to explain some of these changes we have published the **Editorial policy** of the journal in the back of this issue.

The journal now has clearly defined categories of articles. Scientific papers in the traditional style will be published under the heading of **Research Papers**. A new category has been introduced, headed **Contributions**. Many articles do not conform readily to the strict format and content requirements of a scientific paper and these can now be published as contributions. We hope that the creation of this new category will encourage you to submit more material for publication, be it the results of fauna or flora surveys, interesting observations and notes on taxa, new recordings, historical papers or literature reviews, the list is limited only by your imagination. In this issue we have published a bibliography of recent publications dealing with *Banksia* as a contribution. This is a popular genus and we hope this bibliography is of use to *Banksia* enthusiasts who wish to keep up to date with research into the genus. In each issue we would like to publish a commissioned article on a topic of general interest under the heading of a **Commentary**. We hope that these will be both interesting and educational. We would appreciate suggestions of topics to be included in future issues. **Naturalist Notes** will remain and hopefully blossom as you are inspired to send in short informal notes on your observations of our natural history. We will continue to commission and publish **Book Reviews** relevant to Australian natural history. **FNCV News** will keep us informed of what is happening in the club and the **Diary** will let us know what is coming up. **Letters** to the editors are always encouraged and we would like to be able to publish more of them.

We have developed this new format to give everyone the opportunity to contribute to *The Victorian Naturalist*, so get out your pens, typewriters or word processors and start writing. The **Guide to Contributors** at the back of this issue explains how to set out your document. We prefer typed manuscripts because these make the job of the typesetter much easier and therefore save us money. If you do not have access to these facilities you can send us short hand-written notes, preferably well spaced to leave room for editorial marks. If you have an idea for an article that you would like to write, ring us or write to us and we will be happy to discuss it with you.

At this point we would like to make a plea for some assistance with word processing. It would only be small amounts on an irregular basis but would help us a great deal and allow us to devote more time to the magazine. Our phone number is on the back cover so ring us if you think you can help.

In this issue, in addition to the *Banksia* bibliography, you will find a report on the butterflies of La Trobe University. This extensive paper makes a useful contribution to our knowledge of the fauna of the remnant vegetation of metropolitan Melbourne. Another entomological paper contains some observations and comments on potential pollinators of *Micromyrtus ciliata*. In the botanical field you will find a contribution documenting the occurrence of fungi after fire with detailed notes on an uncommon species of fungus. A commentary on the Fauna and Flora Guarantee is essential reading for those unfamiliar with this landmark piece of legislation. Finally the 'Farewell to Mr Sonenberg' gives a most interesting insight into the life of Edward L. Sonenberg, a man who has made an invaluable but unsung contribution to botanical education.

We hope that you enjoy the July/August issue of the Victorian Naturalist.

The Editors

More on the Ada Tree

I refer to an article entitled 'The Ada Tree' in Volume 106, number 3 (1989). The article contains a number of small but important misconceptions which deserve correction.

The Ada Tree is not the tallest known tree in Victoria, and the Department of Conservation, Forests and Lands has not, to my knowledge, ever claimed it to be. There are probably many taller trees in the central highlands, including the Big Tree in the Cumberland Scenic Reserve which was last measured to be approximately 84 metres in height.

The area surrounding the Ada Tree has been logged at least twice this century, firstly before the great fires of 1939, and again in the 1970's. The large trees in the vicinity of Island Creek still exist because:

(a) the wet gully protected these trees from intense fires which killed the mountain ash on the higher slopes;
(b) the trees were either too large to handle as logs or deemed to be overly defective by carlier logging contractors;
(c) in recent logging operations such sites would be protected from logging by Departmental prescriptions.

All that aside, the Ada Tree is certainly a magnificent specimen, and well worth a visit.

Yours faithfully,

J.D. Twentyman
Acting Regional Manager
Dandenong Region

URGENT

To all members

TREASURER REQUIRED IMMEDIATELY

This interesting and essential position entails attending council meetings (once a month) and several hours work on a regular basis. Yvonne Gray has continued working well past her resignation date and this position must be filled **immediately**. Phone Graeme Love (697 5109 B.H.) or Sheila Houghton (551 2708).

There has been an offer of an Assistant Treasurer.

Working Bee and Barbecue

For a pleasant day's outing come along to the Kinglake Working Bee. See p. 164 for details.

Special Book Offer

The FNCV is offering members the latest volume of *'Flora of Australia', Vol. 3, Hamamelidales and Urticales* at the special price of $34.00 (hardcover). The recommended retail price is $44.95. Softcover can also be ordered. The offer is open to members only and books are to be collected personally from a general meeting. Place your order with Sheila Houghton (551 2708).

The Butterfly Fauna of La Trobe University, Victoria

by Michael F. Braby*

Abstract

Observations on the seasonal occurrence and distribution of butterflies were made at La Trobe University and Gresswell Hill between 1982 and 1989. A total of twenty-eight species are recorded of which sixteen (57.1%) are considered resident. For each species, relative abundance and ecological status are indicated, and for some Lycaenidae new information on the life history is given. The butterfly fauna is then briefly compared with areas adjacent to La Trobe University and likely sources for non-resident species are indicated. The conservation significance of the resident fauna is discussed in relation to its close proximity to Melbourne.

Introduction

There are a number of general accounts which list the occurrence of butterflies (Lepidoptera: Hesperioidea, Papilionoidea) for certain broad areas in Victoria (e.g. Tindale 1953; Crosby 1965, 1975; McEvey 1973, 1979; Dunn and Hunting 1983; Braby 1987), but virtually nothing has been published which gives reasonably complete faunal assemblages for specific regions or habitats. The Entomological Society of Victoria (1986) lists, on grid basis, some 66 species which have been recorded over the last forty years within about a 40 km radius of Melbourne; a further 10 species are recorded in the literature and by collectors (Braby, unpublished data). In addition, a vast amount of information has been accumulated on general butterfly distribution near Melbourne over the last one hundred years from specimens (held in Museum and private collections) collected by naturalists and private entomologists, and from papers and reports on field excursions, meetings, etc. published in *The Victorian Naturalist* and *Victorian Entomologist*, but this information has yet to be synthesised and fully evaluated. Popular works by McCubbin (1971) and Common and Waterhouse (1981) also give general localities for some of the rarer and uncommon species.

Much of the natural habitat close to Melbourne (within 20 km) has disappeared and few areas remain which support samples of the natural, though often degraded, vegetation. Not surprisingly, these areas are often the only locations at which resident populations of the indigenous butterfly fauna occur within the metropolitan area. Furthermore, several species are believed to have become extinct from the Melbourne area (D.F. Crosby pers. comm.) through urbanisation and lack of appropriate habitat reservation. Clearly, for the long-term conservation of the remaining suburban butterfly fauna, information on the status and distribution of each species is needed so that appropriate steps can be taken to manage existing reserves and preserve habitats of entomological significance.

In this paper the distribution, seasonal occurrence, relative abundance and ecological status of the butterflies occurring at La Trobe University and Gresswell Forest in the Bundoora-Macleod area is presented. It is one of a series giving a detailed account of the butterfly fauna which currently occurs in the north-eastern region of metropolitan Melbourne. Reference is made to Ambrose's (1975) unpublished list of butterflies since prior to 1982 it appears that very little recording or collecting has been made from the areas studied.

*Department of Zoology, La Trobe University, Bundoora, Victoria, 3083.
Present Address: Department of Zoology, James Cook University, Townsville, Qld., 4811.

The Study Area

La Trobe University (Fig. 1) is situated approximately 13 km NE of Melbourne. The university campus, an area of approximately 196 ha, includes the campus proper (between Ring Road and Kingsbury Drive), a 28 ha Wildlife Reserve and several areas which contain some remnant vegetation between Ring Road and the university boundary. An artificial moat system, which drains the Wildlife Reserve and extends through campus, flows into Darebin Creek. The university also manages Gresswell Forest, a 50 ha bushland reserve situated 2 km north-east of campus (Fig. 1). Between Gresswell Forest and the Wildlife Reserve lies Gresswell Hill, an uncleared prominent hill-top with about 9 ha of natural vegetation, which at the time of writing is not protected, being partly managed by Mont Park Mental Health Authority, but may in future become a conservation reserve (G. Paras pers. comm. 1988).

The university campus, Wildlife Reserve and Gresswell Forest occur on low (60 to 80 m a.s.l.) undulating terrain of sandstone and claystone deposits of Silurian age (Land Conservation Council of Victoria, 1973). Gresswell Hill is of similar geology and reaches an elevation of approximately 120 m above sea level. Mean annual rainfall for La Trobe University is 619 mm (Bureau of Metcorology).

After colonial settlement most of what is now the Wildlife Reserve and university campus was cleared and grazed, so that by 1967, when the University was established, much of the original habitat had disappeared and only scattered stands of the indigenous vegetation remained. These vegetation remnants are largely restricted to areas within the Wildlife Reserve and south-eastern and south-western corners of campus. Elsewhere, the vegetation consists of grasslands of exotic weeds (ie. former pastures) and plantations of introduced and native (mostly non-indigenous)

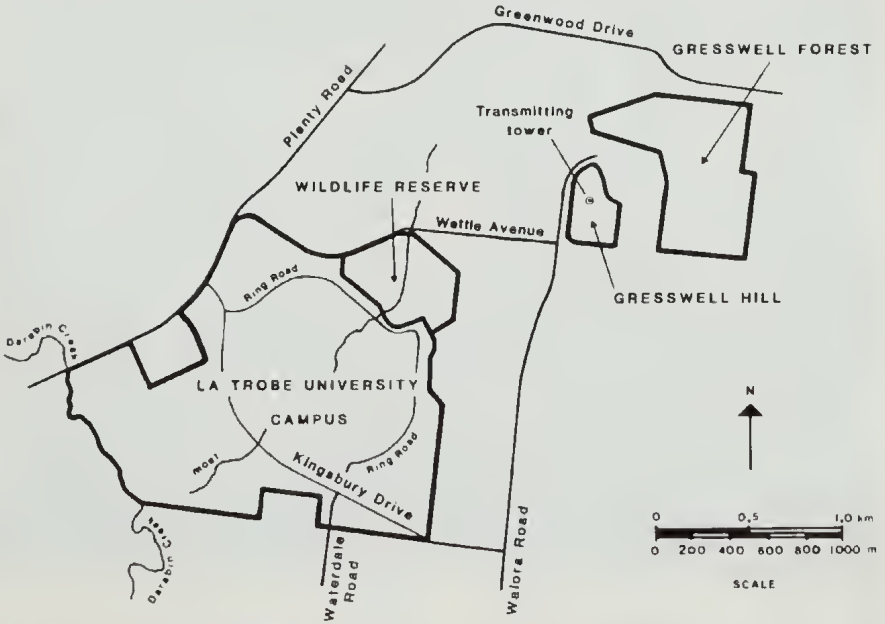


Fig. 1. Map of the study area showing the university campus, Wildlife Reserve, Gresswell Forest and Gresswell Hill.

trees and shrubs. A considerable amount of revegetation of the indigenous flora has also taken place in the Wildlife Reserve.

The vegetation remnants of the university campus and Wildlife Reserve and the vegetation of Gresswell Forest are essentially 'degraded' woodlands of *Eucalyptus camaldulensis* Dehnh. (nomenclature of Forbes and Ross 1988) with a grassy ground layer and a sparse woody stratum in the understorey (Fig. 2) (Carr 1977, 1980, 1983). Scattered stands of small trees and shrubs of *Acacia melanoxylon* R. Br., *A. mearnsii* De Wild., *A. pycnantha* Benth., *A. implexa* Benth. and some *Exocarpos cupressiformis* Labill. and *Cassinia aculeata* (Labill.) R. Br. largely form the woody stratum understorey. The herbaceous ground layer is dominated by *Themeda triandra* Forrsk although other grasses, *viz: Danthonia* spp Lam. & DC., *Microlaena stipoides* (Labill.) R. Br., *Poa morrisii* Vick., *Stipa* spp L. and some *P. labillardieri* Steudel may predominate depending upon slope and soil moisture (Carr 1980, 1983). Much of this ground cover vegetation is weed infested and many of the native species (e.g. orchids and lillies) have probably been lost.

The vegetation of Gresswell Hill is a woodland of *E. camaldulensis* with some *E. melliodora* A. Cunn. The understorey consists of a dense woody stratum of *Acacia pycnantha* with some *A. implexa, A. mearnsii, Cassinia longifolia* R. Br., *C. aculeata* and *Exocarpos cupressiformis* and a grassy ground cover with a more diverse array of native herbs. Further detailed information on the flora of Gresswell Hill is given by Faithful (1987).

The vegetation remnants at La Trobe University appear to represent a vegetation type which is somewhat floristically and structurally intermediate between the grasslands of the newer volcanic or basalt (Quaternary) plains to the west of the university (and which have their eastern edge in the extreme south-west corner of campus) and the mixed eucalypt woodlands and open-forests which occur on more dissected terrain and in a higher rainfall zone to the east (see Carr 1983). Prior to European settlement this vegetation type was formerly widespread to the east and north of metropolitan Melbourne, but has now virtually disappeared through clearing associated with urbanisation (Carr 1983).

Methods

Observations on butterfly incidence and distribution were recorded for La Trobe University campus, Wildlife Reserve, Gresswell Forest and Gresswell Hill by the author on an irregular basis from March 1982 to January 1989. The data accumulated over the seven year period has been combined for each month to give a broad indication of the seasonal occurrence of each species in the species list below.

Relative abundance and ecological status are indicated for each species. For relative abundance each species was arbitrarily determined as common (= widespread and numerous, ≥ 50 records made); uncommon (= thinly distributed, < 50 records made, or populations very localised in distribution) or scarce (= 1 or 2 individuals recorded only). The term 'ecological status' is adopted here to describe the occurrence of breeding populations and is similar to the classification proposed by Kitching *et al.* (1978) and Smithers (1981) for which they use the term 'status'. Each species was indicated as being either resident (= breed regularly with some stage present at all times of the year); visitor (= specimens regularly enter the area but do not breed or very rarely breed); vagrant (= specimens occasionally enter the area but do not breed) or immigrant (= populations enter the area on a seasonal basis but do not breed). It should be noted that for some species the precise ecological status is not known and only a predictive comment is given, based largely on published knowledge of life histories, larval host plants, etc., as the observations reported here were made primarily on adult occurrences during the study period.

Fig. 2. River red gum (*Eucalyptus camaldulensis*) woodland habitat at Gresswell Forest. (Photo: M.F. Braby).

Species List

The distribution, seasonal occurrence, relative abundance and ecological status are summarised below for each recorded species (nomenclature follows that of Common and Waterhouse 1981). Aspects of the life history are also given for some lycaenid species. Twenty-eight species are currently known to occur at La Trobe University and Gresswell Hill.

Hesperiidae

Dispar compacta (Butler). Dispar skipper. Recorded from all areas from late January to mid March. A localised population occurs in the Wildlife Reserve. At Gresswell Hill males may settle and fly high (> 10 m) around foliage and flowers of tall eucalypts. Relative abundance: common. Ecological status: resident (predictive).

Signeta flammeata (Butler). Bright-shield skipper. Two males were captured (and released) at Gresswell Hill in February and March 1988. Both individuals showed a strong tendency to perch 4 to 7 m above the ground on eucalypt or acacia foliage. Relative abundance: scarce. Ecological status: vagrant (possibly visitor).

Taractrocera papyria papyria (Boisduval). White grass-dart. Recorded from all areas between early November and mid March, although adults probably fly earlier and later. Populations appear confined to the vegetation remnants on university campus. This species is usually encountered in small numbers and does not appear as numerous as *D. compacta* or *O. walkeri*. Relative abundance: common. Ecological status: resident (predictive).

Ocybadistes walkeri sothis Waterhouse. Yellow-banded dart. Recorded from all areas between early November and late March, although adults probably appear much earlier and later. Status: common. Presence: resident (predictive).

Papilionidae

Papilio anactus W. S. Macleay. Dingy swallowtail. Occasionally recorded in the Wildlife Reserve and Gresswell Forest, but most sightings have been made at Gresswell Hill where small numbers of males (usually 5 to 10) regularly fly, patrolling in open sunny areas, between late November and mid April. Relative abundance: uncommon. Ecological status: visitor.

Pieridae

Eurema smilax (Donovan). Small grass yellow. A single worn specimen was captured in the Wildlife Reserve on 5 March 1984; the butterfly was moving rapidly in a north-westerly direction. Relative abundance: scarce. Ecological status: vagrant.

Delias aganippe (Donovan). Wood white. Infrequent recordings have been made between late September and late February at Gresswell Hill where males occasionally fly in small numbers (< 5). A single female was observed on 2 September 1982 in remnant vegetation near university campus, in an area which now largely forms part of the new State Forensic Science Laboratory. Relative abundance: uncommon. Ecological status: visitor.

Delias harpalyce (Donovan). Common imperial white. Recorded infrequently between late September and mid April at university campus and Gresswell Hill, where small numbers occasionally fly. This species is not recorded at Gresswell Forest and the only record for the Wildlife Reserve is by Ambrose (1975). A single deformed pupa was located on the host plant *Muellerina eucalyptoides* (DC) Barlow parasitising *Eucalyptus camaldulensis* on university campus. Relative abundance: uncommon. Ecological status: visitor.

Anaphaeis java teutonia (F). Caper white. Recorded from all areas. This species makes regular seasonal influxes during spring when adults migrate in a westerly direction. Butterflies first appear

in late September but are particularly abundant during late October and November; the precise timing of such appearances varies from season to season. A few stragglers have been recorded during December. Relative abundance: common. Ecological status: immigrant.

Pieris rapae rapae (L.). Cabbage white. Recorded from all areas during each month of the year. Status: common. Presence: resident.

Nymphalidae

Danaus chrysippus petilia (Stoll). Lesser wanderer. One individual was observed moving in a north-westerly direction at university campus on 5 March 1984. The species is also recorded for the Wildlife Reserve (Ambrose 1975). Relative abundance: scarce. Ecological status: vagrant.

Danaus plexippus plexippus (L.). Wanderer. A single individual was observed at Gresswell Forest on 12 January 1986. Relative abundance: scarce. Ecological status: vagrant.

Geitoneura acantha ocrea (Donovan). Ringed xenica (Fig. 3). A small localised population occurs at Gresswell Forest, where adults fly from late December to early April and are largely confined to moist, shady microhabitats which prevail along the creek systems and sheltered slopes. A single male was captured (and released) in the Wildlife Reserve on 5 February 1988 and it is not known if a resident population occurs here. Relative

Fig. 3. Male ringed xenica (*Geitoneura acantha*) at Gresswell Forest (x 3.8). (Photo: M. Coupar).

abundance: uncommon. Ecological status: resident.

Geitoneura klugii klugii (Guerin-Meneville). Klug's xenica. Recorded from all areas from early December to mid April. On university campus this species is confined to the vegetation remnants and is less numerous than elsewhere. Relative abundance: common. Ecological status: resident.

Heteronympha merope merope (F.). Common brown. Recorded from all areas from early November to mid May. Relative abundance: common. Ecological status: resident.

Heteronympha penelope sterope Waterhouse. Shouldered brown. One male was recorded at Gresswell Hill on 19 March 1988. Relative abundance: scarce. Ecological status: vagrant.

Polyura pyrrhus sempronius (F.). Tailed emperor. A single individual was observed near the moat system on university campus on 20 March 1985. The specimen was in evidence for only several minutes during early afternoon as it flew rapidly around several large trees before disappearing. A specimen (possibly the same individual) was also observed on several occasions in the same area the previous day (B. Burns pers. comm). Relative abundance: scarce. Ecological status: vagrant.

Vanessa itea (F.). Australian admiral. Recorded infrequently from all areas between late September and mid March. This species is usually observed in very low numbers with most records at Gresswell Hill. Relative abundance: uncommon. Ecological status: visitor.

Vanessa kershawi (McCoy). Painted lady. Recorded from all areas from mid August to early May. Adults are particularly abundant at Gresswell Hill early in the season. This species possibly does not overwinter in the study area; the populations being temporarily established each season by arrival of late-winter and early spring migrants. Relative abundance: common. Ecological status: resident/visitor (predictive).

Junonia villida calybe (Godart). Meadow argus. Recorded from all areas from late September to mid May. This species may exhibit a similar seasonal strategy to *V. kershawi*. Relative abundance: common. Ecological status: resident/visitor (predictive).

Lycaenidae

Hypochrysops delicia delos (Waterhouse and Lyell). Blue Jewel (Fig. 4). Recorded from Gresswell Forest, Wildlife Reserve and Gresswell Hill, where adults fly from mid November to late February. A single larva with attendant ants (*Crematogaster* sp.) was discovered in the Wildlife Reserve by I. Faithful on a 5 m high *Acacia mearnsii*. At Gresswell Hill, Gresswell Forest and Strathallan Creek adjacent to Gresswell Hill this species breeds very locally on 6 to 9 m high trees of *A. mearnsii*, the larvae and pupae predominantly being found in association with ants on trees infested by wood-boring insects. The species is univoltine and overwinters in the larval stage. At Gresswell Hill one larva and a number of eggs (total = 230) were found on the trunk of an 8 m high *A. pycnantha*. All eggs were laid within 1 m from the ground in compact clusters, with a range of 5 to 25 eggs per cluster. Relative abundance: uncommon. Ecological status: resident.

Ogyris abrota Westwood. Dark purple azure (Fig. 5). Recorded from the university campus and slopes of Gresswell Hill where the species breeds locally on *Muellerina eucalyptoides* (usually parasitising *Eucalyptus camaldulensis* but occassionally *Acacia mearnsii*). At Gresswell Hill the attendant ant is *Crematogaster* sp., however, on campus the early stages are associated with *Iridomyrmex* sp. or the introduced *I. humilis*, which has possibly displaced the idigenous ant. The species overwinters in the larval stage and there appear to be two generations annually with pupae occurring during October and November and again during January and

Fig. 4. Male blue jewel (*Hypochrysops delicia*) on golden wattle (*Acacia pycnantha*), a new larval host plant, at Gresswell Hill (x 3.3). (Photo: M. Coupar).

Fig. 5. Male dark purple azure (*Ogyris abrota*) on creeping mistletoe (*Muellerina eucalyptoides*) at University Campus (x 2.8). (Photo: M. Coupar).

February. Adults fly from late October to mid December and again from late January to early April. It is likely that the adult flight periods of the two broods merge in some seasons (i.e. during December and January). Relative abundance: uncommon. Ecological status: resident.

Ogyris olane ocela Waterhouse. Olane azure. Infrequent recordings have been made between early October and early April at Gresswell Hill where adults fly in very small numbers. Relative abundance: uncommon. Ecological status: visitor.

Jalmenus evagoras evagoras (Donovan). Common imperial blue (Fig. 6). Recorded from all areas from early November to late March. This species overwinters in the egg stage and breeds locally on a variety of small wattles (< 3.5 m high) at Gresswell Forest, Wildlife Reserve and university campus. Only a single individual has been recorded at Gresswell Hill, and resident populations do not appear to be established here. On university campus populations are confined to the vegetation remnants in the south-eastern corner. The early stages are associated with *Iridomyrmex* sp. (aff. *gracilis eteocles*) ants and the preferred host plant is *Acacia mearnsii*, although *A. melanoxylon* is occasionally utilised in the Wildlife Reserve and Gresswell Forest. Larvae have also been recorded utilising *A. dealbata* Link and *A. pycnantha* in the Wildlife Reserve (Braby 1988a) and on university campus larvae were found feeding on a single 1 m high plant of the non-indigenous *A. decurrens* (J. Wendl.) Willd. Relative abundance: common. Ecological status: resident.

Nacaduba biocellata biocellata (C. and R. Felder). Double-spotted line blue. Infrequent recordings have been made from all areas between early December and early March. This species is encountered in variable numbers, sometimes being locally abundant for short periods (1-2 weeks) often around particular flowering eucalypts and acacias. Relative abundance: uncommon. Ecological status: resident (predictive).

Theclinesthes serpentata serpentata (Herrich-Schaffer). Chequered blue. Two adults were recorded in the Wildlife Reserve and university campus during March and April 1984. Relative abundance: scarce. Ecological status: resident (predictive).

Lampides boeticus (L.). Pea blue. Recorded from all areas from late October to mid April, although adults probably fly earlier and later. This species appears to be more numerous at Gresswell Forest and Gresswell Hill than elsewhere. Relative abundance: common. Ecological status: resident (predictive).

Zizina labradus ladradus (Godart). Common grass blue. Recorded from all areas from early November to early May, although adults undoubtedly appear earlier. Relative abundance: common. Ecological status: resident.

Lycaenid sp. A few sightings of a small unidentified species of lycaenid have been made at Gresswell Hill in January where adults have been observed flying high (> 10 m) around tree-tops. In size and behaviour they somewhat resemble *N. biocellata*, but may prove to be *Theclinesthes miskini* (T. P. Lucas) or *Acrodipsas* spp. Sands, all of which have been taken in the outer Melbourne region in only a limited number of areas, often on hill-tops (Field 1977; Dunn 1982; Common and Waterhouse 1981). Several colonies of *Iridomyrmex nitidus*, the attendant ant of *A. myrmecophila* (Waterhouse and Lyell), occur on *Acacia melanoxylon* stumps at Gresswell Forest and it is therefore possible that this localised butterfly breeds there.

Discussion

General Comments of the Fauna

Of the 28 species of butterflies recorded for La Trobe University only 16 (57.1%) are considered resident and of these 11 (68.7%) are common and 5 (31.3%) are uncommon or scarce. Five (17.9%) species

Fig. 6. Common imperial blue (*Jalmenus evagoras*) on black wattle (*Acacia mearnsii*) at Wildlife Reserve (x 3.7). (Photo: M. Coupar).

are considered visitor, six (21.4%) vagrant and one (3.6%) immigrant. All visitor and vagrant species are uncommon and scarce respectively.

Total numbers of species recorded for each of the four areas (university campus = 20, Wildlife Reserve = 21, Gresswell Forest = 18, Gresswell Hill = 22) are similar, although it is difficult to make meaningful comparisons as the areas covered differ markedly in area and habitat quality, and the figures do not differentiate between resident and non-resident species. Gresswell Hill appears to contain a relatively high proportion of species (79% of the total) for its small area (< 4% of the total study area). This high density of species undoubtedly reflects the widespread mate-location behaviour of butterflies, referred to as 'hill-topping' (Shields 1967), a reproductive strategy in which males and virgin females instinctively seek hill-tops to mate. Seven (33.3%) species at Gresswell Hill are non-residents within the study area and four of these, *Signeta flammeata, Delias aganippe, Heteronympha penelope* and *Ogyris olane*, are not recorded elsewhere. In addition, seven species (*Dispar compacta, Pupilio anactus, Delias harpalyce, Vanessa itea, V. kershawi, Hypochrysops delicia* and *Lampides boeticus*) are generally observed here in greater numbers than elsewhere. A few other resident species may also utilise the hill-top for mate-location, and it is likely that Gresswell Hill may facilitate genetic interchange between populations of a number of species at Gresswell Forest, university campus and Wildlife Reserve, as well as other nearby areas, which would otherwise be isolated.

Resident Species

General aspects of the biology and life history of three resident lycaenid species viz: *Hypochrysops delicia, Ogyris abrota* and *Jalmenus evagoras* are briefly discussed below.

The occurrence of eggs and a single larva of *Hypochrysops delicia* on *Acacia pycnantha* represents an unrecorded host plant; previously the species was known to utilise only seven different species of *Acacia* (Common and Waterhouse 1981; Braby and Berg 1989). However, as this particular plant was 1 m distant from an *A. mearnsii* tree supporting a colony of *H. delicia*, and no further eggs were located on other *A. pycnantha* trees, it is likely that the presence of these eggs reflect an oviposition mistake. Furthermore, only one larva was found, which was reared on *A. pycnantha* foliage to the adult stage in captivity, indicating that this host plant record is a very isolated occurrence.

Males of *H. delicia* (Fig. 4) exhibit a distinct tendency to hill-top in large numbers during late afternoon at Gresswell Hill. Amongst the terminal foliage of 9 to 12 m high eucalypts, males fly and perch with their wings open at 90°, exposing the brilliant metallic blue uppersides to the late afternoon sun. This behaviour is of interest as adults of this species were previously thought not to open their wings while at rest (McCubbin 1971).

Ogyris abrota (Fig. 5) apparently has two generations annually (Atkins 1976; Common and Waterhouse 1981) and limited evidence on adult and pupal phenology reported here support this, but further detailed information on the life history is needed. The presence of *Iridomyrmex humilis* ants associating with larvae and pupae is of interest as this is the first time an introduced species of ant has been found attending the early stages. Similar observations have been noted along the Yarra River at Richmond (R. Field pers. comm.). It is therefore possible that *I. humilis* has excluded the natural attendant ant in some suburban areas, but whether *I. humilis* is filling the same role as the native ant remains to be established.

Jalmenus evagoras (Fig. 6) has been recorded utilising *Acacia implexa* at Macleod (Cherry Street grassland) adjacent to Gresswell Forest (Braby 1988a), bringing the total number of host plant species upon which this butterfly breeds

to six for the Macleod-Bundoora area. This figure represents about one third (35.3%) of the total number of known host plants used by this species throughout its wide geographic range. Four of the six species (*A. dealbata, A. decurrens, A. pycnantha* and *A. implexa*) are used in very low frequency, although *A. dealbata* is largely confined to a few areas within the Wildlife Reserve.

Visitor and Vagrant Species

Four vagrant species, *Eurema smilax, Danaus chrysippus, D. plexippus* and *Polyura pyrrhus*, make irregular seasonal appearances in Victoria as the adults extend their normal distributions southwards but generally fail to become established or breed for only one or two seasons. *E. smilax* and *D. chrysippus* were both observed during a period when a small migratory flight occurred around Melbourne (Braby 1988b). *D. plexippus* undergoes a regular range expansion and contraction, though does breed seasonally in Victoria (Smithers 1977), whilst *P. pyrrhus* makes very sporadic appearances within the state (Common and Waterhouse 1981).

Five species (*Signeta flammeata, Papilio anactus, Heteronympha penelope, Vanessa itea* and *Ogyris olane*) are not established within the study area because of an absence of their larval host plants and a further two species, *Delias aganippe* and *D. harpalyce*, also do not appear to breed. *Exocarpos cupressiformis*, a host plant of *D. aganippe*, occurs widely in Gresswell Forest and on Gresswell Hill but the early stages of *D. aganippe* have not been located. Similarly, *Muellerina eucalyptoides*, a host plant of *D. harpalyce*, occurs abundantly on university campus but the butterfly does not appear to regularly breed here and only a single pupa has been located. It is highly probable that adults of these seven species enter the area from nearby bushland areas where resident populations appear to be established. Likely sources (within 4 to 8 km) include the Plenty River gorge (between Greensborough and South Morang), the lower Yarra River valley, and possibly Watsonia Army Barracks at Lower Plenty. Breeding populations of *D. harpalyce* and *O. olane* are known to occur at Plenty and Bundoora respectively in the Plenty River Gorge (pers. obs.).

Immigrant Species

Regular seasonal migrations of *Anaphaeis java* have been well noted in Victoria (e.g. McCubbin 1971), but the source of such large population numbers has yet to be determined.

Adjacent Butterfly Fauna

Resident populations of six species were recorded by the author within 5 to 10 km from the boundaries of the study area (Table 1), but were not recorded at La Trobe University or Gresswell Hill. The absence of these species, some of which may have once occurred in this area, is related to the absence or poor development of their natural host plants which may be related to the degraded nature of the existing habitat or complete loss of habitat. For example, small remnant stands of *Lomandra longifolia* Labill., the host plant of *Trapezites symmomus* Hubner, occur at Gresswell Forest but are possibly too limited in number to support a viable population of the skipper. This common and widespread butterfly probably once occurred in the area, and attempts to reintroduce more host plants and establish a resident colony are currently in progress (Braby unpublished data).

In addition to the species listed in Table 1 a further two species were recorded near La Trobe University. A female *Heteronympha banksii* (Leach) was recently sighted (7 April 1987) at Plenty River Gorge, Bundoora (D. F. Crosby pers. comm.), where it is likely that a very small, isolated population persists. A localised colony of *Lucia limbaria* Swainson was also recently located at Campbellfield,

approximately 11 km NW of the study area, in some remnant grassy (*Themeda*) Woodland (*E. camaldulensis*) similar to that which occurs on university campus. The food plant *Oxalis corniculata L.* occurs at La Trobe University and it is thus possible that this species may occur or formerly occurred in the Macleod-Bundoora area.

There are also old specimen records for two species taken near the study area, but the species now appear locally extinct. The first of these is *Trapezites luteus* (Tepper), which was taken around 1942-1943 at Eltham and Research approximately 8 km east and 12 km ENE of La Trobe University respectively (A. N. Burns and M. Le Souf pers. comm.). It is not certain if this species occurred in the study area, but its recorded host plant at Ringwood near Melbourne, *Lomandra filiformis* (Thunb.) Britten (D. F. Crosby pers. comm.) is present. The other species is *Jalmenus ictinus* Hewitson. The Museum of Victoria holds seven specimens which were collected by F. P. Spry in 1921 from Broadmeadows, approximately 12 km WNW of La Trobe University. This species has been taken at only several localities near Melbourne, including Eltham (Braby and Douglas unpublished data) and possibly it is now extinct from the inner Melbourne area (D. F. Crosby pers. comm.). It is likely that intervening populations once occurred between Broadmeadows and Eltham in the Macleod-Bundoora area.

It is of interest to compare the butterfly fauna of La Trobe University with that recorded for several other nearby areas. Preliminary observations made by the author at Plenty River gorge, approximately 5 to 8 km NE of the study area, have yielded 20 species of which 16 are considered resident. The fauna appears similar in composition to that reported here but with two species, *Trapezites symmomus* and *Candalides hyacinthinus* (Semper), not recorded for La Trobe University. Moreover, four common and widespread species (*D. harpalyce, H. penelope, V. itea, O. olane*) are considered resident at Plenty River gorge, but were found to be non-resident at La Trobe University, although resident populations of *H. penelope* and *V. itea* may have once occurred. Original habitat has virtually disappeared from areas to the immediate south, west and north-west of the study area. Brief observations in the few areas which contain some remnant vegetation,

Table 1. Resident species which currently occur near or within the Macleod-Bundoora area but were not recorded from La Trobe University or Gresswell Hill.

Species	Nearest localities	Host plant
Trapezites symmomus soma Waterhouse	Eltham, South Morang, Plenty, Kew	*Lomandra longifolia* Labill.
T. phigalioides Waterhouse	Eltham, Diamond Creek	*L. filiformis* (Thunb.) Britten
T. phigalia phigalia (Hewitson)	Eltham	*L. filiformis*
Hesperilla donnysa patmos Waterhouse	Eltham, Greensborough	*Gahnia radula* (R.Br.) Benth.
Paralucia pyrodiscus lucida Crosby	Eltham, Montmorency, Greensborough	*Bursaria spinosa* Cav.
Candalides hyacinthinus hyacinthinus (Semper)	Eltham, Greensborough, Bundoora, Mill Park, South Morang	*Cassytha pubescens* R.Br.

such as the Yarra River, Darebin and Merri Creeks and Gellibrand Hill Park, have yielded few species (total = 20) of which all but two (*T. symmomus* and *L. limbaria*) occur at La Trobe University.

To the east of the study area 52 species have been recorded for the much larger Eltham-Kangaroo Ground area (Braby and Douglas unpublished data) and this area contains all the species listed for La Trobe University. The almost two-fold difference in the number of species between the two areas is largely attributed to differences in area and habitat, the Eltham-Kangaroo Ground study area being about 30 times larger and containing greater habitat diversity and quality than the present study area.

Conclusions

The butterfly fauna which currently occurs at La Trobe University and Gresswell Hill has high conservation significance in terms of its close proximity to Melbourne. The area preserves a habitat type which is poorly represented elsewhere and contains resident populations of several species, in particular *Geitoneura acantha, G. klugii, Jalmenus evagoras* and *Hypochrysops delicia*, which appear to be absent from or less well established in suburban areas closer to Melbourne. As almost the entire area surrounding La Trobe University and the Mont Park Mental Health Authority is developed and urbanised for several kilometres, populations of some resident species are probably isolated through loss of adjoining habitat.

It is difficult to compare the fauna with nearby areas due to the paucity of detailed studies. The Eltham-Kangaroo Ground district to the east of La Trobe University contains more species, but it must be emphasised that this area is not only substantially larger but containes greater habitat diversity and habitat quality. Moreover, relatively little land of this area is reserved (< 5%) and some species and many populations of resident species occur on private land. The preservation of the butterfly fauna at La Trobe University therefore may in future have considerable conservation importance for the long term survival of some resident species; only a limited number of other such areas may persist in the north-eastern region of Melbourne.

At present unreserved, Gresswell Hill has high conservation value because of the scarcity of hill-tops with natural habitat close to Melbourne. Many butterflies clearly utilise the hill as a resource for mate-location, as indirectly indicated by the relatively high density of species, greater numbers of particular species and the high proportion of non-resident species. The hill may allow genetic interchange between populations within La Trobe University and/or neighbouring areas such as the Plenty River Gorge. The proposed housing development at Mont Park (between Gresswell Forest, Wildlife Reserve and Gresswell Hill), however, could seriously restrict movement of hill-topping species to Gresswell Hill, resulting in considerable reproductive (genetic) isolation of these populations.

Acknowledgements

This paper is dedicated to the late Rod Foster (Keeper, La Trobe University Wildlife Reserve) who generated much inspiration and enthusiasm in initiating this study. Professor Ian W. B. Thornton kindly read the manuscript and made helpful comments. I am grateful to Mr. Ken Walker for identifying the attendant ants of lycaenid species and for allowing access to examine specimens lodged within the Museum of Victoria. Dr. Mike Coupar generously provided his photographs. The author also thanks Dr. Tim New, Mr. George Paras, Dr. Ross Field, Mr. David Crosby, Dr. Alex Burns, Mrs. Mary Le Souf and Mr. Bruce Burns for various comments and valuable information.

References

Ambrose, G.J. (1975). Some moths and butterflies recorded in the Wildlife Reserve in 1975. Unpublished list, held by La Trobe University Wildlife Reserves Management Committee.

Atkins, A. (1976). *Ogyris abrota, Jalmenus icilius* and a request. *Victorian Ent.* 6(5):37-38.

Braby, M.F. (1987). Notes on butterflies in the Big Desert, Victoria. *Victorian Ent.* **17**(2): 19-21.

Braby, M.F. (1988a). New food plants for *Jalmenus evagonas* (Donovan) (Lepidoptera: Lycaenidae). *Aust. ent. Mag.* **15**: 33-34.

Braby, M.F. (1988b). A note on directional flights of *Eurema smilax* (Donovan) (Lepidoptera: Pieridae) and *Danaus chrysippus petita* (Stoll) (Lepidoptera: Nymphalidae). *Aust. ent. Mag.* **15**: 53-57.

Braby, M.F. and Berg, G.N. (1989). Further notes on the butterflies of Wattle Park, Burwood. *Victorian Ent.* **19**(2): 38-42.

Carr, G.W. (1977). The vegetation of La Trobe University Campus. The selection and use of plant species for replanting of the moat system and Wildlife Reserve. Unpublished report, held by La Trobe University Wildlife Reserves Management Committee.

Carr, G.W. (1980). Proposed Development of the vegetation of La Trobe University Wildlife Reserve. Unpublished report, held by La Trobe University Wildlife Reserves Management Committee.

Carr, G.W. (1983). The vegetation of Gresswell Forest Reserve and its Management. Unpublished report, held by La Trobe University Wildlife Reserves Management Committee.

Common, I.F.B. and Waterhouse, D.F. (1981). *Butterflies of Australia*. Revised edition. Angus and Robertson, Sydney. 682 pp.

Crosby, D.F. (1965). Notes on some western Victoria butterflies. *Wings and Stings* August: 4-8.

Crosby, D.F. (1975). Insects of the Victorian National Parks. Part 1: Butterflies. *Victorian Ent.* **5**(3): 117-125.

Dunn, K.L. (1982). Notes on and an important extension to the distribution of *Theclinesthes miskini miskini* (T.P. Lucas) (Lepidoptera: Lycaenidae). *Victorian Ent.* **12**(5): 53-55.

Dunn, K.L. and Hunting, M.M. (1983). Butterflies of the Mount Buffalo National Park, Victoria. *Victorian Ent.* **13**(4): 40-44.

Entomological Society of Victoria (1986). Preliminary distribution maps of butterflies in Victoria.

Faithful, T. (1987). Vascular flora of Gresswell Hill. Unpublished list, held by La Trobe University Wildlife Reserves Management Committee.

Field, R. (1977). Rediscovery of *Pseudodipsas brisbanensis* in Victoria. *Victorian Ent.* **8**(5): 5-7

Forbes, S.J. and Ross, J.H. (1988). A census of the vascular plants of Victoria. Second edition. National Herbarium of Victoria, Department of Conservation, Forests and Lands.

Kitching, R.L., Edwards, E.D., Ferguson, D., Fletcher, M.B. and Walker, J.M. (1978). The butterflies of the Australian Capital Territory. *J. Aust. ent. Soc.* **17**: 125-133.

Land Conservation Council of Victoria (1973). Report on the Melbourne Study Area.

McCubbin, C. (1971). *Australian Butterflies*. Nelson, Melbourne. 206 pp.

McEvey, S.F. (1973). Notes on some moths and butterflies in the Rutherglen district from 1967. *Victorian Ent.* **3**(3): 4-6.

McEvey, S.F. (1979). Butterflies of some Gippsland rain forests. *Victorian Ent.* **9**(2): 12-13.

Shields, O. (1967). Hilltopping. *J. Res. Lepid.* **6**: 69-178.

Smithers, C.N. (1977). Seasonal distribution and breeding status of *Danaus plexippus* (L.) (Lepidoptera: Nymphalidae) in Australia *J. Aust. ent. Soc.* **16**: 175-184.

Smithers, C.N. (1981). A preliminary note on the Papilionoidea (Lepidoptera) of Tuglo Wildlife Refuge, New South Wales. *Aust. ent. Mag.* **7**: 91-96.

Tindale, N.B. (1953). New Rhopalocera and a list of species from the Grampian mountains, western Victoria. *Rec. S. Aust. Mus.* **11**: 43-68.

Notes on Fungi Occurring After Fire in Australia
1. Introduction and Description of *Gerronema postii*

Tom May and Bruce Fuhrer*

Introduction

Fungi are commonly observed to fruit after fire and are often the first new life to appear after bushfires. Fires ranging in extent from campfires to major wildfires will stimulate the fruiting of some fungi. Typical post-fire species include the agarics *Coprinus angulatus* Peck and *Pholiota carbonaria* Smith and the cup fungi *Anthracobia* spp. and *Peziza tenacella* Phill.; these species have been observed to fruit only after fire. Other species, such as *Galerina nana* (Petri) Kühn. and *Descolea recedens* (Cooke and Massee) Sing. occur commonly after fire but are found just as frequently in long unburnt forests.

The factors which cause fungi to fruit after fire in Australia have not been systematically investigated. Possible triggers of fruiting may be related to changes caused by fire to the soil microflora or the physical or chemical properties of the soil, or to the heating and drying effect of the fire. The fruiting bodies may arise from pre-existing mycelia or sclerotia, or from newly germinated spores. Wareup (1981) discusses some overseas research which indicates that post-fire fungi respond to the alkaline conditions present after fire. Wareup (1981) also points out the importance of suitable weather in the post-fire fruiting of fungi.

A factor which may affect some species is the removal of the litter layer by fire, thus producing a favourable environment for fruiting. In unburnt forests *Laccaria* spp. are often found on tracks or other litterless areas and Gardner and Malajczuk (1985) found that, on sites rehabilitated after mining in Western Australia where litter accumulated in troughts between bare ridges, *L. laccata* (Scop.: Fr.) Pat. was commoner on the ridges. *Laccaria* spp. can be observed in high density after fire, possibly due to a preference for bare areas rather than, for example, any specific chemical trigger.

The removal of the litter layer will also allow some fungi to be observed more readily, in particular those species whose fruiting bodies are partly buried under litter. The hypogean or subhypogean species *Labrinthomyces varius* (Rodway) Trappe, *Peziza whitei* (Gilkey) Trappe and *Hymenogaster atratus* (Rodway) Zeller and Dodge were all collected in the Lerderderg Gorge area after the 1983 fires, their fruiting bodies being visible without the usual necessity of raking or digging amongst litter.

A number of fungi which frequently fruit after fire possess sclerotia or pseudosclerotia from which the fruiting bodies arise. Selerotia are underground, solid masses of fungal tissue; the 'native bread' produced by *Polyporus mylittae* Cooke and Massee being a familiar example. Pseudosclerotia are composed of soil particles cemented together by fungal hyphae. These structures, which presumably are able to store nutrients and water and persist in the soil for long periods, enable a rapid fruiting response after fire. Fresh *P. mylittae* fruiting bodies were observed in the Powelltown area amongst still smouldering forest debris after the 1983 fires. Cleland (1976) records the appearance of *Polyporous tumulosus* Cooke and Massee within two weeks after fire. *P. sclerotinius* Rodway, with sclerotia, and *Lentinus dactyloides* Cleland (illustrated in Fuhrer, 1985, as *L. terrestris*), with pseudosclerotia, are also frequently found after fire.

Another interesting aspect is the value of fungi, especially those which fruit

*Department of Botany and Zoology, Monash University, Clayton, Vic., 3168.

underground, as food for animals after bushfires. We have observed lyre-birds digging up sclerotia of *P. mylittae* and also, on recently burnt areas, signs of animals digging for *Mesophellia* and *Castoreum* or partially eaten fruiting bodies of these species. In the mallee, *P. mylittae* is common after fire and it appears that mallee-fowls eat the fruiting bodies (Benshemesh, pers. comm.). Christensen (1980) found that hypogean fungi, such as *Mesophellia*, are important food resources for bettongs, particularly following fires.

The frequent occurrence of fire in Australia provides a good opportunity to observe the effect of fire on fungi. There are many interesting questions for the naturalist. Which species are strictly associated with burnt areas? How long before particular species fruit after fire, and for how many seasons will they persist? Does the intensity of the fire affect the species found? Does the occurrence of fruiting bodies stop sharply at the edge of the burnt area?

Identification is a major problem in answering ecological questions of this kind. We intend to describe in this series some of the commoner fungi associated with fire which have not previously been recorded in Australia or whose records lack adequate documentation. Microscopic details are provided but most species can be readily identified in the field.

Methods

All descriptions have been drawn up solely from Australian collections. Capitalised colour names are from Kelley and Judd (1965). Colour notation is from Munsell (1975, 1977) and Kornerup and Wanscher (1978). Unless otherwise stated, spore measurements are of spores from gill fragments mounted in 3% KOH to which was added a few drops of Congo Red solution (saturated solution in 40% NH_4OH). Dimensions of spores exclude the apiculus and any ornamentation. For spore measurements, '[30/5]', for example, indicates that 30 spores were measured, from 5 collections. $\bar{x}$ is the mean of a particular measurement. Q is the length/width quotient of individual spores. $\bar{Q}$ is the mean of the Q values. All drawings of microscopic characters have been made with the aid of a drawing tube.

Description of Gerronema Postii

Gerronema postii (Fr.) Singer 1961.

Omphalina postii (Fr.) Singer 1947.

See Bigelow (1970) for complete synonymy.

(Figs. 1, 2, 3)

CAP 5-25 mm diam., convex to plano-convex or plane, centrally depressed or umbilicate, margin incurved; translucent-striate at margin; hygrophanous; surface moist, smooth; Brownish Orange or Deep Orange (2.5YR 5/8), darker in centre. GILLS shallow, subdistant, decurrent; Pale Orange Yellow (10YR 8/4); edge concolourous, even. STIPE -48 mm high, 1-2 mm diam., central, even or attenuated downwards; Moderate Orange Yellow (7.5YR 7/8); surface smooth (sometimes sparsely fibrillose-squamulose under lens); basal mycelium densely white pruinose.

SPORES [33/4], 6.5-9.5(-10.5) x 4-6 µm, ($\bar{x}$ = 8.6 x 5.1 µm), larger from 2-spored basdia, 11-13.5 x 5-6.5 µm, ($\bar{x}$ = 12.3 x 5.5 µm); $\bar{Q}$ = 1.31-2.33(-2.86), $\bar{Q}$ = 1.79, ellipsoid, sometimes slightly medially constricted, hyaline, not amyloid, thin-walled, smooth, 1 to many guttalate. BASIDIA 22-32(-40) x 7.5-9 µm, clavate, 4-spored or 2- and 4-spored. CHEILOCYSTIDIA absent. LAMELLAR TRAMA of loosely interwoven hyphae 2-8 µm diam., not amyloid. PILEOPELLIS of repent, interwoven, cylindrical hyphae 3-14 µm diam. STIPITOPELLIS of parallel, cylindrical hyphae 2-8 µm diam., sometimes with scattered CAULOCYSTIDIA 27-71 x 6-13 µm, cylindrical, clavate, ventricose or ventricose-rostrate. CLAMP CONNECTIONS absent.

Fig. 1. *Gerronema postii* fruiting amongst liverwort (*Marchantia*) and moss (*Funaria*) after fire at Anglesea.

Fig. 2. *Gerronema postii*, smaller fruiting bodies.

Habit and Habitat: Gregarious, on the ground, amongst *Marchantia berteroana* Lehm. & Lindenb. and *Funaria hygrometrica* Hedw.; in heath (with *Leptospermum*) or forest (with *Eucalyptus*), usually in poorly drained areas; occurring exclusively after fire, May, Oct.-Nov.

Discussion

In the field the distinguishing characters of *G. postii* are the brownish orange caps which are centrally depressed when mature, and the decurrent gills. Fruiting bodies vary considerably in size, with the largest being found in swampy areas in winter. There is a coloured illustration of *G. postii* in Fuhrer (1985), taken at Anglesea.

The characters of the Australian collections agree well with the information on *G. postii* in Bigelow (1970), Phillips (1981), Singer (1964) and Spooner (1987). *Gerronema marchantiae* Singer & Clemençon, found only on *Marchantia* in alpine and northern Europe, is of similar appearance but the fruiting bodies are smaller and the spores larger than those of *G. postii* (Watling & Romero, 1989).

Omphalia fibuloides (Peck) Sacc. is a species regarded as a synonym of *G. postii* by Bigelow (1970) and was recorded from Australia by Willis (1934) but, according to Willis (1935), the record represents *Omphalia chromacea* Cleland, a common chrome-yellow species.

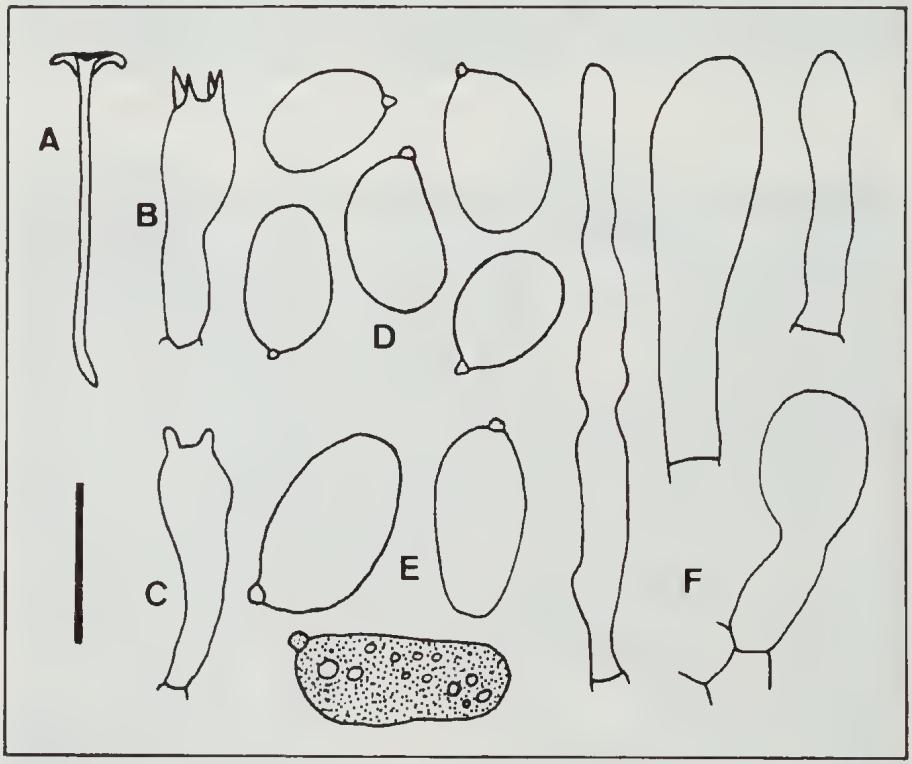


Fig. 3. *Gerronema postii*: A, cross section of fruiting body; B, 4-spored basidium; C, 2-spored basidium; D, spores from 4-spored basidia; E, spores from 2-spored basidia; F, caulocystidia. Scale bar = 20mm for A; 10 µm for B, C, F; 20 µm for D, E.

Gerronema is closely related to *Omphalina* (=*Omphalia*), both genera being characterised by the relatively small fruiting bodies with decurrent gills (omphalioid habit), absence of a veil and white or pale spore print. The two genera are distinguished microscopically by the presence of encrusting pigment in *Omphalina* and intracellular pigment in *Gerronema* (Singer, 1986).

There are two other Australian species of omphalioid habit with orange colours – *Gerronema fibula* (Bull.: Fr.) Sing. and *Omphalina ericetorum* (Fr.: Fr.) M. Lange. *G. fibula* (also placed in *Mycena, Omphalina* or *Rickenella*) differs from *G. postii* in being smaller with a brighter cap colour and has large cystidia on the stipe which are obvious under a hand lens, giving the stipe a bristly appearance. *G. fibula* always grows amongst moss and has not been observed to fruit after fire. *O. ericetorum* as illustrated by Fuhrer (1985), is always found associated with mats of algae, and also differs from *G. postii* in having a cap which is distinctly radially grooved at the margin.

G. postii has been recorded previously only from the Northern Hemisphere where it is an uncommon species, noted as fruiting after fires but not restricted to this habitat. In Victoria *G. postii* fruited abundantly at Anglesea and Belgrave after the 1983 fires. It would be of interest to know the extent of its distribution in Australia, whether it is a recent immigrant or indigenous and if it ever fruits in unburnt forest.

Collections examined

Vic: Marshy Ck., near Anglesea, 6.V.1984, coll. T.W.M. & B.A.F., *May B169* (VPRI 16325); 1984, coll. B.A.F., *May B177* (VPRI 16326); Courtney's Rd. Reserve, Belgrave, 4.X.1983, *May M434* (VPRI 16324); 6.XI.1983, *May M459* (VPRI 16323).

References

Bigelow, H.E. (1970). *Omphalina* in North America. *Mycologia* **62**: 1-32.

Christensen, P.E.S. (1980). The biology of *Bettongia pencillata* Gray, 1837, and *Macropus eugenii* (Desmarest, 1817) in relation to fire. *Forests Department of Western Australia, Bulletin* **91**: 1-90.

Cleland, J.B. (1976). *Toadstools and mushrooms and other larger fungi of South Australia, Parts I and II. 1934-1935.* (Reprint) (Government Printer: South Australia).

Fuhrer, B. (1985). *A field companion to Australian fungi.* (Five Mile Press: Hawthorn).

Gardner, J.H. and Malajczuk, N. (1985). Succession of ectomycorrhizal fungi associated with *Eucalyptus* on rehabilitated bauxite mines in south Western Australia. In Molina, R. (ed.) *6th North American conference on mycorrhizae.* (Forest Research Laboratory: Corvallis). p. 265.

Kelley, K.L. and Judd, D.B. (1965). The ISCC-NBS method of designating colors and a dictionary of color names. *United States Department of Commerce, National Bureau of Standards, Circular* **553**: 1-158.

Kornerup, A. and Wanscher, J.H. (1978). *Methuen handbook of colour.* (Methuen: London).

Munsell (1975). *Munsell soil color charts.* (Munsell Color: Baltimore).

Munsell (1977). *Munsell color charts for plant tissues.* (Ed. 2.) (Munsell Color: Baltimore).

Phillips, R. (1981). *Mushrooms and other fungi of Great Britain and Europe.* (Pan Books: London).

Singer, R. (1964). Die Gattung *Gerronema. Nova Hedwigia* **7**: 53-92.

Singer, R. (1986). *The Agaricales in modern taxonomy.* (Ed. 4) (Koeltz Scientific Books: Koenigstein).

Spooner, B.M. (1987). Profiles of fungi 2. *Cerronema postii* (Fr.) Singer. *The Mycologist* **1**: 19.

Warcup, J.H. (1981). Effect of fire on the soil microflora and other non-vascular plants. In *Fire and the Australian Biota.* Eds A.M. Gill, R.H. Groves and I.R. Noble, pp. 203-14. (Australian Academy of Science: Canberra).

Watling, R. and Romero, A. (1989). Profiles of fungi 17. *Gerronema marchantiae* Singer & Clemençon. *The Mycologist* **3**: 42.

Willis, J.H. (1934). The Agaricaceae or 'gilled fungi'. *Victorian Naturalist* **50**: 264-298.

Willis, J.H. (1935). Revision of the Agaricaceae or gilled fungi. *Victorian Naturalist* **52**: 68-70.

High Body Temperatures in an Australian Frog, *Litoria caerulea*

C. Shine, G. Ross, P. Harlow and R. Shine*

The geographic range of the large and conspicuous green tree frog, *Litoria caerulea* (Hylidae), extends further into the dry, hot parts of the Australian continent than does that of any other tree frog except for the congeneric *L. rubella* (Barker and Grigg 1977). *Litoria caerulea* may survive the high temperatures and desiccating conditions by physiological adaptations that reduce water loss (Brattstrom 1970; Johnson 1970), and is to some degree buffered from these effects by its large body size (over 50 g in large adults; F. Lemckert, pers. comm.). Nonetheless, these frogs might also be expected to seek cool and moist microhabitats for shelter during hot days. This is often not the case, and we have often seen *L. caerulea* in dry habitats exposed to full sunlight even in midsummer. Interestingly, this is true of small as well as large individuals. In this note, we report on body temperatures of frogs measured under these conditions.

The data were gathered in the Macquarie Marshes of central New South Wales (147°30'E, 30°30'S) in January 1981. During radiotelemetric work on snakes in this region, we noticed that juveniles of *Litoria caerulea* commonly sat throughout the day on the broad leaves of cumbungi (*Typha*), an abundant sedge of the area. Although the ground beneath these plants may have been quite moist, there was no free water visible on the leaves. The frogs were up to 2 m above the ground, sitting with all four feet drawn up underneath the body (Fig. 1) and were very inactive unless disturbed. This reluctance to move meant that we were able to measure body temperatures of the frogs by placing the probe of an electronic thermometer (Cormark Pty Ltd, copper-constantin thermocouple) against the frog's lateral surface, shading the frog with our hand so that no direct sunlight reached the probe, and waiting until the reading equilibrated. Air temperatures in the shade were taken at the same time.

The results were clear-cut, if not surprising (Fig. 2). Body temperatures of the frogs (hourly means 24.5 to 35.0 °C) were very similar to ambient temperatures (hourly means 26.8 to 35.4 °C), and much higher than those reported for other populations of *L. caerulea* (maximum of 27.8 °C recorded by Johnson (1970)). Indeed, these temperatures were higher than the vast majority of field temperature records for amphibians reviewed by Duellman and Trueb (1986). Given the high levels of incident solar radiation at the time, the ability of the frogs to remain at slightly lower than ambient temperatures for most of the day is impressive. Even more remarkable is the fact that these small (approximate mass 3 g) amphibians were able to spend several hours in such an environment without any obvious signs of desiccation. Further physiological work on the water relations of this species would be of great interest.

*Zoology Department, The University of Sydney, N.S.W. 2006

References

Barker, J. and G. Grigg (1977). *A Field Guide to Australian Frogs.* (Rigby Ltd.: Adelaide).

Brattstrom, B.H. (1970). Amphibia. In *Comparative Physiology of Thermoregulation.* G.C. Whittow (Ed.). (Academic Press: New York.)

Duellman, W.E. and L. Trueb (1986). *Biology of Amphibians.* (McGraw-Hill Co.: New York).

Johnson, C.R. (1970). Observations on body temperature, critical thermal maxima and tolerance to water loss in the Australian hylid, *Hyla caerulea. Proc. R. Soc. Qld.* 82: 47-50.

Fig 1. Green tree frog, *Litoria caerulea*, on cumbungi stem in full sun. Note posture of frog.

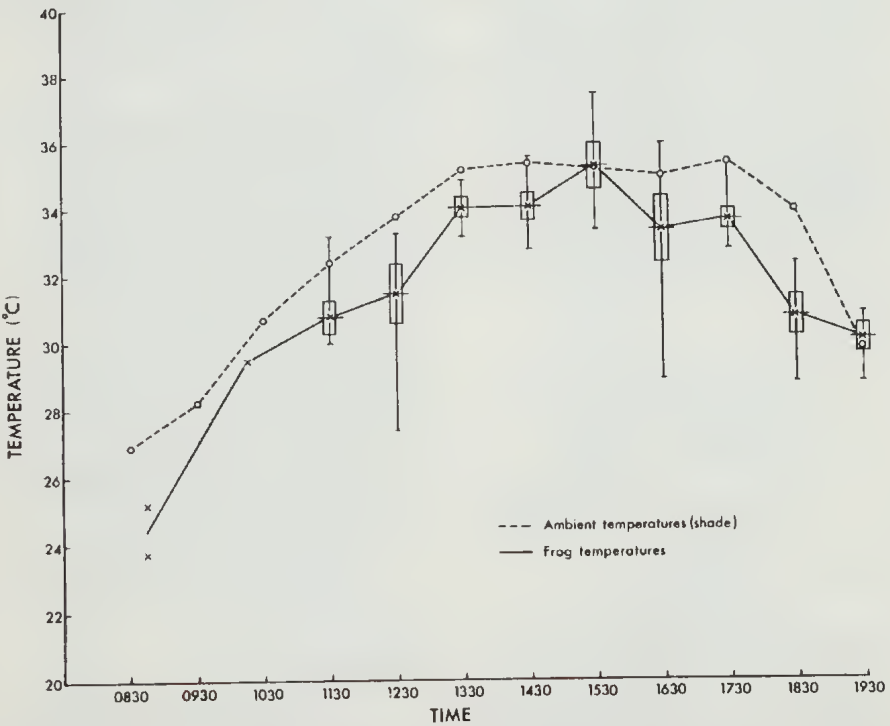


Fig. 2. Ambient (air) temperatures, and body temperatures of *Litoria caerulea*, as measured in January 1981 in the Macquarie Marshes of central New South Wales. The crosses show single data points, vertical lines show ranges, and boxes enclose one standard error on either side of the mean, based on readings from six frogs in each case.

The Biology and Ecology of *Banksia* L.f. A Bibliography of Recent Literature

A. K. Cavanagh*

Introduction

The upsurge of interest in the genus *Banksia* in recent years has centred on reproductive strategies, in particular, on the mechanisms of pollination and on the role of bird and mammal pollinators. The role of Banksias in forest ecosystems, their population dynamics, mechanisms of recruitment after fire and the influence of the fungal disease *Phytophthora cinnamomi* have also received considerable attention. The effects of flower and seed predators, the difference in seed set between various species and the mechanism of seed release, particularly after fire, have all attracted research. One area which is relatively poorly studied is germination – perhaps surprising in view of the extensive cut flower and nursery trade which has developed both in Australia and overseas.

The following bibliography lists more recent papers. No attempt has been made to treat the topic historically. Publications are arranged alphabetically by author under the following categories:

Books
Taxonomy
Reproductive Biology
- Pollination - General
- Pollination - Birds
- Pollination - Mammals
- Seeds Predators and Seed Loss
- Mechanisms of Seed Release
- Seed Germination

Ecology
- General Studies
- Role of Fire
- Role of *Phytophthora*

Certain categories of material have been excluded because they are often difficult to obtain. These include theses and specialised reports prepared for bodies such as the World Wildlife Fund. Abstracts of relevant theses can be found in *'Australian Journal of Ecology'* while a comprehensive list is produced annually by the University of Tasmania Library as the *'Union List of Higher Degree Theses in Australian University Libraries'.*

All *Banksia* taxa recognised by Taylor and Hopper (1988) are listed in the appendix. Each taxon is indexed to relevant publications in the bibliography. Thirty-eight of the 92 Banksia species, sub-species and varieties are referred to in the papers listed in the bibliography. The books listed (1 to 4) cover many or all of the taxa recognised at the time the books were published and therefore are not indexed in the appendix.

* Deakin University

Books

1. George, Alex S. (1984). *'The Banksia Book'.* (Kangaroo Press in association with The Society for Growing Australia Plants - NSW Ltd., Sydney).
2. Holliday, Ivan and Watton, Geoffrey. (1975). *'A Field Guide to Banksias'.* (Rigby Limited, Adelaide).
3. Baglin, Douglass and Mullins, Barbara. (1970). *'Australian Banksias'.* (Horwitz Publications, North Sydney).
4. Taylor, Anne and Hopper, Stephen. (1988). *'The Banksia Atlas'.* Australian Flora and Fauna Series Number 8. Bureau of Flora and Fauna, Canberra and Department of Conservation and Land Management, Western Australia. (Australian Government Publishing Service, Canberra).

Taxonomy

5. Conran, J.G. and Clifford, H.T. (1987). Variation in *Banksia oblongifola* Cav. (Proteaceae). *Brunonia* **10**(2): 177-187.
6. George, A.S. (1981). The genus Banksia L.F. (Proteaceae). *Nuytsia* **3**(3): 239-474.

Taxonomy (cont.)

7. George, A.S. (1988). New taxa and notes on *Banksia* L.f. (Proteaccae). *Nuytsia* **6**(3): 309-317.
8. Hopper, S.D. (1989). New subspecies of *Banksia seminuda* and *B. occidentalis* (Proteaceae) from the south coast of Western Australia. *Nuytsia*. In press.
9. Rye, B.L. (1984). A new species and a new combination among the Proteaceae represented in the Perth region. *Nuytsia* **5**(1): 25-30.
10. Salkin, A.I. (1981). A short history of the discovery and naming of banksias in Eastern Australia. Parts I-VI. *Victorian Naturalist* **98**: 69-71; 106-109; 180-182; 191-194; 254-256; **99**: 136-139.

Reproductive Biology

Pollination – General

11. Armstrong, J.A. (1979). Biotic pollination mechanisms in the Australian flora – a review. *New Zealand Journal of Botany* **17**: 467-508
12. Blake, S.T. (1971). Flowering and seeding habits in some species of *Banksia*. *Queensland Naturalist* **20**(1-3): 21-24.
13. Carolin, R.C. (1961). Pollination of the proteaceae. *Australian Museum Magazine* **13**: 371-374.
14. Carpenter, F. Lynn and Recher, Harry F. (1973). Pollination, reproduction and fire. *The American Naturalist* **113**(6): 871-879.
15. Carthew, Susan M., Ayre, David J. and Whelan, Robert J. (1988). High levels of outcrossing in populations of *Banksia spinulosa* R.Br. and *Banksia paludosa* Smith. *Austral. J. Bot.* **36**: 217-223.
16. Hopper, Stephen D. (1980). Bird and mammal pollen vectors in *Banksia* communities at Cheyne Beach, Western Australia. *Austral. J. Bot.* **28**: 61-75.
17. Hopper, Stephen D. (1980). Vertebrate pollination of Banksias. (Abstract only). *Austral. Syst. Bot. Soc. Newsletter* **25**: 20.
18. Hopper, Stephen D. and Burbidge, Andrew A. (1982). Feeding behaviour of birds and mammals on flowers of *Banksia grandis* and *Eucalyptus angulosa*, pp. 67-75. In: Armstrong, J.A., Powell, J.M. and Richards, A.J. (eds.), *'Pollination and Evolution.'* (Royal Botanic Gardens, Sydney).
19. Keighery, G.J. (1980). Breeding systems of *Banksia*. (Abstract only). *Austral. Syst. Bot. Soc. Newsletter* **25**: 19.
20. Lamont, Byron B. and Collins, Brian G. (1988). Flower colour change in *Banksia ilicifolia*: a signal for pollinators. *Austral. J. Ecol.* **13**: 129-135.
21. Lamont, Byron B., Collins, Brian G. and Cowling, Richard M. (1985). Reproductive biology of the Proteaccae in Australia and South Africa. *Proceedings of the Ecological Society of Australia* **14**: 213-224.
22. Lewis, Jeffrey and Bell, David T. (1981). Reproductive isolation of co-occurring *Banksia* species at the Yule Brook Botany Reserve, Western Australia. *Austral. J. Bot.* **29**: 665-674.
23. Mcfarland, David C. (1985). Flowering biology and phenology of *Banksia integrifolia* and *B. spinulosa* (Proteaccae) in New England National Park, NSW. *Austral. J. Bot.* **33**: 705-714.
24. Paton, David C. and Turner, Vivienne. (1985). Pollination of *Banksia ericifolia* Smith: birds, mammals and insects as pollen vectors. *Austral. J. Bot.* **33**: 271-288.
25. Ramsey, M.W. (1988). Floret opening in *Banksia menziesii* R.Br.: the importance of nectarivorous birds. *Austral. J. Bot.* **36**: 225-232.
26. Salkin, A. (1986). Breeding systems in Eastern Australian banksias. *Victorian Naturalist* **103** (2): 43-47.
27. Scott, John K. (1980). Estimation of the outcrossing rate for *Banksia attenuata* R.Br. and *Banksia menziesii* R.Br. (Proteaceae). *Austral. J. Bot.* **28**: 53-59.

Pollination – General (cont.)

28. Whelan, Robert J. and Goldingay, Ross L. (1986). Do pollinators influence seed-set in *Banksia paludosa* Sm. and *Banksia spinulosa* R.B.r.? *Austral. J. Ecol.* **11**: 181-186.
29. Wooller, R.D., Russell, E.M. and Renfree, M.B. (1983). A technique for sampling pollen carried by vertebrates. *Australian Wildlife Research* **10**: 433-434.
30. Wooller, R.D., Russell, E.M., Renfree, M.B. and Towers, P.A. (1983). A comparsion of seasonal changes in the pollen loads of nectarivorous marsupials and birds. *Australian Wildlife Research* **10**: 311-317.

Pollination – Birds

31. Burbidge, Alan H., Hopper, Stephen D. and Coates, David J. (1979). Pollen loads on New Holland honeyeaters at Qualup, Western Australia. *Western Australian Naturalist* **14**(5): 126-128.
32. Collins, Brian G. (1980). Seasonal variations in the abundance and food preferences of honeyeaters (Meliphagidae) at Wongamine, Western Australia. *Western Australian Naturalist* **14**(8): 207-212.
33. Collins, Brian G. and Spicc, John. (1986). Honeyeaters and the pollination biology of *Banksia prionotes* (Proteaceae). *Austral. J. Bot* **34**: 175-185.
34. Ford, Hugh, Paton, David C. and Forde, Neville. (1979). Birds as pollinators of Australian plants. *New Zealand J. Bot.* **17**: 509-519.
35. Hopper, Stephen D. (1980). Pollen loads on honeyeaters in a *Grevillea rogersoniana* thicket south of Shark Bay. *Western Australian Naturalist* **14**(7): 186-189.
36. Keighery, G.J. (1980). Bird pollination in South Western Australia: a checklist. *Plant Systematics and Evolution* **135**: 171-176.
37. Keighery, G.J. (1982). Bird-pollinated plants in Western Australia, pp. 77-89. In: Armstrong, J.A., Powell, J.M. and Richards, A.J. (eds.), *'Pollination and Evolution.'* (Royal Botanic Gardens, Sydney).
38. Paton, David C. (1981). The significance of pollen in the diet of the New Holland honeyeater, *Phylidonyris novaehollandiae* (Aves: Maliphagidae). *Austral. J. Zool.* **29**: 217-224.
39. Whelan, Robert J. and Burbidge, Allan H. (1980). Flowering phenology, seed set and bird pollination of five Western Australian *Banksia* species. *Austral. J. Ecol.* **5**: 1-7.

Pollination – Mammals

40. Carpenter, F. Lynn (1978). Hooks for mammal pollination? *Oecologia (Berl.)* **35**: 123-132.
41. Goldingay, R.L., Carthew, S.M. and Whelan, R.J. (1987). Transfer of *Banksia spinulosa* pollen by mammals: implications for pollination. *Austral. J. Zool.* **35**: 319-325.
42. Rourke, John and Wiens, Delbert. (1977). Convergent floral evolution in South African and Australian Proteaceae and its possible bearing on pollination by non-flying mammals. *Annals of the Missouri Botanical Gardens* **64**: 1-17.
43. Turner, Vivienne. (1982). Marsupials as pollinators in Australia, pp. 55-66. In: Armstrong, J.A., Powell, J.M. and Richards, A.J. (eds.), *'Pollination and Evolution.'* (Royal Botanic Gardens: Sydney).
44. Turner, V. (1982). Non-flying mammal pollination: an opportunity in Australia, pp. 110-122. In: Williams, E.G., Knox, R.B., Gilbert, J.H and Bernhardt, P. (eds.), *'Pollination '82'.* (School of Botany, University of Melbourne).
45. Turner, V. (1984). *Banksia* pollen as a source of protein in the diet of two Australian marsupials, *Cercartetys nanus* and *Tarsipes rostratus. Oikos* **43**: 53-61.

46. Wiens, Delbert, Renfree, Marilyn and Wooller, Ronald O. (1979). Pollen loads of honey possums (*Tarsipes spenserae*) and non-flying mammal pollination in South Western Australia. *Annals of the Missouri Botanical Gardens* **66**: 830-838.

Seed Predators and Seed Loss

47. Scott, John K. (1979). Ants protectting *Banksia* flowers from destructive insects? *Western Australian Naturalist* **14**(6): 151-154.
48. Scott, John K. (1980). Insects associated with seed production in *Banksia*. (Abstract only). *Austral. Syst. Bot Soc. Newsletter* **25**: 24.
49. Scott, John K. (1980). The impact of destructive insects on reproduction in six species of *Banksia* L.f. (Proteaceae). *Austral. J. Zool.* **30**: 901-921.
50. Scott, John K. (1982). Effect of fire and drought on seed production in *Banksia attenuata* and on its seed predator *Alphitopis nivea* in Western Australia, p. 447. (Abstract only). In: Visser, J.H. and Minks, A.K. (eds.), *'Proceedings of the 5th International Symposium on Insect-Plant Relationships'* (Centre for Agricultural Publishing and Documentation, Wageningen).
51. Scott, John K. and Black, Robert, (1981). Selective predation by white-tailed black cockatoos on fruit of *Banksia attenuata* containing the seed-eating weevil *Alphitopis nivea*. *Australian Wildlife Research* **8**: 421-430.
52. Zammit, Charles and Hood, Christopher. (1986). Impact of flower and seed predators on seed-set in two *Banksia* shrubs. *Austral. J. Ecol.* **11**: 187-193.

Mechanisms of Seed Release

53. Cowling, Richard M. and Lamont, Byron B. (1985). Seed release in *Banksia*: the role of wet-dry cycles. *Austral. J. Ecol.* **10**: 169-171.
54. Gill, A.M (1976). Fire and the opening of *Banksia ornata* F. Muell. follicles. *Austral. J. Bot.* **24**: 329-335.
55. Lamont, Byron B. and Cowling, Richard M. (1984). Flammable infructescences in *Banksia*: fruit-opening mechanism. *Austral. J. Ecol.* **8**: 295-296.
56. Wardrop. A.B. (1983). The opening mechanism of follicles of some species of *Banksia*. *Austral. J. Bot.* **31**: 485-500.

Seed Germination

57. Abbott, Ian. (1984). Emergence, early survival and growth of seedlings of six tree species in Mediterranean forest of Western Australia. *Forest Ecology and Management* **9**: 51-86.
58. Fox, John, Dixon, Bob and Monk, Doug. (1987). Germination in other plant families, pp. 92-97 and 211-223. In: Langkamp, Peter (ed.), *'Germination of Australian Native Plant Seed.'* (AMIRA and Inkata Press, Melbourne).
59. Salkin, A. and Hallam, N.D. (1979). The topodemes of *Banksia canei* J.H. Willis (Proteacea). *Austral. J. Bot.* **26**: 707-721.
60. Siddiqi, M.Y., Myerscough, P.J. and Carolin, R.C. (1976). Studies in the ecology of coastal heath in New South Wales. IV. Seed survival, germination, seedling establishment and early growth in *Banksia serratifolia* Salisb., *B. asplenifolia* Salisb. and *B. ericifolia* L.f. in relation to fire: temperature and nutritional effects. *Austral. J. Ecol.* **1**: 175-183.
61. Sonya, Lynda and Heslehurst, M.R. (1978). Germination characteristics of some *Banksia* species. *Austral. J. Ecol.* **3**: 179-186.
62. Zammit, Charles. (1984). Seedling recruitment strategies in obligate-seeding and resprouting shrubs, pp. 171-172. In: Dell, B. (ed.), *'Medecos IV: Proceedings of the 4th International Conference on Mediterranean Ecosystems.'* (Botany Department, University of Western Australia, Nedlands).

Seed Germination (cont.)

63. Zammit, C.A. and Westoby, M. (1988). Pre-dispersal seed losses, and the survival of seeds and seedlings of two serotinous *Banksia* shrubs in burnt and unburnt heath. *Journal of Ecology* **76**: 200-214.

Ecology

General Studies

64. Abbott, Ian. (1980). Ecology of Mangite, *Banksia grandis* Willd. (Abstract only). *Austral. Syst. Bot. Soc. Newsletter* **25**: 22.
65. Abbott, Ian. (1985). Reproductive ecology of *Banksia grandis* (Proteaceae). *New Phytologist* **99**: 129-148.
66. Abbott, Ian. (1985). Recruitment and mortality in populations of *Banksia grandis* Willd. in Western Australian forest. *Austral. J. Bot.* **33**: 261-270.
67. Abbott, Ian. (1985). Rate of growth of *Banksia grandis* Willd. (Proteaceae) in Western Australian forest. *Austral. J. Bot.* **33**: 381-391.
68. Bell D.T., Shea, S. and Watson, L.E. (1980). A *Banksia grandis* population model to assess management options. (Abstract only). *Austral. Syst. Bot. Soc. Newsletter* **25**: 22.
69. Cowling, R.M. and Lamont, B.B. (1986). Population ecology of Western Australian *Banksia* species: implications for the Wildflower Industry. *Acta Horticulturae* No. **185**: 217-227.
70. Cowling, R.M., Lamont, Byron B. and Pierce, S.M. (1987). Seed bank dynamics of four co-occurring *Banksia* species. *Journal of Ecology* **75**: 289-302.
71. Dodd, J. and Bell, D.T. (1980). Environmental relations of *Banksia* woodlands of the Swan Coastal Plain. (Abstract only). *Austral. Syst. Bot. Soc. Newsletter* **25**: 23.
72. Groves, R.H. (1978). Growth of heath vegetation. IV. Effects of temperature on growth of *Banksia ornata, B. serrata* and *B. serratifolia. Austral. J. Bot.* **26**: 45-51.
73. Lamont, Byron B. (1980). Blue-green algae in nectar of *Banksia aff. sphaerocarpa. Western Australian Naturalist* **14(7)**: 193-194.
74. Lamont, Byron B. and Barker, Mirranie J. (1988). Seed bank dynamics of a serotinous fire sensitive *Banksia* species. *Austral. J. Bot.* **36**: 193-203.
75. Lamont, Byron B. and Van Leeuwen, Stephen J. (1988). Seed production and mortality in a rare *Banksia* species. *Journal of Applied Ecology* **25**: 551-553.
76. Morris, E.C. and Myerscough, P.J. (1983). *Banksia ericifolia* transgresses the self-thinning boundary. *Austral. J. Ecol.* **8**: 199-201.
77. Morris, E.C. and Myerscough, P.J. (1988). Survivorship, growth and self-thinning in *Banksia ericifolia. Austral J. Ecol.* **13**: 181-189.
78. Shea, S.R., Buehrig, R., Bell, D. and Watson, L. (1980). Development of silvicultural techniques to reduce the density of the *B. grandis* component of the *E. marginata* Sm. forest. (Abstract only). *Austral. Syst. Bot. Soc. Newsletter* **25**: 21.
79. Siddiqi, M.Y. and Carolin, R.C. (1976). Studies in the ecology of coastal heath in New South Wales. II. The effects of water supply and phosphorus uptake on the growth of *Banksia serratifolia, B. aspleniifolia* and *B. ericifolia. Proc. Linn. Soc. New South Wales* **101**: 38-52.
80. Zammit, Charles. (1988). Dynamics of resprouting in the lignotuberous shrub *Banksia oblongifolia. Austral. J. Ecol.* **13**: 311-320.

Roles of Fire

81. Bradstock, R.A. and Myerscough, P.J. (1981). Fire effects on seed release and the emergence and establishment of seedlings in *Banksia ericifolia* L.f. *Austral. J. Bot.* **29**: 521-531.

81 (a) Bradstock, R.A. and O'Connell, A.A. (1988). Demography of woody plants in relation to fire: *Banksia*

ericifolia L.f. and *Petrophile pulchella* (Schrad.) R.Br. *Austral. J. Ecol.* **13**: 505-518.

82. Benson, D.H. (1985). Maturation periods of fire-sensitive shrub species in Hawkesbury sandstone vegetation. *Cunninghamia* **1**(3): 339-348
83. Cowling, Richard M. and Lamont, Byron B. (1985). Variation in serotiny of three *Banksia* species along a climatic gradient. *Austral. J. Ecol.* **10**: 345-350.
84. Cowling, R.M. and Lamont, Byron B. (1987). Post-fire recruitment of four co-occurring *Banksia* species. *Journal of Applied Ecology* **24**: 645-658.
85. Gill, A Malcolm and McMahon, Andrew. (1986). A post-fire chronosequence of cone, follicle and seed production in *Banksia ornata*. *Austral. J. Bot.* 34: 425-433.
86. Lamont, B. (1985). Fire reponse of sclerophyll shrublands - a population ecology approach, with particular reference to the genus *Banksia,* pp. 41-46. In: Ford, J. (ed.), *'Ecology and Management of Fire in Natural Ecosystems of Western Australia.'* (Environmental Studies Group, Western Australian Institute of Technology, Bentley).
87. McMahon, A. (1984). The effect of time since fire on heathlands in the Little Desert, NW Victoria, Australia, pp. 99-100. In: Dell, B. (ed.), *'Medecos IV: Proceedings of the 4th International Conference on Mediterranean Ecosystems.'* (Botany Department, University of Western Australia, Nedlands).
88. McMahon, A. (1984). The effects of fire regime components on heathlands in the Little Desert NW Victoria, Australia, pp. 101-102. In: Dell, B (ed.), *'Medecos IV: Proceedings of the 4th International Conference on Mediterranean Ecosystems.'* (Botany Department, University of Western Australia Nedlands).
89. Siddiqi, M.Y., Carolin, R.C. and Myerscough, P.Y. (1976). Studies in the ecology of coastal heath in New South Wales. III. Regrowth of vegetation after fire. *Proc. Linn. Soc. New South Wales* **101**: 53-63.
90. Zammit, Charles and Westoby, Mark. (1987). Population structure and reproductive status of two *Banksia* shrubs at various times after fire. *Vegetatio* **70**: 11-20.
91. Zammit, Charles and Westoby, Mark. (1988). Pre-dispersal seed losses, and the survival of seeds and seedlings of two serotinous *Banksia* shrubs in burnt and unburnt heath. *Journal of Ecology* **76**: 200-214.

Role of Phytophthora

92. Cho, J.J. (1981). *Phytophthora* root rot of *Banksia:* host range and chemical control. *Plant Disease* **65**(10): 830-833.
93. Cho, J.J. (1983). Variability in suspectibility of some *Banksia* species to *Phytophthora cinnamomi* and their distribution in Australia. *Plant Disease* **67**: 869-871.
94. Davison, E.M. (1984). Another look at Jarrah dieback, pp. 35-36. In: Dell, B. (ed.), *'Medecos IV: Proceedings of the 4th Internatinal Conference on Mediterranean Ecosystems.'* (Botany Department, University of Western Australia, Nedlands).
95. Dixon, K.W., Thinlay, and Sivasithamparam, K. (1984). A technique for rapid assessment of *Banksia* L.f. (Proteaceae) species to root rot caused by *Phytophthora cinnamomi. Plant Disease* **68**: 1077-1080.
96. McCredie, Thomas, Dixon, Kingsley W. and Sivasithamparam, K. (1985). Variability in the resistance of *Banksia* L.f. species to *Phytophthora cinnamomi* Rands. *Austral. J. Bot.* **33**: 629-637.
97. Shea, S.R., Schild, D. and Shearer, B. (1984). The effects of the *Banksia grandis* understory on spread and intensification of *Phytophthora cinnamomi* infections in the Jarrah (*Eucalyptus marginata*) forest. (Abstract only). *Austral. Syst. Bot. Soc. Newsletter* **25**: 20.

Appendix
Listing of all *Banksia* spp. (sensu Taylor and Hopper 1988). Species are indexed to relevant papers.

Banksia aculeata A.S. George
Banksia aemula R. Brown – 12, 60, 72, 79, 89
Banksia ashbyi E.G. Baker – 35
Banksia attenuata R. Brown – 22, 27, 30, 32, 39, 46, 48, 49, 50, 51, 53, 57, 70, 83, 84, 86
Banksia audax C. Gardner
Banksia baueri R. Brown
Banksia baxteri R. Brown – 16, 30
Banksia benthamiana C. Gardner
Banksia blechnifolia F. Mueller
Banksia brownii Baxter ex R. Brown
Banksia burdettii G. Baker – 74
Banksia caleyi R. Brown
Banksia candolleana Meissner
Banksia canei J.H. Willis – 59
Banksia chamaephyton A.S. George
Banksia coccinea R. Brown – 30, 31, 46
Banksia conferta A.S. George var. *penicillata* A.S. George
Banksia cuneata A.S. George
Banksia dentata Linnaeus f. – 12
Banksia dryandroides Baxter ex Sweet
Banksia elderiana F. Muell. and Tate
Banksia elegans Meissner
Banksia epica A.S. George – 7
Banksia ericifolia Linnaeus f. var. *ericifolia* – 12, 14, 24, 40, 45, 52, 60, 62, 63, 76, 77, 79, 81, 81a, 82, 89, 90, 91
Banksia ericifolia Linnaeus f. var. *macrantha* A.S. George
Banksia gardneri A.S. George var. *brevidentata* A.S. George
Banksia gardneri A.S. George var. *gardneri*
Banksia gardneri A.S. George var. *hiemalis* A.S. George
Banksia goodii R. Brown
Banksia grandis Willdenow – 18, 30, 39, 48, 49, 64, 65, 66, 67, 68, 78, 94, 97
Banksia grossa A.S. George
Banksia hookeriana Meissner – 21, 55, 86
Banksia ilicifolia R. Brown – 20, 39, 48, 49
Banksia incana A.S. George
Banksia integrifolia Linnaeus f. var. *aquilonia* A.S. George
Banksia integrifolia Linnaeus f. var. *compar* (R. Brown) Bailey – 23
Banksia integrifolia Linnaeus f. var. *integrifolia* – 12, 40, 45, 56, 61
Banksia laevigata Meissner subsp. *fuscolutea* A.S. George
Banksia laevigata Meissner subsp. *laevigata.*
Banksia lanata A.S. George
Banksia laricina C. Gardner
Banksia lemanniana Meissner
Banksia leptophylla A.S. George – 53, 55, 70, 74, 84
Banksia lindleyana Meissner
Banksia littoralis R. Brown – 22, 39, 48, 49
Banksia lullfitzii C. Gardner
Banksia marginata Cavanilles – 12, 38, 45, 56
Banksia media R. Brown – 47
Banksia meisneri Lehmann var. *ascendens* A.S. George
Banksia meisneri Lehmann var. *meisneri*
Banksia menziesii. R. Brown – 22, 25, 39, 48, 49, 53, 55, 70, 83, 84
Banksia micrantha A.S. George
Banksia nutans R. Brown var. *cernuella* A.S. George
Banksia nutans R. Brown var. *nutans* – 30
Banksia oblongifolia Cavanilles var. *minor* (Maiden and Camfield) Conran and Clifford – 5
Banksia oblongifolia Cavanilles var. *oblongifolia* – 5, 12, 14, 52, 60, 62, 63, 79, 80, 82, 89, 90, 91
Banksia occidentalis R. Brown subsp. *formosa* S.D. Hopper – 8
Banksia occidentalis R. Brown subsp. *occidentalis* – 16
Banksia oligantha A.S. George
Banksia oreophila A.S. George

Appendix (cont.)

Banksia ornata F. Muell. ex Meissner – 54, 56, 72, 85, 87, 88
Banksia paludosa R. Brown – 15, 28
Banksia petiolaris F. Muell
Banksia pilostylis C. Gardner
Banksia plagiocarpa A.S. George
Banksia praemorsa Andrews
Banksia prionotes Lindley – 33, 53, 55, 70, 74, 83, 84
Banksia pulchella R. Brown
Banksia quercifolia R. Brown – 30
Banksia repens Labillardiere
Banksia robur Cavanilles
Banksia saxicola A.S. George
Banksia scabrella A.S. George
Banksia sceptrum Meissner
Banksia seminuda (A.S. George) B. Rye subsp. *remanens* S.D. Hopper – 8
Banksia seminuda (A.S. George) B. Rye subsp. *seminuda* – 8
Banksia serrata Linnaeus f. – 40, 45, 61, 72, 82
Banksia solandri R. Brown
Banksia speciosa R. Brown
Banksia spherocarpa R. Brown var. *caesia* A.S. George
Banksia sphaerocarpa R. Brown var. *dolichostyla* A.S. George
Banksia sphaerocarpa R. Brown var. *sphaerocarpa* – 16, 73
Banksia spinulosa Smith var. *collina* (R. Brown) A.S. George – 12, 23
Banksia spinulosa Smith var. *cunninghamii* (Sieber ex Reichenbach) A.S. George
Banksia spinulosa Smith var. *neoanglica* A.S. George – 7
Banksia spinulosa Smith var. *spinulosa* – 12, 14, 15, 28, 40, 41, 45
Banksia telmatiaea A.S. George – 22, 49
Banksia tricuspis Meissner – 75
Banksia verticillata R. Brown
Banksia victoriae Meissner
Banksia violacea C. Gardner

Insects as Potential Pollinators of *Micromyrtus ciliata* (Sm.) Druce, Myrtaceae

G. A. Webb*

Abstract

Insects recorded on *Micromyrtus ciliata* flowers in the Warrumbungles National Park (New South Wales) are listed. Nectar use and foraging behaviour of some insects and potential pollination of *M. ciliata* by insects are discussed.

Introduction

Micromyrtus ciliata (Sm.) Druce is a small spreading shrub, widely distributed in south-eastern Australia, which flowers in spring and early summer (Beadle *et al.* 1983; Jacobs and Pickard 1981). The flowers of *M. ciliata* are small, solitary and located in the axils of upper-leaves (Beadle *et al.* 1983). Typical of many Myrtaceae, flowers of *M. ciliata* are white in colour, produce sweet-smelling nectar and are of the dish and bowl type (Faegri and van der Pijl 1979), characteristics which are apparently attractive to insects.

As far as I am aware there are no published records of insects visting the flowers of *M. ciliata* or any other *Micromyrtus* spp. Given that other species of Myrtaceae have been shown to be highly attractive to insects and indeed pollinated by these vectors (Hawkeswood 1978, 1981, 1987a, b; Ireland and Griffin 1984; Webb 1986a, b, 1987) it would seem reasonable that insects are also attracted to the flowers of *Micromyrtus* and possibly aid pollination.

This paper reports on insects found visting *M. ciliata* in the Warrumbungles National Park, near Coonabarabran, New South Wales, with notes on nectar use and foraging behaviour of several insect species.

*Forestry Commission of New South Wales, P.O. Box 100, Beecroft, N.S.W., 2119
Present Address: N.S.W. Agriculture and Fisheries, P.O. Box K220, Haymarket, NSW, 2000.

Study Areas and Methods

On the Warrumbungle Range in the Warrumbungle National Park, *M. ciliata* grows on exposed volcanic rock outcrops. Plants often grow in small clumps and rarely grow above 1 m. Co-habiting plants include *Callitris glaucophylla* Thompson and L. Johnson (Cupressaceae), *Stackhousia monogyna* Labill. (Stackhousiaceae), *Beyeria viscosa* (Labill.) Miq. (Euphorbiaceae), *Bursaria spinosa* Cav. (Pittosporaceae), and species of *Wahlenbergia* (Campanulaceae), *Dodonaea* (Sapindaceae), *Phebalium* (Rutaceae) and *Zieria* (Rutaceae).

During 6-7 October 1986, approximately thirty plants of *M. ciliata* were examined for flower-visting insects. These insects were either collected by hand and placed in plastic bags for later identification, or simply observed and not captured. Species of Diptera, Hymenoptera and Lepidoptera proved difficult to capture. Identification to family only was possible with some of these insects. Captured insects were examined under a stereo microscope in the laboratory for the presence of pollen. No attempt was made to distinguish between pollen of *M. ciliata* and other plants.

Results and Discussion

Vector Array

Eighteen species (7 Coleoptera, 4 Diptera, 3 Hymenoptera, 3 Hemiptera and one Lepidoptera) were observed on *M. ciliata* flowers (Table 1). This is a relatively more diverse fauna than previously reported for Myrtaceae (Hawkeswood 1978, 1981, 1987a, b; Ireland and Griffin 1984; Webb 1986 a, b, 1987) as previous studies concentrated primarily on Coleoptera.

Table 1. Insects found on the flowers of *Micromyrtus ciliata*

Species	Abundance	Pollen load
Coleoptera		
Alleculidae		
Anaxo sp.	C	**
Atoichus bicolor (Blkb.)	R	*
Dermestidae		
Trogoderma apicipenne Reitt.	R	*
Scarabaeidae		
Phyllotocidium viridis Britton	R	*
Automolius poverus Blanchard	R	*
Chrysomelidae		
Monolepta minuscula Lea	U	*
Cleridae		
Eleale nr. *viridus* Guerin	R	***
Diptera		
Calliphoridae		
Calliphora stygia (F.)	C	*
Muscidae		
sp.	A	–
Syrdphidae		
Melangyna sp.	C	–
Tachinidae		
sp.	C	–
Hymenoptera		
Apidae		
Apis mellifera (L.)	C	**
Halictidae		
sp.	C	–
Scoliidae		
sp.	C	–
Hemiptera		
Acanthosomatidae		
Stictocaremus sp.	C	*
Pentatomidae		
Cuspicona thoracica Westwood	C	*
Scutelleridae		
Scutiphora pedicellata (Kirby)	C	**
Lepidoptera		
Oecophoridae		
Philobota sp.	R	nil

Abundance
R (rare) – 1 to 3 individuals observed
U (uncommon) – 4 to 10 individuals observed
C (common) – 11 to 100 individuals observed
A (abundant) – more than 100 individuals observed

Pollen Loads
* – light (scattered covering, isolated patches or grains)
** – medium (concentrated isolated patches or moderate coverage)
*** – heavy (heavy covering over all or most of body)
– – no specimens captured.

Pollen Loads

The heaviest pollen loads were carried by the alleculids, *Anaxo* sp. and the clerids *Eleale* nr. *viridus* Guerin. *Anaxo* sp., being relatively common at the time the observations were made, could be significant pollen vectors of *M. ciliata*. On the other hand, *Eleale* nr. *viridus* was represented by a single specimen only during the study. *Eleale* spp. are often abundant on Myrtaceae flowers (Ireland and Griffin 1984; Webb 1986a, b) so their virtual absence can probably be attributed to the short duration of the study.

Surprisingly the specimens of the honey bee, *Apis mellifera* (L.) and the fly, *Calliphora stygia* (F.) examined carried only light to medium pollen loads despite the obvious adaptations of their bodies to trap pollen viz. hairiness of the body and legs. Of interest was the concentrated pollen on the densely setose undersurface of the tarsi of the bug, *Scutiphora pedicellata* (Kirby).

Foraging Behaviour and Potential Pollination

Feeding was not observed in any of the beetles, the moth, (*Philobata* sp.) or the two bugs *S. pedicellata* and *Stictocaremus* sp. All bees, wasps, flies and the bugs, *Cuspicona thoracica* Westwood, collected nectar from the corolla.

The syrphid flies, *Melangyna* sp., hovered above flowers while probing corollas. These foraging bouts were of ca. 1 sec duration with at most two individual probes within that time. At the end of each bout these flies quickly moved to another flower, usually on the same plant. It was not possible to determine whether these flies carried pollen. The foraging bouts of other flies, including *C. stygia*, were markedly longer (ca. 2-5 sec) and usually consisted of a single probe. While probing these flies usually perched on nearby flower heads since individual flowers were too small to support their bodies. While perched on flower heads these flies appeared to contact pollen bearing anthers. Data on pollen loads for *C. stygia* indicate that quite large loads may be picked up although it could not be determined whether the pollen was from *M. ciliata*. These flies invariably took flight between foraging bouts and often moved to adjacent plants.

The bug, *C. thoracica*, probed corollas for various lengths of time up to 10 sec then moved to adjacent flowers thereby systematically depleting the nectar supply of entire branchlets. Specimens of *C. thoracica* examined carried few pollen grains unlike those of *S. pedicellata* which carried heavy loads on the tarsi. *S. pedicellata* and *Stictocaremus* sp. were not observed to forage and to a large extent remained stationary, perched on terminal branches. The potential role of these bugs as pollinators of *M. ciliata* is unclear.

All species of Hymenoptera were relatively large and collected nectar by exserting the mouth parts into the corolla tube and drawing up nectar. Most species were active fliers and moved freely between plants. Only *A. mellifera* was observed carrying pollen however halictid and scoliid wasps are apparently well adapted for this role having relatively hairy bodies and legs (Riek 1970).

M. ciliata appears to be pollinated by insects with various species of beetles, flies wasps, bugs and moths being implicated as potential pollen vectors. Further experimentation on the identity of pollen grains found on flower-visting insects and the behaviour of these insects in relation to floral biology will be needed to confirm these preliminary observations.

Acknowledgements

Thanks are due to E. B. Britton and D. H. Colless (Australian National Insect Collection) for identifying beetles and flies respectively.

References

Beadle, N.C.W., O.D. Evans, and R.C. Carolin (1983). *Flora of Sydney Region*. A.H. and A.W. Reed, Sydney.

Faegri, K. and L. Van der Pijl (1979). *The Principles of Pollination Ecology.* 3rd Ed., Permagon Press, Oxford.

Hawkeswood, T. J. (1978). Observations on some Buprestidae (Coleoptera) from the Blue Mountains, New South Wales. *Austr. Zool.* **19**: 257-275.

Hawkeswood, T. J. (1981). Insect pollination of *Angophora woodsiana* F.M.Bail. (Myrtaceae) at Burbank, south eastern Queensland. *Victorian Nat.* **98**: 120-129.

Hawkeswood, T. J. (1987a). Pollination of *Leptospermum flavescens* Sm. (Myrtaceae) by beetles (Coleoptera) in the Blue Mountains, New South Wales, Australia. *G.it.Ent.* **3**: 261-269.

Hawkeswood, T. J. (1987b). Notes on some Coleoptera from *Baeckea stenophylla* F. Muell. (Myrtaceae) in New South Wales, Australia. *G.it.Ent.* **3**: 285-290.

Ireland, J. C. and A. R. Griffin (1984). Observations on the pollination ecology of *Eucalyptus muellerana* Howitt in East Gippsland. *Victorian Nat.* **101**: 207-211.

Jacobs, S. W. L. and J. Pickard (1981). *Plants of New South Wales. A Census of the Cycads, Conifers and Angiosperms.* Gov't Printer, Sydney.

Riek E. F. (1970). Hymenoptera. In *The Insects of Australia*, Melbourne University Press, Melbourne.

Webb, G.A. (1986a). Some insect pollinators of *Kunzea ambigua* (Sm.) Druce (Myrtaceae) near Sydney, New South Wales. *Victorian Nat.* **103**: 12-15.

Webb, G. A. (1986b). Flower-visting beetles of some New South Wales Leptospermoidea. *Victorian Nat.* **103**: 170-174.

Webb, G. A. (1987). Beetle visitors to flowers of *Angophora hispida* (Sm.) D.Blaxell (Myrtaceae) and some other *Angophora* in the Sydney region. *Austr. Zool.* **23**: 59-62.

The Flora and Fauna Guarantee

What is the FFG?

The Flora and Fauna Guarantee (FFG) is an Act of Parliament that aims to conserve Victoria's native flora and fauna. The legislation was passed by parliament and fully proclaimed in 1988. The FFG aims to ensure that Victorian species survive, flourish and maintain their potential for evolutionary development in their native habitat.

The Act takes a preventative approach to flora and fauna conservation. The intentions of the Act are to identify those species or communities whose survival is threatened or is likely to be threatened in the future, to establish management strategies that deal with threats to native flora and fauna and to provide programs for community education in flora and fauna conservation. The FFG embodies the principle that further extinction of plant and animal species should be prevented wherever possible.

Why do we need the FFG?

In the 150 years since European settlement at least 20 mammal species, 2 bird species and 35 plant species, are believed to have become extinct in Victoria. In addition many plant and animal species are currently threatened with extinction because of loss of habitat.

The Flora and Fauna Guarantee Act supersedes the Wildflowers and Native Plants Protection Act. Although this Act was potentially very powerful, it was inadequate in that it did not allow for the protection of entire habitats, which is now recognised as vital for the conservation of individual species. An additional problem was that it did not provide for jurisdiction over private land. The inadequacies of the Wildflowers Act are a legacy of its *ad hoc* development in which individual groups with specific environmental interests pressed for legislation as the need was perceived. Thus no co-ordinated approach to conservation had been developed within a legislative framework. The Flora and Fauna Guarantee Act seeks to address this deficiency, by regarding the environment as an integrated whole, and providing legislation to protect the entire biota.

Which Plants and Animals are Covered by the Act?

All native animals and plants are eligible for consideration under the FFG unless they have been specifically excluded and are listed in Schedule 1 of the legislation (e.g. human disease organisms). In addition, ecological communities are also eligible for consideration.

Implementing the FFG

Legal recognition of a species or community being at risk and requiring special management or protection is achieved by the process of listing. Any person in the community can nominate a taxon or community for listing, which will then be considered by a Scientific Advisory Committee. The Committee consists of seven members, three senior scientific officers from government, two scientists from Victorian education institutions and two scientists from outside government. All nominations will be considered as soon as possible. Nominations may be refused if they have been previously listed or are accompanied by insufficient information. The listing process allows for public comment on listed items. This comment is considered by the Committee prior to their making a final recommendation to the Minister for Conservation, Forests and Lands. The Minister has three years and 30 days from the date the nomination is made in which to decide whether or not the item should be listed.

Once listed, an action statement must be prepared for that particular species or community. This statement provides a summary of how to manage the listed item

and is followed by a comprehensive management plan. Management plans are made available for public comment on their adequacy/inadequacy.

The preservation of a taxon or community depends on identification and preservation of its critical habitat. A critical habitat is a land or water environment on which a taxon or community is dependent and which is necessary for its long term survival. The special management attention required for a critical habitat is then incorporated into management plans and management agreements.

The Act also allows for the listing of potentially threatening processes which endanger the survival, abundance or evolutionary development of native species or communities. An action statement must be prepared following the listing of a process, but an Interim Conservation Order cannot be applied to a process. The object is to identify potentially threatening processes then devise effective management actions to prevent or overcome potential problems.

Protection

The Flora and Fauna Guarantee Act works together with the Wildlife Act and the Fisheries Act to provide the basic powers to protect native plants and animals. These Acts' powers allow control, where necessary, over the taking (i.e. killing, injuring or collecting), trading or keeping of protected flora or fauna. The Guarantee Act contains the powers over protected flora.

Interim Conservation Orders (ICO's) can also be made in cases where the threat to the critical habitat of a listed species or biological community is considered so urgent that immediate action is required. An ICO is a last resort to allow breathing space while protection for the long term is worked out. However most matters should be resolved by negotiations with the landholders or authority controlling the land.

The Order is a legally binding covenant that can be placed on a *listed* species or community on public land. On private land an Interim Conservation Order can only apply to species, not communities. Items *nominated* for listing may also be covered by an Interim Conservation Order if there is an immediate threat. The requirements of the Order include co-operation to protect the habitat of a species and this includes activities that could directly or indirectly interfere with the species habitat e.g. pollutants. The provisions of the Interim Conservation Order over-ride provisions under any other previous Act. The Order is not intended as a penalty mechanism, rather it provides a moratorium so that an appropriate management regime can be put in place for rare and threatened species and communities. The maximum penalty for a breach of an Interim Conservation Order is $10,000.

The Order may have two stages. The first stage lasts ninety days which is a period for consultation. In the case of private land an attempt is made to reach a mutually acceptable arrangement for species conservation and continued management of land in accordance with the landholder's needs. The Order may be extended to two years to give a longer term of protection whilst consultation continues. By the end of this period either a voluntary agreement must be reached with all parties involved (a Land Management Agreement or Public Authority Management Agreement) or controls must be set up under other Acts such as the Planning and Environment Act or the EPA Act to continue protection. The Interim Conservation Order therefore creates the opportunity to sort out the often complex problem of protecting a rare species or community. It allows time for interested parties to formulate a strategy for protection of the plants or animals under threat.

The FFG can provide a framework for local communities to actively participate in the protection of native flora and fauna.

The success of the FFG is dependent on community support. Everyone can actively participate by taking an interest and putting forward nominations, commenting on draft management plans, Interim Conservation Orders and recommendation for listing and by forming and participating in 'Friends' Groups to assist in maintaining habitat.

For more information contact the Department of Conservation, Forests and Lands to obtain a copy of their Question and Answer booklet or 'Guidelines for Nominations'. Copies of the Act are available for study at most public libraries or contact any regional office of the Department of CF&L.

The Editors.

We would like to thank Phillip Sutton, David Jones, Vanessa Craigie and Chris Mitchell for commenting on a draft of this manuscript.

WANTED

Club Reporter

The Club has been without a Club Reporter for nearly a year, which is a matter of great concern to Council.

As the *Victorian Naturalist* is the only contact which many members have with the Club, it is important that reports of meetings and information on Club affairs appear regularly. It is not an onerous job: all that is required is regular attendance at General Meetings and the writing of the report for publication. Ability to type, though desirable, is not necessary. General Meetings are held on the second Monday of the month, and for the remainder of this year will be held at the Royal Society, 9 Victoria Street, Melbourne. If you are able to assist the Club in this capacity, it would be a great service, and a rewarding undertaking.

Please contact the Secretary, Ron Pearson (584 7443) or any member of the Council.

FREE 1988 Index

Due to an error on the part of the editors the 1988 index did not appear in the centre pages as usual. Additional loose copies are available free of charge from the Editors, FNCV, C/- National Herbarium, Birdwood Avenue, South Yarra, 3141.

Obituary

Farewell to Mr Sonenberg

The name of Edward Joseph Sonenberg (1908-1989) is probably not well known in botanical circles in Victoria. Yet his influence has undoubtedly been significant. Those familiar with botanical literature may have seen him credited with preparing the index of some 2500 entries for Ewart's *Flora of Victoria* (1931) or noted the acknowledgement for plant identification work in Zimmer (1937). He is named among the collectors of specimens cited in Vickery's revision of the genus *Danthonia*, Wallaby grasses, (1956), and thanked by Professor J. S. Turner for his help in preparing Land Conservation Council reports. But there are too few written credits marking a lifetime spent furthering the botanical cause in Victoria.

E. J. Sonenberg was born on 14 January 1908 at Carlton, Victoria, the second son of five children of Isaac and Minnie Sonenberg (nee Marks). The family lived behind his father's hairdressing and tobacconist business in Gertrude St, Fitzroy, and later moved to Fenwick St, Carlton.

The young Edward was educated at the Carlton State School, then situated in Faraday St, and received his merit certificate at the age of twelve. He joined the staff of the University of Melbourne in 1922 when he was fourteen, working as a junior laboratory assistant under the direction of the first Professor of Botany and Plant Physiology, Alfred James Ewart (1872-1937). This was the beginning of a career in botany that was to span more than fifty years, encompassing his whole working life.

At this time, Ewart's department was housed in the Biology building with Professor Baldwin Spencer (1860-1929) on the north side of the University lake. Construction of a new Botany building was begun in 1928 and teaching started in March 1929. One of Edward Sonenberg's early memories of work at the University was that of being despatched to the local hotel by Professor Ewart, to return with winchesters of beer to ensure the good humour of the building workers. He and another member of staff (Mr James Mannix) moved the whole department across the campus by trolley to its new quarters. The new building officially opened in November 1929.

Nineteen twenty two was also the year in which Reuben Tom Patton (1883-1962) joined Professor Ewart's staff. Patton is probably best remembered for his pioneering ecological studies of various major plant associations in Victoria, published in a series of papers in the Proceedings of the Royal Society of Victoria between 1933 and 1945. Edward Sonenberg accompanied Patton on many of his field trips around the State and this no doubt laid the foundation for his knowledge of the Victorian flora. He also assisted Patton in survey work for the army, identifying sites suitable for camouflage from the air.

Edward Sonenberg's duties had widened to include collecting plant material for practical classes when he was about sixteen. As Ewart's department grew, particularly following the move to the new building, it was no mean feat collecting for first year classes of more than one hundred students, as well as large second and third year classes. In these days before the convenience of plastic bags and easy access to cars, this meant an early start by public transport, carrying suitcases already heavy with damp newspaper, to prospect the 'wilds' of Studley Park or South Kensington, Port Melbourne or Newmarket or Cheltenham heathland. Many species of weeds and, in those days, native species, would thus be provided for the study of topics such as plant structure, reproduction and identification. Plants had to be sought out and chosen with care so that each student received material that showed the salient botanical features. At this time the department serviced many faculties other than Science. How many hundreds

of students in disciplines ranging from Veterinary Science to Architecture, Agriculture and Medicine, as well as Botany, have passed through practical classes prepared by Edward Sonenberg? Many years later in the citation accompanying the University's Silver Medal awarded to him in 1971, specific mention is made of his organisation of practical classes which were models of order and disciplined presentation.

Among the many staff who received his assistance over the years was the late Mrs Maisie Carr who acknowledged the: 'superb back-up of Mr E. J. Sonenberg, himself with an excellent knowledge of the flora, who provided the materials for her practical classes' (Carr 1989). Mrs Carr taught at the Botany Department between 1949 and 1959. Recognizing the need for an inexpensive student text, she initiated the Botany Department publication *The Families and Genera of Victorian Plants* (Carr 1949). Mr Sonenberg provided valuable assistance with this project, particularly with the Asteraceae (daisy family).

In the 1930's, teaching in systematic botany was much more extensive than it is now and considerable quantities of material were required. Mr Sonenberg enlisted the aid of Mr W. J. Zimmer (1898-1967), a forester stationed in the north-west of the State, who regularly sent bulk quantities of grasses that were used during the winter term when fresh flowering specimens were scarce. Numerous species, typical of the north-west, were involved including *Lamarckia aurea, Stipa eremophila, Paspalidium gracile, Pollinia (=Eulalia) fulva,* and *Chamaeraphis (=Psuedoraphis) spinescens.*

Zimmer had undertaken a pioneering botanical survey of the north-west in which he correlated vegetation types with soils and made the first detailed census of the area. Mr Sonenberg and Dr Patton provided the identifications for Zimmer's collections; old correspondence records such discoveries as 'No. 658 *Pachycornia tenuis* – new record for the state', and 'No. 667 *Scaevola depauperata* – new record for Victoria', as being among Zimmer's specimens.

MELBOURNE UNIVERSITY HERBARIUM

Danthonia penicillata (Labill.) Pal. Beauv.

Collected by E. J. Sonenberg — Date 27. 10. 69

Locality Cemetery, Carlton — Det. E.J.S.

Contrib. — Ch.

Herbarium label showing E. J. Sonenberg's handwriting.

Collecting for the Botany Department Herbarium also started early – some time ago Mr Sonenberg recalled to me with some embarrassment his first efforts when asked to prepare pressed specimens of succulents such as *Sarcocornia* (*Salicornia* – glasswort) without any prior instruction. 'After 3 days', he said, 'they were rather hairy (mouldy)'. Many of his collections are from the inner suburbs of Melbourne and document the rapidly diminishing native flora, as well as the weeds. His elegant and distinctive handwriting is a notable feature of the specimen labels.

Over the years, as his contact with the plant world broadened and his experience increased, he gradually acquired an extensive botanical knowledge. He attended all the departmental excursions to many parts of the State. With a prodigious memory, he developed an authoritative command of the Victorian flora, as well as of poisonous plants and exotics, that inspired a distinguished reputation within the department and the university.

The department received numerous enquiries on all manner of botanical matters, and Mr Sonenberg was consulted almost daily by the university community, particularly the Faculties of Veterinary Science and Agriculture, by government authorities such as the Police, by hospitals, and by the general public. In the field of genetics the late Professor M. J. D. White consulted him on food sources for his insects, while the late D. F. F. Thomson, Professor of Anthropology, returned with difficult plant collections from northern Australia. All were painstakingly helped by Mr Sonenberg. Many of the archival letters dating back to Ewart's time requesting plant identifications or other details have Mr Sonenberg's hand writing in the margins providing the required information.

In about 1965 he completed a paper examining the components of hair balls extracted from the gut of sheep, following a veterinarian's enquiry. This was recommended for publication in the *Australian Veterinary Journal* but never printed. It is unfortunate there are but scanty published records of his work; he was never successfully encouraged to commit his knowledge to paper. It would certainly then have been easier to write about his contributions. But visible evidence should not be taken as the only measure of his standing; the high regard in which he was held by his university colleagues is eloquent acknowledgement.

Some years before his retirement in 1973 concerted efforts were made to arrange the award of an honorary B.Sc. following an initiative of Associate Professor Dr Ethel McLennan (1891-1983). Even if this could have been successfully achieved, Mr Sonenberg declined the award. He said to me once, 'If a man's got any brains, and something to say, he's entitled to publish. I was blessed with a retentive memory, that's all.'

Mr Sonenberg had a reputation for sternness and was not an easy person to get to know, perhaps because his quietness and solitary nature appeared intimidating. Once, on meeting a new member of the technical staff for the first time, he is reported to have said, "So you're Mr Brown? Well, I'm Mr Sonenberg and I like to be called Mr Sonenberg and I like to have my dinner by myself!" While senior members of the academic staff used his surname only, no-one else would have contemplated otherwise than to address him as Mr Sonenberg. Beyond his hearing however he was in later years always known as Sony. With his rather stern manner and attention to details, he inspired suitable fear in new junior laboratory staff, ensuring the maintenance of high standards of preparation and presentation of practical classes. He was promoted to the position of chief technical officer in 1967. He was later offered, but declined, the position of laboratory manager.

Throughout his career and his life, Sony's preferred place was very much behind-the-scenes; he was a most self effacing person and did not readily take credit for his considerable contribution to

the Botany Department over more than 50 years. Punctual to a fault, he was nearly always the first to arrive at the department in the morning, often very early; he gave far more than the standard working day. The long-enforced habit of collecting for classes took such a firm hold that, 16 years after his retirement, students still make use of materials he amassed. He was the mainstay of much of the teaching in the Botany Department for over forty years.

Sony left the Botany Department in 1973 but sadly, he did not find retirement easy. He resolved to give away Botany completely and in this he was almost entirely successful. Although he attended a few field trips after his retirement, he could not be enticed back to any form of part-time involvement in the department despite sevcral entreaties from staff members at the time. With such a large part of his daily life now gone, he seemed to lack direction and purpose. In later years, with his health declining, he moved to a special accommodation home in Fairfield. He died at Fairfield Hospital on 5th February 1989.

During many conversations with him in the last few years he often impressed me with the extent of his knowledge and the capacity of his memory. He had always read widely and his mind was still clear. I know little of his personal life, however Carlton Football Club have lost one of their most ardent fans. On Monday mornings at the university he could often be found deep in discussion with Dr Mc Lennan (a Hawthorn fan), in a post mortem of the previous weekend's games. He also enjoyed a game of cards during

Mr Sonenberg in his room at the Botany Department, University of Melbourne, taken about 1959. He is examining paintings of Western Australian wildflowers by Edgar Dell.

lunch breaks at the university although luckless opponents have been heard to remark, 'Never play cards with Sony – he remembers every card that's gone and knows every card in your hand!'.

We thus mark the passing of a remarkable man of considerable depth of character. At once reserved and unassuming and without great personal ambition, yet dedicated and excelling in his field as a member of the technical staff of the university. Many former students and members of staff would be pleased to see a teaching laboratory in the Botany Department named in his honour. Countless students who have passed through the Botany Department have cause to be thankful for his 'behind-the-scenes' contribution to their understanding of botany, – students who have no doubt moved out into diverse walks of life in their own right and thus amplified Edward Sonenberg's lifetime in support of the botanical cause.

Acknowledgements

I would like to acknowledge the assistance of Mrs Phoebe Adler in supplying details of Edward Sonenberg's early life and for access to family photographs. I am grateful to Dr Sophie C. Ducker for her help with aspects of his career, and of the history of the Botany Department. Drs. D.H. Ashton and J.H. Willis kindly read the manuscript, and Mr. C. O'Brien provided photographic assistance.

References

Carr, D. J. (1989). Obituary – Stella Grace Carr (1912-1988). *Austral. Syst. Bot. Newletter* **58**: 21-7.

Carr, S. G. M. (1949-1960) *The families and genera of Victorian plants.* (Three eds, Botany School, University of Melbourne.)

Ewart, A. J. (1931) *Flora of Victoria* (Govt Printer, Melbourne.)

Vickery, J. (1956). A revision of the genus *Danthonia*. *Contr. NSW Herb.* v. 2, No. 3.

Zimmer, W. J. (1937). *The flora of the far north-west of Victoria.* Forests Commission of Victoria, Bulletin No. 2.

Ian Clarke
National Herbarium of Victoria
Birdwood Avenue
South Yarra 3141

ANNUAL REPORT: FAUNA SURVEY GROUP 1988-1989

This report reviews the activities of the Fauna Survey Group from March 1988 to March 1989. During this period a number of changes have occurred in the Group which dramatically affects its scope and activities. The first involves a change of name from Mammal Survey Group to Fauna Survey Group with a concomitant broadening of scope to include coverage of all terrestrial vertebrate taxa in our field work. Further to this, members are encouraged to undertake field studies in their own specialist areas – whether this be botanical descriptive work of study sites or the documentation of other faunal taxa (insects, etc.).

A second major change involves a fundamental shift in our field program to a project oriented approach. The direct implication of this is that an area or species is intensively studied over a period of time rather than on one or a few short and often disjointed field trips. Under this regimen we expect to obtain a better understanding of the occurrence, distribution and abundance of species and the factors which affect this. This will provide a major and positive effect on the quality of inform-

ation obtained and on the value of our work to wildlife and public land managers.

Administration

The newly elected committee consists of the following: L. Conole (Chairperson), J. Grusovin (Honorary Secretary), P. Myroniuk (Records Officer), M. Aguilar (Newsletter Editor), Ray Gibson (Treasurer), Bill Farrugia, Tom Sault, Russell Thompson, Malcolm Turner, Peter Lynch.

The Group produces an up-to-date and informative monthly newsletter available freely at meetings or $5/annum posted. About 50 members subscribe.

Meetings

The Group met regularly on the first Tuesday of the month at the Astronomers Residence at 8.00 p.m. Average attendances were 19 members and guests. This represents an increase in attendance of about 35% on the previous year. Guest speakers were heard, seminars and workshops conducted and the regular business transacted.

Topics included: February, Lifestyles and Venereal Diseases of Koalas, Kath Handasyde; March, Open Forum: Kangaroo control at Hattah-Kulkyne N.P.; April, Captive Animal Management in Australasian Zoos, P. Myroniuk; May, Vegetation Surveys, Diet analysis and Habitat Delimitation, David Cheal; June, Members Night; July, Workshop: Identification of Skeletal Remains, led by Lawrie Conole; August, Humpback Whales, Janet Lanyon; September, Ecology and Conservation of Long-footed Potoroos, David Scotts; October, Conservation and Ecology of Black-eared Miner, Jon Starks; November, Ecology of Squirrel and Sugar Gliders at Chiltern, Barry Traill; December, Members Night.

Field Work

About 20 surveys were conducted during the year in the following project areas:

1. Aspects of Water-rat Ecology

This species has been under investigation at our study site (the MMBW Farm at Werribee) since 1987. Valuable insights have been obtained into factors which influence the distribution of this native rodent. This aspect of our work will be published shortly. Our program of mark-recapture has so far yielded ambiguous data and we have decided to undertake radio-tagging and tracking of this species. To this end we have obtained a $2000 grant from the M.A. Ingram Trust, however our approaches to the Department of Conservation Forests and Lands for additional funding have been spurned. The MMBW is supporting us with accommodation, use of study site, workshop facilities and some petty expenses.

2. Fauna of Western Plains Forest Isolates.

A limited survey program of the Bamganie State Forest and the Inverleigh Common has been undertaken. Our work builds on and complements the decade of work Mr. L. Conole and Mr. G. Baverstock (local Geelong naturalists) have undertaken in this area. The results of this work will be presented as a report to the Geelong Region of DCF&L together with our proposed management guidelines.

Mr. Conole is currently investigating the possibility of further work in other forest isolates of the area.

3. Leadbeaters Possum

This endangered possum is threatened with major habitat loss as a result of clearfelling forestry practices and the continuing loss of old stags. The Group, in collaboration with DCF&L officers and other parties, is mapping the specific occurrence of this animal in prospective logging areas in the upper Yarra catchment. It is hoped that this information will influence forestry officials in their operations.

4. Mallee Study Area

The Group has undertaken two major excursions to the Berribee and Ned's Corner area of the Mallee (Easter and Christmas 1988). This area, which con-

tains the last remaining tracts of Millewa Land System under native vegetation, and which is the only true arid region in Victoria, had not been previously investigated in depth and we considered it timely to undertake a survey program. The work resulted in several new and important records for the area and our report, together with our recommendations, has been submitted to the Land Conservation Council for consideration. In addition we have established reference study sites (valued at many hundreds of dollars) which we intend utilizing in the future. This work could not have been undertaken successfully without the assistance of Mr. R. Warneke and his colleagues at the Arthur Rylah Institute. The Department provided us with a 4WD vehicle and fuel which would normally cost several thousand dollars to hire. Thanks also goes to Rheem Australia for providing us with lids for our pitfall traps.

5. Nooramunga Marine Coastal Park

The Group has been contracted by the Yarram Region of DCF&L to undertake a study of the islands of the Park. This work will be used specifically for the drafting of a management plan for the Park and is expected to take about two years to complete. Our initial results indicate some interesting discontinuities in the distribution of fauna, particularly reptiles, on the smaller islands. One island (Clonmell Island) appears to be completely overrun by *Coprosma sp.* (an introduced weed) and by the Black Rat; the native fauna is severely depleted.

This project is the most ambitious we have so far undertaken and involves tremendous logistical problems as well as lots of work (about 200-300 pitfall traps, thousands of trap-nights). The Region is providing trapping equipment, transport, communications, mapping and aerial photography, and other services valued at thousands of dollars.

Review

The past year has been a very exciting one for the Group and points the way for the future. Many new faces are appearing at the meetings and the Groups activities have a much higher profile thanks to Margaret Panter's advertising in the 'Age Entertainment Guide' and Lawrie Conoles' appearances on the radio program 'Eclectic Parrot' (3CR Wednesday, 4.30 p.m.).

Our applications to the Department of Conservation for grants have been rejected for two successive years and this neglect from our major beneficiary is starting to hurt. Our trapping equipment is getting old and is falling apart, we lack funds to purchase mapping and aerial photography, and we lack a computerized data aquisition and handling system. In addition to these fundamental problems there is no capacity for future improvement to our infrastructure.

The Group welcomes initiatives from Council to acquire Club premises. Access to a library, meeting rooms, workshop and equipment storage and a laboratory must be regarded as essential for an organization such as ours.

RCA ROADSIDE RESERVES

Report of the Talk given by *Graeme Stone* to the Botany Group

Graeme Stone is the Roadside Development Officer of the R.C.A. His work is concerned with roadside management – preservation of the existing vegetation, the use of herbicides, new planting, the education of roadside workers to improved work practices, etc. He works in co-operation with Landscape Officers and two Horticultural Officers. Fourteen thousand kilometres of highways are in the care of the R.C.A. compared with 300,000 under local councils.

Roads are concerned with touring and lead to recreational pursuits. They are related to farming. The roadsides are the habitat of native plants that have perhaps been otherwise lost in the neighbourhood.

There are many pressures on roadside reserves, e.g. salinity, clearing for fire-breaks and electricity poles. Room has to be taken up to ensure good drainage. Road safety is an important consideration.

There is room for compromise – there can be phase-breaks instead of continuous fire-breaks, power lines and fire-breaks can sometimes be on private land, lower permitted road speeds mean that earth works can be less drastic and trees can be left nearer to the carriageway.

Tree planting is important. About 100,000 trees are planted each year. Regeneration can often be encouraged. Grass is a problem. Research is being carried out with the seed regeneration of Kangaroo grass under Keith McDougall along the Hume Freeway.

Cropping of grass may be an acceptable short-term solution, but future management is likely to be a problem when the soil's fertility declines.

There are poor practices that should be avoided, e.g. dumping soil from a weed-infested area onto land where there are still native plants, or even covering large areas with excess soil from roadworks.

Near Bairnsdale dying trees are a problem – caused by insect infestation. Spraying was tried in the past but the new tactic is to increase the understorey which will encourage insect-eating birds.

Information about remaining native vegetation needs to be collected. It is too expensive on an official scale, and co-operation with local groups and individuals is being encouraged. Some shires have put up notices, and in other cases this has been done at the instigation of concerned individuals. The S.E.C. has a Code of Practice, but it is sometimes interpreted with excessive zeal.

Guidelines for roadside management are to be found in the document: 'Protecting the Environment: a Conservation Strategy for Victoria' which sets out 5 steps to be followed in the line of action to achieve a set goal.

Graeme's talk was illustrated by a set of very pertinent slides.

W.M. Bennet
Hon. Sec. Botany Group

Club News: Who's Doing What?

An event of some moment occurred at the Annual General Meeting on 8 May, when a new Excursion Secretary was elected. **Marie Allender** has retired from the position after 34 years. Marie, who became a Club member in 1947, was elected Excursion Secretary in 1954, which must surely make her the longest-serving office-bearer in the history of the Club, outstripping even F.G.A. Barnard's marathon stint of 32 years as Editor of the *Victorian Naturalist*. In this time she has organised over 500 excursions, ranging from the monthly day trips to annual extended trips to all parts of Australia, and to New Zealand. Very many members have reason to be grateful to Marie for her dedication and quiet efficiency in organising these excursions, which have combined pleasure, field experience and comradeship in the true spirit of the Club. In recognition of her services Marie was made an Honorary member in 1965, and a presentation was made to her in 1985. She is still a member of Council, to which she was also elected in 1954, and I am sure will continue to contribute to the Club, to which she has given so much. The new Excursion Secretary is Mrs **Joan Harry**, 342 High Street, Templestowe, 3107.

At their meeting on 6 June the Fauna Survey Group presented **Tom Sault** with a plaque fashioned out of eucalyptus and mistletoe, in recognition of his services to the group.

We have received a postcard from **Ian Faithfull**, who is travelling in Central Australia. He attended a meeting of the Alice Springs Field Naturalists' Club, who are a small but friendly group. They meet on the 1st Tuesday of the month at the Education Centre, Tregcar Avenue, Alice Springs. Anyone in the area wishing to contact them should ring Gerry Gerrard, 52 8686. Ian reports that the Brahminy Kite has been seen in the area for the first time ever.

Also in Central Australia is **Bruce Fuhrer,** who has gone to photograph the flora, with **Christine** and **Will Ashburner** as assistants.

Details of items suitable for this column should be sent to me, in writing, please! (Address: 30 Golf Links Crescent, Dingley, 3172).

Sheila Houghton

Microscope Donation

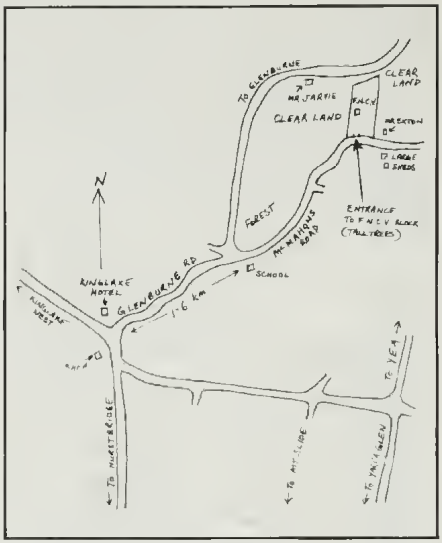
Mary Doery has kindly donated a Henry Crouch Microscope (London) to F.N.C.V. This microscope was probably made around the 1880-1890 period. The microscope is a Wenham binocular model. This model was one of the early attempts to obtain binocular and stereoscopic viewing through one objective. By removing the prism above the objective the microscope can be used as a monocular microscope.

Working Bee and Barbecue: Kinglake Property

The Club has owned the 4.05 ha reserve at Kinglake since 1976 when it was bequeathed to us by Harold Frahm, with the condition that it should be preserved in its natural state. About 3.2 ha are close to their original forested state, and the remaining area, which was used alternately for sheep-grazing and potato growing, has been allowed to regenerate since 1978. The FNCV Council set up a Committee of Management which laid out a plan for the reserve, with a picnic area close to the clubroom, walking track, nature trail, and toilet facilities (see sketch map).

The reserve was named the *Harold Frahm Bird Refuge,* and for many years bird life was of most interest to members. Two bird lists, compiled by J.L. Provan, were published in the *Victorian Naturalist* **100** nos. 2, 6 1983, totalling 106 species. The Botany Group have carried out vegetation surveys, identifying 59 plant species, and several fungi excursions have provided an astonishingly rich yield. Weeds have invaded the cleared area, notably blackberry, which has been largely controlled, English broom and several clovers.

The reserve is now in need of attention: repairs to the clubroom (broken window, painting), slashing along the nature trail, and weeding. **A WORKING BEE** has been arranged for **Sunday, 1 October.** Water and barbecue facilities are available. Meet next to the toilet block in the car park of the Kinglake Hotel at 10 a.m. (Melway 254 P12).



Directions to FNCV Kinglake Nature Reserve. Enter from McMahons Road. (Map not to scale).

Call for Assistance
The Aboriginal History of Mt. Buffalo

To assist in the preparation of the management plan for Mount Buffalo National Park, CFL is requesting information from members of the F.N.C.V. on the aboriginal history of Mount Buffalo. Information on aboriginal sites within the park would be particularly useful.

Information has been obtained from two articles published in *The Victorian Naturalist.* These are Mitchell, S.R. (1940), Aborigines on Mt. Buffalo *Vic. Nat.* **61**: 183-5 and Massola, A. (1966), The Rock Shelter at Mudgegonga, *Vic. Nat.* **83**, 72. It would be desirable for the management of Mt. Buffalo N.P. that CFL had the precise details on the locality of the sites discussed in the two articles named above and of any other sites at Mt. Buffalo.

If any F.N.C.V. members have knowledge that they would care to make available to CFL, please contact:

MAX CHAPPELL
CFL OFFICE, BRIGHT, 3741. Phone: (057) 55 1577

EDITORIAL POLICY

Title

The Victorian Naturalist is the bimonthly publication of the Field Naturalists Club of Victoria.

Scope

The Victorian Naturalist publishes articles on all facets of natural history. Its primary aims are to stimulate interest in natural history and to encourage the publication of articles in both formal and informal styles on a wide range of natural history topics.

Research Report

A succinct and original scientific communication. Preference is given to reports on topics of general interest.

Contributions

Contributions may consist of reports, comments, observations, survey results, bibliographies or other material relating to natural history. The scope is broad and little defined to encourage material on a wide range of topics and in a range of styles. This allows inclusion of material that makes a contribution to our knowledge of natural history but for which the traditional format of scientific papers is not appropriate.

Naturalist Notes

Short and informal natural history communications. These may include reports on excursions and talks.

Commentary

Informative articles that provide an up-to-date overview of contemporary issues relating to natural history. Whilst commentary articles are invited, the editors welcome discussion of topics to be considered for future issues.

Book Reviews

Priority is given to major Australian publications on all facets of natural history. Whilst reviews are commissioned, the editors welcome suggestions of books to be considered for review.

News

Any items of news concerning the FNCV.

Diary

Notice of coming events including activities of FNCV groups and any other activities of interest to *Vic. Nat.* readers.

Review Procedures

Research reports and Contributions are submitted to the editors and are forwarded to the appropriate member of the editorial board for comment. All research reports are assessed by two independent qualified referees prior to publication. Contributions are assessed by the appropriate member of the editorial board and may be refereed at the editors discretion. All other articles are subject to editorial review.

GUIDELINES FOR CONTRIBUTORS

Submission of Manuscripts

The following general statements apply to all submitted manuscripts.

Three copies of the manuscript should be provided, each including all tables and copies of figures. Manuscripts should be typed, double spaced with wide margins and pages numbered. The name and address of all authors should appear beneath the paper title. The full postal address, telephone number and fax number (if available) of the author who is to receive correspondence and check the proofs should be provided.

Abbreviations and Units

SI units (metre, kilogram, etc.) should be used wherever possible. Statistics and measurements should be given in figures (i.e. 10 mm) except where the number beings a sentence. When a number does not refer to a unit of measurement it is spelt out, unless the number is greater than nine. The word 'figure' should be abbreviated to Fig. unless starting a sentence.

Tables and Figures

All illustrations (including photographs) are considered as figures. All figures should be referred to in the text. Original figures or high quality photographic copies should be provided with the manuscript. Each figure should bear the figure number and authors name on the back in pencil. Line drawings should be in black Indian ink on stout white paper or high quality tracing paper. Lettering should be added bearing in mind legibility after reduction. Bar scales are preferred to numerical scales. Figure captions should be numbered consecutively (Fig. 1, Fig. 2, etc.) and provided on a separate page at the end of the manuscript.

Tables should be numbered consecutively (Table 1, Table 2, etc.) and should have an explanatory caption at the top. The presentation of the same data in both tabular and graphical form should be avoided. Tables and figures should be designed to fit within a page width (115 mm) or a column width (55 mm) following reduction.

References

References should be cited in the text by author and year and listed at the end of the text in alphabetical order and in the following form:

Ashton, D.A. (1976). Phosphorus in forest ecosystems at Beenak, Victoria. *Aust. J. Ecol.,* **64**: 171-86.

Gill, A.M. (1981). Adaptive responses of Australian vascular plant species. *In* 'Fire and the Australian Biota'. Eds A.M. Gill, R.H. Groves and T.R. Noble, pp. 243-72. (Australian Academy of Science: Canberra).

Leigh, J., Boden, R. and Briggs, J. (1984). 'Extinct and Endangered Plants of Australia.' (MacMillan: Australia).

Titles of journals should be abbreviated according to the most recent (4th) edition of the World List of Scientific Periodicals (available at most libraries).

Other methods of referencing (e.g. footnotes) may be acceptable in manuscripts other than research reports. The editors should be consulted prior to the submission of a manuscript that uses a method other than author-date.

Research Reports

A research report is a succinct, formal, original scientific communication. Preference will be given to reports that make a significant contribution to natural history literature and are of general appeal. The manuscript should consist of an abstract not exceeding 250 words, an introduction, methods, results, discussion, acknowledgements and references.

Contributions and Naturalist Notes

The general comments on figure and table presentation, referencing and units also apply to these manuscripts. The appropriate style and format will vary with the manuscript but concise simple English should be used at all times. The use of subheadings is encouraged where they improve comprehension.

GROUP MEETINGS

Group Meetings (other than the Day Group) will be held at the Astronomers Residence, Birdwood Avenue, South Yarra (150 metres nearer the Shrine than the Herbarium) at 8.00 pm. until further notice. Any member or visitor invited to all meetings.

Fauna Survey Group (First Tuesday)

Tuesday 5th September "Brush-tailed Rock Wallabies" and "Comments on the use of hair-analysis as survey technique". Bert Lobert.

Tuesday 3rd October "Rockhopper penguins in subantarctic New Zealand." Dr Phillip Moore Director RAOU.

Tuesday 31st October "Conservation and Ecology of Mallee Fowl". Joe Benshemesh.

Geology Group (First Wednesday)

Wednesday 6th September "Victorian Brown Coal" Dr David Allardice.

Wednesday 4th October "Plate Tectonics." Group Discussion.

Botany Group (Second Thursday)

Thursday 14th September "Botanical Exploration of the Port Phillip Bay Area" Dr Sophie Ducker.

Thursday 12th October Subject to be arranged.

Microscopical Group (Third Wednesday)

Wednesday 20th September Pond Life Collecting. Pond Life under the Microscope.

Wednesday 18th October "Fun with Fungi and Microscopes." Mary Cole.

Day Group (Third Thursday)

Thursday 21st September Walk along the Old Outer Circle Railway Track. East Malvern to Alamein Station. Catch the 11.02 am Glen Waverley train to East Malvern Station. Leader Dan McInnes 211 2427.

Thursday 19th October Organ Pipes National Park. Catch the 9.50 am train at Flinders St to Essendon Station then Bus No. 483 at 10.23 am. Leader Dan McInnes 211 2427.

THE HAWTHORN JUNIOR FIELD NATURALISTS CLUB

Meetings are on the last Friday in the month at 7.30 pm at the Balwyn Primary School Hall, corner of Balwyn and Whitehorse Roads, Balwyn.

Friday 22nd September "Fungi".

Friday 27th October "Alpine Wildlife and Plants."

For information about Club excursions or meetings contact President Jonathon Stevenson Phone 830 5886 or Program Officer Rohan Clark Phone 725 8923.

Donations
Australian Natural History Medallion Trust Fund

The following donations to this Fund have been received:

Geelong Field Naturalists Club	$20
West Australian Wildflower Society Inc.	$25
Wildlife Preservation Society of Australia	$20

Our thanks to these donors for their support.

Sheila Houghton
Secretary to the Medallion General Committee

Field Naturalists Club of Victoria

In which is incorporated the Microscopical Society of Victoria

Established 1880

Registered Office: FNCV, c/- National Herbarium, Birdwood Avenue, South Yarra, 3141.

OBJECTS: To stimulate interest in natural history and to preserve and protect Australian fauna and flora.
Members include beginners as well as experienced naturalists.

Patron

His Excellency, The Rev Dr John Davis McCaughey, The Governor of Victoria.

Key Office-Bearers 1989-1990

President: Mr. GRAEME LOVE, P.O. Box 2018, St. Kilda West, 3182 (697 5109 B.H.)

Vice President: Mrs. SHEILA HOUGHTON, FNCV, National Herbarium, Birdwood Avenue, South Yarra, 3141 (551 2708)

Hon. Secretary: Mr. JULIAN GRUSOVIN, 1 Warriner Court, East Oakleigh, 3166. (542 2396 B.H. and 543 8627 A.H.)

Hon. Treasurer: Ms YVONNE GRAY, 46 Albany Cres., Surrey Hills, 3127 (890 1488 A.H.)

Subscription-Secretary: Ms DIANNE CHAMBERS, FNCV, c/- National Herbarium, Birdwood Avenue, South Yarra, 3141 (387 5146).

Editors: ROBYN WATSON and TIM OFFOR, FNCV, c/- National Herbarium, Birdwood Avenue, South Yarra, 3141 (419 3532).

Librarian: Mrs. SHEILA HOUGHTON, FNCV, c/- National Herbarium, Birdwood Avenue, South Yarra, 3141 (551 2708)

Excursion Secretary: Mrs. JOAN HARRY, 342 High Street, Templestowe, 3107 (850 1347)

Club Reporter: Vacant.

Conservation Co-ordinator: Mr. BERT LOBERT, 378 Cotham Road, Kew, 3101. (859 4716 A.H.)

Sales Officer (Books): Vacant.

Sales Officer (Victorian Naturalist only): Mr. D. E. McINNES, 129 Waverley Road, East Malvern, 3145 (211 2427)

Programme Secretary: Vacant.

Publicity Officer: Vacant.

Diary Co-ordinator: Mr. D.E. McINNES, 129 Waverley Road, East Malvern, 3145 (211 2427)

Group Secretaries

Botany: Miss MARGARET POTTER, 1/249 Highfield Road, Burwood, 3125 (29 2779).

Day Group: Mr. D. E. McINNES, 129 Waverley Road, East Malvern, 3145 (211 2427)

Geology: Miss HELEN BARTOSZEWICZ, 16 Euroa Avenue, Nth. Sunshine, 3020 (311 5106 A.H.)

Fauna Survey: Mr. JULIAN GRUSOVIN, 1 Warriner Court, East Oakleigh, 3166. (542 2396 B.H. and 543 8627 A.H.)

Microscopical: Mrs. ELSIE GRAHAM, 147 Broadway, Reservoir, 3073 (469 2509)

MEMBERSHIP

Membership of the F.N.C.V. is open to any person interested in natural history. The *Victorian Naturalist* is distributed free to all members, the club's reference and lending library is available and other activities are indicated in reports set out in the several preceding pages of this magazine.

Subscription rates for 1988

Metropolitan Members (03 area code)	$25.00
Joint Metropolitan Members	$27.00
Country/Interstate/Retired Members	$23.00
Joint Country/Interstate/Retired Members	$25.00
Student (full-time)	$18.00
Junior (under 18; no Victorian Naturalist)	$5.00
Subscription to Victorian Naturalist	$23.00
Overseas Subscription to Victorian Naturalist	$30.00
Affiliated Clubs	$25.00
Subscriber Clubs	$23.00
Individual Journals	$3.50
Late Fee (Renewing Members), after end of March	$2.00

JENKIN BUXTON PRINTERS PTY LTD. 113 ABBOTSFORD ST WEST MELBOURNE 328-4774

The Victorian Naturalist

Vol. 106, No. 5 September/October 1989

Published by the FIELD NATURALISTS CLUB OF VICTORIA

Registered by Australia Post. Publication No. V.B.P. 1268

$3.50

FNCV DIARY

GENERAL MEETINGS (Second Monday)

General Meetings will be held at the Royal Society Hall, 9 Victoria Street, Melbourne until further notice. Meetings commence at 8.00 p.m.

Monday, 13th November, 8.00 p.m.
Australian National History Medallion. Presentation to Mr Bruce Fuhrer, Monash University, Melbourne, Victoria.
Mr Fuhrer will speak on "Plants through the Camera".
(Buffet dinner will precede the presentation, see details on page 173)

Monday, 11th December, 8.00 p.m.
Mr Michael McBain "Speleology"

FNCV NEW MEMBERS July – August

James Turner, Kalimna West.
Mrs Dorothy Cassidy, South Warrandyte.
Ms Louise Mary Stephens, St. Kilda.
Mr B. J. Waldron, Balwyn.
Dr Brian & Pamela Faragher, Canterbury.
Greg Horrocks, Dandenong.
Mr Ross Runnalls, Swifts Creek.
Mr T. Griffiths, West Brunswick.
Ms L. Robin, Mt Waverley.
Mr J. H. & Mrs P. G. Watson, Doncaster.
Christopher Weston and Stacey Malcolm, Rosedale, Vic.
Mrs & Mr Valerie and Christopher Lang, Lismore, Vic.
Miss Patricia Prendergast, Sandringham.
Charles Meredith, Clifton Hill.
Dean Spalding, Macedon, Vic.
Mr Stuart Graham, Frankston.

FNCV EXCURSIONS (First Sunday)

Sunday, 5th Novemher Lerderderg Gorge. Leader: Jack Myer. Bus leaves Batman Avenue. 9.20 a.m. Fare $14. Bring lunch.

Sunday, 3rd December Nepean State Park. This is the last general excursion of the year and our President Mr Graeme Love invites all members to attend and make this a special Christmas break-up. Arrangements have been made to travel on the transporter which goes to Cheviot Hill and Point Nepean. The charge is Adults $5, Pensioners or children $2.50. There will be a special reduced fare of $10 for the coach for the trip. Coach will leave Batman Avenue at 9.30 a.m. sharp. Bring lunch. Book with Joan Harry. (Private cars are not permitted beyond the orientation centre which is at the entrance of the Park beyond Portsea.)

Thursday 4th to Tuesday 9th January, 1990. Mt. Buffalo. Details of this excursion are in July-August *Victorian Naturalist* FNCV Diary. Book with Joan Harry.

GROUP EXCURSIONS

All FNCV members and visitors are invited to attend any Group Excursion.

Fauna Survey Group
Saturday 4th – Tuesday 7th November
Hairy-nosed Wombat survey at Deniliquin.
Saturday 9th – Sunday 10th December
Water-rat studies.
December 26 – January 2nd
Survey Nooramunga Fauna Reserve (Snake and Sunday Islands)

Botany Group
Saturday 25th November
Basalt Plains Flora Remnants. Leader Keith McDougall.

Continued on inside back cover

The Victorian Naturalist

Volume 106, Number 5 September/October, 1989

ISSN 0042-5184

Cover photo: Leadbeater's Possum *(Gymnobelideus leadbeateri),* Plate 91, from *Prodromus of the Zoology of Victoria* by F. McCoy (1885). Reproduced with the kind permission of the Museum of Victoria.

Sites of Zoological Significance

In the May/June issue of *The Victorian Naturalist* I presented a 'Naturalist Note' on the results of some mammal surveys which have been undertaken by Victoria College biology research students working in parts of the Shire of Sherbrooke (Wallis 1989). Three sites were surveyed: private land near Birds Land and Lysterfield Lake Park, Courtneys Road (including Ash Reserve) and Aura Vale Lake Park.

Mansergh *et al.* (1989) have recently reported on sites of zoological significance in the Upper Yarra Valley and Dandenong Ranges. (The corresponding sites of botanical significance are reported in McMahon *et al.* 1989). It is of interest that the three sites I discussed have all been noted as being of regional significance by Mansergh *et al.* (1989). Lysterfield Lake Park, Courtneys Road and Birds Land Reserve were considered as a block and assigned a Regional A significance rating (of significance in the Greater Melbourne Region). The block has a high number of vertebrate species (213, not including fish) and the endangered Regent Honeyeater *(Xenthomyza phrygia)* has been recorded in Lysterfield Lake Park. Mansergh *et al.* (1989) stress the conservation importance of private land between Birds land and Lysterfield Lake Park, as well as endorsing Pergl's (1986) recommendations for management of Courtneys Road bushland. They also recommend further surveying here for such mammals as the White-footed Dunnart *(Sminthopsis leucopus)*, Eastern Pigmy-possum *(Cercartetus nanus)* and the New Holland Mouse *(Pseudomys novaehollandiae)* using pitfall traps. We found no evidence of these species using conventional traps or in predator scats at Courtneys Road.

Aura Vale Lake Park and the Cardinia Reservoir area are considered "Regionally significant (B)" by Mansergh *et al.* (1989), mainly because of the high diversity of birds.

I omitted to include in my note that in the Victoria College (Rusden) studies, all trapping was carried out under permit from the Department of Conservation, Forests and Lands. The relevant permit numbers are 83-63/82, 85-108 and 88-019.

Robert L. Wallis
Department of Science,
Victoria College - Rusden Campus,
Clayton, Vic. 3168.

References

Mansergh, I., Beardsell, C., Bennett, S., Brereton, R., O'Connor, W., Sandiford, K. and Schulz, M. (1989). Report on the sites of zoological significance in the Upper Yarra Valley (Western sections) and Dandenong Ranges. *Arthur Rylah Instit. Env. Res. Tech. Rep.* **90**.

McMahon, A.R.G., Frood, D., Bedggood, S.E. and Carr, G.W. (1989). A review of the sites of botanical significance in the Upper Yarra Valley and Dandenong Ranges Region. Vols 1 and 2. (Ecological Horticulture: Clifton Hill).

Pergl, G. (1986). A study of Courtneys Rd., South Belgrave. Biology Research Project (unpublished), Victoria College - Rusden Campus, Department of Science.

Wallis, R.L. (1989). Mammals between Lysterfield and Cardinia Reservoir in the Shire of Sherbrooke. *Victorian Nat.* **106**: 76-9.

WANTED

Club Reporter

Take the opportunity to get involved with the club and sharpen up your journalistic skills. The Club Reporter writes the general meeting reports and keeps us informed of club activities. This is both an important and enjoyable job. If you would like to help please contact Julian Grusovin on 543 8627 (A.H.).

Award & Dinner
Australian Natural History Medallion

Congratulations to Bruce Fuhrer for being awarded the Australian Natural History Medallion for 1989. The Medallion will be presented at the Club's general meeting on Monday, 13 November 1989 at the Royal Society's rooms, 9 Victoria Street, Melbourne. The meeting will be preceded by a buffet dinner starting at 6.00 p.m. All members are invited to attend the dinner, cost $12.50 the dinner payable at the door. Members wishing to attend should notify the Secretary, Julian Grusovin, 1 Warriner Court, East Oakleigh, 3166 (543 8627 A.H.).

Weed Science Society
and
Department of Conservation, Forests and Lands

Seminar

28th October, 1989 Studley Park Reception Centre,
3 Walmer Street, Kew

Speakers will discuss weed control in native vegetation, with emphasis on practical aspects. *Cost:* $25-$30, including lunch.

For further information contact R. Adair or B. Richardson, Keith Turnbull Research Institute, Ballarto Road, Frankston 3199. (03) 785 0111.

Programme

8.00-9.00 Registration and Coffee
Chairman: Jeff Yugovic, CFL
9.00-9.15 **Overview of Environmental Weeds in Victoria** – Dr Malcom Calder, University of Melbourne
9.15-9.45 **Control of Environmental Weeds in Sherbrooke Forest** – Vivien Freshwater, Friends of Sherbrooke Forest
9.45-10.15 **Local Government Management of Urban Heath land** – Max Pfitzner, Heidelberg City Council
10.15-10.45 Morning Tea
10.45-11.25 **Weed Control in Native Grasslands** – John Morgan, Burnley Horticultural College and Keith McDougall, Department of Conservation, Forests & Lands
11.25-11.55 **Weed Control in La Trobe University Wildlife Reserves** – George Parris, La Trobe University
11.55-12.25 **Control of Riparian Weeds** – Pat Fricker, MMBW
12.25-1.00 **Problems, Priorities & Progress** – Discussion with Panel of Speakers. Chairman: Dr M. Calder, University of Melbourne
1.00-2.00 Lunch (included in cost of Registration Fee)
2.00-2.30 **Release of Biological Control Agent for Boneseed** – Ms Kay Setches, Minister Department Conservation, Forests & Lands
2.30-5.00 **Tour of Weed Control Activities in Studley Park** – Darcy Duggan, Yarra Bend Trust

For bookings contact Robin Adair, Keith Turnbull, Research Institute. P.O. Box 48, Frankston 3199. (03) 785 0111

All bookings close Wed. 25th October.

A Survey of the Distribution of Leadbeater's Possum, *Gymnobelideus leadbeateri* McCoy in the Central Highlands of Victoria.

D.B. Lindenmayer[1], A.P. Smith[2], S.A. Craig[3] and L.F. Lumsden[4].

Introduction

Leadbeater's Possum, *Gymnobelideus leadbeateri,* is a rare and endangered arboreal marsupial inhabiting montane ash forests in the central highlands of Victoria, south-eastern Australia (Thornback and Jenkins 1982). The species was re-discovered in the central highlands of Victoria by Wilkinson (1961). Virtually all subsequent records of the species are from this region. Leadbeater's Possum is known from an area within 37° 20', 37° 55' S latitude and 145° 30', 146° 20' E longitude (Fig. 1, Fig. 2, Appendix).

This paper describes the preliminary results of a survey of the distribution of Leadbeater's Possum in montane ash forests within several catchments administered by the Board of Works as well as areas managed by the Dandenong, Alexandra and Central Gippsland regions of the Department of Conservation, Forests and Lands. The results of the initial phase of the survey undertaken during 1983/84 have been published in Smith *et al.* (1985) and Smith and Lindenmayer (1988).

Methods

A dusk and night-time census of arboreal marsupials was undertaken at 152 sites, each of 3 ha located within, or close to, montane ash forests located in the central highlands of Victoria during 1983/84 and 1987-1989. The stag-watching technique (Seebeck *et al.* 1983) was used to determine the diversity and abundance of animals at 148 sites.

Observers were positioned under hollow-bearing trees approximately 30 min before dusk and remained there until 1 h after dusk. A modified stag-watching program was followed at 4 sites which supported no nest trees. Volunteers were stationed at marked points set at 25 m intervals on the survey site and were requested to scan the canopy for the presence of animals for a period of 30 min before and up to 1 h after dusk.

Forests containing Mountain Ash, *Eucalyptus regnans,* Alpine Ash, *E.delegatensis* or Shining Gum, *E.nitens* were surveyed. At a few localities the dominant tree species was Messmate *E. obliqua.* The survey was stratified to include a range of forest types, ages, aspects and slope positions (ridge, midslope and gully). The number of nest trees on a site ranged from 0-34 per 3 ha.

Results and Discussion

The survey of the distribution of Leadbeater's Possum was highly labour intensive. Over 500 volunteers assisted in the study and more than 1200 person-hours were invested in the stag-watching program. A further 200 h were spent in spotlighting surveys. More than 1100 trees were stag-watched, approximately 15% of these on more than one occasion.

Leadbeater's Possum was recorded at 57 (38%) of all sites surveyed. Eighty-five colonies of Leadbeater's Possum were detected yielding a total of 206 animals. Colony size ranged from 1-6 individuals (mean = 2.42) and was highly variable,

[1] Dept. Forestry
Australian National University
P.O. Box 4 Canberra, A.C.T., 2614.
[2] Dept. of Ecosystem Management
University of New England
Armidale, N.S.W., 2351.
[3] Dept. Conservation, Forests and Lands.
Dandenong Region,
P.O. 246, Healesville, Victoria, 3777.
[4] Arthur Rylah Institute for Environmental Research,
P.O. 137,
Heidelberg, Victoria, 3084.

changing by as many as two animals between successive evenings. Considerable caution is needed when interpreting the results of the survey. The study was biased to include many sites with habitat considered favourable for Leadbeater's Possum to increase the probability of detecting the species. Large areas of montane ash forest were found to be unsuitable for Leadbeater's Possum through the lack of either suitable nest trees or foraging habitat or both.

The survey established the most southerly record of Leadbeater's Possum — on the Bunyip Rd., 1.7 km south-east of the turnoff with A.P.M. track, as well as locating many new sites 5 or more kilometres from previously known localities, particularly within water catchments administered by the Board of Works. The presence of Leadbeater's Possum was confirmed at "The Hermitage" (on the Black Spur, Maroondah Hwy), which is one of the only records of the species on private land. An additional 11 records of Leadbeater's Possum were established by spotlighting. A map of the new distribution records of the species together with those records in the Victorian Mammal Database at the Arthur Rylah Institute for Environmental Research is shown in Fig. 2. The location of all new sightings is given in the Appendix.

Fig. 1. The location of the study area in which surveys for Leadbeater's Possum were undertaken during 1983-84 and 1987-88.

Leadbeater's Possum was not detected at sites lacking nest trees or in areas of mixed species forest where *Eucalyptus obliqua* was the dominant species. The presence of Leadbeater's Possum was reconfirmed at, or close to, several localities last surveyed 10-15 years ago including Starlings Gap, Mt. Horsfall, Ben Cairn and Mt. Gregory. However, the vegetation at several other sites (e.g. Loch Valley, Penny's Saddle) had been extensively modified by timber harvesting practices, and Leadbeater's Possum was not detected.

Seven other species of arboreal marsupials and one species of scanscorial marsupial were detected during the stag-watching program. These were Sugar Glider, *Petaurus breviceps,* Greater Glider, *Petauroides volans,* Mountain Brushtail Possum, *Trichosurus caninus,* Common Brushtail Possum, *Trichosurus vulpecula,* Yellow-bellied Glider, *Petaurus australis,* Common Ringtail Possum, *Pseudocheirus peregrinus,* Feathertail Glider, *Acrobates pygmaeus,* Eastern Pygmy-Possum, *Cercatetus nanus,* and the Brown Antechinus, *Antechinus stuartii.*

Mimicking the alarm call of Leadbeater's Possum was successful in attracting the species. Tape recordings of the call were made from animals removed from nest boxes at the Yellingbo State Nature Reserve. This call was subsequently mimicked during field surveys of the species. Leadbeater's Possum responded to the call on numerous occasions, approaching close enough to be captured by hand. This technique may have some merit as a survey tool, particularly as other techniques of detecting Leadbeater's Possum are either very labour intensive (stag-watching) or have a low rate of success (trapping and spotlighting). However unlike stag-watching, mimicking calls or using those that have been prerecorded cannot establish the density and

abundance of Leadbeater's Possum in a given area of forest. Windy and/or wet conditions reduce the range and audibility of the call. Furthermore, Leadbeater's Possum does not respond after prolonged use of the call or when it is used in tandem with spotlighting.

Acknowledgements

The initial phase of this study (1983/84) was part of a World Wildlife Fund project administered by A.P. Smith. Logistic support for surveys undertaken from 1987-1989 was provided by the Department of Forestry at the Australian National University. Financial and logistic assistance was also provided by the Department of Conservation, Forests and Lands. The assistance of the staff of the Dandenong region, the Arthur Rylah Institute for Environmental Research and the Silvicultural Systems Project is gratefully acknowledged.

Special thanks to Turid Linga, Jerry Alexander, Richard Hill and Peter McHugh for field assistance as well as discussion of many useful ideas. Frank Lawless and Charles Curry organised access to the water catchments administered by the Board of Works.

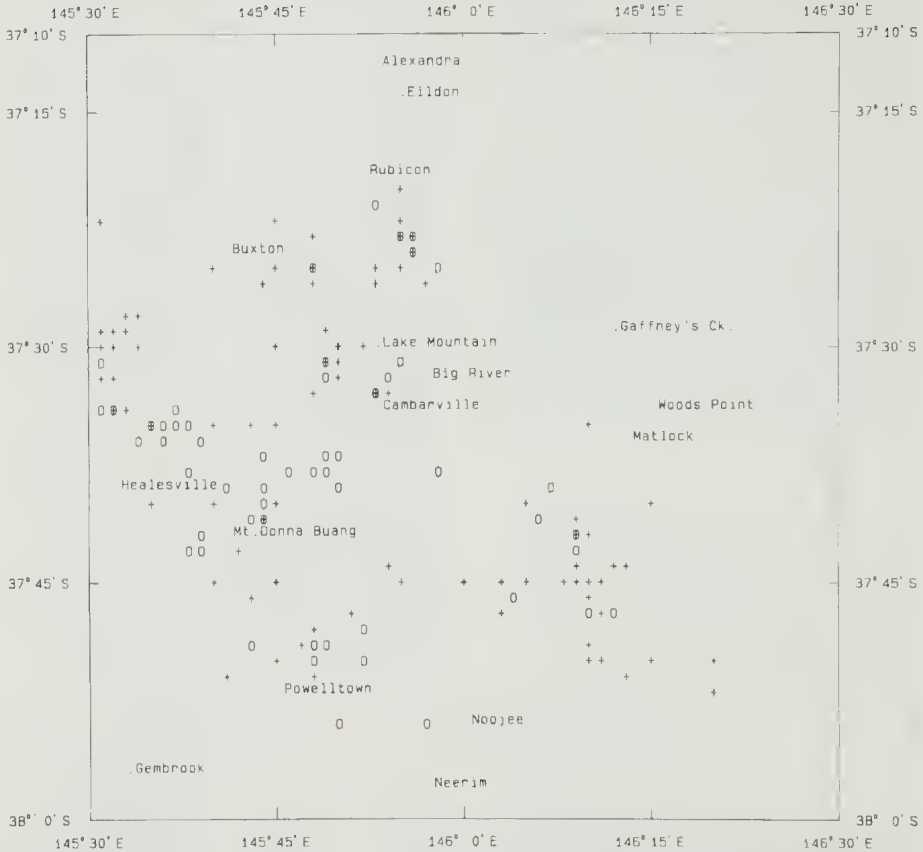


Fig. 2. The location of sighting records of Leadbeater's Possum established in this study (denoted **O**) together with those from the Victorian Mammal Database (denoted +). Scale = 1: 350 000.

This study would have not been possible without the dedicated assistance and support of numerous volunteer observers, particularly those from the Healesville Sanctuary, The Field Naturalists Club of Victoria and The Mammal Survey Group of Victoria. The help of all the people who have assisted in this project is gratefully acknowledged.

References

Seebeck, J.H., Suckling, G.C. and Macfarlane, M.A. (1983). Leadbeater's Possum — survey by stag-watching. *Victorian Nat.* **100**: 92-97.

Smith, A.P. and Lindenmayer, D.B. (1988). Tree hollow requirements of Leadbeater's Possum and other possums and gliders in timber production forests of the Victorian central highlands. *Aust. Wildl. Res.* **15**: 347-362.

Smith, A.P., Lindenmayer, D.B. and Suckling, G.C. (1985). The ecology and management of lead-beater's possum. Research Report to World Wildlife Fund, University of New England, Armidale, N.S.W.

Thornback, T. and Jenkins, T. (1982). The I.U.C.N. Mammal Red Data Book, I.U.C.N., Gland, Switzerland.

Wilkinson, H.E. (1961). The re-discovery of Lead-beater's Possum, *Gymnobelideus leadbeateri* McCoy. *Victorian Nat.* **78**: 97-102.

Appendix

The latitude and longitude of all records has been determined from 1: 100 000 NATMAP topographic maps. Elevation of survey sites has been estimated from 1: 25 000 Fire Control maps supplied by the Board of Works.

Lat. Long.	Alt. (m)	Location
37 41 145 49	800	Acheron Gap.
37 22 145 47	1000	Blue Range Rd.
37 45 146 11	900	1km E bridge, Upper Thomson River.
37 42 146 10	960	Upper Thomson River.
37 46 146 10	1060	Upper Thomson Rd.
37 42 146 09	1040	2 km N Mt. Gregory.
37 41 146 09	1100	3 km S Triangle.
37 44 146 09	1020	4 km S Mt. Gregory.
37 39 145 49	940	3 km N Acheron Gap.
37 45 146 08	1040	5 km NE Toorongo.
37 50 146 11	600	1 km E Tanjil Bren.
37 45 146 09	1020	Cnr. Thomson Valley, Noojee/ Matlock Rd.
37 23 145 48	1040	4 km W Rubicon Dam.
36 00 146 00	900	Cnr MMBW Tks. No. 8 and 27, Upper Yarra Catch.
37 49 145 48	800	0.5 km. NE Starlings Gap on Big Ck. Rd.
37 49 145 49	800	Gap Tk., Starlings Gap.
37 48 145 52	760	Cnr. Federal Short Cut and Federal Rd.
37 50 145 52	760	Cnr Big Tree Walking Tk. and Federal Rd.
37 35 145 38	440	"The Hermitage", Maroondah Hwy.
37 54 145 53	680	1.7 km. SE T/o Bunyip Rd. and A.P.M. Tk.
37 54 145 50	780	Cnr. Wodalls Tk. and Pioneer Ck. Rd.
37 49 145 49	820	Cnr. Big Ck. Rd. and Mississippi Fireline.
37 43 145 39	1000	1 km. E Ben Cairn.
37 53 145 38	520	2 km. SW Dom Dom on Maroondah Hwy.
37 49 145 48	800	Monets Tk. junction with Tin Mine Ck.

Appendix *(cont.)*

Lat. Long.	Alt. (m)	Location
37 54 145 57	800	Burgess Fire Trail 1 km. Nth Kobiolkes Tk.
37 34 145 31	560	Cnr. Sylvia Ck. and Coles Ck. Rds.
37 42 146 09	1000	17 km Rd. 9, Upper Yarra Catch.
37 46 146 04	1040	13 km Rd. 20, Upper Yarra Catch.
37 43 146 09	1020	10 km Rd 11, Upper Yarra Catch.
37 41 146 06	1060	1.5 km Rd. 10 T/o with Rd. 9, Upper Yarra Catch.
37 38 145 58	700	2 km on Rd. 27, Upper Yarra Catch.
37 39 146 07	1060	3.2 km W Triangle.
37 31 145 55	960	Koala Falls, Cambarville Rd.
37 43 145 37	800	1 km W Ben Cairn.
37 34 145 37	720	Cnr Rd. 9 and Monda Tk., Maroondah Catch.
37 36 145 34	880	Cnr. Hardies Ck. Rd. and Monda Tk.
37 36 145 39	600	3 km. Rd. 8, Maroondah Catch.
37 35 145 36	800	Cnr. Rds. 13 and 35, Maroondah Catch.
37 35 145 37	580	2.5 km on Rd. 9, Maroondah Catch.
37 38 145 38	740	1.1 km from Viewpoint. 1, Rd. 3 Maroondah Catch.
37 39 145 41	780	8 km Rd. 27., Maroondah Catch.
37 39 145 50	520	12 km. Rd. 1, O'Shannassy Catch.
37 38 145 46	1140	0.7 km. Rd. 8, O'Shannassy Catch.
37 37 145 44	1080	3.9 km Rd. 8, O'Shannassy Catch.
37 38 145 49	1140	0.8 km. Rd. 5, O'Shannassy Catch.
37 37 145 49	840	2.9 km. Rd. 5, O'Shannassy Catch.
37 37 145 50	700	7.5 km. on Rd. 12, O'Shannassy Catch.
37 41 145 44	900	0.2 km. Rd. 14, O'Shannassy Catch.
37 35 145 35	820	Cnr Rd. 9 and Block 6 Rd., Toolangi.
37 36 145 36	580	1 km. Rd. 39, Maroondah Catch.
37 23 145 55	1000	0.5 km. on Conns Gap Rd.
37 21 145 53	1000	1.3 km on Tk. 6, T/o Snobs Ck. Rd.
37 42 145 39	1020	17.2 km on Rd. 3, Maroondah Catch.
37 38 145 48	1180	Cnr Rds. 5 and 1, O'Shannassy Catch.
37 50 145 48	800	Mackley Ck., Crossing with Big Ck Rd.
37 34 145 54	800	Big Tree Tk., Cambarville.
37 34 145 54	840	Snowy Hill Rd., Cambarville.
37 33 145 49	900	Cnr. Tommy's Bend Rd. and Yellow Dog Rd.
37 26 145 48	1100	Blue Range Rd.
37 25 145 48	1100	Little River bridge, Blue Range Rd.
37 25 145 48	1000	Storm Ck., 1 km W Blue Range Rd.
35 25 146 53	1020	Royston River Rd.
37 34 145 32	960	Northern slopes Mt. St. Leonard.
37 34 145 33	860	Hardy's Ck. Rd.
37 22 145 31	920	4.2 km N Mt. St. Leonard.
37 47 146 03	1130	0.7 km. W summit Mt. Horsfall.
37 47 146 12	1120	Thomson Valley Rd.

Progress of Sugar Glider, *Petaurus breviceps,* establishment at the Tower Hill State Game Reserve, Vic.

G.C. Suckling[1] and P. Goldstraw[2]

Introduction

In 1979 a program of release of captive-bred *P. breviceps* (Sugar Glider) was initiated at the Tower Hill State Game Reserve in south-western Victoria. The first release occurred in that year and subsequent releases were undertaken in 1980 and 1981. Artificial hollows were provided for shelter, because planted trees (approximately 17 years old) did not contain hollows.

A survey of *P. breviceps* at Tower Hill was conducted in May 1981. The results were reported in Suckling and Macfarlane (1983) who concluded that a population had probably been established at Tower Hill, but that continued monitoring would be necessary to substantiate that conclusion.

The present study was conducted in November 1986, to evaluate the continued survival of released *P. breviceps* at Tower Hill and further evaluate the status of the population.

Study Area

The study area and management history were described by Suckling and Macfarlane (1983). Tower Hill is the broad crater (approximately 3 km diameter) of one of Victoria's most recently active volcanoes (Fig. 1). The surrounding volcanic plains were settled by Europeans in the early 1840's. Clearing began soon after and much of the land on the three islands within the crater was cleared by 1861. By 1870 the islands were devoid of trees and the crater slopes were covered with bracken and grass. A restoration program commenced in 1961, when the area became a State Wildlife Reserve (Department of Conservation, Forests and Lands Records.)

[1]Department of Conservation, Forests and Lands, 250 Victoria Parade, East Melbourne Vic. 3002.
[2]Department of Conservation, Forests and Lands, Warrnambool Vic 3280.

The present study was conducted on the main island, which comprises 130 ha of undulating land sheltered by the outer rim of the crater. A barrier of water usually separates this island and two smaller islands (48 and 1 ha) from the steep, treeless rim of the crater.

The canopy on the main island is mainly planted Manna Gum *Eucalyptus viminalis* Labill. and Swamp Gum *E. ovata* Labill. (to 20m in height), in mixture with planted Early Black Wattle *Acacia decurrens* (J. Wendl.) Willd. (to 10 m in height). Various other native species have been planted, the most conspicuous of which are Coast She-oak *Casuarina stricta* Dryand. and Blackwood *Acacia melanoxylon* R. Br. The principal understorey species are Bracken, *Pteridium esculentum* (Forst.f.) Nakai, and various grasses. There are no hollows in any of the planted trees. However, 70 artificial hollows were erected in two sections of the study area during 1979 and 1980.

The release program was fully described by Suckling and Macfarlane (1983). Sugar gliders were first introduced at Tower Hill in November 1971; three adult animals and three juveniles were released (Department of Conservation, Forests and Lands records). At that time the eucalypt and wattle plantations were only 7 years old, and, as no adequate shelter was available for these animals, they probably perished. However, no surveys were conducted so this cannot be verified.

A subsequent program of introductions began in February 1979, when 26 juvenile gliders (12 male and 14 female) were released. In January and February 1980 34 additional gliders (21 males and 13 females) were released, and in February 1981, 12 tagged gliders (six male and six female) were released (D Hackett, personal communication; Department of Conservation, Forests and Lands records). Thus, the total

number of gliders introduced prior to the present study (excluding the 1971 releases) was 72. Virtually all of these gliders were reared in captivity by Mr Hackett, from stock that originated from various forested areas in south-eastern Australia

Methods

The Sugar Glider population was surveyed during November 1986. Trapping was conducted in the vicinity of the 1981 survey sites (see Suckling and Macfarlane 1983). Fifty-three wire-cage traps, 36 by 13 by 13cm, (Gordon Wire Specialties, Kew) were used; all were set for four consecutive nights. Traps were attached to eucalypt and wattle trees at heights ranging from 2 to 5m above ground. A mixture of honey and oats was used as bait and, as an additional attractant, a trail of dilute honey was laid from the trap to the main stem of the tree (Suckling 1980).

Each glider was tagged with one fingerling eartag (Salt Lake Stamp Co., U.S.A.); male gliders on the right ear and female gliders on the left ear. All gliders were examined to determine reproductive condition and age (Suckling 1984). Three age-classes were recognized on the basis of tooth wear: younger than 1 year, 1-2 years and older than 2 years.

All artificial hollows which could be located were examined with the aid of a ladder. Hollows with hinged lids (hollow-

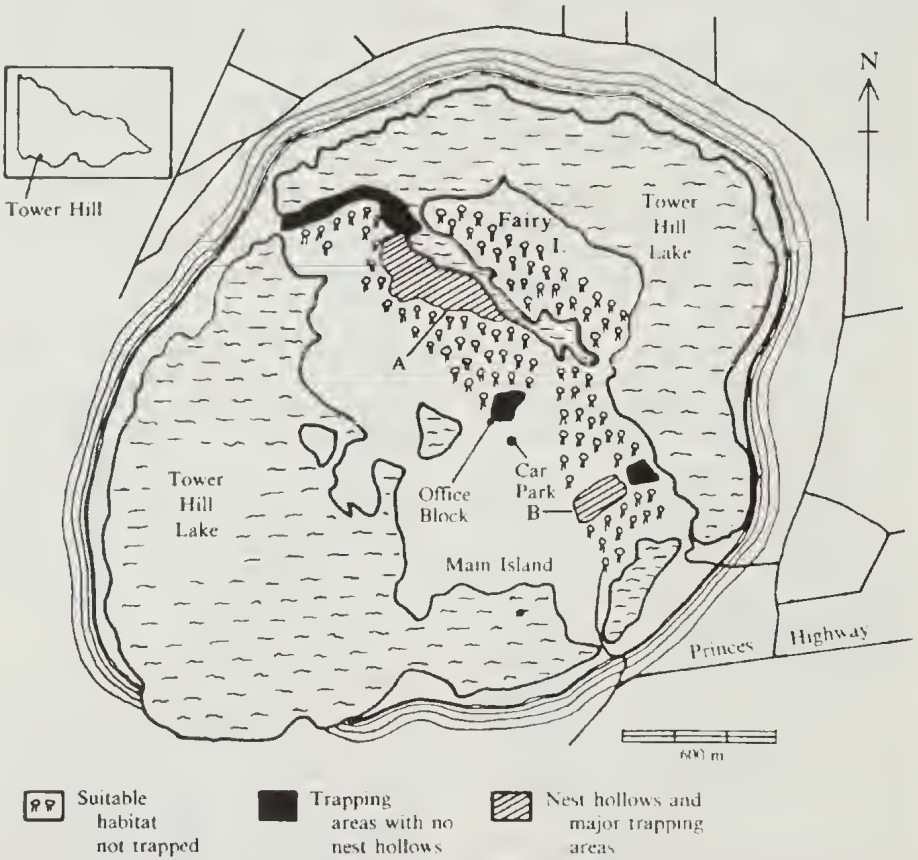


Fig. 1. The study area at Tower Hill State Game Reserve, showing distribution of trapping areas, nest hollows and suitable habitat not trapped, May 1981.

limb types) and terra-cotta pipes were thoroughly checked; box-type hollows which lacked inspection doors were disturbed by knocking vigorously on the box and poking a stick into the exit hole, in an attempt to flush all resident gliders.

Results

Glider Density

Thirty-nine Sugar Gliders (13 males and 26 females) were captured a total of 46 times during the survey (Table 1). It was not possible to determine the number of additional adult gliders not captured, because nest box inspections had been conducted prior to the commencement of tagging.

Examination of the pouches of captured females showed that there were 14 pouch young and 26 nestling young (as indicated by strongly lactating nipples) in the population at the time of the survey. Hence the total population was at least 79 animals including all pouch young.

Population Structure

Trapping results suggested a greater proportion of females than males in the two older age classes (see Table 2) with 15 females captured compared with 8 males in the 1-2 year age class and 7 females compared with 2 males in the 〉2 year class.

Three of the female gliders captured during November 1986 had been tagged in May 1981. One of these females was estimated to be at least 2 years old in May 1981, so was likely to be at least 7.5 years old when captured during the present study.

Table 1. Numbers of Sugar Gliders captured at each trapping site at Tower Hill, November 1986 (numbers of recaptures in parentheses)

Site	Number Captured Male	Female
Channel Track (equivalent to Site A of Suckling & Macfarlane 1983)	8(1)	18(1)
Motorcycle Track (equivalent to Site B of Suckling and Macfarlane 1983)	4(2)	5(0)
Office Block (see Fig. 1 of Suckling and Macfarlane 1983)	1(1)	3(2)
TOTAL	13	26

Table 2. Mean weights of Sugar Gliders captured at Tower Hill during November 1986.

Sex	Age (yr)	Weight (g)	N
Male	〈1	125	3
	1-2	142	8
	〉2	145	2
Female	〈1	114	4
	1-2	117	15
	〉2	128	7

Condition of captured gliders

All of the trapped gliders appeared to be in good health. Mean weights of animals captured at Tower Hill are presented in Table 2. Weights for both sexes compare favourably with weights recorded for animals at Willung (Suckling 1984).

Reproduction

Of the 26 females captured, 22 were more than one year old. Eight females had pouch young, fourteen others were lactating, one had produced young but ceased lactating, one showed signs of being in oestrus (Suckling 1984) and two had undeveloped pouches. The latter two animals were both assessed to have been less than one year old. Two other females assessed to have been less than one year old were breeding during the study. All females assessed to be over one year old were breeding.

Of the 23 females which had produced young in 1986, 20 had twins and the remaining 3 had single young. Mean litter size was 1.9.

Reproduction during 1986 probably commenced late in July or early in August, as assessed from the most advanced breeding females.

Use of Artificial Hollows

Twenty-one Sugar Gliders were found in artificial hollows during the survey. A total of nine were occupied by gliders, but a further 15 showed signs of recent occupation (Table 3). This is consistent with the fact that groups of gliders use a number of different hollows, particularly during the breeding season (Golding 1979; Suckling 1980, 1984). A large proportion (51%) of the box-type artificial hollows were occupied by bees (Table 3).

At the office block site, 4 adult and 4 young gliders were detected in one artificial hollow; 4 adults were captured near this site. The young gliders observed were not yet independent of their parents, as they were seen to cling to the fur of the fleeing adults.

Discussion

Survival and status of Sugar Glider populations at Tower Hill

Populations of Sugar Gliders have now persisted at Tower Hill for almost eight years and this study has reinforced the conclusion of Suckling and Macfarlane (1983) which was that a population of Sugar Gliders had been successfully established at Tower Hill.

Average natality rate (number of young born per adult female) was 1.7, though it must be remembered that the breeding season had not been completed at the time of the survey. In spite of this the overall average natality was similar to that recorded in May 1981 and it appears that reproduction is continuing at a similar rate to that recorded during the 1981 study.

It was not possible to compare recruitment rates with those recorded during 1981 because the two surveys were conducted at different times of year.

The current survey indicates that there are now more Sugar Gliders in the Reserve than were detected during the 1981 study. Although the number of captures during 1986 (39) was only marginally greater than the number of captures during 1981 (32), likely survival rates of pouch young (see Suckling 1984, Suckling and Macfarlane 1983) suggest an autumn 1987 population of at least 60 animals (i.e. at least 39 adults, including 26 females, alive during this study, and an average recruitment of one young per adult female). It is relevant that trapping resulted in the capture of 10, 14, 8 and 7 new individuals respectively on each successive day of the survey. These figures suggest that continued trapping would have revealed a greater number of individual gliders Similarly, recaptures numbered 1, 2 and 4 on the second, third and fourth mornings of trapping respectively, further suggesting that the total population was much greater than that detected.

Another factor to be considered is that gliders were probably occupying a larger area than in 1981, because the habitat had improved (i.e. trees were larger and there was more widespread natural shelter). It is therefore likely that trapping sampled a smaller proportion of the total population than was the case in 1981. Further work is required to confirm the wider distribution of gliders in the reserve.

The survival for a further 5.5 years of at least three female gliders from a total of 17 females tagged during the 1981 study indicates a higher survival rate than in a wild population studied by Suckling

Table 3. Use of artificial hollows by Sugar Gliders at Tower Hill November 1986.

Type of Nest Hollow	Number Inspected	Occupied by Sugar Gliders	With Signs of Recent Occupation	Apparently Unused	Occupied by Bees	Occupied by Starlings or Other Species
Box	59	8	12	6	30	3
Hollow limb	8	1	3	3	1	–
Pipe	1	–	–	1	–	–

(1984). The latter study found that less than 8 percent of one year old females survived to reach four or more years of age. In the present study at least two of the seven females estimated to be approximately one year old in May 1981 survived until at least November 1986. This represents a very high survival rate for females and suggests that the habitat at Tower Hill is highly suited to *P. breviceps* .

The age structure, population size, reproductive success, survival and condition of the Sugar Glider populations at Tower Hill substantiate the conclusion that the species has been established (see also Suckling and Macfarlane 1983; Macfarlane and Suckling 1984).

Management Implications

The continued survival of Sugar Gliders at Tower Hill, despite the absence of supplementary feeding with dilute honey solution, is sufficient indication that existing natural food sources are adequate.

Data on occupation of artificial hollows (13% in 1986 compared with 24% in 1981) indicates a lower use by gliders than was recorded during the 1981 study. This is probably partly due to the increase in natural shelter sites such as decorticating bark and possibly even some small hollows. However, it may also be partly due to the high use of artificial hollows by bees. The data on use of artificial hollows suggest that the hollow-limb type is less suited to occupation by bees. Bees are also more readily removed from this type of artificial hollow because the lids are removeable. The erection of further nesting sites of the hollow-limb type in sites where the habitat is suitable in other respects, should enable the gliders to further increase their populations. The recommendation made by Suckling and Macfarlane (1983) of an optimum density of 3-5 artificial hollows per ha of suitable habitat, are still relevant to the management of glider populations at Tower Hill.

Until such time as the planted trees at Tower Hill form hollows, it will be necessary to ensure that nest sites are provided. Local managers should determine whether it is better to provide additional hollows to replace those which become occupied by bees (or are rendered unsuitable for any other reason), or to carry out maintenance work on the existing hollows, or to adopt some combination of both approaches.

Acknowledgments

The authors are grateful to Mr D. Hackett, Naturalist, Melbourne, for this continued interest in and support for the reintroduction program. We are also grateful to staff of the Portland Region of the Department of Conservation, Forests and Lands for assistance with the field work during this survey.

References

Golding, B.G. (1979). Use of artificial hollows by mammals and birds in the Wombat Forest, Daylesford, Victoria. M. Env.Sc. Thesis, Monash University.

Suckling, G.C. (1980). The effects of fragmentation and disturbance of forest on mammals in a region of Gippsland, Victoria. Ph. D. Thesis, Monash University.

Suckling, G.C. and Macfarlane, M.A. (1983). Introduction of the Sugar Glider, *Petaurus breviceps*, into re-established forest of the Tower Hill State Game Reserve, Vic. *Aust. Wildl. Res.* **10**, 249-58.

Suckling, G.C. (1984). Population ecology of the Sugar Glider, *Petaurus breviceps*, in a system of fragmented habitats. *Aust. Wildl. Res.* **11**, 49-75.

The Distribution and Range Extension in Victoria of the Butterfly *Ocybadistes walkeri sothis* Waterhouse

D.F. Crosby* & K.L. Dunn†

Abstract

Ocybadistes walkeri sothis is now well established in the Melbourne area and has become widely distributed in Victoria during recent years. This extension of the former range is documented and the possible reasons for it discussed.

Introduction

Ocybadistes walkeri Heron (Lepidoptera: Hesperiidae) is a small butterfly in the group called skippers, because of their darting flight. Its wing-span is about 26 mm and the larvae feed on grasses. It was described in 1894 from Damar, Indonesia, and is found widely in Indonesia, Papua-New Guinea and Australia. Six subspecies have been described. Four of these are found in Australia; *O. walkeri sothis* Waterhouse (Fig. 1), the Yellow Banded Dart, from Yeppoon and Rockhampton, Queensland, south through central and coastal New South Wales, Victoria, and Tasmania; *O. w. hypochlorus* Lower, the Southern Dart, is confined to south-eastern South Australia; *O. w. sonia* Waterhouse occurs south from the Shelburne Bay region of Cape York Peninsula (Monteith and Hancock, 1977) to Mackay, Queensland; *O. w. olivia* Waterhouse is restricted to the western sector of the "top end" of the Northern Territory (Common and Waterhouse, 1981). The latter two subspecies do not have common names.

Historical References

With one exception all authors prior to Common and Waterhouse (1972) regarded *O. walkeri* as absent from Victoria. The exception was Meyrick and Lower (1902) who included the distribution "Gisborne, Melbourne, etc." for *Apaustus sunias* (Felder) (*O. walkeri* being given as a synonym). These authors were not confusing this skipper with the White Grass Dart, *Apaustus papyria* (Boisduval), because

Fig. 1. *Ocybadistes walkeri sothis.*

* 74 Gipps Street, East Melbourne, 3002.
† 16 Grace Avenue, Dandenong, 3175.

this was separately listed and given the same distribution. We regard their distribution for *A. sunias* (= *walkeri sothis*) as incorrect, because Waterhouse and Lyell (1914) gave no Victorian records (under *Padraona flavovittata flavovittata* Latreille). G. Lyell was resident in Gisborne and was responsible for most collecting in that area during the early part of this century and would have been expected to have known of the Gisborne record and would have included it in the 1914 book with Waterhouse. The later comment by Waterhouse (1932) that "though searched for, it has not been found in Victoria" also seems to confirm the error. The error appears to be further confirmed by the lack of specimens and literature notes to support the Meyrick and Lower distribution.

Common and Waterhouse (1972) did not directly state that *O. walkeri* occurred in Victoria, but this was implied in the connecting of the records from southern New South Wales (Riverina and Pambula) through eastern Victoria with those of Tasmania on the distribution map for the species. Gisborne and Melbourne were excluded in this map. We have not been able to find the data used to support this extension. However, Common and Waterhouse do give recent Victorian records in their 1981 edition and increase the distribution area on their map to include Melbourne.

Recent Records in Victoria

Less than three decades ago there were no published records of *O. walkeri* from Victoria, other than those of Meyrick and Lower (1902) which we consider erroneous. The first authenticated record appears to be from East Gippsland and this together with the initial and subsequent early records for localities in the major regions of Victoria are set out in Table 1. We have also included in Table 1 the early records from Melbourne, up to the end of the 1979-80 flight season, to give a clearer perspective for the early records for the State as a whole.

Because the early records are important in tracing the apparent steps in the butterfly's range extension, the data on Table 1 is amplified in the following comments.

The earliest records of *O. w. sothis* in Victoria came from Noorinbee, near Cann River, where A. May caught specimens early in December 1960 on flowers of *Buddleia* growing in his garden. These records were never published. On 30 January 1972 J. Landy took specimens in association with Kikuyu grass at Mallacoota.

O. walkeri sothis is not regarded as a mountain species, thus the records from Mt Baw Baw (1500 m) and Mt Erica (1100 m) are significant and possibly indicate that the butterfly may be found in other mountain areas.

The specimens caught by Landy and Crosby at Kerang in March 1979 were feeding on small road-side flowers amongst Couch Grass, which was probably the foodplant.

The first record from Melbourne was in late March 1977, when A. Kinsella identified "a single freshly emerged" specimen at East Brighton. In the following season, A. Atkins found the species "very common" at Black Rock on 21 February 1978, and in March 1979, C. McCubbin photographed specimens in his garden at Box Hill North.

Although specimens have been caught recently at Rainbow and Nhill by F. Douglas, there are no records from the Mt Cole area or the Grampians. A recent record by J. Landy at Anglesea extends the range along the western coast, but there are no records further west into the Otways or the south-western coastal area between the Otways and South Australia.

From the flight season commencing in October 1980, the species spread rapidly in suburban Melbourne and the nearby country areas. Table 2 shows the records

Table 1. The initial and early records of *Ocybadistes walkeri sothis* in major regions in Victoria and Melbourne

Locality	Date	Collector	Reference
		East Gippsland	
Noorinbee	Dec. 1960	A. May	Pers. comm.
Mallacoota	30 Jan. 1972	J. Landy	Pers. comm.
Bemm River	Jan. 1974	R. Field	Pers. comm.
Mallacoota	Feb. 1976	J. Landy	Pers. comm.
Gipsy Point	15 Nov. 1984	M. Hunting & D. Crosby	
		Gippsland	
Tonimbuk	18 Dec. 1983	K. Dunn	
Millgrove	3 Mar. 1985	D. Gooding	Carwardine (1985)
Nyora	30 Nov. 1985	K. Dunn	
Mt Baw Baw	29 Mar. 1986	A. Morton	Pers. comm.
Cannons Creek	14 Dec. 1987	K. Dunn	
Mt Erica	17 Feb. 1988	K. Dunn	
Inverloch	2 Feb. 1989	K. Dunn	
		Central Victoria	
Rutherglen	25 Mar. 1973	S. McEvey	McEvey (1973)
Benalla	23 Feb. 1984	M. Braby	Pers. comm.
		North-Western Victoria	
Gunbower	2 Jan. 1976	A. Atkins	Atkins (1976)
Kerang	19 Apr. 1976	A. Atkins	ANIC
Kerang	31 Mar. 1979	J. Landy & D. Crosby	
Mildura	23 Oct. 1983	D. Holmes	Pers. comm.
		Western Victoria	
Hanging Rock, Woodend	5 Apr. 1985	M. Braby	Pers. comm.
Lerderderg Gorge	1 Dec. 1985	S. Smith	Sattler, Pers. comm.
Melton	30 Oct. 1987	I. Faithfull	Pers. comm.
Rainbow	31 Oct. 1987	F. Douglas	Pers. comm.
Castlemaine	9 Mar. 1988	D. Crosby	
Anglesea	Mar. 1989	J. Landy	Pers. comm.
Nhill	9 Apr. 1989	F. Douglas	Pers. comm.
Wycheproof	19 Apr. 1989	F. Douglas	Pers. comm.
		Melbourne	
Brighton E.	Mar. 1977	A. Kinsella	Kinsella (1977)
Black Rock	21 Feb. 1978	A. Atkins	Atkins (1978)
Box Hill N.	Mar. 1979	C. McCubbin	Pers. comm.
Toorak	1 Mar. 1980	D. Crosby	
Oakleigh S.	1 Mar. 1980	M. Hunting	Pers. comm.
Doncaster E.	17 Mar. 1980	N. Quick	Pers. comm.
Glen Waverley	28 Mar. 1980	N. Quick	Pers. comm.

for the period up to the end of the 1986-87 season. Further expansion has been noted to other adjacent areas since then. The Table 2 records and those from Melbourne in Table 1 are shown in the map, Fig. 2.

Interstate Records

South Australia

Specimens in the South Australian Museum caught on 21 March 1983 by K. R. Germein at Barmera, although rather worn, appear to be *O. walkeri sothis* (confirmed by Fisher, pers. comm.). M. Moore (pers. comm.) reports that the species has been in the Waikerie district since 1976 and that it occurs "from early summer to late May". Specimens from this area have not yet been examined to determine the sub-species to which they belong. However, a single specimen taken by Morton at Naracoorte on 21 December 1984 appears to be *hypochlorus*. Fisher (pers. comm.) advises that the latter sub-

Table 2. Initial location records of *Ocybadistes walkeri sothis* in Melbourne and nearby areas.

Map Ref.*	Locality	Date	Collector	Ref.
1	Malvern	Dec. 1980	P. Carwardine	Carwardine (1981)
2	Dandenong	7 Feb. 1981	K.L. Dunn	
3	East Melbourne	24 Nov. 1981	D.F. Crosby	
4	Prahran	Nov. 1981	D.E.A. Morton	Morton (1985)
5	Eltham	6 Dec. 1981	M.F. Braby	Pers. comm.
6	Blairgowrie	29 Mar. 1982	J.C. LeSouef	ANIC
7	Camberwell	13 Oct. 1982	I. Faithfull	Faithfull (1985)
8	Hurstbridge	Nov. 1982	T.R. New	Pers. comm.
9	Sherbrooke	1 Dec. 1982	K.L. Dunn	
10	Dromana	23 Dec. 1982	D.R. Holmes	Pers. comm.
11	South Yarra	10 Feb. 1983	I. Faithfull	Faithfull (1985)
12	Lysterfield	20 Feb. 1983	M.F. Braby	Pers. comm.
13	Abbotsford	1 Nov. 1983	I. Faithfull	Faithfull (1985)
14	Yarra Bend	12 Nov. 1983	I. Faithfull	Faithfull (1985)
15	The Basin	5 Dec. 1983	K.L. Dunn	
16	Collingwood	11 Feb. 1984	I. Faithfull	Faithfull (1985)
17	Studley Park	18 Feb. 1984	I. Faithfull	Faithfull (1985)
18	Brunswick	9 Nov. 1984	I. Faithfull	Faithfull (1985)
19	Bundoora	22 Dec. 1984	M.F. Braby	Pers. comm.
20	Mt. Dandenong	8 Feb. 1985	K.L. Dunn	
21	Rye	31 Mar. 1985	M.F. Braby	Pers. comm.
22	Hampton	14 Apr. 1985	M.F. Braby	Pers. comm.
23	Eaglemont	12 Nov. 1985	M.F. Braby	Pers. comm.
24	Macleod	30 Nov. 1985	M.F. Braby	Pers. comm.
25	Christmas Hills	15 Dec. 1985	M.F. Braby	Pers. comm.
26	Greensborough	29 Dec. 1985	M.F. Braby	Pers. comm.
27	Belgrave Hts.	4 Mar. 1986	K.L. Dunn	
28	Yarrambat	30 Nov. 1986	M.F. Braby	Pers. comm.
29	Burnley	15 Dec. 1986	M.F. Braby	Pers. comm.
30	Kangaroo Ground	31 Jan. 1987	M.F. Braby	Pers. comm.
31	Narre Warren Nth.	4 Apr. 1987	K.L. Dunn	

* The numbers shown in the column "Map Ref." correspond with those shown on the map in Fig. 3.

species occurs in Adelaide, south to Myponga, north to Port Augusta, and on the Yorke Peninsula at Moonta and Wallaroo. If *hypochlorus* does occur at Naracoorte, the dividing line between that sub-species and *sothis* must be in the 110 km between there and the recently discovered colony at Nhill. Therefore, it would be interesting to survey the area between those two towns to locate colonies for study.

New South Wales, A.C.T., Tasmania

In New South Wales *O. w. sothis* is principally a coastal or near-coastal butterfly. On the south coast, it was recorded as far south as Pambula and Merimbula seventy years ago, and in the south west it was recorded from Deniliquin (Common and Waterhouse, 1981) and Leeton. Braby (pers. comm.) recorded it at Griffith on 27 December 1986, and Faithfull (pers. comm.) took it at Broken Hill on 23 April

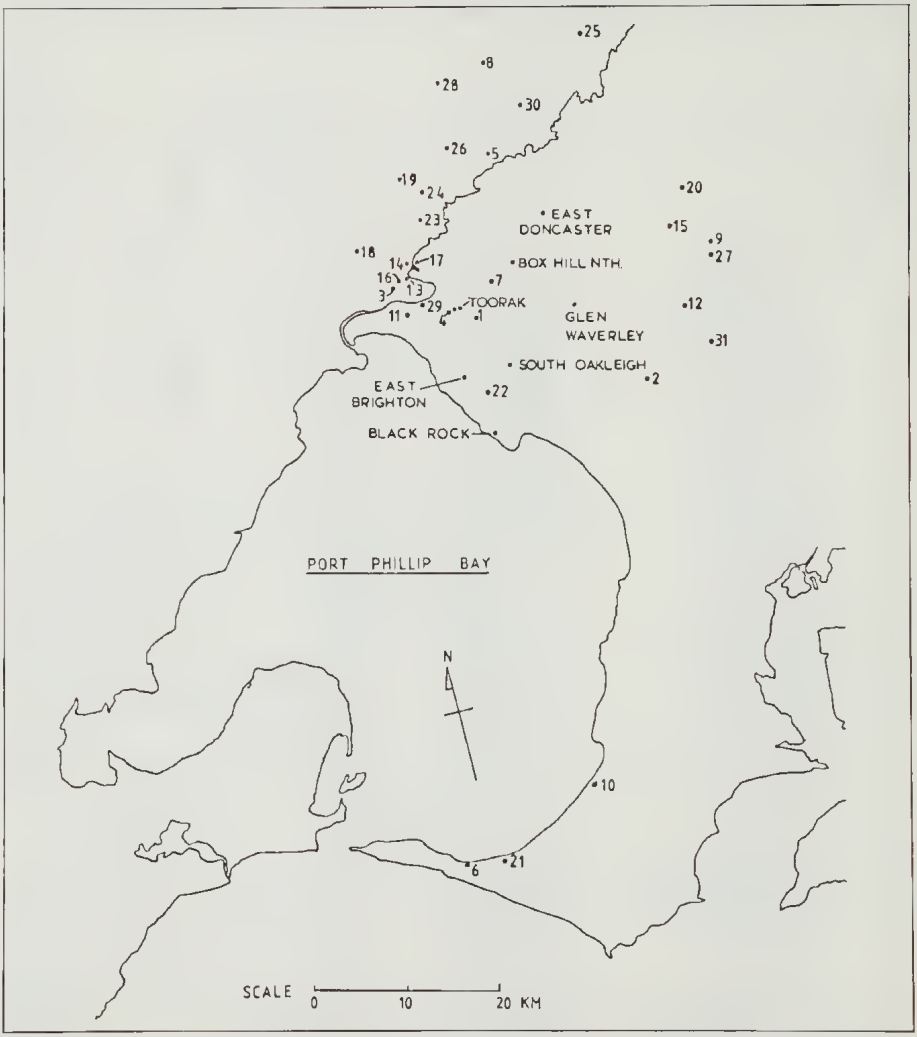


Fig. 2. Distribution of *Ocybadistes walkeri sothis* in Melbourne and nearby areas.

1988. It has been caught at the summit of Mt. Ainslie, A.C.T. (843 m) by Dunn and Atkins, the specimens being in the Australian National Insect Collection, Canberra (ANIC). The butterfly has been recorded from Mt. Painter, A.C.T. (743 m) (Kitching *et al.* 1973). There are no specimens in the ANIC from the Brindabella Range, west of Canberra, nor from the Kosciusko-Snowy Mountains in the south.

Couchman (1956) states that in Tasmania *O. w. sothis* is known from north-west, north and eastern coastal areas from sea level to c.750 feet (230 m) and Couchman and Couchman (1977) placed it in a list of "coastline and shoreline species up to circa 600 metres". Couchman (pers. comm.) confirms that this is still accurate and that there are no records from the Bass Strait islands yet. He states that he has never had the slightest evidence of human introduction of the species to Tasmania.

Figure 3 shows the distribution of *O. walkeri* in south-eastern mainland Australia.

Discussion

Since 1980 *O. w. sothis* has become firmly established in the east, north and north-west of the state and in the Melbourne area. A large number of records both from specimens in collections and from the literature confirm this range extension. There are no records indicating that this species migrates (see Smithers 1978).

Except for the Melbourne area the range extensions appear to be from natural dispersal. Thus, in East Gippsland, the Mallacoota and Gipsy Point records could have resulted from a southern extension from southern New South Wales. Records from Pambula on the coast about 75 km north of Mallacoota date from before 1914, and there is a Waterhouse specimen in the Australian Museum, Sydney, from Merimbula (5 km north of Pambula) dated 9 October 1903, and two others by G. H. Murray from Moruya dated 10 April 1903. However, many collectors, including

Fig. 3. Distribution of *Ocybadistes walkeri* in south-eastern Australia.

Crosby, have often visited the Mallacoota area prior to 1972 without recording the butterfly there. The western extension to Bemm River probably represents a natural coastal extension from Mallacoota. The Noorinbee records could have come from a further western extension from the eastern colonies but, because there have been some unusual records of several typically northern butterflies and moths at Noorinbee in the early 1960's (Burns 1960, 1962, 1962a, 1963), these records of *O. w. sothis* may have come from unrecorded colonies to the north.

Until his death in 1980, C. G. L. Gooding collected extensively in Gippsland for over sixty years and did not record the species in Victoria. Mt Baw Baw has been visited by butterfly collectors for many years and no record of *O. w. sothis* was obtained until that of Morton in March 1986. The species is unlikely to have been overlooked prior to that time. Apart from the interest of this unusual record in a mountain area, there is the difficulty in determining how the butterfly reached Mt Baw Baw and nearby Mt Erica. On current evidence, we feel that these records represent part of the eastern expansion from the Melbourne area.

Range extension through natural dispersal would account for the record at Rutherglen in the north-central area of Victoria. In the N.S.W. Riverina area to the north, specimens were taken at Leeton and Deniliquin prior to 1972, and the species could gradually spread southwards, accounting for McEvey's 1973 record. Extension further south would probably account for the Benalla captures by Braby in February 1984.

In the north-west, along the Murray River, the Kerang district had been intensively surveyed, particularly by resident collector R. E. Trebilcock, during the period 1906 to 1976. No specimens appear to have been recorded from there until 1976. A natural south-western extension from the colonies which have been known to exist in the N.S.W. Riverina area could account for these records, and also for the very recent discoveries at Rainbow and Nhill. A more western extension from the Riverina could reach Mildura and extend even further west to Barmera and Waikerie in South Australia. The record of a specimen at Griffith N.S.W. could also represent a Riverina expansion.

The sudden appearance of *O. w. sothis* in Melbourne does not seem to be so easily explained because of the timing of the records and the apparent distance from other colonies known at that time. We consider that the following causes may be possible explanations for this expansion:

i. The butterfly may have been in Melbourne for a long time, but in an isolated, undiscovered colony.
ii. The species may have reached Melbourne by natural expansion.
iii. Accidental or deliberate introduction may have been involved.

As there have been active butterfly collectors in Melbourne for a century, it seems very unlikely that a relict colony could have persisted there undiscovered and have expanded suddenly in this way. Butterfly populations vary in size depending on seasons but the recorded expansion in the Melbourne area is too rapid and widespread to be explained by natural expansion and dispersal alone, even under the most favourable conditions, from what would have to have been a very restricted colony to have remained undiscovered. Thus we do not believe that the Melbourne records were derived from this source.

The natural dispersals which were recorded in the other areas of the State were probably rapid and appeared to cover large distances, presumably under conditions which were favourable to the butterfly. The most probable source of the Melbourne colonization from natural dispersal would be from the north, by extension from the Benalla area. The early records in Mel-

bourne would then have been in the north of the city, with a gradual widening of records east, south and west thereafter. This does not appear to have been the case because there was a sudden surge in records in widely separated areas of Melbourne in a relatively short period (Table 2). Accordingly, we feel that an alternative, or at least supplementary, explanation is required.

Could the butterfly have been brought into Melbourne? This solution appears possible. The cabbage white butterfly was inadvertently introduced. However, it seems unlikely that anyone would set out to establish a colony of such a small, drab insect of no economic or particular scientific interest. The intentional establishment of a colony would require breeding of a number of adults to ensure viability, and release into an area where there was abundant foodplant, Kikuyu (*Pennisetum clandestinum* Hochst.) or Common Couch (*Cynodon dactylon* (L.)). The use of these two plants, particularly the former since the 1950s, for lawns (with consequent garden and street escapees) would, however, facilitate this. Both grasses are very hardy in poor soils in hot climates, suitable for the butterfly. From the way the species has rapidly become established over the past ten years, such a course could have been successful, but the action lacks obvious motivation.

Accidental introduction thus appears the most probable alternative. In 1974-76 the Melbourne instant lawn trade purchased large quantities of grass grown near Sydney. Included were Buffalo (*Stenotaphrum secundatum* (Walt.)), Kikuyu, and Common Couch. The greater part of these consignments was used in Melbourne, with Buffalo and Kikuyu being laid in public areas, such as nature strips, ovals and schools. Common Couch was generally used in less demanding situations and domestic applications. Large quantities of all types came from grass growers in the Richmond-Windsor region, where *O. walkeri* is known to occur.

Normally, insecticides were not used in the early farming of grasses because the grasses were not badly attacked by pests. However, some herbicides, principally 2-4D, were used to control weeds. The sward is kept to a height of about 50 mm by mowing and the cuttings are allowed to fall. These procedures would not be detrimental to the breeding of the butterfly, which is often associated with marginal agricultural activities and domestic gardens. In the grass farms the grass is well watered, in warm locations, and generally not harvested until November. Transport of the harvested grass in rolls from Sydney would involve some sweating and heat generation but these are kept to the minimum to prevent deterioration. There were no relevant quarantine restrictions operating at the time, and early stages of *O. walkeri* could have been transported in grass rolls without great losses.

Transport costs eventually made the Sydney supply uneconomic and in the late 1970s and early 1980s supplies came alternatively from Narrandera, Albury-Wodonga, and the Seymour-Avenel districts, all of which were or had possibly become breeding areas for the butterfly. It is interesting to note that in 1976-77 there was a bad drought in the Riverina and large shipments of domestic grass cuttings from Sydney were brought in for stock feed. It is possible that juvenile stages of the butterfly on these grass cuttings could have further aided its spread. Grass farms have now been established near Melbourne with the result that supplies from Narrandera have ceased and have been substantially reduced from Albury-Wodonga.

If the butterfly came in the instant lawn consignments, it is possible that relatively large numbers could arrive at one location at one time. Thus, with foodplant immediately available, rapid establishment of a viable colony could be relatively easy. Furthermore, the consignments would have been scattered and colonies could spring

up over a wide area over a few seasons, leading to an apparent "explosion" of the species, consistent with what has been observed.

A general tendency towards western and eastern extensions from Melbourne seems to be noticeable in the recent records. For example, Melton and Castlemaine to the west and southern Gippsland and the mountain areas to the east, including Mt Baw Baw, Millgrove, Cannons Creek.

No investigation into the possible causes for the rapid expansion of *O. walkeri sothis* has been undertaken and this would be an interesting project. We believe that favourable climatic conditions have helped, but such factors as genetic changes and a change in the foodplant preferences may have contributed. The use by the butterfly of Panic Veldt Grass (*Erharta erecta* Lam.), a common exotic weed in Melbourne gardens, has been noted on many occasions since it was recorded by Carwardine in December 1982 (pers. com.) and adaption to this foodplant should have assisted the establishment of new colonies by the transfer of garden plants mixed with this weed already carrying eggs or larvae of the butterfly.

Conclusion

The rapid colonization of large sections of Victoria by *O. walkeri sothis* is an interesting example of a range extension of an Australian butterfly. This contrasts with so many species whose distributions are contracting because of habitat loss. We believe that the available evidence points to there being three causes for this expansion: a natural invasion south and west from the Riverina; a natural invastion south-west from the south coast of New South Wales; accidental introduction into the Melbourne area. We consider that *O. walkeri* is now permanently established in Victoria. Further evidence may help to determine whether the suggested alternatives or other causes actually applied in the expansion process. A study of the methods of dispersal and the reasons for the rapid increase in the rate of dispersal of this butterfly would be valuable.

Acknowledgements

Many collectors have contributed information to this study, including the following: A.F. Atkins, C.H. Borch, M.F. Braby, P. Carwardine, L.E. Couchman, F. Douglas, I. Faithfull, R.P. Field, R.H. Fisher, D.R. Holmes, M.M. Hunting, J.M. Landy, C.W. McCubbin, R.C. Manskie, A. May, M. Moore, D.E.A. Morton, W.N.B. Quick, F.G. Sattler. To these colleagues we offer our thanks.

Thanks are also due to: G. Holloway of the Australian Museum, Sydney; E.D. Edwards of the Australian National Insect Collection (ANIC), Canberra and K.L. Walker of the Museum of Victoria for allowing us to examine specimens in their care; J. Neylan of the Turf Research Institute for general advice. In addition, some distribution data have been obtained from the ENTRECS project of the Entomological Society of Victoria which source is acknowledged with thanks.

Finally, we wish to thank Dr. T.R. New, Zoology Department, LaTrobe University, for his critical reading of the manuscript with much helpful advice, and L.E. Dunn for constructive comments and advice.

References

Atkins, A.F. (1976). Notes on some butterfly captures in Victoria. *Victorian Ent.* 6(2): 13-4.

Atkins, A.F. (1978). *Ocybdistes walkeri* — again. *Victorian Ent.* 8(2): 1.

Burns, A.N. (1960). New and interesting records of butterflies for Victoria. *Victorian Nat.* 77(5): 128-30.

Burns, A.N. (1962). Records of moths and butterflies. *Victorian Nat.* 78(11): 333-5.

Burns A.N. (1962a). New butterfly records for Victoria. *Victorian Nat.* 79(4): 113-4.

Burns, A.N. (1963). Two new butterfly records for Victoria. *Victorian Nat.* 80(3): 76-7.

Carwardine, P. (1981). Report at General Meeting, 20 February, 1981. *Victorian Ent.* 11(2): 13.

Carwardine, P. (1985). Report on excursion to the Warburton area, 3 March. *Victorian Ent.* **15**(3): 37-8.
Common, I.F.B. and Waterhouse, D.F. (1972). Butterflies of Australia. (Angus & Robertson: Sydney).
Common, I.F.B. and Waterhouse, D.F. (1981). 'Butterflies of Australia'. Revised Edition. (Angus & Robertson: Sydney).
Couchman, L.E. (1956). A catalogue of the Tasmanian Lepidoptera-Rhopalocera. *Pap. Proc. Royal Soc. Tasm.* 90: 1-33.
Couchman, L.E. and Couchman, R. (1977). The butterflies of Tasmania. *'Tasmanian Year Book No. 11'.* pp. 66-96.
Faithfull, 1. (1985). Some observations on the behaviour and notes on the extension of range of *Ocybadistes walkeri sothis* (Lepidoptera; Hesperiidae) in the Melbourne metropolitan area. *Victorian Ent.* **15**(1): 6-9.
Fisher, R.H. (1978). *'Butterflies of South Australia'.* (Govt. Printer: Adelaide).
Kinsella, A. (1977). Request for information — *Ocybadistes walkeri. Victorian Ent.* 7(4): 44.
Kitching, R.L., Edwards, E.D., Ferguson, D., Fletcher, M.B., and Walker, J.M. (1978). The butterflies of the Australian Capital Territory. *J. Aust. ent. Soc.* **17**(2): 125-133.
McEvey, S.F. (1973). Notes on moths and butterflies in the Rutherglen district from 1967. *Victorian Ent.* **3**(3): 4-6.
Meyrick, E. and Lower, O.B. (1902). Revision of the Australian Hesperiidae. *Trans. Proc. R. Soc. S. Aust.* 26(2): 38-129.
Monteith, G.B. and Hancock, D.L. (1977). Range extensions and notable records for butterflies of Cape York Peninsula, Australia. *Aust. ent. Mag.* **4**(2): 21-38.
Morton, D.E.A. (1985). More information on *Ocybadistes walkeri sothis. Victorian Ent.* **15**(3): 35.
Smithers, C.N. (1978). Migration records in Australia, 2. Hesperiidae and Papilionidae (Lepidoptera) *Aust. ent. Mag.* **5**(1): 11-14.
Waterhouse, G.A. (1932). *'What Butterfly is That?'* (Angus & Robertson: Sydney).
Waterhouse, G.A. and Lyell, G. (1914). *'The Butterflies of Australia'.* (Angus & Robertson: Sydney).

The first record of *Stenella attenuata* (Gray), the Spotted Dolphin, from Victoria, Australia

Joan M. Dixon*

Summary

The Spotted Dolphin, *Stenella attenuata* has not been recorded previously from Victorian waters. In September 1987, the cranium and right mandible of a small dolphin was found in the sand dunes on the western side of Rame Head, near Wingan Inlet, Victoria, (Lat. 37° 47′ S, Long. 149° 29′ E) and sent to me for identification.

After examination of the specimen, I concluded that it was *Stenella attenuata,* a species not recorded before from Victoria, nor described from other parts of Australia. I have established that material of this species occurs in other state museums and in New Zealand (Baker 1983). This will be the subject of further investigation.

General description of the Victorian specimen

The cranium and right mandible examined are both worn, and teeth missing from rostral and mandibular sockets. A tooth count was established from the tooth sockets; upper tooth row (right) 40, (left) 40; mandibular row (right) 40. The upper tooth count range for the species is 35-48 and the lower 34-47 (Perrin *et al.* 1987). The age of the specimen cannot be determined, but as in many small cetacean species, general wear on soft, porous bone produces an impression of an aged specimen. This record, apart from being battered and incomplete, still retained dried moss fragrants embedded in the bony tissue, indicating that it may have been buried for some time prior to discovery. The specimen is registered as C27319 in the collections of the Museum of Victoria.

*Curator of Mammals
Museum of Victoria
328 Swanston Street, Melbourne, Victoria 3000

Fig. 1. Location of first record of *Stenella attenuata* in Victoria at Rame Head.

Location of the record is given in Fig. 1, diagnostic features in Figs 2 and 3, and a list of measurements (after Perrin *et al.* 1987) is given in Table 1.

Discussion

Stenella attenuata is known to occur in all deep, warm waters of the Atlantic, Pacific and Indian Oceans. Detailed work on variation in the genus has been carried out by Perrin (1975). The taxonomy of *Stenella* has been revised by Perrin *et al.* (1987), when Atlantic and pantropical groups were identified as separate species. The former is now referred to as *S. frontalis,* and the latter retains the specific name *S. attenuata.*

Analysis of available specimens from Pacific areas has shown that there is a wide range of geographic variability both in colouration and skeletal configuration. Few records are known from the eastern Australian seaboard, and it is possible that further investigations will reveal considerable variation, at least in skeletal structure between animals from eastern and western Australia.

The Rame Head specimen fits within the parameters of cranial and mandibular dimensions defined by Perrin *et al.* (1987). The considerable geographic variation in

the species, including cranial measurements, has been demonstrated on a large series of specimens from the eastern tropical Pacific (Perrin 1975; Douglas *et al.* 1984; Perrin *et al.* 1987; Schnell *et al.* 1985, 1986). Material from other parts of the Pacific from the Indian Ocean and from the Atlantic is still too limited to support more than very tentative conclusions concerning geographic variation involving those areas (Perrin *et al.* 1987).

Stenella has received considerable attention in the United States. There it has economic involvement due to the importance of the yellowfin tuna industry.

Table 1. Skull measurements of *Stenella attenuata* C27319 (after Perrin *et al.* 1987).

	Measurement (mm)
1. Condylobasal length	414
2. Length of rostrum	245+
3. Width of rostrum at base	95
4. Width of rostrum at 60mm	55
5. Width of rostrum at mid-length	53
6. Width of premaxillaries at mid-length of rostrum	25
7. Width of rostrum at ¾ length (from post. end)	38
8. Rostrum tip to external nares	285
9. Rostrum tip to internal nares	335
10. Greatest preorbital width	147
11. Greatest postorbital width	188
12. Greatest width of external nares	45
13. Zygomatic width	46
14. Greatest width of premaxillae	44
15. Parietal width	127
16. Height of braincase	132
17. Internal length of braincase	110
18. Length of temporal fossa	65
19. Length of orbit	55
20. Width of internal nares	50
21. Length of upper tooth row	200+
22. Length of lower tooth row	210+
23. Length of ramus	360+
24. Height of ramus	60
25. Diameter of tooth (socket)	5
26. Width of prenarial triangle at 60mm	40

In a subsequent paper, I plan to synthesize all available material on Australasian *Stenella,* and consider the relationship between the data obtained, and those already available from the United States studies.

Acknowledgements

Thanks are extended to Russell Thompson of the Field Naturalists Club of Victoria for locating the specimen, to W. Webb of the Department of Conservation, Forests and Lands, Bairnsdale, for making the specimen available to me for study, and to S. van Dyck and R. Paterson of the Queensland Museum for comments on the identity of the species. T. Entwhistle, Botany Department, The University of Melbourne, checked the plant growth on the specimen. Photography was by Rodney Start.

References

Baker, A. N. (1983) *Whales and Dolphins of New Zealand and Australia. An Identification Guide.* (Victoria University Press: Wellington).

Douglas, M. E., G. D. Schnell and D. J. Hough (1984). Differentiation between inshore and offshore Spotted Dolphins in the Eastern Tropical Pacific Ocean. *J. Mammal.* 65: 375-87.

Perrin, W. F. (1975). Variation of Spotted and Spinner Porpoises (Genus *Stenella*) in the Eastern Tropical Pacific and Hawaii. *Bull. Scripps Inst. Oceanogr.* 21: 1-206.

Perrin, W. F., E. D. Mitchell, J. G. Mead, D. K. Caldwell, P. J. H. van Bree and W. H. Dawbin (1987). Revision of the Spotted Dolphin, *Stenella* spp. *Mar. Mamm. Sci.* 3(2): 99-170.

Schnell, G. D., M. E. Douglas and D. J. Hough (1985). Sexual Dimorphism in Spotted Dolphins (*Stenella attenuata*) in the Eastern Tropical Pacific Ocean. *Mar. Mamm. Sci.* 1(1): 1-14.

Schnell, G. D., M. E. Douglas and D. J. Hough (1986). Geographic patterns of variation in offshore Spotted Dolphins (*Stenella attenuata*) of the Eastern Tropical Pacific Ocean. *Mar. Mamm. Sci.* 2(3): 186-231.

Fig. 2. Dorsal view of cranium of *Stenella attenuata* C 27319.

Fig. 3. Ventral view of cranium of *Stenella attenuata* C 27319.

Further Information on the Giant Gippsland Earthworm *Megascolides australis* (McCoy 1878)

B. D. Van Praagh,[1, 2] A. L. Yen[2] and P. K. Lillywhite[2]

Abstract

The Giant Gippsland Earthworm, *Megascolides australis* McCoy, 1878, is one of the world's largest earthworms and is restricted to a small area in South Gippsland. It is listed by the International Union for the Conservation of Nature as "vulnerable". Despite its fame, very little is known about its basic biology, and there is some incorrect information about the worm in the literature and in the media. Some of this incorrect information is reviewed.

Introduction

The Giant Gippsland Earthworm is one of the largest species of earthworm in the world (Stephenson 1930) and is restricted to a small area in the Bass River Valley of South Gippsland. Since its description in 1878, the Giant Gippsland Earthworm has become one of Victoria's famous endemic animals and occupies a place in local South Gippsland folk-lore, as evidenced by the "Karmai" or Giant Gippsland Earthworm festival held annually in Korrumburra. Smith and Peterson (1982) summarize most of the available information about *M. australis*, and we are providing supplementary information.

Discovery of the Giant Gippsland Earthworm

The worm was first discovered in the Brandy Creek (Warragul) area, and described as *Megascolides australis* (McCoy 1878). Fletcher (1887) erroneously named the species *Notoscolex gippslandicus*, but McCoy's name takes precedence.

Despite the publicity generated since its discovery, scientific information about the worm is scant. The available information is largely confined to anatomy (Bage 1909; McCoy 1878; Spencer 1888a,b; Vejdovsky 1892), taxonomy (Jamieson 1971a,b), or physiology (Weber and Baldwin 1985). Much of the information on the worm's biology and ecology remains in the form of anecdotal information. In the numerous articles written about *M. australis* much information has simply been repeated or reproduced from the original papers of McCoy (1878) and Spencer (1888b). Amongst this literature are some erroneous observations and assumptions about the worm that have been accepted without scientific verification.

[1]Zoology Department, La Trobe University, Bundoora 3083.
[2]Invertebrate Survey Department, Museum of Victoria, 71 Victoria Crescent, Abbotsford 3067.

Size

Size alone has made *M. australis* famous; the question of how an invertebrate of such size and weight has adapted to its environment has largely been neglected except for studies on its respiration (Weber and Baldwin 1985). The length of earthworms varies considerably because of their ability to expand and contract. A contracted worm can more than double its length when relaxed. Dead worms, or living worms held vertically, elongate and this has led to exaggerated estimates of length.

Worms of 3.3 to 3.6 m in length have been reported (Barrett 1929, 1931, 1938; Quick 1963). From the authors' experience, the average size appears to be approximately 1 m in length and 2 cm in diameter. Weight would seem to be a more accurate measure of size since it would not vary with the worm's ability to expand or contract.

Different species of giant earthworms have also been recorded in Sri Lanka, North America, South America, northern New South Wales, southern Queensland, and South Africa. A South African worm,

Microchaetus sp., is usually 30-150 cm in length, but an unsubstantiated newspaper report describes a worm attaining 7 m in length and 75 mm in diameter (Ljungstöm and Reinecke 1969). However, Lee (1985) suggests that a worm of this size would weigh 30 kg and could not move without bursting its skin because of the internal hydostatic pressures that would be required to move so large a mass.

Odour

A peculiar odour resembling that of creosote has been associated with the worm in the past (Barrett 1938; McCoy 1878). We have never encountered this odour and Quick (1963) suggests that the worms may have become contaminated with creosote from new sleepers used for the railway being built at the time.

Gurgling sounds

A distinguishing characteristic of the worm is the gurgling sound it makes as it retreats down its tunnel, a sound aptly compared to water draining out of a bath. The worms emit a milky coelomic fluid from their dorsal pores when disturbed. This fluid also apparently lubricates the worm's tunnel to aid movement and this, combined with the water in the tunnels, probably contributes to the gurgling sound.

Biology

Very little is known about the biology of the worm, and what is known originates mainly from the work of McCoy and Spencer. We still do not know how long the worms live. However, we have been able to differentiate three sizes (presumably age classes) of worms on the basis of the appearance of the clitellum: young worms (11-33 g), subadult worms (40-78 g), and adults (125-260 g) (all weights are fresh weight including soil).

Reproduction

Although the anatomy of the reproductive organs is fairly well documented by Spencer (1888b), the reproductive process is unknown. The worm is hermaphroditic, but parthenogenesis has not been demonstrated in this species, so two individuals are apparently needed for fertilization to take place. The sexual organs are contained within the clitellum which extends from segments 13 to 21 and it is this region that ultimately produces the egg capsule, the mucus for copulation and the milky fluid contained in the capsule.

Egg capsules

The egg capsules laid by *M. australis* are 4-7 cm long x 1-1.5 cm wide. Spencer (1888b) and Quick (1963) state that the capsules contain a single embryo worm surrounded by a milky fluid, but one report claims that the worm lays two eggs in a capsule and normally only one egg reaches maturity (Anonymous 1980). Stewart (1946) reports that only one capsule is laid by a worm in one year and that capsules are always found singly.

Capsules are generally found within the upper 30-40 cm of soil, but have also been reported lying among grass rootlets or free in the soil (Barrett 1938; Quick 1963). Our observations indicate that capsules are found down to a depth of 40 cm in a blind-ended tunnel that comes off another tunnel. The capsules range in weigh from 7.6-12.6 g, with an average of about 9 g.

The incubation period of the worm is unknown but Smith and Peterson (1982) thought that it is about 4 months. However, our observations suggest that it is at least 12 months. Freshly laid capsules are seen in early winter after the soil becomes cool and moist and worms hatch in winter or early spring when the ground is wet. We have found capsules over most of the year, and hatching occurs from August through to January. Emerging worms are reported to be 10-18 cm in length (Smith and Peterson 1982), though we have found them up to 28 cm in length upon hatching.

The capsule splits about a week before the young worm emerges, and the worm can take from one day to a week to completely free itself from the capsule.

Surfacing

Whether or not the worms ever actually come to the surface is disputed. While Stewart (1946) reports that the worms never actually come to the surface and suggests that this is the reason for their limited distribution, because they cannot migrate, others go as far as to claim that the worms often rest with about a foot of their head end out in the open in autumn and winter (Barrett 1938; Quick 1963; Smith and Peterson 1982). Other reports suggest sudden showers may bring the worm to the surface due to the flooding of their tunnels (Smith and Peterson 1982). It is most unlikely that worms do surface completely because they have difficulty moving when they are completely removed from their tunnels.

It is known that worms are found close to the surface in winter when the ground is wet, while during the summer they retreat to greater depths (Barrett 1938). Not much is known about the structure of worm tunnels, however they are thought to be permanent and can go down quite a long way.

We have found that young worms are generally slightly closer to the surface, followed by subadult worms, and adults are found deeper (at an average depth of 47 cm).

Diet and casts

The diet of the worm is unknown but Eve (1974) suggested live roots and organic matter in the soil. We have found root hairs, root particles, grass blades, leaves of dicotyledonous plants, seeds, and organic and mineral matter in the casts.

Very little is known about the cast material of *M. australis,* except that it is deposited below ground, unlike many other earthworms, particularly lumbricids, which are surface casters. The casts back fill some of the tunnels, and it is unknown if the worms eat the casts when they move through the tunnels or leave them blocked. Some casts are older as evidenced by plant roots growing through them and following them through the tunnel. The mounds surrounding the entrances to yabbie burrows were mistaken as Giant Gippsland Earthworm casts by McCoy (1878). It appears that generally the worms are found in areas where yabbies of the genus *Engaeus* are present.

Regeneration

Some far-fetched descriptions of the regenerative capacities of *M. australis* have been made, including an incident where a worm was reportedly cut into nearly a dozen pieces and each section developed into a complete worm (Barrett 1931). Both McCoy (1878) and Fletcher (1887) reported that the worms were very fragile, and that decomposition set in quickly when they were damaged. It is unlikely that the adult worm can regenerate when cut. From our experience, we have found some worms that have wounds that have healed, but the majority of even slightly damaged worms have remained alive for only a short period. They usually shrivel up and begin decomposing within a few hours while the worm is still alive.

Distribution

Prior to the advent of European settlement, the hills of South Gippsland supported dense thick sclerophyll forest composed of large Blue Gums *(Eucalyptus globulus* Labill.), Blackwood *(Acacia melanoxylon* R.Br.), paperbark blackbutt and treeferns (South Gippsland Pioneers' Association 1966). It was also described as a jungle of miscellaneous trees, shrubs and grasses with giant eucalypts that grew close together and reached a height of 300 feet and as much as 10 feet in diameter (Holland 1929).

Human penetration of this region was limited and spasmodic until the mid 1870s (Hartnell 1974). However, as the clearings extended and drew nearer to one another, most of the wildlife was destroyed.

Extensive ploughing had been undertaken by the 1930s, and the land was sown to permanent pasture and used for dairy production. No evidence of the original forest remains except a few remnant Blue Gums scattered sparsely over the landscape or gathered along the banks of streams and in gullies.

The Giant Gippsland Earthworm has survived despite the destruction of the original vegetation and the inevitable changes in soil moisture and temperature that this must have brought about. However, the total effects of this change on the worm numbers and distribution will never be known. Have worm numbers declined? Has the range contracted? It is also probable that the worm's food source has changed with the disappearance of what must have been an extensive plant litter and humus layer. Has this been replaced by pasture grasses (roots, green tissue or rotting tissue) or cattle dung?

The conservation status of *M. australis* remains controversial. It is listed by the International Union for Conversation of Nature as vulnerable (Wells *et al.* 1983). However, opinion is divided as to whether the worm populations are declining. Some claim the abundance and distribution of the worm have declined since the land was first opened up 50 to 60 years ago due to factors such as ploughing and the addition of superphosphate (Anonymous 1980; Quick 1963). It is possible that the worms are not as apparent today because of the reduced amount of earthworks being undertaken compared to when the land was being settled. Others stress that the worm is as abundant as ever although possibly only in small areas (B. Green, personal communication 1987).

A questionnaire study on the distribution of *M. australis* was conducted by Smith and Peterson (1982). They concluded that it is found in deep blue-grey clay soil along creek banks, near soaks and springs, on river flats or on south or west-facing slopes of hills in 100,000 hectares of the Bass River Valley roughly bounded by Loch, Korrumburra and Warragul.

Megascolides australis is found locally in large numbers and can be extremely abundant in very small areas. However its distribution is very patchy and it is not known whether worm numbers are declining or whether its range is contracting. The centre of distribution may be as small as 5,000 hectares. There are a few unconfirmed reports of worms found outside this area, but only one has been confirmed. We recently found *M. australis* in the Mt. Worth State Park.

Although our distributional studies are still incomplete, our findings suggest that the worm is usually restricted to the banks and surrounds of water courses, soaks, underground springs and gullies, and very few have been found on river flats away from water sources.

Acknowledgements

This project is funded by a grant from World Wildlife Fund Australia to the Museum of Victoria. The authors are indebted to Mr Bill Green and his family for their assistance as well as to other residents of Loch. We also wish to thank the Officers of the Shire of Korumburra, Kathy Ebert, Pam Heather, Fraser Hercus, Colin Knight, Chung Cheng Lu, Peter Rawlinson, Brian Smith, Frank Smith and various Friends of the Museum of Victoria for their assistance in various ways.

References

Anonymous, (1980). Karma – the giant worm. *Ballarat Courier.* 19/9/1980.

Bage, F. (1909). Contributions to our knowledge of Australian earthworms. The nephridia. *Proc. R. Soc. Victoria* **22** (N.S.) 224-43.

Barrett, C. (1929). Gippsland's Giant Worm. *Victorian Nat.* **46**: 72.

Barrett, C. (1931). Megascolides, the world's biggest earthworm. *Aust. Mus. Mag.* **4**: 238-43.

Barrett, C. (1938). Australia's Giant Earthworm. *Bull. N. Y. Zool. Soc.* **41**: 66-70.

Eve, J. E. (1974). Gippsland worms. *Victorian Nat.* **91**: 36-38.

Fletcher, J. J. (1887). Notes on Australian Earthworms. Part IV. *Proc. Linn. Soc. N.S.W.* 2nd series. **2**: 601-20.

Hartnell, R. (1974). 'Pack-Tracks to Pastures: A History of the Poowong District.' (Poowong Centenary Committee: Poowong).

Contributions

Holland, J. E. (1929). Korumburra district in the early days. *The Victorian Historical Magazine* **13**: 154-63

Jamieson, B. G. M. (1971a). A review of the megascolecoid earthworm genera (Oligochaeta) of Australia. Part III- the subfamily Megascolecinae. *Mem. Queensland Mus.* **16**: 69-102.

Jamieson, B. G. M. (1971b). A review of the megascolecoid earthworm general (Oligochaeta) of Australia. *Proc. R. Soc. Queensland* **82**: 75-86.

Lee, K. E. (1985). 'Earthworms. Their Ecology and Relationship with Soils and Land Use'. (Academic Press: Sydney).

Ljungström, P. O. and Reinecke, A. J. (1969). Studies on influences of earthworms upon the soil and the parasitological questions. *Pedobiologia* **9**: 152-7.

McCoy, F. (1878). *Megascolides australis* (McCoy). The Giant Earth-Worm. *In* 'Prodromus to the Zoology of Victoria'. **1**: 21-5.

Quick, B. (1963). A giant among worms. *Walkabout* Feb. issue: 14-6.

Smith, B. J. and Peterson, J. A. (1982). Studies of the Giant Gippsland Earthworm *Megascolides australis* McCoy, 1878. *Victorian Nat.* **99**: 164-73.

South Gippsland Pioneers' Association. (1966). 'The Land of the Lyrebird: A Story of Early Settlement in the Great Forest of South Gippsland'. (The Shire of Korumburra: Korumburra).

Spencer, W. B. (1888a). The anatomy of *Megascolides australis. Trans. & Proc. R. Soc. Vict.* **24**: 164-8.

Spencer, W. B. (1888b). On the anatomy of *Megascolides australis*, the Giant Earthworm of Gippsland. *Trans. R. Soc. Victoria* **1**: 3-60.

Stephenson, J. (1930). 'The Oligochaeta'. (Clarendon Press: Oxford).

Stewart, H. (1946). Eggs of the Giant Gippsland Earthworm. *Victorian Nat.* **54**: 107-8.

Vedjdovsky, F. (1892). Zurr Entwicklungsgeschichte des Nephridial- Apparates von Megascolides australis. *Arch. Mikrosk. Anat.* **40**: 552-62.

Weber, R. E. and Baldwin, J. (1985). Blood and erythrocruorin of the giant earthworm, *Megascolides australis*: respiratory characteristics and evidence for CO_2 facilitation of O_2 binding. *Molecular Physiology* **7**: 93-106.

Wells, S. M., Pyke, R. M. and Collins, N. M. (1983). 'The IUCN Invertebrate Red Data Book'. (IUCN: Gland, Switzerland).

Elephant Seals in Tasmania

D. Pemberton and I. J. Skira*

Introduction

The present Tasmanian coastlines were formed 6,000 to 7,000 years ago due to rises in sea levels (Jennings 1971). Remains of Elephant Seals *Mirounga leonina* (L) have been found at sites on the far Northwest and West coasts of Tasmania at Rocky Cape, West Point, Sundown Point and Venables Point (Jones 1966; Stockton 1982). Jones (1966) estimated that there were the remains of several thousand seals at West Point including seals of 3 to 4 months old. This suggests that a pre-historic breeding colony existed somewhere close on the West Coast despite Stockton's (1982) assertion that the remains may have come from dead, tired or sick seals that ended up on the coast.

At the time of European arrival in the late 1790s there were large breeding colonies of Elephant Seals at Sea Elephant Bay on King Island, New Year Islands and somewhere in the Hunters Isles (Micco 1971). Vagrants occurred at the Two Sisters in the Furneaux Group while the aborigines of Port Jackson knew them by the name of 'Miroung' (Micco 1971). The size of the colonies is not known.

Within a few years of their discovery the sealing industry caused the extinction of the Elephant Seals together with Fur Seals and Sea Lions. Recently there was talk of taking Elephant Seal pups from Macquarie Island and re-establishing them on King Island as a Bicentenary Project (Smith 1986, King Island News 2 April 1986). Nothing came out of this suggestion. Today Elephant Seals are uncommon visitors to Tasmania.

Live Seal Recordings in Tasmania since 1977

Twenty-five records of live seals are known from 1977 to June 1989 (Table 1, Fig. 1). The recordings were made by staff from the Department of Parks, Wildlife and Heritage and from the general public that have been followed up by the Department. Sightings of live seals have been recorded on the Department's computerised TASPAWS biological records scheme. There are almost no records of Elephant Seals prior to 1977 which may express the lack of awareness of people to record seals. There are four records of dead beach washed seals, three in Southern Tasmania and one at Ocean Beach near Strahan. Records of live seals at sea include one spotted 40 kilometres north of Bruny Island and another sighted 2 kilometres off-shore Three Hummock Island in Northwest Tasmania.

The live observations are mainly from southern Tasmania, aided by the fact that it is a more populated region and more of the coastline is constantly under observation then in other parts of Tasmania. It is also the nearest landing for seals from Macquarie Island which is the closest major breeding colony to Tasmania of some 100,000 seals (Hindell and Burton 1988). The majority of seals were only ashore for one to two days. Two were present for three weeks, a female on the Coal River at Richmond and a large male which moved between Adventure Bay and various places on the Derwent River near Hobart from January to 15 February 1982. About twice as many males visited compared to females. The males varied greatly in size and thus age.

There are only two records in the 11 years of females giving birth, both at Maatsuyker Island. These records were the result of a determined search of relatively inaccessible bays on the island. In addition lighthouse keepers and fishermen have seen Elephant Seals on Maatsuyker Island over the years (R. Westcott pers. comm.). It is therefore possible that Elephant Seals

*Department of Parks, Wildlife and Heritage, 134 Macquarie Street, Hobart, Tas. 7000.

may breed there. This now brings to four the number of known births reported from Tasmania in modern times. The previous two were at Strahan on the West Coast in 1985 (Davies 1963) and near St. Helens on the East Coast in 1975 (Tyson 1977).

The historic restriction of Elephant Seals to northwest Tasmania may be partially explained by the distribution of their principal food, squid. The relative abundance of the Arrow Squid *Notodarus gouldi* is higher in western Bass Strait than in eastern Bass Strait (Roberts 1982). To the present day very few sightings of Elephant Seals have occurred in this region. The paucity of visitors to Tasmania indicates only that the state is within the dispersal range of the seals from Macquarie Island. It will be many years, if ever before Elephant Seals will re-colonise Tasmania.

References

Davies, J.L. (1963). The Whales and Seals of Tasmania, Hobart. Tasmanian Museum and Art Gallery.

Hindell, M.A. and Burton, H.R. (1988). The history of the elephant seal industry at Macquarie Island and an estimate of the pre-sealing numbers. *Pap. Proc Roy. Soc. Tas.* **122**(1), 159-76.

Jennings, J.N. (1971). Sea level changes and land links. In (Eds) D.J. Mulvaney and J. Golson. Aboriginal Man and Environment in Australia, 1-13 ANU Press Canberrra.

Jones, R. (1966). A speculative archaeological sequence for north-west Tasmania. *Rec. Queen Vict. Mus. Launceston,* **25**: 1-12.

Micco, H.M. (1971). King Island and The Sealing Trade 1802. *Roebuck Soc. Publ.* **3**: 1-51.

Roherts, P.E. (1982). Squid ecology pilot study. Int. Rep. 13. Ministry for Conservation, Victoria.

Smith, D. (1986). Return of the elephant seal. *Geographic* **1**(3): 17.

Stockton, J.H. (1982). The prehistoric geography of Northwest Tasmania. Ph. D. Thesis. ANU, Canberra.

Tyson, R.M. (1977). Birth of an elephant seal on Tasmania's East Coast. *Victorian Nat.* **94**: 212-3.

Table 1. Recordings of live *Mirounga leonina* in Tasmania.

Date	Sex	Age/Size	Locality	Lat.	Long.
11 Jan 1977			New Harbour	43°31'S.,	146°09'E.
12 Jan 1977	F & Pup		Maatsuyker Island	43°39'S.,	146°17'E.
7 Aug 1978	M		Cape Boullanger	42°34'S.,	148°04'E.
19 Nov 1978	F		Adventure Bay	43°19'S.,	147°20'E.
18 Dec 1974		Immature	Carlton River	42°50'S.,	147°44'E.
11 Mar 1980	M	5 m	Cloudy Bay	43°28'S.,	147°13'E.
17 Oct 1980	F	1.77 m	Lauderdale	42°55'S.,	147°29'E.
1 Dec 1980		Immature	Recherche Bay	43°33'S.,	146°54'E.
13 Mar 1981	M	2.75 m	Lighthouse Bay	43°30'S.,	147°09'E.
20 Dec 1981	F	2.45 m	Richmond	42°44'S.,	146°26'E.
19 Jan 1982	M	5 m	Adventure Bay	43°19'S.,	147°20'E.
21 Feb 1982	M		Cox's Bight	43°30'S.,	146°15'E.
Feb 1982	M	Immature	Taroona	42°57'S.,	147°21'E.
31 Aug 1982			Ocean Beach	42°10'S.,	145°15'E.
11 Dec 1982	M	2 m	Pirates Bay	43°01'S.,	147°56'E.
15 Apr 1983	M	4.3 m	Pirates Bay	43°01'S.,	147°56'E.
28 Dec 1983	M	5 m	Adventure Bay	43°19'S.,	147°20'E.
16 Nov 1984	M	2 m	Lauderdale	42°55'S.,	147°29'E.
19 Nov 1984	M	3.5 m	Macquarie Harbour	42°18'S.,	145°22'E.
25 Nov 1984	F	2.5 m	Margate	43°02'S.,	147°16'E.
27 Feb 1985		2 m	Southport	43°30'S.,	146°57'E.
1 Aug 1985		1.6 m	Dover	43°19'S.,	147°01'E.
11 Mar 1986	F		Cremorne	42°58'S.,	147°32'E.
Apr 1986			Hobart	42°53'S.,	147°19'E.
9 Oct 1988	F & Pup		Maatsuyker Island	43°39'S.,	146°17'E.

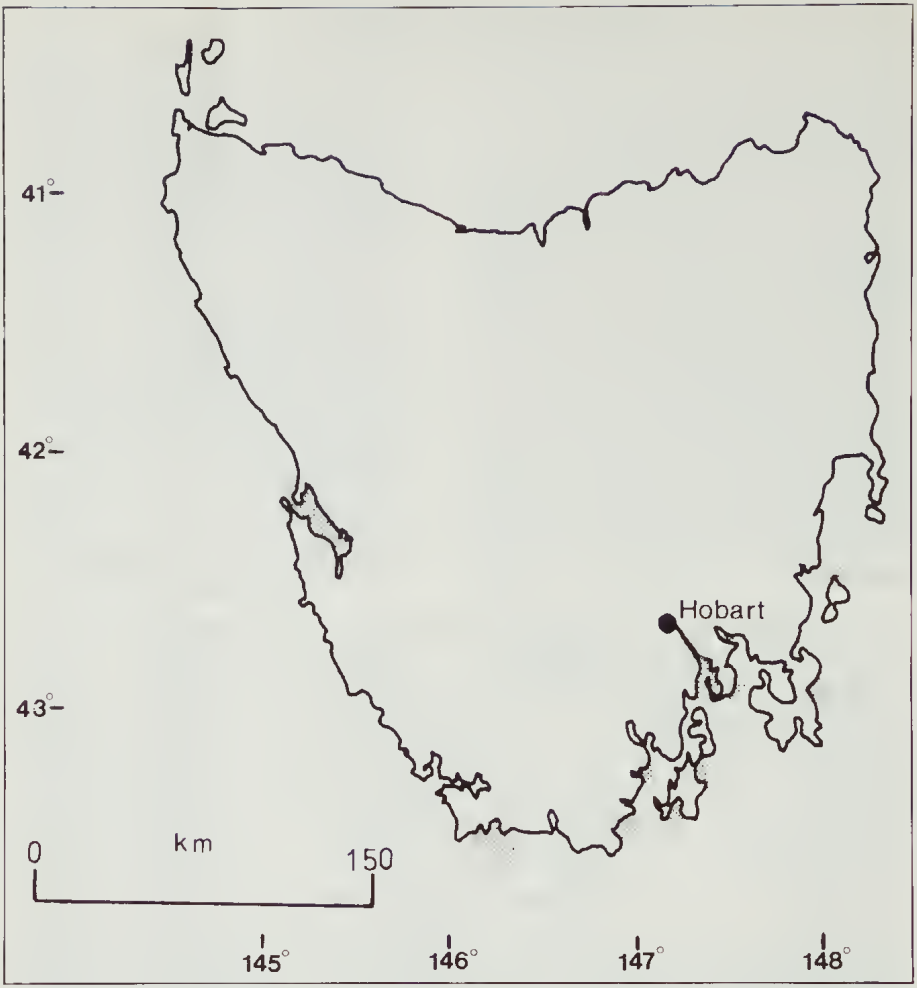


Fig. 1. Map of Tasmania. Sightings of live Elephant Seals are represented by stippled areas.

Bibliography of Ecological Survey Reports, Department of Conservation, Forests and Lands, 1983 to August 1989

Gill Earl[1] and Ian Lunt[2]

For the past seven years, flora and fauna surveys have been conducted in forest blocks where less than half of the estimated timber volume had been removed, before any further harvesting of timber. The results from these surveys are published by the Department of Conservation, Forests and Lands (CFL) as a series of Ecological Survey Reports, commonly known as "pre-logging" reports. By August 1989, 24 reports had been published for forest blocks in East Gippsland, north-east Victoria, the Alpine area, Central Highlands and the Grampians.

In addition to their immediate relevance to forest management, these reports contain a wealth of biological information on plant species, vegetation communities, mammals, birds, frogs and reptiles. They include data from more than 1,800 vegetation quadrats, 25,000 mammal-trap-nights, 930 bat-trap-nights, 500 spotlight-hours, 2,200 scat analyses, over 1,100 bird censuses, and about 5,000 pitfall-bucket-nights. This data is used to describe vegetation communities and to determine significant sites and species.

This bibliography lists all reports published before August 1989. Survey areas in eastern Victoria are shown in Figure 1. Reports 15 and 22 are for the Grampians National Park in western Victoria and report 30 is for the Acheron Forest Block in the Central Highlands. Nine more reports are in preparation. Most reports can be purchased, for $10 each, from the CFL bookshop at 240 Victoria Parade, East Melbourne. They are available for perusal at the relevant regional information centre and at major libraries in Melbourne.

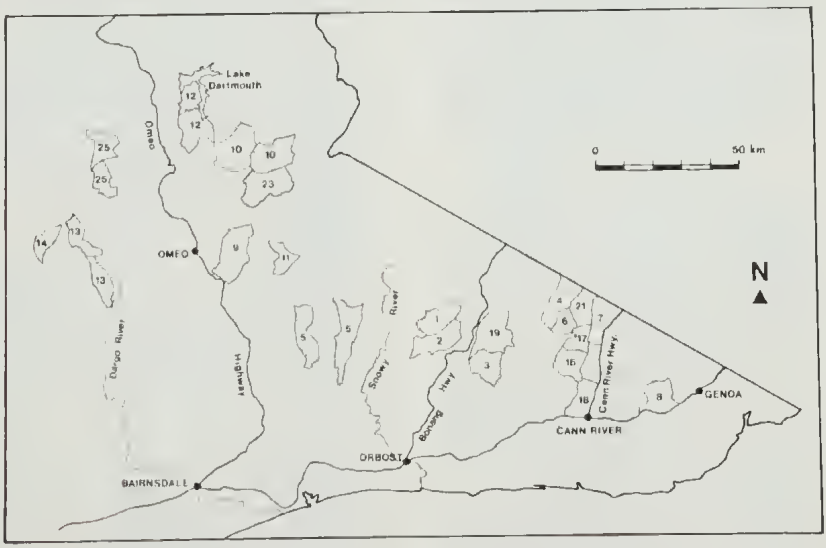


Fig. 1. Forest blocks in eastern Victoria for which Ecological Survey Reports have been published. Numbers refer to the publication number of the reports.

[1] P.O. Box 910, Bairnsdale 3875. [2] 36 Westbourne Street, Brunswick 3056.

Bibliography

1. Chesterfield, E.A., MacFarlane, M.A., Allen, D., Hutchinson, M.N., Triggs, B. and Barley, R.H. (1983). Flora and Fauna of the Rodger Forest Block, East Gippsland, Victoria. Ecological Survey Report No. 1, 107 pp. and maps. (Forests Commission of Victoria: Melbourne).
2. Opie, A.M., Cherry, K.A., Horrocks, G.F.B., Carr, G.W., Schulz, M. and Triggs, B.E. (1984). Flora and Fauna of the Yalmy Forest Block, East Gippsland, Victoria. Ecological Survey Report No. 2, 76 pp. and maps. (Department of Conservation, Forests and Lands: Melbourne).
3. Horrocks, G.F.B., Opie, A.M., Carr, G.W., Cherry, K.A., Brown, G.W., Craig, S.A. and Triggs, B.E. (1984). Flora and Fauna of the Ellery Forest Block, East Gippsland, Victoria. Ecological Survey Report No. 3, 82 pp. and maps. (Department of Conservation, Forests and Lands: Melbourne).
4. Carr, G.W., Horrocks, G.F.B., Cherry, K.A., Opie, A.M., Triggs, B.E. and Schulz, M. (1984). Flora and Fauna of the Coast Range Forest Block, East Gippsland, Victoria. Ecological Survey Report No. 4, 99 pp. and maps. (Department of Conservation, Forests and Lands: Melbourne).
5. MacFarlane, M.A., Loyn, R.H., Chesterfield, E.A., Traill, B.J. and Triggs, B.E. (1984). Flora and Fauna of the Scorpion and Dawson Forest Blocks, East Gippsland, Victoria. Ecological Survey Report No. 5, 65 pp. and maps. (Department of Conservation, Forests and Lands: Melbourne).
6. Brown, G.W., Carr, G.W., Cherry, K.A., Craig, S.A., Horrocks, G.F.B., Menkhorst, K.A., Opie, A.M. and Triggs, B.E. (1986). Flora and Fauna of the Quadra Forest Block, East Gippsland, Victoria. Ecological Survey Report No. 6, 83 pp. and maps. (Department of Conservation, Forests and Lands: Melbourne).
7. Cherry, K.A., Brown, G.W., Carr, G.W., Horrocks, G.F.B., Opie, A.M. and Triggs, B.E. (1986). Flora and Fauna of the Buldah Forest Block, East Gippsland, Victoria. Ecological Survey Report No. 7, 96 pp. and maps. (Department of Conservation, Forests and Lands: Melbourne).
8. MacFarlane, M.A., Schulz, M., Parkes, D.M., Traill, B.J. and Triggs, B.E. (1987). Flora and Fauna of the Buckland Forest Block, East Gippsland, Victoria. Ecological Survey Report No. 8, 93 pp. and maps. (Department of Conservation, Forests and Lands: Melbourne).
9. Opie, A.M., Brown, G.W., Carr, G.W., Cherry, K.A., Horrocks, G.F.B., Menkhorst, K. A. and Triggs, B.E. (1987). Flora and Fauna of the Splitters Range Forest Block, Bairnsdale Region, Victoria. Ecological Survey Report No. 9, 104 pp. and maps. (Department of Conservation, Forests and Lands: Melbourne).
10. Horrocks, G.F.B., Brown, G.W., Carr, G.W., Cherry, K.A., Craig, S.A., Opie, A.M. and Triggs, B.E. (1987). Flora and Fauna of the Beloka and Gibbo River Forest Blocks, Alpine Area, Victoria. Ecological Survey Report No. 10, 90 pp. and maps. (Department of Conservation, Forests and Lands: Melbourne).
11. Parkes, D.M., MacFarlane, M.A., Schulz, M. and Traill, B.J. (1987). Flora and Fauna of the Nunniong North Forest Block, Bairnsdale Region, Victoria. Ecological Survey Report No. 11, 73 pp. and maps. (Department of Conservation, Forests and Lands: Melbourne).
12. Craig, S.A., Brown, G.W., Carr, G.W., Cherry, K.A., Horrocks, G.F.B., Menkhorst, K.A., Opie, A.M. and Triggs, B.E. (1987). Flora and Fauna of the Razorback and Dartmouth Forest Blocks, North-east Region, Victoria. Ecological Survey Report No. 12, 80

pp. and maps. (Department of Conservation, Forests and Lands: Melbourne).
13. Cherry, K.A., Brown, G.W., Carr, G.W., Horrocks, G.F.B., Menkhorst, K.A., Opie, A.M. and Triggs, B.E. (1987). Flora and Fauna of the Freeze-out and Pyke Forest Blocks, North-east Region, Victoria. Ecological Survey Report No. 13, 102 pp. and maps. (Department of Conservation, Forests and Lands: Melbourne).
14. Schulz, M., MacFarlane, M.A., Parkes, D.M. and Traill, B.J. (1987). Flora and Fauna of the Mount Murray Forest Block, North-east Region Victoria. Ecological Survey Report, No. 14, 82 pp. and maps. (Department of Conservation, Forests and Lands: Melbourne).
15. Lunt, I.D., Brown, G.W., Cherry, K.A., Henry, S.R. and Yugovic, J.V. (1987). Flora and Fauna of the Proposed Timber Harvesting Areas in the Grampians National Park, Victoria, Part 1. Ecological Survey Report No. 15, 130 pp. and maps. (Department of Conservation, Forests and Lands: Melbourne).
16. Horrocks, G.F.B., Cherry, K.A., Hurley, V.A., Kevin, P.M., Norris, K.C., Opie, A.M. and Schulz, M. (1987). Flora and Fauna of the Lockup Forest Block, East Gippsland, Victoria. Ecological Survey Report No. 16, 104 pp. and maps. (Department of Conservation, Forests and Lands: Melbourne).
17. Yugovic, J.V., Henry, S.R., Brown, G.W. and Meggs, R.A. (1987). Flora and Fauna of the Sisters Forest Block, East Gippsland, Victoria. Ecological Survey Report No. 17, 93 pp. and maps. (Department of Conservation, Forests and Lands: Melbourne).
18. Brown, G.W., Horrocks, G.F.B., Lunt, I.D., Meggs, R.A. and Sandiford, E.M. (1987). Flora and Fauna of the Noorinbee Forest Block, East Gippsland, Victoria. Ecological Survey Report No. 18, 114 pp. and maps. (Department of Conservation, Forests and Lands: Melbourne).
19. Chesterfield, E.A., Hurley, V.A., Henry, S.R., Schulz, M. and Pyrke, A.F. (1988). Flora and Fauna of the Brodribb Forest Block, East Gippsland, Victoria. Ecological Survey Report No. 19, 159 pp. and maps. (Department of Conservation, Forests and Lands: Melbourne).
21. Henry, S.R., Cherry, K.A., Hurley, V.A., Opie, A.M. and Schulz, M. (1988). Flora and Fauna of the Tennyson Forest Block, East Gippsland, Victoria. Ecological Survey Report No. 21, 106 pp. and maps. (Department of Conservation, Forests and Lands: Melbourne).
22. Brown, G.W., Horrocks, G.F.B., Meggs, R.A., Opie, A.M. and Westaway, J. (1988). Flora and Fauna of Proposed Timber Harvesting Areas in the Grampians National Park, Victoria, Part 2. Ecological Survey Report No. 22, 113 pp. and maps. (Department of Conservation, Forests and Lands: Melbourne).
23. Earl, G.E., Brown, G.W., Cherry, K.A., Horrocks, G.F.B. and Vollebergh, P.J. (1989). Flora and Fauna of the Leinster Forest Block, Alpine Area, Victoria. Ecological Survey Report No. 23, 126 pp. and maps. (Department of Conservation, Forests and Lands: Melbourne).
25. Pyrke, A.F., Gillespie, G.R., Henry, S.R., Meggs, R.A. and Westaway, J. (1988). Flora and Fauna of the Clover and Pretty Valley Forest Blocks, North-east Victoria. Ecological Survey Report No. 25, 137 pp. and maps. (Department of Conservation, Forests and Lands: Melbourne).
30. Brown, G.W., Earl, G.E., Griffiths, R.C., Horrocks, G.F.B. and Williams, L.M. (1989). Flora and Fauna of the Acheron Forest Block, Central Highlands, Victoria. Ecological Survey Report No. 30, 93 pp. and maps. (Department of Conservation, Forests and Lands: Melbourne).

FNCV Excursion to Mt. Kosciusko and Canberra January 19th to 27th 1989

Elizabeth K. Turner, M.D.

After collecting 28 passengers, Frank the driver from McKenzies Bus Services set off along the Tullamarine Freeway to Mickleham and then the Hume Freeway. The first stop was at Grass Tree near Avenel.

Andy Blackburn explained how in the early days travellers from Sydney would aim to get over the Great Dividing Range near Teneriffe Hill. We turned east through Oxley and Everton where we saw the old molybdenite mine – this metal is said to be grey and soft, a bit like graphite. It separates easily into slippery flakes and can be mixed with oil to make a lubricant used in high-performance machines so that this mine was much in demand during World War II.

At Beechworth the bus detoured along the scenic route to view the Powder Magazine and the Chinese Burning Towers in the cemetery. Then to Yackandandah and on to the marvellously named village of Tamgambalanga and to the Hume Weir, where we inspected the site of old Tallangatta, submerged in 1956. We viewed many pelicans, coots, ibis, cormorants and some ducks and swans on the weir. Then through Koetong, where the views along the valley to the Alps were the most spectacular of the whole day in so many varying shades of blue and lilac, to Corryong and our motel.

Friday, January 20th

Another sunlit day and an exciting one as we travelled over the top of Australia's highest mountain range into N.S.W. and finally to Jindabyne – but first we had to cross the Murray at the Bringenbrong Bridge. Here the Indi joins with the Murray to form the longest river in Australia which flows west and finally south into the ocean in South Australia. The river itself is technically in N.S.W. here, the High Court having judged the state boundary to be the top of the high bank. The following information was supplied to us by J. A. (Andy) Blackburn.

'The Boundaries of Victoria'

A brief note based on an article in *The Australian Surveyor* **32** (3), Sept. 1984.

Just past Corryong a sign NSW State Border at the Victorian end of the bridge over the Murray River led to a discourse on state boundaries.

When Victoria was separated from NSW in 1850 the boundary was declared to be a "straight line from Cape Howe to the nearest source of the Murray thence by its course to the South Australian border". In 1855 the river was put under NSW control and the left bank became the boundary.

In 1980 the top of the high bank became the boundary. A man charged with murder in Victoria was acquitted because the body was found with its left foot in the water and was deemed to be in NSW.

In 1839/40 Surveyor Tyers determined the longitude of the mouth of the Glenelg River and between 1847 and 1850 the 141st meridian was marked right up to the Murray and declared to be the eastern boundary of South Australia.

In 1868, with improved technology, this boundary was found to be 2¼ miles too far to the west and its extension north of the Murray was marked in its correct place. Between the old and the new end points the Victorian-South Australian border follows the centre of the Murray River for about 10 km around the bends.

To complete the story, the boundary with Tasmania lies on "thirty nine degrees and twelve minutes of south latitude", about four miles off the tip of Wilsons Promontory.

The bus detoured into Khancoban, which is indeed a large town nowadays and contains no road notices to get one back on to the Highway, so we spent a considerable time tracing our route. Then we followed the road up to Scammell's Lookout overlooking the Geehi Creek. The roadside was ablaze with the orange-yellow bloom of *Senecio* sp., Clustered Everlasting *(Helichrysum semipapposum),* the Yam Daisy

(*Microseris scapigeria),* and St. John's Wort, both native species *(Hypericum japonicum* and *H. gramineum).* There was a great quantity of Hop-bitter pea *(Daviesia latifolia)* not in flower, and the Hazel Pomaderris *(P. apitata)* which was in flower. Also some fine flowering tree lomatias *(L. fraseri)* and many Hyacinth orchids *(Dipodium punctatum).*

We made a botany stop at Dead Horse Gap and found the ground under clumps of tussock grass, covered with the white sweet-smelling Woodruff *(Asperula gunnii)* and nearby we found the red fruits of the Alpine Coprosma *(C. nivalis),* both of these latter being of the Rubiaceae family; also the snow daisy *(Celmisia longifolia).* We stayed at a motel along the shores of Lake Jindabyne.

Saturday, January 21st

Another sunny day with very little wind, even on the top of Mt. Kosciusko where we spent most of the day. The bus could not travel past Charlotte Pass but some of the party walked to and from the summit (2,228 m); others walked a shorter but steeper track to the Blue Lake contained in a cirque formed by the head of a glacier probably some 10-30,000 years ago in the valley to the east of the ranges.

Dr John Mitchell and others who walked to Blue Lake were fascinated by the clarity with which they were able to view the valleys left by two glacier flows, the most easterly larger than the other. These coalesced forming two lakes in the cirques and semi-circular mounds of moraine on their southern sides below the present lake sites. The Blue Lake still contains the unique yabbie, some of whose remains were discovered dead on the path.

We were amazed at the beauty of some large bushes of pale golden grass which we were unable to identify but the Ranger at Charlotte Pass informed us was the Kosciusko Ribbon Grass *(Chionochloa frigida),* endemic to the Kosciusko region.

Most of the party walked along the boardwalk to the small lookout and were impressed by the copious pale blue flowers of the Alpine Mint bush *(Prostanthera cuneata)* alternating with patches of snow daisies and tufted daisies *(Celmisia nivalis* and *C. scapigera).* We were fascinated to discover deep below in the grass the stiff pointed silvery leaves of the *Astelia alpina,* the exerted yellow male inflorescence on a separate plant and the even lower female inflorescence often bearing orange yellow fruits. Patches of lilac Eyebright *(Euphrasia collina)* were frequent in the areas around clumps of Snow Gums *(Eucalyptus pauciflora* subsp. *niphophila)* and in some of the sod tussock grasslands below the road levels grew golden *Craspedia* sp. and bright deep pink Trigger Plants *(Stylidium graminifolium)* alternating with yellow *Kunzea muelleri,* blue *Wahlenbergia ceracea* and Silver Snow Daisies *(Celmisia longifolia).* We observed the male and female plants of the Mountain Aciphyll *(Aciphylla simplicifolia)* and a small species with slender segmented leaves, also the red heads of the Australian Carraway *(Oreomyrrhus eriopoda).*

Bird-life was not prolific, the most ubiquitous species was the Maned Duck. We saw several Flame Robins, one pair nesting in a Snow Gum. These birds spend the summer and their mating and nesting seasons in the high altitudes and migrate during the winter months.

Our bus then took all but the distance walkers down through Perisher Valley to the site of Island Bend township, where the gardens, formerly of miners' homes, have run wild. Exotic lupins, roses and the contents of their cottage gardens have extended into the valleys and hillsides, vying with and often displacing the native alpine vegetation. We went on to the Guthega village and saw below us the dam wall and the commencement of the Jindabyne-Island Bend water tunnel of the Snowy Mountains Hydro-Electric Scheme. A few people found the Alpine Leek-Orchid *(Prasophyllum alpinum)* and the Mauve Leek-Orchid *(Prasophyllum suttonii).* It was easier to find and appreciate

the brilliant whitish clumps of Derwent-speedwell *(Parahebe derwentia)* and the crimson-red mats of Bidgee-Widgee *(Acaena anserinifolia)* and the occasional clumps of Granite Buttercup *(Ranunculus gratticola)*. We also saw the Alpine Baeckea *(B. gunniana)* climbing over granite boulders on the river flats, also the small, white Mud Pratia *(P. surrepens)*. We did not find any mountain Gentians but were pleased by the rose-coloured braets on the Tall Rice-Flower *(Pimelea ligustrina)* and the 'candles' of the candle heath *(Richea continentis)*.

The bus made a return journey to Charlotte Pass, through Smiggin Holes, to pick up the walkers who had returned from the Summit and Blue Lake.

Sunday, January 22nd

An overcast day and we expected a cold mist on the mountain top, but by the time we reached Mt. Blue Cow (so called by a farmer whose Murray Grey cow was always found there, so the story goes), the sun was shining and instead of suffering from 'hypothermia' we were definitely hyperthermic as we climbed around the flowery alpine meadows. To reach the Blue Cow we had to travel to Bullocks Flat, 20 km west of Jindabyne on the Alpine Way, and then take the Skitube Train some 8.4 km through the longest transport tunnel in the southern hemisphere. The train, a Swiss-styled rack rail, took 17 minutes to travel at up to 40 km per hour through Perisher to Blue Cow through this one-way tunnel which was opened in 1988.

We had time to explore the mountain meadows and were delighted to find mats of the Sky Lily *(Herpolirion novae-hollandiae)* with wide, waxy bluish-white stalkless flowers.

The descent on return is travelled at about 20 km per hour. The attendant at the Information Centre at Bullocks Flat had a most appealing baby wombat which she was feeding with green grass. Several of our more energetic members walked down the mountain from Blue Cow to the station at Perisher and caught the train there.

After dinner, Andy Blackburn showed slides of Alpine flora the he had taken on previous visits.

Monday, January 23rd

A warm day; our first port of call was at the Eucumbene dam site. This was the first wall built in the enormous Snowy Mountains Scheme. The paddocks *en route* were covered with bright blue Patterson's Curse *(Echium lycopsis)* and the dried brown flower spikes of the mullein or verbaseum, both introduced weeds which seem to be a frightful pest in this area. At the Eucumbene Lake look-out a family of large deep-brown skinks were sunning themselves. Mother and father were each longer than 2 feet and they had long tails; the baby was approximately 10 inches in length and quite unafraid.

We watched an audio-visual presentation at the Information Centre at Cooma, had lunch in the park and viewed the old houses in Lambie Road, then went on through Berridale and Michelago. At Bredbo we watched seven eagles soaring above the road, four at least were Wedge-tails and the other three may also have been the paler variety, or Little Eagles. The countryside was beginning to look brown and dry, and we were pleased to have cups of tea or coffee in the sheltered viewing area on the Telecom Tower atop Black Mountain in Canberra. We reached our modest hotel accommodation in Northbourne Avenue by 5 p.m.

Tuesday, January 24th

A strenuous day. We had a guided tour over the Botanic Gardens by a young man named Rodney Harvey. At first we were taken through the rainforest area where mist sprays turn on every fifteen minutes for two minutes. In the Queensland section the Stream lily (*Helmholtzia glabberina*) was the most spectacular flower. In the desert areas *Xanthorrhoea* were growing well and we learned that they have con-

tractile roots deep in the ground which can pull the plant further down into the soil.

Two cross-lines on the corners of the plant nameplates meant 'endangered species'. The first we saw was a feathery-leaved soft acacia called *Acacia pubescens* which was frequent in NSW near Sydney 200 years ago and is now represented by a mere 400 plants.

The commoner eucalypts native to Canberra are the Yellow Brittle Gum *Eucalyptus mannifera),* the Scribbly Gum *(E. rossei)* and *E. macrohryncha.*

We snatched some lunch at the kiosk and drove off to the new Parliament House for a tour lasting 2½ hours, after which most of us had a cup of coffee and then off to the Science and Technology Museum where the pneumatic moving dinosaur figures wailed and screamed. We enjoyed the *Muttaburrasaurus,* whose bones were found in Muttaburra, Queensland – almost ¾ of the animals remains were found.

Wednesday, January 25th

Although the temperature in Canberra reached 23°C we were on cold moist mountain tops where a fine rain fell most of the day. Our road was south along the Brindabella range which approximately marks the boundary between ACT and NSW. The views looking west over Kosciusko National Park were extensive and glorious and were mostly of Snow Gum *(Eucalyptus pauciflora* subsp. *niphophila)* sub-alpine forest, 1,400 m elevation, often mixed with Mountain Gum *(E. dalrympleana).* The road was unsealed and there were several notices of locked gates (which were not locked) until we got to a parking area below the summit of Mt. Genini. Here we had to end our journey because of a locked gate. We walked either to the summit or further south-east along the road, later having a picnic lunch.

As the road ran further south-east, the wildflowers became bluer – the whitish Derwent Speedwell *(Veronica derwentiana)* was replaced by bushes of blue Mountain Speedwell *(Parahebe perfoliata).* There were clumps of bluebells *(Wahlengerbia gloriosa),* purple eyebright *(Euphrasia collina)* and blue and pink Austral forget-me-nots *(Myosotis australis),* often with both colours on the end of the flower-stem. Mauve daisies of the *Brachycome* sp. and a dwarf form of pink-bells *(Tetratheca* sp.), never more than 10 centimetres high, and some fine stalks of *Prunella vulgaris.*

Unfortunately, a small wallaby was run over by our bus and a female or immature flame robin dazed itself by flying at its reflection in the stationery bus window. There were many flame robins around the bus and two were observed feeding nesting young.

We found several patches of greenhood orchids, probably *Pterostylis alpina* and *P. decurva.* There were some fine stands of the Potato Orchid or Cinnamon Bells *(Gastrodia sesamoides).*

The Ranger told us that the small shrub with feathery leaves and branched sprays of many greenish umbels above the leaves was not the Panax *(Tieghemo panax)* but now called *Polyscias sambucifolia.* He also informed us that the several notices for Arboretuma, one of which we visited (a fenced-off area in the forest for larches and spruce) were erected in the 1920s and became important during war time when softwoods were needed.

Thursday, January 26

Australia Day in Canberra, and all the shops shut. There were celebrations at Regatta Point near the water-spout in Lake Burley Griffin. Our Tongan waitresses were to perform dances during the afternoon, and it was a hot day!

We drove up Mount Ainslie and there found the gem of the day – a rather plantive looking black-backed magpie carolling for his supper while looking hopefully up from the pavement to the counter of a souvenir-selling caravan drawn up to the kerb. When the shopkeeper emerged with a bag of crusts, the carolling grew louder and 15 other magpies answered the call. All landed and were fed, and carolled louder than before.

Andy Blackburn recorded the concert on tape – the shopkeeper says he can tell the sex of the magpies by the shape of the head. There is no easy way such as we have in Victoria – i.e. the female having a grey back and the male a white back.

On our way home we visited Blundells Farmhouse built in 1866. A few of us then went to the War Memorial below Mt. Ainslie while others spent the morning in the Nature Reserve nearby.

As the afternoon was free, some went again to the Botanic Gardens and others engaged in private entertainments. At 9.15 p.m. there was a trek of Field Nats on to the roof or 10th floor to watch a fireworks display from barges on Lake Burley Griffin, which seemed a fitting farewell for our tour to Melbourne the following day.

Our thanks are due to Marie Allender, our leader, and to Frank the driver who drove us so safely and well over nearly 2,000 kilometres.

FNCV Meeting Reports

General Meetings, February – July 1989

At the February meeting **Jim Montgomery,** a former ranger at Kakadu National Park and now a tour operator in the area, gave a talk entitled ' A Tour of Discovery', assisted by **Terry Pitrone,** who showed slides of Arnhem Land, some Aboriginal paintings, and the flora and fauna.

Dan McInnes exhibited two historic microscopes, the R and J Beck 'Popular Model' from 1865-70 and the Henry Crouch microscope (London) made about 1888-90. The latter was an early attempt to obtain binocular and stereoscopic viewing through one objective. Dan also exhibited *Wolffia australiana* from Cherry Lake, Altona. This is the smallest flowering plant in the World. **Hilary Weatherhead** exhibited a fungus collected in Sherbrooke Forest, believed to be a species of *Mutinus.* This was later confirmed as being *Mutinus certus,* a sub-tropical species. The hot, humid weather would have produced conditions favourable to its fruiting.

Graeme Love, who lived in Malaysia for two years, gave a talk on 'Malaysia Through the Eyes of a Conservationist', at the March meeting. After a brief introduction on the geography and geology of the region he showed slides of the country and its people, and stressed the problems of conservation given the economic needs of Malaysia.

Exhibits included a microscope slide of copper sulphate and magnesia under polarised light, and the means by which colour changes can be obtained **(Dan McInnes);** deformed buds of *Eucalyptus caesia* subsp. *magna* raised from seed from an isolated parent plant. Normal buds were also shown **(Ron Pearson).**

Sheila Houghton, in the Chair for the April meeting, introduced the new Subscription Secretary, **Dianne Chambers.** The speaker for the evening was **Ellen McCulloch,** who gave a very interesting talk entitled 'Birds and People' based on a recent B.O.C. survey on 'Birds in the Garden'. The ten most frequently seen birds were, in numerical order, Magpie, Sparrow, Blackbird, Red Wattle Bird, Spotted Turtle Dove, Starling, Silver Eye, Magpie Lark, Indian Mynah, and Willie Wagtail. Ellen spoke of the many ways in which birds impinge on the lives of people, illustrating this with examples from art and literature.

Under the microscope **Dan McInnes** exhibited what he queried as being marine amoeba or slime mould. He said that the protoplasm of this animal(?) at times flows very quickly, forming blunt pseudopodia which anastomose, forming a network about 0.75mm long by 0.5mm wide. Small nematode worms became stuck on the amoeba (?) and were engulfed by pseudopodia. Within ¾ hour the worm had been digested without trace. Dan also displayed samples of insect mounts.

Other exhibits: Oak leaves and an acorn with a furry cap from a small stand of trees in Mont Albert, for identification **(Yvonne Gray)**. Three fungi: *Gyrosporus cyanescens, Amanita umbrinella, Amanita sp.* **(Sheila Houghton)**.

Tom Sault reported that he and some friends had searched for the brown bittern in the Tootgarook swamp without success, but had seen three species of snake: tiger, red-bellied black, and copperhead. **Hilary Weatherhead** spoke on the trees in the Ada River area, near Powelltown, which has many of the tallest in the state, including the Ada Tree itself. The area is also rich in fern and fungi species. A botany Group excursion in conjunction with the La Trobe Valley FNC was to be held on 22 April. (For further details on the Ada Tree see *Victorian Nat.* **106** (3), 1989). The Secretary announced that he had sorted and indexed 2,970 slides belonging to the late **Madge Lester**, and these would now be handed to the Librarian. **Julian Grusovin** circulated copies of the proposition to set up an Approved Research Institute in connection with the Club. The Taxation Department had originally required us to set up a separate company, but Council had rejected this, and an alternative solution was being sought.

The May General Meeting followed the A.G.M. The President, **Graeme Love**, who was re-elected unopposed, thanked the Council and retiring office-bearers, **Ron Pearson** (Hon. Secretary), **Yvonne Gray** (Hon. Treasurer) and **Russell Thomson** (Hon. Editor), also **Norm and Helen Stanford**, who had resigned during the year. **Marie Allender** was also retiring as Excursion Secretary, though remaining a member of Council. Several government grants had been received during the year: in addition to the regular one which assisted in the publication of the *Victorian Naturalist*, there was funding to assist the Fauna Survey Group's survey of water rats at Werribee. A committee, on which **Graeme Love** represented the FNCV, was currently discussing the setting up of a pool of audio-visual equipment at the Herbarium for use by groups, for which funding was available.

Exhibits: Shaggy sponge crab **(Dan McInnes)**; simple microscope made for tutoring at the U3A **(Urwin Bates)**; variety of *Ramaria* spp. from his lawn **(Russell Ward)**; *Russula* Sp. **(Marie Allender)**; large specimen of *Amauroderma rude* from Ada River **(Sheila Houghton)**; 2 granite samples from excursion to Romsey-Lancefield area **(Graeme Love)**. **Norm Plever** reported seeing a fully grown wombat down a track from Grant's picnic area near Kallista.

Margaret Potter spoke about the Ada Tree, and the meeting approved the sending of a letter to the Department of Conservation, Forests and Lands recommending the preservation of an area of 5 square kilometres around the tree. **Graeme Gillespie** announced that the management plan for the Bogong National Park had been published.

Eric Quinlan spoke on 'The Environmental Effects of the Very Fast Train' at the June meeting. The President appealed for volunteers to fill vacant positions, especially Hon. Treasurer and Club Reporter. The President announced that the Approved Research Institute busines would be held over until the Club's corporate position is clarified.

Exhibits: fungi from Botany Group excursion to the Dom Dom Saddle **(Sheila Houghton)**; Bryozoa from Altona Beach area **(Dan McInnes)**.

Simon Molesworth was the speaker at the July meeting, and gave an interesting and stimulating talk on the activities of the National Trust, especially in relation to natural features. A lively discussion followed the talk, particularly on matters of current interest.

Exhibits: under microscope, diatoms **(Dan McInnes)**. **Sheila Houghton** showed a photograph of **John File Bailey**, which had been received from his granddaughter, **Mrs Loris Hornbuckle**, following an

enquiry to the Club about J. F. Bailey. He was one of the original members, and the second Club Librarian, 1883-84, which position he held at the time of his death, at the early age of 43. An obituary notice appeared in *The Victorian Naturalist* 1: p. 59, in which he was erroneously called **James Bailey. Robyn Watson** reported that there was a Powerful Owl in the fern gully in the Botanic Gardens.

S. Houghton

September Meeting Report

The September General meeting was a members night, a pleasant evening of "cameo" talks covering a broad range of interests. **Dan McInnes** presented a talk and display of algae including microscopic green algae and diatoms. Another microscopic specimen was a blue-green alga (*Anabaena*) with specialised cells called heterocysts which fix nitrogen from the air. Also on display was the green alga *Haematococcus* in its resting stage in which it has a reddish colour.

Margaret Potter from the Botany group showed some excellent slides from Lake Mountain, the Zoo's Butterfly House, and a variety of fungi, including a fungus that specifically grows on *Banksia* cones. On display were a variety of plants including *Actinodium cunninghamii* (Albany "Daisy") which looks like it belongs to the daisy family (Compositae) but in fact is in the Myrtaceae. Other specimens were *Phebalium squamulosum, Hazel* sp. with separate male (catkins) and female (red stigmas) flowers, various wattles, the native grass *Stipa elegantissima* and a variety of pressed native and introduced grasses. Photos from the 'Ada Tree' excursion were also on show.

Arthur Theis gave a talk on collecting mosses and liverworts in the field and demonstrated how they are packed ready for curating at the National Herbarium. Arthur's display included the liverwort *Lepidozia laevifolia* and a *Marchantia* sp. from Carnarvon Gorge.

Sheila Houghton gave a most interesting historical note on Major Ellery, one of the original members of the FNCV. Sheila also exhibited some fungi (*Nidula emodensis* and *Cortinarius* sp.) and a fossil fern from St. Clair, U.S.A. **Jack Douglas** gave us some details about this Carboniferous fossil.

Finally, **Graeme Love** displayed several fine geological specimens including Native Bismuth, Bismuthite, Diamonds, Sapphires, Gold, Agate Blende, and Native Silver.

R.W.

Report on Koala Count French Island — 2nd September 1989

Another successful day, we were left with the feeling that next year will be even better. After a shaky beginning when we thought we wouldn't have anyone, only our well trained leaders, we did a ring around and people came from everywhere, 43 people in total. BOC, students, teachers, Friends and CF&L staff did a wonderful job, our tally for the day was 189 koalas, we couldn't count in the NE area because it was so boggy. Our numbers were well up on last year, so next year who knows? It is an important task monitoring these mammals, each year we learn a bit more and the information is invaluable. If you would like to partake of our survey next year mark us in your diary, Saturday 1st of September, 1990.

Fay Gordes (Friends of French Island).

EDITORIAL POLICY

Title

The Victorian Naturalist is the bi-monthly publication of the Field Naturalists Club of Victoria.

Scope

The Victorian Naturalist publishes articles on all facets of natural history. Its primary aims are to stimulate interest in natural history and to encourage the publication of articles in both formal and informal styles on a wide range of natural history topics.

Research Report

A succinct and original scientific communication. Preference is given to reports on topics of general interest.

Contributions

Contributions may consist of reports, comments, observations, survey results, bibliographies or other material relating to natural history. The scope is broad and little defined to encourage material on a wide range of topics and in a range of styles. This allows inclusion of material that makes a contribution to our knowledge of natural history but for which the traditional format of scientific papers is not appropriate.

Naturalist Notes

Short and informal natural history communications. These may include reports on excursions and talks.

Commentary

Informative articles that provide an up-to-date overview of contemporary issues relating to natural history. Whilst commentary articles are invited, the editors welcome discussion of topics to be considered for future issues.

Book Reviews

Priority is given to major Australian publications on all facets of natural history. Whilst reviews are commissioned, the editors welcome suggestions of books to be considered for review.

News

Any items of news concerning the FNCV.

Diary

Notice of coming events including activities of FNCV groups and any other activities of interest to *Vic. Nat.* readers.

Review Procedures

Research reports and Contributions are submitted to the editors and are forwarded to the appropriate member of the editorial board for comment. All research reports are assessed by two independent qualified referees prior to publication. Contributions are assessed by the appropriate member of the editorial board and may be refereed at the editors discretion. All other articles are subject to editorial review.

GUIDELINES FOR CONTRIBUTORS

Submission of Manuscripts

The following general statements apply to all submitted manuscripts.

Three copies of the manuscript should be provided, each including all tables and copies of figures. Manuscripts should be typed, double spaced with wide margins and pages numbered. The name and address of all authors should appear beneath the paper title. The full postal address, telephone number and fax number (if available) of the author who is to receive correspondence and check the proofs should be provided.

Abbreviations and Units

SI units (metre, kilogram, etc.) should be used wherever possible. Statistics and measurements should be given in figures (i.e. 10 mm) except where the number beings a sentence. When a number does not refer to a unit of measurement it is spelt out, unless the number is greater than nine. The word 'figure' should be abbreviated to Fig. unless starting a sentence.

Tables and Figures

All illustrations (including photographs) are considered as figures. All figures should be referred to in the text. Original figures or high quality photographic copies should be provided with the manuscript. Each figure should bear the figure number and authors name on the back in pencil. Line drawings should be in black Indian ink on stout white paper or high quality tracing paper. Lettering should be added bearing in mind legibility after reduction. Bar scales are preferred to numerical scales. Figure captions should be numbered consecutively (Fig. 1, Fig. 2, etc.) and provided on a separate page at the end of the manuscript.

Tables should be numbered consecutively (Table 1, Table 2, etc.) and should have an explanatory caption at the top. The presentation of the same data in both tabular and graphical form should be avoided. Tables and figures should be designed to fit within a page width (115 mm) or a column width (55 mm) following reduction.

References

References should be cited in the text by author and year and listed at the end of the text in alphabetical order and in the following form:

Ashton, D.H. (1976). Phosphorus in forest ecosystems at Beenak, Victoria. *Aust. J. Ecol.*, **64**: 171-86.

Gill, A.M. (1981). Adaptive responses of Australian vascular plant species. *In* 'Fire and the Australian Biota'. Eds A.M. Gill, R.H. Groves and T.R. Noble, pp. 243-72. (Australian Academy of Science: Canberra).

Leigh, J., Boden, R. and Briggs, J. (1984). 'Extinct and Endangered Plants of Australia'. (MacMillan: Australia).

Titles of journals should be abbreviated according to the most recent (4th) edition of the World List of Scientific Periodicals (available at most libraries).

Other methods of referencing (e.g. footnotes) may be acceptable in manuscripts other than research reports. The editors should be consulted prior to the submission of a manuscript that uses a method other than author-date.

Research Reports

A research report is a succinct, formal, original scientific communication. Preference will be given to reports that make a significant contribution to natural history literature and are of general appeal. The manuscript should consist of an abstract not exceeding 250 words, an introduction, methods, results, discussion, acknowledgements and references.

Contributions and Naturalist Notes

The general comments on figure and table presentation, referencing and units also apply to these manuscripts. The appropriate style and format will vary with the manuscript but concise simple English should be used at all times. The use of subheadings is encouraged where they improve comprehension.

100 Years Ago

The Largest Tree in the World

In a letter to the *Argus,* dated 16th January, Mr David Boyle, of Forest Hill, Nunawading, states that a eucalyptus tree (probably *E. amygdalina*), growing in the ranges not 25 miles from Melbourne, has recently been measured and photographed by himself and Mr N. J. Caire, a member of the F.N.C., and found to be 466 feet high, with a circumference 4 feet from the ground of 81 feet, and at the base of 114 feet. The tree was measured by him some ten years previously, before it lost its top, when it was 525 feet high. Some fine photographs of other large Victorian trees were exhibited at the Centennial Exhibition, but none approached near to the dimensions of this giant of the forest.

Anon., *The Victorian Nat.* Vol. 5, Feb. 1889, p. 152.

GROUP MEETINGS

Group Meetings (other than the Day Group) will be held at the Astronomers Residence, Birdwood Avenue, South Yarra (150 metres nearer the Shrine than the Herbarium) at 8.00 p.m. until further notice. Any member or visitor invited to all meetings.

Fauna Survey Group
(First Tuesday)

Tuesday 31st October
"Conservation and Ecology of Mallee Fowl" Joe Benshemesh.

Tuesday 5th December
Members Night.

Geology Group
(First Wednesday)

Wednesday 1st November
To be arranged.

Wednesday 6th December
Social night and supper.

Botany Group
(Second Thursday)

Thursday 12th October
"Plant Communities at different altitudes in the Swiss Alps" Hilary Weatherhead.

Thursday 9th November
"Conservation of Basalt Plain Grassland Flora" Keith McDougall.

Thursday 14th December
Annual Meeting and Members night.

Microscopical Group
(Third Wednesday)

Wednesday 15th November
"The Video Camera and the Microscope". New tapes.
No meeting in December.

Day Group
(Third Thursday)

Thursday 16th November
"The Melbourne General Cemetery" Historical Graves.
Catch tram 18, 19, 20 in Elizabeth Street, alight at stop 19 at corner Royal Parade and Gatehouse Streets. Meet there at 11.30 a.m.
Leader Andy Blackburn 379 8960.
No Meeting in December.

HAWTHORN JUNIOR FIELD NATURALISTS CLUB

Meetings are on the last Friday in the month at the Balwyn Primary School Hall, corner Balwyn and Whitehorse Roads, Balwyn. Meetings start at 7.30 p.m.

Friday 24th November
"Frogs".

No Meeting in December.

For information contact:
President Jonathon Stevenson 830 5886
or
Rohan Clarke 725 8923

Field Naturalists Club of Victoria

In which is incorporated the Microscopical Society of Victoria

Established 1880

Registered Office: FNCV, c/- National Herbarium, Birdwood Avenue, South Yarra, 3141.

OBJECTIVES: To stimulate interest in natural history and to preserve and protect Australian fauna and flora.
Members include beginners as well as experienced naturalists.

Patron

His Excellency, The Rev Dr John Davis McCaughey, The Governor of Victoria.

Key Office-Bearers 1988-1989

President: Mr. GRAEME LOVE, P.O. Box 2018, St. Kilda West, 3182 (697 5109 B.H.)

Vice President: Mrs. SHEILA HOUGHTON, FNCV, National Herbarium, Birdwood Avenue, South Yarra, 3141 (551 2708)

Hon. Secretary: Mr. JULIAN GRUSOVIN, 1 Warriner Court, East Oakleigh, 3166. (524 2396 B.H. and 543 8627 A.H.)

Hon. Treasurer: Mr BRUCE ABBOTT, 4/597 Orrong Road, Armadale, 3143. (520 4301 A.H.).

Subscription-Secretary: Ms DIANNE CHAMBERS, FNCV, c/- National Herbarium, Birdwood Avenue, South Yarra, 3141 (344 5069 B.H.)

Editors: ROBYN WATSON and TIM OFFOR, FNCV, c/- National Herbarium, Birdwood Avenue, South Yarra, 3141 (419 3532 A.H. and 344 7150 B.H.)

Librarian: Mrs. SHEILA HOUGHTON, FNCV, c/- National Herbarium, Birdwood Avenue, South Yarra, 3141 (551 2708)

Excursion Secretary: Mrs. JOAN HARRY, 342 High Street, Templestowe, 3107 (850 1347)

Club Reporter: Vacant.

Conservation Co-ordinator: Mr. BERT LOBERT, 378 Cotham Road, Kew, 3101. (859 4716 A.H.)

Sales Officer (Books): Vacant.

Sales Officer (Victorian Naturalist only): Mr. D. E. McINNES, 129 Waverley Road, East Malvern, 3145 (211 2427)

Programme Secretary: Vacant.

Publicity Officer: Miss Margaret Potter, 1/249 Highfield Road, Burwood, 3125. (29 2779)

Diary Co-ordinator: Mr. D. E. McINNES, 129 Waverley Road, East Malvern, 3145 (211 2427)

Group Secretaries

Botany: Miss MARGARET POTTER, 1/249 Highfield Road, Burwood, 3125 (29 2779).

Day Group: Mr. D. E. McINNES, 129 Waverley Road, East Malvern, 3145 (211 2427)

Geology: Miss HELEN BARTOSZEWICZ, 16 Euroa Avenue, Nth. Sunshine, 3020 (311 5106 A.H.)

Fauna Survey: Mr. JULIAN GRUSOVIN, 1 Warriner Court, East Oakleigh, 3166. (543 8627).

Microscopical: Mrs. ELSIE GRAHAM, 147 Broadway, Reservoir, 3073 (469 2509)

MEMBERSHIP

Membership of the F.N.C.V. is open to any person interested in natural history. The *Victorian Naturalist* is distributed free to all members, the club's reference and lending library is available and other activities are indicated in reports set out in the several preceding pages of this magazine.

Subscription rates for 1989

Metropolitan Members (03 area code)	$25.00
Joint Metropolitan Members	$27.00
Country/Interstate/Retired Members	$23.00
Joint Country/Interstate/Retired Members	$25.00
Student (full-time)	$18.00
Junior (under 18; no Victorian Naturalist)	$5.00
Subscription to Victorian Naturalist	$23.00
Overseas Subscription to Victorian Naturalist	$30.00
Affiliated Clubs	$25.00
Subscriber Clubs	$23.00
individual Journals	$3.50
Late Fee (Renewing Members), after end of March	$2.00

JENKIN BUXTON PRINTERS PTY. LTD. 1-13 ABBOTSFORD ST. WEST MELBOURNE. 326-4774

The Victorian Naturalist

ol. 106, No. 6 November / December 1989

Published by the FIELD NATURALISTS CLUB OF VICTORIA

Registered by Australia Post. Publication No. V.B.P. 1268

$3.50

FNCV DIARY

GENERAL MEETINGS (Second Monday)

SPECIAL NOTICE:

All General Meetings will now be held at the National Herbarium Hall at the corner of Birdwood Avenue and Dallas Brooks Drive, South Yarra (200 metres East of the Shrine). Meetings commence at 8.00 p.m. There will NOT be a General Meeting in January.

Monday, 12th February, 8.00 p.m.
To be announced.

FNCV EXCURSIONS (First Sunday)

Sunday, 4th February. General Excursion. Belgrave and Sherbrooke Area. Leader Hilary Weatherhead. Meet at Belgrave station car park at 10.15 a.m. Train leaves Flinders St. Station at 8.43 a.m., arrives Belgrave 9.49 a.m.

Saturday 10th to Monday 12th March. Labour Day Weekend. Annual Victorian Field Naturalists Clubs Association get together at Ocean Grove, Bellarine Peninsula. Hosted again by the Geelong Field Naturalists Club. (Details inside the back cover).

GROUP EXCURSIONS

All FNCV members and visitors are invited to attend any Group Excursion.

Fauna Survey Group
Saturday 27th - Monday 29th January
Camp. Tupple Forest. Deniliquin.
Saturday 10th - Sunday 11th February
Camp. M.M.B.W. "Water Rats"

Botany Group
Saturday 24th February
"Aquatic Plants" Possibly in Seymour area.
Saturday 24th March
"Mountain Fruits and Trees" Mt. Donna Buang. Leader Hilary Weatherhead.

GROUP MEETINGS

SPECIAL NOTICE: All Group Meetings (except the Microscopical Group) will now be held at the National Herbarium Hall at the corner of Birdwood Avenue and Dallas Brooks Drive, South Yarra at 8.00 p.m. Any member or visitor invited to all meetings.

Fauna Survey Group
(First Tuesday).
No Group Meetings in January or February.

Geology Group
(First Wednesday)
No Group Meeting in January
Wednesday 7th February
Subject to be arranged.

Botany Group
(Second Thursday)
No Group Meeting in January.
Thursday 8th February
"Aquatic Plants in Australia - their Morphology, Taxonomy, Distribution and Impact on the Environment." Helen Aston.
Thursday 8th March
"Flora of Borneo and North Sumatra". David Albrecht.

Microscopical Group
(Third Wednesday)
The Microscopical Group will continue to hold its meetings at The Astronomers Residence, Birdwood Avenue, South Yarra (150 metres nearer the Shrine than the Herbarium) at 8.00 p.m. during 1990. Any member or visitor invited to all meetings.
Wednesday 17th January
Members Exhibit Night.
Wednesday 21st February
How to use a microscope. How to illuminate the object to get the best result.

Day Group
The Day Group regrets the end of the Day Group and its outings as the attendance of members is too small to continue into 1990.

HAWTHORN JUNIOR FIELD NATURALISTS CLUB

Meetings are on the last Friday in the month at the Balwyn Primary School Hall, corner Balwyn and Whitehorse Roads, Balwyn. Meetings start at 7.30 p.m.

Friday 2nd February
'Natural History Talks" by Junior Council Members

Friday 23rd February
"Mutton Birds" Speaker to be arranged.

For information contact:
President Jonathon Stevenson 830 5886
or
Vice President Rohan Clarke 725 8923

The Victorian Naturalist

Volume 106, Number 6 November / December, 1989

Editors: Robyn Watson and Tim Offor.

ISSN 0042-5184

Cover photo: Professor Tony Lee (*left*), Vice President of the Royal Society of Victoria, presenting the Australian Natural History Medallion (1989) to Bruce Fuhrer (*right*). Photo by Mike Howes.

Distribution and Habitat Preferences of Small Mammals in the Eastern Section of the Angahook-Lorne State Park

W.S. Laidlaw and B.A. Wilson*

Introduction

The Angahook-Lorne State Park is located in the eastern Otway Ranges of Victoria approximately 100 km southwest of Melbourne. It extends from Aireys Inlet to Kennett River and covers 22,350 hectares (Fig. 1). The Park was declared in 1987 and formed by the amalgamation of two forest parks (Land Conservation Council 1987). A resource inventory for the Angahook-Lorne State Park was recently published (Vose *et al.* 1987) and a proposed management plan is currently being produced (Parr-Smith pers. comm.). The present study was carried out in the eastern section (7,500 hectares) of the park (Fig. 1). The geology of the area is characterised by sedimentary rock from the Lower Cretaceous in the west and Tertiary sands and clays in the east. The area has predictable, reliable rainfall throughout the year and experiences hot summers and cool winters.

The vegetation communities in the eastern Otway Ranges are diverse and consist of predominately dry sclerophyll communities (open forest, woodland, heathland, shrubland) with less extensive areas of riparian open forest, fern gullies and damp open forest (Land Conservation Council 1985; Meredith 1986; Wark *et al.* 1987). Several vegetation communities have been identified as significant including the heathy woodland, closed *Melaleuca squarrosa* shrubland and the Bald Hills dry heathland (Land Conservation Council 1987). More than 690 native vascular plant species have been recorded in the area (White 1984).

Thirty-nine mammal species have been recorded in the Angahook-Lorne State Park (Conole and Baverstock 1983; King 1986; Menkhorst in prep.; Vose *et al.* 1987).

*Department of Biological Sciences
Deakin University, Victoria, 3217

Previous studies on small mammals in the area have investigated species reproduction, distribution and habitat preferences as well as recolonisation of sites after wildfire and mine rehabilitation (Kentish 1981, 1983; Wilson 1986; Wilson and Bourne 1984; Wilson and Moloney 1985 b; Wilson *et al.* 1986). These studies have found that the diversity of the small mammal communities is high. Several species which are rare or uncommon in Victoria occur in the area, including *Pseudomys novaehollandiae* (New Holland Mouse), *Antechinus minimus* (Swamp Antechinus) and *Sminthopsis leucopus* (White-footed Dunnart) (Kentish 1981; Land Conservation Council 1985; Ahern *et al.* 1985 a, b; Menkhorst *et al.* 1987; Wilson *et al.* in press; Bourne *et al.* in press).

The previous studies were located outside the State Park. The present study therefore aimed to determine the distribution of mammal species in the eastern section of Angahook-Lorne State Park. The study concentrated on small mammal species and aimed to investigate their habitat preferences and to identify factors affecting these preferences.

The cinnamon fungus (*Phytophthora cinnamomi*) was first identified in the eastern half of the Angahook-Lorne State Park in 1972 on Tertiary soils prone to waterlogging (Land Conservation Council 1976). The fungus has been shown to affect sclerophyll vegetation (Weste 1974, 1981; Dawson and Weste 1985; Kennedy and Weste 1986; Dawson *et al.* 1985). A decrease in canopy cover as well as alterations to the diversity of understorey species are symptomatic of the infection (Weste and Marks 1987). Little is known however about the resultant effects of *Phytophthora cinnamomi* on fauna (Wilson *et al.* in press). The distribution of the

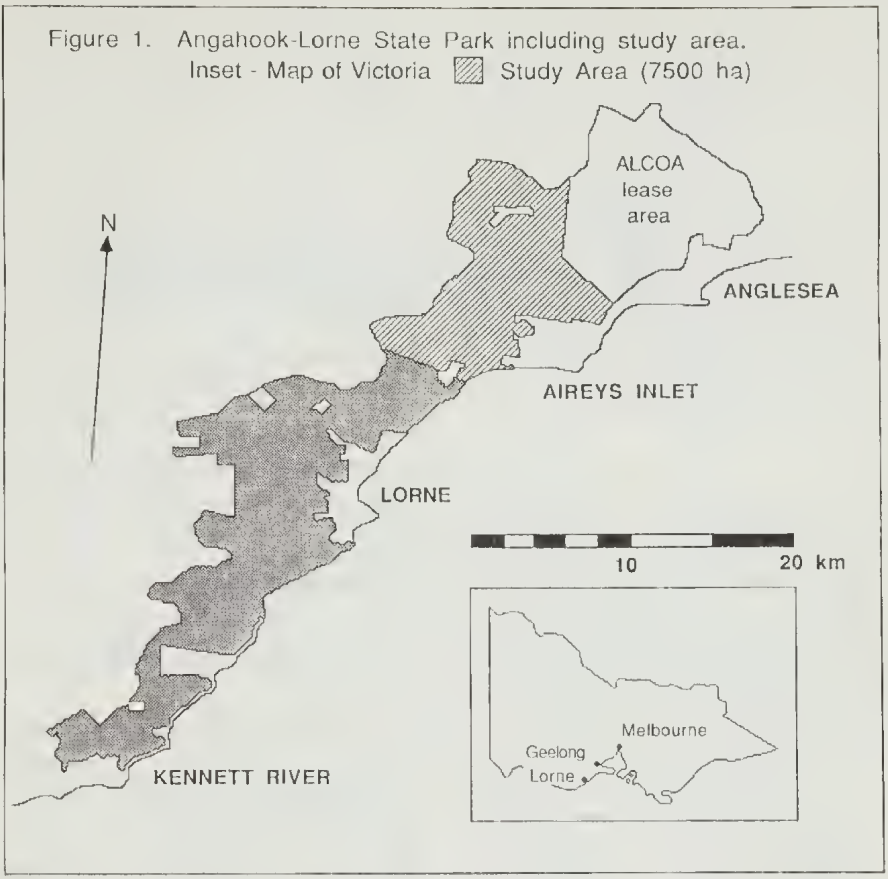


Figure 1. Angahook-Lorne State Park including study area. Inset - Map of Victoria ▨ Study Area (7500 ha)

cinnamon fungus in the eastern Otway Ranges is unknown therefore its presence was also recorded during this study.

Methods

Vegetation map

Five structural vegetation communities (Specht 1970) were identified and their distribution in the park was mapped by interpretation of aerial photographs (Department of Crown Lands and Survey 1979). These communities were similar to those defined in the adjacent ALCOA lease area (Map 1, Land Conservation Council 1987). The five communities were: Riparian Open Forest (30-70% Projective Foliage Cover); Open Forest (30-70% PFC); Woodland (10-30% PFC); Heathland (< 10% PFC); Closed Shrubland (70-100% PFC) (Specht 1970).

Mammal detection and trapping techniques

Twenty-two sampling sites were chosen to cover the study area. They were distributed in proportion to the area covered by the five identified vegetation communities (Table 1).

Live trapping was used to sample small ground-dwelling mammals. Twenty-eight Elliott type B, aluminium, folding traps (9 x 10 x 33 cm), (Elliott Scientific, Upwey, Victoria) and two wire cage traps (16 x 20 x 36 cm), (Gordon Wire Works, Kew, Victoria) were set at each site. Trap spacing of 15 m was used in two parallel lines

Table 1. Description of the vegetation communities identified in the eastern section of the Angahook-Lorne State Park.

Vegetation Community	Percentage of Study Area	Number of Study Sites	Storey Height (m) Upper	Mid	Under	Midstorey Density (%)	Understorey Density (%)	Characteristic Species	Number of Plant Species
Riparian Open Forest	18.5	5	20-35	2-4	1-2	5-30	40-75	*Eucalyptus globulus* *Cyathea australis* *Pultenea* spp.	20-30
Open Forest	64.5	9	15-20	1-2	0.5-1.5	1-15	15-40	*E.obliqua* *E.baxteri* *E.willisii* *E.radiata* *Acacia* spp. *Pultenea* spp. *Gahnia radula*	20-40
Woodland	10.3	4	5-15	1-1.5	1	1-5	10-40	*E.obliqua* *E.baxteri* *E.willisii* *E.radiata* *L.myrsinoides* *H.fastigiata* *L.glacialis* *Dillwynia* spp.	20-25
Heathland	5.8	2	4-5	1-1.5	0.5-1	1-5	5-25	*E.willisii* *L.mrsinoides* *X.australis* *L.glacialis*	30
Closed Shrubland	0.9	2	0	2-3	1-1.5	15-40	50-80	*M.squarrosa* *G.dicarpa*	10

spaced 30 m apart. Traps baited with a mixture of peanut butter, rolled oats and honey, were set for three consecutive nights and cleared every morning. Captured animals were marked for identification purposes. Routine body measurements, weights and the reproductive condition of the animals were recorded. The twenty-two sites were trapped from March to April 1987. In August to September nine of the sites showing evidence of bandicoot diggings were retrapped. Five trapping stations were arranged in cross pattern spaced 50 m apart at each site and each

station consisted of one wire cage and two Elliott traps.

Hair tubes made from PVC piping of 5 cm and 8.5 cm diameters (Suckling 1978) were used for the detection of arboreal animals. Tubes were lined with strips of 2.5 cm double-sided tape. Five tubes (three small and two large) were attached horizontally approximately 2 metres above the ground in separate trees at each of the trapping sites. The tubes were baited and left in place for five nights. Hairs were identified by comparison to known reference samples (Brunner and Coman 1974).

Spotlighting (17 hours) was carried out at ten trapping sites and along tracks and roads between June and September. A hand held spotlight attached to a 12 volt motorcycle battery was used and spotlighting was carried out between sunset and midnight. The presence of scats, diggings, tracks and bones of small mammals were also recorded (Triggs 1984; Morrison 1981).

Floristics and structure of vegetation at study sites

Two 10 m x 1 m quadrats located randomly at the trapping sites were used to analyse the vegetation floristics. The cover/abundance of plant species, litter, bare ground and rocks were visually estimated using the Braun-Blanquet scale (Gullan 1978). Structural attributes of the vegetation were also recorded at the sites. The presence or absence of canopy cover directly above was recorded (using a crosshair telescope) every 2.5 m along a 100 m transect. The percentage Projective Foliage Cover (%PFC) was used to confirm the community classifications defined on the vegetation map. The heights of the upper, mid and under stories were measured. The density of the under storey and mid storey was measured by visually estimating the density of vegetation in three levels; 0 - 0.6 m; 0.6 - 1.2 m; 1.2 - 3 m. The density was scored using the six percentage intervals (< 1%; 1-5%; 5-25%; 25-50%; 50-75%; 75-100%). Six points were measured along a 10 m transect and averaged. The number of logs and sticks present on the site were estimated by counting all occurrences along a 100 m transect and grading them into four size categories.

The presence of diseased and dying *Xanthorrheoa australis* and *Isopogon ceratophyllus* were used to identify active *P.cinnamomi* infection. Remnant bases of *X.australis* and the absence of *I.ceratophyllus* were features used to identify sites previously infected with *P.cinnamomi*. At the study sites a visual estimation of the area (percentage) infected was made.

Analyses of data

The data was analysed to compare small mammal abundance, number of species and species abundance in vegetation communities. Means were compared using the Kruskal-Wallis One Way Layout test (Manoukian 1986). Significant differences between the means were compared using a nonparametric method of multiple comparisons (Conover 1980). Stepwise multiple regression was used to analyse the contribution of habitat components to small mammal abundance and species richness. Only those habitat components which made a significant contribution ($\alpha = 0.05$) where included in the regression equation. R- squared values approaching 100 indicate a large proportion of the total variability explained by the regression. The habitat components used in the regression included the number of plant species, abundance of litter, bare ground cover, rock cover, height of the understorey, height of the midstorey, height of the upperstorey, projective foliage cover, density of vegetation between 0-0.6 m, density of vegetation between 0.6-1.2 m, density of vegetation between 1.2-3.0 m, number of logs < 10 cm diameter, number of logs 10-20 cm, number of logs 20-40 cm, number of logs 40-60 cm, percentage area exhibiting 'dieback' symtoms and abundance of sedges.

Results

Description and mapping of vegetation communities

The vegetation map showing the distribution of the five vegetation communities is shown in Fig. 2. Table 1 contains a summary description of the communities, the percentage of the study area they cover and the number of study sites in each community. A major portion of the study area is covered by riparian and open forests. Woodland and heathlands cover approximately 15 % of the study area and are concentrated in the north-eastern area of the park on Tertiary sands and clays (Fig. 3). There are no woodland and heathland communities on soils from the Lower Cretaceous. The closed shrubland

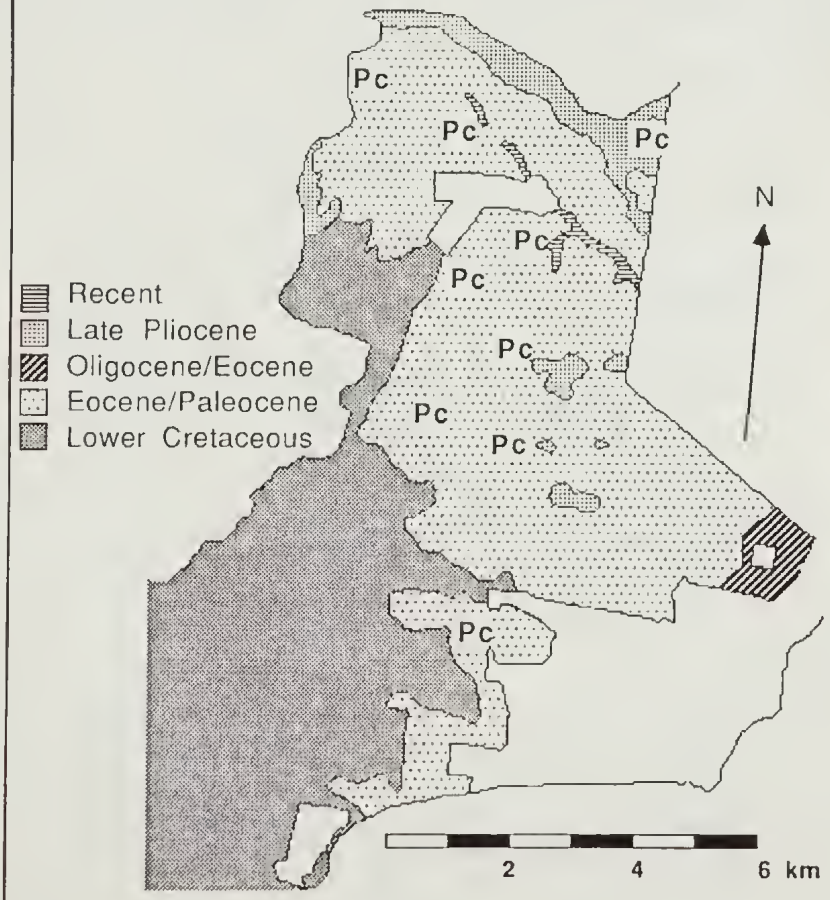
Figure 2. Vegetation map of the study area showing five major plant communities.

communities make up less than one 1% of the study area and are found mostly along Salt and Distillery Creek. The observed infestations of *P.cinnamomi* within the study area are shown in Fig. 3. The effects of *P.cinnamomi* were not observed on soils of the Lower Cretaceous.

Mammal species recorded

Seventeen mammal species were recorded (Table 2). Nine species were detected by trapping. Three species, (*Antechinus stuartii, Mus musculus, Petaurus breviceps*) and a *Rattus* species were detected by hair tubes. Two species, *Pseudochierus peregrinus* and *P.breviceps*, were detected by spotlighting. The presence of *Tachyglossus aculeatus* and *Oryctolagus cuniculus* were detected by observations of diggings and scats. The most widely dis-

Figure 3. Geology map of the study area, showing different sedimentary rocks. (Anglesea: Geological Survey Map, 1980) and the observed distribution of *Phytophthora cinnamomi* (Pc).



tributed small mammal species were *R.fuscipes*, *R.lutreolus* and *A.stuartii* (Table 2).

Abundance and diversity of small mammals in vegetation communities

The abundance of small mammals in each community is shown in Table 3. There was a significant difference ($p < 0.05$) between the mean total abundance of small mammals in the five vegetation communities. The nonparametric post test (Table 4) showed that the abundance of small mammals was significantly ($p < 0.05$) higher in riparian open forest when compared to open forest, woodland and heathland communities. Although a high abundance was recorded in closed shrubland there was no significant difference from the other communities.

Stepwise regression of the habitat components against total small mammal abundance revealed that the density of vegetation between 0-60 cm was the most significant variable in explaining the variations in small mammal abundance (R-squared = 49.49).

There was a significant difference ($p < 0.05$) between the mean abundance of *R.fuscipes* in the five vegetation communities (Table 3). The nonparametric post test showed that the abundance of *R.fuscipes* was significantly higher in riparian open forest compared to open forest, woodland and heathland communities (Table 4). *S.leucopus* was more abundant ($p < 0.05$) in heathlands compared to riparian open forest. No significant differences were observed ($p > 0.05$) for the other species.

Table 2. Mammal species recorded and the method of detection.

D - Diggings H - Hair tubes S - Spotlighting T - Trapping
Sk - Skats O - Observed C - Common U - Uncommon
* - introduced species

Species		Method of Detection	Number of Sites
MONOTREMES			
Tachyglossidae			
Tachyglossus aculeatus	(Short-beaked Echidna)	D	C
MARSUPIALS			
Dasyuridae			
Antechinus stuartii	(Brown Antechinus)	T, H	21
Sminthopsis leucopus	(White-footed Dunnart)	T	1
Peramelidae			
Isoodon obesulus	(Brown Bandicoot)	T,D	4
Perameles nasuta	(Long-nosed Bandicoot)	T	1
Petauridae			
Pseudocheirus peregrinus	(Common Ringtail Possum)	S	4
Petaurus breviceps	(Sugar Glider)	S, H	4
Macropodidae			
Macropus giganteus	(Eastern Grey Kangaroo)	O, Sk	C
Macropus rufogriseus	(Red-necked Wallaby)	O	U
Wallabia bicolor	(Swamp Wallaby)	O	C
PLACENTAL MAMMALS			
Muridae			
Rattus fuscipes assimilis	(Bush Rat)	T, H	21
Rattus lutreolus lutreolus	(Swamp Rat)	T	19
Rattus norvegicus	(Brown Rat)*	T	3
Mus musculus	(House Mouse)*	T, H	7
Canidae			
Vulpes vulpes	(Fox)*	O,Sk	C
Felidae			
Felis catus	(Feral Cat)*	T	1
Leporidae			
Oryctolagus cuniculus	(European Rabbit)*	D,Sk,O	7

Table 3. Abundance of the nine small mammal species trapped in each community. Figures given are mean (±SD) captures per 100 trap nights. ROF - Riparian Open Forest OF - Open Forest W - Woodland H - Heathland C - Closed Shrubland * - Introduced species.

Species	Vegetation Communities					Kruskal-Wallis Comparison of Means
	ROF	OF	W	H	CS	
Antechinus stuartii	9.34(6.6)	6.69(4.0)	4.90(4.5)	6.65(2.1)	8.35 (0.8)	
Isoodon obesulus	0.00(0.0)	0.21(0.4)	0.72(1.0)	0.00(0.0)	0.00 (0.0)	
Perameles nasuta	0.00(0.0)	0.12(0.4)	0.00(0.0)	0.00(0.0)	0.00 (0.0)	
Rattus fuscipes	23.56(9.2)	10.78(7.3)	5.72(3.6)	2.95(3.2)	11.10 (4.7)	p<0.05
Rattus lutreolus	10.68(7.0)	3.00(3.2)	8.20(6.7)	6.30(4.7)	15.00 (5.5)	
Sminthopsis leucopus	0.00(0.0)	0.00(0.0)	0.00(0.0)	0.75(1.1)	0.00 (0.0)	p<0.05
Felis catus *	0.00(0.0)	0.14(0.3)	0.00(0.0)	0.00(0.0)	0.00 (0.0)	
Mus musculus *	0.44(0.9)	0.90(1.8)	1.38(1.7)	0.35(0.5)	0.55 (0.8)	
Rattus norvegicus *	0.44(0.6)	0.00(0.0)	0.83(1.7)	0.00(0.0)	0.00 (0.0)	
Total Abundance	44.46(5.4)	21.84(11.4)	21.75(10.1)	17.00(0.9)	35.00(10.2)	p<0.05

Stepwise regression revealed that the density of vegetation between 60 and 120 cm and the height of the upper storey to be significantly correlated (R-squared = 64.97) with the abundance of *R.fuscipes*. The abundance of *A.stuartii* was best explained by the height of the mid storey (R-squared = 42.59). The abundance of *R.lutreolus* was significantly explained by the number of logs (0-10 cm), the height of the upper storey and the cover/abundance of litter (R-squared = 63.73) (Table 4).

The mean number of small mammal species present was not significantly different ($p > 0.05$) between the five vegetation communities.

The presence or absence of *P.cinnamomi* was not a significant factor in explaining abundance of small mammals or individual species.

Discussion

The vegetation communities in the Angahook-Lorne State Park have been mapped previously (LCC 1974, 1976) and those in the adjacent ALCOA lease area were recently mapped in more detail (LCC 1987). The present study has provided a more detailed and accurate map of the vegetation communities in the eastern section of the park than was previously available. The map shows that the major vegetation communities in the study area are open forest and riparian open forest. Woodlands and heathlands comprise only 15% of the study area and closed shrublands are not well represented. These communities represent the western extension of the vegetation communities of the ALCOA lease area which have been recognised for their diversity (LCC 1987).

The plant pathogen *P.cinnamomi* was recorded only in heathland and woodland communities on soils of Tertiary origin. *P.cinnamomi* has previously been reported as being present on Tertiary soils in the area (LCC, 1976). These infertile sand and gravel soils are conducive to the spread of *P.cinnamomi* (Weste and Marks 1987). The presence of *P.cinnamomi* is likely to result in changes in the floristic composition and possibly simplification of these highly diverse communities (Weste and Marks

Table 4. Summary of a nonparametric post test and stepwise multiple regression analysis.
ROF - Riparian Open Forest OF - Open Forest W - Woodland H - Heathland

Species	Nonparametric Post Test	Regression of Habitat Components	R^2
Total Abundance	ROF > OF ROF > W ROF > H	Density of Vegetation 0 - 60 cm	49.49
R. fuscipes	ROF > OF ROF > W ROF > H	Density of Vegetation 60 -120 cm; Height of Upperstorey.	64.97
R. lutreolus	-	Logs (0-10 cm); Height of Upperstorey; Litter cover.	63.73
A. stuartii	-	Height of Midstorey	42.59
S. leucopus	H > ROF	Not tested	-

1974). A recent study has also reported that *P.cinnamomi* is a significant disturbance factor affecting the diversity and abundance of small mammal species (Wilson *et al.* in press). This was not the case in this study. Possibly too few sites were examined for significant differences to be observed. Seventeen mammal species, including five introduced species were recorded during the study. All of these species have been recorded previously within the park (Vose *et al.* 1987; King 1986; Conole and Baverstock 1983) except for the White-footed Dunnart (*Sminthopsis leucopus*) which was recorded for the first time. A number of species including *C.nanus, A.minimus* and *P.novaehollandiae* which have been recorded adjacent to the park (Wilson *et al.* 1986; Wilson and Moloney 1985 a) were not recorded. In this study a number of techniques were used to detect mammal species. The use of a range of techniques resulted in the detection of a larger number of species than would have been recorded with any one technique. The importance of using several techniques for the detection of mammal species has also been discussed by Lunney and Barker (1986). Species such as *R.fuscipes, R.lutreolus* and *A.stuartii* were widely distributed, being detected at nearly all sites. Previous studies in the adjacent ALCOA lease area have reported wide distributions for these species (Wilson and Moloney 1985a; Wilson *et al.* in press). *I.obesulus* had a limited distribution and occurred at only four sites. Only one capture of *Perameles nasuta* was made in the study area, however the species is considered to be common in the western section of the park (Wallis 1985; Conole and Baverstock 1983). *Petaurus breviceps* was detected at four sites in the park using spotlighting and hair sampling techniques. Further spotlighting and arboreal trapping may identify a wider distribution for this species. *Pseudochierus peregrinus* was detected by spotlighting at three sites in the park and may also be more widely spread than indicated in this study. *Felis catus* was captured on one site close to cleared farm land, however its distribution in the area is not known. Wallis (1985) considered that feral cats were not a significant problem in Victorian natural habitats. There has been little work done however to investigate their effect on native mammals.

There was a significant difference in the abundance of small mammals between three of the vegetation communities. Riparian open forest had significantly higher numbers of small mammals than open forest and woodland. There was a large difference in the total abundance in heathland compared to riparian open forest however this was not significant. The lack of significance may be due to the low sample size of heathland sites (n=2). The highest abundance was recorded in riparian open forest communities. The understories of such communities typically have a greater density of vegetation (Table 1) and in this study the density of vegetation between 0-60 cm was the most significant variable associated with the variations in small mammal abundance. Thus riparian communities support a higher abundance of small mammals, in particular herbivores and omnivores such as *R.lutreolus* and *R.fuscipes*.

The abundance of *R.fuscipes* was significantly greater in riparian open forest compared to woodland and heathland. Two factors, the density of vegetation (60-120 cm) and the upperstorey height, contributed most to this difference in abundance. Previous studies have also found that *R.fuscipes* is associated with moist, structurally complex vegetation (Barnett *et al.* 1978; Braithwaite *et al.* 1978). Heathlands and woodlands are typically drier and structurally simpler than the other vegetation communities and the abundance of *R.fuscipes* is lower. *S.leucopus* which was captured at only one heathland site has been recorded at a number of sites outside the park in heathland, heathy woodland and sand-dune

communities (Wilson *et al.* 1986, in press; Wilson and Moloney 1985; Menkhorst in prep.). These communities are similar to the habitats where it has been recorded elsewhere in Victoria (Morton *et al.* 1980)

There was no significant difference between the number of small mammal species in the five structural communities. Wilson *et al.* (in press) however found differences in small mammal species richness in communities classified on a floristic basis. This may indicate that a floristic classification is capable of identifying more communities than those identified by structural attributes and may be more useful for identifying the preferred habitats of species such as *R.lutreolus* (Braithwaite *et al.* 1978).

There were no significant difference in abundance of two species, *R.lutreolus* and *A.stuartii* between vegetation communities. However significant factors were identified that contributed to their habitat preferences (Table 4). Two structural factors, litter cover and the presence of logs (0-10 cm), were important for *R.lutreolus* and together may represent a need for cover. Previous studies have identified a high sedge component as a requirement for the habitat preference of this species (Watts and Braithwaite 1978). One structural feature was identified as significant for *A.stuartii* (height of mid-storey) and may be important for this scansorial species. *A.stuartii* has previously been reported as being associated with thick shrub layers (Statham and Harden 1982).

The first record of *Sminthopsis leucopus* in the park is of local significance. The preservation of habitats such as the heathlands and heathy woodlands is important for this uncommon species. The distribution of *S.leucopus* is within 50 km of coastal areas of Victoria (Morton *et al.* 1980). The heathlands in the eastern section of the park are part of one of the richest floristic locations in Victoria and the Bald Hills heathland is the only remaining coastal dry heathland in Victoria (LCC 1987). Any management plan should recognise the importance and size of the heathland and heathy woodland component of the park. The LCC (1987) has proposed that 1,390 ha of the adjacent ALCOA lease area be excised and proclaimed as a flora reserve. This is an important recommendation and will provide significant protection for the heathland communities which are not adequately represented in the Angahook-Lorne State Park. Greater protection could have been provided however if the park and the proposed flora reserve had been made contiguous.

The study area is subjected to a range of disturbance factors which have impacts on the small mammals and their habitats, and implications for the management of the park. Recreational four-wheel drive vehicles and trail bikes have caused substantial soil erosion in the area (Vose *et al.* 1987). They may also contribute to the spread of the fungus *P.cinnamomi*. It is recommended that trail use be rationalised to decrease erosion and destruction of vegetation as well as the spread of the pathogen *P.cinnamomi*. Restricted access and protection of uninfected areas is also recommended. Although the utilisation of minor forest produce for firewood has been recommended by the LCC (Vose *et al.* 1987) this practice could be removing important components of mammal habitats. Barnett *et al.* (1978) found *A.stuartii* to be associated with large numbers of logs. Dense vegetation is also an important habitat component for small mammals (Statham and Harden 1982; this study). Little is known about the impact of the wood cutting upon mammals. Studies should be implemented to assess the effect of log removal and vegetation damage associated with wood cutting. Meanwhile strict controls should be placed on the volume and site of wood removal. These problems should be addressed so that the habitats of significant small mammal species in the park be maintained.

Acknowledgements

Thanks to the following people for their invaluable assistance with this project.

Maree McGlynn and Margo Gilbert for their assistance with the field work. Mary White for helping identify plant species. Ross Gollan and Gary Ridgeway for their help with the statistical analysis. Dr Charles Meredith for explaining airphoto interpretation. Damien Moloney and Graeme Newell for their constructive criticisms. We pay tribute to Alexia Everett our colleague and friend who died recently.

This live-capture and release study was carried out under the National Parks and Wildlife permit no. 87-45.

References:

Ahern, L.D., Brown, P.R., Robertson, P. and Seebeck, J.H. (1985). Application of a taxon priority system to some Victorian vertebrate fauna. Department of Conservation, Forests and Lands. *Arthur Rylah Instit. Tech. Rep. Series* No 30.

Barnett, J.L., How, R.A. and Humphreys, W.F. (1978). The use of habitat components by small mammals in eastern Australia. *Aust.J.Ecol.* 3: 277-285.

Bourne, A.R., Kentish, K.M., Moloney, D.J. and Wilson, B.A. (In press). Small mammal recolonisation of revegetated heath woodland after open-cut coal mining at Anglesea, Victoria. *Aust. Wildl. Res.*.

Braithwaite, R.W., Cockburn, A. and Lee, A.K. (1978). Resource partitioning by small mammals in lowland heath communities of South-eastern Australia. *Aust.J.Ecol.*, 3: 423-45.

Brunner, H. and Coman, B.J. (1974). 'The identification of mammalian hair'. (Inkata Press: Melbourne).

Conole, L.E. and Baverstock, G.A. (1983). Mammals of the Angahook-Lorne Forest Park. *Victorian Nat.* 100: 224-32.

Conover, W.J. (1980). *In* 'Practical Nonparametric Statistics' 2ed. (John Wiley and Sons: New York), p229-32.

Dawson, P. and Weste, G. (1985). Changes in the distribution of *Phytophthora cinnamomi* in the Brisbane Ranges National Park between 1970 and 1980-81. *Aust.J.Bot.* 33:309-15.

Dawson, P., Weste, G. and Ashton, D. (1985). Regeneration of Vegetation in Brisbane Ranges after fire and infestation by *Phytphthora cinnamomi*. *Aust.J.Bot.* 33:15-26.

Gullan, P.K. (1978). Vegetation of the Royal Botanical Gardens Annexe at Cranbourne, Victoria. *Proc.R.Soc.Vict.* 90: 225-40.

Kennedy, J and Weste, G. (1986). Vegetation changes associated with invasion by *Phytophthora cinnamomi* on monitored sites in the Grampians, Western Vict. *Aust J.Bot.* 34:251-79.

Kentish, K.M. (1981). The New Holland Mouse: a new record from Anglesea. *Geelong Nat.* 18: 3-7.

Kentish, K.M. (1983). Mine rehabilitation: A study of revegetation and fauna return at Anglesea, Victoria (1980-1982). MSc thesis, Deakin University.

King, D.F. (1986). Further fauna surveys at Moggs Creek - post Ash Wednesday wildfire. *Geelong Nat.* 23: 81-4.

Land Conservation Council (1974). Melbourne Area: District 1 report.

Land Conservation Council (1976). Report on the Corrangamite Study Area. (Land Conservation Council: Victoria).

Land Conservation Council (1985). Report on the Melbourne Area, District 1 Review. (Land Conservation Council: Victoria).

Land Conservation Council (1987). Melbourne Area: District 1 review. Final recommendations. (Land Conservation Council: Victoria).

Lunney, D. and Barker, J. (1986). Mammals of the Coastal Forests near Bega, New South Wales 1. Survey. *Aust.Zool.* 23: 19-28.

Manoukian, E.B. (1986). 'Mathematical Nonparametric Statistics'. (Gordon and Breach Science Publishers: New York). pp. 270-283.

Menkhorst, P., Bennett, A. and Lumsden, L. (1987). Conservation status of mammals in Victoria. *In* 'Nature Conservation in Victoria'. D. Frood and M. Calder. Report to the Victorian National Parks Assoc. Inc.

Menkhorst, P.(In prep.). 'Mammal Atlas of Victoria'. (Arthur Rylah Institute: Melbourne).

Meredith,C.(1986). The vegetation of the Anglesea Lease Area. Report prepared for the Land Conservation Council, Victoria.

Morrison, R.G.B., (1981). 'A field guide to the tracks and traces of Australian animals'. (Rigby Publishers : Adelaide).

Morton, S.R., Wainer, J.W. and Thwaites, T.P. (1980). Distributions and habitats of *Sminthopsis leucopus* and *S. murina* (Marsupialia: Dasyuridae) in southeastern Australia. *Aust.Mamm.* 3: 19-30.

Specht, R.L. (1970). Vegetation. *In* 'The Australian Environment' 4th edn. Ed G.W. Leeper. (CSIRO and Melbourne University Press: Melbourne).

Statham, H.L. and Harden, R.H. (1982). Habitat utilization of *Antechinus stuartii* (Marsupialia) at Petroi, Northern New South Wales. *In* 'Carnivorous marsupials'. Ed. M. Archer (Royal Zoological Society) pp165-85.

Suckling, G.C. (1978). A hair sampling tube for the detection of small mammals in trees. *Aust.Wildl.Res.* 5: 249-52.

Triggs, B. (1984). 'Mammal tracks and signs'. (Oxford University Press: Melbourne).

Vose, K., Simpson, G. and Parr Smith, G., (1987). Angahook-Lorne State Park Resource Inventory. National Parks and Wildlife Service.

Wallis, R. (1985). Mammals around the Barramunga Area, Otway Ranges. *Geelong Nat.* **22**: 90-100.
Wark, M.C., White, M.D., Robertson, D.J. and Marriott, P.F. (1987). Regeneration of heath and heath woodland in the north eastern Otway Ranges following the wildfire of february 1983. *Proc. R. Soc. Vict.*, **99**: 51-88.
Watts, C.H.S. and Braithwaite, R.W. (1978). The diet of *Rattus lutreolus* and five other rodents in Southern Victoria. *Aust.Wildl.Res.* **5**: 47-57.
Weste, G. and Marks, G.C., (1987). The biology of *Phytophthora cinnamomi* in Australasian forests. *Ann. Rev. Phytopathol.*, **25**: 207-29.
Weste, G. (1974). PC. The cause of severe disease in certain native communities in Victoria. *Aust.J.Bot.* **22**:1-8.
Weste, G. (1981). Changes in the vegetation of Sclerophyll shrubby woodland associated with invasion by *Phytophthora cinnamomi*. *Aust.J.Bot.* **29**: 261-76.
White, M.D. (1984). Native plants list, Anglesea, Aireys Inlet. Unpub. Rep.
Wilson, B.A. and Bourne, A.R. (1984). Reproduction in the male dasyurid *Antechinus minimus maritimus* (Marsupalia: Dasyuridae). *Aust.J.Zool.*, **32**: 311-18.
Wilson, B.A. and Moloney, D.J. (1985 a). Small mammals in the Anglesea-Aireys Inlet area of Southern Victoria - a post fire survey. *Victorian Nat.* **102**: 65-70.
Wilson, B.A. and Moloney, D.J. (1985 b). Small mammal recolonization and vegetation regeneration in fire-affeeted areas of the Anglesea-Aireys Inlet Region. Report to Ministry of Conservation, Forests and Lands, Victoria.
Wilson, B.A. (1986). Reproduction in the female dasyurid *Antechinus minimus maritimus* (Marsupalia: Dasyuridae). *Aust.J.Zool.*, **34**: 189-97.
Wilson, B.A., Bourne, A.R. and Jessop, R.E. (1986). Ecology of small mammals in coastal heathland at Anglesea, Victoria. *Aust.Wildl.Res.*, **13**: 397-406.
Wilson, B.A., Robertson, D., Moloney, D.J., Newell, G. and Laidlaw, W.S. (In press). Factors affeeting small mammal distribution and abundance in the eastern Otway Ranges, Victoria. *Proc. Ecol. Soc. Aust.*, **16**:.

Terrestrial Molluscs in the Sunraysia Area in North Western Victoria

J.H. Browne*

Introduction

During 1988 and autumn and early winter 1989, a check was made of the terrestrial molluscs in the Sunraysia irrigation area and surrounding bushland areas mostly at sites up to 35 km from Red Cliffs but including a few outlying ones (Table 1). The molluscs were identified using the field guide of Smith and Kershaw (1979).

The study area has a mediterranean-type climate with a mean annual rainfall of about 270 mm. The soils are neutral to alkaline with a wide range of surface textures; many are calcareous. The regional context is described fully in LCC (1987).

During this survey, five introduced slugs and five introduced and six native snails were found. This represents most but not all of the species that have been recorded for the area over the years. Voucher specimens of all species referred to in this paper have been lodged in the Museum of Victoria, Melbourne. Asterisks will be used to indicate introduced species. All habitat notes given apply to the area defined above.

*52A Fitzroy Avenue, Red Cliffs, Victoria 3496.

Introduced Slugs

To the casual observer there is very little to distinguish the different species found here, but after closer examination the species can be easily separated. Apart from an occasional record in bushland, usually close to where domestic rubbish has been dumped, all are confined to damp areas, generally in household gardens. Slugs from two families were found.

(a) Limacidae

(i) **Deroceras caruanae* (Fig. 1)

Body secretions colourless and non-viscous; easily seen by scraping back of animal, e.g. with a knife. Although sometimes difficult to separate from young *D.*

reticulatum, D. caruanae is slimmer, more uniform in colour and never has white mucus. Although the Museum of Victoria has five collections of this species from the area, it was found only once — in litter under a plum tree.

(ii) **Deroceras reticulatum*
Found in introduced vegetation in damp places.

(iii) **Lehmannia flava* (Fig. 1)
In decaying vegetation in damp situations around human dwellings.

(iv) **Lehmannia nyctelia* (Fig. 1)
The dark stripes along the back of this animal assist in its identification. Found around gardens, sometimes in drier areas such as in the litter under fruit trees, etc.

(b) Milacidae

**Milax gagates* (Fig. 1)
An obvious dorsal keel extending from the tail to the mantle makes this animal easy to separate from the others. Found among introduced plants in damp situations.

Thus, of the seven species of introduced slugs in Victoria, five were recorded from this area. In addition, the Museum of Victoria has a *Limax maximus* (Leopard Slug) specimen from Mildura. Failure to find this species is not surprising as it often occurs more sparsely and spasmodically than the other species (G.G. Allen personal communication).

While *Deroceras reticulatum* and *Milax gagates* were recorded commonly in gardens in the area, the other three species were uncommon, being found only in a single location in Red Cliffs. No native slugs were found nor have any been recorded previously in this area.

Introduced Snails

(a) Helicidae

(i) **Helix aspersa* (Fig. 2)
This is the common and well known garden snail; found in local gardens and irrigated properties, roadsides and some bushland areas close to irrigated properties.

(ii) **Theba pisana* (Fig. 3)
Usually found in large, dense populations sealed onto trees and

Table 1. Occurrence of native terrestrial snails in the Sunraysia area and some nearby areas, 1988-89.

Species	Specimens seen	Location numbers
Gastrocopta margaretae	Empty shells only	1 (two colonies 50 m apart)
Pupilla australis	Only one live animal	1, 2, 3, 4, 5, 6
Pupoides adelaidae	Empty shells only	1, 2, 4, 5
Paralaoma caputspinulae	Empty shells only	1, 2, 3, 5
Elsothera murrayana	Numerous live animals	1, 7
Succinea australis	Numerous live animals	8, 9, 10, 11

Key to location numbers

1. Railway reserve 1.5 km N of Red Cliffs
2. Bushland 4.5 km SE of Red Cliffs
3. Stewart Bushland Reserve 3.5 km SE of Red Cliffs
4. N edge of Sunset Country 15.5 km SSW of Carwarp
5. Bannerton Bushland Reserve 10 km S of Robinvale
6. Wymlet-Annuello Corridor near S end of Hattah-Kulkyne National Park
7. 52A Fitzroy Avenue, Red Cliffs
8. Lake Ranfurley 4 km W of Mildura
9. Sandalong Park 4 km E of Mildura
10. S end of King's Billabong State Game Reserve

Fig. 1 Four alien slug species. **(a)** *Milax gagates* **(b)** *Lehmannia flava* **(c)** *Deroceras caruanae* **(d)** *Lehmannia nyctelia* — immature (e) *L. nyctelia* — mature, but lighter colour than normal. All collected from Red Cliffs. Scale bar = 1 cm.

posts. A severe pest of gardens, crops and also found in open grass and bushland within the cultivated area. They become active with rain. Although not recorded for the district by Davis (1964, 1965), it is thought to have reached there in about 1961 and to have reached 'plague proportions' throughout the area by 1971 (Borlace 1971).

(iii) **Cernuella virgata* (Fig. 4)
Found sealed onto trees, posts and vegetation within the drier parts of this area. Can form large populations along roadsides and in open grassland. Also becomes active with rain. Can be similar in appearance to, and therefore difficult to separate from, small *Theba pisana.* As it was not recorded from the area by Davis (1964, 1965) or by Borlace (1971) it may have arrived sometime since 1971.

(iv) **Cochlicella ventrosa* (Fig. 5)
Found under groundcover plants, on leaves and stems in gardens and cultivated areas. Can be common here on roadside vegetation and grassy areas during rain.
**Cochlicella acuta,* recorded as uncommon in this general area (Smith and Kershaw 1979), was not found.

(b) *Zonitidae
**Oxychilus alliarius* (Fig. 6)
The only known locality is in a bush-house where they are found under flower pots, in drainage holes and other damp areas. As they have been known to have been there for many years they can be expected to be in other similar areas in the district. The species range is recorded as throughout S.E. Australia.

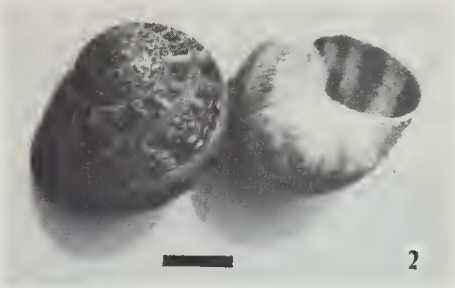


Fig. 2. *Helix aspersa,* Red Cliffs. Scale bar = 1 cm.
Fig. 3. *Theba pisana,* Red Cliffs. Scale bar = 1 cm.
Fig. 4. *Cernuella virgata,* Red Cliffs. Scale bar = 1 cm.
Fig. 5. *Cochlicella ventrosa,* Red Cliffs. Scale bar = 1 mm.
Fig. 6. *Oxychilus alliarius,* Red Cliffs. Scale bar = 2 mm.

Apart from *O. alliarius,* all species of introduced snails were common as live animals in gardens, roadsides and vacant grassy areas within the Irrigation Settlement.

Native Snails

Four families were found, most species are very small. They were found by lying on the ground under mallees and shrubs and picking through the litter, also under the bark round stem bases. Colour refers to the shell of live specimens when these were available (see Table 1).

(a) Pupillidae

(i) *Gastrocopta margaretae* (Fig. 7)
Shells only have been found on two occasions, both in the litter under native shrubs such as *Cassia, Dodonaea, Acacia,* etc. They were found in the Railway Reserve just north of Red Cliffs. These small shells are difficult to find and there could be others of this complex in the arca.
G. bannertonensis has been recorded from mallee at Bannerton, outside this area to the S.E. The Victorian Mallee is about the southern limit of its range.

(ii) *Pupilla australis* (Fig. 8)
Body colour grey; mantle with white spots. This small but plump snail is the most common of the native land snails here. It has been found in the litter of many mallees and native shrubs over a wide area. Its distribution includes most of S.E. Australia but only the east side of Tasmania.

(iii) *Pupoides adelaidae* (Fig. 9)
In this district it has been found in the same area and habitat as, and usually along with, *Pupilla australis* but its numbers are always lower. Its range is central S.E. Australia extending into western Victoria.

(b) Punctidae

Paralaoma caputspinulae (Fig. 10)
Old shells still retain their colour. Because of its small size it has been difficult to find but it has been found in small numbers over a wide area. This has generally been in sandy soil such as that supporting *Eucalyptus incrassata*

Fig. 7. *Gastrocopta margaretae,* Red Cliffs. Scale bar = 0.5 mm.
Fig. 8. *Pupilla australis,* Red Cliffs. Scale bar = 1 mm.

where there is a deep mixture of decaying leaf litter and sand. No live animals were found. Range of this species is throughout S.E. Australia.

(c) Charopidae

Elsothera murrayana (Fig. 11)
It has been found in gardens usually in litter and in the litter under roadside native shrubs, but never in large numbers. It has not been found outside the settled areas. Settlement may have increased its numbers.

Fig. 9. *Pupoides adelaidae,* Red Cliffs. Scale bar = 1 mm.
Fig. 10. *Paralaoma caputspinulae,* Red Cliffs. Scale bar = 0.5 mm.

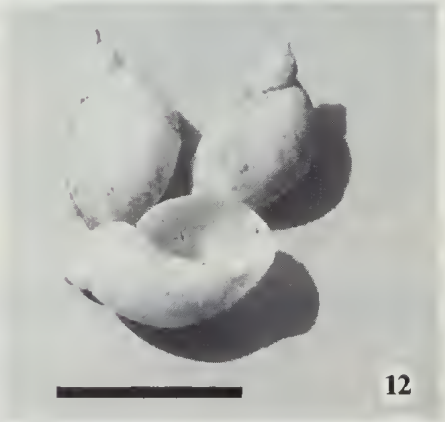


Fig. 11. *Elsothera murrayana,* Red Cliffs. Scale bar = 2 mm.
Fig. 12. *Succinea australis,* Sandalong Park, East of Mildura.
Scale bar = 0.5 mm.

(d) Succineidae

Succinea australis (Fig. 12)
Not uncommon on the black box floodplains on soils where temporary pools form after rain. Can also be found aestivating under black box bark or under logs and branches on the ground. It has also been found among samphire (*Halosarcia* spp.) at Lake Ranfurley, Sandalong Park and Towan Plains. *Succinea* closely resembles the introduced aquatic *Austropeplea tomentosa* found in dams and creeks and which is the main vector of sheep liver fluke.

Virtually nothing is known about the ecology of the native snails. This adds to the difficulty of collecting them and may be one reason why often only empty shells can be found rather than live animals (Table 1).

Apart from *Elsothera murrayana*, all native snail records were from litter under mallee eucalypts and native shrubs. However, none was found in litter under the native trees *Casuarina*, *Callitris* or *Heterodendrum*.

Despite detailed searching on four occasions, no native snails, alive or dead, have yet been found in Hattah-Kulkyne National Park. The reasons for this are unknown.

While Smith and Kershaw (1979) record *Sinumelon fodinale* from beneath *Triodia* in the general area, none have yet been found in this habitat or elsewhere. Although Smith and Kershaw (1979) map *Laomavix collisi* and *Magilaoma penolensis* from throughout south-eastern Australia including north-west Victoria, they have not yet been recorded either.

The present list of eleven terrestrial snails extends the preliminary list of five given by Davis (1964, 1965) for this region.

Acknowledgements

I wish to acknowledge the assistance of Dr. R.F. Parsons and Adrian Daniell both of La Trobe University for their help and for checking some specimens, of M. Bartley and T. Phillips for some of the photography and of G.G. Allen for advice on slugs.

References

Borlace, A. (1971). Census of non-marine molluscs of Victoria. Sunraysia Naturalists' Research Trust 8th Report, pp. 35-6.

Davis, B. (1964). Conchology. Sunraysia Naturalists' Research Trust 2nd Report (un-numbered pages).

Davis, B. (1965). Conchology. Sunraysia Naturalists' Research Trust 3rd Report, p. 41.

Land Conservation Council. (1987) 'Report on the Mallee Area Review.' (Land Conservation Council: Melbourne).

Smith, B.J. and Kershaw, R.C. (1979). 'Field Guide to the Non-Marine Molluscs of South Eastern Australia.' (ANU Press: Canberra).

Obituary

R. M. Bland

We regret to report the death of Dick Bland in September. Dick became a member of the Club in 1969, and was the Club's Auditor, a position which he had planned to fill in his retirement. We offer our sympathy to his wife Muriel.

'Greenhouse' and Wildlife Management in Victoria

Ian Mansergh and Simon Bennett*

"Think global and act local"

Introduction

In the context of global climate change, the word 'greenhouse' entered the language about two decades ago and has recently been the topic of much scientific and community debate throughout the world. An excellent series of articles relevant to the Australian scene is provided in 'Greenhouse: planning for climate change' (Pearman 1988). Adequate response to the problem will more than likely involve large-scale economic, political, social and attitudinal change. The present article concentrates on the predicted responses of fauna to 'greenhouse' and seeks to provide a small contribution to the ongoing debate.

What is 'greenhouse'?

Strictly speaking, the 'greenhouse effect' of the atmosphere has been the major element in allowing earth to create the conditions capable of sustaining life. Without the appropriate mix of greenhouse and non-greenhouse gases earth would have a vastly different climate; for example, in the absence of atmosphere, earth's mean temperature would be - 18° C, analogous to Mars. The 'greenhouse effect' has been positively benign and absolutely necessary for life. 'Greenhouse theory' contributed to accurately predicting the temperatures on Mars and Venus long before empirical evidence was able to confirm the predictions. Not bad evidence for a scientific theory. However, common modern usage of the term 'greenhouse effects' refers to human-induced changes to the atmosphere (i.e. increase in atmospheric 'greenhouse gases') (Henderson-Sellars and Blong 1989).

The 'greenhouse effect' is the name given to a predicted global warming, expect to occur because of an increase in atmospheric concentrations of CO_2 and other 'greenhouse' gases (e.g. chlorofluorocarbons, methane). These gases trap 'sunlight' to the earth, preventing some of the heat radiation escaping into space. The predicted warming would change weather and rainfall patterns at a rate unprecedented in the last 100,000 years and for some parameters e.g. temperature, the magnitude of change will increase further away from the equator (Pittock 1988). Such changes have the capacity to alter the floral and faunal composition, species dominance and the structure, function and distribution of ecosystems in a continental context (Graetz *et al.* 1988; Main 1988). Indeed, the fossil record indicates past changes in species and ecosystem distribution as a result of climate change (for the present purpose 'species' may be used interchangeably with biomes, communities, populations, subspecies and forms). To predict the magnitudes and effects of future changes, models of the worlds climate are required and various are being developed. At present the different scenarios produced by the models are a matter of scientific debate partly because global models are, of necessity coarse, in their resolution. The potential magnitude of the problem and the speed of its consequences demands that we implement a strategy for wildlife conservation.

Conservation of what?

The creation of National Parks and other conservation reserves was a major response of an increasing awareness of the Australian community for the need to conserve its faunal heritage. The tacit expectation was, and remains that these areas have and will retain the capacity to conserve the fauna. The question of which fauna was implicitly presumed to be that which occurs there at present. In Victoria,

*Arthur Rylah Institute for Environmental Research, 123 Brown St., Heidelberg, Victoria. 3084

about 8% of the land area is dedicated to such reserves but this 'system' was not designed to cater for gross macro-climatic changes of the kind predicted for 'greenhouse'. On the contrary, the size and location of many parks and reserves reflect Victoria's long history of the constraints imposed by earlier alienation of land for other uses. Further, since settlement the area of our forests and woodlands has been drastically reduced by over 60% and the de-afforestation continues, particularly in the west of the state (Woodgate and Black 1988). Over two thirds of the land area of the state is alienated from public ownership and much of the remainder is managed for other uses (e.g. timber production) where wildlife conservation is not the highest priority. Consequently, much of the remaining natural environments are disjunct and interspersed with radically altered environments providing little, if any, habitat continuity for a wide range of species. Thus the capacity for adjustment to changing distributions has been drastically reduced.

Faunal distribution and climate

Climate is an important environmental variable in determining the broad range limits of a species, particularly vertebrates. Climate determines, among other things, the moisture and temperature regimes to which flora and fauna species have become adapted. Gross climatic change induces change in faunal distributions, many of which will be permutations and combinations of the models in Fig. 1. Some species already have disjunct ranges, both natural and human-induced, and will be further compromised by 'greenhouse' changes such that their continued survival may depend on their capacity for dispersal.

Broadly, some species may benefit from climatic change and have an expanded range (s) (Type A, Fig. 1). Some species presently 'marginal' to Victoria may become more common. The present and future range(s) of a species may be overlapping or disjunct (Types B and C, Fig. 1) and their long-term security will depend on either continuity of habitat, their dispersal capabilities or both. Others (e.g. alpine specialists) will certainly have contracting ranges (Type D, Fig. 1). Predictions that the rate of change will be rapid warn us that we cannot assume that these distributional changes will occur gradually. An idealised altitudinal cross-section (Fig. 2) indicates the distributional changes over time. The actual future faunal distributions will be modified further by a range of interacting factors including; habitat fragmentation, absence of critical resources (e.g. nest hollows) introduced plants and animals (e.g. weeds, feral predators). Diseases etc. will also behave similarly in changing their distributions, e.g. Cinnamon fungus (*Phytopthora cinnamomi*).

Species at risk

Categories of species most at risk from the 'greenhouse' effects were identified by Peters and Darling (1986), and have been annotated with Victorian examples below:

i) genetically impoverished and/or localised populations, e.g. Helmeted Honeyeater (*Lichenostomus melanops cassidix*);
ii) poor dispersers and annual plants (some alpine species; e.g. at least four species of alpine stoneflies (*Thaumatoperia* spp. and many orchids);
iii) specialized species, especially those dependent on mature vegetation e.g. Leadbeaters Possum (*Gymnobelideus leadbeateri*) or reliant on symbiotic relationships e.g. Eltham Copper Butterfly (*Paralucida pyrodiscus lucida*);
iv) peripheral - disjunct populations, e.g. Brush-tailed Rock wallaby (*Petrogale penicillata*);
v) coastal species, e.g. Orange-bellied Parrot (*Neophema chrysogaster*), coastal form of Sheoak Skink (*Tiliqua casuarinae*);
vi) Montane and alpine species, e.g. Mountain Pygmy-possum (*Burramys*

parvus), Baw Baw Frog (*Philoria frosti*) and montane form of Sheoak Skink (Fig. 3).

Many species fall into one or more of these categories. Indeed about two-thirds of vertebrate fauna presently regarded as threatened in Victoria (CFL 1987) have one or more of these attributes. The Sheoak Skink has the most disparate range of any Victorian reptile (Norris and Mansergh 1981) and both populations appear in vulnerable climate/geographic zones (Fig. 3). The Orange-bellied Parrot falls into at least three of these categories and the Mountain Pygmy-possum, or *Burramys*, falls into four of the six categories, providing important case studies into the complexities of the problem.

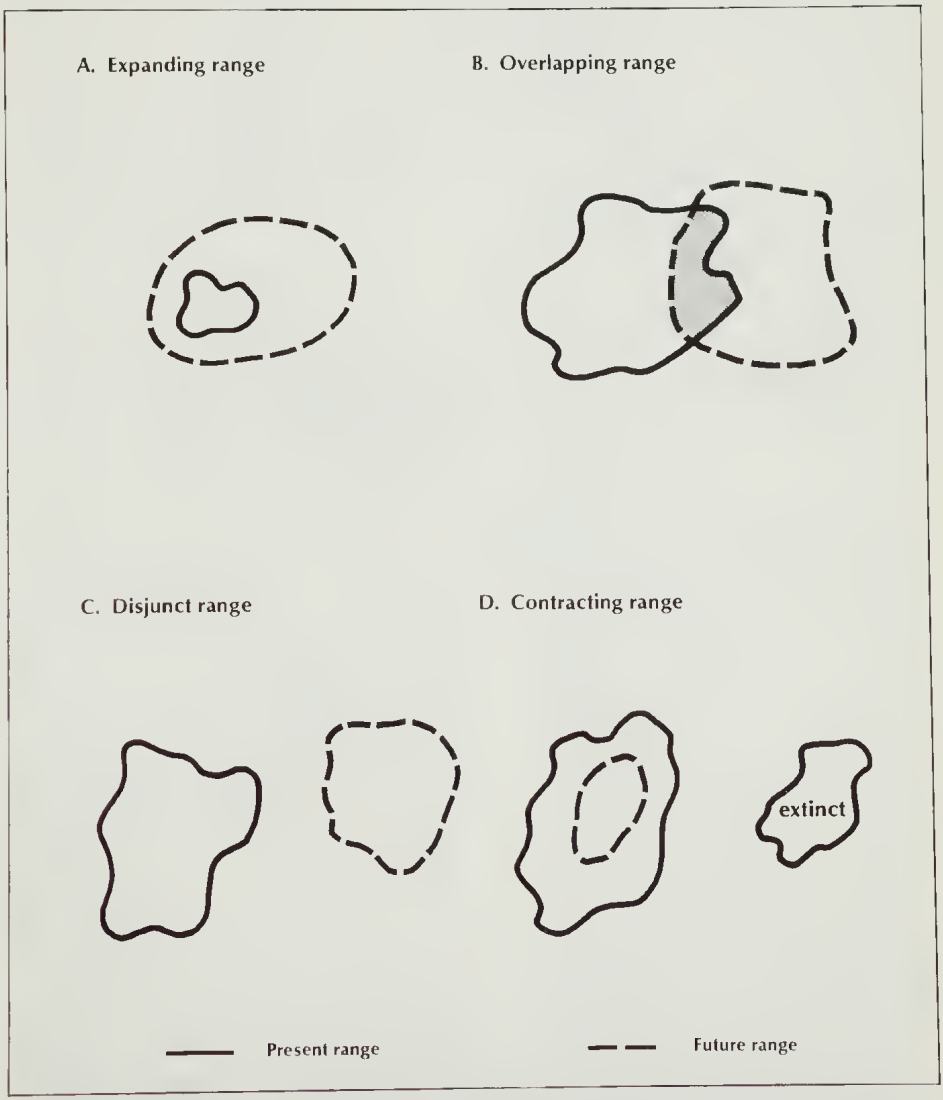


Fig. 1. Models of some faunal distributions under gross climatic change.

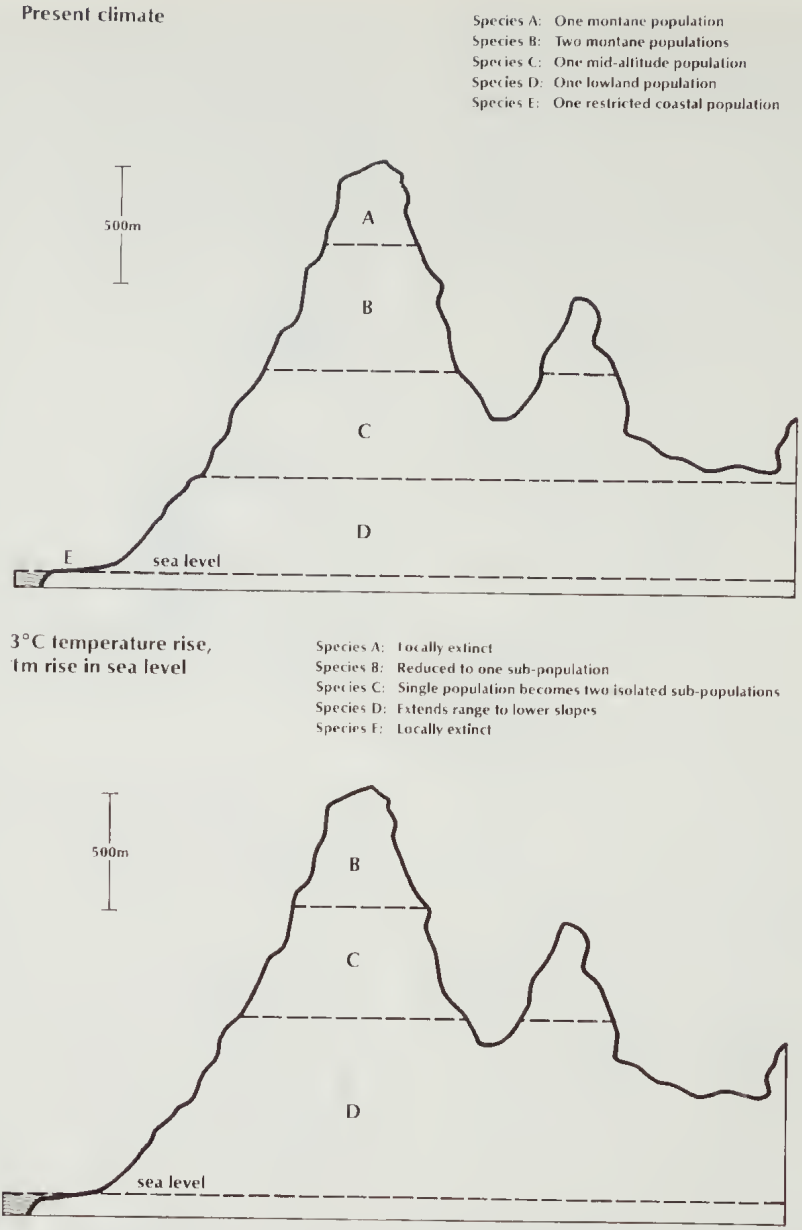


Fig. 2. Idealised altitudinal distribution of five species under **(top)** present climate and, **(bottom)** a scenario of a 500 m shift in altitude and 1 m rise in sea level in response to a 3 ° C rise in temperature from data in Pearman (1988) and Peters and Darling (1986). This scenario is within the range of the 'consensus climate' for 2030 predicted by the 'Greenhouse 87' conference (Pearman 1988). Specialist species to the montane-alpine and coastal habitats become locally extinct and distribution of all other species is altered.

Fig. 3. Distribution of the Shcoak Skink, the reptile with the most disparate range in Victoria. It occupies environments vulnerable at both ends of the spectrum, i.e. alpine and coast.

Two Victorian case studies

Burramys is Australia's only mammal that is restricted to the alpine-sub alpine region. It is currently regarded as vulnerable with a total breeding population estimated to be about 2,300 (Mansergh *et al.* 1989; Mansergh 1989 for data in this section) in at least four sub-populations (Mt Kosciusko, Mt Bogong, Bogong High Plains and Mts Loch - Higginbotham). It is restricted to periglacial rock screes supporting Mountain Plum-pine (*Podocarpus lawrencei*) wet alpine heathland, a mature seral stage plant community which provides a relatively mild microclimate in both summer and winter. Intolerant to heat (an hour at 30° C may be lethal to the possum), the species has been retreating 'uphill' since the last Ice Age to remain in the habitat. The predicted 'greenhouse' effects would appear to be a drastic acceleration of this trend of climatic warming (Fig. 2). For example, the mean snowline will rise about 100 m in altitude per 1° C of ambient warming.

The major food source of *Burramys* is the Bogong moth (*Agrotis infusa*) which breeds and spends its larval stages in the self-mulching soils west of the Great Dividing Range. Sub-adults aestivate in rock crevices and caves in the Alps during October to April. This rich food source is abundant at present and probably underwrites the current population levels of *Burramys*. The moth occurs in millions during the summer months; recently, substantial numbers invaded the new Parliament House in Canberra, attempting to use it as a suboptimal cave for aestivation. The Bogong Moth-possum relationship illustrates the potential complexities of 'greenhouse' with biological changes in one region having the capacity to change the status of other biota hundreds of kilometres away. Thus, to determine the effects of 'greenhouse' on the *Burramys* population, related effects elsewhere must be examined also. One question in this instance is, will favourable climatic conditions prevail over the suitable geological substrate to support the current (fluctuating) levels of the Bogong Moth population?

Other perceived medium term threats to *Burramys* and its habitat from predicted 'greenhouse' effects include:

i) reduction or elimination of rock scree formation due to the contraction of the region of freeze-thaw;
ii) burial of habitat by erosion (change in seasonal rainfall);
iii) invasion from lower altitudes; weeds especially Blackberries (*Rubus* spp. agg.) and increase in abundance of other small mammals, e.g. Bush Rat, (*Rattus fuscipes*);
iv) ambient temperature increase may make presently marginal habitat uninhabitable; and,
v) adverse effects on the Mountain Plum-pine. This species appears to have greatest growth rates in cold moist conditions (e.g. Errinundra Plateau). This plant may live for hundreds of years and in the alpine region grows very slowly. It is difficult to envisage the 're-creation' of the vegetation component of the optimum habitat for the possum at high altitudes in under 100 years.

On the other side of the ledger, perception of the 'greenhouse' effects may lessen the desirability of economic investment in the ski industry; the associated

developments of which have directly and indirectly destroyed habitat of *Burramys* (see Galloway 1988). Further, the optimum habitat provides a milder microclimate in both summer and winter because of the depth of the scree and vegetative cover. All other things being equal (which they never are!), it is likely that the habitat at present may provide a sufficient buffer for a 2 °C ambient temperature rise.

Major strategies used for *Burramys* conservation are to conserve and enhance all remaining areas of habitat in as healthy condition as possible, to maximise numbers of colonies and the total population. A captive breeding colony has been established for research, educational purposes and to increase our understanding of husbanding the species. Artificial corridors and tunnels were used to successfully reconnect fragmented habitat and restore the social organization of the species providing practical and effective means to manage some of the adverse effects of habitat destruction (Mansergh and Scotts 1989). Such experiments are important in demonstrating the 'tolerances' of species and the usefulness of 'manipulated' efforts for population conservation. Our understanding of this aspect of ecology will become of increasing importance.

Another of Victoria's threatened species, the Orange-bellied Parrot is also vulnerable to 'greenhouse'. It breeds in southwestern Tasmania and the total breeding population is less than 200, a large segment which over-winters in low-lying coastal saltmarsh (*Sarcocornia quinqueflora*) along the western shores and islands of Port Phillip Bay, Victoria. This habitat occurs, and has evolved in, circumscribed areas at the interface of the marine and shore environments (Brown *et al.* 1985). Use of over-wintering sites may be traditional.

Some of the 'greenhouse' effects that may directly impinge on the small populations of the Orange-bellied Parrot are: (a) rising sea levels (20-140 cm increases are predicted), (b) increased storminess and, (c) increased wind speeds (see Pearman 1988). The bi-annual migration across Bass Strait will be undertaken by a population that is already at dangerously low levels; it may become more hazardous and the changing weather, less predictable.

Coastal saltmarshes are extremely sensitive to sea level rises, so much so that they have been proposed as a suitable ecological model to examine the effects of sea level rises (Vandersee 1988). At present, erosion of the seaward margins of coastal saltmarsh is common in southeastern Australia. The Orange-bellied Parrot is a good example of many populations of wildlife that utilise the narrow coastal strip. Rising sea-levels could eliminate some existing areas of habitat, but whether adjacent areas would be able to be rapidly colonised by the vegetation is not known. Coastal habitats are typically linear and, in Victoria, the immediate hinterland is often grossly modified for human use. Further, as some coastal structures became increasingly vulnerable, measures to protect their economic values may eliminate the slender band of remnant natural vegetation.

Other considerations

At a more general level, the predicted changes will more than likely have effects on both natural and man induced fire regimes in areas of native vegetation. This will occur at a time when we are just beginning to appreciate the complex role of fire in conservation management of natural areas (L.C.C. 1977). The public and wildlife conservation agencies must remain active in influencing management practices that are primarily determined by considerations other than wildlife conservation.

Further, as it is likely that the distribution of most species will be affected, the present faunal complements of any area will also change. For example, the broad range of insectivorous species in our remaining forests assists in maintaining the health of that ecosystem. Changes in distribution of each component species and

at different rates may leave some habitat types more susceptible to disease or other malaise. Ironically, simplification of some environments may lead to potential complex problems.

Precursors of a strategy?

There are two prerequisites for a strategy: a desired goal and the capacity and will to be able to predict and adapt to changing future circumstances. Broadly, our goal in wildlife conservation is the conservation of genetic diversity and the preservation of the interactive biotic and abiotic processes we may loosely call 'evolution'. This goal demands free-ranging populations of species (and all recognisable and genetically distinct populations) existing in the natural environment in sufficient numbers to enable them to adapt and evolve within that environment(s).

General strategies for risk reduction

The above pencil sketches outline some of the complexities involved considering a single species, communities and natural or management induced events. So what can be done; what should be our strategies for wildlife conservation? 'Greenhouse' brings the following strategies into stark relief, but it should be noted that most of these strategies should be implemented as sound conservation measures, even in the absence of any perceived climatic change. Firstly, wildlife agencies and the general public should be made aware of the potential for drastic 'simplification' of our wildlife heritage resulting from the 'greenhouse' effects. Secondly, it is certainly time for rational action which must avoid the opposite extremes of panic and fatalism. The public, wildlife agencies and conservation managers should adopt policies in response to the 'greenhouse' effects which would include:

Adaptive

1. *Increase resilience of reserve system.* This would ensure that the major reserves were in as healthy condition as possible to adapt to climatic change.

(a) *Phasing out land uses incompatible with maintaining a natural ecosystem in optimal health*, for example ungulates (hoofed grazing animals) in natural environments and conservation areas.

(b) *Making reserves larger and accommodating adjacent climatic zones.* Special attention should be given to coastal areas as these reserves are often linear, sandwiched between the sea and a hinterland often radically changed by human activities. The recently proclaimed Alpine National Park encorporates a range of altitudinally influenced climates providing a buffer against some of the adverse effects of 'greenhouse' (see Fig. 2).

(c) *Establishing or maintaining flexibility in the reserve system and encouraging proper conservation practices on private property.* Wetlands, in all their variety, are environments requiring particular attention, many occur in reserves but many also occur on private property. If the functional location of important areas (e.g. drought refuges, inter-tidal feeding and roosting areas) changes then agencies must respond by protecting areas at present outside the reserve system.

2. *The avoidance of fragmentation and/or elimination of all remaining native vegetation and faunal communities.* These areas will become increasingly important as refugia or as part of the corridor system.

(a) *Implement a state wide regional corridor system* to link major conservation areas. Such areas on public land include streamside reserves and road reserves. In Victoria, many areas have high conservation value (and potential) and licence holders of these areas should be encouraged to retain and manage them for native vegetation. As a legitimate use, landholders managing public leases for conservation should be charged

only nominal rent. Some public agencies are eliminating trees on road side reserves to 'protect' utilities that could be placed in adjacent open areas. Sympathetic policies should be adopted with some urgency as it takes years for some critical resources (e.g. nest hollows) to develop. Areas on private property are no less important.

Ameliorative

1. *Support reafforestation* with local indigenous trees and shrubs. By 'locking up' CO_2 during their growth to maturity, trees have ameliorating effects on the causes of 'greenhouse'. In terms of wildlife conservation it is important that trees planted do not provide a further competitive advantage to introduced species (e.g. Common Starlings, *Sternus vulgaris*) rather that they support local native species. Further, species that are, or have the potential to become, environmental weeds must not be planted as this will stress the remaining natural areas. (At maturity of these forests, when CO_2 storage equals emission, we still have the vexing problem of eliminating the store!). It should be recognised that the symbolic and educative meaning of this activity may be more important than its ameliorative effect.

A way forward ?

Implementation of some of these strategies requires certain specific knowledge; (a) the response of wildlife (flora and fauna) to the predicted climatic changes and, (b) the capacity of the wildlife to adapt to contracting and/or fragmenting habitats (Figs 1 and 2).

Each locality has a characteristic climate which can usually be defined by an amalgam of means, ranges and extremes of rainfall, temperature and other parameters. BIOCLIM, a computer model developed by CSIRO (see Busby 1986), is able to compute a climatic profile (24 variables) from known point localities of a species and hence predict the potential climatic distribution of that profile elsewhere. It is then theoretically possible to input various 'greenhouse' scenarios (different in extremes or different progressions of a 50 year trend) thus establish the distribution of the climatic profile under different regimes. These distributions can then be correlated to broad scale biotic parameters of habitat and the basic dispersal ability of a species in question, i.e. categorise species into the types in Fig. 1. Our estimation of the climatic distributions of some terrestrial coastal species may be imprecise as, except for the water they may extend seaward. However, these qualifications do not unduly affect the major premises (Busby, pers.comm.).

Busby (1988) conducted such an exercise with the endangered Long-footed Potoroo in relation to a 'greenhouse' scenario and predicted a gross change in its geographic distribution; a type C species in Fig. 1. Areas presently occupied would become climatologically unsuitable and the most suitable climate would be centred about 200 km to the north; intervening areas would provide little if any habitat. Further, he suggested Victoria's alpine flora communities would be restricted to Mt Bogong and Feathertop!

A comprehensive climatological study of the entire floral and faunal complement at a state and regional level would allow assessment of: (a) species most at risk, i.e. those least tolerant of predicted changes, (b) the adequacy or otherwise of our reserve system, (c) the best locality for efforts to create/maintain regional biotic corridors, and, (d) ensure research and conservation efforts were rational, systematic and efficient. Furthermore, faunal input into other broad scale conservation problems (e.g. salination and reafforestation) would have added direction and impetus.

Victoria is well suited to conduct case studies as; (a) it supports a wide range of natural environments and areas of 4 of 6 bioclimatic zones in Australia (see Blakers *et al.* 1984) and, (b) the conservation

reserve system has been designed to contain representatives of remaining flora and faunal communities, (c) databases of point localities for all vertebrate species and vascular plants are the most advanced of any State, and; d) the range of environments is diverse over an area that is liable to complex climatic changes. Species for which Victoria represents a small component of their range would require data points from their broader distribution in order to obtain a precise climatic profile.

Apart from implementing other strategies, this research is critical for providing hard data upon which rational wildlife conservation policies and decisions can be made. It also allows the flexibility of updating our efforts as climatologists refine their predictions as to the 'greenhouse' effects, especially at a regional level. It is simplistic to suggest that this research will provide answers to the all the multitude of complex problems but a journey begins with the first step. This basic research will ensure that the first step is in the right direction.

On-going parallel research is also required into the use of 'corridors' by individual species. The *Burramys* corridor was successful because data on the ecology, social organization and dispersal was sufficient to make an educated guess. To expect equivalent data on over 730 vertebrate and 2800 vascular plant species (including the exotics) in Victoria is unrealistic, however, data from modelling should be able to identify species and communities most at risk. Consequent research could then be directed to the environmental processes operating within these groups to enhance their survival prospects. In short our strategies must involve:

- action now to conserve remaining natural areas and make these as healthy and as robust as possible.
- management orientated research to make future efforts efficient and capable of achieving conservation objectives.

Acknowledgements

The substance of this article originally appeared in 'Common Ground', a CF&L magazine. Our thanks to John Busby (CSIRO) and Bob Warneke (ARIER) for providing valuable encouragement and criticism of the manuscript and Martin Batt (CF&L Drafting) who drafted the figures.

References

Blakers, M., Davies, S.J., and Reilly, P. N. (1984). 'The atlas of Australian Birds'. (Royal Australasian Ornithological Union, Melbourne)

Brown, P., Wilson, R., Loyn, R., Murray, N. and Lane, B. (1985). 'The orange-bellied Parrot: an RAOU Conservation Statement'. (Royal Australasian Ornithologists Union: Melbourne).

Busby, J. (1986). Bioclimate predictive system (BIOCLIM): User's manual version 2.0 (Bureau of Flora and Fauna, Canberra.

Busby, J. (1988). Potential impacts of climate change on Australia's flora and fauna. *In* G.I. Pearman (ed.) 'Greenhouse: Planning for climate change' (CSIRO: Melbourne) :387-398.

Galloway, R. W. (1988). The potential impact of climate changes on Australian ski fields. *In* G.I. Pearman (ed.) 'Greenhouse: Planning for climate change' (CSIRO: Melbourne) :428-37.

Graetz, R. D., Walker, B.H. and Walker, P.A. (1988). The consequence of climatic change for seventy percent of Australia. *In* G.I. Pearman (ed.) 'Greenhouse: Planning for climate change' (CSIRO: Melbourne) :399-420.

Henderson-Sellers, A. and Blong R. (1989). The Greenhouse Effect: living in a warmer Australia. (New South Wales University Press: Sydney).

Land Conservation Council (1977). 'Estimates of the time required for recovery of Victorian plant communities from ground and crown fires'. (LCC: Melbourne)

Mansergh, I.M., Kelly, P. and Scotts, D.J. (1989). Management strategy and guidelines for the conservation of the Mountain Pygmy-possum (Burramys parvus) in Victoria. *Arthur Rylah Instit. Env. Res. Tech. Rep.* 66.

Mansergh, I.M. (1989). The ecology and conservation of the Mountain Pygmy-possum (*Burramys parvus*) (Marsuplia: Burramyidae) in Victoria with comparisons to populations in New South Wales. Ph D. thesis La Trobe University, Victoria.

Mansergh, I.M. and Scotts, D.J. (1989). Habitat continuity and social organization of the Mountain Pygmy-possum restored by tunnel. *J. Wildl. Manage.* 53: 701-7

Norris, K. and Mansergh, I. (1981). Sites of zoological significance in East Gippsland (2 vols.). *Min. Conserv., Vict. Env. Stud. Rep. Ser.* 321-2.

References (cont.)

Pearman, G. I. (ed.) (1988). 'Greenhouse: Planning for climate change' (CSIRO: Melbourne).

Peters, R.L. and Darling, J.S. (1986). Potential effects of Greenhouse warming on natural communities. *In* E.P.A. (US) Effects of changes in stratospheric ozone and global climate v.3. Climate Change : 137-159.

Pittock, A.B. (1988). Actual and anticipated changes in Australia's climate. *In* Pearman, G. I. (ed.), 'Greenhouse: Planning for climate change'. (CSIRO: Melbourne):35-51.

Stark, K. P. (1988). Designing for coastal structures in a greenhouse age. *In* Pearman, G. I. (ed.), 'Greenhouse: Planning for climate change' (CSIRO: Melbourne):161-176.

Vanderzee, M. P. (1988). Changes in saltmarsh vegetation as an early indicator of sea-level rise. *In* Pearman, G. I. (ed.), 'Greenhouse: Planning for climate change' (CSIRO: Melbourne):147-160.

Botany in the Service of Medicine

Summary of paper given on 9.7.87 to the F.N.C.V. Botany Group

Elizabeth K. Turner, M.D.

Botany is the science of plants, the biology of dealing with plant life. Medicine is the science and art of dealing with prevention, cure and alleviation of disease. Botany owes an immeasurable debt to medicine. An overwhelming majority of early herbalists and botanists were physicians who were led to the study of botany on account of its connection with the arts of healing. Medicine gave the original impulse both to systematic botany and to the study of the anatomy of plants. Three thousand five hundred years ago, an Egyptian papyrus records the use of some 800 plants and animals to cure disease.

Botany was regarded as a branch of Natural Philosophy and owed its inception to the unparalleled mental activity of the finest period of Greek culture.

Aristotle, Plato's pupil who lived from 384-322 B.C., made many references to plants, and his pupil Theophrastus (born 370 B.C., who also studied under Plato) wrote 'Enquiry into Plants', which has come down to us. This opens with a discussion of the parts of plants which the author tries to interpret by analogy with the organs of animals.

Theophrastus made a description of plants in the Mediterrancan region and also from other lands. It is believed he obtained this knowledge from Alexander the Great (who had also been a pupil of Aristotle). Alexander took trained observers with him to the far east during his military campaigns.

Dioscorides, who lived in the first century A.D., was a medical man — probably an army doctor, as he speaks of having seen many lands. He completed 'De Materia Medica Libriquinque' with more than 1000 plants and plant products. This codex is still to be seen in the Imperial Library in Vienna. It is an account of the names and healing virtues of the herbs enumerated. Dioscorides was accepted without dispute, and even today the names given in 'De Materia Medica' are often cited side by side with those bestowed by Linnaeus, the Swedish physician and naturalist who was born in 1707. It is to Linnaeus and Joachim Jung that we owe the foundation of accurate terminology and the binomial system of plant nomenclature which is still in use.

The first Chair of Botany was founded in Bologna in 1534 and the first European Herbals were written around 1484-5. Paracelsus, a Swiss physician and alchemist born 1493, believed in the doctrine of Signatures; that is, every plant is associated by its appearance and colour, scent or habitat with the disease it can cure. For example, docks always grow near stinging nettles in order to provide a cure *in situ*. Long-lived plants would lengthen a man's life; he thought herbs with yellow sap would cure jaundice (Similar similitis curantur). Walnuts, the kernels of which are brain-like in shape, were good for the brain and their shells would help strengthen the

skull. Even on the Atherton Tablelands today, I was told that the *juice of the cunjevoi* (elephant ears) lily grows near the Gympie or *Stinging Tree.*

American figures now show that 25% of all modern pharmaceutical prescriptions contain drugs originating from higher plants and that more than 70 different chemical compounds from plants are used regularly, although nowadays synthetics are normally less trouble to produce.

In Australia — which was settled by caucasians only 200 years ago — Geoffrey Blainey, who wrote 'The Triumph of the Nomads', stated: 'The average Australian adult and child knew more botany 1000 years ago than they know today. Knowledge of botany supplied them not only with much of their food, but also with drugs'. Dr. L.J. Webb found at least 124 different species of native plants which were believed by aboriginals to have medicinal qualities. No single aborigine knew them all, nor were the plants as curative as the aborigines believed; nevertheless some of their intoxicants, sedatives, ointments, diarrhoea remedies, cough and cold palliatives, fit in with modern pharmaceutical knowledge. Although they used some plants as contraceptives these were little used, because most did not understand the paternity role of the male, believing that women became pregnant by going close to certain 'baby rocks' in outcrops. "Many of their medicines, like some of ours, depended on the faith of the swallower."

Until 1935, we also had relatively few curative drugs in our pharmacopoeia, e.g. digitalis from the foxglove for heart disese; adrenaline from the adrenal gland for shock; morphia from the opium poppy for pain; insulin, discovered by Banting and Best in 1924, from the sheep's pancreas for diabetes; salvarsan for syphilis.

In 1935 along came Prontosil, one of the sulphonamides, which actually killed germs.

There is still a potentially dangerous use of non-investigated herbs and the belief that they cure disease — because herbs are natural some believe 'they can't be harmful'. Comfrey, for example, is still used by some herbal practitioners or users although it is known to cause liver cancer (a pyrolizidine alkaloid is present). This empirical use of plants was of necessity a practice of the early settlers in Australia and elsewhere, because they had nothing else.

Joseph Bancroft of Brisbane, and his son, Thomas , were the modern pioneers of investigation here. Bancroft discovered the use of atropine from the corkwood (*Duboisia*) as a midriatic or pupil dilator in opthalmology.) There has, however, been a sad lack of investigation and exploitation of native plants in Australia. Only about 30 species have been used, 20 of which are eucalypts.

Australia, in spite of being the land of origin of the eucalypts, produces barely 50% of the world's production of 2000 tonnes per annum of eucalyptus oil. Spain and Portugal produce 60% of this oil for liniments, inhalants, cough syrups, flavourings and cleaners. The rich form of eucalyptus from the broad-leaved peppermint or the blue Mallee is imported from Swaziland, South Africa.

Pharmacist Joseph Bosisto migrated to Australia in 1849 and started the production of eucalyptus oil near the Bendigo whipstick. His primitive, *'Heath Robinson'*-type factory was recently closed. It depended on still distillation of the oil from only certain types of eucalypt leaves. The oil came over with the steam and condensed with it and was skimmed off the water and bottled. Some makers boil the leaves.

Cineole, aldehydes and terpenes and many other components make up the mixture Eucalyptus Oil. Cineole is the component most prized in eucalyptus oil. Terpenes are closely related to turpentine oil and steroids.

Oil of eucalyptus is used for colds and as an antiseptic, bactericidal and cleaner,

and can be transformed to menthol and used in gargles and mouth washes.

Essential oils are found in many Australian plants in oil glands and cavities. Essential oils were researched by the Museum of Applied Arts and Sciences in Sydney until 1979 but after they were transferred to another Government department.

Tetra-terpenoids are carotenoids (or Vitamin A). Carotenoids are yellow-coloured and found in carrots, tomatoes and coloured fruits and vegetables. Terpenes are related to steroids — the steroid we know best is cortisone, and the sex hormones oestriol and testosterone.

There are so many Australian plants containing essential oils reputed to be medicinal that I cannot mention them all. As this is a summary of the original lecture, the number of species presented is reduced from over 40 to 25.

Much of this information is gathered with permission from two books and quotations are in inverted commas and referred to the following numbers:

(1) 'Australian Medicinal Plants', Lassack and McCarthy. (1987) Methuen Australia.

(2) 'Wild Medicine in Australia', Cribb and Cribb. (1981) Collins. (1983) Fontana.

Many of these plants are growing in our own Melbourne Botanic Gardens.

Duboisia species

The corkwoods which contain alkaloids. *Duboisia myoporoides* contains Hyoscyamine and Hyoscine, as does *Duboisia Leichhardtii.* The corkwoods are shrubs which grow in drier areas of Queensland, N.S.W., N.T. and N.G. "The amounts of the drug vary with the locality, the season and the rainfall, and diminishes as one goes north" (1).

Another species is *Duboisia Hopwoodii,* from the same regions, which was named by Baron von Mueller after Henry Hopwood, an ex-convict who, in 1856, built a pontoon bridge across the Murray River at Echuca. *D. hopwoodii* was known to some tribes of Aborigines as Pituri. Other tribes had other names for it but 'pituri', became the general name and meant wild tobacco. "The name was used for other masticatory narcotics as well. The western Queensland township of Bedourie is thought to derive its name from Pituri, which grows in the district" (2). It contains mainly Nornicotine and Anabasine to the extent of 1-2% by weight. These have the same narcotic effect as the principles found in greater quantity in tobacco."

The use of the *Duboisia* species as a drug was first recorded by W.J. Wills who, with Burke, lost his life while crossing Central Australia. Wills chewed the specimen as instructed — it was always chewed, not smoked — and found it had a strong effect. The Aborigines usual ball of 'chewed grass' was about the size of a man's thumb — it was sucked within the lower lip and rolled about with the tongue. At meal times it was squeezed behind the ear. The shrub was also used by the Aborigines to poison water so that fish and emus were stupefied and easily caught.

The alkaloids in *D. myoporoides* are predominantly Scopalamine and Hyoscine used first by Dr Bancroft for dilating the pupil and still used for this purpose; also for drying up secretions prior to a general anaesthetic and as a remedy for sea-sickness. The plant also contains Tiglodine, an anti-spastic drug used in the treatment of Parkinson's Disease — it resembles Atropine without its side effects.

An amazing exploitation of *Duboisia* took place during the Second World War. Hyoscine and Atropine had been previously imported from Germany, Japan and China, and the Allies lacked a supply to be used for sea and air sickness in troop ships and amongst air crews, and for eye surgery.

Russell Grimwade of Melbourne, who was Chairman of Drug Houses of Australia, appointed Robin Croll (now living at Olinda, Vic) a Director of the *Duboisia*

project at Kingaroy, Qld. Five hundred million doses of hyoscine were produced and flown overseas in time to dose thousands of troops for the D-Day Normandy landing. Thus Australia at that time was the Allies' sole source of Hyoscine and Atropine.

After the war the projeet lapsed, but the world still uses our Duboisias as the source of three alkalis. Mr Croll says that, if not careful, workers at the *Duboisia* project could develop a dry mouth and double vision.

Dodonaea viscosa (Wild Hops)

Is common in all States and also grows in Peru. Pioneers made a substitute bitter-beer from it; but Aborigines had little knowledge of aleoholic fermentation beause they were nomads and travelled too lightly to be bothered with carrying foods or liquids. However there is a Cider Eucalypt in Tasmania whieh in summer yields a fermented sap but, as Prof. J.B. McClelland commented, 'the alcohol was quite insufficient to produce even merriment'.

"Aborigines applied the leaves of Dodonaea for stings of stone fish or stingrays. Dodonaea eontains 18% tannin, and it is slightly cyanogenic" (2) (that is, it contains hydro-eyanie acid).

Tannins are astringent and precipitate proteins. They are mainly in the bark and sometimes in the leaves and fruit and are used for tanning skins to make leather.

Plants which contain Antibiotics and Bactericidal Drugs

Melaleuca alternifolia (Medicinal tea-tree)

This melaleuca is found in swampy ground in all States.

"Essential oils from tea-tree aged in air have a greater activity than freshly distilled oils. These oils are used internally for rheumatism, also for tinea, infected fingernails, boils, mouth uleers and for shampoos; also for pyorrhoea. They are also used with nutmeg for flavourings. In the Seeond World War they were ineorporated in machine oils" (1).

The oil shows a definite germicidal power against *Staph. aureus,* (the Golden Staph), and *Salmonella typhi* and *Myobacterium phlei.*

The oil eontains some Cineole, as does Eucalyptus oil, which is toxic in strengths of greater than 10%.

Cineole is used for relief of colds. At Port Macquarie there is a high concentration of Cineole in the Melaleuea, almost approaching that for some Eucalyptus oils, but near Casino in northern N.S.W. the concentration of Cineole is low.

Barringtonia acutangula
(The River Mangrove)

"The River Mangrove is a large tree with egg-shaped fruits 2-5 cms long. It occurs in wet gullies in north-west W.A. and Queensland and the Northern Territory near the coast. There are 30 species in the genus which also oecurs in Asia, Malaysia and the Pacific, and in India, where the juice is mixed with oil and used for skin eruptions" (1).

The kernels are powdered and mixed with sago and used for diarrhoea. If mixed with milk they eause vomiting. It was used by the Aborigines and the Australian troops as a fish poison.

Fruit seeds and leaves have a Saponin. Saponins are like soaps and froth when shaken in water.

Solanum Lasiophyllum (W.A. Flannel Bush) and *Solanum aviculare* (The Kangaroo Apple — all states)

Both are members of the Solanaceae family which includes 85 genera sueh as *Datura strammonicum* (the Thorn Apple), *Solanum nigra* (Black Nightshade), *Atropa belladonna* (the deadly nightshade), also the tomato, potato and tobacco. Can be used to provide a drug to dilate the pupils.

Solanine: Part of this alkaloid in a nitrogen containing base is a Sterol which can be converted to Steroids, e.g. Cortisone and the sex hormones, androgens and oestriols. At present these organic chemicals

are dependent on the petroleum industry which is definitely a finite resource.

The 'Age' of 11.6.87 reports that Soviet and Hungarian scientists have established Australian Kangaroo Apple plantations in Eastern Europe from specimens taken from Victoria and N.S.W. and are producing steroids for commercial use. Species of the plant are found in the threatened wet tropical rainforests of North Queensland.

Ficus opposita (Sandpaper Fig)

"A small tree growing in Queensland and N.T. The leaves can be used as sandpaper for softening the skin. The latex is used as a disinfectant and was applied for ringworm" (1).

Lavatera phlebia (Austral Hollyhock)

Grows in all States, flowers lilac, pink and white. Aborigines made a poultice of leaves and applied to boils.

Eucalyptus saligna and *E. camaldulensis*

River Red Gum which occurs in all States and flowers all year round. Kino (or gum exudate) of the eucalypts and angophoras is an astringent and was used for diarrhoea in a 10% solution with water. Astringents are formed from the precipitation of protein by tannins.

Kinos can be used commercially as a cure for diarrhoea dissolved in water strained and evaporated on glass (not metal, as they may form poisons on metal).

Prostanthera rotundifolia (Round-leafed Mintbush)

Grows in Queensland, Tasmania, N.S.W. and Victoria in the Grampians on the Rose's Gap road. Contains a volatile oil which can be used as a carminative (an anti-flatulent or soother) and also contains bactericidal and fungicidal phenolic compounds.

Ipomoea angustifolia of the Convolvulus family Australian Bindweed of N.S.W., N.T. and Queensland on the beach of the Barrier Reef Islands. The juice is a diuretic — boiled leaves made into a poultice have been used for rheumatism and the leaves were used as a contraceptive and pain-killer. The powdered seeds contain some alkaloids of the L.S.D. type and can cause hallucinations in addicts.

The purple flowered 'Morning Glory' has been found occasionally to contain toxic amounts of derivatives of Lysergic Acid too.

Cassia odorata (Australian Senna)

Grows in all States — the leaves were used by the pioneers in doses of 2 grams of 'senna leaves' with no side effects. 10 gms gave abdominal pain. No cases of poisoning have been reported in Australia.

Rubus hilli (Wild Raspberry)

Grows in all States; it is of the Rose family. The small leaves were soaked in warm water and were used for stomach upsets.

Plants used for treating Skin Diseases

Anagallis Arvensis (The Scarlet and Blue Pimpernel).

Introduced into Australia 200 years ago and naturalised in all States.

"An old English rhyme said:
'No heart can think
No tongue can tell
The virtues of
The Pimpernel' " (1)

The plant is sometimes fatal to cattle and cage birds. It has been used in water to dispel melancholy, cleanse the skin, remove freckles and cure toothache, piles and scurvy.

If swallowed, this plant can cause nausea, anorexia, headaches and diarrhoea. Two sheep who died after eating 620 grams had haemorrhages in the gastro-intestinal tract at the post-mortem examination.

Acacia tetragonophylla

The Dead Finish of Australian Arid Regions in all States. "Aborigines soaked the bark in water and drank it for coughs and the leaves were chewed for dysentry and the wood ashes were used as an antiseptic for ritual circumcision. It was said that the wound healed quickly" (1).

Points of the pungent phyllodes were inserted under warts, which were said to wither in one hour.

Melia azedarach (The White Cedar)

A large deciduous tree used as a street tree in Queensland, N.T., N.S.W. and Echuca. Grows wild in the rainforests. The pulp of the fruit was used in India for the treatment of leprosy and scrofula (glands) and for Malaria. In U.S.A., dried berries soaked in whiskey were used as an anthelminthic, or worm cure. The taste is bitter and the action purgative and toxic.

Poisoning of animals and children has been reported. At autopsy, animals show irritation of the gastro-intestinal tract and fatty degeneration of the liver and kidneys.

Different species occur in Australia, Africa, Asia and America.

Santalum lanceolatum (Sandalwood)

Grows on rocky ground in most parts of Australia, e.g. one specimen at least is left in the Warby Ranges (Vic.). The fruits are deep blue, edible and sweetish. They were used by aborigines for boils, sores and discharges. Mashed roots were strained and the liquid applied for rheumatism or to relieve itching. Aborigines used to smoke themselves with burning leaves to gather strength for long journeys. Sandalwood is rich in essential oils which have bactericidal properties against Staph. aureus.

Sarcostemma australe (The Caustic Vine)

This plant is found in dry areas everywhere in Australia, e.g. Coopers Creek. Wounded stems exude a milky sap which is corrosive and causes pain and discomfort to those with fair skins. Aborigines and early settlers used the sap to stop bleeding and cure warts and corns. On Mornington Island the Aborigines used the vine to cure eye trouble, also the whole vine was warmed and applied to the breast to induce lactation.

The plant is reported to be good fodder in drought but in Queensland and N.S.W. has been toxic to sheep and horses. At post mortem there were haemorrhages on the heart, fluid in the chest, and the stomach was distended with gas.

Polygonum hydropiper (Water Pepper)

This species is found on the banks of creeks in Victoria, N.S.W. and Queensland and has a hot, peppery taste. It causes irritation of the digestive tract all the way and is called Smartass in U.S.A. It can be used as a mustard poultice and causes photosensitization in pigs.

It has been used as a diuretic and as an astringent and the seeds are said to be carminative (i.e. to cure flatulence).

Eremophila maculata (Wild fuchsia or Emu Bush)

Grows in arid regions in all States. The Aborigines used the leaves as a blister when suffering from a cold. The plant has resin-secreting glands. Another species of eremophila contains Coumarins. They are what provides the smell in hay and are used in confectionery and lemonade. In medicine, Coumarins are used as anti-coagulants, e.g. Warfarin (which is the basis of 'Ratsak').

Daviesia latifolia (Hop Bitter Pea)

A shrub 1-3 metres high with egg and bacon flowers. Grows in Tasmania, Victoria, N.S.W. and on Mt. Dandenong. A tonic was made from an infusion of the leaves and used for fevers and for the treatment of hydatids.

Goodenia ovata (The Hop Goodenia)

Also grows on Mt Dandenong and in all States. A shrub about 2 metres high

with yellow flowers in the leaf forks. An infusion of leaves and twigs was said to be an anti-diabetic drug.

Bursaria spinosa (Sweet Bursaria)

A common tree and restricted to Australia with spiny white scented flowers and brown flat fruits. The European Horse Chestnut is a close relative. It also contains a derivative called Aesculin used in the treatment of lupus (a butterfly rash) and as a sun-screen. The leaves soaked in water fluoresce deep blue in daylight which is Aesculin which absorbs ultra-violet light. The Aborigines did not use it in medicine.

Along the Cape Schanck Road are the large trees of Sweet Bursaria. There is a huge tree at the back of the University Graduate House in Bouverie Street, Carlton.

Crinum pedunculatum (The Spider Lily)

Is of the amaryllis family. There are 10 species in Australia: in N.S.W., Queensland, N.T. and Victoria. It is used by the Aborigines at Bingle Bay for box jellyfish stings and for piles.

Helichrysum apiculatum (an Everlasting related to Billy Buttons)

A compositae or Asteraceae found in all States. Was used as an anthelminthic (anti-worm) and insect repellant. It contains Saponins. There is no evidence of toxicity.

Conclusion

There is a great deal to be learned from the study of Australian Native Plants, and a wide-open field for chemical and industrial exploitation from which valuable exports could arise.

However, the uncritical and popular empirical use of these plants should be avoided by those who value their lives, as so many contain toxic principles and *plants should properly remain in the service of medicine.*

An Introduction to the Wildflowers of 'The Millewa'

By Margaret Kelly

For many years now the only books that served as introductory guides to the flora of the Mallee were Cochrane, Fuhrer, Rotherham and Willis (1973, revised edition, "Flowers and Plants of Victoria") and Cunningham, Mulham, Milthorpe and Leigh (1981, "Plants of Western New South Wales"). These books were useful but each has its limitations. The former only includes a very short section on Mallee flora and the latter well covers the flora of the more fertile plains but is less than comprehensive in its coverage of the plants of the deeper sands of the mallee shrublands. In addition, both books are too large to usefully serve as field guides and the latter is quite expensive.

Margaret Kelly's recent publication, whilst not claiming to cover all of the flora of the region, is now one of the most comprehensive accounts of the wildflowers of the north-western Mallee. Two hundred and sixty species have been included. Colour photographs are used to illustrate most of the species that any naturalist is likely to come across in their ramblings through mallee scrub, plus a good many other species that are decidedly restricted in distribution and are regionally rare. There is a short description of each illustrated species and some information on flowering times and habitat. Excellent introductory sections discuss the geological history and landforms of the Mallee and introduce the reader to the range of vegetation communities that still occurs on the large areas of uncleared land.

The book is a very good introduction to the fascinating flora of this special region of Victoria. Most of the photographs are clear and sharp and a number of plants that are very difficult to photo-

graph are presented with clear and faithful colour illustrations (e.g. *Dissocarpus biflorus* and *Halgania lavandulacea*). Unfortunately the photographs are not of consistently high quality. Occasionally they may even be out of focus or enlarged to such an extent that the grain of the film becomes visible (e.g. *Goodenia heteromera* and *Santalum acuminatum*).

There are a number of misidentifications and these should be corrected in any reprints (I recommend that a loose erratum sheet be inserted). These misidentifications are:

p.11 – correct *Acacia hakeoides to Acacia notabilis.*

p.20 – correct *Baeckea behrii* (upper photograph) to *Baeckea crassifolia.*

p.27 – correct *Cassinia arcuata* to (prob.) *Helichrysum catadromum.*

p.35 – correct *Daviesia ulicifolia* to *Daviesia arenaria.*

p.39 – *Dodonaea viscosa* ssp. D should more usefully be referred to as *Dodonaea viscosa* ssp. *angustissima.*

p.40 – correct *Elachanthus pusillus* to *Elachanthus glaber.*

p.58 – correct *Helipterum stuartianum* to *Helichrysum leucopsideum.*

p.61 – correct *Helipterum moschatum* to *Helipterum tietkensii.*

p.62 – correct *Hibbertia sericea* to *Hibbertia virgata.*

p.79 – correct *Podolepis canescens* to *Podolepis rugata.*

p.89 – correct *Spyridium eriocephalum* to *Spyridium subochreatum.*

p.90 – correct *Spyridium tridentatum* to *Cryptandra leucophracta.*

p.95 – correct *Thysanotus tuberosus* to *Thysanotus baueri.*

p.104– correct *Aotus ericoides* to *Aotus subspinescens.*

p.107– correct *Cassia nemophila* var. *nemophila* (left-hand photograph) to *Cassia nemophila* var. *coriacea.*

p.117 – correct *Olearia floribunda* to *Olearia brachyphlla.*

In spite of its value as a guide, there are two consistent problems with the book:

(1) The text is poorly located in relation to the photographs. Many times the text is not placed closest to the species to which it refers but is instead adjacent to another species. Unless the reader is familiar with the plants concerned, confusion results and misidentifications are likely. This is a major problem with similar species, e.g. *Pterostylis nana* and *Pterostylis mutica* appear to be transposed so that the text for the former appears to refer to the latter and vice versa; similarly for *Helipterum demissum* and *Helipterum jessenii.* Such apparent transpositions are common and could be corrected in subsequent reprints with the addition of a small arrow connecting the relevant text with its illustration.

(2) My copy of the book fell apart within two weeks of purchase. The binding is poor for a book that would be kept on shelves, it is unacceptable for a book that is likely to be used in the field.

Nevertheless, the book is a most valuable addition to the growing number of regional field guides. It is not cheap (at $26 recommended retail price) but is good value considering the number of colour photographs that have been included. It must be used with considerable care to avoid misidentifications, in view of the confusing placement of text. The binding remains a major problem. All copies should be rebound before they can safely be taken into the field.

David Cheal
Flora and Fauna Survey
and Management Group
CF&L

Australian Natural History Medallion 1989

Bruce A. Fuhrer

In the 50th year of the Australian Natural History Medallion it gives particular pleasure to the Club that the Award Committee has selected to receive the Medallion the person who was not only the FNCV's nominee, but also someone who has been a member since 1963, and has done much to further the interests and enhance the standing of the Club.

It was in Portland, where he opened his own busines as a professional photographer in 1955, that Bruce Fuhrer began to develop his interest in natural history, which has led to his very considerable achievements in botanical photography. In 1957 he formed the Portland Camera Club, of which he was President for six years, and that same year joined the Portland Field Naturalists Club. Returning to Melbourne, he promptly joined the FNCV, and soon became chairman of the Botany Group, a position he held for three years. During this time the club undertook one of its most successful ventures, the publication in conjuction with A.H. and A.W. Reed of *Flowers and plants of Victoria,* to which Bruce contributed a substantial number of photographs. This book, expanded, in its 3rd edition to include Tasmania, while providing the first comprehensive illustrated guide to the flora of Victoria, also laid the foundations of the Club's publication fund.

Bruce Fuhrer is Senior Technical Officer in the Department of Botany and Zoology at Monash University, and has built up an extensive collection of colour transparencies of cryptogamic plants, which are supplemented by voucher specimens in the university herbarium. His publications during the last ten years reveal the widening scope of his work, and display an amazing mastery of technique. This is particularly evident in *Southern Australian liverworts* (Scott). These illustrations represent the first serious attempt to use photographs in a scientific work of this kind, in any country, and have been admired by bryologists world-wide. *Seaweeds of Australia* (Christianson, Clayton, Allender), published in 1981, contains an outstanding collection of photographs of marine algae.

Bruce's tremendous enthusiasm for plants, his keen observation and breadth of experience in natural history, are combined with a genius for photography, which enable him to achieve what is probably his strongest desire, to communicate this knowledge to others. *A field guide to Australian fungi* and *A key to the common genera of gilled fungi in Australia* (with Cole and Holland) are practical works designed for use in the field. Moving into another field Bruce has contributed to *Ferns and fern allies of Victoria and South Australia* (Duncan and Isaac) and *Lichens of South Australia* (Filson and Rogers). In addition photographs by Bruce Fuhrer appear in many text books, and in National Parks information areas. Bruce is an ardent conservationist, and was an inaugural member of the Mt. Richmond National Park management committee in 1960.

This willingness to share his knowledge and experience is evidenced by the establishment, a year or two after he joined the Ringwood Field Naturalists Club, of the Ringwood Junior Field Naturalists Club, of which he was President during the sixteen years of its existence, to be followed by the Basin Junior Field Naturalists Club in 1983; the extent of his lecture programme over the years; the field excursions for naturalists groups and students, and his cheerful availability to naturalists seeking help and information.

In 1988, Bruce conducted a week-long Natural History Awareness programme in the Stirling Ranges, W.A., consisting of interpretation walks and illustrated lectures which proved immensely popular.

Bruce has travelled the length and breadth of Australia, chiefly in search of botanical specimens, though his collection includes some remarkable photographs of the 'Morning Glory' atmospheric phenomenon over Cape York Peninsula. During the course of his field excursions he has discovered a number of new species, two of which have been named after him, *Calostoma fuhreri,* a puffball found in the Little Desert, and the liverwort *Fossombronia fuhreri.*

In 1988 Monash University awarded him an Honorary M.Sc. in recognition of his work in the fields of botany, natural history and photography.

Bruce is married, with one daughter, and lives in Ringwood.

Sheila Houghton

Bruce Fuhrer

BY-LAWS

Council has approved the following amendments to the By-laws.

4 (i) **Application for Membership**
Application for membership shall be made in writing to Council and must include the name, address and category of membership sought by the applicant. The categories of membership are: Ordinary i.e. Metropolitan (03 area code). Joint Ordinary. Country (including interstate). Joint Country. Junior (under 18 years). Student (over 18 years; full-time). Life.

5 **Subscriptions.**

5(ii) **Concessional rate.**
A concessional rate shall be available to pensioners and full-time students (over 18 years). Proof of entitlement in each case shall be required. Joint concessional rate shall be available where applicable.

6 (i) **Receipt of the "Victorian Naturalist".**
Each Life, Ordinary, Country, Honorary and Student member of the Club shall be entitled to receive without extra charge one copy each of the "Victorian Naturalist" published during the currency of that member's subscription. (Art. 11).

7 (iii) **Reminder to Members in Arrears.**
The Treasurer or Appointed Officer shall issue a formal reminder regarding overdue subscriptions. Failure to issue such reminder shall not be a valid reason for non-payment by a member who is in arrears.

20 (ii) **Group**
There shall be no Group membership such as to exclude any Club member.

20 (iv) **Annual General Meeting of Group.**
Groups shall conduct an Annual General Meeting for the election of officers for the forthcoming year. All officers must be financial members of the Club.

20 (viii) **Finance of the Group**
All financial transactions of a Group shall be subject to the approval of Council. Groups shall not levy fees of any kind on Club Members. Reasonable out-of-pocket expenses incurred by members on behalf of the Group and endorsed by the Chairman and Secretary of the Group shall be submitted to Council for consideration for re-imbursement.

24 (i) **Australian Natural History Medallion.**
The Club having been appointed to manage the affairs of the Award of the Australian Natural History Medallion, the Secretary of the Australian Natural History Medallion General Committee shall, by 1st February in each year, prepare and issue to organisations having natural history interests a circular inviting nomination for the Award of the Australian Natural History Medallion and the appointment of a delegate to the Medallion General Committee.

24 (ii) Nominations for the Award following the lapse of a nomination shall be invited from members of the Club at the General Meeting in February and the nominee shall be selected and endorsed by Council at its next succeeding meeting at which time (if necessary) the Council shall appoint the Club's delegate to the Medallion General Committee.

The renumbering of the Articles of Association following the 1975 amendment has affected the references to these Articles in the By-laws, and the appropriate alterations have been made throughout the By-laws.

FNCV Subcription renewals

1990 Subscriptions are due on the **1st of January**

If you do not intend to pay in person at a FNCV meeting in January, please post your subscription now to **FNCV Subscription Secretary, National Herbarium, Birdwood Avenue, South Yarra, Vic. 3141**, together with this form. Subscriptions include the *Victorian Naturalist*.

Metropolitan member (03 area code)	$27
Joint Metropolitan members	$30
Country/Interstate member	$24
Joint Country/Interstate members	$27
Concessional rate (Students/Pensioners*)	$20
Joint Concessional rate	$23
Junior (under18, no *Victorian Naturalist*)	$5
Subscription to *Victorian Naturalist* only	$30
Overseas subscriber	$35 AUD
Clubs	$25

*proof of entitlement is required for student and pensioner subscriptions e.g. photocopy of card.

The Retired category no longer exists

Please save us the expense of reminder notices by sending your subscription now. Receipts will not be sent unless requested.

Please circle one: New subscription / Renewal

Mr/Mrs/Miss/Dr.....
Joint members name.....
Address.....
.....
Postcode.....

Previous address (if different from the above)
.....
.....

Category (from the above list).....

Suscription $.....
Donation $.....
Total enclosed $.....

IMPORTANT NOTICE

CAMPOUT AT OCEAN GROVE

The Geelong Field Naturalists invite FNCV members to the combined VFNCA/WVFNCA 1990 Campout at Ingamells (1989 venue) Ocean Grove on March 9-12th. The day program will probably include some of last year's popular boat excursions such as Mud Island, Snorkel Seals, Swim Fish, ½ Day Cruise, Seals, Gannets, etc., Wader Watching, Aquatic Life, Bayside Vegetation and the magnificant coastline and bush at Anglesea. The evening program will include a presentation by a very enthusiastic expert Shell Collector and we need your club's support to make the "Association Members' Night" interesting and enjoyable. Bunk room accommodation (106 beds) and meals will cost approx. $60. If you need alternative accommodation please make your own arrangements very soon.

ALL BEING WELL

..... members intend to attend the March 1990 Campout at Ocean Grove.

..... members intend to go on the Mud Island bird watching excursion. (Approx. $10)

..... members intend to go on the Snorkel Seals excursion. (Approx. $25)

..... members intend to go on the Swim with Fish excursion. (Approx. $20)

..... members intend to go on the Seals, Gannets, Channel Fort, Corsair Rock, etc. cruise. (Approx. $10)

Will members who hope to attend this weekend please contact Marie Allender (527 2749) to the end of 1989, then contact Mrs. Joan Harry (850 1347). Please mention any of the excursions you will wish to join before Christmas if possible and confirm when full details are available.

Important!

Subscriptions for 1990

There has been a change in the subscription structure. The Retired category no longer exists. Instead Council has amended the By-laws to allow for a **Concessional** Rate, which will apply to both students and pensioners, who provide proof of entitlement. This brings the Club into line with other organisations and will result in some members paying a reduced subscription. Members who are not eligible for this rate will be designated as Metropolitan or Country as appropriate.

The distinction between Affiliated and Subscriber Clubs has been removed from the subscription rates, though the status for Affiliated Clubs, as laid down in the Articles of Association (Article 43), remains.

Subscription rates have been held steady for three years, but it has now become necessary to increase them. Please check the rates carefully when renewing subscriptions, which are **due on 1 January, 1990.**

Field Naturalists Club of Victoria

In which is incorporated the Microscopical Society of Victoria

Established 1880

Registered Office: FNCV, c/- National Herbarium, Birdwood Avenue, South Yarra, 3141.

OBJECTIVES: To stimulate interest in natural history and to preserve and protect Australian fauna and flora.
Members include beginners as well as experienced naturalists.

Patron

His Excellency, The Rev Dr John Davis McCaughey, The Governor of Victoria.

Key Office-Bearers 1988-1989

President: Mr. GRAEME LOVE, P.O. Box 2018, St. Kilda West, 3182 (697 5109 B.H.)

Vice President: Mrs. SHEILA HOUGHTON, FNCV, National Herbarium, Birdwood Avenue, South Yarra, 3141 (551 2708)

Hon. Secretary: Mr. JULIAN GRUSOVIN, 1 Warriner Court, East Oakleigh, 3166. (524 2396 B.H. and 543 8627 A.H.)

Hon. Treasurer: Mr BRUCE ABBOTT, 4/597 Orrong Road, Armadale, 3143. (529 4301 A.H.).

Subscription-Secretary: Ms DIANNE CHAMBERS, FNCV, c/- National Herbarium, Birdwood Avenue, South Yarra, 3141 (344 7604 B.H.)

Editors: ROBYN WATSON and TIM OFFOR, FNCV, c/- National Herbarium, Birdwood Avenue, South Yarra, 3141 (419 3532 A.H. and 344 7150 B.H.)

Librarian: Mrs. SHEILA HOUGHTON, FNCV, c/- National Herbarium, Birdwood Avenue, South Yarra, 3141 (551 2708)

Excursion Secretary: Mrs. JOAN HARRY, 342 High Street, Templestowe, 3107 (850 1347)

Club Reporter: Vacant.

Conservation Co-ordinator: Mr. BERT LOBERT, 378 Colham Road, Kew, 3101. (859 4716 A.H.)

Sales Officer (Books): Vacant.

Sales Officer (Victorian Naturalist only): Mr. D. E. McINNES, 129 Waverley Road, East Malvern, 3145 (571 2427)

Programme Secretary: Vacant.

Publicity Officer: Miss MARGARET POTTER, 1/249 Highfield Road, Burwood, 3125. (29 2779)

Diary Co-ordinator: Mr. D. E. McINNES, 129 Waverley Road, East Malvern, 3145 (211 2427)

Group Secretaries

Botany: Miss MARGARET POTTER, 1/249 Highfield Road, Burwood, 3125 (29 2779).

Geology: Miss HELEN BARTOSZEWICZ, 16 Euroa Avenue, Nth. Sunshine, 3020 (311 5106 A.H.)

Fauna Survey: Mr. JULIAN GRUSOVIN, 1 Warriner Court, East Oakleigh, 3166. (543 8627).

Microscopical: Mrs. ELSIE GRAHAM, 147 Broadway, Reservoir, 3073 (469 2509)

MEMBERSHIP

Membership of the F.N.C.V. is open to any person interested in natural history. The *Victorian Naturalist* is distributed free to all members, the club's reference and lending library is available and other activities are indicated in reports set out in the several preceding pages of this magazine.

Subscription rates for 1990

Metropolitan members (03 area code)	$27
Joint Metropolitan	$30
Country/Interstate members	$24
Joint Country/Interstate members	$27
Concessional rate (Students/pensioners) (proof of entitlement required)	$20
Joint Concessional	$23
Junior (under 18; No Victorian Naturalist)	$5
Clubs	$25
Subscription to Victorian Naturalist	$30
Overseas subscription to Victorian Naturalist	$35 Aust.
Individual journals	$4

JENKIN BUXTON PRINTERS PTY. LTD. 1-13 ABBOTSFORD ST. WEST MELBOURNE 328-4774

The Victorian Naturalist

Index To Volume 105, 1988

Compiled by K.N. Bell