

# **The Victorian Naturalist**

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**Volume 102, 1985**

COMPILED BY K. N. BELL

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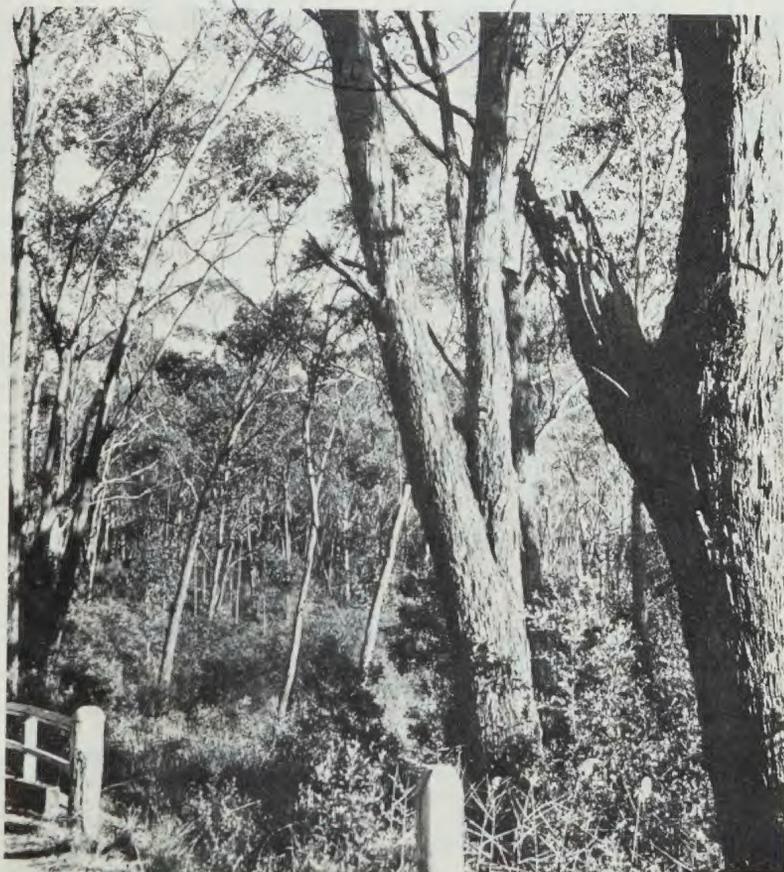


# The Victorian Naturalist

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## FNCV DIARY OF COMING EVENTS

### GENERAL MEETINGS

**Monday, 10th February, 8.00 p.m.**

Mr. Peter Kelly. "Beetles"

**Monday, 17th March, 8.00 p.m.**

Dr. Dianne Simmons. "Fire prevention and its impact on vegetation in urban-fringe areas"

**Monday, 14th April, 8.00 p.m.**

Mrs. Sibely May. "Wildflowers of the South Australian Mallee"

### New Members — July/October 1985 General Meetings

#### Metropolitan

Mrs. Susan E. Brassington, 23 Bridges Ave., Mooroolbark, 3136.

Miss Joy Hick, 55 Mayona Rd., Montmorency, 3094.

Mr. Neville Walsh, 38 Paxton St., East Malvern, 3145.

Ms. Carmel McPhee, 90 Beavers Rd., Northcote, 3070.

Miss Elya D. Coleman, 4/926 Toorak Rd., Camberwell, 3124.

Mrs. Margaret Fahroedin, 1 Fricker Ave., Greensborough, 3088

Mr. Russell Thompson, 20 Howes Rd., Strathmore, 3041.

#### Joint

Mr. Thomas and Mrs. Grace Manks, 58 Victoria St., Sandringham, 3191.

#### Country

Ms. Christina L. Strandly, Carters Lane, Seville, 3139.

#### Interstate

Mr. Morton Kaveney, C/- High School, Mullumbimby, N.S.W., 2482.

### FNCV EXCURSIONS

**Sunday, 2nd February.** Mornington Peninsula. Hopefully to include Portsea but permits will not be issued until a later date. Coach leaves Batman Ave., 9.30 a.m. Fare \$10. Bring a picnic lunch.

**Friday, 7th to Monday, 10th March.** Eurobin Creek — Mt. Buffalo area. The Victorian Field Naturalists' Clubs Association weekend will be held at Noonamecna Lodge, Porepunkah, which is set in 42 acres of natural forest at the base of Mt. Buffalo and is bounded by the National Park and Eurobin Creek. There is a large recreation room, dining room, games room and several accommodation blocks. The accommodation booked for the coach party consists of twin rooms with individual heating, electric blankets on all beds plus blankets and pillowslips. Sheets are not supplied but can be hired. Towels should be taken. All meals are included. Cost \$135 for

accommodation, meals and coach for the four days based on a minimum of twenty persons. Deposit \$20. Those going by car can book accommodation in the Lodge or a campsite on the property. Members owning binoculars should take them as it may be possible to see Halley's Comet as well as birds. Campsites are \$4.50 and caravan sites \$6.50 per night and meals can be provided if booked by mid February. The Coach will leave from the Gas and Fuel Building in Flinders St., at 9.15 a.m. on Friday, 7th March. Bring a picnic lunch. Members going by private transport should meet at the Lodge on Saturday, 8th March, at 1.00 p.m. for afternoon excursion. Day excursion on Sunday and meetings in the evenings.

**Sunday, 6th April.** Plans are under way for an evening excursion, possibly to Wattle Park, to view Halley's Comet. Ring Marie Allender (527 2749) for details.

### GROUP MEETINGS

All FNCV members and visitors are invited to attend Group Meetings.

#### Day Group — Third Thursday

Thursday, 20th February. Half Moon Bay, Black Rock. Leader: Marg Wilson, 836 3521

Thursday, 20th March. Puffing Billy, Belgrave. Leader: Ian Gillespie, 578 1879.

Thursday, 17th April. Seeing Eye Dog School, Malvern. Leader: Joan Miller, 836 2681.

At the National Herbarium, Birdwood Ave., South Yarra at 8.00 p.m.

#### Botany Group — Second Thursday

Thursday, 13th February. "Australia: Spring in Summer". Miss Mary Doery.

Thursday, 13th March. To be announced.

Thursday, 10th April. "Crete: A Flora in Isolation". Mrs. Hilary Weatherhead.

#### Geology Group — First Wednesday

Wednesday, 5th February. Holiday Reminiscences.

Wednesday, 5th March. "Some aspects of conservation of outdoor stone monuments and buildings". Mr. Daniel Tworek.

Wednesday, 2nd April. Galapagos Island Slide Night. Miss L. Bennett.

#### Mammal Survey Group — First Tuesday

Tuesday, 4th February. "Swamp Wallabys". Mr. Ron Waters

Tuesday, 4th March. To be announced.

Tuesday, 25th March. To be announced.

(April Meeting).

#### Microscopical Group — Third Wednesday

Wednesday, 19th February. "Polychaete Worms". Mr. Dan McInnes.

Wednesday, 19th March. "Microscope Slides and Accessories over the Years". Mr. John Daws. Venue: Astronomers residence.

Wednesday, 16th April. "Parasites Affecting Mankind". Dr. Evan Peters.

(Continued inside back cover)



# The Victorian Naturalist

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Cover Illustration: Mountain Swamp Gums (*E. camphora*) in North-Eastern Victoria.

# A New Species of *Calostoma* Desv. (Gasteromycete Fungi)

BY G. A. CRICHTON<sup>1</sup> AND J. H. WILLIS<sup>2</sup>

## Introduction

While Victorian fungus hunters are familiar enough with that extraordinary if widespread puffball, *Calostoma fuscum* (Berk.) Mass., with its 8-15 cm stalk of interlacing, toughly gelatinous brown fibrils and bright yellow to scarlet escape-opening for the white spore-masses, not many observers are acquainted with its less conspicuous congener, *Calostoma rodwayi* Lloyd of fern gully habitats; this latter smaller puffball is almost level with the soil surface, its stalk being immersed in humus to the base of the peridium.

Generally Australia has been credited with these two species only, but collectors over recent years have brought to light some undescribed species, or at least species not previously recorded for the Commonwealth. One such discovery was made by Mr. Bruce A. Fuhrer, while collecting in the Little Desert National Park, far western Victoria, during November 1974 and again in November 1983. In order to establish the distribution of this possibly new species, approaches were made to various herbaria for loan of their *Calostoma* specimens — with quite unexpected results.

The University of Western Australia kindly supplied four specimens; two were labelled as "*C. fuscum*"; but bearing little resemblance to the puffball referred to that species in the eastern States. One other specimen was considered to be *C. luridum* (Berk.) Mass., a name rejected by G.H. Cunningham (1942) as being synonymous with *C. fuscum*; it closely resembles specimens collected by Mr N.S. Bennet, at Stawell, Vic., in 1970. The fourth W.A. specimen does not agree with any other collections we have seen. The

Botanic Garden of Adelaide and the University of Adelaide each had specimens of *C. fuscum* only. The National Herbarium at Sydney, N.S.W. has one collection from Queensland that does not match anything else examined so far, neither does a collection made by Mr Ian McCann, on the Victoria Range, Grampians, Vic., in 1970. Mr Fuhrer's Little Desert *Calostoma* is manifestly distinct from any of the five entities mentioned above, and we now formally describe it under the epithet "*fuhleri*" in honour of its perspicacious discoverer.

*Calostoma fuhleri* Crichton et Willis sp. nov. (Fig. 1)

*A speciebus duabus aliis in Australia descriptis (C. fuscum et C. rodwayi) sic differt: habitazione arida, parvitate (ad 28 mm alta), superficie peridii nigra, forma et amplitudine sporae atque "clipeo" magno irregulare retento stomatem velans.*

*Holotypus:* Damp depressions on sand ridges of Little Desert, Victoria, Australia, B.A. Fuhrer V10, Nov. 1974 (Herb. MONU).

*Topotypi:* loc. cit., B.A. Fuhrer 217, Nov. 1983, (Herb. MONU, DAR, K).

## Description

*Basidiocarps* small, to 28 mm high when soaked (20 mm in dried state), solitary or gregarious, at first hypogean, becoming epigeal, firmly attached to a pseudostipe;

*Pseudostipes* 15-20 mm long and 5-8 mm thick (when soaked), solitary or fused in groups, composed of gelatinous, slightly anastomosing strands of hyaline hyphae, wholly immersed in soil up to base of peridium and heavily encrusted with soil particles, without any evidence of volva.

1. 6 Ainslie Pk. Avenue, Croydon, Vic.

2. 102 Male Street, Brighton, Vic.

*Exoperidium* composed of large, lightly tinted, globose or irregularly swollen hyphae which gelatinize and remain at the apex of the mesoperidium as a tough shield covering the stoma; *shield* irregular, 3-10 mm wide, shed when the stoma splits, its underside moulded in the shape of the stoma and coloured the same vivid red.

*Mesoperidium* globose, to 8 mm dia., becoming pointed at summit as the stoma develops, stalked, rubbery, becoming horn-like in texture when dried, consisting of hyaline thin-walled but rather coarse hyphae 7-9  $\mu\text{m}$  wide; walls of hyphae and interstitial cementing material staining with Cotton Blue to present a convoluted brain-like appearance; *exterior surface* covered with fine black granules (larger below mid-line) which are remnants of the gelatinized exoperidium.

*Stoma* imperfectly opening, slightly raised and formed by the splitting of the

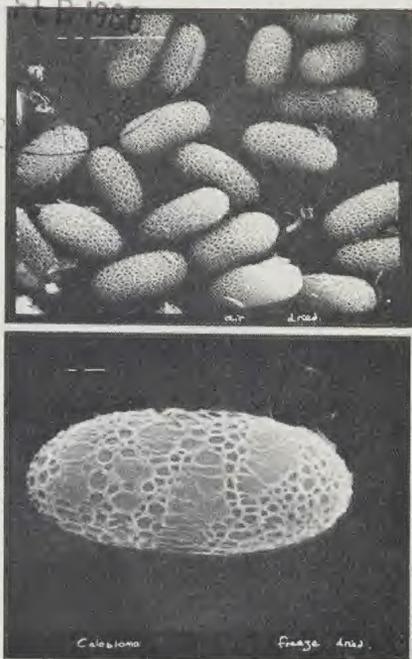


Fig. 2. *C. fuhreri*. SEM by Christine Shankly.

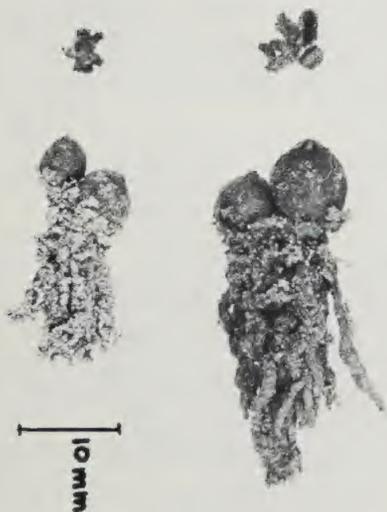


Fig. 1. *C. fuhreri*, by B. Fuhrer.

mesoperidial apex into 4-5 rays (or a long slit with shorter ones radiating), internally coloured a vivid red (Meth. A/8) from amorphous granules which may spill out into the surrounding area in a broad peristomatal band.

*Endoperidium* (or *spore sac*) light yellow, rather tough, of loosely felted hyphae, with a few long, sparsely branched hyaline strands 1.5-2.0  $\mu\text{m}$  thick, their contents staining deeply with Cotton Blue; sac detached except about the inside of the stoma to which it retracts as spores are expelled, sometimes even extruding from the stomatal opening.

*Gleba* white, apparently structureless, of broken hyphae and spores, without evidence of a hymenium; *basidia* wineglass-shaped, tetrasporous, borne singly either randomly or at the ends of hyphae.

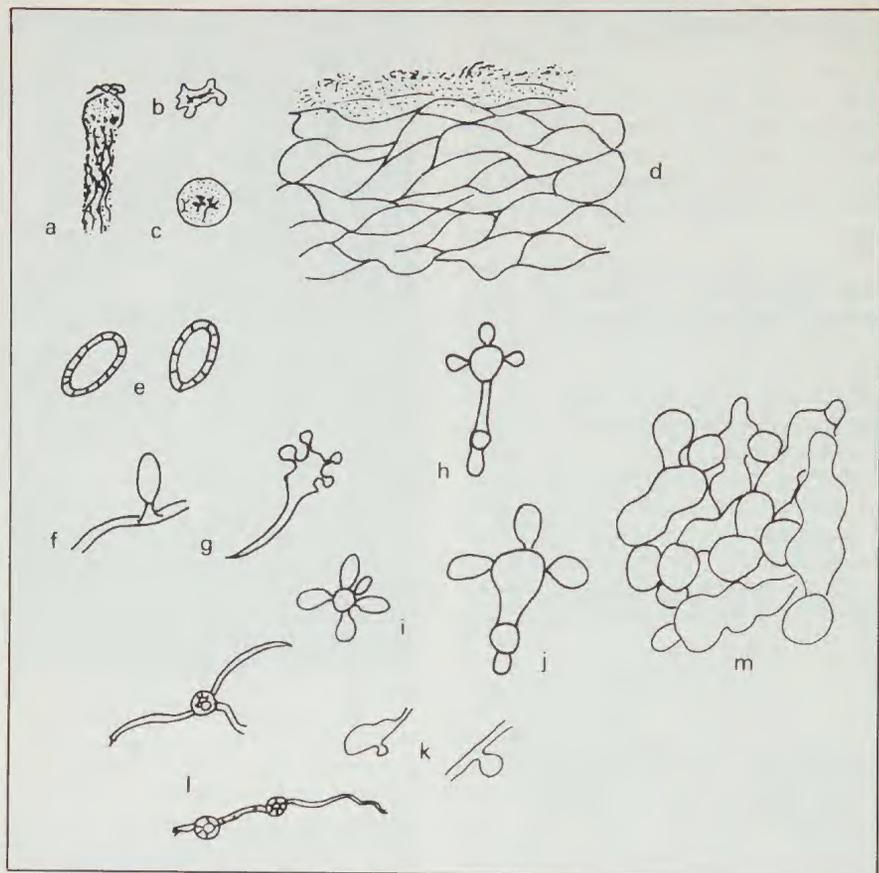


Fig. 3. *Calostoma fuhleri* sp. nov. a) approx. 0.75 actual size, b) shield over stoma, c) stoma, d) structure of mesoperidium, e) spores in section, f-j) stages of basidia and spore development, l) glebal hyphal fragments, m) structure of exoperidium.

*Spores* oblong-elliptical, (14) 20-26 (28)  $\times$  (7) 9-11  $\mu$ m, hyaline, appearing closely and evenly verruculose under light microscopy, unevenly reticulated under scanning electron microscope (Fig. 2): all spore measurements include exosporial ornamentation; inamyloid in Melzers: no reaction to KOH.

No clamp connections located.

#### Discussion

*C. fuhleri* differs from other species of the genus so far attributed to Australia in

its habitat (arid sand-hill country), its small size, black peridial surface, large size and shape of the spores, and retention of the large irregular "shield" for some time over the stoma; this shield differs from the opercular structures of both *C. fuscum* and *C. rodwayi* in its swollen balloon-like hyphal composition. (Fig. 3)

The second collection, which was much more extensive than the first, provided extra information upon which the above description was confirmed; also details of their behaviour under varying weather

conditions were noted, the presence of specimens being mostly suspected by the cracking of a thin crust of the surface soil. When soil was moistened the puffball would be pushed above the surface by expansion of its gelatinous stem; upon drying it would again retract into a cup-shaped cavity in the soil. Specimens were

often seen to be crowded, many with multiple heads from thickened stems.

#### REFERENCES

- Cunningham, G.H. (1942). *Gasteromycetes of Australia & New Zealand*. Dunedin.  
Masse, G. (1888). Monograph of Genus *Calostoma*. *Annals of Botany* 2(5): 25-46.

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## Finger Fern *Grammitis magellanica* subsp. *nothofageti* Parris (Grammitidaceae) — a New Record for the Australian Mainland

BY PAUL BARNETT\* AND SUE BEATTIE\*\*

### Introduction

Until recently the Fern *Grammitis magellanica* subspecies *nothofageti* was only known to occur in New Zealand, where it is widespread, and in two localities in Tasmania — Hastings Cave and Mt. Field National Park. It was therefore of great interest to discover the species on the Australian mainland in the Otway Ranges, Victoria.

### Description

*G. magellanica* ssp. *nothofageti* is a small solitary epiphytic fern growing on the trunks of the Musk Daisy bush, *Olearia argophylla*, from 1-2 m above ground level. (Fig. 1).

It has finger-like fronds over 80 mm long and less than 5 mm wide. Venation is forked with the vein apices terminating well inside the frond margin and sori occurring on each side of the midrib (Fig. 1b).

\*Paul Barnett Carlisle River, Victoria. 3239.

\*\*Sue Beattie 5 Homestead Road, Eltham. 3093.

### Locality

*G. magellanica* ssp. *nothofageti* has so far been found in one locality in the Otways, near the Little Aire Falls, off Phillips Track, approx. 8 km south west Beech Forest Township.

Grid reference 143° 30' 45'' Long., 38° 39' 59'' Lat. Collected 29 Jan. 1985 by P. Barnett. Collections have been lodged at the State Herbarium of South Australia and the National Herbarium of Victoria.

### Habitat

The fern grows on the trunks of the Musk Daisy-bush, *Olearia argophylla* where it gains moisture from the trunk, and probably feeds off the breakdown of lichens and mosses growing on the tree.

In this locality *O. argophylla* forms an understorey to Mountain Ash, *Eucalyptus regnans*, which show no signs of a bush-fire since being logged some 40 or 50 years ago.

The Aire Valley is one of the wettest parts of the State with more than 200 rainy days per year. Rainfall varies from

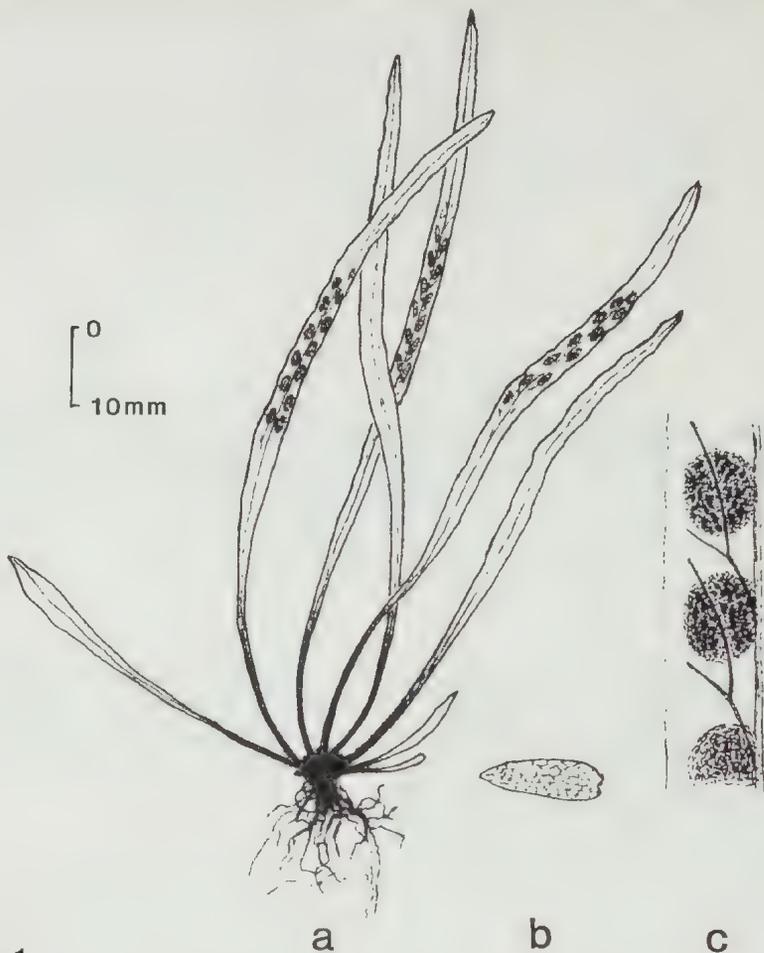


Fig. 1

(a) *Grammitis magellanica* ssp. *nothofageti*

(b) sori x 8 (c) scale x 10

1525 mm (60') to more than 2000 mm (79') per annum mostly in the winter months. Summer temperatures are mild; average maximum temperature in February being 20° C.

#### Acknowledgements

The authors would like to thank Dr. R. J. Chinnock of the South Australian State Herbarium for identifying the Fern, and John Alderson for preparation of the illustrations.

#### REFERENCES

- Beaglehole, A.C. (1980). *The Distribution and Conservation of Vascular Plants in the Corangamite — Otway area, Victoria*. Western Victoria Field. Nats. Clubs Assoc., Portland.
- Jones, D.L. and S.C. Clemesha (1976). *Australian Ferns and Fern Allies*. A.W. Reed, Sydney.
- Parris, B.S. and D.R. Given (1976). A taxonomic revision of the genus *Grammitis* Sw. (Grammitidaceae: Filicales) in New Zealand. *New Zealand J. Bot.* 14: 85-111.

# Land Planarians (Turbellaria: Tricladida: Terricola) Introduced into Australia — 2. *Kontikia orana* Froehlich, 1955

BY L. WINSOR\*

Within the chiefly Indo-Pacific geoplanid land planarian genus *Kontikia* are included some seven species which occur in Australia. One of these species, *Kontikia orana* previously known only from Brazil, has now been recorded in Townsville, Queensland. This paper provides a brief description of *K. orana* together with specimen and literature records of this species. Voucher specimens lodged with the Queensland Museum are prefixed GL. Specimens in the author's collection are prefixed LW.

## Family GEOPLANIDAE

Genus *Kontikia* Froehlich, 1955

*Kontikia orana* Froehlich

?*Geoplana kenneli*, Schirch, 1929

*Kontikia orana* Froehlich, 1955, 1956;  
Froehlich and Froehlich, 1972

## Type Locality

Ubatuba, Sao Paulo, Brazil (Froehlich and Froehlich, 1972)

## Material Examined

AUSTRALIA: QUEENSLAND: Townsville suburbs: Aitkenvale (LW1081); Kelso (LW1114; GL4722; GL4723); Queens Gardens (LW1429; LW1456). BRAZIL: SAO PAULO: Ubatuba (LW736).

## Literature Records

BRAZIL: PARANÁ: Curitiba (Froehlich, 1956b); RIO DE JANEIRO: Via Dutra; SAO PAULO: Baía de Paranaguá area; Itanhaen; Jardim Europa; Vila Atlântica; Ubatuba; STA. CATARINA: Blumenau; Brusque; Itajaí (Froehlich,

1956b); TERRITORIO DO AMAPÁ: Serra do Navio (Froehlich and Froehlich, 1972).

## Description

Living specimens measure 20-25 mm in length. The cylindroid body is gradually tapered anteriorly, more abruptly posteriorly. In a preserved sexual specimen 12.5 mm long, the mouth is 7.6 mm from the anterior tip and gonopore 3.1 mm posterior to the mouth. Small but prominent eyes pass posteriorly from the anterior tip in a slightly staggered single submarginal row. A pale sensorial zone is situated around the ventral margin of the anterior tip.

Dorsal ground colour, which extends to the outer ventral zone, varies from an ash grey to a pale orange. There are three dorsal longitudinal stripes (Fig. 1): a black median stripe, about quarter body width, separated by the same interval of ground colour from the lateral stripes. The brown lateral stripes are generally half the width of the median stripe. Anteriorly the three stripes merge into the brownish colour of the anterior tip. The ventral surface is translucent white.

The copulatory organs (Fig. 2) are situated in the posterior quarter of the body. A complex network of ducts link testes and vas deferens. The latter, just anterior to the copulatory organs form spermiducal vesicles. These then ascend, incurve and penetrate the mid anterior wall of the penis bulb, combine and open directly into the prostatic duct. This then communicates with the ejaculatory duct which opens into the common atrium through a small papilla.

Ovovitelline ducts pass posteriorly from the ovaries, rise either side of the posteri-

\*Honorary Associate, Museum of Victoria, Melbourne, Vic. 3000.

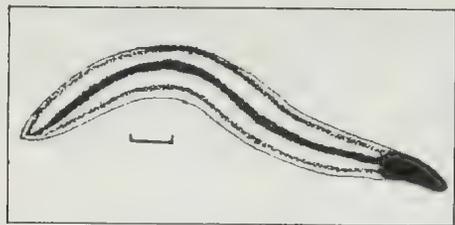


Fig. 1. *Kontikia orana*. Dorsal aspect. Scale bar represents 1 mm.

or diverticulum and adjoin the distal end of the glandular canal. In this area a complex anastomosing network of vitelline lacunae link the canal and ovovitelline ducts. Following copulation, these lacunae may be filled with spermatozoa. The glandular canal, and lying immediately beneath it the posterior diverticulum, both open into the common atrium through the dorso-posterior atrial wall. There is no connection between the posterior diverticulum and the glandular canal, ovovitelline ducts, vitelline lacunae or intestine.

#### Specific Characters

Many *Kontikia* species have similar colour and stripe patterns. For this rea-

son full identification of a species requires histological examination of sexual specimens.

Internally the copulatory organs of *K. orana* are very similar to those of *K. whartoni*, Beauchamp, 1956 from Reunion Island. Whether *K. orana* and *K. whartoni* Beauchamp are conspecific with *K. whartoni* (Gulliver, 1868) from Rodriguez Island is not clear and must await re-examination of the original specimens.

Other similar species of *Kontikia* differ from *K. orana* chiefly by the absence of the vitelline lacunal complex and by the presence of a genito-intestinal communication between the posterior diverticulum and the intestinal rami.

#### Occurrence

In Brazil it is considered that *K. orana* is an introduced species possibly transported from overseas together with banana rhizomes (Froehlich, 1955). It is confined to man-modified areas. In Townsville, Queensland a similar situation exists. Here *K. orana* is confined to urban gardens and is found in association with two introduced species of land planarians *Bipalium kewense* and *Platydemus*

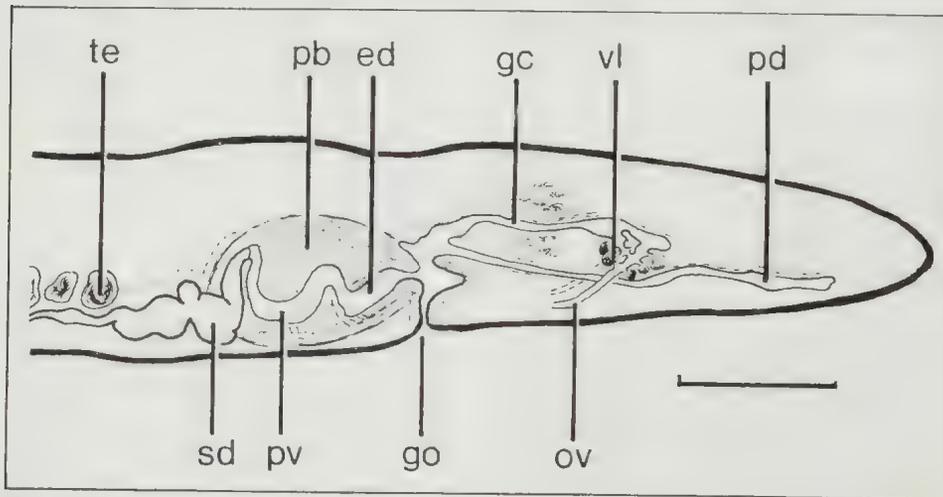


Fig. 2. *Kontikia orana*. Copulatory organs. ed — ejaculatory duct; gc — glandular canal; go — gonopore; ov — ovovitelline duct; pb — penis bulb, pd — posterior diverticulum; pv — prostatic vesicle; sd — spermiducal vesicles; te — testis; vl — vitelline lacunae (filled with spermatozoa). Scale bar represents 0.5 mm.

*manokwari*, and the introduced veronicellid molluscs *Laevicaulis alte* and *Vaginulus plebeius*. Spread of *Kontikia orana* to the newer western suburbs of Townsville may be via banana rhizomes but at present there exists only circumstantial evidence supporting this mode of dispersal.

#### Acknowledgements

I am indebted to Dr Eudoxia Froehlich, University of Sao Paulo, Brazil, for providing specimens for comparative purposes. Mr Milos Prazak kindly undertook translations from French papers. The generous support by the C.S.I.R.O. Science and Industry Endowment Fund is gratefully acknowledged.

## Vegetation Map and Guide to the Plant Communities of East Gippsland

The Department of Conservation, Forests and Lands has recently released a Floristic Vegetation Map and Guide to the Plant Communities of East Gippsland. The Map and Guide, presented as a double sided colour poster, was compiled by staff at the National Herbarium and gives a comprehensive overview of the vegetation in the region east of the Omeo Highway.

The poster was based on the results of a classification of east Gippsland vegetation by members of the National Herbarium Survey Team in 1981. Plant species were recorded from over 600 sites in the East Gippsland region, and the map and guide list the species and briefly describes the twenty-one plant communities which represent the major vegetation types in the area.

The poster gives information on the climate and geography of the region, effects of fire, timber harvesting and agriculture in East Gippsland and details of the conservation status of the various floristic communities. In addition, the poster includes photos of each plant community with lists of major plant species. The map gives the locations of where the plant communities can be found.

#### REFERENCES

- Beauchamp, P. de. (1956) A propos *Kontikia whar-toni* (Gulliver) Planarie terrestre des Mascareignes. *Bull. Soc. zool. Fr.* 80:307-313.
- Froehlich, C. G. (1955) Sobre morfologia e taxonomia das Geoplanidae. *Bôlem. Fac. Filos. Ciênc. Univ. S Paulo* 19:192-251.
- Froehlich, C. G. (1956a) On the biology of land planarians. *Bôlem. Fac. Filos. Ciênc. Univ. S Paulo* 20:263-272.
- Froehlich, C. G. (1956b) Planarias terrestres do Paraná. *Dusenía* 7:173-191.
- Froehlich, E. M. and Froehlich, C. G. (1972) Planarians from the Amazonian Region. *Papeis. Dep. Zool. S Paulo.* 26:29-45.
- Gulliver, G. (1868) Turbellaria. *Phil. Trans. R. Soc.* 168:557-563.

Details included in the vegetation guide and map will be invaluable in providing information for the future management and planning of the area. It will also be useful for naturalists and others interested in the environment who want to find out more about the ecology of the East Gippsland region.

The poster retails for \$4.75 per copy and is available from the following retail outlets:

- \* The National Herbarium of Victoria
- \* Department of Conservation, Forests and Lands: Information Centres —  
Ground Floor, 240 Victoria Pde., East Melbourne.  
Ground Floor, 601 Bourke St., Melbourne.

Stocks of the poster are also available from the Department of Conservation, Forests and Lands Regional Offices in Bairnsdale and Orbost.

For postage and packaging (Victoria only), add \$1.70 for one or two map/posters \$2.70 for three to fifteen. Copies can be provided either flat or prefolded (please specify).

# Some Insect Pollinators of *Kunzea ambigua* (Sm.) Druce (Myrtaceae) near Sydney, New South Wales

BY G. A. WEBB\*

## Introduction

*Kunzea ambigua* (Sm.) Druce is a small (< 3m) shrub found in eastern Victoria and along the coast and tablelands of New South Wales. In the Sydney area *K. ambigua* is common on sandstone soils and in disturbed situations.

During spring and summer when *K. ambigua* flowers, hoards of insects are attracted to the copious nectar produced. However, the few published studies of insect visitors to *K. ambigua* flowers have been restricted to the Buprestidae (Coleoptera) (Nitikin 1979, Williams 1977, Williams and Williams 1983).

During the spring and summer of 1982-83 and 1983-84 four localities in and around Sydney were visited to observe insects visiting *K. ambigua* flowers. Though insects of several orders were collected, only data on Coleoptera are available so far and presented here.

## Study areas and methods

Four localities (Fig. 1) were visited on a number of occasions during October and November 1982 and November and December 1983. Bargo (22 December 1983) and Alford's Point (4 November 1983) were visited on only single occasions while Cowan (27 October, 3 and 5 November, 1982) and Darling Mills State Forest (7, 21 and 25 November, 1983) were visited on three occasions each. The Alford's Point and Darling Mills State Forest sites were sampled more intensively than the other two sites. Insects were captured by hand and in sweep nets and aspirators.

## Results and discussion

Forty species of Coleoptera representing twelve families (Table 1) were found

on *K. ambigua* flowers. The most common flower-visiting beetles were the Buprestidae, Scarabaeidae, Mordellidae and Cleridae, though only the Buprestidae were found at all four sites. *Stigmodera sexplagiata* Gory was found at three sites (not Bargo) but no species was found at all four sites. Since Bargo and Alford's Point were visited only once and collecting at Cowan was of only limited duration on each occasion, some species may have been overlooked and therefore the species lists may be incomplete.

Several authors (Nitikin 1979, Williams 1977 and Williams and Williams 1983) have listed Buprestidae found on *K. ambigua* flowers from different localities near Sydney. Williams and Williams (1983) provided the most comprehensive list with seventeen species of *Stigmodera* and *Neocuris guerin* Hope. Five of these, *S. bifasciata*, *S. rufipennis*, *S. scalaris*, *S. sexplagiata* and *S. subpura* were recorded during this study. Five species collected in this study, *S. deccemaculata*, *S. erythroptera*, *S. flavopicta*, *S. macularia* and *S. sexguttata* are new records.

To my knowledge, there are no records of Coleoptera, other than Buprestidae, from *K. ambigua* flowers. However, this should not imply that *K. ambigua* attracts solely buprestids since other Myrtaceae are commonly visited by a diverse coleopteran fauna (Ashton 1975, Brooks 1948a,b, 1965, Hawkeswood 1978, 1981, 1982, Ireland and Griffin 1984, Musgrave 1951) and *K. ambigua* exhibits similar floral structure to other insect attracting Myrtaceae. It is more likely that *K. ambigua* has not previously been examined for other Coleoptera.

Not all species recorded are solely nectar seeking. Several families (Cleridae, Coccinellidae and Cantharidae) are predators of other insects (Britton 1970) and

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Fig 1. Study sites

the Chrysomelidae, Scarabaeidae and Cleridae may seek pollen (Hawkeswood 1982, 1983). Nevertheless, their presence on flowers, irrespective of their food preferences indicates that they may contact pollen bearing anthers and therefore serve as vectors of pollen transfer. However, it should be kept in mind, as Ireland and Griffin (1984) pointed out, that effective pollination is only achieved if: (1) insect body structure is suitable for pollen adherence; (2) stigma contact is achieved and (3) the stigma is receptive.

No data is available on stigma contact or receptivity. However, many beetles, particularly the scarabs *Phyllotocus* spp. and the clerids *Eleale* spp., carried pollen on their bodies. The Scarabaeidae and Cleridae appear particularly well adapted for pollen transport, trapping pollen amongst hairs and bristles over the body. In other less or non-hairy taxa pollen may still be trapped around the mouth parts and amongst the joints of the body. If, as is

the case with some other Myrtaceae (Ashton 1975, Hawkeswood 1981), *K. ambigua* pollen is sticky, then pollen may also adhere to glabrous surfaces of the body.

No measure of insect abundance is given in Table 1 as it was my original intention to provide only an inventory of flower visiting insects. Nevertheless, the scarabs (*Phyllotocus* spp.) and the clerids (*Eleale* spp.) were amongst the most common beetles found on flowers, particularly in the Darling Mills State Forest and Alford's Point sites. Their abundance and suitability for pollen transport would therefore suggest that they may be important vectors. Though the Buprestidae and Mordellidae were amongst the most abundant taxa on flowers they may be less important pollinators of *K. ambigua* as relatively little pollen was carried on the body.

Some beetles found on *K. ambigua* were also found on other flowering plants in the Alford's Point study area (Table 1). Some Buprestidae and the lycid, *Metriorhynchus rhipidius* Macl. were found simultaneously on *Leptospermum flavescens* Sm. whilst others of several families were found later (3 December 1983) on nearby *Angophora bakeri* C. Hall and *Angophora hispida* (Sm.) Blaxell. Williams and Williams (1983) found species of Buprestidae progressing from plant species to species along a chronological flowering succession in a Myrtaceae dominated plant community containing *K. ambigua*, *L. flavescens* and *A. hispida*. Hawkeswood (1981) noted that the large scarabs, *Eupoecila australasiae* (Donovan) and *Polystigma punctata* (Donovan) were common vectors of a wide range of summer flowering plants. These observations suggest that some of the species recorded are not food plant specific, at least not at the plant species level. However, Hawkeswood (1981) and Williams and Williams (1977) have suggested that some beetle genera may be specific to broader plant taxa. In the Buprestidae, the genus *Ethon* and some *Cisseus* and *Melobasis* are most

Table 1. Beetles found on flowers of *Kunzea ambigua*. Lf, Ah and Ab indicate that species were found also on *Leptospermum flavescens* (November) or *Angophora hispida* and *Angophora bakeri* (December) respectively.

	Cumberland State Forest	Alfords Pt.	Cowan	Bargo
Col: Buprestidae				
<i>Sugmodera bifasciata</i> (Hope)	*	*		
<i>decemmaculata</i> (Kirby)			*	
<i>erythroptera</i> (Boisduval)	*	*Lf		
<i>flavopicta</i> (Boisduval)			*	
<i>macularia</i> (Donovan)				*
<i>rufipennis</i> (Kirby)		*Lf,Ah		
<i>scalaris</i> (Boisduval)		*		
<i>sexguttata</i> Macleay		*Ah		
<i>sexplagiata</i> Gory	*	*Lf	*	
<i>subpura</i> Blackburn	*			
Col: Lycidae				
<i>Metriorrhynchus rhipidius</i> Macleay		*Lf,Ah		
Col: Scarabaeidae				
<i>Automolus valgoides</i> (Blanchard)	*			
<i>Microvalgus nigrinus</i> Macleay	*			
<i>Microvalgus nr. castaneipennis</i> Macleay	*			
<i>Phyllotocus kingii</i> Macleay	*			
<i>Phyllotocus marginipennis</i> Macleay		*Ah		
<i>Phyllotocus scutellaris</i> Macleay	*	*		
<i>Polystigma punctatum</i> (Don.)		*Ah		
Col: Mordellidae				
<i>Mordella limbata</i> Waterhouse	*	*Ah		
<i>Mordella promiscua</i> Erichs	*			
<i>Mordella sydneyana</i> Blackburn	*	*Ab		
<i>Mordella nr. tristis</i> Lea	*			
Col: Cleridae				
<i>Eleale pulchra</i> Newman	*			
<i>Eleale nr. simplex</i> Newman		*		
<i>Eleale nr. viridis</i> Guerin	*	*Ah,Ab		
<i>Phlogister cribatus</i> Blackburn	*			
<i>Phlogister instabilis</i> Newman	*			
<i>Scrobiger splendidus</i> Newman	*			
Col: Coccinellidae				
<i>Coccinella repandra</i> Thb.			*	
<i>Harmonia conformis</i> (Boisduval)	*			
Col: Cantharidae				
<i>Cauliognathus pulchellus</i> Macleay		*Ah		
Col: Chrysomelidae				
<i>Edusella abdominalis</i> Lea		*		
<i>Edusella puberula</i> Boh.	*			
? <i>Geloptera porosa</i> Lea			*	
<i>Mecynodera coxalgica</i> Boisduval	*	*		
Col: Belidae				
<i>Belus nr. semipunctata</i> F	*			
Col: Curculionidae				
<i>Eugnomus</i> sp.	*			
<i>Meriphys nr. fullo</i> Erich			*	
Col: Elateridae				
<i>Crepidomenus metallescens</i> Candeze	*			
Col: Dermestidae				
<i>Trogoderma</i> sp.			*	

commonly found on Papilionaceae while *Stigmodera* frequent Myrtaceae.

In conclusion, a diverse coleopteran fauna was found to visit *K. ambigua* flowers. The most common taxa were the Buprestidae, Scarabaeidae, Mordellidae and Cleridae all of which are visitors of a wide range of other native flowering plants. *K. ambigua* is probably beetle-pollinated (Cantharophily) though other invertebrate and vertebrate vectors cannot be ruled out.

#### Acknowledgements

Drs. A. Calder and E. Zimmerman and Mr. T. Weir (CSIRO Division of Entomology) and Mr. G. Williams kindly identified some Coleoptera.

#### REFERENCES

Ashton, D.H. (1975). Studies of flowering behaviour in *Eucalyptus regnans* F. Muell. *Aust. J. Bot.* 23: 399-411.

Britton, E.B. (1970). Coleoptera Chapter 30, In: *The Insects of Australia*. CSIRO, Melb. Univ. Press Carlton.

Brooks, J.G. (1948a). Some north Queensland Coleoptera and their food plants. *N. Qld. Nat.* 15:26-29.

Brooks, J.G. (1948b). North Queensland Coleoptera and their food plants. Pt. 2. *N. Qld. Nat.* 16:6-7.

Brooks, J.G. (1965). North Queensland Coleoptera — their food and host plants. Pt. 3 *N. Qld. Nat.* 32: 29-30.

Hawkeswood, T.J. (1978). Observations on some Buprestidae (Coleoptera) from the Blue Mountains, New South Wales. *Aust. Zool.* 19:257-275.

Hawkeswood, T.J. (1981). Insect pollination of *Angophora woodsiana* F.M. Bail. (Myrtaceae) at Burbank, Southeast Queensland. *Victorian Nat.* 98: 120-129.

Hawkeswood, T.J. (1982). Notes on insect pollination of two species of *Eucalyptus* (Myrtaceae) from southwest Western Australia. *Victorian Nat.* 99: 28-37.

Hawkeswood, T.J. (1983). Observations on *Pyrgoides dryops* (Blackburn) (Coleoptera:Chrysomelidae), a pollen-feeding beetle on *Acacia leiocalyx* (Domin) Pedley, at Brisbane, Southeast Queensland. *Victorian Nat.* 100:156-158.

Ireland, J.C. & A.R. Griffin (1984). Observations on the pollination ecology of *Eucalyptus muellerana* Howitt in East Gippsland. *Victorian Nat.* 101: 207-211.

Musgrave A. (1951). An insect calendar. II. *Aust. Mus. mag.* 10:252-260.

Nitkins, M.I. (1979). Buprestidae collected in the County of Cumberland 1957-1960. *Circ. ent. Sect. R. Zool. Soc. N.S.W.* 3:5-6.

Williams, G.A. (1977). A list of the Buprestidae (Coleoptera) collected from *Leptospermum flavescens* Sm. at East Minto, New South Wales. *Aust. ent. Mag.* 3:81-82.

Williams, G.A. and T. Williams (1983). A list of the Buprestidae (Coleoptera) of the Sydney basin, New South Wales, with adult food plant records and biological notes on food plant associations. *Aust. ent. Mag.* 9:81-93.

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## WORKING BEE AND OPEN DAY FNCV KINGLAKE PROPERTY SUNDAY 9 FEBRUARY

The FNCV owns a bush block at Kinglake, the Harold Frahm Bird Refuge, about 3 km north-east of the Kinglake Hotel. We will be holding an Open Day and working bee there on Sunday 9 February: members are requested to make every effort to attend. The primary purpose of the visit is to tackle the weed problems, particularly the blackberries, so please bring suitable tools and wear suitable clothing.

Further details: Ian Faithfull 419 9908 (AH)

Noel Disken 82 3471 (AH)

# Description of Two Punctid Snail Genera from Tasmania (Mollusca : Pulmonata)

BY RON C. KERSHAW\* AND BRIAN J. SMITH\*

## Introduction

The purpose of this paper is to make available or validate two names of genera of punctid snails from Tasmania which were proposed invalidly by Iredale in 1933. The generic groups for which these names were proposed are, in our opinion, real. These names have been accepted and used as valid in previous work (McMichael and Iredale, 1959; Smith and Kershaw, 1979, 1981). However, in a more critical examination of the original descriptions of the genera during work on the compilation of a check-list of the non-marine molluscs of Australia, one of us (BJS) determined that these descriptions were invalid under the International Code of Zoological Nomenclature. The descriptions are judged to be invalid as they contain no description or diagnosis of the new taxon and no differentiation with any other taxon.

The sections of the Iredale (1933) paper in which he introduces the names *Pasmaditta* and *Pedicamista* are as follows:

"*Helix jungermanniae* Petterd was allotted to *Flammulina* by Suter and the last location by May was in *Laoma*, another Neozelonica group more familiar to Suter than to May, the generic name *Pasmaditta* is here introduced".

"*Pedicamista* is proposed for *H. coesus* Cox, which was also placed by May in *Laoma*, though Suter had assigned it to *Phrixgnathus* from the type of which it differs as much as from the typical *Laoma*".

These snails belong to the family Punctidae, a modern revision of the Australian species of which is being prepared by Dr. Frank Climo of the National Museum of

New Zealand. However, we understand (F. Climo, pers. comm.) that this is still a considerable way from completion. In the meantime valid names are needed for these two genera to facilitate their inclusion in the Catalogue of the Non-Marine Molluscs of Australia. These can be amended or put into synonymy at a later date when a clearer idea emerges of their status in a revised study of the Tasmanian punctids.

## Taxonomy

*Pasmaditta* gen. nov.

*Pasmaditta* Iredale, 1933. *Rec. Aust. Mus.* 19:53 (nomen nudum).

*Diagnosis:* Shell small, planate, depressed globose, of 4-5 whorls with height less than half the width. Umbilicus narrow, about a quarter of the shell diameter. Protoconch 1.5 whorls with sculpture of very faint spiral striae, often apparently smooth. Adult sculpture of weak very low rounded irregular radial riblets, generally close, oblique with narrow sloping depression in the interstices passing into the umbilicus. Interstices with extremely fine sub-aligned pustules giving the impression of decussate striae which gives a "frosted" texture to the shell. There are also minute radial lirae. Colour brown to bronze.

*Type species:* *Helix jungermanniae* Petterd, 1879.

*Pedicamista* gen. nov.

*Pedicamista* Iredale, 1933. *Rec. Aust. Mus.* 19:53 (nomen nudum).

*Diagnosis:* Shell broadly depressed conoid, somewhat globose, 5 whorls with height about half the width. Umbilicus narrow, about a fifth of the shell diameter. Protoconch 1.75 whorls, smooth. Adult sculpture of weak low rounded riblets,

\* Museum of Victoria, Melbourne, 3000.

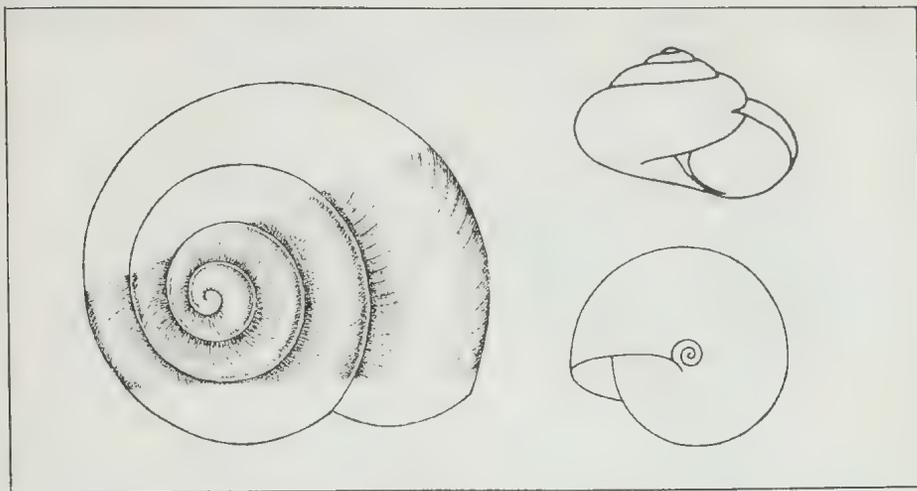


Fig. 1. *Pasmaditta jungermanniae* (Petterd, 1879)

crossed by spiral striae on the body whorl; very weak to absent on the base. Colour yellowish to brownish.

*Type species: Helix (Charopa) coesus* Legrand, 1871.

*Remarks:* The family Punctidae is a world-wide family which appears to have undergone some local radiation in Southern Australia (F. Climo — pers. comm.) (Smith, 1984). In Tasmania, besides the two genera described here there are four other punctid genera recorded for the state. These are *Paralaoma*, *Laomavix*, *Magilaoma* and *Miselaoma* (Smith and Kershaw, 1981). Two further genera are recorded from southern Victoria, and may have a Tasmanian affinity. These are *Excellaoma* and *Turbolaoma* (Smith and Kershaw, 1979).

*Pasmaditta* and *Pedicamista* can be easily separated from most of these other punctid genera by gross shell morphology as follows:—

*Laomavix* is a much smaller shell with a very wide umbilicus.

*Magilaoma* is turbinate with an elevated spine, peripheral keel and very narrow umbilicus.

*Miselaoma* is a much smaller shell with

a turbinate shell and very narrow umbilicus.

*Excellaoma* is a much larger shell with a closed to minute umbilicus.

*Turbolaoma* has a high turbinate shell and a very narrow umbilicus.

Only *Paralaoma* could be confused with these two new genera as superficially they have a similar shape and sculpture. *Paralaoma* is a widely distributed, variable group which should probably be subdivided into several generic groupings. It is characterized by its bold, spaced sculpture. Shell shape is very variable with a flattened to subconical spire, distinctly rounded whorls and rounded, descending aperture.

*Pasmaditta* does not have the bold sculpture of *Paralaoma* and the secondary sculpture is more complex. *Paralaoma* species are usually found in leaf and bark litter of dry forest areas whereas the type species of *Pasmaditta* is so far only known from under moss on sheltered delerite rock faces in the Cataract Gorge, Launceston.

*Pedicamista* also lacks the bold sculpture of *Paralaoma*. Its moderately conoid shell and broad roundly lunate aperture easily separate it from latter genus and

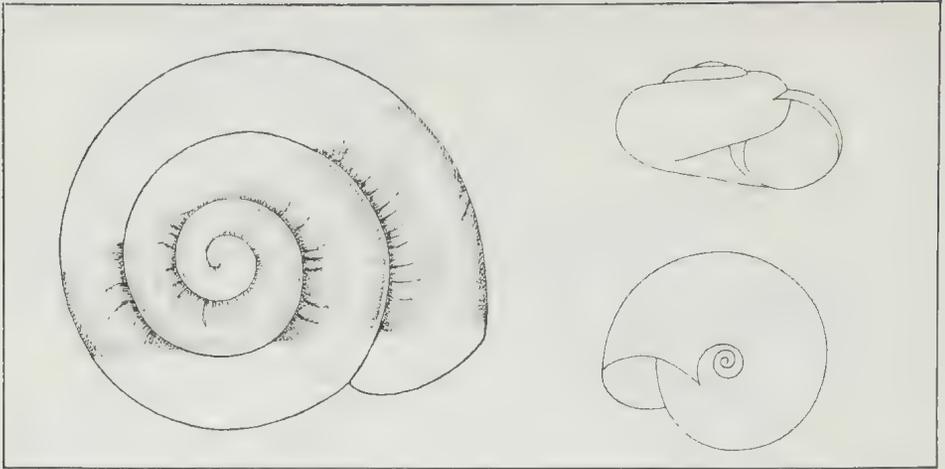


Fig. 2. *Pedicamista coesa* (Legrand, 1871).

from *Pasmaditta*. Very little is known about the habitat requirements of this genus for, although the type species was believed widely distributed in Tasmania, few specimens have survived in collections.

Solem (1983) figured the anatomy of *Pedicamista coesa* using it to illustrate "the essential unity of structure within the Punctidae" (p.54). He also made an indirect comment on the placement of the species as follows: "As a systematic comment, *Punctum* and *Paralaoma* may well be synonyms, but "*Paralaoma*" *coesa* probably does not belong to the same genus" (p. 56).

#### Acknowledgements

We would like to thank Rhyll Plant for the drawings and Lisa Giuliani for typing the manuscript. Thanks are also due to the Science and Industry Endowment Fund for support for RCK and to Bureau of Flora and Fauna and

Australian Biological Resources Study for support for BJS.

#### REFERENCES

- Iredale, T. (1933). Systematic notes on Australian land snails. *Rec. Aust. Mus.* 19:37-59.
- McMichael, D. F. and T. Iredale. (1959). The land and freshwater Mollusca of Australia, in A. Keast, R.L. Crocker and C.S. Christian (eds.), *Biogeography and ecology in Australia*: 224-245. The Hague.
- Smith, B.J. (1984). Regional endemism of the south-eastern Australian land mollusc fauna in: A. Solem and A.C. van Bruggen (eds.), *World-wide snails; Biogeographical studies on non-marine Mollusca*: 178-188. Brill, Leiden.
- Smith, B.J. and R.C. Kershaw (1979). *Field guide to the non-marine molluscs of south-eastern Australia*. 285 pp. ANU Press, Canberra.
- Smith B.J. and R.C. Kershaw (1981). *Tasmanian land and freshwater molluscs. Fauna of Tasmania, Handbook No. 5*, 148 pp. University of Tasmania.
- Solem, A. (1983). *Endodontoid land snails from Pacific Islands (Mollusca: Pulmonata: Sigmurethra)*. Part II. Families Punctidae and Charopidae, Zoogeography. Chicago, Field Museum Press, 336 pp.

### \$500 LEGACY FROM MRS E. BENNETT

The Club has received an amount of \$500 from the estate of the late Mrs. E. Bennett, a well known Honorary Member, who joined the FNCV in 1942. We are grateful for this benefaction and wish to thank those responsible for forwarding the money to the Club.

Council has decided to invest the money for the time being, until some worthwhile project is determined.

Noel Disken,  
Honorary Treasurer.

# The Distribution of Some *Eucalyptus* Species (the Swamp Gums) in the Yarra Valley, Victoria

BY DIANNE SIMMONS\* and GLEN BROWN†

## Introduction

The "Swamp Gums" *Eucalyptus ovata* Labill., *E.camphora* R.T. Baker and *E.yarraensis* Maiden and Cambage (Boland *et al.*, 1984) are interesting and taxonomically confusing species, which have been placed together to form the superspecies *Ovata* in the informal classification of Pryor and Johnson (1971). The three species are morphologically similar and can be difficult to separate, especially on herbarium material. They are typically found on low lying and periodically waterlogged sites. Ladiges *et al.* (1984) have recently suggested that *E.aromaphloia* Pryor and Willis, another species tolerant of waterlogged sites, should also be included in this group, though it is readily distinguished from them on adult morphology. Taxonomic difficulties have resulted in misleading distribution maps for all of these species, and this has contributed to further misidentification of the species in the field. Recent distribution maps for these species can show quite different geographic ranges (e.g. Brooker and Kleinig, 1983; Chippendale and Wolf, 1981; Costermans, 1981). The area of the Yarra Valley near Healesville is particularly interesting, as all four species occur there, often in close proximity, and there has been considerable uncertainty in the identification of a number of populations clearly belonging to this group.

This paper aims to provide some general information on the distribution of the species in Victoria, and more particularly in the Yarra Valley. Some morphological characters which can be

used to separate the four species are given in Table 1 and good illustrations are provided by Costermans (1981). Differences between *E.ovata*, *E.yarraensis* and *E.camphora* will be considered in some detail. Volatile oils have also been used to provide additional information about some difficult populations (Simmons, 1974).

## The Species

*E.ovata* (Swamp Gum). This species has creamy-white gum bark, which is rough at the base, ovate-lanceolate leaves with undulate margins, distinctly conical fruits with very short pedicels and level valves. This is the best known species with the widest range (Fig. 1). It is distributed over southern Victoria and into N.S.W., South Australia and Tasmania. *E.ovata* is typically found along watercourses and in low lying areas subject to periodic waterlogging, but it is not confined to them, and it is often found on drier ridges and well drained sites over a wide range of soil types (Cahill, 1977; Clifford, 1953; Clucas and Ladiges, 1979). Some taller forms previously included with *E.ovata* have since been referred to *E.brookeruna* A.M. Gray (Clucas and Ladiges, 1979; Ladiges *et al.*, 1981).

There is a general increase in fruit size from east to west across Victoria (Simmons, 1974), and populations around the Victoria/South Australia border have been described as *E.ovata* var. *grandiflora* Maiden (Brooker and Kleinig, 1983). Contrary to a number of distribution maps (e.g. Costermans, 1981; Chippendale and Wolf, 1981), *E.ovata* barely crosses the Great Dividing Range (Simmons, 1974). *E.ovata* hybridizes with a number of other species such as *E.crenulata* (Simmons and Parsons, 1976), *E.cypellocarpa* and *E.viminalis* (Clucas and Ladiges, 1979),

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† 58 King St., Yarra Glen. 3775.

Table 1. Morphological characteristics of *E.camphora*, *E.ovata*, *E.yarraensis* and *E.aromaphloia*.

Character	<i>E.camphora</i>	<i>E.ovata</i>	<i>E.yarraensis</i>	<i>E.aromaphloia</i>
Bark	Gum, grey	Gum, cream	Rough	Rough
Adult Leaves	Ovate-orbicular	Ovate-lanceolate	Ovate-lanceolate	Lanceolate
Fruit Shape	Conical	Conical	Hemispherical	Hemispherical
Valves	Exsert	Level	Slightly exsert	Exsert
Flowering Times	March-April	May-October	December-March	February-March

*E.aromaphloia* (Pryor and Willis, 1955) and *E.aggregata* (Simmons, 1985).

*E.camphora* (Mountain Swamp Gum, Broad Leaved Sally). This species has grey gum bark, which is rough at the base, ovate-orbicular leaves, often emarginate and sometimes with mucronate tips, small, distinctly pedicellate fruits and exsert valves. This species is generally found in montane areas of Victoria and N.S.W. (Fig. 1), where it is confined to cold waterlogged sites, sometimes with *E.stellulata*. Contrary to most published distribution maps (Brooker and Kleinig, 1983; Costermans, 1981; Hall *et al.*, 1970; Ladiges *et al.*, 1984), it also occurs in the foothills as far west as the Yarra River near Healesville, and east of the Hume Highway near Strathbogrie, Lima South and Greta South, and in these lower altitude areas it is frequently confused with *E.ovata*.

*E.yarraensis* (Yarra Gum, often included with "Swamp Gum", e.g. Rosengren *et al.* 1983). This species has rough bark to the smallest branches (*contra* Hall and Brooker, 1973), glossy green ovate-lanceolate leaves and pedicellate and distinctly hemispherical fruits with level or slightly exsert valves. *E.yarraensis* was described from the Yarra Valley "near Healesville" (Maiden, 1903-31), but it has since been found to

have a wide though patchy distribution in Victoria (Fig. 1), and it is never common. It occurs on a range of soil types (Cahill, 1977).

In the past, *E.yarraensis* has been considered as a hybrid (Johnson, 1962) and a variety of *E.ovata*, but it is now generally accepted as being of specific rank (Brooker and Kleinig, 1983; Costermans, 1981; Hall *et al.*, 1970, Pryor and Johnson, 1974). Johnson

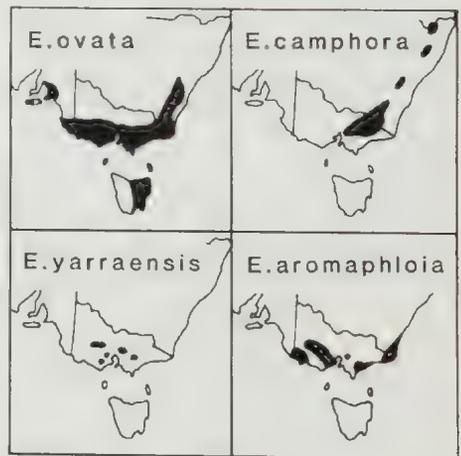


Fig. 1. Distribution of *E.ovata*, *E.camphora*, *E.yarraensis* and *E.aromaphloia* in Victoria (following Brooker and Kleinig, 1983 and Costermans, 1981).

(1962) suggested that *E.yarraensis* was derived from hybridization between *E.ovata* and *E.aggregata*, however this seems unlikely. *E.yarraensis* can be readily recognized by the distinctive composition of its volatile leaf oils, which contain up to 90% benzaldehyde and have a very strong smell of almond essence when boiled for a few minutes (Simmons, 1974). *E.yarraensis* and *E.ovata* often grow in close association, but they do not actually form mixed stands in the study area (Cahill, 1977; Simmons, 1974). Ecological factors which determine the local distribution patterns of *E.ovata* and *E.yarraensis* are complex, but do not seem to be due simply to soil differences or waterlogging tolerances. There is a tendency for *E.yarraensis* to be found on soils with higher fertility than *E.ovata*, and many of these sites have been cleared for agriculture (Cahill, 1977; Pryor and Briggs, 1981).

*E.yarraensis* is regarded as a vulnerable species (Leigh *et al.*, 1981) in danger of extinction (Pryor and Briggs, 1981). It is often not recognized as a species (e.g. in Land Conservation Council Reports) and is therefore not considered for protection at all, and in other situations, because of its wide geographic range it is not always accepted as endangered. However, it only occurs as scattered trees in relatively small populations over its range, and many of these populations are at risk due to clearing of habitat for agriculture. The very small stands and single trees remaining in some areas consist of ageing and degenerate trees with no sign of regeneration, due to grazing, agriculture and roadside clearing. Pryor and Briggs (1981) regard *E.yarraensis* as one of the most threatened of eucalypt species.

*E.aromaphloia* (Scent Bark, Creswick Apple Box). This species has rough bark to the smallest branches, lanceolate leaves, pedicellate hemispherical fruits with exsert domed disc and valves. *E.aromaphloia* has often been regarded as a species of western Victoria, found

generally on valley slopes and flats. However since it has become better recognized, its range has been extended (Fig. 1). The lack of concordance of distribution maps gives some indication of the generally confusing information about this species (Brooker and Kleinig, 1983; P. Ladiges, pers.comm.; Pryor and Willis, 1954; Costermans, 1981). It is not always recognized, and herbarium material appears similar to a number of other species (Pryor and Willis, 1954). It appears to readily hybridize with a number of species such as *E.viminalis* and *E.ovata* (Ladiges, 1974; Pryor, 1955). In western Victoria there may be continuous variation from *E.aromaphloia* to *E.viminalis* due to extensive past hybridization (Pryor, 1955), and this has further affected its recognition. It has been confused with *E.bridgesiana* in recent work on the Yarra Valley (Gullan *et al.*, 1979), though the two species are generally readily separated. There have been nomenclatural difficulties in the past, as both *E.aromaphloia* and *E.bridgesiana* (and a number of other species) have been referred to as "*E.stuartiana*" (Pryor and Willis, 1954), but this has not usually caused taxonomic difficulty in identifying these species. *E.aromaphloia* is generally morphologically distinct in the study area.

### The Yarra Valley

The core populations of *E.ovata*, *E.camphora*, *E.yarraensis* are readily distinguished. However, in some areas, particularly the Yarra Valley, there are several populations of indeterminate status, and several individuals and populations cannot be readily assigned to a taxon. Populations can usually be assigned to *E.yarraensis* on morphological evidence, and this can be easily confirmed by the composition of the volatile oils. It is generally more difficult to separate populations of *E.camphora* and *E.ovata* (Costermans, 1981).

Five trees from each of three populations assigned to core *E.camphora*, *E.ovata* and *E.yarraensis* were sampled and nine morphological characters (internode length, petiole length, leaf blade length, leaf blade breadth, distance from base of leaf to the widest point, peduncle length, fruit diameter, fruit

length and pedicel length) were measured on ten leaves and fruits from each tree (Table 2). Sample locations are shown in Fig.3.

Principal Coordinates Analysis (based on the nine measured morphological characters) indicates that the three species form identifiable clusters (Fig. 2). These

Table 2. Comparison of some morphological characters for *E.camphora*, *E.ovata* and *E.yarraensis* in the Yarra Valley, Victoria.

Character (in mm)	<i>E.camphora</i>	<i>E.ovata</i>	<i>E.yarraensis</i>
Internode length	19 (16-20)	15 (14-17)	15 (12-17)
Petiole length	33 (27-47)	29 (23-35)	23 (20-27)
Leaf length	126 (108-143)	120 (106-126)	110 (100-116)
Leaf breadth	56 (50-64)	41 (32-47)	38 (36-43)
Distance from leaf base to widest point	53 (42-59)	50 (47-51)	46 (39-52)
Peduncle length	9.4 (7.3-11.3)	9.6 (6.4-11.0)	5.4 (4.9-5.8)
Fruit diameter	5.6 (5.0-7.0)	6.1 (5.6-6.9)	4.4 (4.0-5.0)
Fruit length	4.1 (3.7-4.6)	4.8 (4.0-5.8)	3.6 (3.3-3.9)
Pedicel length	3.7 (2.4-5.0)	4.1 (3.5-4.6)	1.7 (1.4-2.3)

Range of the 5 trees sampled are given in parentheses.

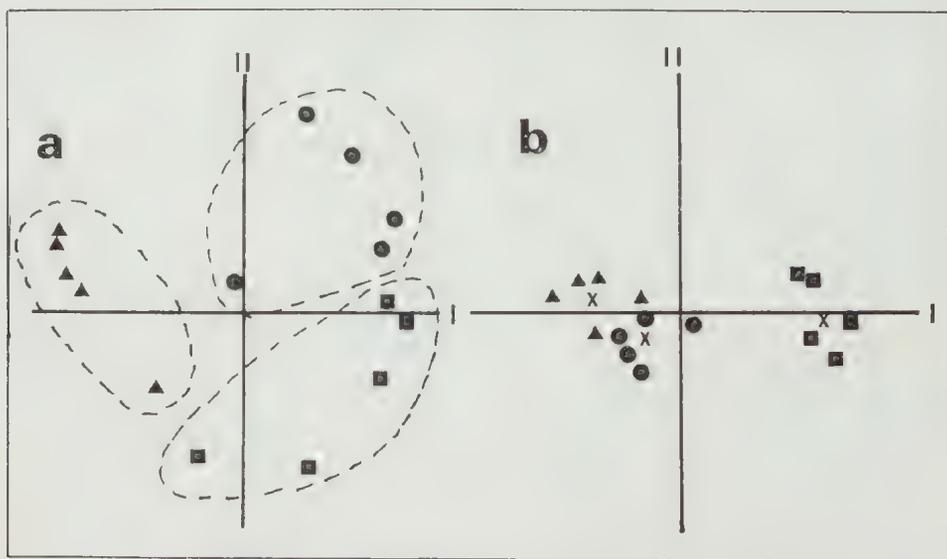


Fig. 2. a) Principal Coordinates Analysis from morphological data. The first axis accounts for 47% of the total variation, and the second axis 16%. b) Canonical Variate Analysis from morphological data. The first canonical variate accounts for 97% of the total variation, with the second variate accounting for the remaining 3%. x are group centroids. (●) *E.ovata*, (■) *E.camphora*, (▲) *E.yarraensis*.

groups can be further elucidated by Canonical Variate Analysis (Nie *et al.*, 1975). The basic aim of Canonical Variate Analysis (or Discriminate Analysis) is the description of population differences, and the first two canonical variates can often convey much information about population separation (Hopper *et al.*, 1984). This analysis indicates that *E.camphora* forms a distinct group, with *E.ovata* and *E.yarraensis* being closer to each other. Differences in flowering times between *E.ovata* and *E.yarraensis* may maintain genetic isolation of these species. Thus morphological evidence confirms that there are three taxa in this group present in the Yarra Valley. The distribution of these species, as well as *E.aromaphloia* was determined by a

traverse of major roads and is shown in Fig. 3. *E.ovata* is most widely distributed in the area, predominantly in the south along water courses and other low lying areas. *E.camphora* is generally confined to cold, wet sites in the north of the study area, and *E.yarraensis* is scattered, but most common on the Yarra floodplain near Coldstream, in the west of the area. *E.aromaphloia* is found off the Yarra floodplain, at more elevated sites often in valley bottoms.

There are a few populations which are not readily assigned to either *E.ovata* or *E.camphora*. It is not clear whether these difficult populations have arisen by hybridization or introgression between *E.ovata* and *E.camphora* or are the result of convergent evolution and

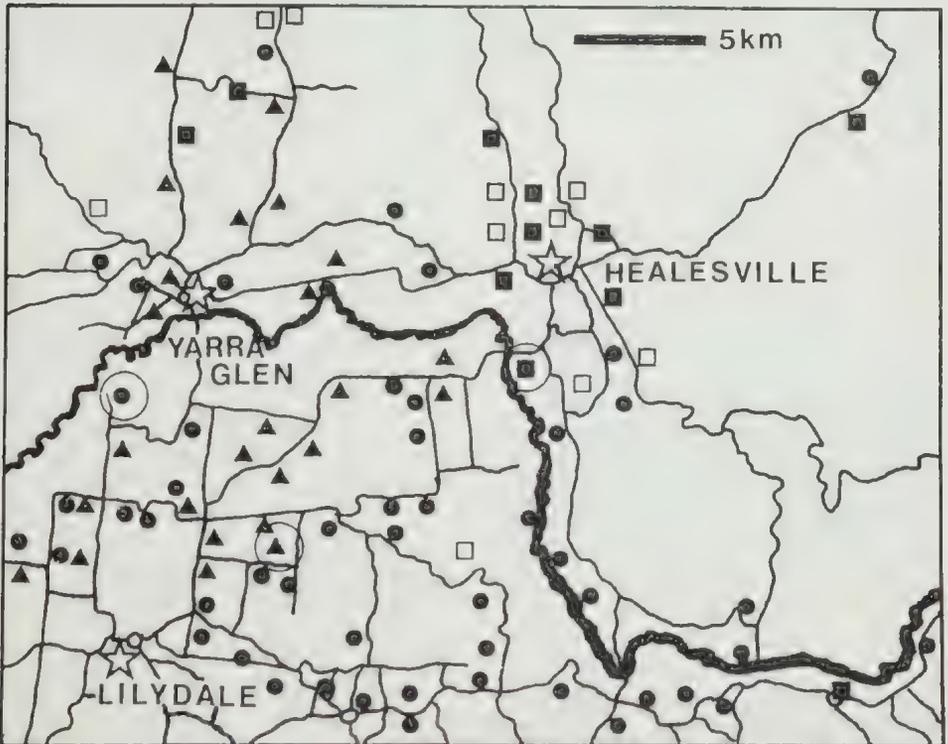


Fig. 3. Distribution of the species in the Yarra Valley. Populations sampled for analysis of morphological data are circled. (●) *E.ovata*, (■) *E.camphora*, (▲) *E.yarraensis*, (○) *E.aromaphloia*. Thick line shows Yarra River, all other lines indicate major roads.

differentiation in the species in an area forming the periphery of the range of both species. The similarity of *E.ovata* and *E.camphora* in both morphology and volatile leaf oils in this area makes detection of hybridization difficult. Further work using progeny testing and seedling characters (Ladiges *et al.*, 1984) may give valuable information.

In the Yarra Valley, many taxonomic difficulties have arisen as a result of both *E.camphora* not being recognized, and also the supposed indeterminate status of *E.yarraensis*. *E.yarraensis* is mapped at the Everard Reserve on the Yarra River near Healesville (Rosengren *et al.*, 1983), however the grey gum bark and small, distinctly pedicellate conical fruits with exert valves, indicate that this population should be assigned to *E.camphora*. Analysis of the volatile leaf oils confirms that it should be regarded as *E.camphora* (Simmons and Parsons, 1976), but this population is still of significance as it forms the most westerly point in the distribution of *E.camphora*.

It is unfortunate that some recent publications have failed to adequately differentiate between some populations of these species (Gullan *et al.*, 1979; Rosengren *et al.*, 1983) as this perpetuates the confusion in a group of species which, though superficially morphologically similar, can be satisfactorily differentiated once their presence in an area is recognized. The species form a mosaic distribution pattern, and the species occurring at any site are likely to be determined by a complex interaction of soil factors, waterlogging tolerance and drought tolerance. It is interesting to note that the four closely related species, as well as the narrow endemic *E.crenulata*, also an endangered species, are all tolerant of waterlogged sites, and are all found in the small area of the Yarra Valley. Two of the eight endangered eucalypt species listed by Pryor and Briggs (1981) for Victoria are found in this area.

## REFERENCES

- 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*. Nelson, Melbourne.
- Brooker, M.I.H. and Kleinig, D.A. (1983). *Field Guide to Eucalypts. Vol 1. South Eastern Australia*. Inkata Press, Melbourne.
- Cahill, D. (1977). The taxonomy, distribution and waterlogging tolerances of *E.ovata* Labill. and *E.yarraensis* Maiden and Cambage. B. Sc.(Hons.) Thesis. Botany Dept., Monash University.
- Chippendale, G.M. and Wolf, L. (1981). *The Natural Distribution of Eucalyptus in Australia*. Commonwealth of Australia, Canberra.
- Clifford, H.T. (1953). On the distribution of the species of *Eucalyptus* in the region of the Dandenong Range, Victoria. *Proc. R. Soc. Vic.* 65: 30-55.
- Clucas, R.D. and Ladiges, P.Y. (1979). Variations in populations of *Eucalyptus ovata* Labill., and the effects of waterlogging on seedling growth. *Aust. J. Bot.* 27: 301-15.
- Costermans, L. (1981). *Native Trees and Shrubs of South-Eastern Australia*. Rigby, Melbourne.
- Gullan, P.K., Parkes, P.M., Morton, A.G., Bartley, M.J. (1979). *Sites of Botanical Significance in the Upper Yarra Region*. Ministry for Conservation, Victoria.
- Hall, N. and Brooker, I. (1973). Yarra Gum *Eucalyptus yarraensis* Maiden and Cambage. Commonwealth of Australia Forestry and Timber Bureau, Forest Tree Series No. 76.
- Hall, N., Johnston, R.D. and Chippendale, G.M. (1970). *Forest Trees of Australia*. Australian Govt. Publishing Service, Canberra.
- Hopper, S.D., Campbell, N.A. and Caputi, N. (1984). Geographical variation, subspecies discrimination and evolution in fruits, leaves and buds of *Eucalyptus caesia* (Myrtaceae). *Nuytsia* 5: 179-194.
- Johnson, L.A.S. (1962) Studies in the taxonomy of *Eucalyptus*. *Cont. N.S.W. Nat. Herb.* 3: 103-26.
- Ladiges, P.Y., Gray, A.M. and Brooker, M.I.H. (1981). Pattern of geographic variation, based on seedling morphology, in *Eucalyptus ovata* Labill. and *E.brookerana* A.M. Gray and comparisons with some other *Eucalyptus* Species. *Aust. J. Bot.* 29: 593-603.
- Ladiges, P.Y., Dale, M.B., Ross, D.R. and Shields, K.G. (1984). Seedling characters and phylogenetic relationships in the Informal Series *Ovatae* of *Eucalyptus*, Subgenus *Symphomyrtus*. *Aust. J. Bot.* 32: 1-13.
- Leigh, J., Briggs, J. and Hartley, W. (1981). *Rare and Threatened Australian Plants*. Australian National Parks and Wildlife Service Special Publication No.7.
- Maiden, J.H. (1901-1931). *A Critical Revision of the Genus Eucalyptus*. Govt. Printer, Sydney.
- Nie, N., Bent, D.H. and Hull, C.H. (1970). *SPSS Statistical Package for the Social Sciences*. McGraw-Hill, New York.

- Pryor, L.D. (1955). The genetic and systematic status of *Eucalyptus huberiana* Naudin, *E. viminalis* Labill. and *E. aromaphloia* Pryor and Willis. *Trans. R. Soc. S.A.* 79: 156-164.
- Pryor, L.D. and Briggs, J.D. (1981). *Australian Endangered Species: Eucalypts*. Australian National Parks and Wildlife Service Special Publication No. 5.
- Pryor, L.D. and Johnson, L.A.S. (1971). *A Classification of the Eucalypts*. A.N.U., Canberra.
- Pryor, L.D. and Willis, J.H. (1954). A new Victorian (and South Australian eucalypt. *Victorian Nat.* 71: 125-129.
- Rosengren, N., Frood, D. and Lowe, K. (1983). *Sites of Environmental Significance in the Flood Plain of the Upper Yarra River*. Upper Yarra Valley and Dandenong Ranges Authority.
- Simmons, D. (1974). *Geographic Variation in the Morphology and Leaf Oils of Some Eucalyptus Species*. Ph. D. Thesis. Botany Dept. La Trobe University, Bundoora.
- Simmons, D. (1985). Observations on disjunct populations of *Eucalyptus aggregata* in Victoria and N.S.W., with notes on the status of *E. rodwayi*. *Victorian Nat.* 103: 131-136.
- Simmons, D. and Parsons, R.F. (1976). Analysis of a hybrid swarm involving *Eucalyptus crenulata* and *E. ovata* using leaf oils and morphology. *Bioch. Sys. and Ecol.* 4: 97-101.

### FNCV LIBRARY

During the last year \$300 has been expended on purchasing books for the Club library. A similar amount will be spent this year for the same purpose. Members financial support is appreciated as are donations of books of which there have been many.

Sheila Houghton, the Club Librarian, is presently updating the library record system. A new periodicals register has been purchased with money applied from the Cedric Ralph Fund. An amount of \$100 is involved. Our thanks are extended to the donator of this money.

Noel Disken,  
Honorary Treasurer.

### REFENCING OF THE FNCV COSSTICK RESERVE MARYBOROUGH

As a result of wild fire burning through the FNCV's Cosstick Reserve near Maryborough in early 1985 extensive refencing had to be undertaken. Some money was received from the Department of Agriculture and Rural Affairs under Bush Fire Relief funding arrangements and for this we are very grateful. However the balance of the funding had to be made up by the Club. Council decided to use funds from legacies that had been held for some years. It would be remiss if the application of these funds was not acknowledged. The amounts and sources involved were:

- \$200 from the Ivy Dixon Fund
- \$300 from the P. F. Morris Fund
- \$ 20 from the R. S. Chisholm Fund

Our thanks are recorded to the people who provided these sums and I am certain that the amounts involved have been well spent.

The intensive efforts of the Maryborough Field Naturalists Club in the provision of labour and other assistance is also acknowledged.

Noel Disken,  
Honorary Treasurer.

## F.N.C.V. Excursion to Point Cook, August, 1985

Our August Club excursion took us to one of the more recently gazetted of the M.M.B.W. reserves — Point Cook Metropolitan Park. Situated on the bay between Point Cook RAAF Base and the Cheetham Salt Works, this 1000 acre recreation area has been equipped with a good road, car parking facilities, barbecues and conveniences, and is already proving a most popular venue for family picnics, not only for folk living in the western suburbs, but from elsewhere in the metropolitan area.

Point Cooke (with an "e") was originally named after John Cooke, mate of the vessel "*Rattlesnake*" which was used to chart part of Port Phillip Bay in 1836.

Historically this is a most interesting reserve. Prior to the white settlement, the beach and wetlands would undoubtedly have provided a rich source of food for the Aborigines who had occupied the land for perhaps 30,000 years. The several lakes and swamplands abound with numerous waterbirds and the rocky shores — now a marine park — would have provided them with shell fish and other delicacies.

In 1849 the land was leased for grazing until about 1853 it was sold to Thomas and Andrew Chirnside who built a blue-stone homestead, a weatherboard dwelling and bluestone stables on the promontory. The date 1857 is above the front door of the main building and all three are recorded on the State and National Historic Buildings Register and are classified by the National Trust. Currently they are being repaired and are not yet open for public inspection. It is proposed that the homestead property will be kept as a 'living museum' with horses and other livestock, old vehicles, several of which we saw, already beautifully restored, harness and numerous other articles of a bygone age.

Gradually the home station was expanded into a large pastoral empire —

famous for breeding racehorses, and for its fox and deer hunts. Later the Chirnsides moved to their great mansion, Werribee Park, and the Point Cook property was used chiefly as a place for sporting entertainment.

Much planting of native Australian trees and shrubs has already been achieved in the park by the Board and gradually many indigenous species are returning. The coast, the lakes and swamps, the open plains and scattered eucalypts provide a haven for many birds — indeed we were informed that approximately 170 species have been recorded. Wide patches of bracken fern have been retained as shelter for quail and other little ground birds. Altogether much careful thought and effort is being put into developing what will be quite a notable addition to the list of parks open to the public and the M.M.B.W. is to be commended. Our group was welcomed with courtesy by the Rangers who went to considerable trouble to make our visit a most informative and interesting one.

As the icy wind blowing that day was not conducive to lingering, we decided we would pay a visit to Werribee Park on our way home — and were again impressed with the M.M.B.W.'s organization for real family enjoyment. We were driven around the park in a small bus so that we could see the wide variety of animals grazing peacefully in the broad acres — zebras, camels, rhinos, buffalo, kangaroos, deer, llamas, and many others — quite unafraid of us and accustomed to the vehicle. The gnarled old red gums on the banks of the winding Werribee River lent character to the scene and were home to sundry galahs and other birds.

Altogether a great day of historical and natural history interest — thankyou Marie.

Gwynnyth Taylor

# REPORT OF THE SPRINGTIME GET TOGETHER OF THE VICTORIAN FIELD NATURALISTS CLUBS ASSOCIATION, MARYBOROUGH OCTOBER 5th and 6th 1985

One hundred and ten persons attended the meeting, they came from 17 Field Naturalists Clubs around Victoria and were entertained by the energetic Maryborough Club at their fine new local-stone Club Rooms which they built and share with the Maryborough Rifle Club in bushland outside the north-western boundary of the town, off the Timor Road.

Maryborough bush suffered severely this year from an enormous bushfire in January 1985, the beautiful Box/Ironbark forest is only just beginning to regenerate after the rains which did not occur for more than 3 months after the burn.

The understory of acacias showed some signs of returning, but flowering above the blackened earth there was a profuse growth of orchids of several kinds, probably the most common were the blue Waxlip (*Glossodia major*) and Pink Fingers (*Caladenia carnea catenata*) and the Musky Caladenia (*C. angustata*).

There were also many Leopard Orchids (*Diuris maculata*) and three different colours of Sun Orchids; the blue *Thelymitra aristata* and *I. longifolia*, the yellow Rabbit Ears (*T. antennifera*) and the Salmon Sun Orchid (*T. rubra*).

Also abundant were the golden Yam Daisies (*Microseris scapigera*) and the small creeping *Thysanotis patersonii* which had nothing to climb upon.

*Brunonia australis*, the blue Pin-cushion, was ready to bloom, but of midget height only. Along the road verges near Cosstick Reserve which was entirely burnt out, but has been re-fenced, were bushes of *Grevillea alpina* with flowers of three distinct hues, red, greenish-yellow and white.

Botanical stops were made at Cosstick Reserve and at three sites in Paddys Ranges, including Possum Gully Track and the Whipstick where it was pleasing

to note the regeneration of the vegetation. Twenty-three species of birds were recorded, including the Fuscous and several other Honey-eaters, the Pallid and Horsefields Bronze-cuckoos and Mistletoe Bird, however the Maryborough Club members told us that the bird population had been sadly depleted by the fires, especially their nesting sites.

A magnificent casserole and salad dinner was provided for 110 persons in the Maryborough Club Rooms, after which a general meeting was held, chaired by the President of the V.F.N.C.A. Mr. Albert Perry of Ballarat, who subsequently led the singing around a huge logfire outside the Clubhouse, accompanied by a piano accordion and electric organ, some recitations were given and then after supper most of the visitors retired to hotels or camping areas for the night.

Mrs. Helen Stanford manned the bookstall in the Clubhouse.

Next morning, Sunday, October 6th, the group divided into two. One group went on a local bush bird excursion to the Havelock Forest area and recorded 43 different species, including a fine Gilbert Whistler and nest of Wedge-tailed Eagle and the nest of a White-winged chough, the other group visited the Aboriginal water wells at Bull Gully made by the Jajowurrong tribe, recorded by Aldo Massola in 1956 in the Victorian Naturalist, Vol. 73, No. 4. A Special Purpose Reserve of 0.2 ha. has been gazetted to protect this set of well and the Maryborough Field Naturalist Club has erected a high wire enclosure to protect them against vandalism, but this has not prevented beer bottles being thrown in to smash against the sandstone rocks.

A visit was then paid to the largest Quartz reef in Victoria and possibly in Australia, at Lillicur near Amhurst, 15 kilometres from Maryborough, where a

deep mine shaft lies uncovered on the crest of the hill and a fine view of the surrounding countryside and the Pyrenees Mountains was obtained from the summit, here we also found the gnat orchid (*Acianthus exertus*) in flower.

Small Aboriginal wells were visited near a roadside in Paddys Ranges, but there was no water in this well, it was filled with blackened mud and debris.

A barbecue luncheon was provided for

more than 80 persons in the open bushland near the Clubhouse.

On the homeward journey, bus passengers made a stop in the forest near the stone ruins of the old Gower school and here we found bushes of the Fairy Waxflower (*Eriostemon verrucosus*), *Grevillea parviflora* and the Rough Wattle (*Acacia aspera*) as well as the Gold Dust Wattle (*A. acinacea*).

**Dr. Elizabeth K. Turner**

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### **Australian Natural History Medallion, 1985: Jack Hyett**

Jack Hyett worked for the Education Department of Victoria from 1933 until, 1976, first as a primary school teacher, and after 1963 at Burwood State College. He lectured for the Council of Adult Education on *Bird Study in Australia*, directed their Outback Study Schools, and led birdwatching and wildlife tours in Australia and overseas, to the Galapagos Islands, Ecuador, Sri Lanka, India and South Africa.

In 1933, he joined the Bird Observers Club, and is now the custodian of the Historic Photographic Collection. He was the foundation president of the Ringwood Field Naturalist Club and the Victorian

Ornithological Research Group, and is a member of several clubs including the F.N.C.V., R.A.O.U. and the Wildlife Preservation Society of Sri Lanka.

He served for seven years on the bird survey of Wilson's Promontory, and also conducted the mammal survey of the Promontory.

Jack Hyett has published several books and numerous articles on birds and mammals, edited four volumes of *The Emu*, and is currently sub-editor of *The Australian birdwatcher*, for which he has prepared indices, as well as a *Bird species index to the first 100 volumes of the Victorian Naturalist*.

# FIELD NATURALISTS CLUB OF VICTORIA

## Reports of recent activities

### General Meeting

Monday, 11th November

Mr. Alf Fairhall read from the December 1918, Vic. Nat., the report of the General Meeting held on the 11th of November, 1918. News had just been posted of the cessation of hostilities between the Allied Nations and the Germans, and that the Germans had accepted the terms of the Armistice. After singing the National Anthem and giving three cheers for the King, the meeting went on as usual in spite of the fact that Melbourne went mad that night in celebration. Mr. Fairhall said that he was one of the thousands celebrating in the streets.

Dr. Terry O'Brien, Vice-President of the Royal Society of Victoria was called upon to introduce the winner of the 1985 Australian Natural History Medallion, Mr. Jack Hyett. He spoke of the importance of people like Mr. Hyett to form a link between amateur naturalists and professional biologists who have become increasingly separated over the years. Dr. O'Brien then gave a few details about Mr. Hyett's life and some of his achievements which, he said, should "awe the older and inspire the younger". (A short biography of Mr. Jack Hyett appeared earlier in this issue).

After accepting the Medallion, Mr. Jack Hyett then presented the address for the evening, entitled "Before the Medallion" in which he described the careers of some eminent Australian natural historians who died before the advent of the award. These were his personal choice being people who had impressed and influenced him.

— Colonel W. V. Legge (1841-1918). Foundation president of the R.A.O.U. In 1900. Author of "A History of the Birds of Ceylon", "A Systematic List of Tasmanian Birds" and on the committee for the first Australian bird checklist.

— Mrs. Ellis Rowan (1848-1922), granddaughter of John Cotton who wrote books on birds. A keen wildflower painter and adventurous traveller, she painted in N.Z., Australia, the U.S.A. and New Guinea, where she painted 45 of the Birds of Paradise. She was a friend of Baron von Mueller who encouraged her and named her specimens. Her paintings caused a great deal of interest and several books of her works have been published.

— Mr. A. J. Campbell (1853-1929), the premier oologist of his time. Heavily involved with Le Souef in the formation of the R.A.O.U. (1900) and the B.O.C. (1905). Founder of the Wattle League. Active member of the F.N.C.V. Prolific collector of nests, eggs and skins of Australian birds and author of several books.

— Mr. W. H. D. Le Souef (1856-1923). Son of A.A.C. Le Souef (Director of Melbourne Zoo) was Assistant Director for many years and in 1902 succeeded his father as Director. Co-founder with A. J. Campbell of R.A.O.U. President 1907-1909. Egg and nest collector and author.

— Mr. W. W. Froggat (1858-1937), Entomologist. Collected specimens for several Australian Museums. In 1896, became N.S.W. Government Entomologist until retirement in 1923 and was sent overseas on various projects. Author of several books on insects and other topics.

— Mr. Tom Payne Bellchambers (1857-1929). Worked for a while with a steamship on the Murray River where he met and was very impressed by the remnants of the local Aboriginal tribes and their knowledge. He established a sanctuary for native animals at Humbug Scrub near Elizabeth, S.A., and was the first to breed Mallee Fowl in captivity. He wrote nature columns for the Adelaide Register and his publications had a big

influence on the children and people of South Australia.

—**Dr. John A. Leach (1870-1929)**. Was a school teacher for several years then became an Inspector of Schools. He was appointed Organising Inspector of Nature Study and his work had a tremendous affect on generations of children. In 1922 he completed his doctorate on two theses, Myology of *Strepera* (Currawongs) and Revision of Victorian Lampreys. Published prolifically and gave many public lectures. Founded Victorian Gould League. President F.N.C.V. 1912-1914.

### Exhibits

— Books authored by Jack Hyett. "Australian Mammals", "A Bushman's Year" and "A Species Index of Australian Native and Introduced Birds. Victorian Naturalist Volumes 1 to 100".

— Seats of Echidna, Western Grey Kangaroo and Common Dunnart from the Border Track in the Big Desert Wilderness. (Mr. I. Faithfull).

— Under microscopes: (i) A fernlike hydroid, *Aglapopenia plumosa* showing the basket-shaped structure called a corbula which protects the reproductive parts. (ii) Oolites. These are small spheres of concentrically laminated silica. These oolites have been bound together by a limy cement to form rock. (Mr. D. McInnes).

— Tussock moth eggs and caterpillars from Yarra Junction feeding on *Eucalyptus leucoxylon* leaves. (Mrs. C. Falkingham).

— Spotted slate from Anakie Gorge, slickensides from Bendigo and shale showing perfect cubes of pyrites. (Mr. A. Blackburn).

### Nature Notes

— Mr. Blackburn drew the attention of the meeting to an unusual coincidence of astronomical events. Tomorrow the earth, moon and sun will all be aligned, the moon will be new and at perigee, the closes point in its orbit to the earth. This

is likely to result in a very high tide tomorrow.

— Three different species of case moths found on a pine tree, each one having chosen a different material to camouflage its case. One has surrounded itself with small twigs, another pine needles and the third with nothing more than a fine dust adhering to its silk.

### General Meeting

#### Monday, 9th December

**Members** stood and observed a moments silence in memory of Mr. Frank Robbins who died early last month. Mr. Robbins joined the Club in 1943 and had a wide range of interests. His studies had included the Permian glacial pavements of the Eppalock area and a botanical survey of the Whipstick.

**The Speaker** for the evening was Mr. Michael McBain who spoke on "The Victorian Underworld: A Natural History of Caves". Mr. McBain is a very keen speleologist and has spent a lot of time caving in Australia and overseas.

Victoria is very well off for caves, as it has excellent examples of both limestone caves and of larva caves in the west. The caves at Buchan are part of a band of limestone running down the east coast of Australia as far as Ida Bay near Hobart where there are some very deep caves.

Mr. McBain went on to describe the processes of formation of various types of caves and cave deposits illustrating his talk with many slides. The formations he described included gypsum "flowers" in larva caves, helictites, stalactites and salagmites, "shawls", rim pools and oolites or "cave pearls".

The lack of sunlight in caves means, of course, that there are no green plants and hence food is scarce for any animals that live there. The only plants are fungi which live on piles of bat dung.

Although the cave environment is dark, it is also constant in temperature and of high humidity and some animals survive entirely in caves. They do so either by

(Continued from inside front cover)

## GROUP EXCURSIONS

All FNCV members and visitors are invited to attend Group Excursions

### Botany Group

Saturday, 22nd February. Point Lonsdale: Seaweeds and Sand-dunes.

Saturday, 22nd March. "Jehosaphat Gully" Section. Kinglake N.P. Leader: Mr. A. Thies.

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### Geology Group

Sunday, 9th March. New Fossil Beach, Mornington.  
Sunday, 6th April. To be announced.

### Mammal Survey Group

Friday, 28th March—Tuesday, 1st April. Easter Camp.

feeding on detritus washed into the cave or other organic wastes or by preying on other cave dwellers. These cave creatures have slow metabolic rates and are often blind and include species of fish, salamanders, shrimp, spiders, insects isopods and copepods.

Other animals use the shelter and constant environment of caves as a refuge and leave the cave to feed. This includes many species of bat and in the Philippines swiftlets which, like bats use echo-location to find their way about in the dark.

### Exhibits

— Under microscopes: Slides from a collection donated to the Club by the late Mr. John Strong: A wasp from a deciduous oak and the radula of a marine mollusc. (Mr. U. Bates).

— Books and old issues of the Victorian Naturalist dealing with the subject of caves (Mrs. S. Houghton).

— More books about caving. (Mr. M. McBain).

— Frozen dead birds from Portland; a Gadfly or Diving-petrel, a Fairy Prion, a Broad-billed Prion (all found beachwashed) and a Brush Bronzewing. (Mr. P. Shaw).

### Nature Notes

— Numerous Kookaburras were observed catching Redfin English Perch from Lake Eildon and knocking them on the branches of dead stags in the lake to kill them. (Mr. T. Sault).

**C. M. Shankly**

# 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.

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## 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.

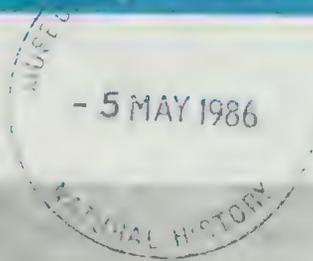
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## FNCV DIARY OF COMING EVENTS

### GENERAL MEETINGS

#### Monday, 14th April, 8.00 p.m.

Mrs. Sibely May. "Wildflowers of the South Australian Mallee"  
Honorary Membership will be awarded to Mr. R. C. Kershaw.

#### Monday, 12th May, 8.00 p.m.

Annual General Meeting. Reports of the Council, Treasurer and Auditors. Election of Office-Bearers and Council.

Mrs. Sheila Houghton: "The History of the FNCV".

#### Monday, 16th June, 8.00 p.m.

Dr. Robyn Adams. "Distribution of *Callitris* in Victoria and some interesting populations close to Melbourne".

#### New Members — December 1985-January 1986

##### *Metropolitan*

Andrea Jayne Bartrop, 38 Conyers St., The Basin, 3154.

Ms. Caroline Copley, Flat 3/270 Williams Rd., Toorak, 3142.

Mrs. Jean Gamon, 10 Roslyn St., Brighton, 3186.

Mr. K. D. Jackson, 12 Collins St., Box Hill, 3128.

Mrs. Judy Murray, 6 Helston St., Nth Balwyn, 3104.

G. J. Paras, 9 Edgar St., Heidelberg, 3084.

Gerard Pillai, 40 Rubicon St., Reservoir, 3073.

John Smith, 18 Jackson St., Sunbury, 3429.

Miss Margaret Wark, 8/61 Haines St., Nth Melbourne, 3051.

Brenda K. McIlroy and Guy T. McIlroy, P.O. Box 210 E. Bentleigh, 3165.

Mr. P. A. Wlodarczyk and C. Constantinov, 21 Hammond St., Altona, 3018.

##### *Student*

Miss Jenny Chappill, 18 Benjamin St., Parkville, 3052.

Bill Vasiliadis, 28 Warren Rd., Cheltenham, 3192.

Warwick Williams, 45 Osborne Rd., Warrandyte, 3113.

##### *Country*

J. Forbes, Tankerton, French Island, 3921.

Mrs. Caroline Lindner, Burns St., Axedale, 3551.

Dr. P. R. Milne, 1 Willow Drive, Bendigo, 3550.

##### *Joint Metropolitan*

Martin Phillip Cohen and Catherine Margaret Hillas, 266 Barkers Rd., Hawthorn, 3122.

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### FNCV EXCURSIONS

**Sunday, 6th April.** Possibly an evening excursion to review Halley's Comet. Ring Marie Allender (527-2749) for details.

**Sunday, 4th May.** Mrs. Hilary Weatherhead will lead a fern excursion in the Dandenongs. The coach will leave Batman Ave. at 9.30 a.m. Fare \$10. Bring picnic lunch. Mrs. Weatherhead to join excursion at Grant's Picnic Ground at 10.45 a.m.

**Sunday, 1st June.** Dr. J. H. Willis will lead a fungal excursion, probably in the Powelltown area. The coach will leave Batman Ave. at 9.30 a.m. Fare \$11. Bring a picnic lunch.

\*Would anyone interested in an excursion to Kangaroo Island in mid-October, please let Marie Allender (527-2749) know.

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### GROUP EXCURSIONS

All FNCV members and visitors are invited to attend Group Excursions

#### **Botany Group**

Saturday, 26th April. Sections of the Two Bays Walking Track, Nepean State Park. Leader: Stefanie Rennick. Meet at 10.30 a.m. in the "Sea Winds" car park.

Saturday, 24th May. "Fungi!" Beenak Forest. Leader: Mr. Tom May.

Saturday, 28th June. Organ Pipes and Brimbank Park. Leader: Mr. Andy Blackburn.

#### **Geology Group**

No excursion April.

Sunday, 11th May. Fingal Beach, Mornington.

#### **Mammal Survey Group**

Excursion to be announced.

(Continued inside back cover)



# The Victorian Naturalist

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Editorial Committee: P. Lawson, D. McClellan, J. Phillips,  
R. Thompson, L. Williams.

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Cover Illustration: Lake Coranderk — Photo L. Williams.

# Survey of Fish Fauna in Badger Creek and Waters in the Coranderrk Bushland Reserve, Healesville Sanctuary

BY J. D. KOEHN\*

## Introduction

A total of 44 species of native fish have been described as utilising fresh water in Victoria (Cadwallader & Backhouse, 1983; Sanger, 1984). Unlike mammals and birds, little attempt has been made to document their distributions on a state-wide basis. Recent fauna surveys conducted by the Fisheries and Wildlife Service (e.g. Robertson *et al.*, 1982a, 1982b, 1983a, 1983b; Chesterfield *et al.*, 1983; Opie *et al.*, 1984; Horrocks *et al.*, 1984; Carr *et al.*, in press), have been concerned mainly with non-piscean vertebrates and like many other faunal surveys collect little or no data on fishes (Jackson & Davies, 1983a). Consequently, reports for land management recommendations such as those prepared by the Land Conservation Council, may utilise fish data which is inadequate or outdated.

Recently the results of several surveys of freshwater fish fauna in selected areas have been published (Cadwallader, 1979; Jackson & Davies, 1983a, 1983b; Tunbridge, 1983). Some data are also available on native freshwater fish distributions from results of surveys of trout populations by the Fisheries and Wildlife Service (Baxter, in press). Generally however, distributional data are compiled from information obtained in many smaller surveys, often conducted as a consequence of other work (e.g. Renowden, 1968; Frankenberg, 1969; Chessman & Williams, 1974; Llewellyn, 1974; Beumer & Harrington, 1977; Gooley, 1977; Backhouse & Vanner, 1978; Apps *et al.*, 1979; Backhouse & Gooley, 1979; Bell *et al.*, 1980; Beumer & Harrington, 1980; Jackson, 1980).

Tunbridge and Glenane (1983) and Cadwallader and Backhouse (1983) have recently combined such data, along with data from other sources, to provide species lists and distribution maps on a statewide basis.

This paper documents fish species present in Badger Creek and waters within the Coranderrk Bushland Reserve, Healesville Sanctuary.

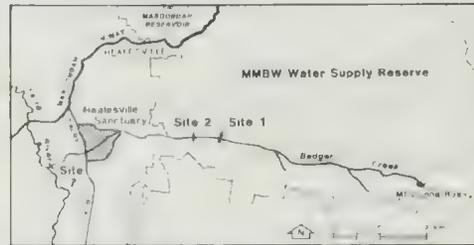


Fig. 1. Map showing survey sites on Badger Creek, outside Healesville Sanctuary.

## The study area

Badger Creek rises on the north-western slopes of Mt. Donna Buang flowing in a westerly direction through a Melbourne and Metropolitan Board of Works (MMBW) catchment reserve, then the outer areas of the Healesville township including the Healesville Sanctuary (Sir Colin Mackenzie Fauna Park), before reaching the Yarra River about 17 km from its source (Fig. 1). A small diversion weir controlled by the MMBW exists on Badger Creek about 8 km upstream of its junction with the Yarra River. The surrounding vegetation is essentially tall, open eucalypt forest (*sensu* Specht, 1972), with open grazing land downstream of the Healesville Sanctuary.

\*Arthur Rylah Institute for Environmental Research, 123 Brown Street, Heidelberg, 3084.



Fig. 2. Map showing survey sites within the Coranderrk Bushland Reserve, Healesville Sanctuary.

Sampling was undertaken at 7 sites (Figs. 1 and 2). Sites 1 and 2 consist of cascades with fast water flowing through boulder areas. Further downstream (Site 3) Badger Creek consists of alternating pool and riffle sequences with an average width of 3 m and maximum depth 1.4 m. Site 7, at the junction with the Yarra River, generally consists of slow flowing water with aquatic vegetation.

The Coranderrk Bushland Reserve portion of the Healesville Sanctuary consists of about 142 ha of mostly natural bushland set aside for the study of natural history (Fig. 2). It is used extensively by departments from the three Melbourne universities, many naturalist groups and government departments. In addition to Badger Creek, the Coranderrk Bushland Reserve also contains several lentic waters. The largest is Lake Coranderrk (about 6 ha) which is used as a water supply for the Fauna Park. Stocking of this lake with 200 rainbow trout (*Salmo gairdneri*) occurred in 1978. Lake Coranderrk (Site 4) is fringed with a dense band of marginal emergent vegetation, as is Piccaninny Pond (Site 5) and the two small fire dams (Site 6). Sites 5 and 6 also contain aquatic vegetation and have highly organic water with low oxygen content and poor quality.

## Methods

Sampling was undertaken between 7 May, 1984 and 5 March, 1985 (Table 1), using a Smith-Root Mark VIA model electrofisher (pulsed D.C. at 672 V.). Length of creek sampled ranged from 80 to 500 m (Table 1). Electrofishing in Piccaninny Pond (Site 5) and Lake Coranderrk (Site 4) was restricted to a shoreline water depth of 1 m. Additional electrofishing from an aluminium punt was conducted in Lake Coranderrk.

Fish species were identified according to Cadwallader and Backhouse (1983). Where field identification was uncertain, specimens were preserved in 10% formalin for later examination. For all fish total length (TL) or fork length (LCF), where appropriate, was measured.

## Results

Thirteen fish species were recorded during the survey (Table 2), nine of which were native. Four species may be sought by anglers: brown trout (*Salmo trutta*) freshwater blackfish (*Gadopsis marmoratus*), redfin or English perch (*Perca fluviatilis*) and short-finned eel (*Anguilla australis*) Barnham, 1983). In addition, the short-finned eel is also of commercial significance in Victoria.

Collection by electrofishing was efficient at all sites except Lake Coranderrk (Site 4) and Piccaninny Pond (Site 5) where deep turbid water made capture difficult. Numbers of short-finned eels at these sites may have been underestimated. Sightings of rainbow trout in 1978 (P.S. Lake pers. comm.) and brown trout (*S. trutta*) in 1983, (G. W. Wilson, pers. comm. 1983) in Lake Coranderrk were not substantiated by this survey.

Short-finned eels were the most widespread species, being present at all sites. Only adult eels (> 30 cm TL) were collected in lentic sites (Site 4, 5, 6), whilst the majority of specimens collected at sites 1 and 2 were elvers (< 30 cm TL). Large numbers of brown trout were present at Sites 1 and 2. Roach (*Rutilus rutilus*) were present at sites 3 and 7, with what appeared

**Table 1.** Details of sites sampled on Badger Creek and within the Coranderrk Bushland Reserve, Healesville Sanctuary.

Site No.	Name	Length of water sampled	Date sampled	Dominant substrate	Description/Comments
1.	Badger Creek — Coranderrk Weir	150 m (including weir)	30.1.85	B	Weir silted. Cascades, Boulders.
2.	Badger Creek — MMBW Park	80 m	30.1.85	B	Cascades, Boulders.
3.	Badger Creek — Coranderrk Bushland Reserve	500 m	7-11.5.85	C	Riffle, run, pool sequences. Wood debris.
4.	Lake Coranderrk	400 m along shoreline and boat	30.1.85	S	Turbid, silted, emergent vegetation.
5.	Piccaninny Pond	180 m along shoreline	11.12.84	S	Silted. Highly organic, low oxygen, emergent and aquatic vegetation.
6.	Fire dams	Entire	11.12.84	S	Silted. Highly organic, low oxygen, emergent and aquatic vegetation.
7.	Badger Creek — Yarra River Junction	150 m	5.3.85	S	Silted. Wood debris. Slow flowing. Emergent and aquatic vegetation.

B = Boulders, C = Cobbles, S = Silt. (Cummins 1962).

to be young-of-the-year fish (<40 mm LCF) being caught at the latter site in March. A shoal of Australia smelt (*Retropinna semoni*) was also encountered at this site.

One adult short-head lamprey (*Mordacia mordax*) was collected at Site 7. Ammocoetes of the pouched lamprey (*Geotria australis*) were collected from Site 3. Due to the burrowing tendencies of ammocoetes, collection was hampered and their abundance and distribution may have been underestimated.

The numerical abundance, length range and species' status (including conservation status as designated by Cadwallader *et al.*, 1984) for each species at each sample Site is given in Table 2.

### Discussion

Fifteen fish species have been recorded in reaches of the Yarra River from

downstream of Healesville to Warburton (Tunbridge & Glenane, 1983). Twelve of these species and one additional species (*Galaxias brevipinnis*) were recorded in this survey. Macquarie perch (*Macquaria australasica*), carp (*Cyprinus carpio*) and the common galaxias (*Galaxias maculatus*) were not recorded in this survey, although they are found in the Yarra River and thus may occur occasionally in the lower reaches of Badger Creek.

The number of species per station increased with increasing distance downstream in Badger Creek, probably reflecting an increase in diversity of available habitat. The distribution of fishes recorded in this survey may be best explained in terms of their habitat requirements. For example the wide ranging distribution of the short-finned eel is indicative of the wide range of habitats



which can be tolerated by this species (Cadwallader & Backhouse, 1983) and its ability to gain access to waterbodies under difficult conditions. Sites 1 and 2 generally provided little cover for the larger specimens of this species which appeared to prefer the silted and vegetated areas of the other sites. Specimens of the migratory lamprey species were only found in Badger Creek at Sites 3 and 7 where silted stream-bank areas provided habitat for the burrowing activities of ammocoetes (Potter, 1970; Potter *et al.*, 1980).

The mountain galaxias is primarily a small-stream species (McDowall, 1980) and was found only at sites 3 and 7. At both of these sites, particularly site 3, where the mountain galaxias numerically dominated the fish community, numbers of brown trout were low. There are several reports of the apparent fragmentation of the range of the mountain galaxias due to interactions with introduced brown trout in Australia, with almost mutually exclusive distributions often occurring between these two species (Tilzey, 1976; Cadwallader, 1979; Fletcher, 1979; Jackson & Williams, 1980; Jackson & Davies, 1983a). In this survey the mountain galaxias was absent from the two uppermost stream stations (Sites 1 and 2) where brown trout numbers were high. Two specimens of adult broad-finned galaxias were found at Site 2. This species is usually found only in steep rocky streams with fast flowing water (Cadwallader & Backhouse, 1983), such as that provided at Sites 1 and 2. The absence of other specimens may be indicative either of only a small population whose numbers may also have been affected by the presence of brown trout (Jackson & Williams, 1980) or that sites 1 and 2 were at the lower extremities of the habitat range for adults of this species. The presence of only a single specimen of spotted galaxias at Site 3 may also be indicative of low numbers of this species.

Brown trout prefer cool, well oxygenated waters and require a gravel substrate for spawning (McDowall & Tilzey, 1980). The

numbers of brown trout dominating the fish communities at Sites 1 and 2 may indicate their preference for this habitat compared to slower waters further downstream (Sites 3 and 7) where numbers were lower. The stream populations at these sites may be self maintaining or supplemented by migration from the Yarra River which is regularly stocked by the Fisheries and Wildlife Service (Barnham, 1985).

Freshwater blackfish show a preference for habitats with slower water and abundant wood debris, which they use both for cover and spawning sites (Koehn, in press; Jackson, 1978a, 1978b). During the survey, freshwater blackfish were found only at the stream sites which provided such habitat (Sites 3 and 7). Although this species is known to survive in farm dams (Jackson, pers. comm.) it was not found in the lentic waters surveyed, possibly due to low oxygen levels or a lack of access. Dobson and Baldwin (1982) suggested that the low oxygen-binding properties of blackfish blood probably limited its ability to survive in waters of low oxygen content. Interactions between this species and brown trout may also affect its range and abundance (Jackson, 1978b). The absence of freshwater blackfish from upstream sites (1 and 2) may be related to high water velocities, lack of suitable cover and possibly interaction with brown trout. A similar situation was noted by Cadwallader (1979) in a survey of Seven Creeks.

Southern pigmy perch are commonly found in weedy slow-flowing or still waters (Llewellyn, 1974) and are often associated with aquatic macrophytes (Cadwallader, 1979) and mud substrates (Jackson & Davies, 1983a). During the survey, southern pigmy perch were always found associated with aquatic vegetation and a silt substrate in essentially lentic situations (Sites 5, 6 and 7). Goldfish are also known to prefer still or stagnant waters, being capable of tolerating low oxygen concentrations (Cadwallader & Backhouse, 1983) and were found only at Sites 5 and 7. Since Site 6

(fire dams) is completely isolated from any other waterway, their absence from this location is probably due to a lack of access.

Roach, a species typically found in slower waters but which can also thrive in moderately fast flows (Cadwallader & Backhouse, 1983), was found at Sites 3 and 7. Redfin, which also prefers slower waters but is unable to persist in rapid flows, was only found at Site 7, presumably being excluded from higher sites by riffle areas. Similarly, Australian smelt, which is known to occupy a wide variety of habitats in slow-flowing waters and lakes, often using macrophytes for cover, was only found at Site 7.

The distribution of fish species in Badger Creek and waters within the Coranderrk Bushland Reserve as determined in this survey can generally be explained by the habitat requirements of each species. The absence of some species from isolated waters may be due to lack of access. Interactions of native species with brown trout may also be a factor influencing the observed distributions.

Nine native fish species occur in Badger Creek. Although none are unique to the area, several aspects make this an interesting faunal assemblage. Two species, the broad-finned galaxias and the spotted galaxias, have restricted distributions in Victoria. Current information on the pouched lamprey is insufficient to establish a status accurately, but it is considered to be either restricted in distribution or rare (Cadwallader *et al.*, 1984). The freshwater blackfish, a popular angling species, exists in substantial numbers in the mid regions of Badger Creek. The status and taxonomy of this species has been the subject of much discussion and is considered to require careful monitoring in Victoria (Cadwallader *et al.*, 1984), as its abundance and range have been reduced.

The occurrence of the mountain galaxias in the mid to lower reaches of the creek is of interest since they are often precluded from such areas in other streams by trout.

The Coranderrk Bushland Reserve provides a rare opportunity to view a

stream surrounded by relatively natural lowland forest. Such stream surrounds, combined with the native fish populations, represent a valuable attribute of the Healesville Sanctuary. Careful management of Badger Creek and its catchment should be undertaken to ensure the maintenance of this freshwater ecosystem.

#### Acknowledgements

The author thanks Rob Gibb, John McKenzie and Bill O'Connor for technical assistance, Gary Wilson and the Healesville Sanctuary for their support, Alicia McShane for drafting assistance and Dr. P. D. Jackson for critical comments on the manuscript.

#### REFERENCES

- Apps, G. J., Beumer, J. P., and Backhouse, G. N. (1979). Survey of fishes in Wyperfeld National Park and Lake Werrimbeam. *Victorian Nat.* 96:32-34.
- Backhouse, G. N. and Gooley, G. J. (1979). The fish fauna of Bridgewater Lakes, Portland, Victoria. *Victorian Nat.* 96:232-238.
- Backhouse, G. N. and Vanner, P. W. (1978). Observations on the biology of the dwarf galaxiid, *Galaxiella pusilla* (Mack) (Pisces: Galaxiidae). *Victorian Nat.* 95:128-132.
- Barnham, C. (1983). *Report on the census of angling clubs 1983*. Fisheries and Wildlife Division, Ministry for Conservation, Melbourne, Victoria.
- Barnham, C. (1985). Listing of salmonid liberations 1968-1984. Divisional data (unpublished). Fisheries and Wildlife Service, Department of Conservation, Forests and Lands, Melbourne, Victoria.
- Baxter, A. F. (in press). Trout Management Group fish population surveys, 1978-79; location of sampling sites and fish species caught. *Arthur Rylah Institute for Environmental Research Technical Report Series No. 15*.
- Bell, J. D., Berra, T. M., Jackson, P. D., Last, P. R. and Sloane, R. D. (1980). Recent records of the Australian grayling *Prototroctes maraena* (Pisces: Prototroctidae) with notes on its distribution. *Aust. Zool.* 20: 419-431.
- Beumer, J. P. and Harrington, D. J. (1977). Fishes of the Nicholson River, Gippsland. *Victorian Nat.* 94:201-204.
- Beumer, J. P. and Harrington, D. J. (1980). Pre-impoundment distribution of fishes in the Lerderderg River, Victoria. *Victorian Nat.* 97:68-72.
- Cadwallader, P. L. (1979). Distribution of native and introduced fish in the Seven Creeks River System, Victoria. *Aust. J. Ecol.* 4:361-385.
- Cadwallader, P. L. and Backhouse, G. N. (1983). *A Guide to the Freshwater Fish of Victoria* (Government Printer: Melbourne).
- Cadwallader, P. L., Backhouse, G. N., Beumer, J. P. and Jackson, P. D., (1984). The conservation status of the native freshwater fish of Victoria. *Victorian Nat.* 101:112-114.

- Carr, G. W., Horrocks, G. F. B., Cherry, K. A., Opie, A. M., Triggs, B. E. and Schulz, M. (in press). Flora and fauna of the Coast Range Forest Block, East Gippsland, Victoria. *Department of Conservation, Forests and Lands Ecological Survey Report No. 4*. (Government Printer: Melbourne).
- Chessman, B. C. and Williams, W. D. (1974). Distribution of fish in inland saline waters in Victoria, Australia. *Aust. J. Mar. Freshw. Res.* 25:167-172.
- Chesterfield, E. A., MacFarlane, M. A., Allen, D., Hutchinson, M. N., Triggs, B. and Barley, R. (1983). Flora and fauna of the Rodger Forest Block, East Gippsland, Victoria. *Forests Commission Victoria Ecological Survey Report No. 1*. (Government Printer: Melbourne).
- Cummins, K. W. (1962). An evaluation of some techniques for the collection and analysis of benthic samples with special emphasis on lentic waters. *Am. Midl. Nat.* 67:477-504.
- Dobson, G. P. and Baldwin, J. (1982). Regulation of blood oxygen affinity in the Australian blackfish *Gadopsis marmoratus*. I. Correlations between oxygen-binding properties, habitat and swimming behaviour. *J. Exp. Biol.* 99:223-244.
- Fletcher, A. R. (1979). Effects of *Salmo trutta* on *Galaxias olidus* and macroinvertebrates in stream communities. M.Sc. Thesis, Department of Zoology, Monash University, Clayton, Victoria.
- Frankenberg, R. S. (1969). Studies of the evolution of Galaxiid fishes with particular reference to the Australian fauna. Ph.D. Thesis, University of Melbourne, Parkville, Victoria.
- Gooley, G. J. (1977). An ecological survey of the fish and macroinvertebrate fauna of the Bass River and other streams in the Westernport Bay catchment. B.Sc. (Hons.) Thesis. University of Melbourne, Parkville, Victoria.
- 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. *Department of Conservation, Forests and Lands Ecological Survey Report No. 3*. (Government Printer: Melbourne)
- Jackson, P. D. (1978a). Spawning and early development of the river blackfish *Gadopsis marmoratus* (Gadopsiformes: Gadopsidae) in the McKenzie River, Victoria. *Aust. J. Mar. Freshw. Res.* 29:293-98.
- Jackson, P. D. (1978b). Benthic invertebrate fauna and feeding relationships of brown trout, *Salmo trutta* Linnaeus, and river blackfish, *Gadopsis marmoratus* Richardson, in the Aberfeldy River, Victoria. *Aust. J. Mar. Freshw. Res.* 29:725-42.
- Jackson, P. D. (1980). Survey of fishes in the west branch of the Tarwin River above Berry's Creek. *Victorian Nat.* 97:11-14.
- Jackson, P. D. and Davis, J. N. (1983a). Survey of the fish fauna in the Grampians region, south-western Victoria. *Proc. R. Soc. Vict.* 95:39-51.
- Jackson, P. D. and Davies, J. N. (1983b). *The Freshwater and Estuarine Fishes of Wilsons Promontory National Park*. (Government Printer: Melbourne).
- Jackson, P. D. and Williams, W. D. (1980). Effects of brown trout *Salmo trutta* Linnaeus, on the distribution of some native fishes in three areas of Southern Victoria, Australia. *Aust. J. Mar. Freshw. Res.* 31:61-67.
- Koehn, J. (in press). Approaches to determining flow and habitat requirements for native freshwater fish in Victoria. In: Campbell, I.C. (ed.) *Stream Protection*, (Water Studies Centre, Chisholm Institute Technology: Melbourne).
- Llewellyn, L. C. (1974). Spawning, development and distribution of the southern pigmy perch *Nannoperca australis australis* (Gunther) from inland waters in eastern Australia. *Aust. J. Mar. Freshw. Res.* 25:121-149.
- McDowall, R. M. (1980). Family Galaxiidae. In: McDowall, R. M. (Ed). *Freshwater Fishes of South-eastern Australia*. (Reed: Sydney), p.55-69.
- McDowall, R. M. and Tilzey, R. D. J. (1980). Family Salmonidae. In: *Freshwater Fishes of South-eastern Australia*. McDowall, R. M. (Ed). (Reed: Sydney), pp72-78.
- 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. *Department of Conservation, Forests and Lands Ecological Survey Report No. 2*. (Government Printer: Melbourne).
- Potter, J. C. (1970). The lifecycles and ecology of Australian lampreys of the genus *Mordacia*. *J. Zool.* 161:487-511.
- Potter, J. C., Hilliard, R. W. and Bird, D. J. (1980). Metamorphosis in the Southern hemisphere lamprey *Geotria australis*. *J. Zool.* 290:405-430.
- Renowden, J. (1968). An ecological survey of the freshwater fish of the Otway District. B.Sc. (Hons) Thesis. University of Melbourne, Parkville, Victoria.
- Robertson, P., Duncan, P., Lumsden, L., Silveira, C. and Menkhorst, P., (1982a). Report and recommendations on the special investigation into the vertebrate fauna of the Hill End Area. (unpublished internal report), Fisheries and Wildlife Service, Victoria.
- Robertson, P., Alexander, J., Duncan, P., Johnson, P., Lumsden, L. and Silveira, C. (1982b). Report and recommendations to the Land Conservation Council on the vertebrate fauna of the North-eastern Study Area, District I. (unpublished internal report), Fisheries and Wildlife Service, Victoria.
- Robertson, P., Alexander, J., Duncan, P., Johnson, P., Lumsden and Silveira, C. (1983a). Preliminary report on the Mt. Wills (Alpine Area) faunal survey. (unpublished internal report), Fisheries and Wildlife Service, Victoria.
- Robertson, P., Alexander, J., Duncan, P., Johnson, P., Lumsden, L. and Silveira, C. (1983b). Report to the Land Conservation Council on the vertebrate fauna of the Murray Valley Study Area. (unpublished internal report), Fisheries and Wildlife Service, Victoria.

Sanger, A. (1984). Description of a new species of *Gadopsis* (Pisces: Gadopsidae) from Victoria. *Proc. R. Soc. Vict.* 96:93-97.

Specht, R. L. (1972). *The Vegetation of South Australia*. (Government Printer: South Australia).

Tilzey, R. D. J. (1976). Observations on interactions between indigenous Galaxiidae and introduced Salmonidae in the Lake Eucumbene catchment, New South Wales. *Aust. J. Mar. Freshw. Res.* 27:551-564.

Tunbridge, B. R. (1983). Fish populations in the Croajingolong National Park. *Arthur Rylah Institute for Environmental Research Technical Report Series*. No. 9.

Tunbridge, B. R. and Glenane, R. G. (1983). *Fisheries Value and Classification of Fresh and Estuarine Waters of Victoria*. (Government Printer: Melbourne).

## Breeding Systems in Eastern Australian Banksias

BY A. SALKIN\*

It is more than probable that the first person to note the discrepancy between the profusion of flowers on a banksia spike and the paucity of seed set was the Spanish botanist Antonio Jose Cavanilles (1800). If he was not the first to observe it, he must have been the first to put this observation into print. In the *Anales De Historia Natural* No. 3 of March 1800, he comments on the flowers and fruit of *Banksia serrata* collected at Port Jackson in 1793 by Luis Nee, the botanist on the Alessandro Malaspina expedition of exploration and scientific research (Burke, 1967).

"How prodigal nature appears to be in adorning each spike with so many flowers in order to produce some twenty seeds! And how admirable in enclosing these between such thick hard walls in creating such corpulent fruit from ovules so tiny they can hardly be seen".

The problem commented on by Cavanilles in 1800 is at present no nearer solution. What controls fertilization and seed set in *Banksia* species is not known. Indeed the general paucity of literature on banksias is compounded when it comes to breeding systems. Guthrie and Salter (1950), Carolin (1961) and Rourke (1969) have written generally about the Proteaceae "pollen presenters" but their descriptions of pollination mechanisms do not indicate in any way how the system works, and

particularly how it is that only a very small percentage of flowers in *Banksia* spp. set seed. More recently, Paton and Ford (Paton, 1974; Ford & Paton, 1976; Paton & Ford, 1976) have made observations on the way honey eaters transfer pollen, their feeding habits and therefore the frequency of their visits. Their work certainly implicates birds as the chief pollinators and partners in a very close symbiotic relationship. Nevertheless although birds frequently visit such species as *B. ornata* and *B. serrata* very few flowers set seed and when hand pollination is resorted to the results are even more dismal. Experiments to hand pollinate *B. integrifolia*, *B. marginata*, *B. ericifolia* and *B. spinulosa* have failed during four flowering seasons. Experiments in Western Australia to hand pollinate western banksias have also been unsuccessful (Keighery, pers. comm.).

If we are to fully understand the breeding systems in *Banksia* sp. then hand pollination is the first essential step. There is also another and perhaps more important consideration and that is, until pollen from one species or one race can be transferred to another there is no possibility of mapping genes. There are many very simple breeding experiments that could and should be conducted. In Victoria there is one variety of *B. spinulosa* from French Island that has a yellow flower whereas the common form has a buff to orange perianth and black style. Hand pollination between

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these forms would indicate if the yellow is recessive as might be suspected and if this is so the question then arises, why does it exist as a small interbreeding heterozygous island in a sea of dominant alleles. The form is at present only found as a small colony at French Island whereas the other form is plentiful not only on French Island but at Lang Lang, The Gurdies and common through most of Gippsland.

Another more important question that breeding experiments might solve is that of putative hybrids.

It is assumed, but by no means proven, that the intermediate forms have arisen from hybridization at some time in the past and some sieving has occurred and stable populations now occur. The only possible way to prove this hypothesis is of course through breeding experiments.

Failure to hand pollinate is at the moment a very large handicap in being able to clearly understand the breeding system and some of the related problems but a number of observations may be made that may help in explaining not only why hand pollination is difficult but also the problem of low seed set.

*Banksia* flowers develop over a long period of time. From the time the last flower has opened and presented its pollen, buds for the next season's flowering are already present. The individual flowers which are on a spike also develop slowly. Fig. 1 gives a pictorial account of part of this development but not all flowers develop at this rate, some develop much more quickly so that there is always a succession of flowers. The tree on which this study was made is 15 years old, six metres high by four metres and in 1984 had 668 flower spikes with between 500 to 2,000 flowers on each spike. It set seed on only eight of these spikes and produced 176 follicles. It provides food for four Wattlebirds (*Anthochaera carunculata*), who defend it from six Spinebills (*Acanthorhynchus tenuirostris*), and two or more Plumed Honey Eaters (*Meliphaga penicil-*

*lata*). As the Wattlebirds spend from May to October in the vicinity of the tree it would appear to be their major source of nectar.

*Banksias* produce pollen at a very early stage and attempts to look at chromosomes or early stages of pollen formation have to be made before the floral tube has become longer than the bract. Squashes of flowers at this stage show that there is remarkable uniformity throughout the length of the spike in the sequence of development. The sequence from pollen mother cell to tetrads may take as short a time as 12 hours. This makes it very difficult to obtain material for chromosome studies. Material that has been fixed, embedded and sectioned using the methods suggested by O'Brien *et al.* (1972) show the same close sequence in buds taken at random from anywhere on the spike.

This synchrony of pollen development is not shown at anthesis, which in *Banksia* spp. is one of the more unusual features of flower development. *Banksias*, like most of the Proteaceae, have the stigma held in a limb which is a bulbous organ formed by the ends of the perianth parts in which the pollen develops. Microscopic studies have shown that the pollen develops in direct contact with the stigma from a very early stage and as much as six months before anthesis. Anthesis may be regarded as when the limb dehisces. Sections of flowers just prior to anthesis show that the pollen is separated from the stigmatic surface by a phenolic compound which also seems to serve the function of holding the pollen in place. There is in this arrangement the strong suggestion that this is a device for self pollination. Bagging experiments to exclude all pollinators has shown a negative result except for a spike of *B. serrata* and *B. spinulosa* var. *cunninghamii*. It should be noted that negative results are common even when spikes are not bagged.

Two species of *Grevillea* — *G. leucoptris* and *G. aspera* — given the same treatment also produced viable seeds. It would there-

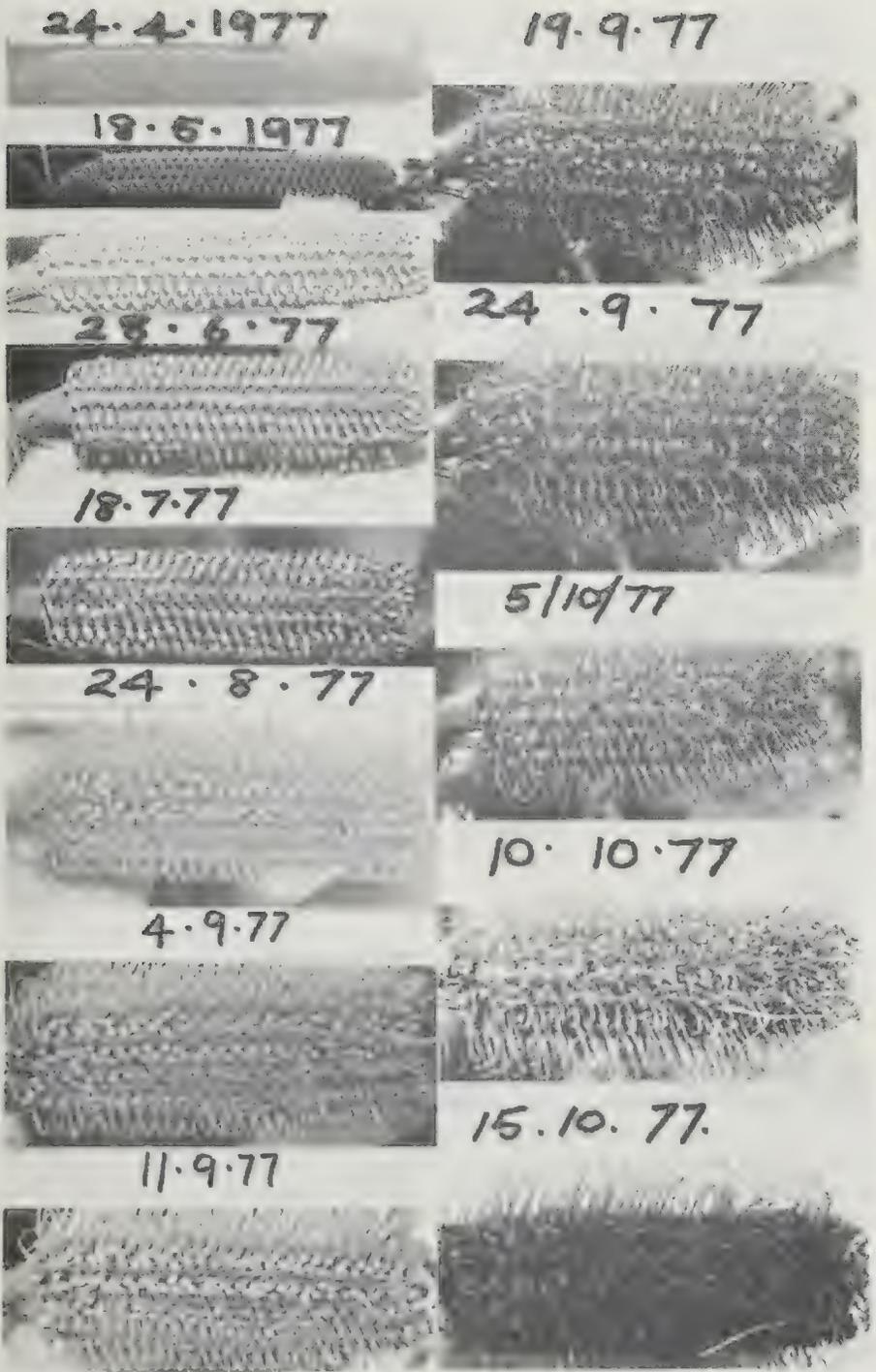


Fig. 1. *Banksia* flower development.

fore appear in banksias to be mainly a placement device so that pollinators receive pollen at the correct distance to deposit it on the stigma of a flower of the same species, but it may also serve to self pollinate the flower.

The sequence of flowering (anthesis) in *B. ericifolia* and other *Oncostylis* spp. is from top to bottom. In other *Banksia* sections it is from bottom to top. Occasionally some stigmas will emerge in a random fashion from other parts of the spike and these emerge without pollen. It was thought at first that perhaps these were the flowers that were to be pollinated but when these did not set seed it was realised that for some reason they had come out before the limb had dehisced. This indicates that there is a careful timing of limb dehiscence and style expansion but occasionally the timing is incorrect and the style pulls out of the limb leaving the pollen still in the limb.

Flowering was followed in one spike from the time when buds were level with the bracts, which is the time when pollen is being formed, and photographs taken of the changes to the flower. From May 24, until September 4, the flowers slowly developed to the stage where the styles and limb were fully expanded.

Between 4 and 11 September, the first styles emerged and styles continued to emerge until October 5, so that the process of flowering for one spike was over a period of one month. During this period nectar was produced but because the flower was on the outside of the tree and 1.5 m from the ground honey-eaters were not observed feeding from it; however bees were observed taking nectar and two night flying long tongued moths were observed feeding on a number of nights. These were *Euplexia nigerrima* Guen and *Persectania ewengii* Westwood. Neither the bees nor the moths were observed to come in contact with the pollen on the ends of the styles. By October 10, the flower was no longer producing nectar and by October 15, it had lost its colour. Pollen still remained attached to

the stigmas at this stage and it was observed that a few styles had not pulled free from the limb. The spike set no seed. In fact, of the 668 spikes produced in 1984 only eight spikes produced seed and these are not in abundance, only 176 follicles for the eight spikes. This failure to produce seeds is difficult to explain but a number of suggestions may be ventured. Keighery (pers. comm.) regards nutrients as being a key to low seed set and this has a great deal of merit, particularly in species with massive follicles such as *B. serrata*. The random pattern in which seed is set on these cones does suggest that once an ovary in a certain position has been fertilized nutrients to other flowers are cut off.

Whilst this appears to be a satisfactory explanation for low seed set it does not explain the absence of seed set. It does however indicate the random nature of fertilization. The sequence of flowering on a *Banksia* spike suggests that the time when an ovule is capable of being fertilized is very short so that if pollen is not on a stigma at the right place and the right time the flower does not get fertilized. This would explain why hand pollination is not successful whereas pollination by birds is. The frequency of visits by birds to flowers would then be of critical importance. The more visits the greater chance of high seed set.

The other problem of selfing is more difficult to resolve. Banksias do appear to self from pollen that is already on the stigma but failure to self may simply be due to the barrier of phenolic material that holds it in position. As some *Grevilleas* do self readily without the aid of a pollinator, it would seem less likely that there are physiological barriers in a closely allied member of the family and it might be best to accept the simpler explanation consistent with the facts. That is, pollen already on the stigma is capable of fertilizing the flower. As the nature of the flower is that of one normally pollinated by birds we can accept that it is pollinated by birds, but this does not rule out the possibility of autogamy or other

agencies such as bees, moths, small marsupials and even rats (Paton, pers. comm.) are capable of pollinating banksia flowers, but not necessarily fertilizing them. The very low frequency of hybrids seem to confirm that selfing is the most common form of fertilization and bagging experiments demonstrate that this is from pollen already on the stigma. The fact that hybrids exist means that some cross pollination does occur, but this is of a much lower frequency than selfing.

The problem of pollinating banksia in order to cross species or forms is, with a little ingenuity, capable of solution. At Monash University where the Zoology Department have a number of captive honey-eaters in cages it has been possible to place flowering plants of the species where cross fertilization is required.

At present it is too early to assess results from this experiment but experiments of this nature should provide us with some of the information that is required, i.e. whether *Banksia* spp. are capable of selfing and whether crosses between species are possible and if so, whether they produce swarms or the types of suspected crosses found in natural vegetation.

But of that other problem, why there are so many flowers and so few seed set, proposed by Cavanilles nearly 200 years ago, that may be a little more difficult to resolve experimentally.

## Note

Since this paper was written, work done by Paton and Turner (1985) has thrown a little more light on the problem of pollination in *Banksia* spp. The main pollinators have been positively identified, and Paton and Turner have also been able to hand pollinate *B. ericifolia* but with a lower rate of success than natural pollination.

The problem of low seed set was also investigated and a number of causes were suggested, such as insufficient nutrients. This should prove to be an interesting, if difficult, avenue for further research.

## REFERENCES

- Burke I. and K. (eds.) (1967). The Spanish at Port Jackson. (Australian Documentary Facsimile Society; Sydney).
- Carolin, R. (1961). Pollination of the Proteaceae. *Aust. Mus. Mag. Sept. 1961:371-4.*
- Cavanilles, A. J. (1800). Observations on the soil, natives and plants of Port Jackson and Botany Bay. *Anales De Hist. Nat. 3:181-245.* Trans. R. J. Dorr.
- Guthrie, L., and Salter, T. M. (1950). Proteaceae. In R. S. Adamson and T. M. Salter. *Flora of the Cape Peninsula.* (Cape Town, Juta).
- O'Brien, T. P., Clark, R. L., and Lumley, P. (1972). Manual of Techniques in Plant Histology. (Monash University Botany Dept. Publications: Clayton).
- Paton, D. C. (1974). Pollination by birds in some native plants. Unpublished B.Sc. Thesis, Dept. Zool., University of Adelaide.
- Paton, D. C. and Ford, H. A. (1976). Pollination by birds of native plants in South Australia. *Emu 77:73-85.*
- Paton, D.C. and Turner V. (1985). Pollination of *Banksia ericifolia* Smith: mammals and insects and pollen vectors. *Aust. J. Bot. 33:271-86.*
- Rourke, J. P. (1969). Taxonomic studies on *Sorocephalus* R. Br., and *Spatalla* Salisb. *J. S. Afr. Bot. suppl. 7:124.*

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The Club has received a most exceptional donation of an almost complete set of The Victorian Naturalist Volumes 1-100. The generous donor, Mr. A. F. Busby is deserving of our thanks. There is but one missing issue, Vol. 70, No. 4. If anyone has unwanted copies of this issue it would be a great service to the Club to complete the set. Please address any donation to the Hon. Secretary at the Herbarium.

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# The Diet of *Pseudemoia spenceri* (Lucas and Frost, 1894) (Lacertilia: Scincidae), a Species Endemic to South-eastern Australia

BY G. W. BROWN\*

## Abstract

*Pseudemoia spenceri* is an arboreal lizard found only in montane regions with high rainfall in south-eastern Australia. Dietary analysis reveals that *P. spenceri* is a wide-ranging opportunistic forager. Multi-categorisation of prey items shows *P. spenceri* to take a large proportion of soft-bodied, aerial and/or arboreal prey, many of which are detritivores. This is uncommon amongst south-eastern Australian scincids, and is a direct result of the vertical distribution displayed by *P. spenceri*.

## Introduction

Greer (1979) subdivided the Australian scincid fauna into three distinct supra-generic groups based on a complement of morphological characters: *Egernia*, *Eugongylus* (or *Leiolopisma*) and *Sphenomorphus*. Of these three groups the *Leiolopisma* species and their allies are the dominant species in south-eastern Australia. The leiolopismid assemblage is composed of species that are generally small, diurnal and surface-dwelling to arboreal in vertical distribution.

*Pseudemoia* is an interesting member of the *Leiolopisma* group in that it is the only lizard genus endemic to south-eastern Australia (Rawlinson, 1974). *P. spenceri*, the mainland representative of this di-specific genus, is a small, active, shuttling heliotherm found only in regions of high rainfall (Fig. 1). It is confined to montane wet sclerophyll forest or subalpine woodland and shows the greatest arboreal nature of any scincid species in south-eastern Australia. Unusually few Australian skinks have utilised arboreal habitats, possibly

because 'sufficient spatial heterogeneity in the form of vegetation and ground cover has existed to allow the coexistence of a large number of species' (Pengilly, 1972). That this species is well disposed to an arboreal mode of life is illustrated by its well-developed pentadactyl limbs and a general dorso-ventral flattening of the body.

A number of authors (e.g. Jenkins and Bartell, 1980; Rawlinson, 1974) have reported *P. spenceri* as being an insectivore, although no detailed quantification or qualification of its diet has been published. This study examined the feeding preferences of *P. spenceri*. By identifying the trophic levels of food items of *P. spenceri*, it was possible to more accurately assess the role of *P. spenceri* within the ecosystem and in the energy cycle in general. Nomenclature follows Cogger (1983).

## Materials and methods

*Study area:* Mt Baw Baw

Elevation 1560 m A.S.L. (summit)

Map SJ 55-6 (1:250,000) Ref. 423333

Royal Australian Survey Corps (1972).

All specimens were collected from 'Neulyn's Mill' in the Mt Baw Baw Alpine Reserve, 4 km by road south-west of the alpine village. Mt Baw Baw has a cool, wet climate and average rainfall exceeds 1400 mm per annum. Regular snowfalls occur between June and October and summer is the driest season, although there is no summer drought (Bureau of Meteorology, 1975).

The granitic Baw Baw plateau is characterised by undulating terrain across the summit and steep, erosional escarpments. Friable, brownish gradational soils support tall open-forest. The canopy is dominated by *Eucalyptus delegatensis* (Alpine Ash) regrowth. A secondary tree

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Fig. 1. *Pseudomoia spenceri*, Mt. Baw Baw

layer is composed of *Acacia dealbata* (Silver Wattle), *Nothofagus cunninghami* (Myrtle Beech), *A. frigescens* (Montane Wattle) and *Atherosperma moschatum* (Southern Sassafras), while ferns and broad-leaved shrubs form a dense understorey. Logs and rocks are thickly invested with mosses and liverworts, and a well-developed litter layer overlies the forest floor.

At Neulyn's Mill skinks utilised buildings, dead trees and fallen logs as microhabitats, points around natural or man-made clearings that were exposed to solar radiation.

**Field technique:** Between December 1978 and November 1981, several collecting trips were made so that specimens of *P. spenceri* were taken during every season except winter, when sampling was prohibited by very low temperatures and concomitant snow cover. Lizards collected by the author were supplemented by specimens captured by Mr P. Robertson (Zoologist, Arthur Rylah Institute, Heidelberg, Victoria).

The site was systematically searched during every collecting trip and skinks were either captured by hand or by noosing gun (Cogger, 1983). Captured lizards were killed within two hours of collection by the injection of Barbitone-sodium ( $C_8H_{11}O_3N_2Na$ ) into the heart region. Once the lizard was dead, the gut was removed, labelled and preserved in 80% ethanol. The eviscerated lizard was labelled, then preserved in 10% neutralised formalin.

**Laboratory technique:** Any contents of the preserved alimentary canal were evacuated into a petri dish for identification, counting and measuring. Non-food items (e.g. slough, inorganic material, internal parasites) were separated and recorded.

Where possible, food items were identified to family. The volume of small items was estimated using an ocular micrometer and larger items were measured using dial calipers. The volume of partially digested or otherwise incomplete animal

items was sometimes assessed by extrapolation, using comparison with whole specimens of a similar size.

Identified and measured, food items were further categorised into:

(a) Trophic levels: Primary consumer, Secondary consumer, Omnivore, Detritivore (animal) (see Odum, 1971).

(b) Life-forms: Aerial, Arboreal, Terrestrial and combinations of these three fundamental life-forms.

(c) Hardness: Hard-bodied (e.g. Order Gastropoda, Order Coleoptera) or soft-bodied. Some bias may arise for the

hardness classification as hard-bodied items tend to remain in a recognisable state throughout the gut whereas soft-bodied items are digested more rapidly.

## Results

### Gut contents

Nine (11%) of the skinks examined had an empty gut. The incidence of non-food items was low except for internal parasites (13.7%). Inorganic material was found in eight (10%) lizards, but in such small volumes that it appeared skinks accidentally ingested sand or grit while feeding.

Table 1. Composition of food records for all *P. spenceri* examined. N = 82.

Food Taxa	Frequency: no of skinks containing prey items		Number of families identified	Number Total no. of prey items		No. of measurable prey items	Volume Volume of measurable food items	
	n	%		n	%		vol.	%
<i>Animalia</i>								
Gastropoda	1	1.4		1	0.2	1	217.6	4.3
Acari	3	4.2	1	5	0.8	5	< 0.1	*
Araneida	25	34.7	1	38	6.3	34	321.6	6.4
Opiliones	1	1.4		1	0.2	1	43.9	0.9
Isopoda	3	4.2		3	0.5	3	38.9	0.8
Amphipoda	1	1.4		1	0.2	1	83.1	1.7
Chilopoda	3	4.2		3	0.5	1	19.2	0.4
Blattodea	3	4.2		3	0.5	2	324.8	6.5
Coleoptera — adult	46	63.9	4	123	20.6	117	1003.7	19.9
— larva	3	4.2		3	0.5	1	0.9	*
Collembola	1	1.4		1	0.2	1	0.2	*
Dermaptora	1	1.4		1	0.2	1	27.8	0.5
Diptera — adult	56	77.8	14	163	27.3	155	1722.8	34.2
— larva	3	4.2		4	0.7	4	23.9	0.5
Hemiptera	33	45.8	6	50	8.4	39	246.2	4.9
Hymenoptera	33	45.8	10	72	12.1	53	68.1	1.4
Formicidae	5	6.9		7	1.2	7	13.2	0.3
Isoptera	11	15.3		80	13.4	80	656.7	13.0
Lepidoptera — adult	6	8.3		8	1.3	5	12.5	0.2
— larva	6	8.3		7	1.2	5	52.2	1.0
Neuroptera — adult	7	9.7		10	1.7	7	50.9	1.0
— larva	1	1.4		2	0.3	2	1.3	*
Orthoptera	1	1.4	1	1	0.2	1	92.0	1.8
Unid. Invertebrates	9	12.5		9	1.5	2	4.0	0.1
Total Animalia	72	100.0		596	100.0	528	5025.5	99.8
<i>Plantae/Fungi</i>								
Monocotyledonae	3	4.2					9.0	0.2
Total Food items	72	100.0					5034.5	100.0

\* < 0.1%

Most prey items were undigested enough to permit their inclusion in the analysis: 88.6% were measurable and 98.5% were identifiable (Table 1). The frequency and amount of plant material recovered was negligible.

### Food records

Consideration of the composition of the diet by Family or by Order (Table 1) reveals that a range of food items was consumed, indicating opportunistic feeding. The diet of *P. spenceri* was composed entirely of invertebrates, especially insects (89.8% by number, 85.8% by volume). Volumetrically, this skink drew most of its food from three taxa: adult Coleoptera, adult Diptera (especially Calliphoridae) and Isoptera constituted 67.1% of the total food volume.

Numerically, the trend towards dependence on a few prey taxa was also evident. Adult Coleoptera (particularly Tenebrionidae and Curculionidae), adult Diptera (particularly Sciaridae), Hymenoptera and Isoptera provided 73.4% of food items taken.

**Trophic levels.** Table 2 details the numerical and volumetric values for trophic levels of assignable food items. *P. spenceri* is a predator that feeds predominantly on primary consumers and animal detritivores. Numerically, primary consumers are more important, but almost equivalent biomass is derived from fewer animal detritivores. This was due largely to the ingestion of several Calliphoridae and Blattodea (Table 1). *P. spenceri* appears to tap the detritus energy pool, and is one of very few scincid species in south-eastern Australia that relies on this prey element (Brown, 1983).

**Life forms.** Table 3 reveals that *P. spenceri* took a large proportion of flying and/or arboreal invertebrates as food, 52.3% of the prey volume. That the contribution of terrestrial prey to the diet was also substantial (numerically and volumetrically) indicates that *P. spenceri* may feed in both arboreal and in ground-level situations. Field observations have confirmed this.

### Size classes and hardness of prey items.

The size class distribution of prey items in the diet of *P. spenceri* is presented in Table 4. 93.5% of total prey ingested were in 0-20 mm<sup>3</sup> size class, and the proportion of smaller prey is accentuated, as 88.9% are less than 10 mm<sup>3</sup> in volume. The frequency of hard-bodied prey items is greatest in the smallest prey size-class, a result of either the lack of hard-bodied invertebrates of substantial size or else the physical limitations on ingestion imposed by large hard-bodied items on ingestion. *P. spenceri* derived most of its diet (70.3% numerically and 77.5% by volume) from soft-bodied invertebrates.

The importance of large prey items in the diet is highlighted by the volumetric prey-size distribution. A few large prey items provide a greater biomass than many small ones.

**Temporal variation in diet.** No specimens of *P. spenceri* were collected from Mt. Baw Baw during winter and only eight were captured in autumn, however a temporal analysis of diet revealed that feeding was concentrated in the warmer months and the biomass of the dominant food taxa changed markedly with the seasons (Table 5). For example, *P. spenceri* took Diptera in summer (49.3% total volume), Araneida in autumn (45.9%) and adult Coleoptera, Diptera and Isoptera in spring (20.0%, 23.8%, 21.6% respectively). If this variation in diet was merely reflecting seasonal prey availability, then prey numbers should also reveal abrupt seasonal variation, although no measure of potential prey availability was made. For many prey taxa this was the case, although some (e.g Diptera, Araneida) were reliable contributors to the diet year-around. In some instances (eg., Gastropoda, Blattodea), an appreciable percentage of the seasonal volume was derived from a very small number of prey items, emphasising the opportunistic nature of feeding and verifying the importance of large items in the diet.

### Discussion

*P. spenceri* was described by Rawlinson (1974) as a 'highly active, insectivorous

Table 2. Trophic levels of assignable prey items. Absolute and percentage figures are presented.

TI total prey items		Vol. volume of measurable items (mm <sup>3</sup> )												
MI total measurable items		1° consumer		2° consumer		Omnivore		Total						
TI	MI	Vol.	Vol.	TI	MI	Vol.	Vol.	TI	MI	Vol.				
67	67	1489.0	192	177	1589.2	93	85	546.2	6	6	33.8	358	335	3658.2
18.7		40.7	53.6	43.5	26.0	14.9	1.7	0.9	100.0		100.0			100.0

Table 3. Life forms of assignable prey items. Absolute and percentage figures are presented

TI total prey items  
MI total measurable items

Vol. volume of measurable items (mm<sup>3</sup>)  
\* < 0.1%

Aerial		Arboreal		Terrestrial		Aerial/Arboreal		Terrestrial		Arboreal/Terrestrial		Total		
TI	MI	Vol.	Vol.	TI	MI	Vol.	Vol.	TI	MI	Vol.	Vol.	TI	MI	Vol.
120	112	435.5	111	93	594.3	125	118	1474.6	79	59	1242.9	1	1	0.6
23.6		10.0	21.8	13.7	13.7	24.6	34.0	34.0	15.5	28.6	28.6	0.2		*
												73	68	592.5
												14.3		13.7
												509	451	4340.4
												100.0		100.0

Table 4. Size classes of prey items, including the percentage number and volume of hard and soft prey items per size class (volume).

Size class — volume (mm <sup>3</sup> )	Percentage number			Percentage volume		
	Hard	Soft	Total	Hard	Soft	Total
0-1	7.8	19.0	26.8	0.3	1.1	1.4
1-2	12.1	10.6	22.7	2.0	1.6	3.6
2-3	4.2	6.1	10.3	1.0	1.5	2.5
3-4	1.1	2.1	3.2	0.4	0.8	1.2
4-5	—	2.1	2.1	—	1.0	1.0
5-10	1.3	22.5	23.8	0.9	18.7	19.6
10-15	—	1.9	2.5	0.8	2.3	3.1
15-20	0.2	1.9	2.1	0.4	3.5	3.9
20-50	0.9	1.7	2.6	3.4	6.2	9.6
50-100	1.3	1.3	2.6	10.3	10.9	21.2
> 100	0.2	1.1	1.3	3.0	29.9	32.9
Total	29.7	70.3	100.0	22.5	77.5	100.0

Table 5. Seasonal composition of food records for *P. spenceri* from Mt. Baw Baw (N = 82). Volume (mm<sup>3</sup>) refers to measurable items.

	Summer (N = 52)			Autumn (N = 8)			Spring (N = 22)		
	Total prey items n	No. meas. items	Volume mm <sup>3</sup>	Total prey items n	No. meas. items	Volume mm <sup>3</sup>	Total prey items n	No. meas. items	Volume mm <sup>3</sup>
Gastropoda									
Acari	3	3	0.1				1	1	217.6
Araneida	17	14	212.4	2	2	6.4	2	2	0.03
Opiliones			10.3			45.9	19	18	102.7
Isopoda	2	2	27.1			1.3	1	1	43.9
Amphipoda			1.3				1	1	11.8
Chilopoda	3	1	19.2			0.9	1	1	83.1
Blattodea			0.9						2.8
Coleoptera — adult	97	91	413.4			20.1	3	2	324.8
— larva	1		0.3				27	26	590.3
Collembola							2	1	0.9
Dermoptera							1	1	0.2
Diptera — adult	99	95	1015.0	3	3	24.8	61	57	704.3
— larva	1	1	1.6				3	3	22.3
Hemiptera	38	27	199.4	1	1	29.3	11	11	42.8
Hymenoptera	62	45	50.9				9	8	17.3
Formicidae	7	7	13.2			0.6			0.6
Isoptera	3	3	17.1			0.8			0.9
Lepidoptera — adult	7	5	12.5			0.6			0.8
— larva	4	3	21.5			1.0			1.4
Neuroptera — adult	9	6	46.4			2.3			0.6
— larva									
Orthoptera							77	77	639.6
Unid. Invertebrates	6	1	1.0			0.1	1	1	0.4
Plantae/Fungi			9.0			0.4	3	2	30.7
Total food items	359	304	2059.8	6	6	100.0	231	219	2960.8
Skinks with food items	48			2			22		100.0
No. items/skink	7.5			3.0			10.5		
Volume items/skink			42.9			7.0			134.6
Diversity (vol.)			3.279			2.786			6.098

\* < 0.1%

Diversity (based on volume only) calculated using Simpson's (1949) Diversity Index.

skink . . . and the most agile reptile found in cool and cold temperate zones of south-eastern Australia'. This study confirms Rawlinson's appraisal. The active, arboreal nature of foraging shown by *P. spenceri* is reflected in the importance of adult Diptera to the diet (27.3% numerically, 34.2% by volume; Table 1). Other prime contributors to prey volume were Coleoptera (19.9%) and Isoptera (13.0%), inhabitants of the rotting log mounds and dead trees which characterise the Mt. Baw Baw site. The incidence of non-food items was low and the amount of inorganic material so small that it could have only been ingested secondarily, probably not deliberately as an aid to comminution.

The influence of arboreality on the diet is delineated by the proportion of prey that is considered aerial (Brown, 1983). Comparison with other, more cryptic scincid species distinguishes *P. spenceri* as a wide-ranging forager that has access to flying prey. Similar results have been recorded for *Cryptoblepharus carnabyi*, another arboreal skink distributed in south-eastern Australia. Presumably, the exposure to and the exploitation of different types of prey is a result of the differential usage of the spatial component of a habitat, a theory documented by Pianka (1966) who suggested that substrate preferences are important determinants of foods eaten by scincids.

Occupation of arboreal microhabitats has also conferred on *P. spenceri* access to the detritus cycle, albeit mainly via aerial/arboreal prey. Most scincids take primary consumers as the dominant prey element (numerically and volumetrically), and it is usually only those scincid species that have direct association with the damp detritus layer (e.g. fossorial species like *Anotis maccoyi*) that exhibit a significant animal detritivore component in the diet. *P. spenceri* is distinct amongst the south-eastern Australian scincids in that it derives a substantial volume of its food from the detritivore element, but it takes this prey in the form of highly active aerial detritivores

like saprophagous Diptera or small Blattodea and Isoptera that apparently share with *P. spenceri* the microhabitats afforded by dead trees.

Rawlinson (1981) suggested that the Australian herpetofauna probably depends on the detritus cycle for food. He postulated that Australian elapid snakes rely primarily on frogs and lizards which in turn directly exploit the detritus cycle. The results of this study show *P. spenceri* to utilise detritivores. Whether elapids subsequently prey heavily on *P. spenceri* is doubtful, principally because of the agility and arboreal nature of this scincid. Only one species of elapid snake, *Drysdalia coronoides*, has been documented as preying on *P. spenceri*, and then in extremely small numbers (Shine, 1981).

Most of the small *Leiopisma* species and their allies are obvious elements of the grazing cycle (Brown, 1983), relying on primary consumers as food. Hence, it would seem that there is only limited exploitation of the detritus energy cycle by Australian reptiles.

The establishment of prey size-classes is practical in that it allows comparison of prey utilisation by size for sympatric scincid species, and it also provides a useful indicator of the maximum prey size that may be ingested. *P. spenceri* consumed more soft-bodied than hard-bodied prey items, the latter usually less than 10 mm<sup>3</sup> in volume. This suggests either a paucity of hard-bodied items within the foraging sphere of *P. spenceri* or else a preference by this species for soft-bodied items that are more easily manipulated and swallowed. Almost all of the arboreal and/or aerial prey items that characterise the diet of *P. spenceri* are soft-bodied, lacking an extensive chitinous exoskeleton.

Although significant numbers of skinks were only collected for summer and spring and the results for a seasonal analysis must therefore be viewed with some reservation, it is still apparent that *P. spenceri* is a generalist feeder that takes a wide variety of taxa and utilises temporally abundant

invertebrates. Seasonal variation in prey availability obviously influences the diet of this type of forager, and this phenomenon has been documented for a number of other lizard species (e.g. Fam. Iguanidae: Ballinger and Ballinger, 1979; Rose, 1976; Fam. Lacertidae: Robinson and Cunningham, 1978). In each case the dietary fluctuations reflected the availability of food items. The reproductive cycle of *P. spenceri* also possibly affects the amount of food consumed at different times of the year, but no investigation was made of this potential influence.

In Australian terrestrial ecosystems the scincid fauna has radiated extensively, probably because of generalised feeding habits and reduced competition pressure from other vertebrate groups. This is particularly true in the deserts (Pianka, 1966) and the forests (Pengilley, 1972) where large numbers of species co-exist. *P. spenceri* shares its montane habitat with a number of sympatric scincids, none of which show the same degree of arboreality.

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#### REFERENCES

Ballinger, R. E. and Ballinger, R. A. (1979). Food resource utilization during periods of low and high food availability in *Sceloporus jarrovi*. *Southwest. Nat.* 24:347-64.

Brown, G. W. (1983). Comparative feeding ecology of south-eastern Australian scincids. Unpubl. Ph.D. thesis, La Trobe University, Melbourne.

Bureau of Meteorology (Australia) (1975). *Climatic Averages*. Victoria, Australian Government Publishing Service, Canberra.

Cogger, H. G. (1983). *Reptiles and amphibians of Australia*. (rev. ed.). A.J. and A.W. Reed, Sydney.

Greer, A. E. (1979). A phylogenetic subdivision of Australian skinks. *Rec. Aust. Mus.* 32:339-71.

Jenkins, R. and Bartell, R. (1980). *A field guide to reptiles of the Australian high country*. Inkata Press, Melbourne.

Odum, E. P. (1971). *Fundamentals of Ecology*. 3rd edition. Saunders, Philadelphia.

Pengilley, R. (1972). Systematic relationships and ecology of some lygosomine lizards from south-eastern Australia. 2 Vols., Unpublished Ph.D. Thesis, A.N.U., Canberra.

Pianka, E. R. (1966). Convexity, desert lizards and spatial heterogeneity. *Ecology* 47:1055-59.

Pianka, E. R. (1977). "Reptilian species diversity", Chap. 1, in Gans, C. and Tinkle, D. W. (eds.) *Biology of the Reptilia*, Vol. 7: *Ecology and Behaviour*. a, Academic Press, London.

Rawlinson, P. A. (1974). Revision of the endemic south-eastern Australian lizard genus *Pseudemoia* (Scincidae: Lygosominae). *Mem. Nat. Mus. Vict.* 35:87-96.

Rawlinson, P. A. (1981). "Conservation of Australian amphibian and reptile communities", Chap. 25, in Banks, C. B. and Martin, A. A. (eds.), *Proceedings of Melbourne Herpetological Symposium*, The Zoological Board of Victoria.

Robertson, P. (1981). "Comparative reproductive ecology of two south-eastern Australian skinks" Chap. 10, in Banks, C. B. and Martin, A. A. (eds.), *Proceedings of the Melbourne Herpetological Symposium*. The Zoological Board of Victoria.

Robinson, M. D. and Cunningham, A. B. (1978). Comparative diet of two Namib Desert sand lizards (Lacertidae). *Madoqua* 11:41-45.

Rose, B. R. (1976). Habitat and prey selection of *Sceloporus occidentalis* and *Sceloporus graciosus*. *Ecology* 57:531-41.

Schoener, T. W. (1967). The ecological significance of sexual dimorphism in size in the lizard *Anolis conspersus*. *Science* 155:474-76.

Schoener, T. W. (1968). The *Anolis* lizards of Bimini: resource partitioning in a complex fauna. *Ecology* 49:704-26.

Shine, R. (1981). Venomous snakes in cold climates: ecology of the Australian genus *Drysdalia* (Serpentes: Elapidae). *Copeia* 1981:14-25.

Simpson, E. H. (1949). Measurement of diversity. *Nature* 163:688.

## F.N.C.V. Excursion to Queensland — August, 1985

On 9 August, 1985 the group of 25 left Brisbane by bus, and travelled via Apsley, Glass House Mountains, Nambour, Gympie to Rainbow Beach. En route, there were stops to view fine stands of *Angophora costata* (Smooth-barked Angophora), *Tristania conferta* (Brush Box), Scribbly Gums, floriferous *Hovea acutifolia*, *Hardenbergia violacea* and *Acacia* species. It was interesting to see cleared areas surrounded by bush, which had growing in them bananas, pineapples, avocados and citrus plants. In some places sugar cane grew as windbreaks. There was time for short walks in Beerburri Forest Park and Mount Beerwah National Park. A detour to Caloundra on the Pacific Ocean coast was the lunch stop, and here we observed Pelicans and flocks of Crested Terns and Silver Gulls.

One day at Rainbow Beach gave us time to investigate a rainforest — part of Cooloola National Park, heathland, mangroves at Carlo Point, sand beaches and a spectacular sand blow.

We were awed by the height and layering of rainforest vegetation; the sudden lowering of temperature; dim light filtered green with occasional shafts of sunlight; the silence broken by calls of whipbirds, rustle among loose tree bark and ground floor leaves made by foraging Rufous Shrike-thrushes. Green Catbirds were heard, and above the tree canopy a Grey Goshawk soared. More observations included palms, ropes of lianes, buttresses at base of tall trees, and epiphytes.

Beyond the rainforest many plants in the dry heathland were flowering. Among the plants identified were three species of pink Boronias, pink *Eriostemon australasius* (Waxflower), *Sowerbaea juncea* (Vanilla Lily), *Hakea sericea* (Needlebush), *Patersonia glabrata* (Leafy Purple-flag), *Hibbertia vestita* (Hairy Guinea-flower), *Gompholobium glabratum* (Dainty Wedge-pea), pink *Pimelea*, *Acacia sauveolens* (Sweet Wattle) and *Leptosper-*

*mum* species. In one shallow swamp area, *Banksia robur* (Broad-leafed Banksias) were dominant, and near the edges masses of bright green *Restio tetraphyllus* (Tassel Cord-rush) known locally as Feather-plant or Fox Tail. There were *Eucalyptus intermedia* (Red Bloodwoods), and *Schizaea bifida* (Comb Fern) found.

A late afternoon visit to Carlo Point proved worthwhile for the bird enthusiasts. Their observations included Eastern Curlew, Whimbrel, Varied Triller, Mangrove Honeyeaters, Brown Quail, and Mangrove Heron. We all appreciated songful birds, particularly mornings and evenings around our Rainbow Beach units. These were Brown Honeyeaters, Peaceful Doves, Rainbow Lorikeets and Spangled Drongos. Pied Butcherbirds, memorable for their melodious song were numerous throughout all areas of the mainland en route.

On 11 August, two 4WD vehicles took us from Rainbow Beach along firm sands of the shore, northwards, 13 km to Inskip Point, where a ferry crossing brought us to Hook Point on Fraser Island. Travelling along firm sands again on the 75 Mile Beach of the east coast, crossing four freshwater creeks, the settlement of Eurong was reached. Eurong, which means a place of many camps, was our base for day excursions. The day by day highlights were as follows.

DAY 1 included an hour's walk through rainforest in Pile Valley, following crystal clear Woongoolber Creek to Central Station, a Forestry Headquarters. A stand of tall *Syncarpia hillii* (Satinay or Turpentine Trees) were shown to us at the start of the track. We examined the woody fruits of seven fused carpels strewn on the ground, and felt the fibrous and deeply furrowed bark. Of special significance in the creek, grew *Angiopteris evecta*, 15 ft. high ferns with fronds up to 24 ft. These ferns are reputed to be unchanged for 250 million years. At Central Station there

were fine specimens of *Eucalyptus grandis* (Rose Flooded Gums), *Araucaria cunninghamii* (Hoop Pine), *Agathis robusta* (Kauri), *Ophioglossum pendulum* (Ribbon Fern), growing on a Staghorn Fern. At Lake McKenzie and all lakes visited, there were *Melaleuca quinquenervia* (Paperbarks) clearly identifiable by 5-veined leaves, also *Phebalium woomye* (Wallum Phebalium) with terminal clusters of small white and sometimes pink flowers, *Dodonea triquetra* (Hop-bush) in fruit, and the mauve flowers on *Chloanthes parviflorus*.

DAY 2 was a drive north passing Yidney Rocks to Happy Valley settlement, wading in Eli Creek, on the 'Maheno' ship-wreck a lone Reef Heron in white phase, to Allom Lake. In the Wallum heathland, a Flying Duck Orchid, *Hovea* with white flowers, *Xylomelum pyriforme* (Woody Pear) in fruit, *Dipodium punctatum* (Hyacinth Orchids) and an epiphytic *Dendrobium* orchid with white flowers were significant.

DAY 3, in the morning a visit to Lake Boomanjin, and to Central Station again, with time to see over the Forestry Information Centre, and watch dingoes appear out of the forest looking for food. In the vicinity of Lake Boomanjin, several species of mistletoe plants were found, and a Mistletoe bird observed. Growing out of the water were the inflorescences of purple flowers of *Burmania disticha* (Forked Burmania).

The afternoon was free, which was an opportunity to explore Eurong settlement. Fore-dunes had sand stabilisers, trailers of *Hibbertia scandens* (Guinea Flower) in flower and fruit, *Stackhousia spathulata*, blue flowered *Scaevola calendulacea* (Fan flower), peltate leaves identified *Stephania japonica*. Further from the shore grew *Banksia integrifolia* and *Allocasuarina equisetifolia* var. *incana* (Coastal Sheoak). In a nearby valley six species of Honeyeaters were observed flying to bathe and drink at a bird bath in a private garden. These Honeyeaters were the Scarlet, Brown, Lewin, White-cheeked, White-

throated, and Yellow-faced. In the area Rufous Whistlers and Varied Trillers were songful, and Rainbow birds were sighted. Early morning observations included beautiful Red-backed Wrens, flocks of Rainbow Lorikeets, Pheasant Coucals and Fantailed Cuckoos.

DAY 4 route took us further north, approximately 40 km, to Orchid Beach Resort, passing the Great Sandy National Park, 'Cathedrals' or pinnacles of coloured cliff sand, to Indian Head and Waddy Point both rocky headlands. This day was memorable for the beauty of seascapes, bracing off-shore winds, sounds of rough seas, groups of surf fishermen, discovery of more birds, — Pied Oystercatchers, Crested Terns, Red-capped Plovers, soaring flight of Brahminy Kites, White-breasted Sea-Eagles and Osprey; Brumbies browsing, and sea shell finds.

DAY 5 was a second visit to Happy Valley from where a sandy track took us to Yidney swamp and heathland, the Pinnacles, Rainbow Gorge where a broom-like shrub was in flower, *Jacksonia scoparia*. A special find in an open forest area was *Pterostylis baptistii* (King Greenhoods). One swamp traversed had dense growth of Coral Fern and Climbing Fern.

DAY 6 was special for some members for the thrill of a short island flight. The airstrip for the 3-passenger plane was the firm beach sand! This, our last day was to Wabby Lake. On the walk were found *Schizea dichotoma* (Branched Comb Fern), *Elaeocarpus reticulatus* (Blueberry Ash) in fruit, *Eucalyptus signata* (Scribbly Gum), *E. tereticornis* (Forest Red Gum), *E. tessellaris* (Moreton Bay Ash), *Caladenia alba*, *Galeo cassyhoides* (Climbing Orchid). A Darter, Little Pied Cormorant, and three Little Grebes had priority for observation at the rest site beside Wabby Lake. Rainbow Beach was reached in the afternoon.

On 18 August, via the sand 'highway', we drove south to Double Island Head and Light House, passing Teewah coloured sands, detoured through a part of Cooloola

National Park, a ferry crossing of the Noosa River through Tewantin, and to Noosa Heads for a 3 day stay.

The first day in perfect weather was spent on an Everglades Cruise Vessel taking us upstream for about 40 km on the Noosa River, passing through Cooroibah and Cootharaba Lakes, with a stop at Kinaba Wildlife Information Centre, and pulling in at the jetty by Harry's Hut. There was a much photographed goanna. Unforgettable will be the reflections of vegetation in still waters, and the variety of bird life. For many of us it was a first sighting of Jabirus, and special to see Osprey and White-breasted Sea-Eagles on their nests.

The next day a tour was arranged, taking us first to Laguna Look-out at Noosa, then

to the hinterland which included Wappa Dam and Park, Dulong lookout, Mapleton Falls National Park, Obi Obi Valley, Mary Cairncross Rainforest Park in the Blackall Ranges, to Landsborough and Nambour, then via Bli Bli and Coolum returning to Noosa Heads.

August 21 was spent in Noosa National Park on rainforest and coastal walks. Twelve days, each one memorable, yet unique were the days experienced on Fraser Island.

For the use of their Bird Notes in this report, thanks are due to Dorothy Dawson and Pat Glancy, and special thanks to Marie Allender for the excellent planning of this successful excursion to Queensland.

**Mary K. Doery.**

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### *Naturalist Review*

## **The History of Australian Exploration 1788-1888**

By Ernest Favenc (1888). (Facsimile Edition, 1983, by Golden Press Pty. Ltd., Gladesville, New South Wales, 2111). 474 pp. c. \$16 (Hardcover).

This is a facsimile edition of a well known book (at least to students of Australian history) by Ernest Favenc (c. 1846-1908), an English explorer and author in Australia between 1863 and 1908, who wrote novels, two Australian history books and numerous short stories and newspaper articles. He was one of the most prolific writers of his time. The present book is the largest and probably the most important of his literary contributions.

Favenc has been best remembered as an author, and his exploratory feats appear to have been regarded as less important than those of such earlier explorers as Sturt, Burke, Wills, Leichardt, Kennedy etc. However, during 1878 to 1879, Favenc organized an expedition to document the geographical and vegetative features of the country in the neighbourhood of a then proposed railway line to Port Darwin. The expedition left Blackall in western Queensland and reached the Overland Telegraph Line. This successful mission

had the effect of opening up a large area of pastoral country which by 1888 had been well stocked. Four years later Favenc undertook useful exploratory work in the north-west of Western Australia. In 1883 Favenc traced the heads of the rivers running into the Gulf of Carpentaria near the Queensland border, and during 1884 crossed from the border to the Overland Telegraph Line and across the narrow coastal ranges to the mouth of the Macarthur River (Northern Territory). The river was later opened as a port and settlement of this area soon followed.

*The History of Australian Exploration 1788-1888* is a mammoth book. The introduction is broken into two parts, the first of which deals with the early navigators who passed or landed on Australian shores, and the second deals briefly with the geography of Australia. In this latter part, mention is briefly made of the vegetation of the "new territory", viz. various *Eucalyptus* species, *Acacia pendula* and *Casuarina*, while some of the

distinctive, better known avifauna such as the Kookaburra, Brolga, Ibis and Jabiru are mentioned.

The bulk of this massive tome contains 20 chapters arranged into 2 parts. The first part deals with land exploration (14 chapters) and the second with sea voyages (six chapters). Favenc's work is a most easily read account, lavishly supplemented with quotes from journals and notes on the habitat and fauna encountered by the early explorers and their attitudes towards the natural environment and the aborigines. At the end of the book there is an appendix, an index of names, dates and incidents, and a chronological summary of the feats of all the major early explorers. The appendix contains letters and other valuable historical documents. Of particular interest in this section is the report on the amazing aboriginal cave paintings discovered by Lieutenant George Grey near the Glenelg River in Western Australia during 1838. There are 5 illustrations showing some of

these drawings; they are copied from Grey's journals. There is also a reprint of Ludwig Leichardt's last letter, a comment on nardoo (*Marsilea*) and a list (with discussion) on poison plants. The index of names and the chronological summary are of much value.

A highlight of this facsimile edition is the inclusion of a colour map (reproduction) published in Paris during 1863 showing the routes taken by explorers in Australia during 1840-1863. Favenc's book is probably unknown to many of the new generations of Australians, and it is heartening to see various publishers presently undertaking facsimile productions of books which I regard as often forgotten and unobtainable, but important historical documents. For around \$16, this hardcover book is good value. The colour map alone must be worth at least \$5. I recommend this book to naturalists and all those interested in Australian history.

T. J. Hawkeswood.

## **CAUTION!!**

### **DON'T READ THIS**

*If you have already paid your subscription  
for 1986.*

*If you have forgotten, then*  
**THIS IS YOUR LAST COPY OF**  
**"THE VICTORIAN NATURALIST"**

unless

Your subscription is paid by the  
**END OF APRIL**

# FIELD NATURALISTS CLUB OF VICTORIA

## REPORT BY COUNCIL

In accordance with Section 270 of the Companies (Victoria) Code 1981, the members of the Council submit herewith balance sheet as at 31 December 1985, and the 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:—

Mrs. S. Houghton  
Mr. G. Love  
Mr. N. Disken  
Miss M. Allender  
Mr. B. Lobert  
Miss W. Clark  
Mr. I Faithfull  
Miss M. Potter  
Miss C. Shankly  
Mrs. H. Stanford  
Mr. W. Ashburner  
Miss B. Sommerville

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 deficit of the Club for the year ended 31 December, 1985 was \$132 in the General Account. In addition surpluses were earned in the following Funds:—

Building Fund, \$1,340, Publications Fund \$7,466  
Excursion Fund \$4,496, Special Funds \$277

4. The following transfers to and from Funds have been made during the year ended 31 December, 1985:—

From Income & Expenditure Account to Club Improvement Account \$1,802

5. The Club has issued no shares or debentures during the year.

6. 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. Conservation issues were brought to the attention of members. The Australian Natural History Medallion was administered and awarded to Mr. Jack Hyett. Following bad fires at Maryborough, the Club's fauna reserve was refenced. A Regeneration Project was undertaken at the Club's Kinglake property. Financial and technical support was given to the Hawthorn Junior Field Naturalists Club to assist with 1985 Nature Show.

7. No significant changes in the state of affairs of the Club occurred during the financial year ended 31 December, 1985.

8. 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 1985.

9. 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, 1985 are unlikely to have any significant effect on the financial results in future years.

10. At the date of this report there exists no charge on the assets of the Club which has arisen since the end of the financial year and secures the liabilities of any other person and no contingent liability has arisen since the end of the financial year.

11. No member of the Council has an interest in a contract or proposed contract with the Club, being an interest the nature of which would have been declared by the member of the Council in accordance with Section 228(1) of the Code.

12. Information on Members of the Council:—

*Sheila Houghton* — Acting President

Occupation — Librarian

Council Member Since — 1981

*Wendy Clark* — Immediate Past President

Occupation — Photographer

Council Member Since — 1978

*Ian Faithfull* — Secretary

Occupation — Public Servant

Council Member Since — 1983

*Noel Disken* — Treasurer

Occupation — Public Servant

Council Member Since — 1984

*Marie Allender* — Member of Council

Occupation — Retired

Council Member Since — 1956

*Will Ashburner* — Member of Council

Occupation — Nursery Manager

Council Member Since — 1985

*Bertram Lobert* — Member of Council

Occupation — Biologist

Council Member Since — 1984

*Graeme Love* — Member of Council

Occupation — Public Servant

Council Member Since — 1985

*Margaret Potter* — Member of Council

Occupation — Retired Teacher

Council Member Since — 1985

*Christine Shankly* — Member of Council

Occupation — Technician

Council Member Since — 1983

*Betty Sommerville* — Member of Council

Occupation — Retired

Council Member Since — 1985

*Helen Stanford* — Member of Council

Occupation — Homemaker

Council Member Since — 1983

13. 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 3rd Day of April, 1986  
in accordance with a resolution of the Council.

S. Houghton Acting President  
N. Disken Treasurer

**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:-

- (a) The accompanying accounts, being the Balance Sheet, Statement of Income and Expenditure and Notes to Accounts, together with the Statement by Members of the Council, are properly drawn up in accordance with the provision 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, 1985 and of the results of the company for the year ended on that date; and
  - (ii) the other matters required by Section 269 of that Code to be dealt with in accounts; and are in accordance with Australian Accounting Standards.
- (b) The accounting records and other records, and the registers required by that Code to be kept by the company have been properly kept in accordance with the provisions of that Code.

DANBY BLAND PROVAN & CO.  
Chartered Accountants  
R. M. Bland  
Partner

Melbourne  
3rd April 1986

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## **Nominations of FNCV Council Members and Office Bearers**

The FNCV Annual General Meeting will be held on Monday, 12 May 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, Assistant Secretary, Treasurer, Assistant Treasurer, Editor, Assistant Editor, Librarian, Assistant Librarian, Excursion Secretary, Programme Secretary, Conservation Co-ordinator, Club Reporter.

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 Thursday of the month at the Herbarium. If you nominate a person for a particular office and that person is willing to be a member of the 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 accept nomination.

Nominations, endorsed by two members of the Club should be received by the Hon. Secretary by Friday, 9 May.

The Club is entitled to 2 representatives on the Conservation Council of Victoria. We also require an Information Officer (at General Meetings) and a Display Co-ordinator. If you would like to undertake these jobs, or know of members who would, please let the Secretary know.

Ian Faithfull,  
Hon. Secretary

**Field Naturalist 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, 1985.
  - (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. This statement is made in accordance with a resolution of the Members of Council.

SIGNED at MELBOURNE this 3rd day of April, 1986

S. Houghton Acting President  
N. Disken Treasurer

1. Auditor's Remuneration of \$200 relates to auditing services only. No other benefits were received by the Auditors in respect of their services to the Club.
2. No Emoluments were paid by the Club to any member of the Council.
3. State Treasury Grants for 1983/84 and 1984/85 and 1985/86 have been received, but grants totalling \$4,879 had not yet been applied against expenditure at 31/12/1985.
4. Basis of Accounting. The accounts have been prepared under the historical cost convention and have not been adjusted to take into account the current cost of specific assets.

**FIELD NATURALISTS CLUB OF VICTORIA  
BUILDING FUND**

Balance of Fund at 31 December 1984 .....	\$9,668
Interest on Investments and Bank Account .....	1,340
Balance of Fund at 31 December 1985 .....	<u>11,008</u>

**PUBLICATIONS FUND**

Balance of Fund at 31 December 1984 .....	56,141
Interest on Investments and Bank Account .....	7,211
Surplus for the year from —	
Fossil Book .....	220
Ferns of Victoria and Tasmania .....	35
Balance of Fund at 31 December 1985 .....	<u>63,607</u>

**CLUB IMPROVEMENT ACCOUNT**

Balance of Account at 31 December 1984 .....	9,296
Book Sales Account Profit .....	1,812
Balance of Account at 31 December 1985 .....	<u>11,108</u>

**EXCURSION FUND**

Balance of Fund at 31 December 1984 .....	13,590
Interest on Investments and Bank Account .....	1,911
Surplus on Tours .....	2,585
Balance of Fund at 31 December 1985 .....	<u>18,086</u>

**FIELD NATURALISTS CLUB OF VICTORIA**  
**STATEMENT OF INCOME & EXPENDITURE — YEAR ENDED 31/12/1985**

**INCOME**

<b>1984</b>	
Subscriptions Received —	
Arrears	\$48
Current	13,193
Supporting	424
14,190	13,665
685	817
Sales of "Victorian Naturalist"	
Interest Received —	
Library Fund	15
Bank Account	233
Commonwealth Bonds	1,475
Bonds — M. Wright Legacy	767
Bonds — C. M. Walker Legacy	147
National Mutual Deposit	—
Life Membership Fund	78
Natural History Medallion Fund	323
3,510	3,038
2	145
1,973	1,812
1,975	1,957
678	132
Deficit for year	
1,975	1,957
678	132
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# FIELD NATURALISTS CLUB OF VICTORIA BALANCE SHEET AS AT 31 DECEMBER, 1985

## LIABILITIES

<b>Current Liabilities</b>		1984	
Subscriptions paid in advance	\$1,855		
Sundry Creditors	3,378		
M. A. Ingram Trust Grant in hand	154		
Treasury Grant in hand (Note 3)	4,879		
		10,266	
<b>Special Funds &amp; Accounts</b>			
Building Fund	11,008		
Publication Fund	63,607		
Excursion Fund	18,086		
Marie Allender Excursion Fund	6,000		
Library Fund	100		
Club Improvement Account	11,108		
Estate M. Wright Legacy	5,217		
Estate C. M. Walker Legacy	1,466		
Estate R. S. Chisholm	20		
Estate J. F. Knox Legacy	200		
Estate E. Bennett	500		
Estate Ivy Dixon	200		
Estate I. Hanks	204		
Wilfred C. Woolard Fund	955		
D. E. McInnes Fund	1,004		
V. H. & B. E. Miller Fund	446		
N. A. Wakefield Memorial Fund	90		
P. F. Morris Gift Account	300		
Cedric Ralph Gift Account	250		
P. Matches Memorial Fund	500		
Kinglake Project Fund	398		
Natural History Medallion Fund	2,648		
Life Membership Fund	520		
		124,303	
		109,046	

## ASSETS

<b>Current Assets</b>		1984	
Cash at Bank	\$6,731		
Australian Savings Bonds at Cost	10,000		
Sundry Debtors	725		
Stocks on Hand at cost —			
Badges & Sundries	95		
Books for Sale	1,406		
Victorian Naturalist Subject Index	785		
		19,742	
<b>Fixed Assets at cost</b>			
Library Furniture & Equipment	9,854		
Land — Cosstick Reserve, Maryborough	213		
— Harold C. Frahm, Kinglake	—		
		10,047	
<b>Investment of Funds at cost</b>			
Australian Savings Bonds	8,300		
Esanda Ltd. Debentures	8,300		
National Mutual Permanent			
Building Society — Deposit	7,498		
Statewide Building Society — Deposit	430		
		24,528	
<b>Building Fund</b>			
Australian Savings Bonds at cost	3,100		
Esanda Ltd. Debentures at cost	6,600		
Sundry Debtors	—		
Cash at Bank	1,308		
Less Sundry Creditors	—		
		11,008	

**Surplus Account**

12,793
466
( 678)
<u>12,581</u>

Balance at 1/1/1984
Transfer from Club Improvement Fund
Surplus (Deficit) for year

12,581
( 132)
<u>12,449</u>

**Publications Fund**

45,380	Australian Savings Bonds at cost	45,380
2,500	Esanda Ltd. — Debentures at cost	5,000
—	Telecom — Bonds at cost	1,500
7,215	Book Stocks at cost	6,907
3,227	Sundry Debtors	1,322
( 2,181)	Cash at Bank	3,498
<u>56,141</u>	Less Sundry Creditors	—
		<u>63,607</u>

**Excursion Fund**

1,00	Australian Savings Bonds at cost	1,000
7,646	Nat. Mutual Bld. Soc. — Deposit	8,349
9,667	Cash at Bank	8,707
( 4,723)	Sundry Creditors	30
<u>13,590</u>	Less Sundry Creditors	—
<u>126,108</u>		<u>18,086</u>

<u>126,108</u>
<u>147,018</u>

<u>147,018</u>
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<u>18,086</u>
<u>147,018</u>

# FIELD NATURALISTS CLUB OF VICTORIA

## Reports of recent activities

### General Meeting

Monday, 10th February

**The Speaker** for the evening was Mr. Peter Kelly, a past President of the FNCV who spoke on the topic of "Beetles". Beetles are an extremely diverse and successful group, having evolved more species than any other order of animals and having filled almost every conceivable terrestrial and many freshwater niches. After giving a description of basic beetle anatomy and life histories, Mr. Kelly went on to describe characteristics of some of the more common of the hundred or more families of beetles, illustrating his talk with many excellent slides. These included:

*Carabidae* — carabs. A ground dwelling carnivorous group which prey upon other insects and therefore benefit farmers by eating crop pests. They are usually darkly coloured or iridescent and do not often take to the wing.

*Silphidae* — Carrion Beetles feed on the flesh of dead animals. The Collector must have a strong stomach to find these.

*Scarabaeidae* — Scarabs. A large and very colourful group with burrowing larvae which includes the familiar Christmas Beetles.

*Euprestidae* — Jewel Beetles. The adults of this family are very attractively coloured and feed on nectar. Australia has many beautiful species of these.

*Cerambycidae* — Longicorns have very long antennae, often several times the length of the body, originating from the middle of their eye. The larvae are wood borers and many do considerable damage to living trees, even on occasion ring-barking them. Some species have fine scales, like those of a butterfly, on their elytra which aid them in camouflage.

*Curculionidae* — Weevils have a long protruding snout with elbowed antennae at its end. Most are plant eaters and some are important pests in grain crops.

*Chrysomelidae* — Leaf-eating Beetles are usually small and often attractively coloured. Both the larvae and adults are leaf-eaters and the adults have pads of thousands of fine hairs on their feet which enable them to cling to smooth leaf surfaces.

### Exhibits

— A blackberry cane infected with blackberry rust from the FNCV property at Kinglake. Mr. Ian Faithfull.

— Newly hatched Emperor Gum Moth caterpillars and eggs, newly hatched garden snails, a cup moth cocoon and pupa taken from a cocoon found under eucalypt bark, a bee and some bee-mimicing flies found on a Shasta Daisy and their yellow excreta, like the so-called "yellow rain", consisting of daisy pollen. Mr. Unwin Bates.

— Under microscopes: An unknown species of Gorgonian coral which has eight pinnate tentacles and many ornamental spicules embedded around its base.

— Walking jellyfish, *Clavatella prolifera* (*Eleutheria dichotoma*), are hydroid medusae which instead of swimming around like ordinary medusae, crawl along on their tentacles of which there are usually six. These specimens were found at Black Rock and have been described by Mr. H. Bishop in 1972 (Vic. Nat.; 89(1), 16-19). Mounted specimens were shown of a new species from Black Rock with up to eighteen tentacles which is similar to a species from Port Jackson with thirty tentacles illustrated in a book. Mr. Dan McInnes.

— A box of beetles showing specimens from many different families. Mr. Peter Kelly.

### Nature Notes

— The entire Metcalfe Flora Reserve has been burnt by a bushfire. Mrs. Sheila Houghton.

(Continued from inside front cover)

## GROUP MEETINGS

FNCV members and visitors are invited to attend any Group Meetings.

### Day Group — Third Thursday

Thursday, 17th April. "Seeing Eye Dog School" Malvern. Meet at 11.30 a.m. at Malvern Gardens — cnr. High St. and Spring Rd. Travel by Glen Iris tram No. 6. Alight at Stop No. 42. Leader: Joan Miller 836-2681.

Thursday, 15th May. "Brimbank" M.M.B.W. Park, Keilor. Train departs 10.30 a.m. from Flinders St. Alight at Essendon Station, thence by bus 476 for Keilor. Leader: Andy Blackburn 379-8960.

Thursday, 19th June. Fawkner Park and Jewish Museum. Leader: Dan McInnes 211-2427.

At the National Herbarium, Burwood Ave., South Yarra.

### Botany Group — Second Thursday

Thursday, 10th April. "Crete: A flora in isolation". Mrs. Hilary Weatherhead.

Thursday, 8th May. "Daisies". Mrs. Maureen Schaumann and Mrs. Judy Barker of the SGAP *Brachycome/Helipterum* Study Group.

Thursday, 12th June. Members' Night.

### Geology Group — First Wednesday

Wednesday, 2nd April. Galapagos Island Slide Night. Miss L. Bennett.

Wednesday, 7th May "Saurus": What are they? — a summary of extinction theories", Mr. Graeme Love.

Wednesday, 4th June. "Petrology for the Beginner". Mrs. Gaby Love.

### Mammal Survey Group — First Tuesday

Tuesday, 6th May. To be announced.

Tuesday, 3rd June. To be announced.

### Microscopical Group — Third Wednesday

Wednesday, 16th April. "Parasites affecting Mankind". Dr. Evan Peters.

Wednesday, 21st May. "Grinding a Telescope Mirror". Mr. Russel Ward.

Wednesday, 18th June. "Rheinberg Filters and Crystals under Polarized Light". Mr. J. Endacott.

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## Special Note for Authors Using Wordprocessors

The editors of the Victorian Naturalist are investigating the possibility of translating manuscripts directly from wordprocessing discs to the typesetting machine without rekeying by the typesetter. If this can be done, there is a potential for considerable savings in printing costs, as it would be much faster and would eliminate the possibility of typographical errors.

If your next paper for Naturalist is to be entered on a wordprocessor, please contact Russell Thompson (45 1594, 17 Powlett St., Heidelberg, 3084), for information relating to the compatibility of your discs and the method of preparing copy for this purpose.

---

— A large number of ibis have been seen flying around the Lower Yarra area and Batman Avenue. Mr. Norm Plever.

— A large colony of Fruit Bats (> 200) are living at present in the Fern Gully area of the Botanic Gardens. Mr. Tom Sault.

— Magpies seen chasing beetles in the treetops after the sun had set at Rowville. Mr. Doug Weston.

— Mr. Dan McInnes reported reading an

article saying that the little wasp which pollinates the Moreton Bay Fig flowers does not occur as far south as Melbourne and that the figs set on our trees therefore do not contain viable seed. He wondered whether this was true or not. Several other people in the audience reported having seen young Moreton Bay Fig seedlings growing in the forks of other trees around Melbourne.

# 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 1985-1986

*President*

"Vacant"

*Vice President:* Mrs. SHEILA HOUGHTON, 30 Golf Links Cres., Dingley, 3172 (551 2708 A.H.)

*Hon. Secretary:* Mr. I. FAITHFULL, 83 Easey Street, Collingwood, 3066 (419 9908 A.H.)

*Hon. Treasurer:* Mr. NOEL DISKEN, 24 Mayston St., Hawthorn East, 3123 (82 3471 A.H.)

*Subscription-Secretary:* c/ National Herbarium, Birdwood Avenue, South Yarra, 3141.

*Editorial Material:* Forward to Ms. J. U. PHILLIPS, C/- Museum of Victoria, Russell St., Melbourne, 3000.

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

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

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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.

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# The Victorian Naturalist

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## FNCV DIARY OF COMING EVENTS

### GENERAL MEETINGS

#### Monday, 16th June, 8.00 p.m.

Dr. Robyn Adams. "Distribution of *Callitris* in Victoria and some interesting populations close to Melbourne".

#### Monday, 14th July, 8.00 p.m.

Mr. Bruce Fuhrer. "Aspects of the Gulf Country".

#### Monday, 11th August, 8.00 p.m.

Margaret Blakers. "The FNCV Old-time Naturalists Project".

#### New Members — 21.1.86-31.3.86

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Miss Dianne Chambers, St. Hildas College, Parkville, 3052.

Mr. Stephen Craig, C/- 37 Scotland Ave., Greensborough, 3033.

Mildred M. Driver, 36 Barnshury Rd., Deepdene, 3103.

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Mr. Andrew Paget, 24 Corbert St., Ferntree Gully, 3156

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Miss D. L. Robinson, 11 Mackie Court, Blairgowrie, 3942.

Mrs. L. J. Rogers, RMB 5361, Horsham, 3401.

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### FNCV EXCURSIONS

**Sunday, 6th July.** Museum of Victoria. Meet at Russell St., entrance at 2 p.m. Should any members wish to take a picnic lunch it is suggested they meet at the corner of Wellington Parade and Lansdowne St., at 11.15 a.m. and lunch in the Fitzroy Gardens.

**Sunday, 3rd August.** Zoological Gardens. Meet at the entrance near Royal Park Station at 10.30 a.m.

**Sunday, 31st August.** Working-bee at FNCV Property, Kinglake.

**Sunday, 7th September.** Tallarook. Leader: Peter Kelly. The coach will leave from Batman Avenue at 9.30 a.m., fare \$12. Bring a picnic lunch.

**Saturday, 4th — Sunday, 5th October.** VFNCA weekend staying overnight in Ballarat, visiting Linton Saturday, and Devil's Kitchen Sunday. Details will be in the next Naturalist but bookings may be made now. Cost will be about \$55 for coach and accommodation.

**2nd or 3rd weekend in October.** Warby Ranges Campout. Leader: John Milligan. Contact Will Ashburner (890 7370) for details.

**Wednesday, 22nd — Tuesday, 28 October.** Kangaroo Island. This excursion will start officially from Adelaide to allow members to choose their mode and time of travel, however, some sleeping berths have been booked on the train leaving Melbourne on the 21st, as accommodation is heavily booked in Adelaide then. The train is due in Adelaide at 8.05 a.m. and we will go to Kangaroo Island during the day. The motel has a guest-house section as well as motel rooms with P.F. Costs will vary with numbers but very approximately \$450 guest house or \$490 motel twin share with air fare for Kangaroo Island from Adelaide, all meals, tours and accommodation.

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### GROUP EXCURSIONS

All FNCV members and visitors are invited to attend Group Excursions

#### **Botany Group**

Saturday, 28th June. Organ Pipes and Brimbank Park. Leader: Andy Blackburn.

Saturday, 26th July. Studley Park, Kew.

Saturday, 23rd August. Acacias. Warrandyte. Leader: Mr. Ian Morrison.

#### **Geology Group**

Excursions to be announced.

#### **Mammal Survey Group**

Saturday, 7th — Monday, 9th June. Rock Wallaby Survey. Grampians.

Saturday 16th — Sunday 17th August. Rushworth.

(Continued on page 1.B.C)



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Editorial Committee: R. Thomson, D. McClellan, V. Spencer.

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Cover Illustration: Yellow bellied glider (*Petaurus australis*). Photo: John Seebeck

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# A Record of Twins in the Yellow-bellied Glider, (*Petaurus australis* Shaw) (Marsupialia: Petauridae) with Notes on the Litter Size and Reproductive Strategy of the Species

BY S. A. CRAIG\*

The Yellow-bellied Glider, *Petaurus australis* Shaw has attracted considerable interest recently, with various researchers addressing aspects of its biology and ecology (Craig and Belcher, 1980; Kavanagh and Rohan-Jones, 1982; Smith and Russell, 1982; Henry and Craig, 1984; Russell, 1984; Craig, 1985; Goldingay, 1985); however its reproductive physiology and strategy remains poorly understood.

Species in the Family Petauridae are polyoestrous, with the smaller species being polytocous with litters of one to five (Tyndale-Biscoe, 1983), while for *P. australis* this has yet to be conclusively determined.

The pouch morphology of *P. australis* is of particular interest because it is unique among the marsupials in having two compartments separated by a well-developed furred septum (Craig and Belcher, 1980). Fleay (1933) commented that with only two mammae in the pouch, evidently no more than a single young is reared each year. Until recently this was thought to be the case, however on 9 November 1984 a female examined at Wingan Inlet, Victoria (149°29'41"E, 37°44'29"S) was found to be carrying two pouch young. Of thirty-six pouch young records from various localities throughout their range in Queensland, New South Wales and Victoria, this is the first record of twins (Fig. 1). When first noted the twins had a crown rump length of approximately 20 mm, and based on the development of young in the Sugar Glider, *Petaurus breviceps* (Smith, 1979), were born between late October and early November. When

examined on 7 January 1985, both young, one of each sex, were well developed and some data relating to their age were recorded (Table 1). Their eyes were closed, ears free and the head, shoulders and back were dark grey; hair was visible on their tail tips. This particular adult female was first examined in August 1980 when she was an adult, and again in November 1981, September 1982, November 1983, November 1984, January 1985 and September 1985. In September 1982 she had a single pouch young and in September 1985, following the last examination of the twins in January 1985, her pouch compartments were heavily stained with both nipples regressed and of equal length. It is not known at this stage if the young were successfully reared to independence.

The lack of twin births in *P. australis* contrasts with that of its smaller congeners in Australia, *P. breviceps* and the Squirrel Glider, *Petaurus norfolcensis*.

Suckling (1984) found that of 116 litters born to *P. breviceps* at his study site, 81% were twins and the remainder single young. Henry (1985) recorded 76% twins and 24% single young from 62 litters. In a captive colony of *P. breviceps* Smith (1979) recorded 33.5% twins and 66.5% single young from 39 births.

Data on litter size in *P. norfolcensis* from the wild is meagre; a search of Fisheries and Wildlife Service records revealed only 2 specimens with pouch young; both were litters of two. Smith (1979) recorded 47% twins and 53% single young from 17 captive births and at the Sir Colin Mackenzie Fauna Park, Healesville, Victoria 40.7% twins and 59.3% single young have been recorded from 27 litters between 1977 and 1985 (Carla Srb, pers. comm.).

\* Arthur Rylah Institute for Environmental Research, Fisheries and Wildlife Service, Department of Conservation, Forests and Lands, 123 Brown Street, Heidelberg, Vic., 3084.

Table 1. Age related measurements of *P. australis* twin pouch young, Wigan Inlet, January, 1985.

Sex	Approx. (weeks) Age	Pes (mm)	Tail (mm)
Male	8	15.4	95.4
Female	8	17.6	103.7

*P. australis* is found in a variety of forest types throughout its range from south eastern South Australia to north eastern Queensland (Craig and Belcher, 1980; Henry and Craig, 1984; Kavanagh, 1984; Russell, 1984; Craig, 1985) and they have been recorded with pouch young in all months of the year (Fig. 1).

In Victoria 68.8% of pouch young records are between August and December, while in Queensland pouch young have been recorded in all months except November, with 63% occurring between May and September. No data exists for South Australia and is too limited for New South Wales to show any seasonal trends (Fig. 1).

In the wild, when food is seasonally

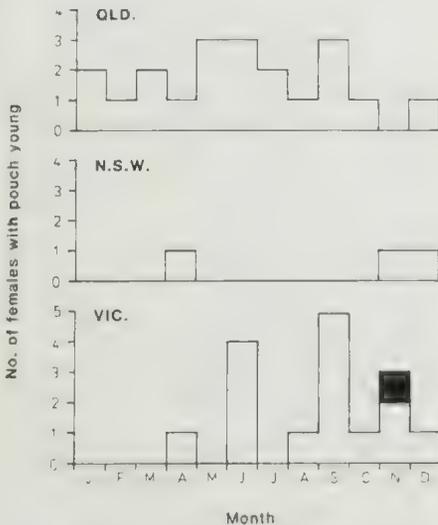


Fig. 1. Approximate birth months for *P. australis* in the wild, 1978-1985. Open columns litters of one; solid column litter of two. Data from Craig (1985), Henry and Craig (1984), R. Goldingay, D. Hespe, R. Kavanagh, G. McKay, M. O'Sullivan and R. Russell unpublished.

abundant, births in marsupials are generally timed so that the period of weaning or late lactation corresponds with the period of maximum food abundance (Lyndale-Biscoe, 1979). The extended breeding period of *P. australis* highlights the species' versatility in adapting to a wide range of seasonal variations in climate and food availability.

At least two of the three species of *Petaurus* found in Australia feed on plant and insect exudates to satisfy the bulk of their energy requirements. *Petaurus breviceps* favours *Acacia* gum and sap from Apple Box, *Eucalyptus bridgesiana* and nectar (Smith, 1982). *P. australis* favours the sap from many different species of eucalyptus and two species of *Angophora* as well as nectar and insect exudates (Craig and Belcher, 1980; Smith and Russell, 1982; Henry and Craig, 1984; Craig, 1985, Craig, unpub. data). The diet of *P. norfolcensis* is not well known and is currently under investigation in Victoria. Preliminary results suggest their diet consists primarily of arboreal insects, the significance of plant exudates being unclear at present (P. Menkhorst, pers. comm.)

Despite the similarities in their diet and feeding behaviour, adult body weights are about 130 g, 230 g and 630 g for *P. breviceps*, *P. norfolcensis* and *P. australis* respectively (Craig, 1985; Suckling, 1983).

Sap, gum, nectar and insect feeders in the Family Petauridae are characterised by medium-small size, low protein diets and consequently reduced offspring production rates, small litters and increased longevity (Smith and Lee, 1984). It has been argued that since litter size and litter frequency increase with decreasing body size in mammals, that animals should be small whenever possible and large size should be considered a specialised response

to specific ecological or socio-biological constraints (McNab, 1980; Clutton-Brock and Harvey, 1982). Smith and Lee (1984) argued that body size is an important determinant of female reproductive strategy through its influence on growth rates and metabolism but that low protein and high fibre diets may depress reproductive rates below maximum levels set by physiological laws of scaling. Smith and Lee (1984) hypothesised that litter size in the petaurid phalangeroids has been constrained by the low proportion of protein (insects and pollen) relative to energy (nectar, saps, gums, honeydew) available in their forest environments.

The mean litter size of the three species of Australian *Petaurus* shows a decrease in the incidence of twins with an increase in body size, (Smith and Lee, 1984) with litters of two in the largest species, *P. australis* being a rare occurrence. All available data for this species suggests that their large size, combined with their specialised diet, necessitates a large home-range in order to satisfy the bulk of their energy requirements (Henry and Craig, 1984; Craig, 1985), resulting in generally low population densities throughout their range, compared with the other species of *Petaurus*, and a specialised reproductive strategy. The majority of females give birth to a single young every second year (Craig, 1985) suggesting that the species would need to be long-lived in order to maximise reproductive potential, thus maintaining adequate population levels under natural conditions.

The reproductive strategies of *Petaurus* species require further investigation in a variety of forest environments throughout their range. An area where all three species occur together, such as in the Kiola State Forest in New South Wales (Davey, 1984) presents the opportunity to compare their habitat use, food resource partitioning and reproductive strategies.

#### Acknowledgements

I would like to thank Ross Goldingay, Rod Kavanagh, David Hespe, Dr. George McKay,

Mark O'Sullivan, Rupert Russell and staff of the Sir Colin Mackenzie Fauna Park, Healesville for permission to use their unpublished data. I would also like to thank National Parks Service staff at Cann River for their help and continuing co-operation with the study of Yellow-bellied Gliders at Wigan Inlet. Peter Menkhurst and John Seebeck provided useful comments, Alicia McShane drew the figure and Robyn Fowler typed the manuscript.

#### REFERENCES

- Clutton-Brock, T. H. and Harvey, P. H. (1982). The functional significance of body size among mammals. *Spec. Publ. Amer. Soc. Mamm.* 7:633-63.
- Craig, S. A. (1985). Social organisation, reproduction and feeding behaviour of a population of Yellow-bellied Gliders. *Petaurus australis* (Marsupialia: Petauridae). *Aust. Wildl. Res.* 12:1-18.
- Craig, S. A. and Belcher, C. A. (1980). A technique for live trapping the Yellow-bellied Glider, *Petaurus australis*, with notes on the biology of the species. *Victorian Nat.* 97:205-10.
- Davey, S. M. (1984). Habitat preferences of arboreal marsupials within a coastal forest in southern New South Wales. Pp. 509-16 in *Possums and Gliders*. Eds. A. P. Smith and I. D. Hume. Australian Mammal Society, Sydney.
- Fleay, D. (1933). A beautiful Phalanger. *Victorian Nat.* 50:35-40.
- Goldingay, R. L. (1985). Aspects of the foraging behaviour of the Yellow-bellied Glider, *Petaurus australis* (Marsupialia: Petauridae) at Bombala, New South Wales. *Aust. Mammal.* (in press).
- 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. P. Smith and I. D. Hume. Australian Mammal Society, Sydney.
- Henry, S. R. (1985). The Diet and Socio-ecology of gliding possums in Victoria. Ph.D. Thesis. Monash University, Melbourne.
- Kavanagh, R. P. (1984). Seasonal changes in habitat use by gliders and possums in south eastern New South Wales. Pp. 527-43 in *Possums and Gliders*. Eds. A. P. Smith and I. D. Hume. Australian Mammal Society, Sydney.
- Kavanagh, R. P. and Rohan-Jones, W. (1982). Calling behaviour of the Yellow-bellied Glider (*Petaurus australis* Shaw) (Marsupialia: Petauridae). *Aust. Mammal.* 5:95-111.
- McNab, B. K. (1980). Food habits, energetics, and the population biology of mammals. *American Nat.* 116:106-24.
- Russell, R. (1984). Social behaviour of the Yellow-bellied Glider, *Petaurus australis reginae* in north Queensland. Pp. 343-53 in *Possums and Gliders*. Eds. A. P. Smith and I. D. Hume. Australian Mammal Society, Sydney.
- Smith, A. P. (1982). Diet and feeding strategies of the marsupial Sugar Glider in temperate Australia. *J. Anim. Ecol.* 51:149-66.

- Smith, A. and Russell, R. (1982). Diet of the Yellow-bellied Glider *Petaurus australis* (Marsupialia: Petauridae) in north Queensland. *Aust. Mammal.* 5:41-5.
- Smith, A. P. and Lee, A. K. (1984). The evolution of strategies for survival and reproduction in possums and gliders. Pp. 17-33 in *Possums and Gliders*. Eds. A. P. Smith and I. D. Hume. Australian Mammal Society, Sydney.
- Smith, M. J. (1979). Observations on growth of *Petaurus breviceps* and *P. norfolcensis* (Petauridae: Marsupialia) in captivity. *Aust. Wildl. Res.*, 6:141-50.
- Suckling, G. C. (1983). Sugar Glider and Squirrel Glider. In *The Complete Book of Australian Mammals*. (Ed. R. Strahan). (Angus and Robertson: Sydney).
- Suckling, G. C. (1984). Population ecology of the Sugar Glider, *Petaurus breviceps* in a system of fragmented habitats. *Aust. Wildl. Res.*, 11:49-75.
- Tyndale-Biscoe, C. H. (1979). Ecology of small marsupials. Pp. 343-79 in *Ecology of Small Mammals*. Ed. D. M. Stoddart. Chapman and Hall, London.
- Tyndale-Biscoe, C. H. (1983). Reproductive physiology of possums and gliders. *Bull. Aust. Mamm. Soc.* 8(2):34.

## ***Mirbelia pungens* Cunn. ex G. Don (Papilionaceae): A New Species Record for Victoria**

BY D. E. ALBRECHT\* AND N. G. WALSH\*

One might imagine that after 200 years of occupation and almost as long a history of biological exploration, the flora of this state would be thoroughly documented and, save for the ever-increasing weed flora and casual or short-lived plant introductions, Victoria's plant register would be complete. However, the current census of the vascular plants of Victoria (Forbes *et al.*, 1984) indicates that this is certainly not the case, listing 4040 currently accepted species, subspecies and varieties compared with about 3500 in 1973 when J. H. Willis' *Handbook to the Plants in Victoria* was published.

The number of taxa continues to grow with the recent discovery of *Mirbelia pungens*, a small pea-flowered shrub in the Mt. Coopracambra region of East Gippsland.

The genus *Mirbelia* (with 27 species), a member of the Tribe Mirbelieae, is endemic in Australia occurring in all states except South Australia and Tasmania. It is included in that group of peas commonly known as "eggs and bacon" but is

distinguished from other genera in the Mirbelieae by the pod which has a thin longitudinal partition between the two valves. Victoria has two other species of *Mirbelia* viz. *M. oxvlobioides* F. Muell., an erect shrub to 1.8 m tall, widespread in the drier mountainous regions (with a couple of outlying lowland populations near Creswick and Bairnsdale) and *M. rubifolia* (Andrews) G. Don, a fine-stemmed semi-shrub known in Victoria only from coastal heathland near Mallacoota and not discovered in this state until 1979 (see Fig. 1).

### **Description of *Mirbelia pungens***

A prostrate to weakly ascending semi-shrub to 0.4 m tall with stems up to 0.6 m long; younger stems covered by short, semi-appressed hairs, older stems glabrous. Leaves sessile (unstaked), alternate or irregularly in whorls of 3, narrow linear, 10-15 mm long x 1 mm wide, narrowed at the apex to a fine sharp point; margins tightly recurved and almost concealing the undersurface, often leaving the raised, hairy midvein exposed; upper surface glabrous, the lateral veins slightly raised. Flowers virtually sessile, solitary or paired

\* National Herbarium of Victoria, Birdwood Ave., South Yarra, 3141.

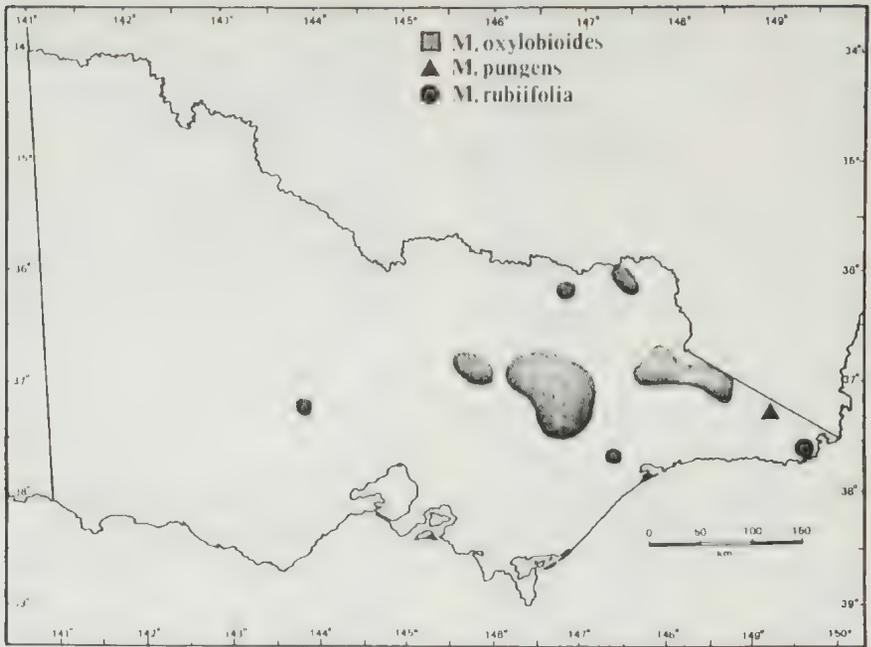


Fig. 1. Distribution of the genus *Mirbelia* in Victoria.

in axils, orange-yellow, streaked maroon toward base (flower colour in NSW plants varies from orange-red to purple). Calyx finely hairy, cup shaped, 2-3 mm long with five short equal apical lobes. Petals to 6 mm long, the standard notched at apex, broader than long and about twice the length of the other segments. Stamens and style contained within the closely folded lower segment (keel). The fruit is a hairy ovoid pod about 3 mm long, shortly beaked at the apex. There are one or two seeds per pod.

#### Distribution

*Mirbelia pungens* is an uncommon species throughout its range from southern Queensland to the Victorian site, being well represented by herbarium collections only from the granitic northern NSW tablelands and the sandy shrub country between Dubbo and the Warrumbungles. Other known localities within its range are scattered and often disjunct (see Fig. 3) and

have little in common other than the low nutrient status of the substrate. The discovery of the plant in Victoria provides yet another disjunct locality with the nearest known sites being the Cocoparra Range (near Griffith) and the Tinderry Range south east of Canberra.

#### Habitat

*Mirbelia pungens* was located on a large north-facing Devonian grano-diorite outcrop at 600 m altitude about 5 km west of Mt. Coopracambra. (Several similar but smaller outcrops in the area were traversed but only one population was discovered.) The plants were growing in gravelly soil in crevices and on platforms of the outcrop. Associated species included *Kunzea ambigua*, *Lepidosperma urophorum*, *Stypandra glauca*, *Comesperma ericinum*, *Platysace lanceolata*, *Acacia myrtifolia*, and the rare *Goodenia bellidifolia* in an open heathy formation. Open forest

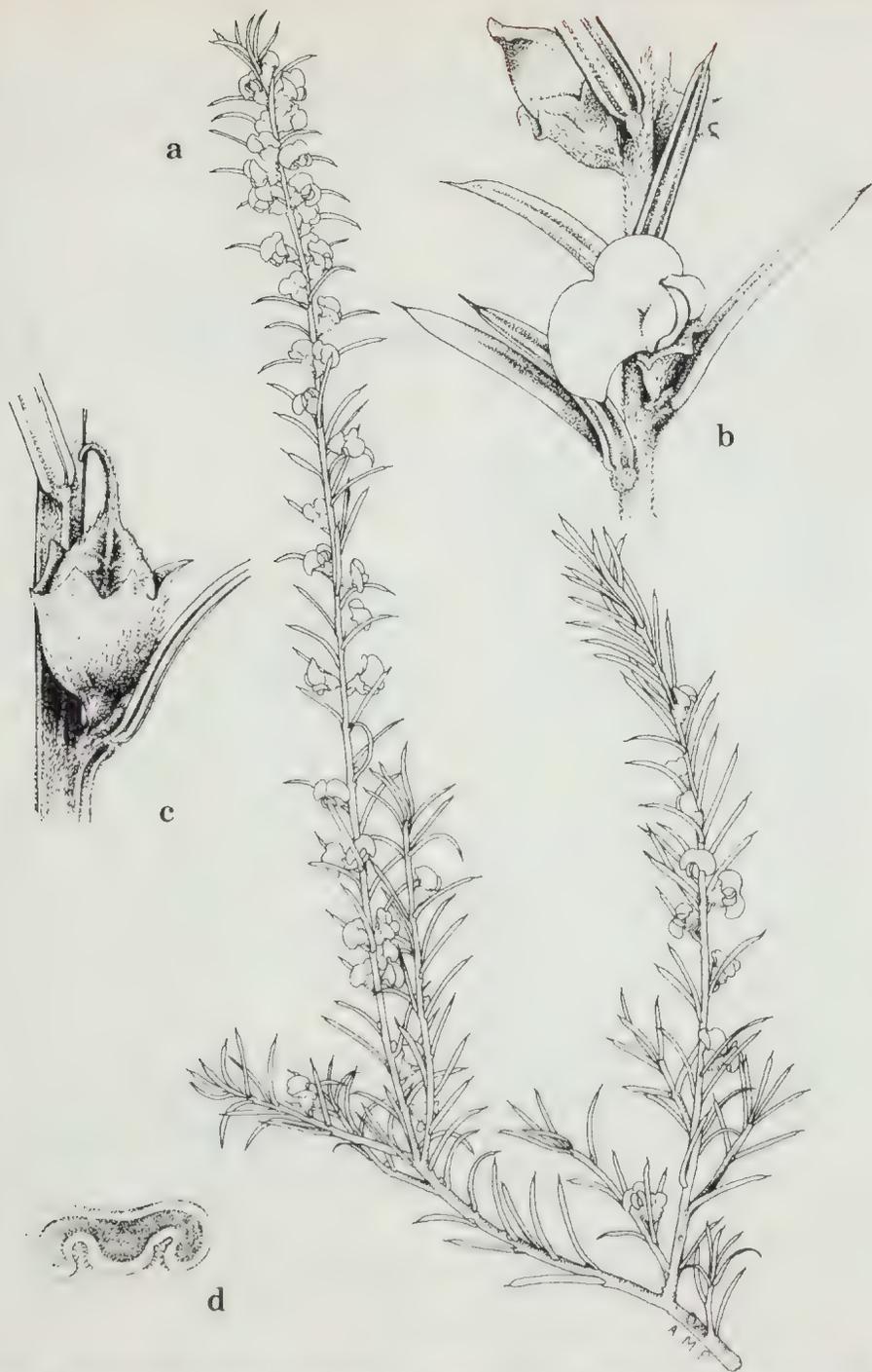


Fig. 2. *Mirbelia pungens*. a. habit x1; b. section of flowering shoot x4; c. fruit x6; d. transverse section through leaf x18. Drawn from specimen lodged at the National Herbarium of Victoria (MEL) - D. E. Albrecht & N. G. Walsh 2258, 19.X.1985.

surrounds the outcrop and is dominated by *Eucalyptus sieberi* with occasional *E. agglomerata* and *E. smithii*.

**Conservation status**

The population is very small, totalling approximately 30 individuals within an area of about 1 ha. on public but not reserved land. The area had been burnt by wildfire in early 1983 but the *Mirbelia* population remained intact, having been protected by the surrounding expanse of rock.

**Key to the species of *Mirbelia* in Victoria**

1. Erect shrubs 0.5-1.8 m high. Leaves elliptic to narrow-elliptic (3-10 x 2-5 mm) with acute (but not sharp-pointed) recurved apices. Lateral veins obscure. Flowers in terminal clusters, orange-yellow and maroon. A widespread shrub of drier subalps.

... *M. oxylobioides*

\*1. Prostrate or weakly ascending shrubs to 0.4 m high. Leaves mostly about 10 mm long, tapered at apex to a distinct pungent point.

... 2

2. Flowers in terminal clusters, pink-mauve, leaves in regular whorls of 3, lanceolate to narrow-elliptic, 2-5 mm broad, prominently reticulate-veined, margins slightly recurved, undersurface clearly visible. Confined to coastal heath in east Gippsland.

... *M. rubrifolia*

\*2. Flowers axillary, orange-yellow and maroon, leaves alternate or irregularly whorled, linear, about 1 mm broad; margins strongly recurved, obscuring undersurface (except midvein).

... *M. pungens*.

**REFERENCES**

Forbes, S. J., Gullan, P. K., Kilgour, R. A. and Powell, M. A. (1984). *A Census of the Vascular Plants of Victoria*. National Herbarium of Victoria.

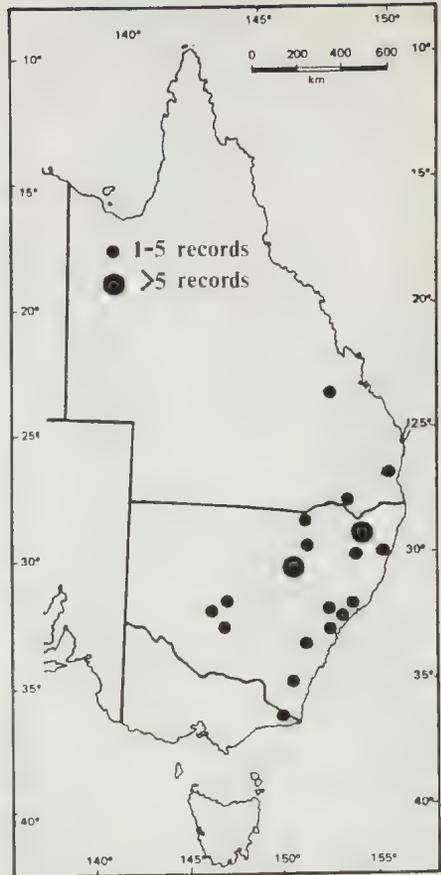


Fig. 3. Distribution of *Mirbelia pungens*.

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We thank Joy Thompson (Sydney Herbarium) for confirming the identification of our material, Anita Podwysinski for the illustration and Jim Ross for useful comments on the manuscript.

Thompson, J. (1961). In Contributions from New South Wales Herbarium. Flora Series 101:60.  
Willis, J. H. (1973). *A Handbook to Plants in Victoria*. Vol. 2. Melbourne University Press.

# Roles of Predator Scat Analysis in Australian Mammal Research

BY HANS BRUNNER\* AND L. ROBERT WALLIS\*\*

## Introduction

Since the publication of a photographic key to the hair structure of some Australian mammals by Brunner and Coman (1974) predator scat analysis has become more widely used.

It is the purpose of this paper to examine the roles of predator scat analysis in mammalian research, to review some Australian studies and to recommend planning guidelines for future studies.

## Predators in Australia

Predators of mammals in Australia include three widely distributed introduced species of Carnivora: the fox (*Vulpes vulpes*), dog (*Canis familiaris*) and cat (*Felis catus*). Native predators are the dingo (*C. f. dingo*) and some dasyurid marsupials with restricted distributions: quolls or native cats (*Dasyurus* spp.) and the Tasmanian devil (*Sarcophilus harissii*). Raptors (e.g. wedged-tailed eagle, *Aquila audax*) and owls (e.g. barn owl, *Tyto alba*; powerful owl, *Ninox strenua* and barking owl, *N. connivens*) also commonly prey on mammals and regurgitate pellets containing their fur and bones. Some large reptiles (e.g. pythons) also produce scats containing fur and bones of prey.

## Collecting and processing scats.

Predator scats are most commonly found along roads, tracks and along edges where bush adjoins clearings or grassland. This enables the regular collection of scats to be made along pre-determined transects. Scats are best sealed in envelopes which have written on them date, site of collection and type of predator. The scat should be placed in the envelope with forceps.

Scats should be dried at 80°C for 24 hours to free them of viable parasite eggs. After soaking the scats in water for about 24 hours in separate containers they can be washed in a fine sieve (250  $\mu$  mesh) under running water and the remaining material flushed into a dissecting tray. Hair tufts, bones and teeth are then picked out and air dried for examination.

Each species of mammal has a characteristic guard hair structure, although hairs of some closely related mammals are similar. When a mammal is consumed by a predator such as a fox, the hair of the prey usually passes through the digestive tract with little alteration. By using photographic keys and reference material it is thus possible to examine hair taken from washed predator scats and identify the mammalian prey consumed. Bones, teeth and claws from predator scats can also be used to identify prey species.

Keys to mammal identification based on hair morphology have been constructed and used overseas for forensic purposes (de Broom and Dreyer, 1953), to determine taxonomic relationships (Keogh, 1975), but mostly to analyse the diet of carnivores (Hausman, 1920; Mathiak, 1938; Mayer, 1952; Day, 1966; Dreyer, 1966; Turkowski, 1969, 1980; Hewson *et al.*, 1975; Stuart, 1976; Faliu *et al.*, 1979; Perrin and Campbell, 1980).

The hair can be identified with the use of a microscope on the general appearance of guard hairs, their cross sectional shape and size, relative widths of medulla and cortex, cuticular scale pattern and structure of medulla as seen in whole mounts using photographic keys as in Brunner and Coman (1974).

The cellulose acetate yarn used for packing when making cross sections has lately proved difficult to obtain. A suitable substitute (a 300 denier dull rayon yarn)

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is now available (Wallis and Brunner, 1984).

Bones, teeth and claws are best compared with reference material.

## Purposes of predator scat analysis in Australia

### (i) Diet of predators

The major function for predator scat analysis has been to determine the diet of the carnivore concerned. Traditionally, dietary studies have involved stomach content analysis (e.g., Ryan and Croft, 1974; Whitehouse, 1977; Jones and Coman, 1981), but recently scats have been used as well for this purpose.

Reports of studies into diets of single species using scat analysis include those on the fox by Brunner *et al.*, 1975, 1976a; Friend, 1978 and Seebeck, 1978. Diets of dogs and dingoes have been reported in Newsome *et al.*, 1983 and Robertshaw and Harden, 1985. Other carnivores whose diets have been investigated using predator scat or raptor pellet analysis in Australia are the feral cat (Jones, 1977), eastern quoll (*Dasyurus viverrinus*) (Blackhall, 1980), barn owl (Valente 1981), powerful owl (Tilley, 1982), wedge-tailed eagle (Brooker and Ridpath, 1980; Hull, 1984) and nine other species of diurnal raptor (Baker-Gabb, 1984).

Several studies have compared the diets of carnivorous species living in the same area. In Victoria, Suckling *et al.* (1976) have compared small numbers of scats collected from dogs, foxes and cats living in pine and nearby eucalypt forest near Myrtleford. Brunner (1978) has examined large numbers of fox and dog scats from the Dartmouth inundation site (also in north-eastern Victoria) while Chesterfield *et al.* (1983) and Triggs *et al.* (1984) compared diets of carnivores living in East Gippsland. The data from such comparative studies show that large prey species such as macropods (*Macropus* spp. and *Wallabia bicolor*) and common wombat (*Vombatus ursinus*) occur more frequently in the diet of dogs than of foxes while the latter and cats favour small prey items such as

possums, *Antechinus* spp. and rodents (see Tables 1 and 2).

Another conclusion that is evident from dietary studies is the opportunistic nature of the predators — they tend to feed on what is most available and easy to obtain rather than exhibit strong preference for specific foods. Thus rabbits occurred in 69% of carnivore scats collected in bushland at Naringal East (V) (Seebeck, 1978), but occurred in fewer than 1% of scats collected at Croajingalong National Park (V) (Triggs *et al.*, 1984) where rabbits exist in much lower densities (Table 2). Wherever suitable mammalian prey is abundant it is likely to constitute an important dietary component of the introduced predators; for instance, common ringtail possums at Croajingalong National Park (Table 2), common brushtail possums (*Trichosorus vulpecula*) and broad-toothed rats (*Mastacomys fuscus*) at Powelltown (Brunner *et al.*, 1977 and Table 3) and common wombats at Dartmouth and Croajingalong National Park (Table 2). The reverse may also be taken as indirect evidence of the possible absence of a prey species from a particular area; thus *Mastacomys fuscus* which seems to be readily eaten by foxes was not found in apparently suitable habitat at Croajingalong National Park (Triggs *et al.*, 1984) and is presumably absent or in very low numbers in those parts of the Park examined.

Determining diet by predator scat analysis has several advantages. The technique is non-destructive and produces only minimal disturbance of the population being studied. By working in the one area over a period of time it may be possible to study the seasonal variation in diet of a single group of predators and thus reduce the variation which would result from having to study different individuals from different habitats using stomach analysis.

There are some possible disadvantages in using predator scat analysis to determine the predator's diet. One is that "soft" food such as frogs, slugs and worms may be

	Dogs		Foxes		Cats	
	V	O	V	O	V	O
Mammals	72.2	109.5	81.2	86.6	88.0	67.0
<i>Wallabia bicolor</i>	14.8	23.5	1.0	2.5	—	—
<i>Macropus giganteus</i>	9.6	7.2	—	—	—	—
<i>Vombatus ursinus</i>	10.2	19.9	<1	1.0	—	—
<i>Trichosurus vulpecula</i>	8.5	7.2	1.6	2.2	1.9	1.2
<i>Pseudocheirus peregrinus</i>	—	—	<1	1.1	6.6	3.7
<i>Rattus</i> spp.	—	—	—	—	6.5	6.2
<i>Mus musculus</i>	—	—	19.5	31.3	18.1	18.5
<i>Oryctolagus cuniculus</i>	6.7	6.0	34.7	38.8	40.1	17.5
<i>Ovis aries</i>	3.9	4.2	—	—	<1	1.2
<i>Bos taurus</i>	4.3	3.0	<1	1.0	—	—

Table 1. Important mammalian food items in stomachs of dingoes and dogs, foxes and cats. Data adapted from Coman (1972), Coman (1973) and Coman and Brunner (1972) respectively. V = % by volume each species comprised in predator stomachs and O = % occurrence of each prey species in predator stomachs. With few exceptions, V and O figures are similar for a particular predator/prey combination. Note that % O may exceed 100 if more than one prey item occurs in a prey stomach. Not all prey species are included in the table.

SITE: PREDATOR: No. SCATS:	DARTMOUTH SITE		CROAJINGALONG NP			RODGER BLOCK	
	Fox 2080	Dog 342	Fox 935	Dog 403	Cat 47	Fox 45	Dog 103
Macropodidae							
<i>Wallabia bicolor</i>	12	58	5	22	—	9	42
<i>Macropus giganteus</i>	2	7	<1	<1	—	—	—
<i>M. rufogriseus</i>	—	—	3	14	—	—	—
<i>Potorous longipes</i>	—	—	—	—	—	7	4
Phalangeridae							
<i>Trichosurus</i> spp.	9	3	3	3	2	22	35
Petauridae							
<i>Pseudocheirus peregrinus</i>	<1	—	59	39	57	4	6
<i>Petaurus breviceps</i>	<1	—	1	—	9	—	—
<i>P. australis</i>	<1	—	<1	<1	—	—	2
<i>Petauroides volans</i>	4	2	<1	1	—	7	5
Peramelidae							
<i>Perameles nasuta</i>	7	1	6	5	2	—	—
Dasyuridae							
<i>Antechinus stuartii</i>	7	<1	19	13	15	2	2
<i>A. swainsonii</i>	2	<1	4	2	—	2	2
Vombatidae							
<i>Vombatus ursinus</i>	4	14	1	11	—	2	20
Tachyglossidae							
<i>Tachyglossus aculeatus</i>	<1	<1	<1	6	2	—	5
Muridae							
<i>Rattus fuscipes</i>	11	3	13	8	13	29	2
<i>R. lutreolus</i>	<1	3	3	2	9	—	—
Leporidae							
<i>Oryctolagus cuniculus</i>	27	2	1	1	—	9	2

Table 2. Percentage occurrence of the more common mammalian prey species in seats of three introduced carnivores living near the Dartmouth inundation site, Croajingalong National Park and the Rodger Forest Block. Data adapted from Brunner (1978), Triggs *et al.* (1984) and Chesterfield *et al.* (1983) respectively.

	A	B
<i>Rattus fuscipes</i> (Bush Rat)	19	56
<i>Mastacomys fuscus</i> (Broad-toothed Rat)	18	3
<i>Oryctolagus cuniculus</i> (Rabbit)	15	1
<i>Antechinus stuartii</i> (Brown Antechinus)	13	23
<i>Perameles nasuta</i> (Long-nosed Bandicoot)	7	1
<i>Antechinus swainsonii</i> (Dusky Antechinus)	4	7
<i>Mus musculus</i> (House Mouse)	1	3
<i>Rattus lutreolus</i> (Swamp Rat)	1	2
<i>Rattus rattus</i> (Black Rat)	1	1

Table 3. Percentage occurrence of specific mammals in 576 fox and dog scats collected at Sumner Spur, near Powelltown (V) (column A) and the number of times each of these mammal species was actually trapped in the same area per 100 trapped mammals (column B) (3409 trap nights, 583 mammals trapped).

completely digested so that recognizable food remains do not occur in scats. Some mammalian prey may be less evident in scats than in the stomach of the predator. However, overseas studies indicate that stomachs, intestines and scats yield similar frequencies of food items (Wood, 1954; Turkowski, 1969). A third disadvantage is that while it is possible to determine the volume different prey species occupy in the predator stomach, scat analysis can only yield percentage occurrence. Thus, one large and important meal of one prey item could be equally as significant as a minor item by scat analysis. However, data from several Victorian studies indicate that the differences between percentage occurrence and percentage volume of prey items in predator stomachs are not great for the more important foods (Table 1). Since the occurrences of food items in stomachs are likely to be similar to those in scats, such a perceived disadvantage in using predator scat analysis to determine a predator's diet is only minor.

Predator scat analysis can thus quickly provide much information on diets of carnivores. It is possible that some of the information obtained from such studies might not have been obtainable using conventional methods such as stomach analysis. A difficulty in scat analysis, however, is that separation of dog, fox and cat scats is not always possible, although Morrison (1981), Triggs, (1984) and Triggs

*et al.* (1984) provide useful identification aids. Other workers have separated predator scats on the basis of size alone. Thus Newsome *et al.* (1983) only used scats larger than 2cm diameter in their study of the diet of dingoes, and thus ignored many smaller dingo scats to avoid including large fox scats in their analyses.

#### (ii) Mammal surveys

Predator scat analysis has been used as a survey tool to help determine what species of mammal live in an area. As with conventional methods such as spotlighting and trapping it has advantages and disadvantages.

#### Benefits

- (1) Field collection of scats requires little time or specialist skill. It can usually be performed while other survey methods are being carried out. Collection of scats can be made whenever it is convenient — traps have to be checked regularly, irrespective of weather etc.
- (2) Scat analysis does not damage wildlife. It is non-intrusive. Live trapping, for instance, carries with it some probability of trap trauma, shock and death.
- (3) No permits are required (except in National Parks).
- (4) Scats can be stored and processed when convenient.
- (5) With the exception of the microscope, the technique is inexpensive. Preliminary

data in New South Wales and Victoria indicate predator scat analysis is a more cost effective survey tool for qualitative data than conventional methods (Lunney, pers. comm; Suckling, pers. comm.).

(6) Scat analysis can provide useful data besides mammal survey data.

(7) More species may be detected by predator scat analysis than with conventional techniques. This is probably because the predator is more efficient at obtaining prey than the surveyor — either because it is difficult to trap or because it occurs in such low densities the chances of it being trapped are minimal. Some examples best illustrate these points. Brunner *et al.* (1976a) used predator scat analysis to survey the mammals in the Dartmouth inundation area prior to the dam's construction. They detected eight species not recorded by trapping or spotlighting — *Tachyglossus aculeatus*, *Isoodon obesulus*, *Antechinus flavipes*, *Sminthopsis murina*, *S. leucopus*, *Petaurus australis*, *Gymnobelideus leadbeateri* and *Rattus lutreolus*. The authors do admit errors might have occurred for species detected infrequently in scats and not previously found in the area. Thus Morton *et al.* (1980) were suspicious of *S. leucopus* being present so far north in the State, but Macfarlane (pers. comm.) recently observed this species in the Mt. Murray Forest Block near Mt. Hotham. Predator scat analysis thus added species to the survey list not obtained by conventional techniques. Trapping and spotlighting recorded several species of bats not detected by predator scat analysis. Clearly the most comprehensive species list is obtained when all available methods are used in the survey.

The broad-toothed rat is a native rodent of south-eastern Australia and has proved difficult to live trap in the field. Predator scat analysis, however, has proved particularly useful in

detecting the species' presence as its teeth and hair are readily distinguishable from those of other rodents. At Naringal, Cann River and in the South Gippsland Highlands in Victoria, extensive trapping failed to locate the species, but its remains have been found in predator scats (Seebeck, 1978; Macfarlane, pers. comm.; Norris *et al.*, 1974). At one site at Sherbrooke Forest Park, Gullan and Robinson (1980) failed to trap any broad-toothed rats in 13 600 trap nights over three years, yet the species has been detected in 61 out of 1622 predator scats containing mammalian remains collected from all over the park (Wallis *et al.*, 1982).

Friend (1978) surveyed the mammals in some Gippsland (V) pine plantations and adjacent eucalypt forest using predator scat analysis and conventional methods of live trapping, spotlighting and daytime observations. He found the two methods yielded similar numbers of species in each of the forest types and that in most cases the percentage frequency occurrence calculated from predator scat analysis for the most common species agreed with relative abundance estimated by the conventional techniques. Scat analysis detected three species unobtained from conventional methods: *Sminthopsis leucopus*, *Cercartetus nanus*, and *M. fuscus*. On the other hand, predator scat analysis failed to detect four species known to occur in the area: *Acrobatas pygmaeus*, *Cervus unicolor*, *Macropus giganteus* and *Phascolarctos cinereus*.

Lyon *et al.* (1980) obtained similar results for their study of mammals at Boola Boola (Gippsland, V). Again, three species were detected only by predator scat analysis (*M. fuscus*, *A. pygmaeus* and *Perameles nasuta*).

Predator scat analysis has also yielded two species of mammal not previously known from Little Desert National Park in Victoria (*Antechinus flavipes*, *Capra hircus*) (Craik, 1979).

*Ningui yvonneae* is a small dasyurid that has only recently been found in Victoria by pitfall trapping (Fleming and Cockburn, 1979). Conventional trapping failed to detect this species in Victoria, but predator scat analysis recently carried out in Wyperfeld National Park has found it to be present there (Grossek, 1979).

(8) Scat analysis can provide data on occurrence of species which are difficult to identify by conventional methods. One week's intensive trapping near Loch Valley (V) failed to catch the bandicoot responsible for numerous fresh diggings. Such identification was possible, however, by recognition of bandicoot hairs in predator and in bandicoot droppings (as grooming hairs) (Brunner, unpublished data). Similarly, the bandicoot responsible for diggings observed at Sumner Spur, Powelltown (V) has been confirmed as *P. nasuta* by predator scat analysis (Brunner *et al.*, 1977). This bandicoot was also trapped only once in 12 604 trap nights at Dartmouth (V) but its remains were found in 149 of 1649 predator scats collected there (Brunner *et al.*, 1976a).

#### Limitations of predator scat analysis as a survey tool

- (1) Some species likely to exist in the area may be poorly represented in scats (e.g. bats).
- (2) Some experience is needed in identifying hairs. Much practice is needed using hairs firstly from known species. (Of course, experience is also required in trapping and spotlighting!)
- (3) The hair of some closely related species is often difficult to differentiate (e.g. brushtail possums *Trichosurus vulpecula* and *T. caninus*).
- (4) Predator scat analysis rarely provides accurate distribution data, particularly in patchy habitats, as the predators may move considerable distances while hunting and may also mark their territories with scats (Ables, 1969). Carnivores, however, are unlikely to

retain waste material in the digestive tract for long periods. Thus in a comparative study of mammals in various successional stages of *Eucalyptus regnans* forest in the Central Highlands of Victoria, *Mus musculus* were both trapped and detected from scats in recently harvested areas (> 50 ha) but were not recorded by any technique elsewhere in the forest (Macfarlane, pers. comm.).

(5) Caution must be taken in relating frequencies of occurrence of prey species in scats with actual densities of each species that are presumed to exist in the field. This is for several reasons — one large prey item (a wallaby or wombat) may provide several meals for several foxes and hence increase the presumed density of that species in the collection area. Weaver and Hoffman (1979) also have evidence that the number of prey individuals actually consumed by coyotes may be underestimated for prey less than 107 g and overestimated for larger prey. This has been supported by Meriweather and Johnson (1980) who found mammalian prey of different sizes were not equally digestible in coyotes and that workers using predator scat analysis might also fail to detect smaller species. Floyd *et al.*, (1978) found the same to occur in wolves, but did point out that because small prey have relatively more hair than larger mammals (surface area: volume is greater in small animals), the remains of small prey occurred in greater proportion relative to the prey's weight than did the remains of bigger prey. These authors also provide techniques to calculate the relative numbers of each prey species as well as a seemingly pointless warning against the use of predator scat analysis when scats are likely to contain more than one prey species.

Another reason for not equating percentage occurrence of prey species in scats with likely relative densities of the species in the field is that predators may be more efficient at hunting some low

density prey species and thus bias the results of a survey. It is particularly dangerous to speculate on prey preferences of a predator by comparing relative occurrences of certain prey species in predator scats with trapping success data for those animals. Thus Green and Osborne (1981) have contrasted low trapping ratios of *Mastacomys fuscus* to *Rattus fuscipes* (0.15: 1) at Kosciusko National Park to indicate selective predation by foxes on *Mastacomys*. Since the relative "trap shyness" or "trap proneness" of the two prey species is unknown, such an inference is speculative. The situation is best exemplified in our data from Powelltown (V) using 3409 trap nights and 576 fox scats (Table 3). Does the high percentage of *Mastacomys* in predator scats indicate a high population density of a difficult to trap mammal, or does it indicate strong preference by foxes for *Mastacomys* which occurs in low numbers? It thus appears that neither predator scat analysis nor trapping gives an accurate indication of relative densities.

Predator scat analysis can thus be used to complement conventional mammal survey techniques. The area to be studied should first be divided into broad habitat types or subareas and a description (floristic and/or structural) made of each.

Clearly the more scats that are collected in a study, the more information will be obtained (see Hanson and Grayhill, 1956). A study may (and probably should) allow for a regular collection of scats over one or several years if a proper study is to be done, e.g. Leinati *et al.* (1960) collected 5280 scats over three years in his Italian study; Brunner *et al.* (1975) examined 1880 scats collected over two years in Sherbrooke Forest Park (V). Collections of low numbers of scats cannot hope to realise comprehensive mammal survey data — species not commonly consumed are likely to be missed and small prey may not be detected even if eaten by the carnivore (see

Meriweather and Johnson, 1980). Of course, not all projects require large collections. If the aim of the study is to see if species X occurs in an area, one need only collect and examine scats until the remains of X have been positively confirmed.

(iii) *The study of one species*

Predator scat analysis can often provide useful data on the general distribution of a single mammal species. In such situations it is not necessary to identify all the remains found in predator scats, but only seek to detect the presence of the particular prey species concerned.

A possible use of predator scat analysis could be to thus monitor the presence of uncommon species in predator scats over time such as has been done with *Mastacomys fuscus* at Sherbrooke Forest Park (Wallis *et al.*, 1982). However, limitation 5 mentioned previously should be considered when interpreting quantitative data from predator scat research. Other Victorian mammals which might be similarly studied are Leadbeater's possum (*Gymnobealideus leadbeateri*), spotted-tail quoll (*Dasyurus maculatus*), potoroos (*Potorous tridactylus* and *P. longipes*) and rodents (e.g. *Pseudomys novae-hollandiae*, *P. shorridgei* and *P. fumeus*). Two rare mainland marsupials (*D. maculatus* and *Potorous longipes*) were recently detected by predator scat analysis in the Rodger Forest Block, East Gippsland (V). Conventional techniques had failed to find these mammals (Chesterfield *et al.*, 1983).

In March 1984, a freshly killed carcass was discovered in the Rodger Forest Block study site and was positively identified as *P. longipes*, thus confirming its presence (Suckling, pers. comm.). Hair and teeth of *D. maculatus* have also been obtained from a dog scat collected from the Goonmirk Rocks reserve, Errinundra Plateau E. Gippsland, (V) (Wallis and Brunner, 1984).

Owl pellet analysis in south-west Queensland has indicated the presence of a native mammal (*Planigale tenuirostris*) from a site where it had not previously been

known (Valente, 1981). Bailey (1983) used predator scat analysis to ascertain if foxes ate the rare Pilliga mouse (*Pseudomys pilligaensis*). We are also investigating the possible predation by cats of the rare and localised mainland population of *Perameles gunnii* at Hamilton (V). Finally, Woolley and Valente (1982) have used predator scat analysis in an attempt to locate a colony of the extremely rare dibbler (*Parantechinus apicalis*) in Western Australia. The construction of photographic key for hair structure using local mammals, many of which were not included in Brunner and Coman (1974) is an important part of the technique (Valente and Woolley, 1981).

Further single species studies might concentrate on the predator itself. Thus Brunner *et al.*, 1976b investigated the dispersal of blackberry seeds by foxes using scat analysis. The extent of predation on ground nesting birds by foxes in roosting and breeding areas could also be determined by predator scat analysis. A study of raptor pellets might also indicate the abundance in the predator's diet of sheep, other mammals, or particular birds. Thus, wedge-tailed eagles living in a mixture of open forest and pasture habitat near Melbourne have been shown to take very few sheep, their diet consisting mainly of rabbits, possums and birds (Hull, 1984).

### Conclusion

Predator scat analysis can serve many roles in mammal research. It is cheap, cost-effective and can quickly provide qualitative data which can be used as the basis for more detailed subsequent research. Extensive and well planned predator scat analysis can provide valuable survey data, dietary information and distribution records of rare species.

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### REFERENCES

- Ables, E. D. (1969). Home range studies of red foxes (*Vulpes vulpes*). *J. Mammal* 50:108-120.
- Bailey, C. J. (1983). The diet of the red fox (*Vulpes vulpes*) in the Pilliga Scrub, north-western New South Wales. Paper presented at 28th Scientific meeting, Australian Mammal Society, Armidale.
- Baker-Gabb, D. J. (1984). The breeding ecology of twelve species of diurnal raptor in north-western Victoria. *Aust. Wildl. Res.* 11:145-160.
- Blackhall, S. (1980). Diet of the eastern native-cat, *Dasyurus viverrinus* (Shaw) in southern Tasmania. *Aust. Wildl. Res.* 7:191-197.
- Brooker, M. G. and Ridpath, M. G. (1980). The diet of the wedge-tailed eagle, *Aquila audax*, in Western Australia. *Aust. Wildl. Res.* 7:433-452.
- Brunner, H. (1978). The diet of dingoes and foxes in the Dartmouth Reservoir area. In Victorian State Rivers and Water Supply Commission: Dartmouth Dam Project Report on Environmental Studies. Part 2, chapter 2. pp.19-28.
- Brunner, H. and Coman, B. J. (1974). *The Identification of Mammalian Hair*. Inkata Press, Melbourne.
- Brunner, H., Lloyd, J. W. and Coman, B. J. (1975). Fox scat analysis in a forest park in south-eastern Australia. *Aust. Wildl. Res.* 2:147-154.
- Brunner, H., Amor, R. I. and Stevens, P. L. (1976a). The use of predator scat analysis at Dartmouth in north-eastern Victoria. *Aust. Wildl. Res.* 3:85-90.
- Brunner, H., Harris, R. V. and Amor, R. L. (1976b). A note on the dispersal of seeds of blackberry (*Rubus procerus*, P. J. Meull.) by foxes and emus. *Weed Research* 16:171-173.
- Brunner, H., Wallis, R. L. and Voulier, P. E. (1977). Locating and trapping the broad-toothed rat (*Mastacomys fuscus* Thomas) at Powelltown. *Victorian Nat.* 93:207-210.
- Chesterfield, E. A., Macfarlane, M. A., Allen, D., Hutchinson, M. N., Triggs, B. and Bailey, R. H. (1983). *Flora and fauna of the Rodger Forest Block, East Gippsland, Victoria*. Forests Commission of Victoria.
- Coman, B. J. (1972). Helminth parasites of the dingo and feral dog in Victoria with some notes on the diet of the host. *Aust. Vet. J.* 48:456-461.
- Coman, B. J. (1973). The diet of red foxes, *Vulpes vulpes* L., in Victoria. *Aust. J. Zool.* 21:391-401.
- Coman, B. J. and Brunner, H. (1972). Food habits of the feral house cat in Victoria. *J. Wildl. Mgmt.* 36:848-853.
- Craik, J. A. (1979). The diet of mammalian predators (*Vulpes vulpes*, *Canis familiaris* and *Felis catus*) in the Little Desert National Park, Victoria. B.Sc. (Hons) thesis: Dept. Zoology, LaTrobe University.
- Day, M. G. (1966). Identification of hair and feather remains in the gut and faeces of stoats and weasels. *J. Zool. (Lond.)* 148:201-217.
- Debroom, H. P. A. and Dreyer, J. H. (1953). The possibility of identifying hair from South African game for forensic purposes. *S. Afr. J. Sci.* 49:233-234.
- Dreyer, J. H. (1966). A study of hair morphology of the family Bovidae. *Onderstepoort J. Vet. Res.* 33:379-472.
- Falui, L., Lingneroux, Y., Parrat, J., Reeh, J. and Sautet, J. Y. (1979). Etude en microscopie optique des poils (Pili) de la faune pyrénéenne sauvage en vue de leur détermination. *Anat. Histol. Embryol.* 8:307-317.
- Heming, M. R. and Cockburn, A. (1979). *Ningau*: a new genus of dasyurid for Victoria. *Victorian Nat.* 96:142-145.

- Floyd., T. J. Meeh, L. D. and Jordan, P. A. (1978). Relating wolf scat content to prey consumed. *J. Wildl. Mgmt.* 42: 528-532.
- Friend, G. R. (1978). A comparison of predator scat analysis with conventional techniques in a mammal survey of contrasting habitats in Gippsland, Victoria. *Aust. Wildl. Res.* 5:75-83.
- Green, K. and Osborne, W. S. (1981). The diet of foxes, *Vulpes vulpes* (L.), in relation to abundance of prey above the winter snowline in New South Wales. *Aust. Wildl. Res.* 8:349-360.
- Grossek, G. L. (1979). The diet of mammalian predators (*Canis familiaris*, *Felis catus* and *Vulpes vulpes*) in Wyperfeld National Park. B.Sc. (Hons.) thesis: Dept. Zoology, LaTrobe University.
- Gullan, P. K. and Robinson, A. C. (1980). Vegetation and small mammals of a Victorian forest. *Aust. Mammal.* 3:87-95.
- Hanson, W. R. and Grayhill, F. (1956). Sample size in food habit analyses. *J. Wildl. Mgmt.* 20:64-68.
- Hausman, I. A. (1920). Structural characteristics of the hair of mammals. *Am. Natur.* 54:496-523.
- Hewson, R., Kild, H. H. and Knox, A. G. (1975). The food of foxes (*Vulpes vulpes* L.) in Scottish forests. *J. Zool. (Lond)* 179:224-226.
- Hull, C. L. (1984). A dietary analysis of the wedge-tailed eagle, *Aquila audax*, in the Yellinbo district, Victoria. Biology 308 project report, Victoria College — Rusden.
- Jones, E. (1977). Ecology of the feral cat, *Felis catus* (L.) (Carnivora: Felidae) on MacQuarie Island. *Aust. Wildl. Res.* 4:537-547.
- Jones, E. and Coman, B. J. (1981). Ecology of the feral cat, *Felis catus* (L.) in south-eastern Australia. 1. Diet. *Aust. Wildl. Res.* 8:537-547.
- Keogh, H. (1975). A study of hair characteristics of 42 species of South African Muridae and the taxonomic application of these characteristics as definitive criteria. M.Sc. thesis: University of Cape Town, Rondebosch.
- Leinati, L., Mandelli, G., Videsott, R. and Grimaldi, E. (1960). Indagini sulle abitudini alimentari della volpe (*Vulpes vulpes* L.) del Parco Nazionale del Gran Paradiso. *La Clinica Veterinaria* 83:305-328.
- Loy, R. H., Macfarlane, M. A., Chesterfield, E. A. and Harris, J. A. (1980). Forest utilization and the flora and fauna in Boola Boola State Forest in south-eastern Victoria. *For. Comm. Vic. Bull.* 28:1-80.
- Mathiak, W. V. (1938). A key to hairs of the mammals of southern Michigan. *J. Wildl. Mgmt.* 2:251-268.
- Mayer, W. V. (1952). The hair of Californian mammals with keys to the dorsal guard hairs of Californian mammals. *Am. Midl. Nat.* 48:480-512.
- Meriweather, D. and Johnson, M. K. (1980). Mammalian prey digestibility by coyotes. *J. Mammal.* 61:774-775.
- Morrison, R. G. B. (1981). *A Field Guide to the Tracks and Traces of Australian Mammals*. Rigby, Adelaide.
- Morton, S. R., Wainer, J. W. and Thwaites, I. P. (1980). Distribution and habitats of *Sminthopsis leucopus* and *S. murina* (Marsupialia: Dasyuridae) in south-eastern Australia. *Aust. Mammal.* 3:19-30.
- Newsome, A. E., Catling, P. C. and Corbett, L. K. (1983). The feeding ecology of the dingo. II. Dietary and numerical relationships with fluctuating prey populations in south-eastern Australia. *Aust. J. Ecol.* 8:345-366.
- Norris, K. C., Gilmore, A. M. and Menkhorst, P. W. (1979). Vertebrate fauna of South Gippsland, Victoria. *Mem. Nat. Mus. Vict.* 40:105-199.
- Perrin, M. R. and Campbell, B. S. (1980). Key to mammals of the Andries Vosloo Kudu Reserve (Eastern Cape), based on their hair morphology, for use in predator scat analysis. *S. Afr. Tydskr. Natuurnav.* 10:1-14.
- Robertshaw, J. D. and Harden, R. H. (1985). The ecology of the dingo in north-eastern New South Wales. II. Diet. *Aust. Wildl. Res.* 12:39-50.
- Ryan, G. E. and Croft, J. D. (1974). Observations on the food of the fox, *Vulpes vulpes* (L.), in Kinchega National Park, Menindee, New South Wales. *Aust. Wildl. Res.* 1:89-94.
- Seebeck, J. H. (1978). Diet of the fox *Vulpes vulpes* in a western Victorian forest. *Aust. J. Ecol.* 3:105-108.
- Stuart, C. D. (1976). Diet of the black-backed jackel *Canis mesomelas* in the central Namib Desert, South West Africa. *Zool. Afr.* 11: 193-207.
- Suckling, G. C., Backen, E., Heislens, A. and Neumann, F. G. (1976). The flora and fauna of radiata pine plantations in north-eastern Victoria. *For. Comm. Vic. Bull.* 24:1-58.
- Lilley, C. (1982). The diet of the powerful owl, *Ninox strenua* in Victoria. *Aust. Wildl. Res.* 9:157-175.
- Iriggs, B., Brunner, H. and Cullen, J. M. (1984). The food of fox, dog and cat in Croajingalong National Park. *Aust. Wildl. Res.* 11:491-499.
- Iriggs, B. (1984). *Mammal Tracks and Signs: A Field Guide to South-eastern Australia*. Oxford University Press, Melbourne.
- Iurkowski, T. J. (1969). Food habits and behaviour of the gray fox (*Urocyon cinereoargenteus*) in the lower and upper Sonoran life zones of south-western United States. Ph.D. thesis: Arizona State University, Tempe.
- Iurkowski, E. J. (1980). Carnivora food habits and habitat use in Ponderosa Pine Forests. USDA For. Service Res. Rep. RM-215.
- Valente, A. (1981). Vertebrate remains in pellets of the barn owl, *Tyto alba* from Plant Downs Station, south-western Queensland. *Aust. Wildl. Res.* 8:181-185.
- Valente, A. and Woolley, P. A. (1981). Hair structure of some Western Australian mammals. *J. Roy. Soc., B.* 4. 64:101-132.
- Wallis, R. L., Brunner, H. and Menkhorst, P. W. (1982). Victorian field studies on the broad-toothed rat (*Mastacomys fuscus* (Thomas)). *Victorian Nat.* 99:12-21.
- Wallis, R. L. and Brunner, H. (1984). Predator scat analysis — availability of packing yarn and a report of an unusual dog scat from East Gippland. *Victorian Nat.* 100:79.
- Weaver, J. L. and Hoffman, S. W. (1979). Differential detectability of rodents in coyote scats. *J. Wildl. Mgmt.* 43:783-786.
- Whitehouse, S. J. O. (1977). The diet of the dingo in Western Australia. *Aust. Wildl. Res.* 4:145-150.
- Wood, J. E. (1954). Food habits of furbearers of the upland post oak region in Texas. *J. Mammal.* 35:406-415.
- Woolley, P. A. and Valente, A. (1982). The dibbler, *Parantechinus apicalis* (Marsupialia: Dasyuridae): failure to locate populations in four regions in the south of Western Australia. *Aust. Mammal.* 5:241-245.

**REPORT ON F.N.C.V. EXCURSION TO TASMANIA**  
**JANUARY 12th to 19th WITH AN EXCURSION FOR SOME TO JANUARY**  
**22nd, 1986**

Hobart is not the easiest town in which to find a meal for thirty hungry Victorian Field Naturalists on a Sunday night, January 12th at 6 p.m., however we eventually found a few small, usually ancient, pubs with a counter-tea and survived. The weather during the entire trip was favourable, a light Scotch mist was falling when we arrived on Sunday, 12th January, there was a sudden rain squall which threatened to drown us on Maria Island and there was some light rain on our departure, but apart from a biting chill wind on the top of the Hartz Mountains we were not aware of the cold. However, as is not unusual in a bus group, a mild "viral" cold affected at least 6 of the party.

Our headquarters were at Hadley's Hotel in Murray St., where the Redline bus called each morning about 8.30 or 9 a.m. to convey us on our excursions; a small take-away next to the hotel supplied most of the lunches.

Our first excursion was to the south through Kingston to the Hartz Mountains where we were met by Dr. Winifred Curtis, Emeritus Professor of Botany at the University of Tasmania, she identified plants and corrected some of our botanical misconceptions, e.g. there was a showy yellowish white, sweet smelling flower of the Proteaceae family which we took to be a *Grevillea*, but she explained that it was an endemic *Lomatia polymorpha*, we also found *Leptospermum rupestre* in flower, red *Richea scoparia* and saw our first leatherwoods (*Eucryphia lucida*) and masses of pale lilac *Prostanthera lasianthos*, the Christmas Bush, which was in flower all over Tasmania. The roadside was lined by the pale pink drooping heads of *Bauera rubioides* making a dense tangle in the wet heathland, with pinky lilac *Melaleuca squamea*. There were bushes of Satinwood (*Phebalium squameum*) and

Stinkwood (*Zieria arborescens*). The rocks along the road cuttings looked as if Cayenne Pepper had been sprinkled over them. Dr. Curtis explained to our surprise that this was due to the presence of a green algae. We also found the snow berry (*Gaultheria hispida*) and a red berried *Pernetia tasmanica*.

We descended per bus to the swiftly flowing Huon River where we ate lunch, the waters were the colour of beer and beside the river Dr. Curtis showed us Huon Pines (*Largarstrobos franklinii*), horizontal scrub (*Anodopetalum biglandulosum*), *Richea sprengeliodes* whose foliage really did resemble the Heath *Sprengelia incarnata* which we also discovered, but the flowers were dead and brownish. The Tasmanian Myrtle (*Nothofagus cunninghamii*) had coloured reddish-orange new shoots and in the forest we found bird orchids (*Chiloglottis gunii*) and a yellow sun orchid (*Thelymitra megaloclypta*) and Cinnamon Bells (*Gastrodia sesamoides*). Port Huon looked deserted, it was once a thriving port for the export of apples, but very few orchards remain now, as the government had ordered their destruction following the collapse of the overseas market due largely to the effects of the E.E.C.

On the mountain at the Tahune forest we also found the unique endemic *Leptospermum riparium* with persistent calyx on the fruit, linear leaves and four carpels, there was also *Drimys*, the mountain pepper and some white flower spikes of the native Laurel (*Anopterus glandulosus*) and many tiny seedlings of the celery topped pine (*Phyllocladus asplenifolius*).

On Tuesday, January 14th, we drove south to Kettering and caught the ferry to Bruny Island. It was a golden day and the shallow tidal flats in the numerous bays

were mirror-smooth with blue water over sand with flocks of wading and other birds. Pied Oyster Catchers, Pied and Black Cormorants, Black Swans and ducks and native hens.

North Bruny Island is largely farmland with sheep, it is connected by a narrow sandy spit, which is a mutton bird and penguin reserve, across to South Bruny Island and Adventure Bay, where there are lots of small holiday shacks, there are about 400 permanent residents on the whole island and apparently one shop.

We visited the Blight Museum rebuilt of convict made bricks with their characteristic thumb marks, we crossed a mountain range Mount Bruny 504 m in South Bruny covered with horizontal scrub and the endemic yellow blanket leaf (*Bedfordia linearis*). We climbed the South Bruny Lighthouse built in 1836, the second oldest in Australia (the oldest being the Macquarie off N.S.W.), from the top we could see the Larbillardiere State Reserve, a peninsula stretching to the north where Christmas Bells (*Blandfordia punicea*) and red *Epacus impressa* grew.

The following day, January 15th, we ascended Mt. Wellington to the pinnacle at an altitude of 4,166 feet. Here again we were helped by Dr. Winifred Curtis by proxy, through the media of her pamphlet "Forests and Flowers of Mt. Wellington", which we bought at the Tasmanian Museum in Argyle St. On the mountain we encountered the Kerosene Bush (*Helichrysum lepidifolium*), the Tasmanian Stringbark, our Messmate (*Eucalyptus obliqua*), Swamp gum or our Mountain Ash (*E. regnans*) and our Dogwood (*Cassinia* sp.) Tasmanian dogwood is *Pomaderris apetala*.

Most of the plants previously mentioned from the Hartz Mountains were seen again on Mt. Wellington and other mountains as well as a beautiful lemon scented Boronia (*B. citriodora*) on the summit and the beautiful pinkish-yellow inflorescence of the Mountain Rocket (*Bellenden montana*). There were some stands of red Waratah (*Telopea truncata*) past its

flowering season, but later in the southwest we saw many flowers of the perfumed endemic White Waratah (*Agastachys odorata*) a handsome shrub.

Tasmanian Snowgums (*E. coccifera*) were numerous, but we failed to find the only representative of the pines on the mountain, namely (*Podocarpus alpina*). We also found faintly purple Eyebrights (*Euphrasia gibbsiae*) and some Button Grass in flower (*Gymnoschoenus sphaerocephalus*).

We walked from the Springs down what was mislabelled "Jacksons Track, half an hour to Ferntree", after slipping and sliding down over mossy rocks, between beds of bird orchids, with many Turquoise berry plants (*Drymophila cyanocarpa*) for 1½ hours and passing a mountain grave labelled the Radford cenotaph at the spot where a boy of 19 years of that name died in 1903 during a race to the pinnacle. We eventually reached the new Ferntree Tavern, the bus and lunch.

The next day, January 16th, we travelled north through Sorrell and to Orford and Louisville where we caught a small, passenger-only ferry for Maria Island and had a guided tour by the ranger over the convict founded town of Darlington first inhabited by Aborigines who occupied the site during the visits of Cox in 1789 and Baudin in 1802. There is abundant water, game, marsupials and Cape Barren geese, shellfish and precipitous dolomite cliffs full of fossils facing the ocean. The island has undergone two convict eras, the first 1825 to 1832, the second 1842 to 1850 and still has substantial convict built buildings surrounding a village green.

In 1884-1896 an Italian, Diego Bernacchi established wine-making and silk industries on the island, he renamed the town San Diego and there were over 250 people living there in 1887. Later, a cement works was established from working the limestone deposits, all these endeavours flourished temporarily only; a second industrial era began in 1920 and collapsed during the Great Depression in 1930, the island has now become a National Park



*Photo 1. Ancestor hunting in Rokeby churchyard.*

in 1972 and offers some sanctuary to hikers and holiday makers.

High up, in the lath and plaster attic of a small cottage, one can see a fireplace used by the Irish political prisoner Smith-O'Brien while he wrote his autobiography — his cottage at Port Arthur is better known.

Next day, Friday, January 17th we crossed the Bowen Bridge and the tour developed into an ancestor hunting day for several members of the party. Elizabeth Turner searched in vain for the grave of her great-grandfather, William Charles Clark who came to Hobart town in 1816 as a sort of little brother to John Beamont, the Treasurer of the Colony. Both were buried in a single grave, formerly at the back of St. John's Church, Newtown, but the area is now a geriatric centre and the gravestone may have been removed, probably to Cornelian Bay Cemetery. It is family folk lore that William Charles Clark reported

that he had seen Governor Collins lady, then only 16 years, riding a pig in the backyard of Government House, then built at the chosen site of Sullivans Cove on the west bank of the Derwent.

In Photo 1, you will see Andy Blackburn in the churchyard of St. Mathews Anglican Church, Rokeby, his famous civil engineer and surveyor great-great-grandfather designed many churches and bridges throughout Tasmania and Victoria, the Yan Yean Scheme and in Tasmanian his works included St. Mathews, Rokeby 1840, the Lady Franklin Museum and St. Georges' Battery Point. He is photographing the grave of Urias Allender, Marie's great-great-grandfather (Marie stands nearby). Urias came to Van Diemens Land in 1804 and was the first licenced boatman on the Derwent river and ran a ferry from Hobart to Kangaroo Point.

Also in the yard was the grave of Reverend Robert Knopwood, Pioneer



Hobart and tours by F.N.C.V.

Priest of Van Diemens Land who died on 18th September, 1838.

Elsie Costermans, mother of Leon the author of "Native Trees and Shrubs of South Eastern Australia", the oldest and probably the most active member of our party (she was born in January 1900) and is in front of some of the headstones centre right. Rueben Kent and several others were also searching for ancestors during our visit.

We visited Risdon Cove, the site of the original, official settlement of Hobartown by a small party of 49 people under the command of Lt. John Bowen in September, 1803. A few ruins of the original huts and houses remain only.

We travelled down through Lauderdale to Opossum Bay and had our lunch overlooking Clifton Surf Beach on South Arm facing Storm Bay and overlooking Betsey Island, from here we had a good view of the Derwent Light House mentioned in the recent Sydney to Hobart yacht race and known as the Iron Pot. During a stroll in the woodlands we first became aware of the song of the Crested Honeyeater which followed us throughout Tasmania.

On Saturday, January 18th, we travelled to the National Park on the east side of gigantic Mt. Field, we visited the Russell Falls and then climbed up and over the Horseshoe and Lady Barron Falls and back to the car park, the track was of squelchy, black mud and took us 3 hours. We startled

a Paddymelon Wallaby and a tiny potoroo. The most impressive flora in the wet beech forest was the colourful fungi, mostly in shelves along the fallen, rotting tree trunks.

Next morning, Sunday 19th January, the party split up, three-quarters returning to Melbourne by plane, while 10 of us left in two four-wheel drive cars for Queenstown and the Lake St. Clair, and Franklin Wild Rivers National Park.

On Monday, 20th January, our Land Cruisers travelled to the precipitous and beautiful Franklin River Gorge along the unmaintained controversial road out over Mt. McCutcheon and Mt. McCall, "the road that leads to nowhere", as work on it ceased when the area was declared a World Heritage area, here we found shrubs of flowering *Baeckea gunniana*, which had a spicy perfume and somewhat resembled our Grampians thryptomene. We walked some of the way down the Crotty-Kelly track and had lunch at the junction of the Bird and Nora Rivers.

On Tuesday, January 21st, we travelled south down logging roads in the Florentine River valley and visited a *Eucalyptus regnans* tree 95 metres tall, one of a stand of tall trees, spared by the logging teams from the devastation of clear-felling for wood-chips which so much marred this magnificent valley. It was in this valley in 1933 that the last Tasmanian Tiger or thylacine was captured, this unfortunate animal was the last of its species and died in the Hobart Zoo on 7th September, 1936, the same year as the Tasmanian Tiger was added to the list of protected wildlife. A government bounty of £1 per head had previously been paid for this animal, this scheme was terminated in 1909, but in the preceeding 21 years 2184 bounties had been paid ensuring the extinction of this shy and secretive species which was said to have a quiet, nervous temperament compared to its cousin the Tasmanian devil, whose bodies were frequently found killed on the motor roads. Apparently the Devils seek the carrion on the road at night and are confused and blinded by car lights, but

thankfully the Devil seems to be in no danger of extinction. Wombats were also seen dead by the roadside and several lively echidnas.

That night we spent at the new Lake Pedder Lodge at Strathgordon situated on a jagged isthmus between Lake Gordon in the north and the beautiful Lake Pedder recently inundated to the south. Here there was a small flock of endemic green rosellas feeding near the Lodge.

On our last day, Wednesday, 22nd January, we visited the spectacular dam at the end of the Gordon River. We did not have time to travel the Scotts Peak dam south of Pedder, but travelled north-east on logging roads to the Styx River Valley. This river eventually flows into the Derwent at Hayes, north-west of New Norfolk where we joined the Lyell Highway, then we travelled across the Derwent at Bridgewater, through Brighton to Richmond where we visited the historic, sandstone bridge, built in 1823, before travelling south through Sorell to the Causeway, to the Hobart airport to catch the 5 p.m. plane home to Melbourne.

Through our entire trip we saw no evidence of mistletoe anywhere.

Dorothy Dawson and Pat Glancy kept a list of over 70 species of birds seen, actually 74 different species, including 10 endemic to Tasmania:

Tasmanian Native Hen, Yellow Wattlebird, Yellow-throated Honeyeater, Black-headed Honeyeater, Green Rosella, Strong-billed Honeyeater, Tasmanian Thornbill, Dusky Robin, Brown Shrub Hen and the most exciting of all was the 40 Spotted Pardolotte, an endangered species seen on Maria Island. It is thought that more than half the total population of the birds live on Maria Island.

Another exciting find was a small wallaby skull found by Lil Kirk on the Hartz Mountain, this proved to be the skull of *Thylogale billardierii* or red-bellied wallaby, not found on the mainland and seldom in Tasmania, the Department of Mammology found it so interesting that they kept the specimen for their research.

Andy Blackburn reports that he photographed 90 different plant species, including a few fungi, and that 30 were endemic to Tasmania.

The lists of fauna and flora mentioned above are in no way exhaustive, and are included because of the particular beauty, abundance or their unique endemity.

**Dr. Elizabeth K. Turner.**

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### **Botany Group Annual Report 1985-86**

The Botany Group has continued to be well supported by members, as shown by the average attendance of 28 at monthly meetings. These have been concerned with a number of areas of Australia, from Tasmania to Queensland, as well as the study of specific plant families, namely Proteaceae and Rushes, Sedges and Grasses. As shown by the large attendance on that evening, this latter was one which was much appreciated, most of us previously having been quite ignorant in that area. We are indebted to David Albrecht of the Herbarium staff not only for his carefully prepared talk but also for his leading of the follow-up excursion which also attracted a large attendance.

Over the past 12 months excursions have not been so well attended, the average attendance being only thirteen. This is due to several factors among which, especially, is the need for volunteers, who know an area, to do the planning and to act as leaders. This is well illustrated by the knowledge and enjoyment gained from the excursion on a damp day in mid-winter to the Royal Botanic Gardens. This was led by Madge Lester who knows the Gardens very well and who introduced us to a number of sub-tropical trees, a notable feature of our Gardens, many of them in flower at that time.

The Group has functioned with a President, together with several who shared the position of Minute Secretary, and a Programme Committee. We are indebted to those from outside the Club as well as to all those from within the Club who have contributed to our enjoyment of the study of the large subject of Botany.

— MARGARET POTTER  
(President)

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### **Geology Group Annual Report 1985**

Events come and go, yet in their midst an Annual Report must be written. This year was similar to 1984 with regard to attendance, while subject matter presented, covered many aspects. It should be appreciated that attendances over the past two years, ie 1984/85, represent the fourth highest average attendance since 1972.

Our subjects, in 1985, covered; — Mineralogy (Carbon-in-Pulp Processing; Practical Lesson; Asbestos related Diseases; Tertiary basaltic rock minerals), Paleontology (Some Australian Fossils; Dinosaur Cove), Geotechnics (Permian Plate Tectonics, Volcanics around Melbourne). A rather lively evening, ensued thanks to Noel Wigmore and his "Human Evolutionary Development".

Yet again, inter-group activities were to the fore with a visit to the Basin Field Naturalists (Speaker: Gabi Love).

By using the Excursion Field-Book (Education Dept., Curriculum Branch), we were able to visit Sth. Morang, Templestowe and Warrandyte. Further afield saw us visit the Blackwood area, finally finishing the year with Volcanics around Melbourne.

It should be mentioned that 1985 also presented us with a wide range of speakers, namely Dr. T. Rich, Dr. B. Birch, Mr. N. Archibald, Mr. P. Duanne, Mr. N. Wigmore and Mrs. G. Love.

Finally, once again I take this opportunity to thank everyone who has assisted me throughout 1985.

— GRAEME C. LOVE  
Chairman

## Day Group Annual Report 1985

Chairman: Mr. Alf Fairhall.

Vice Chairman: Mr. Ian Gillespie.

Secretary: Mr. Dan McInnes.

Excursions suitable for public transport were arranged for the year 1985 and visits were made to the following places with a member of the group acting as leader and information officer for the day.

Feb.	Botanical Gardens and The Craft Cottage
Mar.	Port Melbourne. History and Beach
April	Central Park and Hedgeley Dene Gardens Malvern
May	Maranoa Gardens
June	Coburg Lake and Merrie Creek Walk
July	The State Theatre and The Art Gallery
Aug.	Westerfolds M.M.B.W. Park
Sept.	Maribyrnong River Park
Oct.	Zoological Gardens
Nov.	Yarra River Park Spencer St.

The average attendance was 14 with a top of 26 at Maranoa Gardens.

D.E. McINNES  
Sect. Day Group

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## Microscopical Group Annual Report 1985-86

The group membership and attendances remained constant.

New members to the group were Mr. and Mrs. Russell and Barbara Ward.

Mr. John Strong a member of many years died on the 15th July, 1985.

Dr. R. Hamond returned to England on the 13th October 1985, after residing in Australia for 17 years.

Club members were able to assist Prof. Bolton, Monash Uni. in his research on the Grayson and Shepherd ruling machines.

Mr. C. Nance, a club member kindly donated books to the group.

Donations of books and microscope equipment was received for the benefit of the group from the estates of the late Miss Roma Johnson and Mr. J. Strong.

The group continued under the able chairmanship of Mr. U. Bates.

January was Members night and later in the year a very interesting evening by members on Foraminifera, with discussion and exhibits.

Speakers and Lectures for the year —

- |                        |  |
|------------------------|--|
| Dr. E. Peters, (2).    | 1. Flashlight Photography thru the Microscope.       |
|                        | 2. Movie Photography with the Microscope.            |
| Mr. D. McInnes, (3).   | 1. Rock Sections & Crystals.                         |
|                        | 2. Marine Life under the Microscope.                 |
|                        | 3. Polychete Worms.                                  |
| Mr. R. D. Graham, (1). | 1. A Book List of Microscopy.                        |
| Mr. U. Bates, (1).     | 1. Plant Sections.                                   |
| Mr. J. Dawes, (2).     | 1. Chemical Stains and Mountants Historical.         |
|                        | 2. Microscope Slides and Accessories over the years. |

Mrs. E. C. GRAHAM  
Hon. Sec. of the Microscopical Group.

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## Subscription Now Due

Membership subscriptions are due at the beginning of the year. If you haven't yet renewed please think of it. Prompt payment is a great help to the Club and ensures you will continue to receive the Victorian Naturalist.

## Natural History Medallion Fund

During 1985 donations to this very worthwhile fund have not totalled very much. The Award is made each year and the cost of producing a medallion has increased markedly in recent times. I would encourage all members to consider donating to this fund.

To the following persons and organisations I would like to thank you on behalf of the Natural History Medallion Fund Committee for your most generous donations:—

Miss H. Aston (5th Donation)	\$20
E. and K. Gill	\$10
Royal Society of S.Aust.Inc.	\$100
P. W. Mitchell	\$20
	<hr/>
	\$150
	<hr/>

Previous total, acknowledged Vic. Nat. Vol. 101 No. 6, page 239

\$2623.70

The new balance invested in the Fund is at 19/3/86

\$2773.70

N. DISKEN

Hon. Treasurer.

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## FIELD NATURALISTS CLUB OF VICTORIA

### Reports of recent activities

#### General Meeting

#### Monday, 17th March

**The Speaker** of the evening was Dr. Dianne Simmons, a "Eucalyptologist" from Victoria College, Rusden who spoke on "Fire prevention and its impact on vegetation in urban-fringe areas". Dr. Simmons is interested in the field dynamics of fire and litter build up and is involved with her local Country Fire Authority at Christmas Hills.

She stressed that the fire protection measures she was involved in were only directed at protecting homes and other valuable localized assets, and that she was not talking about fires in forests and does not agree with the concept of broad-scale "fuel reduction burning". Much of the "prescribed" burning carried out by foresters is done in an attempt, not to reduce the risk of bushfires, but to increase timber production by reducing the competition for the trees by burning the understorey and temporarily increasing the availability of nutrients (although in the long term nutrients are lost from the system) or for various other management reasons.

Dr. Simmons outlined the structure of the C.F.A. and its mode of operation. Each brigade acts autonomously to formulate policies for fire prevention in its local area, and since there may be only 20 active members and half that number involved in policy making, the decisions reached depend very much on a few individuals.

There are often great conflicts in the area of fire prevention. Many people feel that fire prevention measures are too destructive to the environment whereas others feel that property should be protected at all cost. Dr. Simmons discussed some of the recommended procedures to protect property from fire and things to do in the event of fire. Studies have shown that most houses which burn do so minutes after the front of the fire has passed as the result of smouldering embers catching alight and that houses nearly always survive the fire if someone is home to put out these embers. It is far safer to stay with the house, provided simple precautions have been taken, than it is to take to the roads.

The effects of fire on vegetation depend

very much on the species involved. Some species, such as Mountain Ash, are killed by fire whereas others require a more frequent fire regime to survive. Fire can therefore be used as a management tool to achieve and maintain a particular vegetation type and can be used to increase species diversity in some areas. Before deciding on a burn, it is always important to consider timing and expected weather patterns as these will have a great impact on any regrowth.

Dr. Simmons stressed that since local C.F.A. brigades decide their own strategies, it is very important for conservationists and people knowing of important vegetation in need of protection to put their case to the C.F.A. and to work with them to formulate policies which will protect our native flora and fauna. Many valuable localized patches could easily be lost unless fire prevention committees are made aware of their importance.

### Exhibits

— Under microscopes, some old paper covered slides showing the tongue of a bee, the silicious skeletons of “polycystinia” (marine radiolarians) and *Istmia enervis*, a colonial diatom; also a scaly-backed polychaete worm of the family Chrysopetelidae from Black Rock. Mr. Dan McInnes.

— Three species of Skipper butterflies caught in Melbourne; *Taractrocera papyria*, the White Grass Dart, *Dispar compacta*, the Dingy Skipper and *Ocybadistes walkeri*, the Yellow-banded Dart, a species which appears to be expanding its range rapidly westward and largely displacing the other two. Recent publications by the South Australian Museum on entomology. Mr. Ian Faithfull.

— Goose Barnacles, *Lepas anatifera* on a glass jar found washed up at Gunnamatta Beach; Fossil wood from a coal seam between Mr. Eliza and Mornington and fossil leaves and plant remains, including early eucalypt leaves, from

lignitic clay at Mornington. Both from the Middle Tertiary. Mr. Tom Sault.

— Corundum crystals from north of Mt. Narryer, W.A. including a crystal in the mother rock, Banded Gneiss containing Zircon by which it was dated at 3.35 billion years old from Mt. Narryer and Tourmaline crystals also from W.A. Mr. Bill Corrick.

— Old bones, probably from a Grey Kangaroo, found in the school ground at Mandeville Hall. Mrs. Lauren Faragher.

### Nature Notes

— There are thought to be over 500 fruit bats roosting in the Botanic Gardens. Mrs. Margaret Corrick.

— There have been a lot of butterflies (probably the Common Brown) around lately. Mrs. Sheila Houghton.

— Rainbow Lorikeets seen at Brighton. Mr. Ian Faithfull also reported seeing them around the Fitzroy Housing Commission buildings.

### General Meeting Monday, 14th April

**Honorary Membership** was awarded to Mr. Ron C. Kershaw after having completed 40 years membership of the FNCV. Mr. Kershaw now lives in Launceston and was unable to attend the meeting. His family has had a long history of association with the Club; his grandfather having been on the committee for 30 years and another relative, David Kershaw, having been a founder member. Mr. Kershaw is particularly interested in terrestrial molluscs and co-authored the book “Field Guide to the Non-Marine Molluscs of South Eastern Australia” with our ex-president, Dr. Brian Smith.

**The Speaker** for the evening was Mrs. Sibely May, a retired science and biology teacher who spoke on “Wildflowers of the South Australian Mallee”. Mrs. May grew up in South Australia and after first visiting the Yorke Peninsula at the age of 13, has had a fascination with the area ever since.

Mrs. May began by giving a brief

account of the history of botanical exploration of the Peninsula. It was named in 1802 by Matthew Flinders in the Investigator who had with him, the young botanist Robert Brown.

Many people, she said, believe the Mallee to be a dull and uninteresting place, but whereas the flowers are not generally showy, they have a great delicacy and beauty of their own and are well worth getting to know.

This point was certainly demonstrated by the many beautiful slides and interesting anecdotes which she then presented to the meeting. She spoke on a wide range of species, including some of the more unusual ones she had met with over the years. A large number of species have been painstakingly illustrated in watercolours by Mrs. May and examples of her work were on display after the meeting.

Thanks were given to Mrs. May by Mrs. Margaret Corrick who pointed out how much modern Herbaria rely on collections made by the old collectors many years ago and what a valuable contribution to our knowledge enthusiasts like Mrs. May can make.

#### Exhibits

— In illustration of her talk: A sprig of Holly Grevillea, *G. ilicifolia*, a flowering plant of *Halgania cyanea* in a pot, pinned specimens of the blue butterfly, *Ogyris amaryllis* which feeds on the scarlet-flowered mistletoe, *Amyma melaleucaea*, which in turn grows only on *Melaleuca lanceolata* and books of her paintings and field notes. Mrs. Sibely May.

— Under microscopes: The cuticle of a eucalypt leaf showing the stomata — a

leaf tunnelling insect had eaten away the inside of the leaf leaving the cuticle intact, slides of 2 species of human lice, *Pediculus capitis* and *P. pubis* and a parasitic tick, *Ixodes plumbeus*, from a Carpet Snake. Mr. Urwin Bates.

— Several species of marine hydroids; *Plumularia setaceoides*, *Aglaophenia plumosa*, "*Silicularia*", "*Orthopyxis*", "*Amphis betsia*" and *Antennella indivisa* (*Plumularia campanula*) from Black Rock Mr. Dan McInnes.

— Part of the skin of the Common Brown Snake, *Pseudonaja textilis* from Kyneton. Mrs. Sheila Houghton.

— Jewel Beetles, *Julidomorpha bakewelli* ("Jumbo Jets") and *Stigmodera* (*Themognatha*) *parryi* and part of the pupal case of a Cossid Moth, probably a female Giant Wood Moth, *Xyleutes liturata* from the Big Desert in March. Mr. Ian Faithfull.

— Astronomical slides showing the south celestial pole photographed with a half hour exposure in Central Australia and an image of the moon eclipsing the sun, projected onto paper through a theodolite. Mr. Andy Blackburn.

#### Nature Notes

— 165,000 people went to Jells Park last week to view Halley's Comet.

— There is epicormic regrowth on the eucalypts at the Melcalfe Flora Reserve but little other regrowth. There has been very little rain since the fire over two months ago. Mrs. Sheila Houghton.

— Java Doves have been seen nesting — very early?

— Flying Foxes roosting in her Moreton Bay Fig in Canterbury. Miss Laura White.

C. M. Shankly.

## 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
\$18	\$25	\$35	\$45	\$55	\$65	\$75

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.

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## Special Note for Authors Using Wordprocessors

Many wordprocessing 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 Russell Thomson, 17 Powlett St., Heidelberg, 344 5704 (B.H.).

(Continued from I.F.C.)

## GROUP MEETINGS

FNCV members and visitors are invited to attend any Group Meetings.

### Day Group — Third Thursday

Thursday, 19th June. Fawkner Park then visit to "The Jewish Museum of Australia", South Yarra. Meet at the corner of Toorak Rd., and Park St. at 11.30 a.m. Travel by Toorak Rd., tram no. 8. Alight at stop no. 23. Leader: Dan McInnes 211-2427.

Thursday, 17th July. Ringcraft Diamond Salon. Video display and demonstration of gemstones. Meet at the corner of Elizabeth and Lonsdale Sts. at 11.25 a.m. Leader: Dan McInnes 211-2427.

Thursday, 28th August. (note change of date) Mounted Police Depot, St. Kilda Rd. Meet at the entrance of National Gallery at 10.45 a.m. Leader: Betty Gillespie 587-1879.

At the National Herbarium, Birdwood Ave., South Yarra.

### Botany Group — Second Thursday

Thursday, 12th June. Members' Night.

Thursday, 10th July. "Wildflowers of the Nepean State Park Walking Tracks". Mrs. Ilma Dunn and Mrs. Stefanie Rennick.

Thursday, 14th August. "Endangered Plants". Mr. David Cheal.

### Geology Group — First Wednesday

Wednesday, 4th June. "Petrology for Beginner". Mrs. Gaby Love.

Wednesday, 2nd July. "Himalayas, Nepal and Kashmir — Slide Night". Mr. Graham Baker.

Wednesday, 6th August. To be announced.

### Mammal Survey Group — First Tuesday

Tuesday, 3rd June. To be announced.

Tuesday, 8th July. To be announced.

Tuesday, 5th August. To be announced.

### Microscopical Group — Third Wednesday

Wednesday, 18th June. "Rheinberg Filters and Crystals under Polarized Light". Mr. John Endacott. (To be held in the Chemistry Building, Swinburne Institute of Technology at 8.00 p.m.)

Wednesday, 16th July. "Bryozoa". Mr. Dan McInnes.

Wednesday, 20th August. "Early Books on Microscopy and Natural History". Mr. John Dawes.

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## Gold Mining and Environmental Values

Concern has been increasing over the last few months about modern gold mining techniques involving wholesale clearing of mining claims. Advocates of this technology claim no long-term harm is done to the environment, and that their machines enable "cost-effective rehabilitation and regeneration" of the areas concerned.

It is difficult to get an overall assessment of the amount of environmental damage that may be occurring as a result of this modern goldrush. The Victorian National Parks Association is interested in collecting information from people familiar with affected areas. It would welcome accounts of the extent and locations of affected areas including effects on localized plant communities and rare species, and accounts of the effectiveness or regeneration techniques.

We therefore request that people with information write to:

Tony Faithfull, Vice President,  
Victorian National Parks Association,  
Box 785F G.P.O. Melbourne 3001.

## 'HUNTERS OF THE SKIES'

(Lindsay Cupper)

The Goshawk; the Falcon

The Soaring Hunters and the Fishing Hunters

## FILM NIGHT

in aid of the Australian Childrens' Choir

Expo '86

3rd & 4th July, 8 p.m. at Collingwood Education Centre Theatre,  
cnr. Cromwell St. and McCutcheon Way, Collingwood.

Tickets: \$6.50 adult, \$4.50 children & pensioners.

Available from:

Mrs. V. Hessler,  
13 Dalgety Road, Beaumaris.  
589-5015 (7-10 p.m.)

# 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 1986-1987

*President:* Dr. JACK DOUGLAS, 42 Sunhill Rd., Mt. Waverley, 3149 (277 4804 A.H.)

*Vice President:* Vacant.

*Hon. Secretary (Acting):* Mr. I. FAITHFULL, 83 Easey Street, Collingwood, 3066 (419 9908 A.H.)

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*Subscription-Secretary:* Mr. N. STANFORD, c/- National Herbarium, Birdwood Avenue, South Yarra, 3141.

*Editorial Material:* Editorial Committee, c/- National Herbarium, Birdwood Avenue, South Yarra, 3141.

*Librarian:* Mrs. SHEILA HOUGHTON, FNCV, 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:* Miss CHRISTINE SHANKLY, 50 Glyndon Road, Camberwell, 3124 (836 7187 A.H.)

*Conservation Co-ordinator:* Mr. BOB GRAHAM, 147 Broadway, Reservoir, 3073.

*Sales Officer (Books):* Mrs H. STANFORD, 100 Middlesex Road, Surrey Hills, 3127 (830 1505)

*Sales Officer (Victorian Naturalist only):* 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, Mth. Sunshine, 3020 (311 5106 A.H.)

*Mammal Survey:* Mr LANCE WILLIAMS, 29 Erica Crescent, Heathmont, 3135 (879 1962 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 1986

Metropolitan Members (03 area code) .....	\$20.00
Joint Metropolitan Members .....	\$22.00
Country/Interstate/Retired Members .....	\$18.00
Joint Country/Interstate/Retired Members .....	\$20.00
Student (full-time) .....	\$14.00
Junior (under 18; no Victorian Naturalist) .....	\$3.00
Subscription to Victorian Naturalist .....	\$18.00
Overseas Subscription to Victorian Naturalist .....	\$25.00
Affiliated Clubs .....	\$20.00
Subscriber Clubs .....	\$18.00
Individual Journals .....	\$3.00

# The Victorian Naturalist

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## FNCV DIARY OF COMING EVENTS

### GENERAL MEETINGS

**Monday, 11th August, 8.00 p.m.**

Margaret Blakers. "The FNCV Old-time Naturalists Project".

**Monday, 8th September, 8.00 p.m.**

Members' Night.

**Monday, 6th October, 8.00 p.m. (Note change of date).**

Dr Jim Willis. "The Botanical Explorations of Baron von Mueller".

**New Members — 31.3.86-26.5.86**

#### *Metropolitan*

Dr J. May, 48 Williams Rd., Blackburn, 3130.

Mrs Susan Ure, 7/2 Yarra St., Hawthorn, 3122.

Mr Peter L. Griffiths, 17/23 Park St., Hawthorn, 3122.

Mr V. C. Routley, 3/17 Elphin Grove, Hawthorn, 3122.

Catherine G. Riley, 14 Pleasant Rd., East Hawthorn, 3123.

#### *Joint Metropolitan*

Mr David Ball and Pauline Benzies, 2/13 Selwyn Ave., Elwood, 3184.

Dr Arthur J. Farnworth and Mrs Enid H. Farnworth, 47 The Boulevard, Doncaster, 3108.

#### *Country*

Roger Leslie, R.M.B. 1290, Moyhu, 3732.

#### *Student*

Miss Cathy Rich, 12 Amess St., North Carlton, 3054.

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### WORKING BEE

KINGLAKE, SUNDAY 31st AUGUST

Vandals have caused some damage to the building on the FNCV block at Kinglake and the committee would be very glad of some assistance in putting it to rights. Much of the work is tidying up etc., so everyone can help but Ian Faithfull (419 9908) would like to hear from any available handy people. Lists

of plants and birds seen at the block were damaged so please make a record of what you can see. Some weeding is also needed. Please bring lunch, BBQ if desired, fill your car with tools and helpers and meet at the block by 10.30 a.m. Let Ian know if you need transport.

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### FNCV EXCURSIONS

**Sunday, 3rd August.** Zoological Gardens. Meet at the entrance near Royal Park Station at 10.30 a.m.

**Sunday, 7th September.** Tallarook area. Leader: Peter Kelly. The coach will leave Batman Ave., at 9.30 a.m. Fare \$12. Bring picnic lunch.

**Saturday, 4th and Sunday, 5th October.** Victorian Field Naturalists Clubs Association spring get-together. This will be based in Ballarat where some o/n accommodation has been booked at the Old Ballarat Inn, the venue for the evening meeting at 7 p.m. with Phil Day, a geologist speaking on the Devil's Kitchen area. A coach has been booked and will leave from the Gas and Fuel Building in Flinders St., at 8.30 a.m. on Saturday for Ballarat then on the Bird Observers Clarkesdale Reserve near Linton, meeting at the Ranger's cottage at 1.20 p.m. As well as the bird reserve there is a nearby flora reserve owned by the Ballarat FNC. At the end of the afternoon we will return to Ballarat in time to obtain a meal before the meeting. Sunday morning we will leave for the Devil's Kitchen area where we will probably stay until early afternoon before returning to Melbourne via Mt. Clear. Bring picnic lunches for Saturday and Sunday. Coach and accommodation is \$55 and \$20 should be sent as a deposit to Marie Allender when booking. Members traveling by car could contact Marie to see

if she has surplus accommodation or book direct. The Old Ballarat Inn is opposite Sovereign Hill, Midland Highway, Ballarat. Campers and caravanners can book at the Goldfields Caravan Park, 108 Clayton St., Ballarat (053 32 7888). These weekends provide a wonderful opportunity to meet country members so we hope you can attend.

**October weekend campout** in the Warby Ranges. Leader: John Milligan. Ring Will Ashburner 789 8485 for details.

**Wednesday, 22nd — Tuesday, 28th October.** Kangaroo Island. Meet at Adelaide (Keswick) Rail Terminal at 8.15 a.m. on 22.10.1986, where a coach will be waiting to take the party to the airport for plane to K.I. We will stay at Ellsens Guesthouse Motel on a D.B.B. basis. Day tours are being arranged and most will include lunch. Cost, subjected to any unexpected increases, is at present for Motel twin share \$480, Guesthouse \$430, single supplement \$65. This includes accommodation on the island, tours, plane to and from Adelaide and transport between Adelaide and the airport. A deposit of \$100 should be paid when booking, but do not send money before confirming there is a vacancy. There is no

(Continued inside back cover)



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## President's Note

Being newly elected to this office, I am still somewhat unsure of the qualifications demanded of the President of the FNCV.

What I can offer stems from a boyhood in the Otways and the Heytesbury Forest in the 30's; my earliest memories being of Satinwood (*Phlebalium*) hedges and walking to school on cold winter mornings over hosts of bright yellow worms (I still have no idea of the names of these!) . . . a Gould League Certificate in 1936 . . . and then to the suburbs and the Greenies in the blue gum outside my sleepout. My interaction with the FNCV began when I became a member in the early part of my 30 years as a geologist with the Geological Survey . . . a time when I constantly renewed my love with our countryside; a love which forms a common bond between most of our members.

Trying to cope with a large family (my wife, son and five daughters), my long experience in the Public Service, and my constant involvement with sporting bodies and scientific societies has, hopefully, conditioned me for the committee work I now face with the Presidency of the FNCV.

Looking at the growing difficulties of keeping our organisation running, I wonder if members, especially those who can't manage to get to meetings very often, realise the enormous amount of work involved in all committee jobs.

The SECRETARY (Honorary), must cope with a pile of letters each week, often from members, but also involving Club participation in this or that Government Committee or Field Survey, or University Project . . . a myriad of responsibilities generating heaps of correspondence. Of course detailed minutes must be produced for all general meetings and council meetings.

Our LIBRARIAN, who attends our Herbarium office and copes with library mail and enquiries twice a week (as well as normal cataloguing etc.) and our EXCURSION SECRETARY, who arranges transport for major outings, deserve special mention particularly as many members probably are unaware of their existence.

Perhaps I can expand on the duties and the achievements of these and other office bearers some other time, however, for the moment I hope that I have made the point that there are a dozen or so dedicated people (Council members and Group Committee members) who are keeping this Club running. I think it is a marvellous thing that for a hundred years this Club has been able to attract people with such dedication. I am sure we can continue to do so. **If you feel you have some special talent to offer, or if you have some time to spare, please ring me, or one of the others listed on the back of the Naturalist.**

Jack Douglas  
President, FNCV.

## National Koala Survey

The Australian National Parks and Wildlife Service is co-ordinating a major study of the Koala in Australia. Funding for this project has been provided by the American Express Corporation and by the Commonwealth Government. Some funding has gone to research teams at Monash and Queensland Universities, who are looking at the biology and epidemiology of chlamydial disease in natural Koala populations.

The other main thrust of the study will be a national Koala survey to be conducted over the next six months. The aim of the survey is to provide information on the distribution and abundance of Koalas and on the prevalence of diseases among them. Findings will contribute to a national management plan for Koalas. A survey co-ordinator has been appointed to the wildlife agency in each of the four states involved: Queensland, New South Wales, Victoria, and South Australia. The co-ordinator for Victoria is (Ms) Chris Porter, who is based at the Arthur Rylah Institute at Heidelberg.

The survey is a massive task to be accomplished in six months, especially in Victoria, where Koala populations are widely distributed. Hence, help is being enlisted from various conservation and naturalist groups and other volunteers throughout the state. In addition, the assistance of Conservation, Forests and Lands staff is being sought.

Help can be provided by:

1. Reporting all Koala sightings to Chris at the Arthur Rylah Institute. Standard record sheets will be provided. These ask for such information as specific locality, habitat type, and tree species. Where possible, information on sex of the Koala, presence of back young and external signs of disease is being sought.

2. Arranging organized surveys in particular areas. Instructions will be given on how to best carry out a survey in your area.

**Anyone willing to help with the survey should contact Chris Porter at the Arthur Rylah Institute, P.O. Box 137, Heidelberg, 3084, or telephone 450 8600.**

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## Vegetation Survey — Melbourne Metropolitan Area

The Von Mueller Institute of the Department of Conservation, Forests and Lands is presently undertaking a vegetation survey of the Melbourne Metropolitan Area, which is part of the 'Conservation Resources Study', a joint project between the Department of Conservation, Forests and Lands and the Ministry for Planning and Environment.

1. Identify all remnants of natural (or near natural) vegetation in the study area.
2. Survey as many of these sites as possible.
3. Develop a data base for use by land managers, including sites of botanical significance in the area.
4. Determine the distribution of plant species and communities.
5. Determine the past and present distribution of vegetation types in the area.

The Vegetation Survey of the Melbourne Metropolitan Area is to be printed in 1988, and it is intended to produce a large vegetation map of the area.

The sites requiring survey have been identified from aerial photographs, and a Preliminary Report has been produced, giving brief descriptions of the major vegetation types in the study area, with an annotated plant list.

The FNCV has been approached to assist in supplementing knowledge of the remnant vegetation of the Melbourne area, firstly by supplying plant lists compiled on Club excursions, or records kept by individual members; secondly by undertaking surveys of sites; and thirdly by collating information on the historical vegetation of the Melbourne area from the *Victorian Naturalist*.

Vegetation surveys can be carried out in two ways, by preparing species lists for defined areas, or by detailed quadrat-based surveys. The latter technique is used by most professional botanists, and an explanation would be provided for those unfamiliar with it, who wished to participate.

Here is an opportunity for Club members to engage in a worthwhile project, and one in which amateurs can play a useful part. If you are interested in taking part in this project, please contact **David Albrecht**, c/- National Herbarium, Birdwood Avenue, South Yarra, 3141.

# Changes in Cliff Morphology at Black Rock Point 1973-1986

BY ERIC C. F. BIRD AND NEVILLE J. ROSENGREN\*

## Introduction

Black Rock Point is a cliff about 130 metres long and up to 13 metres high, cut in soft Tertiary sediments on the north-east coast of Port Phillip Bay (Fig. 1). It is one of the few remaining active cliffs on the coastline fringing the south-eastern suburbs of Melbourne, most of the original cliffs having been artificially stabilised to form vegetated coastal slopes. A scheme to stabilise the cliffs at Black Rock Point in this way was opposed by local conservation groups in the early nineteen-seventies, and in 1972 the then Minister for Conservation, Mr. W. A. Borthwick, decided that these cliffs should be left in a natural condition so that research and survey work could be carried out to

1973), and in the ensuing years, frequent visits have been made to the site to monitor changes in relation to coastal processes.

The coast at Black Rock Point consists of two coves, bordered and separated by minor headlands, and fronted by an undulating rocky shore platform up to 30 metres wide, developed on relatively resistant Black Rock Sandstone, a ferruginous rock with layers that harden on exposure to the atmosphere. The minor headlands occur where the top of the Black Rock Sandstone rises, while the coves have been cut out where slight synclines bring the base of the overlying Red Bluff Sand, a less resistant, poorly consolidated clayey sand formation, down below high tide level. To the north a car park has been built on

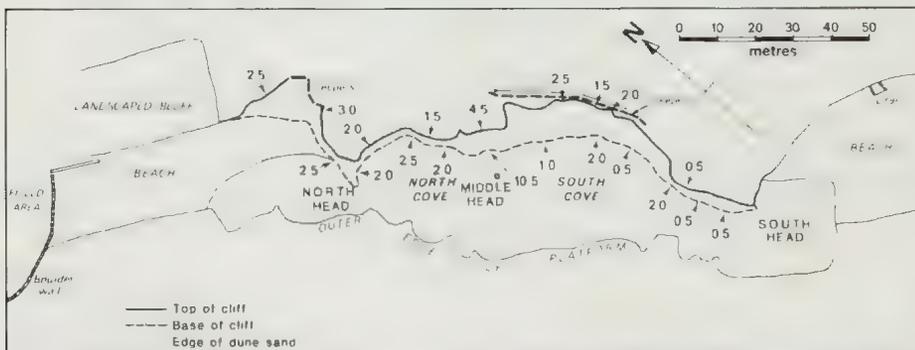


Fig. 1. Map of coastal features at Black Rock Point, based on a survey made in January 1986. Figures indicate extent of cliff-crest and cliff-base retreat (in metres) since original survey in 1973 (Bird, Cullen and Rosengren, 1973: Fig. 2).

determine changes in progress, and obtain information necessary for long-term coastal management. A preliminary account of conservation problems at Black Rock Point was published in the Victorian Naturalist (Bird, Cullen and Rosengren

reclaimed land, backed by an artificial grassy slope, from which a cliff emerges, gaining in height to about 6 metres on North Head. Behind North Cove is a scrub-covered valley, with an incised gully opening on to a white sandy beach at the back of the shore platform, and cliffs ascending in height to about 5 metres on either side. Middle Head, prominent in 1973, is now much reduced.

\* Department of Geography, University of Melbourne, Parkville, Victoria, 3052.

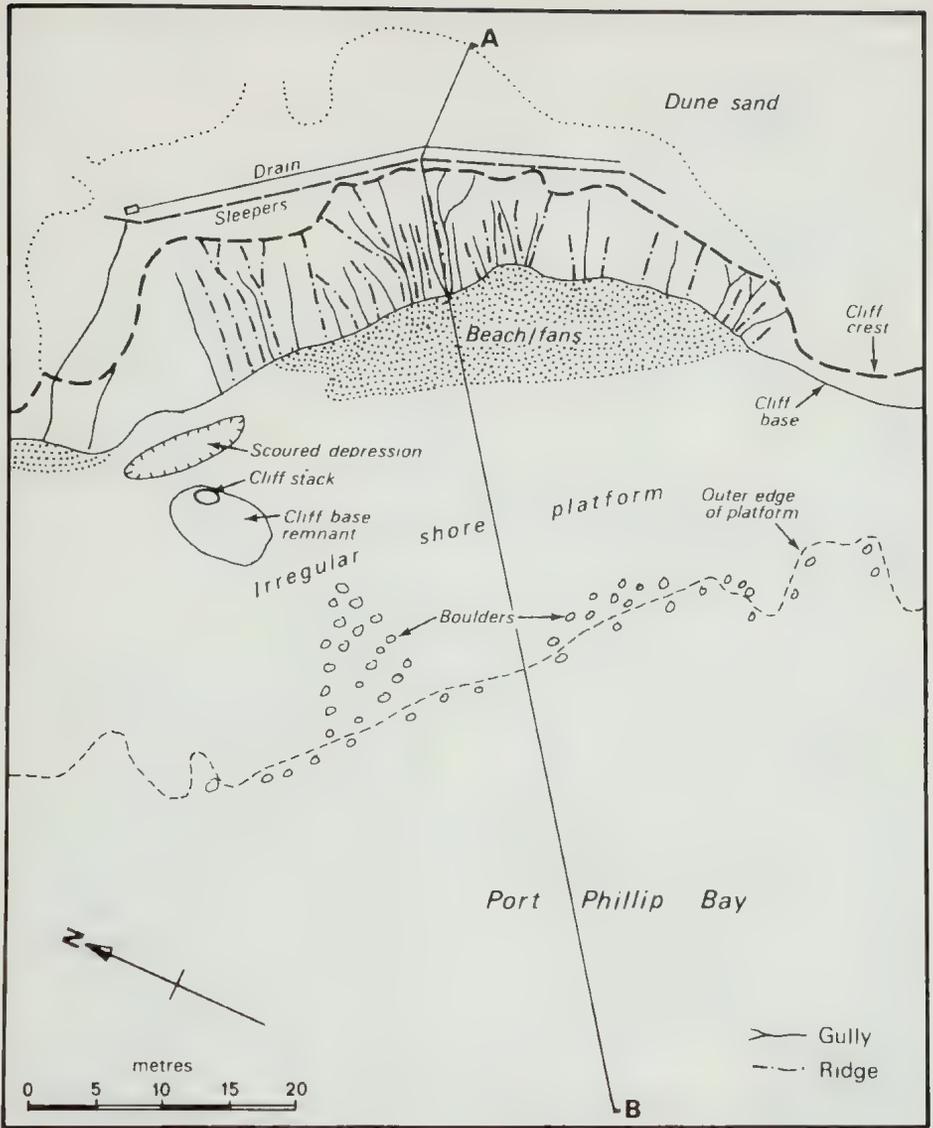


Fig. 2. Detailed map of South Cove, Black Rock Point (for location see Fig. 1), showing pattern of cliff-face gullies and butresses. AB is line of section shown in Fig. 3.

South Cove (Fig. 2) has a more even-crested cliff averaging 11 metres high, the cliff face showing vertical gullies and butresses, crossed by minor ledges related to outcrops of slightly more coherent layers in the Red Bluff Sand. The gullies vary in width from a few centimetres to more than

a metre: the smallest are rills a centimetre or so wide. A surveyed cross-section of South Cove is shown (Fig. 3) with details of cliff profiles (Fig. 4). At South Head, on another rise of Black Rock Sandstone, the cliffs pass into scrub-covered bluffs which extend behind the wide Black Rock

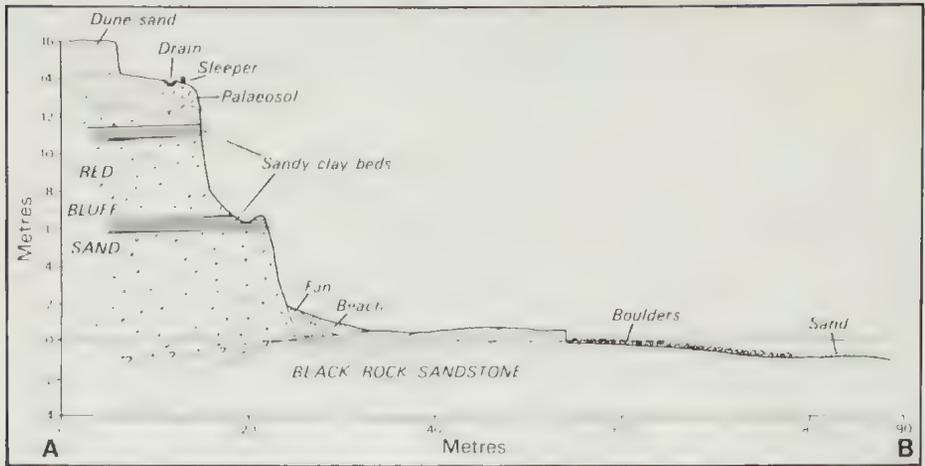


Fig. 3. Cross section AB (see Fig. 2), showing general relationships between cliff and shore platform and the landward-dipping Red Bluff Sand and Black Rock Sandstone. Heights in metres above and below a mean low spring tide datum.

Beach to the south. Offshore, beyond the outer edge of the shore platform, a submerged rocky platform is partly strewn with sandstone boulders, and partly sand-veneered (Whiteway 1985).

The evolution of these coastal landforms was discussed by Bird, Cullen and Rosengren (1973; see Fig. 3), with some deductions concerning the processes at work. Subsequent observations and measurements, notably of cliff-base recession in South Cove, culminated in a complete re-survey of Black Rock Point in January 1986. The present article summarises the changes that have occurred since 1973.

#### Method of survey

Four control points, marked by concrete plugs inserted into holes drilled into the shore platform, were established as a basis for plane-tabling in the 1973 survey, and these were relocated and used again in 1986. Distances and height differences were plotted directly on the plane-table by means of a tachometric alidade, taking readings on a staff held at various points along the base and crest of the cliff, and at accessible points in gullies and on buttresses. Inaccess-

sible points were marked on the cliff, and mapped by intersection from two control points, reading vertical angles through the alidade, and resolving first the horizontal and then the vertical triangles.

#### Changes 1973-86

Since 1973 there have been only minor changes on the shore platform. At the outer edge, wave action has penetrated further into joints and fissures, loosening and undermining blocks of sandstone, some of which have been thrown up on the platform by storms. On the surface of the platform there has been local deepening and widening of grooves and enlargement of potholes by wave abrasion, particularly where sand and gravel have been circulated within enclosed depressions.

There have been varying amounts of recession of the cliff crest and the cliff base, as shown in Fig. 1. In general the cliff crest and cliff base have retreated up to 2 metres since 1973 on the softer Red Bluff Sand, and less than a metre where the more resistant Black Rock Sandstone outcrops at the cliff base.

The most extensive changes have taken place on Middle Head, a narrow promon-

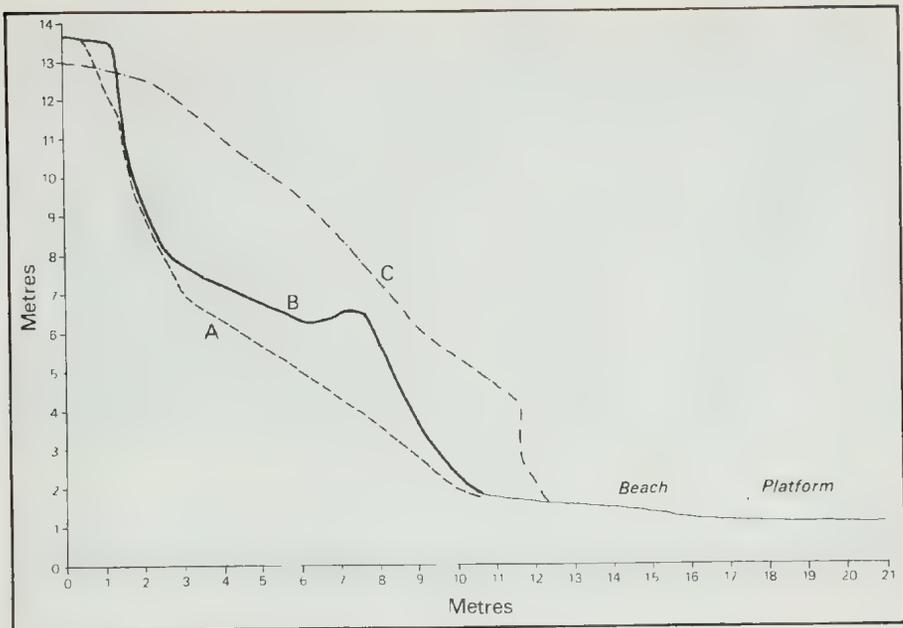


Fig. 4. Profiles of the central gully (A) and adjacent buttresses (B, C) on the cliff in South Cove, Black Rock Point. Heights above mean low spring tide datum.

tory of clayey sand in 1973, which became gradually thinner, until it was breached during the storm of 27-30 June, 1980 to form a window, which soon enlarged into a natural arch (Fig. 5). This collapsed late in August 1981 leaving an outlying stack, which has gradually diminished to a height of 2.2 metres, while the cliff to the rear has been undercut and steepened. The outcome is that the cliff base has retreated about 10.5 metres at this point, erosion having been rapid here because the landward dip brings the softer Red Bluff Sand down below high tide level, where swirling waves have scoured out a furrow in the soft rock between the stack and the cliff. The sequence is shown diagrammatically in (Fig. 6). Similar changes occurred in the early nineteen-thirties at Quiet Corner, about 1.5 kilometres south of Black Rock Point, where an elongated promontory of Red Bluff Sand was breached by marine erosion, leaving an outlying stack (which has since disappeared) on a slab of Black

Rock Sandstone (which still remains) (Bird 1984).

In South Cove the crest of the cliff has receded irregularly at the heads of gullies, which have been cut back by up to 1.5 metres, but comparison of (Figs. 7 and 8) shows only minor changes. The central gullies mapped in 1973 have enlarged and



Fig. 5. Natural arch at Black Rock Point, April 1981. This arch formed during a storm in June 1980, gradually enlarged, and finally collapsed in August 1981, leaving an outlying stack. Photo: Eric Bird.

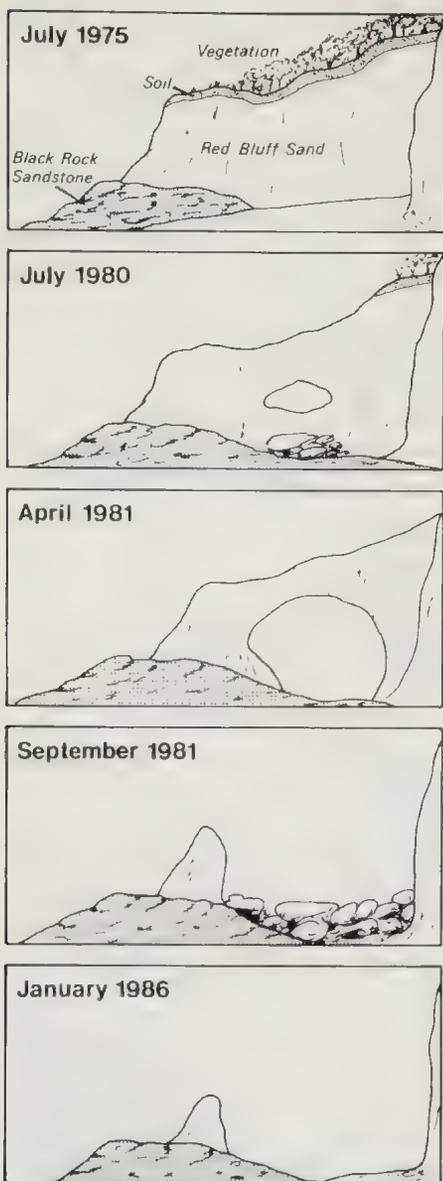


Fig. 6. Stages in the formation and destruction of the natural arch at Middle Head, Black Rock Point.

coalesced, but headward erosion slackened after May 1981, when Sandringham Council inserted a bank and drain at the cliff crest to intercept runoff during periods

of heavy rainfall (Fig. 9). As a result, cliff-crest recession (1.5 metres) has been less than basal retreat (up to 2 metres), so that the cliff profile has become steeper, with segments almost vertical.

With the exception of this man-made steepening, the pattern and extent of changes in cliff morphology at Black Rock Point have been much as anticipated in 1973. Certainly the rate of cliff-crest recession (up to 38.5 cm/yr) is far too slow to constitute any immediate threat to Beach Road, which is here 80 to 100 metres inland.

### Coastal processes

In 1973 it was deduced that the cliffs at Black Rock Point had been shaped partly by runoff during heavy rainfall, and partly by basal undercutting by storm waves. In addition, there had been local minor erosion as the result of people scrambling up and down the cliffs. These processes have subsequently been observed to cause changes in cliff morphology at Black Rock Point, especially during periods of wet weather, or when high tides accompany strong wave action.

Behind South Cove, erosion of cliff-face gullies occurred during heavy rainfall, when water flowed down a seaward-sloping ramp of relatively impermeable organic soil, and over the cliff face, washing down sand and clay to form fans beneath each gully. Observations at Black Rock Point during rainy weather indicated that runoff was more effective when the sandy clay had been soaked by preceding rainfall than when the substrate was dry, and that it depended on short-term rainfall intensity. Gully erosion was mainly due to this runoff, but raindrop impact, seepage, and slumping also occurred. Locally, downwash formed vertical strips of sandy material adhering to the cliff face, similar to the sand stalagmites described by Baker (1942).

Gully erosion and slumping were observed during heavy downpours on 17 February 1972, 30 January, 4 and 19 February, and 31 October 1973, 3 October 1975, 29 February 1976, 10 September 1977,

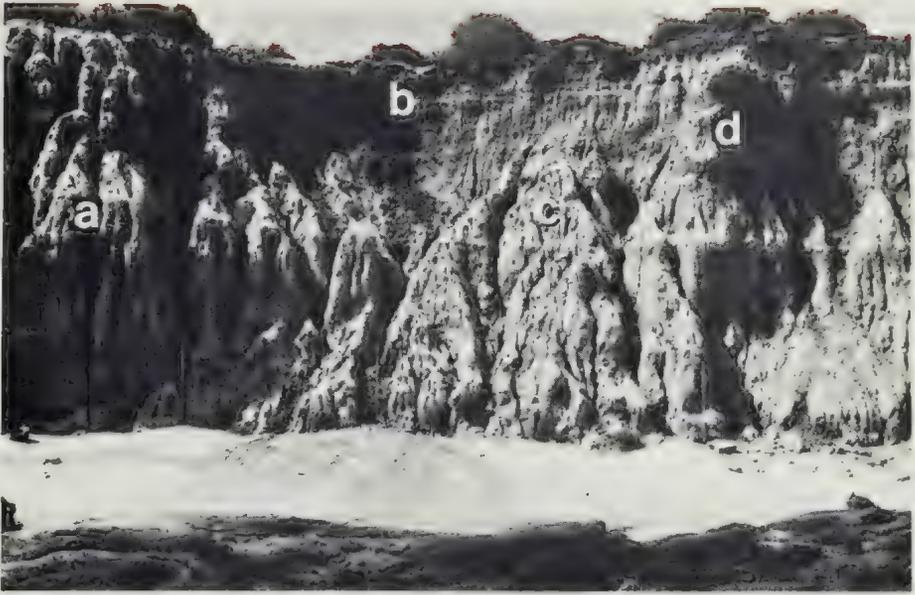


Fig. 7. Gullied cliff in South Cove, Black Rock Point, as it was in March 1973. Letters a, b, c and d indicate equivalent positions on the cliff face in Figs. 7 and 8. Photo: Eric Bird.



Fig. 8. Cliff in South Cove, Black Rock Point, January 1986. Comparison with Fig. 7 shows that the central sector has enlarged into an amphitheatre backed by a steeper wall, the top of which has been stabilised since the insertion of a bank and drain to intercept runoff over the cliff face. Photo: Eric Bird.



Fig. 9. Cliff management works at Black Rock Point. In order to stop runoff from the cliff-crest ramp cascading down the cliff face, sleepers were inserted in 1981 to form a bank, backed by a drain to divert the flow during heavy rainfall. The ramp (left) has been netted, and sown with grasses and shrubs to further impede runoff. Photo: Eric Bird.

and 29 June 1980, but there was no simple correlation between erosional events and the local (Sandringham) daily rainfall data (Woodcock 1982). Acknowledging that some brief episodes of gully erosion may have been missed, these nine observations

within a decade suggest a recurrence about once a year. Each downpour resulted in the deposition of confluent fans of white quartz sand (the clay being rapidly dispersed) to augment the beach, which was subsequently smoothed by waves reaching

the backshore in a succeeding high tide. As has been indicated, erosion by runoff has been much reduced since the cliff-crest bank and drain were inserted in 1981.

Spring tide range at Black Rock Point is about a metre. Observations of tidal levels here in relation to predictions for the Williamstown tide gauge have shown that in calm weather the sea reaches the base of the cliffs when the level at the Williamstown tide gauge rises above 0.9 metres. This occurs on about 30% of high tides, but severe marine erosion occurs only when strong wave action accompanies a high tide (Fig. 10), scouring away the beach trimming back the fans of downwashed material, undercutting the cliff, and triggering minor slumping. Onshore winds may augment tidal levels by up to 0.3 metres. Episodes of severe marine erosion occurred at Black Rock Point on 25 August

and 5 October 1971, 22-23 April 1972, 20-21 April, 2 September and 20 October 1973, 22 October 1974, 1 August 1976, 7-8 April 1977, 12 August 1978, and 27-30 June 1980; the latter was the most prolonged storm of the decade, and comparison of photographs taken before and after suggest that this single event caused about half the cliff-base recession measured in South Cove from 1973 to 1986. Severe marine erosion, thus defined, has therefore occurred at intervals of about a year. Slight marine erosion, defined as the scouring of the beach and the cutting back of fans of downwashed material without actual recession of the cliff base, occurs up to five times a year, mainly during winter storms; a recurrence interval of about 0.2 years.

The cliffs at Black Rock Point have thus changed in response to both subaerial erosion (runoff after heavy rains) and marine erosion (removal of the beach and basal undercutting). Subaerial erosion has developed and maintained a gullied cliff face, similar in appearance to the face of an abandoned quarry in soft sandy material inland; the deepening and widening of gullies has led to the retreat of a steep slope (40 to 50 degrees). Marine erosion has undercut and steepened the gullied slope, in places developing a smooth vertical cliff. Removal of basal fans by wave action has prevented the accumulation of colluvial downwash of the kind seen at the concave base of the scrub-covered bluffs to the south. There is no doubt that if marine erosion ceased, colluvial deposition would persist, and a slope-foot concavity would develop.

In 1973, it was predicted that the slow recession of the outer edge of the shore platform would result in diminishing cliff-base marine erosion, and eventually in a subaerially-smoothed coastal bluff, stable enough to be colonised by vegetation (Bird, Cullen and Rosengren 1973, Fig. 3). In the long term (> 100 years) this is still likely to occur, but the short-term evolution (< 100 years) has been influenced by the insertion of a bank and drain at the cliff



Fig. 10. Storm waves at high tide reach the base of the cliff at Black Rock Point (1 August, 1976). Arrow shows where the natural arch formed in 1980 (see Fig. 5). Photo: Neville Rosengren.

crest to prevent runoff down the cliff face, and the outcome in recent years has been to increase the role of marine erosion and diminish the role of subaerial processes. In consequence, parts of the cliff have become steeper and smoother, with a profile that is more marine than subaerial. Nevertheless, if the sea remains at its present level, the persistence of the hard sandstone shore platform will ensure that marine erosion gradually diminishes, so that eventually a subaerially-shaped profile will develop.

### Cliff management

In 1981 the geomorphological evolution of Black Rock Point was modified by the placing of railway sleepers to form a bank and drain along the top of the cliff to halt the runoff that previously occurred down the cliff face. This has diminished the erosional effects of runoff after heavy rain, and thus reduced the rate of erosion of Black Rock Point.

Such cliff management has the advantage that it does not obscure and destroy the cliff face as a scenic and scientific feature. Black Rock Point was indeed the first "Site of Scientific Interest" to be recorded in Victoria, and the first to be recognised in coastal planning (Bird 1979). The dispute over the management of this scientific site set an important precedent

in that subsequently many such sites, on the coast and inland, have been preserved or managed in such a way as to perpetuate their scientific values (Rosengren 1984). Further studies of the evolution of cliff morphology at Black Rock Point will proceed in association with experimental management to maintain these scientific values.

### Acknowledgements

We are grateful to Mark Ellaway for assistance in the survey work, to Rob Bartlett for preparing the maps and sections, and to Wendy Nicol for photographic work. The research forms part of a project supported by an A.R.G.S. Grant.

### REFERENCES

- Baker, G. (1942). Sand stalagmites. *J. Geol.* 50:662-667.  
 Bird, E. C. F. (1979). Sites of special scientific interest. *Victorian Nat.* 96:21-28.  
 Bird, E. C. F. (1984). *Geology and Landforms of Beach Park. Sandringham Environment Series, No. 2. Sandringham City Council.*  
 Bird, E. C. F., Cullen P. W. and Rosengren, N. J. (1973). Conservation problems at Black Rock Point. *Victorian Nat.* 90:240-247.  
 Rosengren, N. J. (1984). Sites of geological and geomorphological significance in the catchment of Westernport Bay. *Ministry for Conservation, Environmental Studies Series, Publication 401.*  
 Whiteway, R. (1985). Marine life of the coastal fringe. *Sandringham Environment Series No. 6. Sandringham City Council.*  
 Woodcock, F. (1982). Weather and climate. *Sandringham Environment Series No. 5. Sandringham City Council.*

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## Natural History Medallion Fund

On behalf of the Natural Medallion Fund, I would like to thank the following organisations for their continued support:—

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# A Breeding Aggregation of *Chauliognathus pulchellus* Macleay (Coleoptera: Cantharidae)

G. A. WEBB\*

## Introduction

*Chauliognathus pulchellus* Macleay is a medium sized, aposematic cantharid beetle common in south-eastern Australia, particularly in montane areas (Britton 1970, Moore and Brown 1978). Adults are active during summer and are commonly attracted to blossom in large numbers, where they feed on nectar and pollen (Brooks 1948, Hawkeswood 1978, 1981, Moore and Brown 1978, Webb 1985, 1986). Swarming of *C. pulchellus* has rarely been reported in the literature (Froggatt 1907: 168, McKeown 1942: 129, Zeck 1919) though this phenomenon is apparently quite common (D. I. Bevege pers. comm., R. H. Eldridge pers. comm., B. P. Moore pers. comm.) Hadlington and Johnstone (1982) reported swarming in cantharid beetles but did not indicate which species.

Moore and Brown (1978) suggest that *C. pulchellus* adults are primarily diurnal and often roost overnight in dense aggregations on grass stems and other low vantages beneath their blossom food source. Zeck (1919) earlier reported an aggregation of *C. pulchellus* on the ground but did not indicate at what time of day the aggregation was observed nor whether a suitable food source was available.

In January 1985, an aggregation of *C. pulchellus* was observed in tall open eucalypt forest in the Coolangubra State Forest (37°01'S 149°23'E) near Bombala, New South Wales. Observations on density, roost specificity, behaviour and possible food sources are presented.

## Observations

### Vegetation

The tall open forest was dominated by *Eucalyptus viminalis* Labill., *Eucalyptus radiata* Sieb. ex DC. and *Eucalyptus ovata*

Labill. with *Banksia marginata* Cav., *Acacia melanoxylon* R. Br., *Acacia dealbata* Link and *Lomatia myricoides* (Gaertn. f.) Domin as major understorey shrubs. Ground vegetation included *Lomandra longifolia* Labill., *Gahnia sieberiana* Kunth and *Poa* sp. At the time of observation three tree species *E. radiata*, *E. viminalis* and *Eucalyptus fastigata* Dean and Maiden were flowering in the Coolangubra S.F. (R. P. Kavanagh, pers. comm.) Fifty percent of *E. radiata*, the dominant species in the immediate study, were flowering as were smaller proportions of *E. viminalis* and *E. fastigata*. No understorey or ground layer plants were flowering at that time.

### Aggregation

The aggregation was first observed at 12 noon on 18 January, 1985. Individuals and copulating of *C. pulchellus* were found crawling over the foliage of *L. longifolia* or tightly packed in the bases of *L. longifolia* clumps. Many individuals were in flight. A few individuals and pairs were also found on the foliage and stems of other plant species (*G. sieberiana*, *L. myricoides* and *Eucalyptus* saplings). The boundary of the aggregation was marked out with red tape for future reference. The aggregation covered ca. 117 m<sup>2</sup> in area. All *L. longifolia* clumps within the marked area had at least one *C. pulchellus* adult on them.

On 18 January, the aggregation was conservatively estimated at 10 000 individuals. On subsequent visits (10 a.m. — 21 January, 9 a.m. — 23 January, 5 p.m. — 26 January, 5 p.m. — 28 January) numbers were sequentially reduced. On 26 January, the number of *C. pulchellus* remaining were counted and the distribution and abundance in and around the marked area of the original observation was noted (Fig. 1). 227 individuals were still

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**Key:**

**Vegetation**

- Er = Eucalyptus radiata
- Ev = Eucalyptus viminalis
- Gs = Ghania siebertiana
- Lm = Lomatia myricoides
- Bm = Banksia marginata

**C. pulchellus numbers**

- P = pair
- S = single

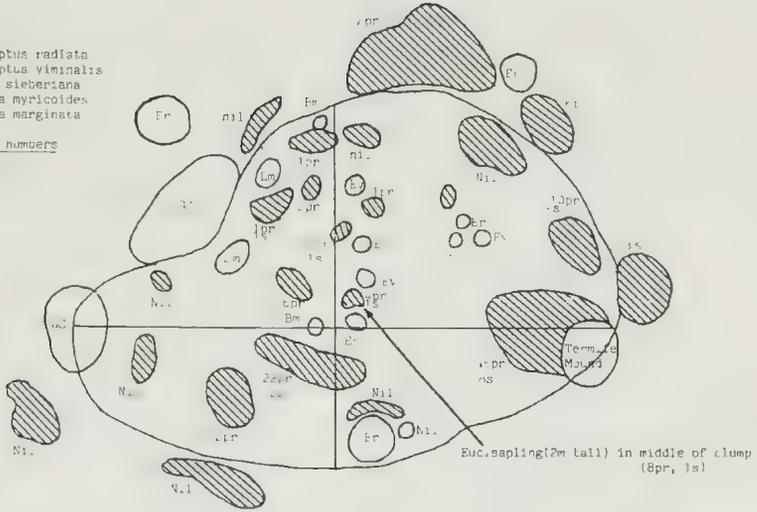


Fig. 1: Distribution and abundance of *Chauliognathus pulchellus* Macleay on *Lomandra longifolia* Labill. in relation to surrounding vegetation. *L. longifolia* clumps are shown as cross hatched areas with the number of *C. pulchellus* shown beside them.

present, 92% of which were paired up in copulation (i.e. with the male riding on the female's back). Apart from 17 individuals (8 pairs and a lone individual) (7%) found on a *Eucalyptus* sapling growing up through a *L. longifolia* clump, all *C. pulchellus* were found on *L. longifolia*. Many *L. longifolia* clumps were vacant at that stage. The largest number (98) of *C. pulchellus* was found on the largest clump but size did not necessarily correlate with numbers of *C. pulchellus* present. By 28 January, less than 10 individuals remained in the marked area.

On 26 January, adjoining areas within the forest were examined for *C. pulchellus*. Apart from scattered individuals or copulating pairs, no *C. pulchellus* were found even in areas of extensive *L. longifolia* cover.

**Behaviour**

When disturbed, *C. pulchellus* quickly moved to the underside of the *L. longifolia* leaf and subsequently dropped to the ground burying themselves beneath leaf

litter in and around the *L. longifolia* clumps. Copulating pairs usually separated when disturbed. When searched out, individuals were usually found several centimetres below the litter surface close to the soil layer.

On several occasions, females were observed presumably attempting to remove males from their backs by grasping their perch with the anterior two pairs of legs and shaking the abdomen vigorously. On no occasion was this seen to work.

**Discussion**

Zeck (1919) reported swarming in *C. pulchellus* but suggested no reason for the aggregation. The aggregation observed here was presumably for the purpose of breeding since 92% of animals in the aggregation were paired and in copulation however it is unclear what mechanism(s) was responsible for the aggregation. Considering the near 1:1 male-female ratio in the aggregation, attraction could not have resulted from a sex-specific pheromone since they tend to attract only

large numbers of the targeted sex. General pheromones may also illicit aggregation in some beetles (Chapman 1969). Males of the lycid, *Lycas loripes* emit a pheromone which attracts both sexes to an abundant food source (blossoms). Mating occurs in these aggregations. *C. pulchellus* may occur in dense aggregations on blossoms (Bevege pers. comm., Eldridge pers. comm., Froggatt 1907, Moore pers. comm., Moore and Brown 1978) during which mating occurs suggesting that *C. pulchellus* (one or both sexes) may also emit a pheromone which attracts other individuals to blossom. Alternately, *C. pulchellus* individuals may be attracted, over a short range, by the general body odour of conspecifics (Moore pers. comm.)

Unfortunately, while a large proportion of eucalypts in the area were flowering during January 1985 (Kavanagh pers. comm.) no observations of overstorey flowering in the immediate study area nor of the presence of *C. pulchellus* on the blossoms were made. If blossom was the original stimulus for aggregation the presence of large numbers of *C. pulchellus* on the ground may be attributed to the fact that most were paired up and in copulation. Conceivably females were unable to fly while carrying males. However, the fact that most *C. pulchellus* were perched on *L. longifolia* in the presence of other suitable perches suggests that *L. longifolia* may be important for other reasons than food. A clue to this obvious attraction to *L. longifolia* may be found in the fact that other insects, particularly flies (see Moorehouse and Colbo 1973 for review), use certain plants as markers for aggregation and breeding. The heavily littered bases of *L. longifolia* clumps may be ideal oviposition sites for *C. pulchellus* and/or its larval prey (i.e. the eggs and larvae of locusts, mantids and flies) (Goode 1980, McKeown 1942, Tillyard 1926).

Chapman (1969) indicated that there may be adaptive advantages, other than maximising breeding efficiency, in aggregation. Chapman suggested that aggrega-

tions of distasteful insects with aposematic colouration may also reduce population losses through predators learning to avoid them more quickly. Cantharidin, an anti-predator substance in *Cantharis* (now a Meloid beetle), is not present in the Cantharidae. However, Moore and Brown (1978) have recently identified several alkaloids including precocinelline, in secretions from the defensive glands of the prothorax and abdomen of *C. pulchellus* and suggest that this secretion may be an effective deterrent to vertebrate predators.

#### Acknowledgements

Thanks are due to Dr. B.P. Moore for his enlightening comments on some of the observations made here and to S. I. Bevege, R. H. Eldridge, R. P. Kavanagh and B. P. Moore for allowing the use of their unpublished data.

#### REFERENCES

- Britton, E. B. (1970). Coleoptera Ch. 30 *In The Insects of Australia*. CSIRO, Melbourne.
- Brooks, J. G. (1948). North Queensland Coleoptera and their food plants Pt. 2. *N. Qld. Nat.* 16:6-7.
- Chapman, R. F. (1969). *The Insects. Structure And Function*. English University Press Ltd., London.
- Froggatt, W. W. (1907). *Australian Insects*. William Brooks and Co. Sydney.
- Goode, J. (1980). *Insects of Australia*. Angus and Robertson Publishers, Sydney.
- Hadlington, P. W. and Johnson, J. A. (1982). *An Introduction to Australian Insects*. New South Wales University Press, Sydney.
- Hawkeswood, T. J. (1978). Observations on some Buprestidae (Coleoptera) from the Blue Mountains, N.S.W. *Austr. Zoologist*. 19:257-275.
- Hawkeswood, T. J. (1981). Insect pollination of *Angophora woodsiana* F. M. Bail. (Myrtaceae) at Burbank, south-east Queensland. *Vic. Nat.* 98:120-129.
- McKeown K. (1942). *Australian Insects. An Introductory Handbook*. Royal Zoological Society of N.S.W., Sydney.
- Moore B. P. and Brown, W. V. (1978). Prococinelline and related alkaloids in the Australian soldier beetle, *Chauliognathus pulchellus* (Coleoptera: Cantharidae). *Insect Biochem.* 8:393-395.
- Moorehouse, D. E. and Colbo, M. H. (1973). On the Swarming of *Austrosimulium pestilens* Mackerras and Mackerras (Diptera: Simuliidae). *J. Aust. Ent. Soc.* 12:127-130.
- Tillyard, R. J. (1926). *The Insect of Australia and New Zealand*. Angus and Robertson Ltd., Sydney.
- Webb, G. A. (1985). Insect Pollinators of *Hakea microcarpa* (Proteaceae) near Bombala, New South Wales. *Vic. Nat.* 102:204.
- Webb, G. A. (1986). Insect Pollinators of *Kunzea ambigua* (Myrtaceae) near Sydney, New South Wales. *Vic. Nat.* 103:12-15.
- Zeck, E. H. (1919). Swarming of the soldier beetles, *Telephorus pulchellus* Aust. *Zool.* 1:205-206.

# Fossil Sea Lion from Queenscliff, Victoria

BY EDMUND D. GILL\* AND ARTHUR COLLINS†

In the Colony of Victoria last century, the discovery of gold and other minerals resulted in the concentration of geological studies on the ancient rocks; the recent ones were little understood. Thus when Professor Sir Frederick McCoy received at the Museum a fossil sea lion from Queenscliff in Port Phillip Bay he dated it Pliocene and classified it as a new species (McCoy, 1877). Dr. J. Allan Berry of New Zealand visited the Museum in Melbourne in the 1960's and recognized that this fossil belongs to the living species of *Neophoca cineria*. He died unfortunately, but his results were recorded in Gill (1968), and the fossil dated as Last Interglacial. Because this sea lion does not live so far south now, it is one of the species that indicates that the climate was warmer in the last Interglacial.

## Biology

Ride (1970), refers to the agility of this species, and the time spent ashore in the breeding season, so to find the seal on the ancient dune is not surprising. As the cranium and jaw were found together, and they are perfectly preserved, it is likely that the whole skeleton was present. Probably the postcranial skeleton is still in the rock. Ride states that existing populations extend from the Abrolhos Islands in Western Australia to Kangaroo Island in South Australia, always on coastal islands except for one point south of Streaky Bay in S.A. So it is interesting to note that in the Last Interglacial the dune rock at Queenscliff formed an island.

## Fossil Site

Dr. D. J. Williams was the Health Officer at Queenscliff when the fossil sea lion was found, and he told Professor McCoy that it was found at a depth of "five feet", by workmen excavating calcrete for road-

making. As the fossil came from two layers below the calcrete level, it is possible that the find was made in an associated drainage trench or such as envisaged in Fig. 1. That there is no mark on the skull suggests that the site was excavated more carefully than a calcrete quarry.

## Stratigraphy

The general geology of the Queenscliff area is described in Douglas and Ferguson (1976), and the geological maps of the area. Queenscliff is built on a hill that is a remnant of an old dune line formed of lime sand (calcarenites) created by the breakup of marine shells and such on the beach. Most residents in the 1870s came from the United Kingdom where this type of rock is unknown, so it is not surprising that Dr. Williams called it marl. The calcrete is a subsoil hardpan formed in a dry period when lime gathered in the B horizon instead of washing through as it does at present. At the height of the dry period the topsoil blew away. Dr. Williams called the calcrete "limestone". Since then a juvenile soil has formed at the surface that he correctly called a sandy loam. The fossil seal was found in "sandstone", the fourth formation from the surface.

## Fossil Matrix

"Sandstone" can mean so many things that the fossil skull was examined for clues. In some of the deep recesses of the skull some of the original enclosing sediment was discovered. Arthur Collins examined it under a microscope and found it consisted of rounded and polished quartz grains of medium size, some covered with white secondary carbonate. How can a layer of quartz sand occur in a calcarenite dune? It is an ancient soil where the lime has been leached away. Rounded, polished grains of medium size fit that ecology. So the sea lion crawled up on a soil that covered the ancient sand dune.

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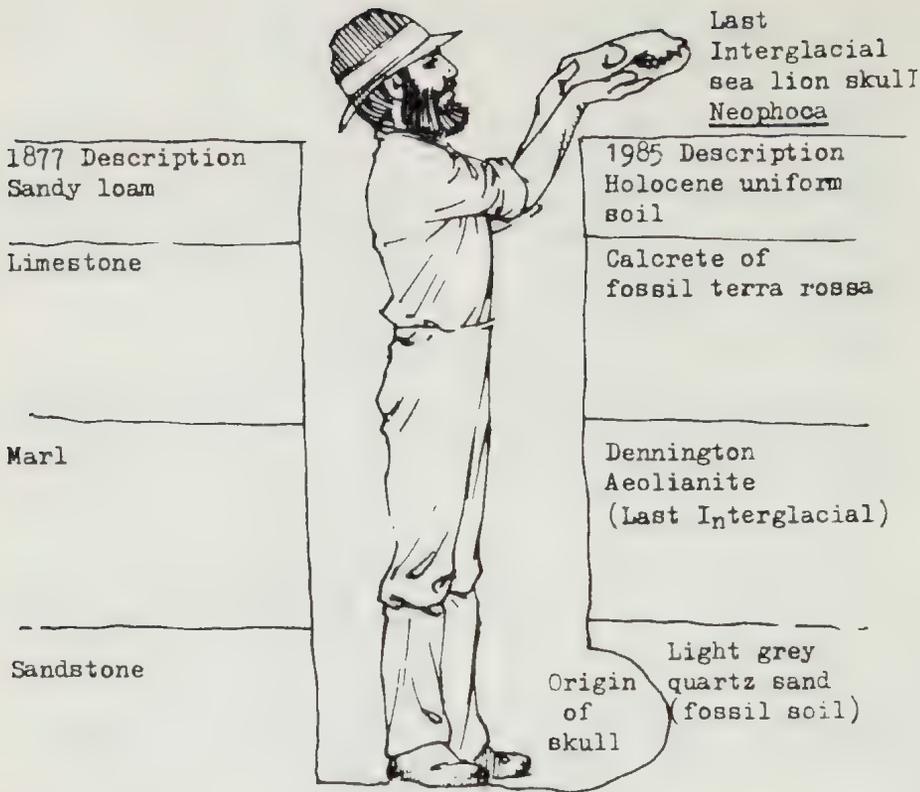


Fig. 1. Reconstruction of the finding of the fossil sea lion at Queenscliff, Victoria. On the left is the original description of the strata, and on the right is the modern stratigraphy. Drawing by Don Miller.

### Relict Landscape

A soil is formed on a dune only when it is stabilized and vegetated. Carbon dioxide in rainwater and acids from vegetal decomposition achieve the leaching. The sea lion was probably a member of a herd that came ashore to give birth. This individual died and the sand covered it. If the remainder of its skeleton is still there, the bones of a baby seal may also be present. Later, a sandblow occurred that put a layer of calcarenite over the site, ensuring the preservation of the seal bones. Because the environment is so rich in lime, the bones have been perfectly preserved.

### Age of the Fossil Sea Lion

In the railway cuttings and other excavations it can be seen that the main part of the ridge on which Queenscliff stands is built of firm calcarenite on which is the fossil soil that contained the seal bones. Over that is a younger uncemented calcarenite capped with the solid calcrete (Fig. 1). The age of the sea lion is not that of the ancient cemented dune, but of the younger one on top. The dune succession at Warrnambool has been worked out as follows (Gill, 1985):

5. *Armstrong Aeolianite* — Soft sand  
Up to 5000 years (C14 dating)

4. *Dennington Aeolianite* — Soft sand capped by calcrete; overlies marine bed  
Two dunes c. 90 000 yr and c. 110 000 yr (U/Th dating)
3. "Nicholson" *Aeolianite* — Partly cemented  
c. 200 000 yr
2. *Warrnambool Aeolianite* — Cemented  
c. 300 000 yr
1. *Sunnyside Calcarene* — Cemented  
c. 400 000 yr (U/Th dating)

The main dune at Queenscliff is Nicholson Aeolianite, over which is the Last Interglacial Dennington Aeolianite, to which cycle the sea lion belongs. At Point Lonsdale, Dennington Aeolianite is present, over which is blown the modern Armstrong Aeolianite.

It is only in the warmer Last Interglacial that the sea lions lived in Victoria. The furthest west they come at present is Kangaroo Island in South Australia.

#### REFERENCES

- Douglas, J. G. (1976), Eds. *Geology of Victoria*. Melbourne.
- Gill, E. D. (1968), Fossil sea lion as a palaeoclimatologic indicator. *Palaeogeography, Palaeoclimatology, Palaeoecology* 32:235-239.
- Gill, E. D. (1985), *Coastal processes and the sanding of Warrnambool Harbour*. Warrnambool Institute of Advanced Education Press, 78 pp.
- Gill, E. D. and Collins (1983), Ancient seaway between Geelong Harbour and Bass Strait, Victoria. *Vic. Naturalist* 100:76-79.
- McCoy, F. (1877). *Prodromus of the Palaeontology of Victoria* Decade 5. Government Printer, Melbourne, 9 pp.
- Ride, W. D. L. (1970). *A Guide to the Native Mammals of Australia*. Oxford University Press 249 pp.

## Some Notes on Butterflies from South-eastern Australia

K. L. DUNN\* AND C. E. ASTON†

### Introduction

This paper relates to extensions to the known distribution of several species: *Suniana sunias nola* (Waterhouse), *Heteronympha solandri solandri* Waterhouse, *Heteronympha penelope* Waterhouse, *Tisiphone abeona* (Donovan), *Candalides heathi alpinus* Waterhouse, and *Neolucia mathewi* (Miskin). The presence of *Netrocoryne repanda repanda* C. and R. Felder in Victoria is confirmed. *Polyura sempronius sempronius* (Fabricius) is recorded ovipositing on *Ulmus parvifolia* and a new foodplant is recorded for *Taractrocera papyria papyria* (Boisduval). All specimens are in the private collections of K. L. Dunn (KLD) or C. E. Aston (CEA). Map references are provided for obscure localities.

### Hesperiidae

*Netrocoryne repanda repanda* C. and R. Felder

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Common and Waterhouse (1981) recorded this species from north-eastern Victoria and illustrated the distribution as extending as far south as Cann River. To date, the species has not been collected from the Cann River district (A. May, pers. comm.) A. N. Burns (pers. comm.) believes that the original specimen was taken from Corryong early this century. This specimen is now lost. One female taken 1 km. north of Little River Gorge Lookout, Rocky Range, Victoria (ref: 37° 04' S, 148° 20' E), on 25 February, 1985 by KLD re-establishes the presence of *N. r. repanda* in Victoria. This locality is about 110 kilometres south south east of Corryong.

*Taractrocera papyria papyria* (Boisduval)

On 12 January, 1985 a larva was taken at Kambah Pool, A.C.T., by CEA feeding on common reed *Phragmites australis*. Pupation occurred three days later and a male emerged on 26 January, 1985. *P. australis* has not previously been recorded as a foodplant for *T. p. papyria*. (*P. australis* was identified by CEA from Wheeler et al., 1982).

*Suniana sunias nola* (Waterhouse)

This subspecies has been recorded from Rainbow Beach, Queensland (Dunn, 1983) to Taree, New South Wales (Common and Waterhouse, 1981). A male taken from Tea Gardens, New South Wales on 16 December, 1983, by CEA represents a southern extension to the recorded distribution of *S. s. nola*.

**Nymphalidae**

*Heteronympha solandri solandri*  
(Waterhouse)

In late February, 1985, several specimens were observed and two taken at Mount Seldom-seen, Victoria (ref: 37°06'S, 148°12'E), by KLD. This locality represents an eastern extension to the distribution of this species in Victoria as previously recorded by Common and Waterhouse (1981).

*Heteronympha penelope* spp. Waterhouse

*H. p. penelope* Waterhouse is recorded as far south as Thredbo, New South Wales (ref: 36°31'S, 148°11'E) by KLD and CEA. The Victorian subspecies *H. p. sterope* Waterhouse occurs as far east as Buchan Caves, Victoria (ref: 37°30'S, 148°11'E) (specimens held by KLD). A number of specimens of *H. penelope* were taken by KLD from 12 km. south of Gelantipy, Victoria (ref: 37°19'S, 148°15'E), the Little River Falls, Victoria (ref: 37°04'S, 148°19'E) and Ingebyra, New South Wales (ref: 36°39'S, 148°30'E). In addition there is a specimen from Bonang, Victoria (ref: 37°11'S, 148°44'E) in the Australian National Insect Collection (ANIC). These localities represent intermediate areas between the ranges of *H. p. penelope* and *H. p. sterope* thereby amalgamating their distribution. The variability of these specimens prevented determination of their subspecific status. These observations suggest that the geographical variation within these two subspecies is probably clinal.

*Tisiphone abeona* ssp. (Donovan)

On 15 December, 1983 several specimens were taken by M.M. Hunting at 3 km. east

of Timboon, Victoria, (specimens held by KLD). *T. abeona* has not previously been recorded between Cape Otway (Common and Waterhouse 1981) and Portland, western Victoria (ANIC). Timboon lies between the recorded distribution of *T. a. albifascia* Waterhouse and *T. a. antoni* Tindale.

*Polyura sempronius sempronius*  
(Fabricius)

On 14 March, 1985, KLD observed *P. s. sempronius* ovipositing on "Chinese elm" *Ulmus parvifolia* variety *sempervirens* (Ulmaceae) in Canberra, A.C.T. One egg was taken which hatched on 21 March, 1985, however, the larva failed to commence feeding.

**Lycaenidae**

*Candalides heathi alpinus* Waterhouse

Two males and one female taken by KLD at 5 km east of Dellicknora, Victoria (ref: 37°06'S, 148°45'E) represents the first record of *C. h. alpinus* from Victoria. *C. h. alpinus* was previously recorded from Mount Kosciusko New South Wales, the Brindabella Range, A.C.T. (Common and Waterhouse, 1981), on Black Mountain and Mount Ainslie (Atkins, 1984) and the lower slopes of the Tinderry Mountains N.S.W. (ANIC). Specimens in the ANIC taken by W.N.B. Quick at Bindaree Hut, Victoria (ref: 37°10'S, 146°32'E) may also belong to this subspecies.

*Neolucia mathewi* (Miskin)

Two males taken at Bemm River, Victoria on 10 December, 1984, by KLD represent a western extension to the distribution of this species along the eastern Victorian coastline. Mallacoota was the previous western most coastal record in eastern Victoria (Common and Waterhouse, 1981).

**Acknowledgements**

We thank M. M. Hunting for permission to include his record of *T. abeona*, B. Millington (Dept. of Botany, A.N.U.) for kindly identifying the *Ulmus* species and E. D. Edwards (Div. of Entomology, CSIRO) for his critical reading of the manuscript.

## REFERENCES

- Atkins, A. F. 1984. Notes and records for some butterflies from eastern Australia 1980-84. *Victorian Ent.* 14:26-29.
- Common, I. F. B. and Waterhouse, D. F. 1981. *Butterflies of Australia*. (Second edition) Sydney: Angus and Robertson.

- Dunn, K. L. 1983. New distribution records for some Queensland butterflies. *Aust. ent. Mag.*, 9:94.
- Wheeler, D. J. B., Jacobs, S. W. and Norton B. E., 1982. *Grasses of New South Wales*. Armidale: University of New England Monographs.

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## Ronald Calder Kershaw — Honorary Member

Mr R. C. Kershaw was awarded Honorary Membership in April after 40 years of continuous membership. He was already a Life Member of the Club and has made major contributions to the study of natural history.

Mr. Kershaw's great grandfather William Kershaw was present at meetings to establish the Club but he was not at the

foundation meeting. His great uncle David was, however, a foundation member. J. A. Kershaw, RCK's grandfather, was Secretary of the Club from 1901-5 and 1906-8 and was on the Committee for more than 30 years. This continuity over the life of the Club is particularly noteworthy.

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## Ronald Calder Kershaw

Ron Kershaw was born in Melbourne but spent every opportunity in the bush with his father collecting beetles, spiders and other such beasts which were then stored in matchboxes on the mantelpiece to the disgust of his mother. These items were mostly passed to James Kershaw, then Curator of Zoology at the National Museum. The boy developed a strong interest in nature and science which has remained with him. His early education was in accountancy followed by five and a half years of service with the A.I.F. in the Middle East and New Guinea. Further interest was stimulated in natural science and studies were continued. Serious illness interfered with his plans and he moved to Tasmania to try a farming life.

In Melbourne he was much influenced by Charles Gabriel who encouraged him to study land Mollusca. The enthusiasm of Stan Colliver was another strong influence. In Tasmania, as well as developing the farm, he was interested in business and became chairman of directors of a small company. He was also a rotarian, secretary of the local progress association,

president of the school parents and friends and chaired the T.F.F. poultry commodity committee, inter alia.

After some 16 years he sold his business interests and moved to Launceston where he joined the Department of Agriculture. Ultimately his work was concentrated on the classification of soils. In his own time he provided an identification service of Mollusca collected by veterinary and extension staff.

The Queen Victoria Museum appointed him Honorary Associate in Malacology, a position he held for 21 years following which he became Honorary Research Associate. He was also appointed Honorary Associate in Invertebrate Zoology with the Museum of Victoria. He has published 73 papers and articles, and jointly with Dr. B. J. Smith, two books on terrestrial Mollusca. Since retirement his research work has been concentrated to a greater degree on the anatomy of snails. He has also been involved in the preparation of reports to the Forestry Commission on the status of snails in Tasmanian forests.

# Observations on the Longicorn Beetle, *Tritocosmia roei* (Hope) (Coleoptera: Cerambycidae)

BY T. J. HAWKESWOOD\*

*Tritocosmia roei* (Hope) is a small, dark brown longicorn beetle 13-14 mm long, with an apparent widespread distribution throughout southern Australia from Western Australia to southern Queensland (McKeown, 1947). The antennae of this species are distinctive in that segments 1 and 2 are long, while the remainder are short — the combined length of segments 1 and 2 are longer than the other 8 segments; in addition, the distal end of segment 1 is enlarged and the distal end of segment 2 bears a prominent, dense, cylindrical brush of black hairs. Nothing previously has been recorded on its biology.

On August 15, 1982, I examined a fallen branch of *Eucalyptus umbra* R. T. Baker (White Mahogany) (Myrtaceae) on the Griffith University campus, Brisbane, Queensland. The widest end of the branch was moist and covered in fungus while the other portion was dead and dry. Most of the branch had been infested with larval cerambycids. Breaking one end of the branch exposed two active adults of *Tritocosmia roei* (Hope). This represents the first published larval host record for the species.

In the laboratory, several adults were extracted from the smaller diameter dry branchlets (13-18 mm diameter). Splitting the timber with a screw-driver revealed larvae, pupae and teneral adults of *T. roei*, resting in pupal chambers 14-17 mm long ( $15.6 \pm 1.3$ ,  $n = 5$ ), by 3-3.5 mm wide ( $3.1 \pm 0.2$ ,  $n = 5$ ) by 1.2-1.8 mm high ( $1.4 \pm 0.2$ ,  $n = 5$ ). The branchlets were cut into small billets about 10-15 cm long and placed in plastic containers. During the following week, most of the adults (total 11) had emerged. Five were transferred to

another container and 6 remained in the original one. Over the next several days observations were made on their general and mating behaviour.

The new adults, after emerging from the wood were slow-moving. Within one to several hours, mating occurred. The male approached the female with the antennae vigorously moving each alternately up and down; when in close proximity to the female, the male touched the apical area of the abdomen with the antennal brushes before mounting and undergoing copulation. Copulation lasted 5-10 minutes. If an intruding male approached close, the copulating male would break away from the female and chase the other male way, with the antennae produced straight in front so that the brushes were prominently displayed and the remaining antennal segments bent backwards. The aggressor male would poke at the offending male with the antennae, and often moved them simultaneously up and down in an offensive manner. From my observations, it does appear that the two basal antennal segments and antennal brushes play an important role in the behavioural biology of this insect. These notes are provided since little is known on the biology of Australian Cerambycidae and the role of antennal modifications.

## REFERENCES

- McKeown, K. C. (1947). Catalogue of the Cerambycidae (Coleoptera) of Australia. Memoir X. Australian Museum, Sydney, pp. 1-190.

\*49 Venner Road, Annerley, Brisbane, Queensland, 4103.

# Yellow-Faced Whip Snake Taken by a Brown Falcon

BY W. M. BREN AND W. B. EMISON

The Brown Falcon (*Falco berigora*) is a diurnal, opportunistic hunter, which feeds on small mammals, birds, lizards, snakes and a variety of invertebrates (Frith 1976). It is one of Australia's most wide-spread bird species (Blakers *et al.* 1984) and it occurs in most terrestrial habitats in Victoria.

On 20 April, 1985 at 1300 hours, in the Sunset Country of NW Victoria (13.5 km NE of Millewa South Bore, 141° 11' 34" 42') a Brown Falcon was observed in the upper dead branches of a mallee. The vegetation at this locality was fire-regenerating mallee scrub of *Eucalyptus dumosa*, *E. gracilis*, *E. incrassata*, *Callitris verrucosa*, *Leptospermum laevigatum* (mallee form) and *Triodia irritans*.

When disturbed, the falcon took flight carrying a snake, which it dropped after flying a few metres. When the snake was retrieved, we found it to be barely alive, having severe puncture wounds to the lower one-third of its body and a fractured skull. The snake died about five minutes later and was immediately refrigerated. It was later identified by J. Coventry (Museum of Victoria) as a Yellow-faced Whip Snake (*Demansia psammophis*); a male, 70 cm in length. This species is a swift-moving diurnal snake which occurs throughout most of continental Australia, including the NW of Victoria (Cogger 1979).

Although most standard references indicate that the diet of the Brown Falcon includes snakes, they give few precise details. However, a summary of information available on snakes taken by Brown Falcons was recently published by Sonter and Debus (1985) and they list the following eight species of snakes as prey of this falcon: Eastern Brown Snake (*Pseudonaja textilis*); Copperhead (*Austrelaps superbus*); Red-bellied Black Snake (*Pseudechis porphyriacus*); Mulga Snake (*Pseudechis australis*); Western Brown Snake (*Pseudonaja nuchalis*); Mainland Tiger Snake (*Notechis scutatus*); Black Tiger Snake (*Notechis ater*); and White-lipped Snake (*Drysdalia coronoides*). To this list we can now add the Yellow-faced Whip Snake. Because of the widespread distribution of this falcon in Australia, it is likely that other species of snakes are preyed upon; more qualitative and quantitative data on this aspect of the diet of the Brown Falcon are required.

## REFERENCES

- Blakers, M., Davies, S. J. F. and Reilly, P. N. (1984). *The Atlas of Australian Birds*. Melbourne University Press, Melbourne.
- Cogger, H. G. (1979). *Reptiles and Amphibians of Australia*. A. H. and A. W. Reed, Sydney.
- Frith, H. J. (Ed.), (1982). *Complete Book of Australian Birds*. Reader's Digest Services, Sydney.
- Sonter, C. and Debus, S. J. S. (1985). The Brown Falcon *Falco berigora* a predator of snakes. *Aust. Bird Watcher* 11:92-93.

Arthur Rylah Institute for Environmental Research,  
123 Brown Street, Heidelberg, Vic. 3084.

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## Club Delegate

Council has appointed Mr Geoff Shepherd to the Melbourne and Metropolitan Board of Works Werribee Farm Wildlife Consultative Committee.

## Naturalist Review

### "Birds and other vertebrates of South West Tasmania (with emphasis on coastal environments)"

BY GARY WHITE

Published by the author, Gary White. Retail \$4.95.

South-west Tasmania is an isolated region with no roads and access is principally by foot or by boat around the coastline. As a result little information is available on the fauna of the region, except from scattered articles and notes in various books and journals, from museum records, and people's unpublished observations. This book is valuable to people visiting the region in that it provides a summary of these records on vertebrate animals (excluding fish) found on islands and the coast between Point Hibbs and Recherche Bay and as far inland as Strathgordon and the lower Gordon River. Previously it was difficult to find out what species you were likely to come across in this region without a tedious literature search.

*Birds and other vertebrates of South West Tasmania* is broken into a number of sections including an introduction; systematic treatment of birds including unconfirmed records and inland South West records; other vertebrates occurring in the area, divided into mammals, reptiles and amphibians; plus a reference section; acknowledgements; further reading and an index. In addition there are four full page monochrome prints.

In the systematic treatment each species is examined separately with generous referencing to past references of the species with the region. This is valuable for those who want to pursue individual records further. I feel, however, that in some cases these species treatments are too brief and leave the reader in limbo as to the true status of the species in the region. Also in some cases, too much emphasis has been placed on past references with little attempt to provide an overview of the species within the South West area.

The book is a handy size for people intending to tramp through the region on foot. Unfortunately there is no map with place names listed. This makes it difficult to know the whereabouts of some of the localities referred to in the text.

This book helps to indicate gaps in our knowledge of the South West vertebrate fauna. However, I find the title misleading — "with emphasis on coastal environments". A survey of the waders of all beaches on the south coast and north to Port Davey entrance by Schultz and Menkhurst (A survey of the waders of South-west Tasmania. *The Stilt* 5 (1984), 21-24) was not referred to. In the last few years the knowledge of seabirds occurring off the coast of South West Tasmania has increased. Many species commonly and/or regularly occurring off the coast have been left out (eg. Kerguelen Petrel, Bullers Albatross, and Thin-billed Prion), and some species that are included are more common than Gary White has indicated (eg. Fluttering Shearwater and Wilsons Storm-Petrel). Cetaceans have not been included.

The author uses current and recommended nomenclature for all groups. Unfortunately the annotated species list does not follow the order of Strahan (Recommended common names of Australian mammals. *Aust. Mam. Soc. Bull.* 6 (1980), 13-23) for mammals or Cogger, Cameron and Cogger (Amphibia and reptilia. In: *Zoological catalogue of Australia* Vol. 1 (Ed.) D. W. Watson, Aust. Govt. Publ. Serv., Canberra) for reptiles and amphibians. This is unfortunate in that it makes it confusing to readers used to these taxonomic orderings.

The author is obviously more at home with birds as some of the mammals, reptile and amphibian treatment are lacking in detail. For example, no information has been provided as to when hibernating mammals and reptiles are active or what time of the year the various frog species vocalize.

Such criticisms aside, Gary White's book has a good reference section, is well indexed and systematically covers all the vertebrate groups (excluding fish) found in the South

West. It is not only a must for naturalists and bushwalkers who would like to know what to expect in the area or the status of species they have seen — it is also an aid for those undertaking more serious surveys of fauna within the region. Hopefully it will provide an impetus for people visiting the area to report rare species which will in turn lead to a better understanding of the fauna of the region.

M. SHULZ

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### Frank Pinchen — Artist and Ornithologist

Frank Pinchen was one of those amateur naturalists of the 1940's and 1950's who preceded the environmental and conservation movements of the late 1960's. As he is now in hospital and unlikely to be independent ever again, it is time to acknowledge the work and talent of this modest man who was always on the fringe or in the background. His two most evident achievements were his lithographic work for the aborted Georgian House publication of W. H. Nicholls *The Orchids of Australia* and his work to save the helmeted honeyeater — now Victoria's faunal emblem.

Frank was born in Finley, New South Wales in 1917, the son of a land selector. He never went to secondary school but inherited his artistic talent from his mother. From the beginning his art was secondary to his study of wildlife, especially birds. After years of physical toil on the farms around Finley he came to Melbourne in 1940 to study art at Swinburne College and at the National Gallery Art School. The war interrupted his studies but after serving his country from 1941 until 1946 he was able to study full time in 1947 and 1948 at Swinburne Technical College. He then studied at the Melbourne Technical College under Harold Freedman and it was through this artist that he came into contact with Georgian House. Due to the efforts of its Director, Mr. Ted Harris, this publisher had decided to publish in twenty parts the paintings of William Henry Nicholls who had devoted his life to the study and painting of the orchids of Australia. It is recorded in the second

part that in order to improve the plates the publishers had switched to hand lithography by H. Freedman and F. Pinchen. Frank worked steadily and determinedly in Freedman's Boronia studios and in conjunction with his teacher, Freedman, did produce faithful copies of the original paintings by means of zinc plates. But the work was before its time and proved uneconomic. Paradoxically it may have been the last attempt to use hand lithography to reproduce wildlife paintings. After four parts were published, the project ended. Later, in 1969 Nelson published a one volume work by photographic means. Frank's lithographic talents are evident not only in the plates of the orchids but in the practice lithographs which he completed and which along with all of his life works have been lovingly preserved by his sister. Harold Freedman has stated that Frank's talents as an artist complemented his outstanding talents as a naturalist. To my amateur eye all of his work — his schoolboy bird book, the pencil portrait of the Princess Elizabeth, and especially the small water paintings for his projected Field Guide to the Birds of Victoria — reflect the beauty and simplicity of his soul.

At the beginning of the 1950's Frank began to join or attend societies and organizations such as the Royal Australian Ornithologists' Union, the Bird Observers' Club of Victoria, the Field Naturalists' Club of Victoria and the National Parks Association. His main interest and contribution was the fight to preserve the helmeted honeyeater. He was an important part

of the "Survey Cassidix" group, the President being E. Hanks and the Secretary Garnet Johnson. Frank drew the maps of the Yellingbo and other areas which the group needed to survey the habitat of the bird. This was a pioneering survey and many have recognised its worth and importance. Frank made over 200 trips to Yellingbo and seemed to want to keep a watchful eye on the subsequent successful fight to save the endangered bird. The papers relating to this Survey are in the National Library in Canberra.

There is much more to Frank's life than what I have mentioned, especially his skill as a bird photographer. Those who have seen his slides have acknowledged his patience and skill in the field. And yet Frank was always on the fringe, never at the centre of the early naturalist movements. In 1981, he proudly related how as a boy he had bought three New South Wales Gould League cards at ninepence each so that Cayley's book could be published. In 1952 he went to Central Australia with Crosbie Morrison and he also accompanied such men as Jack Hyett, Garnet Johnson, E. Hanks, Roy Wheeler, Hugh Wilson, the Mitchells, Murray Bouchier and Ralph Kenyon on many field trips and drew logos and large backdrops for the organisations with which he was involved. Mrs. Tess Kloot has informed me that she knows of four articles which he published in *The Bird Observer, Melbourne*, but perhaps the best way to end

this article is to quote three people talking on different aspects of his life.

'There is nothing I can teach you, Frank, you just need to practise'. (One of Frank's first art teachers in 1940. Told to me by Frank's sister in 1985).

'Frank is the greatest living authority on the helmeted honeyeater'. (A member of the Field Naturalist's Club of Victoria on Frank's 210 trip to Yellingbo. Said to myself on 20 Feb., 1977).

'Did Frank ever do anything less than well? (A lifelong resident of Finley and friend of Frank's on being asked by Frank's sister about his prowess on the trombone. Told to me by Frank's sister in 1985).

1. (a) "Report on the Yellingbo Outing", *The Bird Observer*, Melbourne, March 1955.
- (b) "Birds of the Sale District, Victorian Part I", *The Bird Observer*, Melbourne, September 1956.
- (c) "Birds of the Sale District, Part II", *The Bird Observer*, Melbourne, October 1956.
- (d) "Birds of the Sale District Part III", *The Bird Observer*, Melbourne, November 1956.

David McVilly  
January, 1986

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## Library Report 1985/86

This year has been one of overhaul and review of the Club library. Early in 1985 we were notified by CSIRO that as the Scientific Serials in Australian Libraries (SSAL) Supplement had ceased publication, and was being incorporated in the National Union Catalogue of Serials (NUCOS), produced by the National Library of Australia, the Club's holdings of periodicals should be revised and updated. Since this had not been done since 1957, it proved to be a complicated task, and a number of inaccuracies in our recorded holdings gradually emerged.

Because the Club holds items which are not readily available elsewhere Council was reluctant to withdraw completely from NUCOS, but suggested that our name should not appear for serials held by other libraries. The need to keep information current can pose problems for a library staffed by volunteers, but it is hoped that

when the review is completed the more significant entries will be incorporated in the National Union Catalogue.

Lack of space is a constant problem, and it was decided that for periodicals easily available from other sources, public, university and special libraries to which members have access, limited files only would be retained. The library holds almost complete sets of the proceedings of the Royal Societies of all the Australian states, and New Zealand, records of the Australian and state museums, the Kew Bulletin, and Microscopy, the journal of the Quekett Society, the Australian Journal of Botany, and of Zoology, and a variety of other organisations' publications, most of which are received on an exchange basis with the Victorian Naturalist.

During the year we were informed that the Museum of Victoria could no longer house the

Club's archives, and these were returned to us. At present they are stored in a rather haphazard fashion in the library, but plans are in hand for better organisation, a detailed listing, and measures to ensure their preservation.

In January, a working bee was held to reorganize the library to accommodate shelving and a steel cupboard returned to us from the Museum. The new arrangement has given us a little more space and appears to be working satisfactorily.

I should like to thank those who helped during a very strenuous day, Olive O'Hagan, Tom Sault, Mike Howes, Will Ashburner and Dr. Brian Smith. A stocktake was then begun, and has almost been completed, with generally satisfactory results. A proportion of the stock was found not to have been catalogued, and this is being remedied. Many of the books are being relabelled to facilitate location, and some are being reclassified.

In October, Council allocated \$300 for the purchase of books, of which about half has so far been spent. Efforts have been made to fill gaps in the stock and the library now has all the published volumes of the *Flora of Australia*, and a complete set of A. C. Beaglehole's reports

on the *Distribution and Conservation of Vascular Plants* in Victoria, as well as the majority of the Land Conservation Council Reports. The library has also benefited from donations from members, notably from the collection of the late Mrs. Bennett, who was a member for 66 years, Mr. Cliff Nance, Mr. John Strong, Dr. A. W. Beasley, Miss Madge Lester, and the Schultz family. In all 65 books have been added to the library during the year. Borrowings amounted to 91.

Several requests have been received to consult the archives, particularly the early Minute Books, and since the return of the archives to the Club, arrangements have been made for people to examine them in the Herbarium library. Our thanks go the Librarian, Helen Cohn, for this co-operation, and for her help in other ways. A number of other enquiries, mainly of an historical nature, have been received.

Finally, I should like to thank Mrs Olive O'Hagan for all the help she has given with the routine work, and in particular for her willing assistance and encouragement in all the extra tasks of the year.

Sheila Houghton  
Hon. Librarian

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## Gold Mining and Environmental Values

Concern has been increasing over the last few months about modern gold mining techniques involving wholesale clearing of mining claims. Advocates of this technology claim no long-term harm is done to the environment, and that their machines enable "cost-effective rehabilitation and regeneration" of the areas concerned.

It is difficult to get an overall assessment of the amount of environmental damage that may be occurring as a result of this modern goldrush. The Victorian National Parks Association is interested in collecting information from people familiar with affected areas. It would welcome accounts of the extent and locations of affected areas including effects on localized plant communities and rare species, and accounts of the effectiveness or regeneration techniques.

We therefore request that people with information write to:

Tony Faithfull, Vice President,  
Victorian National Parks Association,  
Box 785F G.P.O. Melbourne 3001.

## The Field Naturalists Club of Victoria One Hundred and Sixth Annual Report of the Council 1985-86

As at 23 October, 1985 the membership was as follows: Honorary Members, 45; Life Members, 6; Metropolitan Members, 316 (of whom 87 were Joint Members); Country Members, 166, (of whom 27 were joint); Retired Members, 104, (38 Joint); Student Members, 18; a total of 655.

This is a decrease of 83, or 11%, on the figures of the last report. The current decline in membership began in about 1982 and if it continues at the present rate will leave the Club with no members by 1996. The only membership category to show an increase is that of full-time students.

Council has made efforts to halt the decline in membership. These include the distribution of 2,000 publicity brochures, the appointment of a new Subscription Secretary and the mailing of personal reminder notices to unfinancial members. It is still too early to assess the effect of these measures.

In March, the new Governor of Victoria, His Excellency Dr. Davis McCaughey accepted an invitation to become Patron of the FNCV.

We recorded with regret the deaths of several members. Mr. Ernest Busby (joined 1967); Mr. David Lee, Secretary of the Club from 1966 to 1972 and a founder member of the Conservation Council of Victoria (joined 1963); Miss Mervyn Davis (joined 1948); and Mr. Frank Robbins, as Honorary Member (joined 1943).

Honorary Memberships were awarded to Mr. Geoff Shepherd, Mr. Brian Williams, Mr. Neil Burrows, Miss Joan Forster and Mr. Ron Kershaw for 40 years continuous membership, and to Miss Laura White for her outstanding contribution to the Club over a long period.

The Australian Natural History Medallion was awarded to Mr. Jack Hyett at the November meeting, easily the best attended of the year. The award recognised Mr. Hyett's magnificent achievements in ornithology, mammology and general natural history and his contribution to many naturalists organisations.

The Club published Mr. Hyett's most recent work, the "Species Index of Australian Native and Introduced Birds. Victorian Naturalist Volumes 1 to 100" during the year.

Average attendance at General Meetings was 48 persons. Speakers covered a variety of topics, and at the September meeting, the annual Members' Night, Mrs. Elsie Costermans and

Mr. Andy Blackburn gave illustrated talks on the Fraser Island Excursion, Mr. Lance Williams spoke on recent activities of the Mammal Survey Group, and Miss Wendy Clark talked on the Big Desert. Mr. Geoff Law of the ACF spoke on woodchipping.

Mr. Dan McInnes presented the best exhibits (particularly marine hydroids) and Mr. Tom Sault had the most interesting nature note with his record of kookaburras taking fish at Lake Eildon.

Day excursions were to Sherbrooke, Ripponlea, Point Cook Metropolitan Park, Winneke Dam, Healesville, the Mornington Peninsula and the Dandenongs, mainly by coach and some members attended the Halley's comet viewing sessions at Jells Park. Three week-long excursions visited Rotamah Island, Queensland (Rainbow Beach, Fraser Island, Noosa Heads, etc.) and Tasmania (Hobart the base). Two campouts led by John Milligan and Jim Willis were held at Creswick and the Baw Baws, and John Milligan led a day walk in the Stoney Creek area near Clonbinane. The Club was represented at the VFNCA weekends at Maryborough in October and Porepunkah in March. The excursion programme was supplemented by the many field trips organised by the Groups.

Miss Marie Allender has held the position of Excursions Secretary since 1954. An Excursions Subcommittee of Council drew up a series of guidelines for Club excursions, presented in July, among which was the proposal for the formation of a smaller committee, to work with Miss Allender (in light of her intention to retire either this year or in 1987) and learn the 'secrets' of running a successful excursion programme.

All Office Bearers and Council Members were elected unopposed. (There were no nominations for Vice-President, Assistant Secretary, Assistant Treasurer, Assistant Librarian, Editor and Assistant Editor). The Editorial Committee, having indicated their willingness to continue, were reappointed. Messrs Will Ashburner and Bertram Lobert were appointed to the two vacant positions on Council in June and October respectively. Dr. Smith resigned as President in December, preceding his move to Wangaratta, and Mrs Houghton, who accepted appointment as Vice President, has been Acting President for the rest of the year. Mr. Graeme Love was appointed to fill the Council vacancy thus

created. Bob Graham volunteered to become Conservation Co-ordinator in January.

FNCV action on conservation issues was minimal. There were but two questions on which there was involvement: road widening in the Errinundra Flora Reserve and clearing for agriculture in the Mallee. Messers Lance Williams, Michael McBain and Ian Faithfull have alternated as Club representatives on the Conservation Council of Victoria. Mr. Faithfull has presented written reports on these meetings at Club Council. It is disappointing that this major object of the Club: "To take all steps as may be considered most effective to conserve and protect the natural environment. . ."; has been so poorly fulfilled. No submissions were made to the Land Conservation Council despite their release of a number of major reports during the year.

The Club owns two properties, at Kinglake (The Harold Frahm Bird Refuge), and Maryborough (The Walter (Jim) and Louisa Cosstick Wildflower Reserve). Working bees have been held at Kinglake to keep the property useable and fire safe, to control blackberries and to further a continuing regeneration study in the northern section of the property. The Maryborough Field Naturalists Club has continued as custodian of the Cosstick Reserve. In the middle of last year the Reserve was refenced, primarily through their work, after the devastating wildfires of January. Most recently their vigilance led to the arrest of a thief who had removed a large section of rabbit proof wire from the fence. The efforts of the MFNC have now boosted the native vascular plant list of the reserve to 66. A large grant as received from the Department of Agriculture under bushfire relief for refencing and for this we are grateful.

Monetary assisting from the Department of Conservation, Forests and Lands was received for a project, proposed and conducted by Margaret Blankers and John Woinarski, involving the recording of the oral history of old time Victorian naturalists. The \$4,000 received is enabling the completion of stage 1 of the project. \$1,500 was received from the Department of Management and Budget as continuing assistance with the publication of the Victorian Naturalist. We tender our thanks.

Major donations have come from the estate of the late Eulalie Bennett who joined the Club in 1918 at the age of 26 (\$500 and valuable books), and from Mr. A. F. Busby (an almost complete set of the Victorian Naturalist Vols.

1-100). We are also grateful for the numerous smaller donations.

The Victorian Naturalist Editorial Committee consisted of Ms. Joan Phillips, Mr. Russell Thompson, Mr. Peter Lawson, Miss Diana McClellan and Mr. Lance Williams, who each took charge of a separate issue. A significant cost increase was announced by Jenkin Buxton Printers in January (after no change since May 1984). 1,000 copies of a 40 page issue will now cost \$2,175 plus extras, roughly \$55 per page. During the year the main articles covered a wide range of subjects from entomology, botany and herpetology to land management and natural history publication. There was some emphasis on ecology, particularly pollination. Eight major excursion reports were published. The Naturalist remains a quality journal, in many ways the best thing the Club does, but page limitations imposed to contain costs have restricted the content. The cost containment has, however, been effective. A number of issues have appeared very late due to a number of causes. Miss Allender proposed a new publishing format in mid 1985 with 10 issues per year and two magazine style supplements of a similar quality to the present Naturalist. Council spent considerable time on this proposal, but, taking into account, amongst other things, the small number of opinions submitted by members, it was agreed that the present format be maintained.

There has been a very small increase in the number of subscribers to the Victorian Naturalist.

Problems have again been encountered with the provision of the Australian Natural History Medallion. Matcham Skipper, the sculptor, has informed us that further medals will be charged at a rate higher than the \$250 for the new medallion obtained in 1986.

The special interest Groups have continued to play a major role in the Club. Particularly noteworthy have been the Mammal Survey Group's work in the Big Desert and their rock wallaby survey in the Grampians. The past year has seen many beneficial changes in the library. Reports on all these activities will appear in the Victorian Naturalist.

Amongst other developments of interest during the year was the announcement of plans for extensions to the National Herbarium (a Club submission was presented on this).

Our thanks go to those members who have contributed their time and skills to the benefit

of the Club, in particular to Mrs Helen Stanford, our indefatigable Book Sales Officer, who is an important revenue raiser for the Club, and Miss Christine Shankly, who has combined the onerous duties of Programme Secretary and Club Reporter. Without her efforts we would not have speakers at General Meetings, and I am sure she would welcome suggestions for future meetings and assistance in making meetings more noteworthy. Others to whom our thanks are due are Mr. Urwin Bates, Mr. Ian Gillespie, who has maintained and operated our public address system since about 1962, and Mrs. Olive O'Hagen who continues to assist regularly in the library. For those who remain unmentioned I hope there is some solace in anonymity.

In conclusion, a note of pessimism. The Club has a fine tradition, but an uncertain future. It

is all very well to survive but even this is not assured anymore. In an environment of increasing leisure time and continuing public interest in natural history we should prosper and expand. Our age profile is not representative of the broader population, but skewed towards older groups. I believe much more effort needs to be devoted to youth. A bit of adventure in field excursions, some innovative projects, new directions and energy are needed. We need the idea and the people to implement them. It is our responsibility here tonight to entrust the future to a new Council and new Office Bearers.

IAN FAITHFULL,  
Hon. Secretary,  
11 May, 1986

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## FIELD NATURALISTS CLUB OF VICTORIA

### Reports of recent activities

#### **Annual General Meeting Monday, 12th May**

The annual report of the Club for 1985/86 was read by the Hon. Secretary, Mr Ian Faithfull. The report is printed in full elsewhere in this issue.

The Treasurer's report for 1985 was then read by the treasurer, Mr Noel Disken. Financial statements are printed in full in the March/April issue of the Naturalist.

#### **Election of Office-bearers and Council Members**

Officers elected: President; Dr. Jack Douglas, Hon. Treasurer; Ms Yvonne Gray, Assist. Treasurer; Mrs Helen Stanford, Editorial Committee; Mr Russell Thompson, Miss Diana McLellan and Miss Vicki Spencer, Librarian; Mrs Sheila Houghton, Excursion Secretary; Miss Marie Allender. Offices vacant: Vice-president, Hon. Secretary, Assist. Secretary, Assist. Librarian, Programme Secretary.

Council Members elected: Mr Peter Griffiths, Mrs Helen Stanford, Mr Graeme Love, Miss Helen Bartoszewicz, Mrs Sheila Houghton, Miss Marie

Allender, Ms Yvonne Gray, Miss Christine Shankly, Mr Stephen Forbes, Mr Michael Howes and the president, Dr Jack Douglas.

Other positions: Conservation Co-ordinator, Mr Bob Graham, Club Reporter; Miss Christine Shankly, Conservation Council of Victoria Representatives; Mr Bob Graham, Mr Michael McBain and Mr Ian Faithfull, Book Sales Officer; Mrs Helen Stanford, Vic. Nat. Sales Officer; Mr Dan McInnes, Publicity Officer; Miss Margaret Potter. Vacancies still exist for an Information Officer and a Tea Person for General Meetings.

The newly elected President, Dr Jack Douglas then took the chair and introduced himself. He has had a long association with the Club, having been a member for 20 years and highlighted the need to revitalize the Club and attract new and young members. Dr Douglas then introduced Mrs Sheila Houghton, the retiring Acting President to give the Presidential address.

Mrs Houghton gave a very interesting talk entitled "Did You Know? Glimpses

of the Club's History", which was not intended to give a complete history of the Club, but rather glimpses at some of its activities over the past 106 years. As FNCV Librarian, Mrs Houghton had spent considerable time going through the Club's archives and rearranging the library and in doing so had uncovered many items of interest.

Some of the things Mrs Houghton spoke of were the various ways in which Club anniversaries had been celebrated over the years, some of the more notable excursions, the botanical artist Amy Vardy Fuller and her paintings and the Club's long involvement with conservation issues.

Mrs Houghton finished by pointing out the need to assess the changing role of the Club in the community and the expectations and needs of new members, as unless we are able to satisfy them our membership will continue to decline. Her talk was illustrated with a selection of slides and exhibits.

#### Nature Notes

— A Yabby seen walking about in the middle of the day, probably a land yabby. Mrs Hilary Weatherhead.

— A Brown Goshawk has taken three young chickens from her North Balwyn backyard. Miss Wendy Clark.

— A Grey-headed Fruit Bat seen hanging from electricity wires for several days at Rosebud. And about fifty bats were seen feeding on insects in daylight over the water of the Delatite Arm of Lake Eildon last month. Mr Tom Sault.

— It was observed by his father that there are not nearly as many bats around these days as there used to be. Dr Jack Douglas.

#### Exhibits

— In illustration of her talk: Old photographs of Club excursions and events, anniversary and nature show programmes, a picture of Herbert Bennett Williamson (for many years Assist. Secretary and Librarian), a FNCV banner, Australian and African wildflower paintings by Miss Amy Vardy Fuller (1869-1944), a large copper billy engraved with the Club

emblem made for and presented to the FNCV in 1950 by Mr J. Glover of Wonthaggi, an old Australian Natural History Medallion, a portrait of H. P. Dickens and the 1980 Victorian Conservation Prize — a painting by Neil Douglas, awarded to the Club. Mrs Sheila Houghton.

— Under microscopes: A nudibranch, a small leech, the colonial, freshwater green alga, *Scenedesmus* and some marine hydroids from Balnarring sent in by Mary Doery. Mr Dan McInnes.

— A small wasp from an oak leaf — the source of oak leaf miner caterpillar. Mr. Urwin Bates.

— Ostracods from his garden pond. Mr Russell Ward.

### General Meetings

#### Monday, 16th June

The Speaker for the evening was Dr Robyn Adams of Victoria College, Rusden who spoke on the "Distribution of *Callitris* in Victoria and some Interesting Populations Close to Melbourne".

*Callitris* is a coniferous genus of about fourteen species, five of which occur in Victoria. They are very attractive trees and being easy to germinate and grow, make fine garden specimens.

Dr Adams described the Victorian species and their distributions. Although they are fairly widespread, mixed stands of more than one species of *Callitris* do not occur, apparently because of the narrow requirements of each species.

In the past *Callitris* species have been widely exploited for their durable timber or cleared to make way for agriculture so their present patchy distribution may represent only the remnants of their former range.

There are several small and isolated occurrences of *C. columellaris* and *C. endlicheri* close to Melbourne. These and other existing stands of *Callitris* are frequently under threat due to clearing by man, erosion, fire and the grazing of seedlings especially by rabbits. Threatened

populations need to be recognized and steps taken to ensure their survival and regeneration.

An article by Dr Adams on this subject has appeared previously in this journal (Vic. Nat. 102: 48-51).

#### Nature Notes

— Many Grey Kangaroos seen at Yan Yean Reservoir.

— Several species of birds seem to be increasing in abundance around North Balwyn lately, including Willy Wagtails, Magpies, Grey Fantails and pardalotes. Miss Wendy Clark.

— Fifty or more Cape Barren Geese seen on the eastern side of Shallow Inlet, Wilsons Promontory. Mr K. Marshall.

— At Mallacoota in May — a small marsupial? mouse on a track was quite unafraid of observer even sitting on his

foot. A lyrebird was also seen at close range. Mr Richard Faragher.

#### Exhibits

— Under microscope (one of which was 120 years old): Pond life from Caulfield Racecourse Lake including the rotifers *Conochilus* and *Asplachna* and sections of porphoritic basalt and feldspar under polarized light. Mr Dan McInnes.

— The small cup-fungus, *Anthrocobia muelleri* and the bird's-nest fungus *Nidula emodensis* from the Metcalfe Flora Reserve. Mrs Sheila Houghton.

— A newly emerged moth, *Oenochroma vinaria*, which had developed from a caterpillar on a *Grevillea* in her garden. Miss Wendy Clark.

— Pupae of the Imperial White Butterfly, *Delias harpalyce* on a twig of the mistletoe *Amyema pendula*. Mr Tom Sault.

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### V.F.N.C.A.'s 1986 LABOUR DAY WEEKEND EXCURSION TO POREPUNKAH

Friday, March 7th proved to be the hottest day of the year and although the 27 of us in the bus enjoyed the views while travelling north-east through Alexandra and Mansfield, Whitfield, Dandongdale to Myrtleford, then along the Ovens Valley Highway to Porepunkah, that valley certainly lived up to its name as it was over 36°C when we arrived at our destination. The Buffalo Park Ranger told us that it was 30°C on the summit and that the temperatures rarely rise above 25°C, so that after more than eight hours travel in a non-air-conditioned bus we were ready for the amenities of Nonameena Lodge. It is situated at the entrance to the Buffalo Park, opposite the old Buffalo Lodge built circa 1867 as the first accommodation and staging post for the intrepid mountaineers. Baron F. von Mueller, the first to explore the mountain, may have ascended via Goldie's Spur. Goldie was first to climb the great granite massif in 1845.

At 5 a.m. on Saturday, March 8th, most of the party assembled in front of the Lodge to marvel at Halley's Comet visible

to the naked eye as a smudged star, most continued to rise for more viewing at an unearthly hour during the weekend.

At 1 p.m. the following day Saturday, 8th March, 63 members from 13 clubs around Victoria were welcomed and we set off for a glorious trip per bus up the Buckland Valley, led by Mr Eric Jackson of the Wangaratta Club. We were dismayed to note the overgrowth of blackberries in all the ravines and river banks and the still visible evidence of soil erosion, wash aways of the stones and general devastation left by the gold rush of the mid-19th century.

The bus made three stops where we botanized and bird watched and visited the river, noting dams and built up sluicing areas probably erected by Chinese gold miners. The third stop was made just over a narrow bridge across a fork of the Buckland River where on July 4th, 1857, 500 European gold miners set upon 2500 Chinese miners at 11 a.m. and drove them entirely out of the valley before 4 p.m. the same day. An unknown number of Chinese were killed, some of these lie buried at

Beechworth Cemetery, the bodies of others were hidden in thick bushland, however their huts and holdings were savagely destroyed.

After dinner, a short Annual General Meeting was held in the Recreation Hall. As there were no other nominations, Mr Albert Perry of the Creswick Club accepted the Presidency of the Club for a second year and gave a short Presidential address and Dr Elizabeth Turner agreed to continue as Secretary/Treasurer for another year. At 8 p.m., the Buffalo Park Ranger Bob Adams, gave an interesting slide show on the history and natural history of Buffalo National Park. It was suggested that the Springtime Get-Together on October 4th and 5th 1986, be held in the Linton and Devil's Kitchen area.

On Sunday, March 9th, Mr Arnold Piesse of Wangaratta acted as courier and leader for an all day excursion to Buffalo. Mr Piesse pointed to a section of the roadside where the sandstone gave way to granite and the vegetation altered just as suddenly from Peppermint eucalyptus forest to Brittle Gum (*E. mannifera*) to Mountain Grey Gum (*E. cypellocarpa*) and higher up Alpine Ash (*E. delegatensis*). He also said that it took 30 years before the Alpine Ash was old enough to produce seed and that these seeds must rely on being frozen and also being burnt before germinating, we noted the occasional bright red leaves of the Alpine Ash characteristic of the young sapling.

Some members walked up to the top of the Horn and after a picnic lunch, many members walked downhill to Lyrebird Plain. Much of this area had been burnt out in the January 1985 bushfires, however the snow gums (*E. pauciflora*) had begun to regenerate from their underground ligno-tubers and the roadsides were ablaze with the gold of the flowers of the Fireweed Groundsel (*Senecio linearifolius*) and several bright orange to pale gold Everlastings, chiefly the orange (*Helichrysum acuminatum*); the curling everlasting (*H. scorpioides*), the pale (*H.*

*rutidolepis*) and the branched (*H. adenophorum* var. *waddellae*) which had large white flowers with the outer bracts pink. The cascade everlasting (*H. thyrsoideum*) made a beautiful display with loose reddish white clusters.

Clumps of lilac veined mountain gentian (*Gentianella diemensis*) were in flower on the snow plains and we found the Mauve Leek Orchid (*Prasophyllum suttonii*). Blue violets (*Viola betonicifolia*) made a lovely ground cover as well as the granite buttercup (*Ranunculus graniticola*) which was in flower on the grassland and in sphagnum bogs.

In contrast to our overhot journey on the previous Friday, a cold, almost snowy wind prevailed and there was a good rainfall in the afternoon.

After dinner on Sunday, March 9th Club reports were heard from representatives of the following Field Naturalists Clubs:

1. Albury-Wodonga — Anne Davies and May Pagenstecher
2. Benalla — Mrs Jane Priest
3. Creswick — Edna Williams
4. Maryborough — Thelma Argall
5. Mid-Murray — Grace Willoughby
6. Mt. Martha — Mr Daffin
7. North-East — Mr Arnold Piesse
8. Peninsula — Florence Hosking
9. Stawell — Ian McCann
10. Victorian F.N.C. — Marie Allender

Dr Roger Briggs of Myrtleford gave a slide session of outstandingly superior photography of Native Terrestrial Orchids.

A large log fire heated the Recreation Hall on Monday morning, March 10th and the remainder of the Clubs reports were heard. The President, Albert Perry, gave votes of thanks to the management of Noonameena and to Helen Stanford, who manned the book stall and to the guides on the excursions. Dorothy Dawson recorded 52 species of birds; Honey Eaters were well represented, as well as the Satin Bower bird and Boobook Owl.

Votes of thanks were passed to the President and the Secretary/Treasurer for a thoroughly enjoyable weekend.

Dr Elizabeth K. Turner

## 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
\$18	\$25	\$35	\$45	\$55	\$65	\$75

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.

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## Special Note for Authors Using Wordprocessors

Many wordprocessing 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 Russell Thomson, 17 Powlett St., Heidelberg. 344 5704 (B.H.).

(Continued from inside front cover)

accommodation available in Adelaide on the 21st so I have booked some sleepers on the Overland in case they are required, these are \$73 one way only. Anyone wanting one should contact Marie Allender and include the fare with their deposits. Some rooms at the Grosvenor have also been reserved on the 28th,

let me know if you need one — \$45 twin share. Final payments should be paid by the 8th September.

**Preliminary Notice:** There will be an excursion to Harrietville for a week in January 1987, starting Saturday, 11th January and an Alpine campout Australia Day Weekend. Details later.

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## GROUP MEETINGS

FNCV members and visitors are invited to attend any Group Meetings.

### Day Group — Third Thursday

Thursday, 28th August (note change of date). Mounted Police Depot, St. Kilda Rd., Meet at the entrance of the National Gallery at 10.45 a.m. Leader: Betty Gillespie 587 1879.

Thursday, 18th September. Warrandyte. Catch the 10.31 a.m. Warrandyte bus at the corner of Russell and Flinders Sts., (next bus 12.30 p.m.) Return bus leaves Warrandyte at 2.30 p.m. Leader Joan Miller 836 2681.

Thursday, 16th October. Zoological Gardens. Meet at Royal Park Station at 11.30 a.m. Leader Ian Gillespie 587 1879.

At the National Herbarium, Birdwood Ave., South Yarra at 8 p.m.

### Botany Group — Second Thursday

Thursday, 14th August. "Endangered Plants". Mr David Cheal.

Thursday, 11th September. "Sandringham Flora Revisited". Ms Daintrey Fletcher.

Thursday, 2nd October (note change of date). "Prostanthera and its Allies — a Discussion of Problems and Diversity". Mr Barry Conn.

### Geology Group — First Wednesday

Wednesday, 6th August. Mineral workshop.  
Wednesday, 3rd September. To be announced.  
Wednesday, 1st October. To be announced.

### Mammal Survey Group — First Tuesday

Tuesday, 5th August. To be announced.  
Tuesday, 2nd September. To be announced.  
Tuesday, 7th October. To be announced.

### Microscopical Group — Third Wednesday

Wednesday, 20th August. "Early Books on Microscopy and Natural History". Mr. John Dawes.  
Wednesday, 17th September. "Eggs of Moths and Butterflies and Slime Moulds". Mr Urwin Bates.  
Wednesday, 8th October (not change of date). "Pollen and Diatoms in Victorian Brown Coal". Mr R. Graham.

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## GROUP EXCURSIONS

All FNCV members and visitors are invited to attend Group Excursions

### Botany Group

Saturday, 23rd August. Warrandyte — Acacias. Leader: Mr Ian Morrison.

Saturday, 27th September. Sandringham — Bay Road Reserve and Beaumaris H.S. Heathland. Leader: Ms Daintrey Fletcher.

Saturday, 25th October. Courney's Rd. Leader: Mrs Hilary Weatherhead.

### Mammal Survey Group

Saturday 16th — Sunday 17th August. Rushworth.

# 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 1985-1986

*President:* Dr JACK DOUGLAS, 42 Sunhill Rd., Mt. Waverley, 3149 (277 4804 A.H.)

*Vice President:* Mr G. LOVE, P.O. Box 2018, St. Kilda West, 3182.

*Secretary:* Mr M. D. HOWES, c/o R.M.I.T. Dept. of Applied Biology, G.P.O. Box 2476V, Melbourne, 3001.

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

*Subscription-Secretary:* Mr N. STANFORD, c/- National Herbarium, Birdwood Avenue, South Yarra, 3141.

*Editorial Material:* The Editorial Committee, Victorian Naturalist, FNCV, c/- National Herbarium, Birdwood Ave., South Yarra, 3141.

*Librarian:* Mrs SHEILA HOUGHTON, FNCV, 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:* Miss CHRISTINE SHANKLY, 50 Glyndon Road, Camberwell, 3124 (836 7187 A.H.)

*Conservation Co-ordinator:* Mr BOB GRAHAM, 147 Broadway, Reservoir, 3073.

*Sales Officer (Books):* Mrs H. STANFORD, 100 Middlesex Road, Surrey Hills, 3127 (830 1505)

*Sales Officer (Victorian Naturalist only):* 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.)

*Mammal Survey:* Mr LANCE WILLIAMS, 29 Erica Crescent, Heathmont, 3135 (879 1962 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 1986

Metropolitan Members (03 area code) .....	\$20.00
Joint Metropolitan Members .....	\$22.00
Country/Interstate/Retired Members .....	\$18.00
Joint Country/Interstate/Retired Members .....	\$20.00
Student (full-time) .....	\$14.00
Junior (under 18; no Victorian Naturalist) .....	\$3.00
Subscription to Victorian Naturalist .....	\$18.00
Overseas Subscription to Victorian Naturalist .....	\$25.00
Affiliated Clubs .....	\$20.00
Subscriber Clubs .....	\$18.00
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# The Victorian Naturalist

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NATURAL HISTORY



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## FNCV DIARY OF COMING EVENTS

### GENERAL MEETINGS

**Monday, 6th October, 8.00 p.m.**

(Note Change of date).

Dr. Jim Willis. "The Botanical Explorations of Baron von Mueller"

**Monday, 10th November, 8.00 p.m.**

Mr. Michael Howes. "Isopods";

**Monday, 8th December, 8.00 p.m.**

Australian Natural History Medallion Presentation (from November).

Awarded to Mr. Graham Pizzey.

**New Members 25-5-86 — 16-7-86**

#### *Metropolitan*

Miss Louise Patrice Brown  
1 Florence St., Glen Waverley, 3150  
Miss Deborah Campbell  
21 Eloura Ave., East Brighton, 3187  
Mrs. Elaine Heggie  
5 Le Mans Court, Doncaster, 3108  
Mrs. Joan Wallis,  
7 Dudley St., Mitcham, 3132  
Mr. Charles R. Collett  
23 Hope St., West Footscray, 3012

Mr. Arthur Singe  
22 Suffolk St., Wantirna, 3152  
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42 Sunhill Rd., Mt. Waverley, 3149  
Mr. Michael Harvey Kottek  
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### FNCV EXCURSIONS

**October weekend campout** in the Warby Ranges.  
Leader: John Milligan. Ring Will Ashburner 789 8485 (A.H.) for details.

**Wednesday, 22nd - Tuesday, 28th October.** Kangaroo Island. See last Naturalist for details or contact Marie Allender 527 2749.

**Tuesday, 4th November.** Antonia Park and Yarren Dheran. Meet at Antonia Park picnic area at 11 a.m. Bus 303 from Mitcham Station passes the Park but there may be a special timetable on Cup Day, so check about a fortnight before as details are not presently available. Would members going by car who could pick up someone at the station in case of transport problems please let Marie Allender know. Bring a picnic lunch.

**Sunday, 30th November.** Club break up picnic at Kinglake block at 1.00 p.m. There will be some jobs to be done on the property but plenty of time to enjoy

ourselves. There will be a coach leaving Batman Avenue at 9.30 a.m. (fare \$10.00) which will go to Winneke Reservoir on the way and reach Kinglake before lunch. Bring your own food (BBQ if desired, weather permitting) and drink. Members travelling by car will be welcomed any time after 10 a.m.

**Saturday, 10th - Friday, 16th January 1987** Harrierville with day trips to Mt. Hotham and other alpine areas etc. Accommodation has been booked in a new complex on a D.B.B. basis. The complex has a heated indoor/outdoor swimming pool, tennis courts, table tennis, laundry, kiosk etc. Our coach will leave Flinders St. outside the Gas and Fuel Building at 8.30 a.m. Bring a picnic meal. Cost approximately \$330. Please send \$50 deposit to the excursion secretary, Marie Allender when booking.

**Australia Day Weekend 1987.** Alpine campout. Contact Will Ashburner, 789 8485 (A.H.) for details.

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### GROUP MEETINGS

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

#### **Day Group - Third Thursday**

Thursday, 16th October. Zoological Gardens. Meet at Royal Park Station at 11.30 a.m. Leader: Ian Gillespie 578 1879.

Thursday, 20th November. Kananook Creek Walk, Frankston. Catch 10.20 a.m. Frankston train at

Flinders Street Station, arrive at Frankston Station 11.23 a.m. Leader: Marg Wilson.

No meeting in December or January at the National Herbarium, Birdwood Avenue, South Yarra at 8.00 p.m.

(Continued on I.B.C.)



# The Victorian Naturalist

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Cover Illustration: Krefft's Tortoise - Photo C. Banks.

# Rediscovery of *Pterostylis woollsii* R. D. Fitzgerald in Victoria After Half a Century.

BY DAVID\* AND CAM† BEARDSSELL

*Pterostylis woollsii* is one of the most spectacular Australian terrestrial orchids. It is an endangered species largely restricted to granite outcrops in the Tablelands and Western slopes of N.S.W. It was described by R. D. Fitzgerald in Australian Orchids 1 (2) published in 1876. It was the first recorded in Victoria by Edith Rich in 1928 in exposed "bush near Rushworth" (Nicholls 1928). This specimen illustrated by W. H. Nicholls in *Orchids of Australia* (1969) is now located in the Melbourne herbarium (MEL. 578483). The private herbarium of the late J. J. Leppitt also contains a well preserved specimen of *P. woollsii*. This herbarium sheet is labelled *Pterostylis woollsii*, Rushworth, Miss A. C. Holden, November 1, 1940. On Saturday, October 22, 1984 we located a single specimen of *P. woollsii* near Rushworth while carrying out a population survey of the endangered *Pterostylis setifera* (Clements, Matthias and Jones 1984). The specimen, growing among several plants of *P. setifera*, was still in bud and at that stage not determinable as *P. woollsii*. Since the sepal points were just emerging from the floral bract we surmised that the plant was *P. biseta*, or possibly even *P. woollsii* for which we were also systematically and hopefully searching. On Sunday, November 11, the second author accompanied by Jeffrey Jeanes returned to the site and, the unidentified greenhood was instantly recognised as *P. woollsii*. After some searching a further ten individuals were found growing in open areas among *Eucalyptus*

polybractea. Further searching on November 16 resulted in the location of a total of 34 specimens, nine at another site under *Eucalyptus microcarpa*.

From the information provided by Nicholls (1928) it would seem that the present sites are in different locations to where Edith Rich found *P. woollsii* in 1928. It is worth noting that *P. woollsii* in the present localities is robust, with some specimens having up to four flowers, each lateral sepals 12-14cm in length. Generally only one flower is open at one time. The present Victorian specimens of *P. woollsii* are similar to that illustrated by Fitzgerald (note that the plant figured in the centre of Fitzgerald's plate is smaller than life size). Most of the present specimens are however green rather than the brown colour depicted by both Fitzgerald (1876) and Nicholls (1928).

It is amazing that such a large, yet delicate plant as *P. woollsii* can grow in hard, stony soil which is too hot to touch after exposure to the November midday sun.

## Acknowledgements

This note is dedicated to the late J. J. Leppitt, whose encouragement was largely responsible for the rediscovery. The rediscovery was shared with Jeffrey Jeanes and John Eichler whose knowledge and enthusiasm played an important role. We would like to thank Miss D. Irvine for word processing, and Dr. E. G. Williams for correcting the manuscript.

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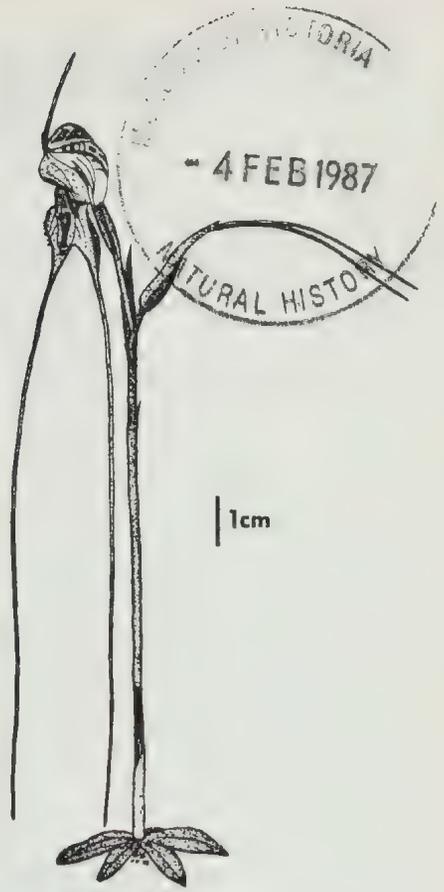


Figure 1. Typical Victorian specimens of *P. woollsii*.

REFERENCES:

Clements, M. A., Matthias, I. G. and Jones, D. L. 1984. A new species of *Pterostylis* (Orchidaceae) from south eastern Australia. *Kew Bull.* 40. 77-80.  
 Fitzgerald, R. D. 1876. *Australian Orchids*. 1 (2), N.S.W. Government Printer.

Nicholls, W. H. 1928. A new Victorian greenhood. *Pterostylis woollsii*, Fitzg. *Victorian Nat.* 45: 223-224.  
 Nicholls, W. H. 1969. *Orchids in Australia*. Complete edition (ed.) D. L. Jones and B. Muir, Nelson, Melbourne.

# Fire Damage and Regeneration of *Dendrobium speciosum* Sm. (Orchidaceae) in Eastern Victoria

PETER B. ADAMS\*

## Abstract

The intense fires of March 1983 extensively damaged lithophytic Victorian colonies of *Dendrobium speciosum* Sm. (Large Rock Orchid) at the southern limit of its distribution. Lightly burnt plants suffered damage to leaves only, and were capable of flowering and seed set in the following spring. Moderately burnt plants lost all leaves and part of the root system, and pseudobulbs were desiccated. These plants did not flower in the subsequent flowering season. Severely burnt plants suffered incineration of pseudobulbs to charred stumps. In November 1983 most plants were regenerating strongly from basal shoots, exhibiting a greater than ten fold increase over the number of new shoots produced by unburnt plants. All plants were regenerating in April 1984. Stimulation of vegetative growth by fire, survival in protected sites, and seed production are predicted to return the colonies to pre-fire condition in a few years. *Dendrobium speciosum* is an orchid with a high resistance to fire damage and a strong regenerative capacity which is a feature of many other Australian plants.

## Introduction

Few details are known of the natural history of orchid species of south-eastern Australia, and particularly of the effects of fire on epiphytic and lithophytic orchids. Fire enhances vegetative growth of some terrestrial orchids, and may increase (Jones, 1968; Hansen 1964; Barnett, 1984) or decrease (Barnett, 1984) flowering in the following spring. A rare opportunity for study was provided by the catastrophic fires of March 1983 which



Figure 1 Mature unburnt plant of *Dendrobium speciosum*, one metre in height.

burnt 125,000 ha of forest in eastern Victoria.

*Dendrobium speciosum* is a common lithophytic and epiphytic orchid along the east coast of Australia from Cape York Peninsula to East Gippsland. In Victoria, colonies of the lithophytic variety *speciosum* grow a metre in height and more than a metre in diameter. Each plant consists of numerous pseudobulbs (canes) which are thickened at the base and taper towards the apex where they are topped by thick, leathery, ovate leaves (Figure 1). There is a mass display of pale yellow flowers annually in November. This paper outlines the effects of fire on one of Australia's largest and best known orchids and describes adaptive responses which ensure survival.

\*School of Botany, University of Melbourne, Parkville.

No. plants	Plant size range diam. (cm)	No. plants with new growths	No. new growths on each plant	**Mean No. of new growths per 1m diam. plant $\pm$ S.D.	No. plants flowering	Total No. racemes	Conversion flowers to pods (%) $\pm$ S.D.
16	40-110	4	3, 2*, 4, 3	1.2 $\pm$ 1.0	9	31	13 $\pm$ 9

\* flowering plant

\*\* A parameter adjusting number of new growths per plant (column 4) for plant size obtained by calculating number of new growths produced for a standard 1 metre diameter plant, consisting on average of 75 pseudobulbs (canes).

S.D. Standard deviation.

**Table 1** Unburnt Site (Site 3)

### Sites

Three study areas were selected in Croajingolong National Park, East Gippsland, where *D. speciosum* is shaded by an overstorey of *Eucalyptus sieberi* (Silver Top), *E. muelleriana* (Yellow Stringybark), *E. globoidea* (White Stringybark), *Tristania laurina* (Kanooka), and *Casuarina littoralis* (Black She-Oak). Four years of drought prior to March 1983 had produced a thick accumulation of debris around the orchid plants. Two study sites 1 km apart with moderate and severe fire damage were selected. Initial studies were conducted in August 1983 and April 1984.

At Site 1, plants on a rocky ridge 50m above a rainforest creek took the full impact of a fire which blazed intensely through dense dry forest. All orchids at this site were severely damaged. At Site 2, a lesser amount of damage resulted to a colony distributed over a wider area on an exposed outcrop of lichen-covered granitic rock. Some plants, sheltered by large boulders and in crevices, escaped damage. A third and unburnt site (Site 3), 10 km from the burnt area in similar terrain was selected for comparison. At both burnt sites small plants from 1-10 cm diameter survived.

### Results

#### Degrees of Fire Damage

Fire damaged plants were classified into three main types:

- (a) Lightly burnt: leaf shedding and heat damage
- (b) Moderately burnt: desiccation of pseudobulbs with complete loss of leaves; partial damage to root system
- (c) Severely burnt: incineration of pseudobulbs to charred stumps; complete loss of root system

Moderate damage was characterized by a total loss of leaves, drying and shrinking of canes, *without* their actual burning (charring). Roots of desiccated plants were largely burnt, along with the overlying lichen and moss mat, leaving a fibrous skeleton of dead roots up to two metres in diameter surrounding larger plants. Some plants were poorly attached to their substrate.

Only when canes became dry due to the heat, did they burn and char (severe damage). No plants were burnt completely to charred cane stumps, and only one plant was considered dead.

#### Growth of Unburnt Plants

Production of new growths is compared at study areas by calculating the mean number of new growths arising from a standard plant of 1 metre diameter. On average, a plant of this size consists of 75 pseudobulbs, approximately half of these bearing leaves.

New canes of *D. speciosum* arise from buds at the base of mature pseudobulbs.

Degree of Damage	No. Plants	Plant size range diam. (cm)	No. plants with new growths	No. of new growths on each plant	** Mean No. of new growths per 1m diam. plant $\pm$ S.D.	No. plants flowering	Total No. racemes	Conversion flowers to pods (%)
Unburnt	6	30-100	2	2, 1*	0.8 $\pm$ 0.6	2	8	0, 25
Light	4	20-85	4	5, 3, 12, 7	12.3 $\pm$ 3.1	1	6	7
Moderate	3	90-130	3	17, 16, 16	14.7 $\pm$ 2.3	0	—	—
Heavy	10	20-120	10	12, 14, 4, 15, 9, 11, 7, 5, 2, 6	12.3 $\pm$ 5.8	0	—	—

\* flowering plant

\*\* A parameter adjusting number of new growths per plant (column 4) for plant size obtained by calculating number of new growths produced for a standard 1 metre diameter plant, consisting on average of 75 pseudobulbs (canes).

S.D. Standard deviation.

**Table 2** Moderately Burnt Site (Site 2)

Degree of Damage	No. plants	Plant size range diam. (cm)	No. plants with new growths	No. of new growths on each plant	** Mean No. of new growths per 1m diam. plant $\pm$ S.D.
Light	0	—	—	—	—
Moderate	3	30-120	3	7, 6, 13	12.4 $\pm$ 7.0
Severe	10	30-80	9	1, 1, 4, 1, 5, 1, 4, 0*, 3, 2	5.5 $\pm$ 2.1

\* plant ? dead

\*\* A parameter adjusting number of new growths per plant (column 4) for plant size obtained by calculating number of new growths produced for a standard 1 metre diameter plant, consisting on average of 75 pseudobulbs (canes).

S.D. Standard deviation.

**Table 3** Severely Burnt Site (Site 1)

Flowering plants tend to produce few or no new growths until seed pods are well developed in January. Between March and November 1983 a low number of new growths was produced in unburnt plants. An average number of 1.2 new growths per 1m diameter plant was observed at the unburnt site in November 1983 (Table 1).

#### **Growth Responses Following Fire Damage (November 1983)**

There was a strong growth response, indicated by a greater than ten fold increase in number of new growths, when only leaves were damaged by fire (light degree of burning) (Table 2). A value of

12.3 new growths per 1m diameter plant was calculated for lightly burnt plants at Site 2.

Moderate fire damage at Sites 1 and 2 produced the greatest number of new growths, 12.4 and 14.7 new growths per 1m diameter plant respectively, a more than ten fold increase in growth over unburnt plants (Tables 2, 3). New growths, up to sixteen per plant, arose basally from the side of original canes on all aspects of these plants, indicating that a small part of the canes containing quiescent buds remains alive after fire. In November 1983, new shoots were advancing rapidly

on many burnt plants, producing canes up to 25cm in height and with up to five leaves per cane.

Severely burnt plants at Site 1 produced fewer new growths than plants with a moderate degree of burning (Table 3). Quiescent buds at the base of many charred canes were killed by intense heat. New shoots were still developing in November 1983, and two almost detached plants which initially appeared to be dead, were making their first growths. In April 1984, all plants were growing actively.

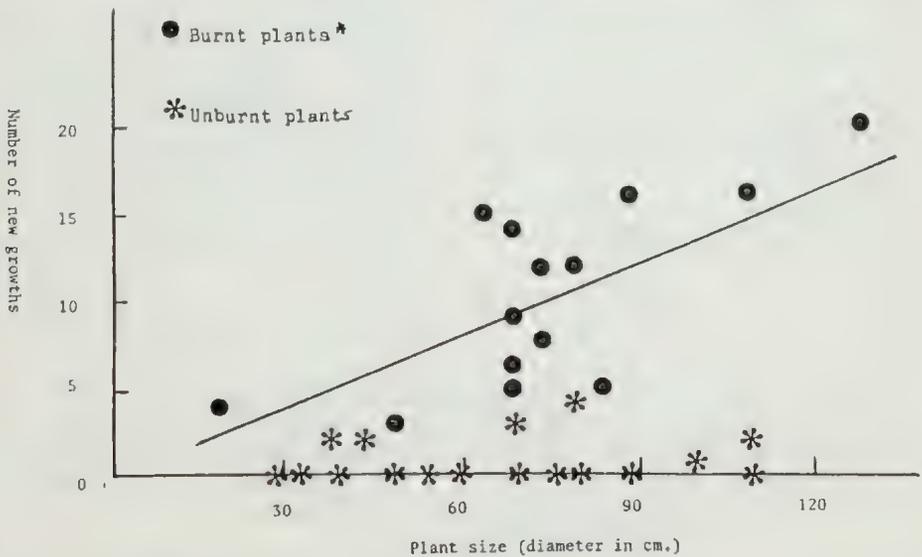
#### Flowering and Pollination in Burnt and Unburnt Plants

Flowering occurred on lightly burnt plants which had shed leaves or received leaf scorching, provided that the apical buds which produce flower spikes were not destroyed. In burnt areas approximately 30% of plants capable of flowering developed flower racemes (Table 2) compared with 55% in the unburnt colony (Table 1).

Mean conversion rates of flowers to capsules (seed pod set) of 12.5% (unburnt plants) and 7.0 (for lightly burnt plant) were calculated for the scattered flowering plants in the moderately burnt area, and a mean conversion rate of 13% for plants at the unburnt site (Table 1, 2).

#### Discussion

Forested areas of Australia have long been subject to uncontrolled fire arising from lightning and land use by aborigines, foresters and graziers. The study reported here shows that a fire of high intensity did not seriously threaten survival of small colonies of lithophytic *D. speciosum* at the southern limit of distribution. This orchid exhibited considerable resistance to fire, and a strong regenerative capacity. The thick fleshy leaves, tough cuticle, and cane sheaths appear important in survival. In comparison all above ground parts of sclerophyllous plants a few metres away were killed. Closely apposed pseudobulbs



\* Linear regression equation  $Y = 0.16X - 0.9$  applies only to burnt plants

:- correlation coefficient  $r = 0.8$ , significant at a probability level of 0.01

Figure 2 Relationship between number of new growths and plant size.

containing reserves of water and food storage material desiccate and shrink rather than burn, protecting quiescent shoots at their base. Very few if any plants were killed. Leaf or pseudobulb damage stimulated a more than ten fold increase in new shoot production from the base of burnt plants in the first six to eight months following fire.

There was a general increase in the number of pseudobulbs on burnt plants with increasing size of the plant which was not evident for unburnt plants (Fig. 2). This finding probably reflects the greater number of quiescent basal shoots on larger plants. Some larger plants produced few growths because of total incineration of up to half of the plant mass. At current growth rates burnt plants may require two or three seasons for full recovery. Regeneration from basal shoots in this species is similar to that of *D. kingianum* (pers. obs., Coffs Harbour, 1983), which occupies a similar ecological niche in N.S.W. It also resembles the pattern of regeneration of burnt tussock-forming grasses. In contrast, epiphytic orchids of this region, *Sarcochilus australis* and *Plectorrhiza tridentata* suffering fire damage in March 1983 were killed outright, and regenerated only from unburnt pockets (Adams and Lawson, 1984).

Perpetuation and natural regeneration of *D. speciosum* colonies is due to

vegetative regrowth of burnt plants, seedlings produced from flowering of minimally damaged plants, and continuing growth of unburnt plants. Flowering occurred in 30% of plants with intact apical flower buds, indicating that burning of surrounding forests for many kilometres did not eliminate pollinators.

A longer term follow up study of these colonies is now in progress and will be the subject of a further report.

#### Acknowledgements

The author wishes to thank Drs. D. M. Calder, D. H. Ashton and P. Y. Ladiges (Botany School University of Melbourne) and Dr. S. D. Lawson, for helpful discussion and critical comment and L. F. Adams for technical assistance. Ken Morrison and his staff (National Parks Service) have provided guidance and assistance on surveys during the last five years.

#### REFERENCES:

- Adams, P. B. and Lawson, S. D. (1984) Effect of fire on Victorian epiphytic and lithophytic orchids. *The Orchadian* 7: 282-286
- Barnett, J. M. (1984) The initial effects of fire on orchids in a stringy bark-box forest. *Victorian Nat.* 105: 188-190
- Hansen, K. (1964) Studies on the regeneration of heath vegetation after burning off. *Bot. Tidskr.* 60: 1-41
- Jones, D. L. (1968) Abnormality in *Leptoceras finbriatum* (Lindl.) *Victorian Nat.* 85: 326-328.

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### Friends of Black Hill

A small group interested in the Black Hill Reserve, 8 km north of Kyneton, seek those who may have done field studies, photography, etc. in the area to assist in the preparation of a booklet on the natural history of the reserve and its surrounds.

Please contact Bill Doherty (054) 23 4121

# Prey of Sooty Owls in East Gippsland before and after Fire

BY RICHARD H. LOYN\*, BARRY J. TRAILL† AND BARBARA E. TRIGGS‡

## Abstract

Pellets of Sooty Owls *Tyto tenebricosa* were collected from rainforest in East Gippsland (Victoria). They contained remains of arboreal and ground-dwelling mammals in roughly equal numbers, sometimes in the same pellet, and a few insects. Fourteen pellets from one site contained remains of seven mammal species including three that were not otherwise found in a concurrent mammal survey. Six pellets collected at this site after severe wildfire contained remains of just one common species of ground-dwelling mammal (Bush Rat *Rattus fuscipes*), despite continued presence of arboreal mammals in the area.

## Introduction

Sooty Owls inhabit rainforest and wet eucalypt forest in eastern Australia and Papua New Guinea, and no other species of *Tyto* is exclusively a forest bird. Little is known of their ecology or hunting behaviour, especially in the southern part of their range (Schodde and Mason 1980). Observations have been made in northern N.S.W. (Hyem 1979), where introduced Black Rats *Rattus rattus* are an important component of the diet. These versatile mammals could be taken either in trees or on the ground, and Hyem observed male Sooty Owls searching higher among trees than females. Most studies have shown that arboreal mammals are taken more than ground-dwelling species (Howe 1935, Fleay 1968, Schodde & Mason 1980, Smith 1984).

This paper reports the contents of regurgitated pellets in East Gippsland, before and after a wildfire, and sheds some light on the ecology of the owls and the mammal fauna of the region.

## Pellet Collection and Analysis

Three pellets were collected below a tree-fern *Cyathea australis* near Malla-cootta in November 1978, at a Sooty Owl's roosting site located by Dr. David Hollands. During a flora and fauna survey in January 1983 a Sooty Owl responded immediately to taped calls in a 15 ha patch of rainforest (dominated by Lilly-pilly *Acmena smithii*) beside the Thurra River near Cann River. On the next day a Sooty Owl was flushed from a group of tree-ferns at this site, and fourteen pellets and some disintegrated debris were collected below. The rainforest was burnt in the severe wildfires of February 1983, and no Sooty Owls were found two weeks after the fire but one responded to tapes at night in May 1983 (D. Allen and D. Eades, pers. comm.), and nearby in February 1985. Six pellets were collected in June 1983; they were not fresh but showed no sign of charring, so had presumably been regurgitated since the fire.

Pellets were examined and hairs identified by the method of Brunner and Coman (1974). Bones in the pellets were identified with help from a reference collection.

## Results and Discussion

### (1) Pellets from unburnt forest.

The pellets from Mallacoota contained hair and bones of Sugar Glider *Petaurus breviceps* and Brown Antechinus *Antechinus stuartii*. The 14 pre-fire pellets and debris from Thurra River contained hair

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and bones of seven mammal species, and five of them contained remains of more than one species (Table 1). The bones of Greater Glider measured 53mm (ulna), 49mm (humerus) and 27mm (upper jaw from incisor to last molar) compared with 85, 79 and 32mm respectively in a fully grown reference specimen from the Museum of Victoria (C7776). Hence the Greater Gliders taken were probably immature.

Of these mammal species, Brown Antechinus and Eastern Pygmy Possum forage on the ground and in trees and their remains occurred in five pellets out of fourteen. The three gliders spend most of their time in trees (remains in eight pellets) and Bush Rats and Smoky Mice forage mainly on the ground (remains in six pellets). Hence it seems that Sooty Owls take prey both from the ground and in trees, as suggested by other authors. Two pellets each contained remains of species that are mainly arboreal (Sugar Glider) and mainly ground-dwelling (Bush Rat and Smoky Mouse respectively), so it appears that individuals take prey in both situations, even if more than one owl had been using this roost.

The 14 pre-fire pellets also contained a moth's wing (probably Bogong Moth *Agrotis infusa*) some beetle carapace fragments and an unidentified seed, but no remains of birds or reptiles. Birds feature more prominently in pellets of Powerful Owls *Ninox strenua* (Seebeck 1976, Tilley 1982) and of Sooty Owls further north in Australia (Schodde & Mason 1980). Insects feature prominently in pellets from Sooty Owls of the small north Queensland form (Schodde & Mason 1980), considered by those authors as a full species *Tyto multipunctata*. However, insects had not previously been recorded in the diet of southern Sooty Owls.

## 2. Burnt forest.

The six post-fire pellets all contained hair and bones of Bush Rats only. Observa-

tions at night (Loyn *et al.* in prep) showed that Sugar Gliders and Yellow-bellied Gliders *Petaurus australis* were still common in adjacent eucalypt forest, despite complete burning or scorching of canopy foliage. Bush Rats had presumably become easy prey as little ground cover remained within the rainforest, whereas arboreal mammals could still hide in hollows and among branches and clusters of scorched foliage. This limited evidence suggests that Sooty Owls are opportunistic hunters within their specialised habitat. A Sooty Owl was heard in nearby burnt eucalypt forest in February 1985, so the species can apparently survive in burnt forest though nothing is known about changes to the quality of habitat, especially for breeding. No pellets were found at the original roost site in February 1985.

## (3) Use of pellets in mammal survey.

The rarest species found in pellets was the Smoky Mouse *Pseudomys fumeus* which was considered to be endemic to Victoria and had not been recorded closer than the coastal heaths of East Wingan 35 km away; records have come from a range of habitats including dry ridges but not rainforest (Menkhurst & Seebeck 1981). Sooty Owls venture into dry forest but immediate responses to tapes usually come from wet gullies or rainforest, at any time of night (pers. obs.), so it is likely that most of their hunting is done in these habitats or close to them. It would be of interest to determine the habitats used by Smoky Mice in this region.

The diversity of mammals in the pre-fire pellets is remarkable. Simultaneous trapping (60 trap-nights, with folding Elliott aluminium traps and some small wire cages) revealed only two mammal species (Bush Rat and Brown Antechinus). Observations at night revealed five arboreal species (Sugar Glider, Yellow-bellied Glider, Greater Glider, Common Ringtail Possum *Pseudocheirus peregrinus* and Bobuck *Trichosurus caninus*). A Long-nosed Bandicoot *Perameles nasuta* was seen after the fire.

**Table 1.** Occurrence of mammal species in Sooty Owl pellets, Thurra River, January 1983 (before fire).

Species	Habit †	Occurrence in individual pellets at Thurra River before fire														No. of pellets	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14		
Bush Rat <i>Rattus fuscipes</i>	G	X	X	X	X	X										X	5
Smoky Mouse <i>Pseudomys fumeus</i>	G						X										1
Brown Antechinus <i>Antechinus stuartii</i>	G/A							X	X	X	X						4
Eastern Pygmy Possum <i>Cercartetus nanus</i>	G/A				X					X							2
Feathertail Glider <i>Acrobates pygmaeus</i>	A									X							1
Sugar Glider <i>Petaurus breviceps</i>	A					X	X				X	X	X	X		X	6
Greater Glider <i>Petauroides volans</i>	A													X	X	X	1

† G = mainly ground-dwelling, A = mainly arboreal, G/A = ground-dwelling and arboreal.

Three species (Feathertail Glider, Eastern Pygmy Possum and Smoky Mouse) were not found by us except in owl pellets. Sooty Owls are clearly better at locating some mammal species than we are, and owl pellets can be a valuable tool in mammal surveys.

**Acknowledgements**

The observations at Thurra River were part of a survey of flora and fauna before additional logging in the Coagalah forest block. We are grateful to all members of the team and to Denis Read and staff at the Cann River district for help and co-operation. Dr. David Hollands (Orbost) located the roost at Mallacoota and Malcolm A. Macfarlane analysed the pellets from there. We also thank Ms Joan Dixon, Museum of Victoria, for the loan of reference specimens in her care, and E. G. McNabb (Borongia) for the taped owl calls.

**REFERENCES:**

Brunner, H. and Coman, B. J. (1974) *The Identification of Mammalian Hair*. (Inkata Press: Melbourne).

Fleay, D. H. (1968) *Nightwatchmen of Bush and Plain. Australian Owls and Owl-like Birds*. (Jacaranda Press: Brisbane).

Howe, F. E. (1935) Some field notes on the Sooty Owl. *Emu* 34, 317-318.

Hyem, E. L. (1979) Observations on owls in the Upper Manning River District, N.S.W. *Corella* 3, 17-25.

Menkhurst, P. W. and Seebeck, J. H. (1981) The distribution, habitat and status of *Pseudomys fumeus* Brazenor (Rodentia: Muridae). *Aust. Wildl. Res.* 8, 87-96.

Schodde, R. and Mason, I. J. (1980) *Nocturnal Birds of Australia*. (Lansdowne Editions: Melbourne), 135 pp.

Seebeck, J. H. (1976) The diet of the powerful owl, *Ninox strenua*, in western Victoria. *Emu* 76, 167-70.

Smith, P. (1984) Prey items of the sooty owl and barn owl at Bega, New South Wales. *Corella* 8, 71-72.

Tilley, S. (1982) The diet of the powerful owl, *Ninox strenua* in Victoria. *Aust. Wild. Res.* 9, 157-75.

**1986 Australian Natural History Medallion**

The Field Naturalists Club of Victoria congratulates Mr. Graham Pizzey, the recipient of the 1986 Australian Natural History Medallion.

Due to a prior commitment Mr. Pizzey is unable to speak at the Presentation meeting in November. However, he has offered to speak at the December meeting, and, therefore, the Presentation meeting has been postponed until Monday, 8th December.

Michael D. Howes,  
Hon. Secretary

# Members of the Malvaceae Family Rare in North Western Victoria

BY J. H. BROWNE\*

Some members of the *Malvaceae* Family found in the more arid parts of Australia have their southern limits in N.W. Victoria. Their numbers here are not great. In two cases they are found only in the one locality, while a third has not been found here for a number of years. They are members of the genera *Abutilon*, *Hibiscus* and *Radyera*. The purpose of this paper is to present data on their description, identification, local habitat, numbers and conservation. Species nomenclature follows Cunningham *et al.* (1981).

## *Abutilon fraseri* (Dwarf Lantern-flower) (Fig. 1)

Recorded for the arid areas of all mainland States.

A small, erect, yellow-flowered perennial (although some may be short-lived) that can grow to a height of 40cm. In Victoria most are 15 to 25cm high. Annual growth commences with the spring rains, but the main growth and flowering occurs after summer rain. When good rains occur during the warmer parts of summer, seed can germinate and plants flower in about 6 weeks.

In Victoria it is confined to the sandy red loam in or close to the Sunraysia Irrigation area. It was first found in 1950 on private property at Sunny Cliffs, about 4 km north of Red Cliffs. The area had been cleared in the 1930's, planted to several crops of wheat, then abandoned and allowed to regenerate. Reasonable numbers of *A. fraseri* were still found there in the late 1960's but by 1978 only 8 plants were seen although the owners knew of a few more. The area has since



Fig. 1. *Abutilon fraseri*. Red Cliffs Scenic Reserve.

been planted to grape vines and it is unlikely that any plants remain.

Since that first record, other stands have been found including a few plants on the N.S.W. side of the river. One stand in the Merbein Cemetery in 1976 has not been seen since and can be presumed extinct due to mowing and the use of weedicides.

Another stand was found in 1978 on the uncleared roadside next to an irrigated grape-vine property in the N.E. part of Red Cliffs. This was checked prior to writing this. Much of the roadside vegetation there has since been cleared and no *A. fraseri* were seen. If any do remain the numbers will be small and

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Fig. 2. *Abutilon otocarpum*. Menindee, N.S.W.

there is no long term future for them as it is the general practice here to clear the roadsides next to irrigated properties.

The largest stand of all and now possibly the only one left in Victoria, is in the Red Cliffs Scenic Reserve. This is a Reserve on top of the local river cliff from which the town of Red Cliffs gets its name. In the late 1960's a few plants were found but eventually scattered plants were noticed over most of the upstream 1 km of the Reserve. At about this time the S.E.C. built their main powerline from Horsham to this area along the cliff top. This involved the removal of some trees and shrubs and also the general disturbance of the soil in the building of the pylons. This was followed by the wet seasons in the early to mid 1970's, resulting in hundreds of plants in the disturbed areas. There are three powerlines there now, the vegetation beneath them being controlled by occasional slashing. Hundreds of *A. fraseri* can still be found beneath the lines and also among the

vegetation beside them. A dozen plants may be in the litter under an old Hopbush (*Dodonaea*) or in the protection of a fallen tree limb.

As this is a Reserve, the future for *A. fraseri* should be secure there. The soil is sandy red loam, a little higher than the surrounding areas. The vegetation is mixed, the more common species being *Casuarina cristata*, *Callitris preissii*, *Hakea leucoptera*, *Cassia nemophila*, *Dodonaea angustissima*, *Acacia bivenosa*, *Sida* spp. and annuals. Most likely it would have been the same original vegetation in the other stands.

#### *Abutilon otocarpum* (Desert Lantern) (Fig. 2)

Found in all mainland States and in Victoria in grids, A, B, F and G (Beaglehole 1980; Willis, 1972).

An erect shrub, generally 60cm high on the red loam ridges and dunes. My observation locally is that it is never more than several kilometres from the river flood-

plain, being absent from areas like the Sunset Country where there is a similar soil type.

This plant has a dense velvety covering that makes it easy to distinguish from *A. fraseri*. So far the two have not been found together, although they both can be found in a similar habitat, whereas the other two local *Abutilons* are found on the river flood plain.

The largest known local stand is at the N.W. end of the Mildura Cemetery on a large ridge of sandy red loam surrounded by an old *Eucalyptus largiflorens* flood plain. Other vegetation on the ridge includes shrubs such as *Acacia victoriae*, *A. bivenosa* and *Dodonaea angustissima* and among the smaller perennials are *Sida ammophila* and *Ptilotus polystachyus*. Both these last two are uncommon plants in Victoria, as is *Frankenia gracilis*, occurring in large numbers along the base of the ridge. *A. otocarpum* is generally found as scattered plants or small stands. It is often noticed in favourable years on the roadside along the river road between Red Cliffs and Nangiloc. Small numbers are also west of Mildura. There would have been soil disturbance in most of these areas at one time.

In Grid A, the only ones known in a Reserve are those in the Hattah/Kulkyne National Park. They were not found there for several years, possibly due to severe drought and kangaroo grazing, but about 50 plants re-appeared there in November 1985 (J. G. Eichler pers. comm.). The habitat is sandy red loam with scattered *Acacia bivenosa* and *Dodonaea angustissima* above the S.W. bank of Lake Hattah.

Both this species and *A. fraseri* would be suitable for dry area gardens.

***Abutilon theophrasti* (Chingma Lantern; Swamp Chinese Lantern in N.S.W.) (Fig. 3).**

An erect annual 30cm to over 1 metre high, with round, cordate leaves to 10cm long.

An introduced species from the Mediterranean and Asia, but now found in all mainland States. In Victoria it is found in the grids A, B, C, F, G, H and J (Beaughlehole, 1980).

In N.W. Victoria it is confined to the drying mud around lakes, generally those connected with the river or in billabongs and water-holes after a flood. It can completely dominate the drying mud on the beds of some of these and then is not found again until after the next flood recedes. In the Hattah Lakes or other larger lakes, such as Lake Wallawalla in the extreme N. W. of the State, that can fill just with a single high river level, it is more likely to be found as scattered plants as the water from the shallower parts recedes.



Fig. 3. *Abutilon theophrasti*. Lake Arawak, Hattah-Kulkyne National Park.



Fig. 4. *Abutilon oxycarpum*. Bottle Bend Reserved Forest.

***Abutilon oxycarpum* (Called Straggly Lantern-flower in N.S.W.) (Fig. 4).**

A small, inconspicuous, slender herb, with small yellow flowers. Most plants here are about 6cm high although some have reached a height of 20cm and about the same across in a good season. In the pre-flowering seedling stage they are not unlike small plants of the more common, introduced *Malva parviflora*. The species also closely resembles *Abutilon malvifolium* and the two may not be distinct species.

In spite of searching in other suitable habitats on the river flood plain in this area it remains confined in Victoria to two stands and some scattered plants in Bottle Bend Reserved Forest 7-9 km east of Red Cliffs. *A. oxycarpum* is also found in the arid areas of all mainland States, although there are few records. Uncommon in western N.S.W. (Cunningham *et al.* (1981) where height ranges from 60-90cm. In

Victoria at least it is an annual. Some Victorian plants that germinate in the spring and survive our hot dry summer do respond to autumn rain but are always killed by winter frosts.

The first Victorian record was mid-April 1983 when about 50 seedlings, some with flowers and fruit, were found. The largest had been grazed by kangaroos. A second stand of 30 plants about 2 km away was found a fortnight later, the largest plants, some 20cm high, eventually maturing about 20 capsules each. This has since proved to be the largest of the two stands.

The 1983 germination can only have been the result of 4.5cm of rain late the previous February, as only occasional showers occurred after that. *A. oxycarpum* then, can germinate after one good summer rain and produce mature fruit in less than 10 weeks, some plants possibly in as little as 6-8 weeks. There have not



Fig. 5. *Hibiscus brachysiphonius*. Bottle Bend Reserved Forest.

been good summer rains since. Small plants, many maturing fruit from only a single flower, have been found in both stands late in the last two springs. In January, 1986 there were no plants in one stand and about a dozen small ones in the other.

Habitat is the low-lying open areas of cracking grey clay on the *Eucalyptus largiflorens* flood plain. Associated plants are: *Sida corrugata* var. *angustifolia*, *S. trichopoda*, *Atriplex leptophylla*, *Stelligera endecaspinis* and others. The smaller of the two stands also has *Disphyma clavellatum* and some *Ptilotus nobilis*, the larger some *Muehlenbeckia cunninghamii*.

Cattle are allowed into the area in some years. There is also a small number of kangaroos. Both have been known to graze the plants. To prevent grazing and to mark the stands, the former Forest Commission of Victoria fenced both areas.

***Hibiscus brachysiphonius* (Low Hibiscus)**  
(Fig. 5)

A low-growing, spreading perennial,

Victorian plants being up to 25cm across. Seedling and lower leaves are obovate, upper mature leaves deeply cut into three lobes. The solitary, pale pink flowers, lasting only one day, are about 2.5cm across and are on thin peduncles 10 to 12cm long.

A rather inconspicuous plant unless in flower. Found only in cracking clay soils in the arid areas of all mainland states, although the number of actual localities is low. Said to be widespread but relatively uncommon in western N.S.W. (Cunningham *et al.* 1981). The only Victorian stand consists of eight mature plants but seedlings have been found, none of which have so far survived the dry parts of summer.

Found for the first time in Victoria when a single flower was noticed three weeks after the same 4.5cm of rain in late February 1983 referred to in the *Abutilon oxycarpum* section above. A check soon found that there were eight regrowth plants and fifteen seedlings. These plants were severely grazed by kangaroos despite low kangaroo numbers. This and the dry conditions that followed reduced the stand

to just the eight regrowth plants by mid-April 1983. Only two of these matured fruit capsules. The stand is only 50-60 metres from the first *Abutilon oxycarpum* stand found, has also been fenced by the former Forests Commission and can no longer be grazed. The mature plants die back to just a rootstock during winter and dry conditions.

From observation in spring 1985, the plants need the warmer weather before regrowth starts. Although there was rain in August, it was not until mid-October that regrowth and a single seedling was noticed. Flowering started in late November and because of dry conditions only lasted about three weeks. Four plants produced capsules but even so there should be plenty of seed in the enclosed area now.

Its Victorian habitat is cracking grey clay with the associated plants found in or near the enclosure the same as the nearby smaller *Abutilon oxycarpum* stand: — *Eucalyptus largiflorens*, *Sida corrugata* var. *angustifolia*, *S. trichopoda*, *Atriplex leptophylla*, *Stelligera endecaspinis*, *Disphyma clavellatum* and *Ptilotus nobilis*.

While fencing has secured the plants from grazing, the fact that there are so few plants in only a single stand leads to some concern for their future. Also the area can be covered during the peak of a high river flood. What effect that may have is at present unknown.

***Hibiscus trionum* (Bladder Ketmia)**  
(Fig. 6)

An annual to about 60cm high. Flowers yellow with a purple centre. The large inflated calyx with about twenty conspicuous nerves makes this plant easy to identify.

Found in all mainland States and most grids in Victoria (Beaglehole, 1980). A cosmopolitan plant regarded as a weed in many places, but regarded by Willis (1972) as apparently indigenous to north Australia.



Fig. 6. *Hibiscus trionum*. Garden-grown plant, Red Cliffs.

It is seldom found in this area and then only on roadsides or waste areas most of which receive at least some water from nearby irrigation properties. An ornamental plant, the seed of which has been available in local nurseries. Its occurrence here can only be as a garden escapee.

***Radyera farragei* (Desert Rose Mallow)**  
(called **Bush Hibiscus** in N.S.W.) (Fig. 7)

A stellate, tomentose shrub to over 1 metre high. Stems erect, stout, from a woody base. Leaves orbicular, cordate, large, up to 15cm in diameter. Flowers large, purplish with a darker centre, usually only one open at a time from the cluster of about 3 buds. An ornamental plant suitable for gardens.

Also found in the arid areas of W.A., S.A. and N.S.W. In western New South Wales it is "reasonably widespread but seldom common" and "generally more common in recently burnt mallee" (Cunningham *et al.* 1981). In Central Australia the habitat is given as roadsides, creek levees and flood-out areas (Jessop, 1981).



Fig. 7. *Radyera farragei*. Danggali Conservation Park, S.A.

In Victoria it is a rare plant confined to grids A and F (Beaughole, 1980). Grid F has two known records, both from the Bolton area. One was about 1940, the second in 1962. In grid A, Willis (1978) records it from West Merbein and Hattah. Those at West Merbein occurred after land clearing. This area has long since been planted to wheat and the plants were not found again. The Hattah record is apparently unvouchered and is not on any Hattah/Kulkyne National Park Vegetation List. As the first of these was compiled in 1970, at least it has not been found there since that date.

More recent grid A finds are:-

No. 1.  $\pm 3$  km S. W. of the Millewa Reference area, which is about 6 km north of the Sturt Highway on the Victorian and South Australian border. The number of plants is unknown. 28 October 1977.

No. 2. Side of a track about 3 km south of the 65 mile peg on the Sturt

Highway. One plant which was nearly dead but had mature seed. 6 June 1978.

No. 3. 4.5 km south west of Carwarp. On private property, about 50 plants. Spring 1978.

No. 4. Sunset Country. Side of the track on the west side of the N.W. part of the Raak Plains. Three plants. 9 October 1978.

There have been no reports of any plants being found in this area since 1978. The first and last two areas mentioned above were checked this spring.

All these recent finds were after fire, for numbers 1 and 2 perhaps little more than grass fires while 3 and 4 were after summer wild-fire that killed the mallee tops. These fires would have been some of the many about January 1975 that followed two wet years. Rainfall for 1975 was also above average. In area No. 2 the sides of the track were mostly cleared. Nos. 1, 3 and 4 all had the same habitat of low-lying calcareous loam, with scattered large *Eucalyptus oleosa* and some *E. dumosa*. *Sclerolaena quinquecupis* was the dominant ground cover plant.

From observations on garden-grown plants, *R. farragei* is unlikely to flower the first year; subsequently, seeding can be very prolific. However, where seen in the wild in Victoria and New South Wales, there is never a large number of plants found in any one stand. It usually occurs after fire. Because the plants found locally occurred in areas not previously burnt for many years, the seed may have a long soil storage life.

The plants were found after good rains — the need for these as well as fire or disturbance may partly account for its rarity. Much of its likely former habitat in Victoria has been cleared for farming for many years. This, and the practice of controlling wildfires, may have eliminated it from many areas.

The plants at site 3 were grazed by stock; probably most or all of the species dealt with here are palatable to grazing mammals so that their conservation may involve some grazing control.

*R. farragei* has been grown here in Mildura. It is very ornamental and although perhaps not long-lived is worth a place in any garden. Propagation has been difficult, only about 10% of the seed germinating and then the plants being difficult to establish. Treating the seed by soaking or with hot water did not improve the percentage germination. By contrast, seed of the *Abutilons* mentioned above will germinate in reasonable numbers without any treatment.

As with a number of the Victorian *Sidas* (Browne, 1984), some of the species dealt with here can show weedy or pioneer-type behaviour following disturbance or fire. This may be related in part to a proportion of the seeds being hard-seeded and capable of long-term soil storage as is known in a range of Malvaceae (Rolston, 1978).

### Acknowledgements

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### REFERENCES:

- Beaglehole, A. C. (1980). *Victorian Vascular Plant Checklists*. Western Victorian Field Naturalists Clubs Association, Portland.
- Browne, J. H. (1984) *Sidas of the Mildura and surrounding districts*. *Vict. Nat.* 101: 228-233.
- Cunningham, G. M., Mulham, W. E., Milthorpe, P.L. and Leigh, J. H., (1981). *Plants of Western New South Wales*. N.S.W. Govt. Printing Office, Sydney.
- Jessop, J. (ed.) (1981). *Flora of Central Australia*. A. H. and A. W. Reed, Sydney.
- Rolston, M. R., (1978). Water impermeable seed dormancy. *Bot. Rev.* 44: 365-396.
- Willis, J. H., (1972). *A Handbook to Plants in Victoria*. Vol. II, Melbourne University Press.
- Willis, J. H., (1978). 507 species of indigenous Victorian plants which are variously rare, very localized and / or endangered, with localities as far as known. Forests Commission of Victoria, unpublished report.

### Appendix

#### A Key to *Abutilon*, *Hibiscus* and *Radyera* in Victoria\*

- |   |   |
|---|---|
| 1. Epicalyx segments (bracts) more than 3 .....   | 2 |
| Epicalyx none .....   |   |
| <i>Abutilon</i> .....   | 3 |
| 2. Leaves divided, flowers, solitary .....  |   |
| <i>Hibiscus</i> .....   | 6 |
| Leaves reniform or orbicular, flowers in dense clusters. Tomentose shrub over 1 metre high .....                  |   |
| <i>Radyera farragei</i> F. Muell. ....  |   |
| 3. Mericarps easily separating in fruit .....   | 4 |
| Mericarps fused in fruit .....  | 5 |
| 4. Calyx umbilicate at the base and strongly 5-keeled. Mericarps 10-20, pubescent; seeds wrinkled, glabrous ..... |   |
| <i>Abutilon otocarpum</i> F. Muell. ....  |   |
| Calyx neither umbilicate nor strongly 5-keeled; mericarps 10, + glabrous; seed pubescent .....                    |   |
| <i>Abutilon fraseri</i> Hook. ex Walp. ....   |   |
| <i>Abutilon theophrasti</i> Med. ....   |   |
| 5. Tall, robust annual; fruit 17mm in diameter, blackish .....  |   |
| Small herb, fruit 7mm in diameter, twice as long as calyx. Mericarps with two short awns .....                    |   |
| <i>Abutilon oxycarpum</i> F. Muell. ....  |   |
| 6. Low perennial of river flood plain. Calyx 12mm long with ciliate lobes .....                                   |   |
| <i>Hibiscus brachysiphonius</i> F. Muell. ....  |   |
| Annual. Calyx 15-20mm long, inflated with conspicuous nerves .....  |   |
| <i>Hibiscus trionum</i> Hochr. ....   |   |

\*Adapted from Jessop (1981).

# Induced Colour Change in a Krefft's Tortoise

CHRIS B. BANKS\*

## Introduction

Environmentally-related colour change in reptiles is a relatively unknown phenomenon. Most studies have centred around lizards, particularly chameleons and anoles. Kirschner (1985) demonstrated a clear 'background response' in juvenile Saltwater Crocodiles (*Crocodylus porosus*) and there are three reported instances in chelonians (Bartley, 1966, in Bellairs, 1970; Dunn, 1982; Woolley, 1957). The removal of a female Krefft's Tortoise (*Emydura krefftii*) from its display enclosure at the Royal Melbourne Zoo provided the opportunity to gain quantitative data on colour change in this species.

Krefft's Tortoise (*Emydura krefftii*) is a medium-sized chelonian inhabiting the rivers and waterholes of north-east Australia (Cogger, 1985). Its carapace colouration is described variously as olive-brown, pale brown, almost black and dark brown with or without darker flecks and blotches (Cann, 1978; Cogger, 1985). One consistent characteristic is a pale yellow to cream temporal streak and a similarly coloured strip along the lower jaw to the side of the neck.

## Materials and Methods

On 27 January, 1984, an adult female *E. krefftii* was removed from display for treatment of a fractured femur in the left hind leg. The injury was caused by an accidental bite from a Freshwater Crocodile (*Crocodylus johnstoni*), four of which occupied the exhibit with the tortoises. The tortoise was at least 15 years old and had a carapace length of 284mm. A small stainless steel pin (20mm in length) was surgically implanted to hold the broken bone and the leg was set in

plaster. The tortoise was maintained in a 2 x 1 x 0.5m high, pale green fibreglass tank and kept dry for 10 days, after which water to a maximum depth of 30cm was added. Feeding then recommenced and the cast was removed after a further 20 days. After a rehabilitation period of three months, the tortoise was returned to display. However, it had to be removed an hour later as a further bite had occurred on the same leg. It was presumed that the cause was the very pale colour of the animal's legs, resulting from the confinement in the pale tank, which the crocodile had mistaken for a piece of mouse, as the diet of both crocodiles and tortoises was chopped mice and fish.

The tortoise was returned to the pale, off-limit tank to recover; fortunately there was no break on this occasion. To reduce the risk of a further bite, the tortoise was transferred to a black fibreglass tank (2 x 1 x 0.5m high) on 22 September once it had fully recovered. The opportunity was then taken to document the expected change in colour of the animal's feet and, to a lesser extent, its carapace.

Observations were made at 10-day intervals. The tortoise's feet were photographed with colour slide film and the colour checked against the swatches in The American Museum of Natural History's Naturalists's Colour Guide (Smithe, 1975).

## Results

The gradual darkening of skin colour from paler than 'Pearl Grey' to 'Dark Neutral Grey' over 80 days is presented in Table 1. The tortoise was returned to display on the 81st day with no more than a cursory inspection from the crocodiles.

Over the same period, the carapace also became a darker but to lesser degree than the legs and feet. At Day 1, the colour ranged from Amber (Colour 36) to Tawny (38), by Day 30 it was Russet (34), by Day

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50 Cinnamon-Brown (33) and by Day 80 it was Cinnamon-Brown/Olive-Brown (33/28).

### Discussion

The results support the findings of Dunn (1982) and Kirshner (1985) and are of value in demonstrating the ability of an adult rather than a juvenile, to exhibit a background response. It was not stated in Woolley's study of *Chelodina oblonga* whether the tortoise was an adult or a juvenile (Woolley, 1957). This study also provides quantitative data on the colour change as a standardised colour guide was used.

Pressure on available off-limit housing resulted in the tortoise being returned to display as soon as it had become dark enough to not cause undue attention from the crocodiles. It would have been of value to monitor the tortoise for six months and then place it in a pale tank to compare the rapidity of the response to that exhibited by juveniles of the same species in Dunn's study (1982).

The observations presented here highlight the value of captive populations in providing important data which can lead to a better understanding of wild populations of the same and related species. They also have implications for the proposal of new taxa using colour as the main criterion.

Day	Colour Name	Colour Number
1.	Paler than 'Pearl Grey'	Paler than 81
10.	'Pale Neutral Grey'.	86
20.	No change from day 10.	
30.	Legs 'Light Neutral Grey'.	85
	Feet 'Medium Neutral Grey'.	84
40.	No change from Day 30.	
50.	No change from Day 30.	
60.	No change from Day 30.	
70.	Legs and feet 'Medium Neutral Grey'.	84
80.	Front legs/feet 'Medium Neutral Grey'.	84
	Rear legs/feet 'Dark Neutral Grey'.	83

Table 1. Change in skin colour of legs and feet of an *Emydura krefftii* at Melbourne Zoo.

### References

- Bellaïrs, A. (1970) *The life of reptiles*. Vol. 1. Universe Press, New York.
- Cann, J. (1978) *Tortoises of Australia*. Angus & Robertson, Sydney.
- Cogger, H. G. (1985) *Reptiles & Amphibians of Australia*. A. H. & A. W. Reed, Frenchs Forest, N.S.W.
- Dunn, R. W. (1982) Effects of environment upon tortoise pigmentation. *Aust. Zool.* 21(1):105-107.
- Kirshner, D. (1985) Environmental effects on dorsal colouration in the Saltwater Crocodile, *Crocodylus porosus*. In: Grigg, G., Shine, R., and H. Ehmann (eds) *Biology of Australasian Frogs and Reptiles*. Royal Zoological Society of New South Wales: 397-402.
- Smithe, F. B. (1975) *Naturalists' Color Guide*. The American Museum of Natural History, New York.
- Woolley, P. (1957) Colour changes in a chelonian. *Nature* 179:1255-1256.

### Book Sale

A sale of books discarded from the Club Library will be held at the November General Meeting, 10th November. Personal sales only at the meeting, but if anyone would like a list of the books available, please send a self-addressed envelope to the Hon. Librarian, Sheila Houghton, c/- FNCV, National Herbarium, Birdwood Avenue, South Yarra, 3141.

## *Adiantum capillus-veneris* L. (Adiantaceae): A New Species Record for Victoria

BY W. R. ARCHER\*

There are approximately 200 species of *Adiantum* in the world of which nine are indigenous to Australia (Elliot & Jones, 1982). Only four were thought to occur in Victoria but in 1981 a fifth species, *A. capillus-veneris* L., was located in the State. This species is also found in Western Australia (Hamersley Range), Queensland where rare, South Australia (Yorke Peninsula, Murray and South East Regions) (Black, 1978), New South Wales (one record only — Northbridge, suburban Sydney, spontaneous in sandstone caves, 1943 (MEL 1512267)) and the Northern Territory (two regions) (Hartley & Leigh, 1979). It is also widespread throughout the world but in Australia *A. capillus-veneris* was previously considered confined to warm regions and relatively uncommon (Jones & Clemesha, 1976).

In South Australia *A. capillus-veneris* appears to be restricted to limestone, and grows in erosion zones along the Murray River near Blanche Town and in sinkholes and wells on Yorke Peninsula and in the south-east of the State (Black, 1978). Jones & Clemesha (1976) state that it usually grows among rocks on ledges and cliffs close to water, not extending above 200 metre altitude.

The colony in Victoria is situated on the Mornington Peninsula on a very steep easterly-facing bank, set in a deep sheltered gully above Main Creek. Alkaline seepage from a catchment area above flows through the colony depositing calcium carbonate over basaltic rocks and soils, covering an area of 15 metres x 10 metres.

In the habitat, the colony is well established and has obviously existed for a considerable time. This is evidenced by

remnants of *A. capillus-veneris* in older calcareous deposits where seepage has now ceased, or been greatly reduced due to shifting drainage patterns. Also alluvial basaltic soils have been deposited in sequence over numerous calcareous layers of which fern rhizomes have been deeply embedded.

The surrounding environment has been modified since European settlement and contains many alien plant species. However, the *A. capillus-veneris* colony has not been seriously affected due to the steepness of the western bank where the colony is sited and also to Main Creek restricting access from the east, permitting the *Adiantum* habitat to survive in remarkably good condition.

Elliot & Jones (1982) state that *A. capillus-veneris* is suited to warm tropical areas, or a heated glasshouse in cool climates. A little above the Main Creek colony a thicket of *Rapanea howittiana* survives, like *A. capillus-veneris*, at the most southerly extent of its range, possibly indicating that this area has a less extreme climate than most other parts of southern Victoria.

When seen from the eastern side of Main Creek the *A. capillus-veneris* colony appears to be a very vigorous, lush-growing form of *Adiantum aethiopicum*, Common Maidenhair. This factor, combined with the problem of crossing the creek, has probably caused the colony to be overlooked. Even when viewed closely the general appearance is that of a robust *A. aethiopicum*. However, the obvious oblong sori positioned on the pinnule margins between the sinuses are very different from the sub-orbicular sori actually in the sinuses of the Common Maidenhair (see fig. 12; Black, 1978).

*A. capillus-veneris* is well known in

\*17 Ashleigh Avenue, Frankston, 3199

cultivation and commonly grown as an indoor plant, consequently the possibility of the Main Creek colony originating from this source cannot be ignored. However, this seems unlikely, as not only has the colony existed for a considerable time but the plant has been recorded only once in N.S.W., where it is commercially grown, and has not been found close to populated areas in other States. This apparently indicates that the cultivated plant does not readily colonise new areas.

Voucher material for *A. capillus-veneris* collected 8 February, 1981, by W. R. Archer, from the Main Creek colony has been lodged at the National Herbarium of Victoria (MEL 104661; MEL 584831).

#### Acknowledgements

My thanks go to Mrs B. Duncan, Monash University, for confirming the plant identification and to Dr R. F. Parsons, La Trobe University, for checking the draft of this paper and for various helpful comments and general information.

#### References

- Black, J. M. (1978) *Flora of South Australia*. Part 1. 3rd Ed. Rev. and edit. J. P. Jessop. Government Printer, South Australia.
- Elliot, W. R., & Jones, D. L. (1982) *Encyclopaedia of Australian Plants*. Vol. 2. Lothian Publishing Co. Pty. Ltd., Melbourne.
- Jones, D. L. & Clemesha, S. C. (1976) *Australian Ferns and Fern Allies*. A. H. & A. W. Reed Pty. Ltd., Sydney.
- Hartley, W. & Leigh, J. (1979) *Australian Plants at Risk*, Australian National Parks and Wildlife Service. Occas. Pap. No. 3.
- Willis, J. H. (1972) *A Handbook to Plants in Victoria*. Vol. 2, Dicotyledons. Melbourne University Press, Melbourne.

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## FIELD NATURALISTS CLUB OF VICTORIA

Reports of recent activities.

### General Meeting Monday, 14th July

A minute of silence was observed to mark the recent death of Joyce Annear who joined the Club in 1959 with her two sisters.

The President then introduced the speaker for the evening, Mr. Bruce Fuhrer, a Senior Technical Officer at Monash University who spoke on "Aspects of the Gulf Country".

Mr. Fuhrer was mostly familiar with the

area around Burketown in North Queensland which is situated about 40 km from the Gulf of Carpentaria on the edge of a large saltpan. He initially went there expecting to find a largely untouched wilderness, but was very disappointed to find that the area has been devastated by the activities of man. Years of overgrazing and regular burning have greatly reduced the extent and diversity of the native vegetation and resulted in serious erosion of the topsoil and the silting up of coastal river systems.

In spite of the barrenness of the landscape, Mr. Fuhrer, like a true naturalist, still found many things to take an interest in. He described, with the aid of slides, many interesting places and phenomena including: the large salt pans with their associated salt-tolerant vegetation; the mangrove communities which support about seven species of mangroves and many animals including crabs, fish, birds, etc.; a hot, freshwater bore around which live many microscopic algae and which attracts wallabys and birds to drink; termite mounds; the wildflowers of the area; the river systems and the very long wave-like cloud formation known as the Morning Glory which he and a group of mathematicians from Monash had gone there to study. He also discussed some of the enormous conservation problems of the area posed by introduced animals and plants, erosion and the activities of man.

#### Exhibits

- Under microscopes: Skeletal remains of the bryozoans, *Catenicella* and *Scrupocellaria* from Western Port; A marine flatworm *Thysanozoon* from Black Rock. The numerous dorsal papillae and anterior tentacles cause this flatworm to look very much like a nudibranch; A brightly coloured opisthobranch mollusc, *Oxynoe viridis* which feeds on green algae especially *Caulerpa*, and can drop its tail to escape danger. Mr. Dan McInnes.

- Under a microscope: Hay infusoria containing various bacteria, ciliates flagellates, etc. Mr. Urwin Bates.

- A couple of very small introduced dung beetles which are spreading rapidly up the east coast and which feed on cattle, swamp wallaby and wombat dung. Mr. Ian Faithfull.

- A box of scarab beetles; Distribution maps of Victorian insects. The amateur naturalist can play a big part in collecting records for these. Mr. Ian Faithfull.

- Some slides of fungi from the Metcalfe Flora Reserve including *Anthrocobia muelleri*, *Iyromyces peliculosus*, *Coltricia laeto* and *Lentinellus flabelliformis* as well as slides from a recent Botany Group excursion to Powelltown, Mrs. Sheila Houghton.

#### Nature Notes

- Excavations have exposed a good section of the Red Bluff Sands near the corner of Glenferrie and Wattleree Roads. Mr. Dan McInnes

#### General Meeting Monday, 11th August

**The Speaker** for the evening was Ms. Margaret Blakers who works part-time for both the R.M.I.T. and the Wilderness Society and who spoke on "The FNCV Old-time Naturalist Project."

During her period of involvement with The Atlas of Australian Birds, Ms. Blakers became aware of the wealth of knowledge about natural history which many enthusiastic amateur naturalists had accumulated over the years and that this knowledge was in danger of being lost, as these people, many of whom are now elderly, died. She and Mr. John Woinarski, a zoologist, decided to begin an oral history project to record the lives and knowledge of some of these older naturalists. They applied for and received funding from the Department of Conservation, Forests and Lands to carry out their research on behalf of the FNCV.

The project is still at a fairly early stage, as although much preliminary work and some of the interviews have been completed, the information has not yet been analysed or transcribed.

Ms. Blakers played excerpts from interviews she had completed with Miss Jean Galbraith and Mr. Norm Favaloro as an example of the sort of information they were collecting. The tapes of the interviews and all information collected will eventually go to the La Trobe Library for the use of future researchers and it is hoped that a book and perhaps a radio series will be produced for the public.

#### Exhibits

- Under microscopes: A new record for southern Australia, a stalked jellyfish (Order Stauromedusae) probably of the genus *Steno-*

(Continued from I.F.C.)

#### Botany Group - Second Thursday

Thursday, 2nd October (note change of date). "Prostanthera" and its Allies - a Discussion of Problems and Diversity' Mr. Barry Conn.

Thursday, 13th November. "A Botanist Visits China" Dr. Jim Willis.

Thursday, 11th December. Annual Meeting and Members' Night.

#### Geology Group - First Wednesday

Wednesday, 1st October. Members' Night - General Geology.

Wednesday, 5th November. "Carbonate Complex

of the Lennard Shelf, Kimberleys, W.A." Dr. Eric Lohe.

Wednesday, 3rd December. Members' Night.

#### Mammal Survey Group - First Tuesday

Tuesday, 7th October. To be announced.

Tuesday, 28th October (November meeting). To be announced.

Tuesday, 2nd December. Christmas Members' Night.

#### Microscopical Group - Third Wednesday

Wednesday, 8th October (note change of date).

"Pollen and Diatoms in Victorian Brown Coal" Mr. R. Graham.

Wednesday, 19th November. "Bacteria" Dr. E. Peters.

## GROUP EXCURSIONS

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

#### Botany Group

Saturday, 25th October, Courtney's Road, Leader: Mrs. Hilary Weatherhead.

Saturday, 22nd November. Lake Mountain. Leader Mrs. Ilma Dunn.

#### Mammal Survey Group

Saturday, 1st - Tuesday, 4th November. Big-Desert Camp.

Saturday 18th - Sunday 19th. Survey of Currawong Bush Park.

Friday, 26th December - Thursday, 1st January, 1987, East Gippsland.

For details of M.S.G. activities ring the Secretary, Mr. Julian Grusovin on 211 4997.

*scyphus*; A yellow nudibranch, *Doriopsilla carneola* from Black Rock; and a spider, probably *Desis marina*, which lives in the intertidal zone of the shore and which can apparently survive long periods of immersion in salt water (this one having been under water for three days). Mr. Dan McInnes.

- A small fungus growing on a walnut twig. Mr. Urwin Bates.

- Numerous mineral specimens. Mr. Graeme Love.

#### Nature Notes

- On his lawn in Rosebud, mouse-spiders are very numerous. The females are larger than the males and dig a hole about 2 cm across and 1/2 metre deep. They must remove a considerable volume of sand but appear to disperse it evenly over the surface as there are no mounds of sand near the burrows. Mr. Tom Sault.

- Yellow-tailed Black Cockatoos have been seen pruning the tips off a Silky Hakea bush without apparently eating it. What are they doing? Mrs. Hilary Weatherhead.

- Mr. Urwin Bates said that he had seen Yellow-tailed Black Cockatoos doing the same thing to pine trees.

- Mr. Karl Kleinecke recounted reading an article which suggested that by damaging trees in this way, Cockatoos were making them more vulnerable to insect attack and thus ensuring their own future food supply.

C. M. Shankly

The World Congress of Herpetology announces the

### FIRST WORLD CONGRESS OF HERPETOLOGY

11-19 September 1989

at the University of Kent, Canterbury (U.K.)

This international congress will be the first of a series occurring at regular intervals at venues around the world. Such a meeting will enable all persons interested in herpetology to meet and exchange information to promote the advance of knowledge and the conservation of the world's amphibians and reptiles. The congress will consist of topical symposia, poster sessions, plenary speakers, workshops, displays, excursions, and meetings of ancillary groups. Subjects and moderators of symposia will be announced well in advance so that potential participants can volunteer. The meeting will be open to all persons. Registration will begin 1 January 1988.

For further details and mail listing, write: Dr. Ian R. Svingland, World Congress of Herpetology, Rutherford College, University of Kent, Canterbury, Kent CT2 7NX, United Kingdom

Sponsoring organizations and individuals are welcome. For further details write: Dr. Marinus S. Hoogmoed, Rijksmuseum van Natuurlijke Historie, Postbus 9517, 2300 RA Leiden, The Netherlands

# 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.

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

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## 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 1986

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# The Victorian Naturalist

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## FNCV DIARY OF COMING EVENTS

### GENERAL MEETINGS

#### Monday, 8th December, 8.00 p.m.

Australian Natural History Medallion Presentation (from November). Mr. Graham Pizzey "A Tale of Two Worlds - A Naturalists' View of Reality?"

#### Monday, 9th February, 8.00 p.m.

Mr. Max Dean. "Aboriginal Rock Paintings?"

#### New Members 17-7-85 to 29-9-86

##### *Metropolitan*

Mrs. D. M. Godfrey, P.O. Box 328, Rosanna, 3084.  
Mr. Keith D. Goodman, 11 Mary Avenue, Edithvale, 3196.  
Mr. Andrew Perkins, 113 Asling Street, Gardenvale, 3185.  
Mr. Kevin Redmond, 1/6 Charlotte Street, Collingwood, 3066.  
Mrs. Thomason M. Yock, 8A Fairmount Road, East Hawthorn, 3123.

Mr. C. Andersson, P.O. Box 207, Box Hill, 3128.  
Mr. John A. Horton, 21 Bayswater Road, Kensington, 3031.  
Mr. Peter Lynch, 18 College Parade, Kew, 3101.

##### *Country*

E. P. & S. A. Fenn, 4 Inlet View Court, Mallacoota, 3889.

### FNCV EXCURSIONS

**Saturday, 10th - Friday, 16th January.** Harrierville with day trips to Omeo, Mt. Hotham and other alpine areas. See last Naturalist for accommodation details. A deposit of \$50 should be paid when booking and the balance of \$330 paid by Friday, 19th December. The coach will leave from the Gas and Fuel Building in Flinders Street at 8.30 a.m. Bring a picnic lunch.  
**Australia Day weekend Alpine Campout. The Cobberas.** Contact Will Ashburner on 789 8485 (A.H.) for details.

**Sunday, 1st February.** Mornington Peninsula. This will be led by Mr. and Mrs. Kent, members of the Mt. Martha F.N.C. The coach will leave Batman Avenue at 9.30 a.m., fare \$10. Bring a picnic lunch. There will be a second pick-up point at the corner of Hawthorn and Balaclava Roads, Caulfield.

**Saturday, 7th - Monday, 9th March.** Victorian Field Naturalists Clubs Association combined weekend will be held at Inverloch this year and leaders will include Mr. and Mrs. Brewster. There will be an excursion Saturday afternoon and an evening meeting. On Sunday there will be a full day outing with an evening get-together and Monday a morning excursion before departing for home after lunch. A coach has been chartered for the weekend which will leave Flinders Street outside Gas and Fuel Building at 8.45 a.m. Bring a picnic lunch. Cost for accommodation R.O. and coach for the three days approximately \$95. Exact cost may vary according to numbers. Please book with excursion secretary as soon as possible, sending a \$25 deposit. The Saturday afternoon excursion will leave from Inverloch Motel, Bass Highway at 1 p.m.

### GROUP MEETINGS

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

#### **Day Group - Third Thursday.**

No excursion in December or January.

Thursday, 19th February. Flagstaff Gardens and Meat Market Craft Centre. Meet at Flagstaff Gardens at 11.30 a.m. Leader: Dan McInnes 211 2427.

**At the National Herbarium, Birdwood Avenue, South Yarra at 8.00 p.m.**

#### **Botany Group - Second Thursday.**

Thursday, 11th December. Annual Meeting and Members' night.

Thursday, 12th February. "Port Phillip Bay - Yesterday, Today and Tomorrow?" Mr. Bram Dawson.

#### **Geology Group - First Wednesday.**

Wednesday, 3rd December. Members' Night.

Wednesday, 4th February. "Further Developments in the Voyager Saga (Planets)" Dr. Andrew Prentice.

#### **Mammal Survey Group - First Tuesday.**

Tuesday, 2nd December. Christmas Members' Night.

Tuesday, 3rd February. To be announced.

#### **Miscroscopical Group - Third Wednesday.**

Wednesday, 21st January. Members' Night.

Wednesday, 18th February. "Rotifers" Mr. Dan McInnes.

### GROUP EXCURSIONS

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

#### **Botany Group**

**Saturday, 28th February.** Cement Creek, Warburton. Ferns and Mosses. Leader: Mr. Arthur Thies.

#### **Mammal Survey Group.**

Friday, 26th December - Thursday, 1st January, 1987, East Gippsland. For further details of M.S.G. activities ring the secretary, Mr. Julian Grusovin on 211 4997.



# The Victorian Naturalist

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Editorial Committee: R. Thomson, D. McClellan, V. Spencer

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Cover Illustration: *Sarcochilus australis* Gunn's Orchid

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# Host Species of Gunn's Orchid (*Sarcochilus australis*) from Otway National Park

BY PAUL BARNETT\* AND SUE BEATTIE†

*Sarcochilus australis* (Fig. 1) is an epiphytic orchid found scattered through wetter sclerophyll forests of Victoria, and commonly occurring in the Otway Ranges on the seaward side of the ridges.

In the Otway region, the Prickly

Currant Bush *Coprosma quadrifida* was previously thought to be its principal host shrub. Recent study of this orchid along an 8 km strip of Great Ocean Road, west of Apollo Bay, has revealed the following 16 host species.

<i>Acacia melanoxylon</i>	Blackwood
<i>Acacia verticillata</i>	Prickly Moses
<i>Bedfordia arborescens</i>	Blanket Leaf
<i>Coprosma hirtella</i>	Rough Coprosma
<i>Coprosma quadrifida</i>	Prickly Currantbush
<i>Correa lawrenciana</i>	Mountain Correa
<i>Eucalyptus regnans</i>	Mountain Ash (one orchid on one tree)
<i>Leptospermum juniperinum</i>	Tea Tree (one orchid on one tree)
<i>Notelaea ligustrina</i>	Mock Olive
<i>Nothofagus cunninghamii</i>	Myrtle Beech
<i>Olearia argophylla</i>	Musk Daisy Bush
<i>Phebalium squameum</i>	Satin Box
<i>Pimelea axiflora</i>	Bootlace Bush
<i>Pittosporum bicolor</i>	Banyalla
<i>Pomaderris aspera</i>	Hazel
<i>Prostanthera lasianthos</i>	Christmas Bush

Plants were found from 0.5 m above ground level to over 20 m on very large *Acacia melanoxylon*.

## Acknowledgement

The authors wish to express thanks to John Alderson for preparation of the illustration.

\*Carlisle River, Victoria 3239.

†5 Homestead Road, Eltham 3095.

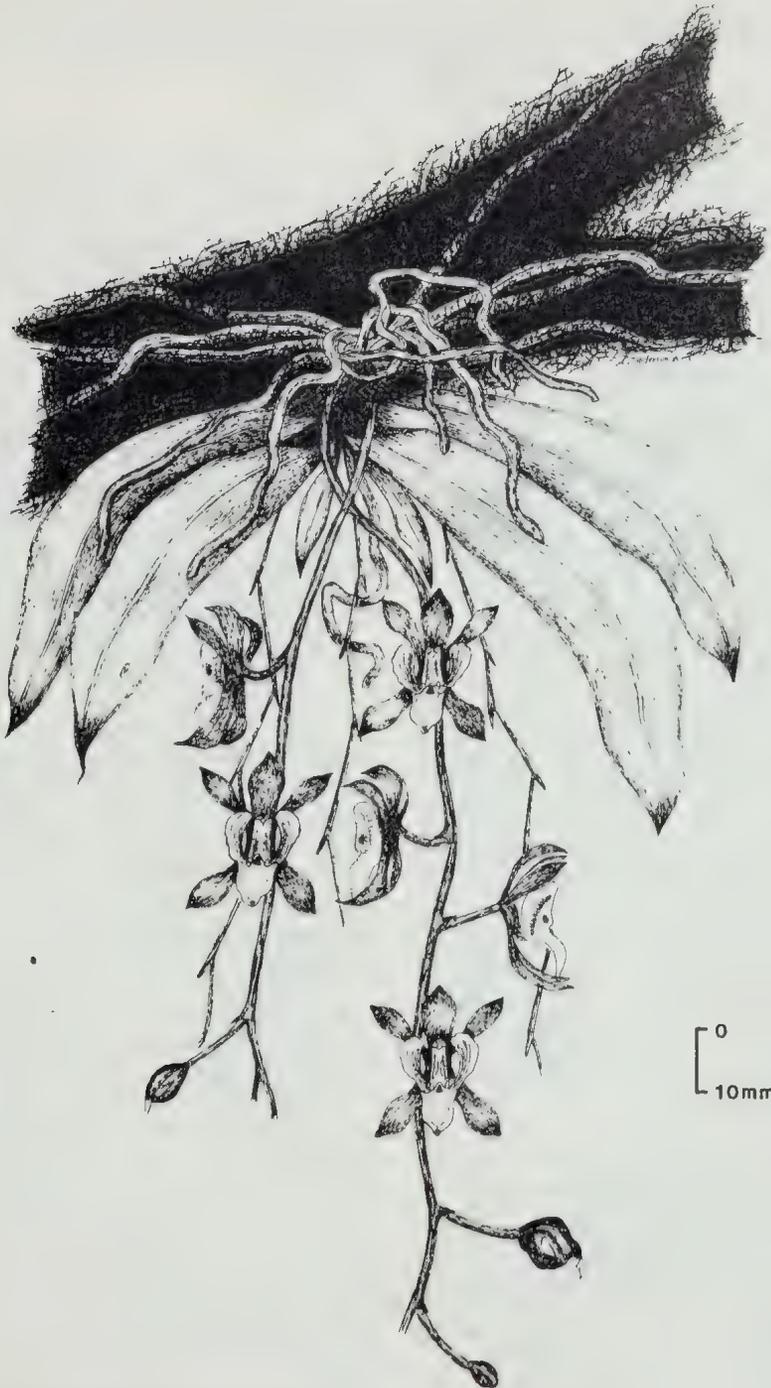


Fig. 1 *Sarcochilus australis* Gunn's Orchid.

# Flower-visiting Beetles of Some New South Wales Leptospermoidea

BY G. A. WEBB\*

## Introduction

Flowers of Myrtaceae, particularly the Leptospermoidea, are characterised by simple "dish and bowl" type flowers with white, cream or dull colouration, a strong smelling nectar and easily accessible pollen or nectar. They are therefore likely to be pollinated by unspecialised vectors such as beetles, flies, wasps and bats (Faegri and Van der Pijl 1979). Bees, wasps, flies and scorpionflies have been recorded as flower visitors to *Leptospermum* (Armstrong 1979; Breeden and Breeden 1972: 185; Clifford and Drake 1979; Costin *et al* 1979: 291; Keighery 1974; Michener 1965; Musgrave 1951; Rayment 1929, 1930, 1935, 1954; Riek 1970; Stoutamire 1975; Wakefield 1954) as well as a diverse Coleopteran fauna (Barnard 1884; Best 1881 a,b, 1882, 1920; Froggatt 1894; Hawkeswood 1978, Williams 1977; Williams and Williams 1983). Apart from two buprestids (Williams and Williams 1983) there have been no previous records of insects visiting *Baeckea*.

Flower-visiting insects were collected from eight species of New South Wales Leptospermoidea (2 *Baeckea* and 6 *Leptospermum*). Beetles, wasps, bees and flies were captured or recorded during the study. Beetles only are considered in this paper.

## Study Areas and Methods

Eight species of Leptospermoidea (6 *Leptospermum* and 2 *Baeckea*) were examined at various times during daylight hours between November 1983 and January 1985 at 3 locations (Bombala, Eden and Sydney) in New South Wales.

## Bombala

1. *Leptospermum juniperinum* Sm. a. (15 December 1983) Mixed stand of *L. juniperinum* and *L. myrtifolium* (not flowering) in grazing land 20 km southeast of Bombala (Southern Access Road to Nalbaugh State Forest). b. (17, 18, 20 January 1984) Scattered plants in 5 year old pine plantation 15 km east of Bombala (Burrumbucco Road) with *Kunzea capitata* and *Casuarina nana*. c. (15 December 1983) Scattered plants along Coolangubra Forest Way, Coolangubra State Forest.

2. *Leptospermum lanigerum* (Ait.) Sm. (21 December 1983). Scattered plants along the banks of the Genoa River near the corner of Cann Valley Highway and Imlay Road, 30 km southeast of Bombala.

3. *Leptospermum myrtifolium* Sieb. ex D.C. (17 January 1983). Large almost pure stand of *L. myrtifolium* with scattered *Hakea microcarpa* R. Br. on Cann Valley Highway near the Mila-Rockton Road, 20 km south of Bombala.

4. *Leptospermum phyllicoides* (A. Cunn. ex Schau.) Cheel a. (21 December 1983) Scattered plants along the banks of the Genoa River near the corner of Cann Valley Highway and Imlay Road, 30 km south east of Bombala and along the road cuttings of the Cann Valley Highway. b. (17 January 1984) Scattered plants, with *Bursaria spinosa* Cav. and *Cassinia longifolia* R. Br., in grazing land along the Southern Access Road to Nalbaugh S.F., Bombala.

5. *Baeckea utilis* F. Muell. (19 January 1984) Scattered plants in low lying swamp and adjoining eucalypt forest in the Coolangubra State Forest, Bombala.

## Eden

6. *Baeckea virgatus* Andr. (19 January

\*Forestry Commission of New South Wales  
P.O. Box 100, Beecroft, N.S.W. 2119

1985) Scattered tall plants behind the front dune at Wonboyn Beach, Nadgee Nature Reserve, Eden.

### Sydney

7. *Leptospermum flavescens* Sm. a. (4 November 1983) Scattered plants along roadside (Old Illawarra Road) at Alford's Point 25 km southwest of Sydney. b. (28 November 1984) Single tall plant (cultivated) in garden in the Cumberland State Forest, 25 km northwest of Sydney.

8. *Leptospermum attenuatum* Sm. a. Dense stands, with *Kunzea ambigua* (Sm.) Druce in the Darling Mills State Forest, 25 km northwest of Sydney. b. (22 December 1983) Scattered plants with *K. ambigua* along the roadside (Southwestern Freeway F4) near Bargo, 100 km southwest of Sydney.

Sampling intensity varied from single short visits of 15 minutes (for *B. virgata*) to many hours over several days (for *L. juniperinum* and *L. myrtifolium*).

### Results and Discussion

Forty-two species of beetles (Table 1) were recorded from flowers examined. The greatest number recorded from any one species (*L. juniperinum*) was 16. In general, the number of beetle species recorded increased with sampling time.

The most common taxa were species of Buprestidae (11 species), Mordellidae (7 species) and Scarabaeidae (6 species). These data are consistent with other studies of the beetle fauna associated with Myrtaceae flowers (Hawkeswood 1978; Ireland and Griffin 1984; Webb 1986a) where these families were common visitors. Ninety-three species of Buprestidae have been previously recorded from *Leptospermum* and *Baeckea* (Hawkeswood 1978; Williams 1977; Williams and Williams 1983). Of the 11 species recorded in this study, 3 (*Stigmodera delta* Thom., *Stigmodera dimidiata* Carter and *Cisseus acuducta* Kirby) have not previously been recorded from *Leptospermum* or *Baeckea*.

Apart from the observations of

Hawkeswood (1978), records of Coleoptera, other than Buprestidae, on *Leptospermum* are rather anecdotal (Barnard 1884, Best 1881a, b, 1882, 1920 Froggatt 1894) and there are apparently no records for *Baeckea*. Few of the species recorded by Hawkeswood (1978) from *L. flavescens* and *L. phyllicoides* were recorded in the present study. This is not surprising since both studies were of short duration and conducted in different localities. Nevertheless, these observations suggest that a diverse Coleopteran fauna may visit *Leptospermum* and *Baeckea* flowers.

Forty percent of the beetles recorded on the Leptospermoidea from Bombala have been recorded on other flowering plants in that area - *Hakea microcarpa* R. Br (Webb 1985) and various Asteraceae (Webb 1986b). This may suggest that beetles on the whole are indiscriminate pollinators. Strong smelling nectar is one of the primary attractants for beetles (Faegri and Van der Pijl 1979). *H. microcarpa* and some of the Asteraceae examined had noticeable strong smelling nectar and it is thus not surprising that similar suites of beetles were found on these plants of very different floral structure. Whether the nectar of the more complex flowers of Proteaceae and Asteraceae is accessible to beetles, particularly large taxa, is not known. Both families appear more suited to exploitation by long-beaked probing insects and vertebrates and/or primarily pollen feeders (Armstrong 1979, Ford *et al.* 1979).

Of the taxa recorded during this study, Armstrong (1979) lists only the Buprestidae, Mordellidae, Lagriidae and Oedemeridae as being exclusively anthophilous in their adult stage. The Cantharidae and Cleridae commonly visit flowers where they feed on other insects and take pollen and nectar. The remaining families contain only some anthophilous species. The Psephenidae and Cistelidae have apparently not been previously recorded visiting flowers.

	Leptospermum juniperinum			Leptospermum lanifera		Leptospermum myrtilifolium		Leptospermum phyllicoides		Baeckea utilis		Eden		Sydney	
	a	b	c			a	b	a	b	a	b	a	b	a	b
Col: Buprestidae <i>Stigmmodera delica</i> Thom. <i>Stigmmodera dimidiata</i> Carter <i>Stigmmodera erythroptera</i> (Boisduval) <i>Stigmmodera flavopicta</i> (Boisduval) <i>Stigmmodera macularia</i> (Donovan) <i>Stigmmodera naevata</i> Saunders <i>Stigmmodera ostospilota</i> Laport and Gory <i>Stigmmodera rufipennis</i> (Kirby) <i>Stigmmodera saxatilis</i> Gory <i>Cissene caudata</i> Kirby <i>Cissene</i> nr. <i>nitidiventris</i> Carter	*			*			*		*			*			*
Col: Lycidae <i>Metricorrhynchus rufipennis</i> Macleay	*							*				*			*
Col: Scarabaeidae <i>Anoplognathus australis</i> Boisduval <i>Automolus vulgaris</i> Britton <i>Phyllocoelus malleus</i> Fisch. <i>Phyllocoelus rufipennis</i> (Boisduval) <i>Phyllocoelus scutellaris</i> Macleay <i>Polyctigma punctatum</i> Don.	*		*	*		*	*	*	*	*	*	*		*	*
Col: Mordellidae <i>Hosbthanasomita leucosticta</i> Germine <i>Hosbthanasomita dumblelli</i> (Lea) <i>Mordella australis</i> Boisduval <i>Mordella</i> nr. <i>humeralis</i> Waterhouse <i>Mordella limbata</i> Waterhouse <i>Mordella promiscua</i> Erichs <i>Mordella sydneyana</i> Blackburn	*		*	*		*	*	*	*	*	*	*		*	*



Flies, wasps and the introduced honeybee *Apis mellifera* L. were often more abundant on the flowers of some *Leptospermum* than were beetles. At one site (Genoa River), flies were very abundant on *L. phyllicoides* and probably, by sheer weight of numbers, far more important than beetles as potential pollen vectors. Wasps, and particularly the honeybee, were also abundant on some *L. juniperinum* and *L. myrtifolium* at Bombala.

No vertebrates were observed visiting any of the *Leptospermum* or *Baeckea* examined and have rarely been reported visiting these plant genera (Armstrong 1979, Clifford and Drake 1979, Ford *et al.* 1979). This is not surprising since birds and mammals tend to be attracted to more complex and colourful flowers which provide significant nectar rewards (Faegri and Van der Pijl 1979, Ford *et al.* 1979).

Insects, therefore, are the most likely candidates as pollinators of *Leptospermum* and *Baeckea*. However, it is unclear which insect groups are the more important. The data suggest that pollination may be affected by a wide range of insect taxa.

#### REFERENCES

Armstrong, J. A. (1979). Biotic pollination mechanisms in the Australian flora - a review. *N.Z. J. Bot.* 17: 467-508.

Barnard, F. G. A. (1884). Notes on a days outing on the Dandenong Ranges. *Victorian Nat.* 1: 19.

Best, D. (1881a). Longicorn beetles of Victoria II. *Southern Science Rec.* 1: 21-24.

Best, D. (1881b). Longicorn beetles of Victoria IV. *Southern Science Rec.* 1: 69-72.

Best, D. (1882). Longicorn beetles of Victoria V. *Southern Science Rec.* 2: 35-38.

Best, D. (1920). To the alps for Coleoptera. *Victorian Nat.* 37: 85-90.

Breeden, S. and K. Breeden (1972). *Australia's Southeast. A natural history of Australia*: 2. William Collins (Aust.) Ltd., Sydney.

Clifford, H. T. and W. E. Drake (1979). Pollination and dispersal in Australian heathlands in R. L. Specht (ed.) *Heathlands of the World*, Elsevier Scientific Publ. Co., Amsterdam.

Costin, A. B., M. Gray, C. J. Totterdell and D. J. Wimbush (1979). *Kosciusko Alpine Flora*. CSIRO Melbourne.

Faegri, K. and L. Van der Pijl (1979). *The principles*

*of pollination ecology*. 3rd Ed. Pergamon Press, Oxford.

Ford, H. A., D. C. Paton and Forde, N. (1979). Birds as pollinators of Australian plants. *New Zealand J. Botany* 17: 509-519.

Froggatt, W. W. (1894). On the life-histories of Australian Coleoptera Part II. *Proc. Linn. Soc. N.S.W.* 9: 113-125.

Hawkeswood, T. J. (1978). Observations on some Buprestidae (Coleoptera) from the Blue Mountains, N.S.W. *Aust. Zool.* 19: 257-275.

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.

Keighery, G. J. (1974). Mecoptera as vectors - a new record. *West. Aust. Nat.* 13: 17-19.

Michener, C. D. (1965). A classification of the bees of the Australian and Pacific Regions. *Bull. Amer. Mus. Nat. Hist.* 130: 1-362.

Musgrave, A. (1951). A insect calendar (Part II) *Aust. Mus. Mag.* 10: 252-257.

Rayment, T. (1929). Bees from east Gippsland. *Victorian Nat.* 46: 124-129.

Rayment, T. (1930). Studies in Australian bees. *Victorian Nat.* 47: 9-16.

Rayment, T. (1935). *A Cluster of Bees*. Endeavour Press, Sydney.

Rayment, T. (1954). New bees and wasps XXIII. *Megachile cliffordii*. *Victorian Nat.* 71: 59-61.

Riek, E. F. (1970). Mecoptera. In ed. I. M. Mackerras, *The Insects of Australia*, Melb. Univ. Press pp. 636-646.

Stoutamire, W. P. (1975). Pseudocopulation in Australian terrestrial orchids. *Bull. Amer. Orchid Soc.* 44: 226-233.

Wakefield, N. A. (1954). Notes on a Phynnid (sic) wasp. *Victorian Nat.* 70: 222.

Webb, G. A. (1985). Insect pollinators of *Hakea microcarpa* (Proteaceae) at Bombala, New South Wales. *Victorian Nat.* 102: 204.

Webb, G. A. (1986a). Some insect pollinators of *Kunzea ambigua* (Sm.) Druce (Myrtaceae) near Sydney, New South Wales. *Victoria Nat.* 103: 12-15.

Webb, G. A. (1986b). Beetle visitors to *Helichrysum bracteatum* (Vent.) Andr. and some other Asteraceae near Bombala, New South Wales. Submitted to (Vic. Nat.).

Williams, G. A. (1977). A list of the Buprestidae (Coleoptera) collected from *Leptospermum flavescens* Sm. at East Minto, New South Wales. *Aust. Ent. Mag.* 3: 81-82.

Williams, G. A. and T. Williams (1983). A list of the Buprestidae (Coleoptera) of the Sydney basin, New South Wales, with adult food plant records and biological notes on food plant associations. *Aust. Ent. Mag.* 9: 81-93.

# The Cainozoic Lava Flows of Barfold Gorge

BY D. A. WALLACE\*, AND C. D. OLLIER†

A sequence of four superimposed basaltic lava flows are well exposed at Barfold Gorge, near Redesdale in Central Victoria (Grid Ref. 144°32'S, 37°34'W). The lava sequence, about 80 metres thick, unconformably overlies bedrock of tightly folded Lower Ordovician slate, sandstone and siltstone. In places there are Miocene gravels between the bedrock and the basalt, which were worked for deep lead gold in the 1860's.

The general geology of the area and details of the Cainozoic volcanic units have been described by Wilkinson (1980). The volcanic units, numbered 1 to 4 by Wilkinson, are all basaltic in composition. The lowermost unit (#1) is a blue-black oligoclase basalt, 6 metres thick, with lines of vesicles containing calcite and aragonite. It has columnar jointing, and also platy jointing. This is overlain by a massive 20 metre thick flow of dark anorthoclase basalt (#2). The top flow is a buff coloured vesicular olivine basalt, about 30 metres thick which Wilkinson subdivided into a lower (#3) unit and an upper (#4) unit.

All the lava flows except #4 display columnar jointing which is well exposed along both sides of the gorge. The most spectacular colonnades are developed in the #2 unit downstream from Mitchells Falls. Tessellated pavements, exposed in the river bed above and below Mitchells Falls, strikingly reflect in plan view the nearly regular geometrical mosaic formed by joint polyhedra within the #1 and #2 basalts.

A fossil soil layer about 1.5 metres thick lies between the #1 and #2 basalts (Fig. 1) and indicates a significant time gap between the two lava flows. The soil can

be traced for about 30 metres along the northern bank of the river below Mitchells Falls. It consists of a poorly sorted mixture of angular and rounded basaltic clasts within a yellow-brown clay which may be palagonitic. The clay breaks into angular peds and is partly gleyed, indicating considerable action of soil-forming processes. Fragments of wood are embedded in the upper surface of the deposit, and an in-situ root of unknown species was also observed.

The fossil soil horizon is continuous with a relict stream bed, also subsequently buried by the #2 flow, about 3 metres wide and 1 metre deep, and filled with alluvium.

Where the #2 flow overlies the fossil soil horizon and stream bed it is massive and crudely jointed. The basal part of the flow differs texturally from that above, as it is vesicular up to 20 cm above the base. The vesicles are flattened and their long axes are aligned parallel to the flow surface. The base of the flow, which elsewhere is generally planar, is complicated. In some places the base consists of convex-down curves, which appear to be the base of crude columns, as vertical cracks start where neighbouring convexities meet. The significance of this structure is not known: it may be some sort of load structure formed when the flow was still plastic, or it might perhaps be formed as some sort of flow structure. The multi-convex base of the lava is reminiscent of scour and fill sole-structures common in some grey-wackes and associated with turbidity currents, although of course such rapid flow is not possible with lava.

Where the lava crossed the fossil stream bed a heap of vesicular scoriaceous basalt and slaggy breccia was formed. This is interpreted as a hyaloclastite created by thermal autobrecciation of the hot fluid lava when it came in contact with water

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Fig. 1. Section of the foot of Barfold Gorge near Mitchells Falls showing (1) the upper (#2) lava flow of columnar basalt overlying (2) a fossil soil horizon which had developed over (3) the basalt (#1) flow of platy lava.

in the stream. The process envisaged has been described by Waters (1960): fluid lava, on abrupt contact with water tends to granulate like molten slag; the breccia so formed would accumulate to a depth approximately equal to the depth of water. In the Barfold Gorge example the breccia is considerably thicker (2 metres) than any likely depth of water in the small stream.

A zone of yellow discolouration extends vertically through the massive crudely jointed basalt directly over the breccia pile, like a "chimney" through the basalt. The yellowing is attributed to localized incipient palagonitization of the glassy matrix of the basalt by reaction with the gases generated by contact of the lava with water in the stream.

The overlying massive lava is arched over the heap of scoriaceous rubble, and the columns are distorted. This may result from changes in the pattern of isotherms during cooling rather than mobility of the flow.

The fossil soil, stream bed, and the

associated scoriaceous lava are largely responsible for the existence and location of the Mitchells Falls. Waterfalls often occur where a hard caprock overlies a soft, erodable rock. At Mitchells Falls the basalt of unit #2 forms the caprock, and the weathered top of #1, the soil layer, provides the erodable layer. The scoriaceous heap is especially prone to erosion and gives rise to small alcoves (Fig. 2). The old stream ran diagonally across the line of the present Campaspe, and erosion along this line caused a widening of the valley and presented a broad front along which erosion could attack the soil horizon. The present Mitchells Falls are just upstream of the line of scoriaceous basalt.

#### Ages of the basalts

Samples of all flows were taken for age determination by whole rock potassium/argon dating and for paleomagnetic polarity determinations. Owing to the presence of secondary carbonates only the uppermost flow proved suitable for dating.

It gave an age of  $3.12 \pm 0.05$  million years and is normally polarised, which corresponds within the limits of error with a period of normal magnetic polarity. In contrast, flows #1, #2 and #3 were all reversely polarised (M. Idnurm, BMR, pers. comm.).

Wilkinson (1980) reports a potassium argon date from the Axedale quarry of 6.95 million years, which he states is from a flow continuous with the #3 flow at Barfold Gorge. The ages of the lower two flows can only be guessed. The degree of soil formation is similar to that on unburied flows that may be over a million years old, but the small amount of stream incision in the lower flows suggests that a much smaller interval might be more appropriate. A close temporal relationship between flows #1, #2 and #3 is also inferred by their all being of reversed polarity. A reasonable guess for the age of lava flow #1 might be about 8 million years.

Since flow #4 erupted, the landscape has been dissected by the Campaspe River. The average rate of downcutting (80 metres in 3.1 million years) is only about 25 mm in 1,000 years. (This measure of erosion, millimetres per thousand years, is a standard way of expressing erosion rates, and is known as a Bubnoff unit, B.) The average rate of erosion on plains around the world is about 50 B (Ollier, 1982, p.249), so 25 B would be rather small. But the world average relates to general surface lowering, and the Barfold Gorge figure given above related simply to vertical erosion within the gorge itself. If the volume of material eroded from the gorge were averaged over the large area of its catchment then the erosion rate would be exceedingly small, perhaps only about 1 B.



Fig. 2. Section of gorge immediately below Mitchells Falls. (1) alteration 'chimney' (2) columnar #2 basalt (3) scoriaceous rumbly lava (4) fossil soil (5) basal #1 flow of platy lava.

Such very low erosion rates seem to be typical of much of Australia. (Ollier, op.cit.).

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**REFERENCES**

Ollier, C. D. 1982. *Tectonics and Landforms*. Longman.  
 Waters, A. C. 1960 Determining direction of flow in basalts. *Amer. J. Sci.*, 258-A, 350-366.  
 Wilkinson, H. E. 1980 (in) *Barfold Gorge, A case for conservation*. Loddon-Campaspe Regional Planning Authority Report.

# Ferns of the Mornington Peninsula

BY W. R. ARCHER\*

A fern survey was conducted on the Mornington Peninsula between 1978 and 1981, where most accessible and naturally vegetated areas were investigated. Emphasis was placed on the area south of a line drawn between Safety Beach and Balnarring, for this area contains the major Peninsula creek systems and the least interfered-with sections of natural vegetation.

The surveyed area is very variable with alkaline sands, and calcareous deposits south of Rosebud West to Point Nepean and back to Cape Schanck, where it changes to basalt which continues around the shore line of Bass Strait and into Westernport Bay. Land formations climb steeply east of Boneo Road (where alkaline sand changes to acid), up to the granite formations of Arthurs Seat at 300 metres, being the highest point on the Peninsula. The basalt area climbs more gently from Bass Strait and Westernport to Red Hill, with sands, clays and red basaltic soils covering the underlying basalt rock formations.

These extremely variable geographic formations, greatly simplified here, have led to the creation of very diverse and complex environments, producing habitats suitable for a great variety of animals and plant species, many of which survive today although often as remnants.

European settlement has had a profound impact on the Peninsula over the last 140 years, but began in October 1803 with the arrival of His Majesty's Ship, the *Calcutta*, under the command of Colonel David Collins, carrying marines, convicts and settlers, who made camp at Sullivan Bay, south-east of present day Sorrento. The settlement was not successful and was re-established in Tasmania the following

year (Crook 1983). It was not until 1840 that Captain James Reid established a "run" near Mount Martha which became the first permanent settlement (Rogers 1961). Since these times the Peninsula has experienced a steady population increase, with statistics to June 1984 of 77,400 permanent residents, with Flinders Shire (the main area of the survey) having 30,300 (Australian Bureau of Statistics). According to a Shire spokesman, holiday-makers in the summer months further increase the populous in the Flinders Shire to over 100,000.

With the popularity of the Mornington Peninsula, considerable pressures have been placed on the natural systems for a long time, resulting in major modifications to many areas. Those that have survived in reasonable condition have probably done so because the soils were poor, and of low economic value, or gradient so steep they acted as a natural deterrent. These areas tend to border the main creek systems, environments dominated by the Austral Grass-tree *Xanthorrhoea australis*, or the Arthurs Seat escarpment. Although much remains in private ownership, a considerable portion has been acquired or is controlled by the National Parks Service. While not all fern species occur within the Parks area the majority do if only as remnant populations.

Blackberry, *Rubus* spp., although heavily infesting large areas was surprisingly absent, or very weak in dense naturally vegetated sections, possibly indicating a lack of interest in these habitats by seed carrying birds and animals, or a protective closed plant community resisting the Blackberries' intrusion.

All ferns discovered during the survey were fully authenticated, and new species for Major Grid P, of the Vascular Flora of Victoria (Beaglehole 1980), lodged with the Melbourne National Herbarium.

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Keys to abbreviations used in the main text are as follows:

- V.C. = Very Common, appearing in thousands.  
C. = Common, appearing in hundreds.  
R. = Rare, appearing in dozens.  
V.R. = Very Rare, less than 2 dozen.  
\* = New fern species for Major Grid P (Beaglehole 1980).  
: = New fern species for Mornington Peninsula.  
+ = No specimen in Herbarium, recorded from literature only.  
M.C. = Main Creek.  
M.C.T. = Main Creek Tributaries.  
L.C. = Lightwood Creek.  
S.C. = Stony Creek.  
W.C. = Waterfall Creek.  
N.S.P. = Nepean State Park. This consists of a number of small fragmented and often isolated reserves, some as yet officially unnamed. Of the few that are, "Greens Bush" and "Highfield" are mentioned, others such as Baldry's Crossing are described by their locality.

Fern species recorded during the survey are as follows:

#### Family Osmundaceae

*Todea barbara* (L.) T. Moore Austral King-fern. C. in the head-waters of many creek systems where there is sub-surface moisture. Represented by not C. in N.S.P.'s, except for a large colony in a tributary to L.C., and scattered in W.C.

#### Family Schizaeaceae

: *Schizaea fistulosa* Labill. Narrow Comb-fern. Found in only two areas, but due to the difficulty of spotting these ferns in dense wet heaths, the possibility of them being overlooked is high. C. on private property Browns Road, Main Ridge. R. in a swampy section near the head of L.C. Greens Bush, N.S.P.

: *Schizaea bifida* Willd. Forked Comb-fern. Found only on private property in company with *S. fistulosa* where R. Both colonies in danger from clearing operations.

#### Family Gleicheniaceae

: *Gleichenia dicarpa* R. Br. Pouched Coral-fern. C. but very localised on private property in tributary to Splitters Creek off Wilson Road, and west of Purves Road off Waterfall Gully Road. V.C. in wet heath Pearcedale, Baxter and the Langwarrin Flora and Fauna Reserve.

*Gleichenia microphylla* R. Br. Scrambling Coral-fern. V.C. in boggy sections of swamps and creek tributaries, climbing on itself and neighbouring vegetation to heights of 3 metres, smothering smaller plants in the process.

#### Family Hymenophyllaceae

*Hymenophyllum cupressiforme* Labill. Common Filmy Fern. Found in three N.S.P.'s where C. but very localised. Restricted to moist rocks in M.C. near Baldry's Crossing, and below falls in W.C., but on the trunks of *Dicksonia antarctica* in L.C., Greens Bush.

\* *Polyphlebium venosum* (R. Br.) Copel. Veined Bristle-fern. C. but localised, growing on the trunks of Soft Tree-ferns with *H. cupressiforme* in L.C., Greens Bush N.S.P.

#### Family Cyathaceae

+ *Cyathea australis* (R. Br.) Domin. Rough Tree-fern. V.R. to C. in most Southern Peninsula creek systems, preferring sheltered, moist elevated well-drained situations.

#### Family Dicksoniaceae

*Dicksonia antarctica* Labill. Soft Tree-fern. C. and well represented in most creek systems, usually close to water. (Fig. 1.)



Fig. 1. Tree ferns (*Dicksonia*) along Drum Drum Alloc Creek, Mornington Peninsula. (Photo: J. H. Willis).

### Family Dennstaedtiaceae

*Calcitra dubia* (R. br.) Maxon Common Ground-fern. V.C. on sheltered banks of most creek systems.

*Hypolepis rugosula* (Labill.) J. Sm. Ruddy Ground-fern. Found in damp to boggy sections of most creeks, varying from R. to V.C.

+ *Hypolepis punctata* (Thunb.) Kuhn Down Ground-fern. Usually localised in minor sheltered moist gullies leading to the main creek system. V.C. in the Baldry's Crossing, N.S.P.

+ *Hypolepis muelleri* N.A. Wakefield Harsh Ground-fern. C. in M.C. Highfield N.S.P., often under *Pomaderris aspera* where other vegetation is sparse, also C. at the head of Mantons Creek in the Flora Reserve, Mornington/Flinders Road. Represented but R. elsewhere.

*Pteridium esculentum* (Forst. f.) Naskai Austral Bracken. V.C. in most parts of the Peninsula, and is proving to be a most troublesome weed by invading and smothering other indigenous flora in heath-land areas.

*Histiopteris incisa* (Thunb.) J. Sm. Bat's-wing Fern. R. to V.R. in most creek systems, but more common in the Red Hill district.

### Family Lindsaeaceae

*Lindsaea linearis* Swartz Screw Fern. V.C. in damp to wet heath.

### Family Adiantaceae

*Adiantum aethiopicum* L. Common Maidenhair. V.C. fern, found in a variety of habitats from exposed coastal cliffs to sheltered gullies.

\* *Adiantum capillus-veneris* L. Venus Maidenhair. C. but localised in M.C., part of the Cape Schanck Coastal Park, growing on a steep bank in a lime rich seepage area and represents the only known colony in Victoria (Archer 1986).

*Pteris tremula* R. Br. Tender Brake. R. to C. in shady moist environments of most creek systems.

\* *Pteris comans* Forst. f. Netted Brake. A rare Victorian fern, but C. in M.C. and M.C.T. Highfield N.S.P., and a M.C.T. part of the Cape Schanck Coastal Park. The three main colonies occur in dense shade, with strong seepage, and in close proximity to *Rapanea howittiana*.

+ *Pellaea falcata* (R. Br.) Fee Sickle Fern. V.C. in a M.C.T. Highfield N.S.P. Scattered in M.C. between Baldry's Crossing N.S.P. and Cape Schanck Coastal Park. R. in W.C. N.S.P. and private property S.C. Usually confined to small colonies on moist steeply sloping, often rocky creek banks.

*Cheilanthes austrotenuifolia* H. Quirk and T. C. Chambers Rock Fern. V.C. in the N.S.P. above W.C., but R. on the Arthurs Seat escarpment, and in the Joseph Harris Scout Park, Mount Martha.

### Family Polypodiaceae

*Microsorium diversifolium* (Willd.) Copeland Kangaroo Fern. Represented in most main creek systems, but C. only in a M.C.T., Highfield N.S.P. Scattered small colonies in M.C., L.C. and Tributaries. Usually found in sheltered gullies growing on logs, trees and the trunks of *Dicksonia antarctica*.

### Family Aspleniaceae

*Asplenium flabellifolium* Cav. Necklace Fern. V.C. fern of creek banks and

rocky areas.

- \* *Asplenium bulbiferum* Forst. f. Mother Spleenwort. A V.R. Peninsula fern, found only in M.C. and a M.C.T. Highfield N.S.P., and Greens Bush N.S.P., where restricted to deep, very shaded gullies close to water.

#### Family Athyriaceae

- \* *Athyrium australe* (R. Br.) Presl. Austral Lady-fern. Only three plants observed in private property on the eastern side of M.C. opposite Highfield N.S.P.

#### Family Aspidiaceae

- Polystichum proliferum* (R. Br.) C. Presl. Mother Shield-fern. C. to V.C. in cool, shaded, well-drained environments. Most areas.
- + *Lastreopsis acuminata* (Houlston) Morton Shiny Shield-fern. V.R. in M.C. Baldry's Crossing N.S.P., and a M.C.T. Highfield N.S.P. All plants close to water in very sheltered positions.

#### Family Blechnaceae

- + *Blechnum cartilagineum* Swartz Gristle Fern. Not discovered in any N.S.P., but V.C. on private property in S.C. bordered by Shands Road. There exists a small colony on the Shands Roadside above M.C., and scattered colonies in Dunns Creek some of which may be within the Bittern-Dromana Roadside Reserve. However, Shire roadside clearing and fern collectors place the long term survival of these colonies in doubt. An isolated sighting was made in a small rocky creek south of Waterfall Gully Road, in a similar habitat with accompanying plant communities to W.C., and may indicate this fern once existed in this N.S.P. or has been overlooked during the survey.
- + *Blechnum patersonii* (R. Br.) Mett. Strap Water-fern. R. in M.C. Baldry's Crossing N.S.P., where confined to a steep moist bank close to the waters edge under *Cya thea australis*.
- Blechnum nudum* (Labill.) Mett. Fishbone Water-fern. C. to V.C. in most creek

systems of the survey area.

- Blechnum chambersii* Tindale Lance Water-fern. V.R. in M.C. where known from only two colonies, with a total of seventeen plants. Both colonies in N.S.Ps. with the main one in Highfield, and the other, first recorded by Willis January 1942 (Willis pers. comm.) survives as a remnant in the Gwenmarlin Road area. The Colonies are restricted to shaded, cool, moist rocky banks close to water.

*Blechnum watsii* Tindale Hard Water-fern. C. to V.C. in most areas.

*Blechnum minus* (R. Br.) Ettingsh. Soft Water-fern. V.C. on creek banks and boggy tributaries.

- + *Doodia caudata* (Cav.) R. Br. Small Rasp-fern. C. on private property in the lower sections of S.C., rarer and widely scattered in M.C. between Baldry's Crossing and Highfield N.S.P's., where confined to very steep banks, close to waters edge.

*Doodia media* R. Br. Common Rasp-fern. V.C. along W.C. N.S.P., and C. in private property south of Waterfall Gully Road growing in close proximity to *Blechnum cartilagineum*. Represented but R. elsewhere usually on high banks among rocks, or shallow soils over rock. M.C. and a M.C.T. Highfield N.S.P., also along S.C. on private property.

#### Family Azollaceae

*Azolla filiculoides* Lam. Pacific Azolla. V.C. in ponds, dams and open swamps.

#### Family Selaginellaceae

*Selaginella kraussiana* (Kunze) Garden Selaginella. V.C. along M.C., and some M.C.T. Native to Africa, presumed to be an escapee from cultivation. This species was well established along Main Creek by 1942 (Willis, pers. comm.).

*Selaginella uliginosa* (Labill.) Spring Swamp Selaginella. V.C. in damp or swampy heaths.

At least four other fern species are known to have occurred in the survey area last century, and are now thought to be locally extinct. These were collected by J. Baldry who owned land where Main Creek intersects with Baldrys Road, here Main Creek meanders through a deep valley containing steep banks, and sheltered creek flats. The east side has been cleared for many years, but the western bank, now part of a State Park retains much vegetation, and remnants indicate the wealth of Flora that once must have existed here.

Of the ferns collected by J. Baldry, three were probably from or near his property. Two were Filmy Ferns, *Hymenophyllum australe* and *H. flabellatum*. The third, currently a rare Victorian fern and of which Baldry only noted one, was *Cyathea cunninghamii*, the Slender Tree-fern. All were collected in 1883 (Willis pers. comm.).

The fourth fern collected by J. Baldry was *Tmesipteris billardieri*, the Long Fork-fern, which is commonly found growing on the trunks of the Soft Tree-fern, *Dicksonia antarctica*. The specimen held at the National Herbarium, Victoria, is labelled "Western Port" (J. Baldry 1896), (Willis pers. comm.). Regrettably in this area little of the original vegetation remains, and if the location on the label was correct, this fern has disappeared from the district.

*Lycopodium deuterodensum*, the Bushy Clubmoss, recorded near Flinders, (Willis 1973), has probably suffered a similar fate to that of *T. billardieri*. Although not recorded during this survey, it may exist in one of the many damp peaty depressions of Greens Bush and Highfield Nepean State Parks.

Another plant in doubt is the Tiny Selaginella, *Selaginella gracillima*, recorded from Mount Martha in 1949 and 1958 (Duncan pers. comm.), also near Somers (Calder 1972). Both areas have experienced extensive development since, where the indigenous vegetation has not been removed or considerably modified.

The past and present wealth of the Pen-

insula fern flora can be gauged by the forty-five plants listed here. Two of these are rare State-wide, and another, a new species for Victoria, a record that is surprising considering the small, and relatively dry area involved. In the whole of Britain and Ireland, there are only 69 native Pteridophytes recorded (Page 1982), and even in lush rain forests where ferns are usually associated, the species number would be difficult to better. It is also unlikely that all fern species on the Peninsula were encountered, and no doubt in the course of time, keen searchers will add others to the list.

### Acknowledgements

My thanks to Mrs. B. Duncan, Monash University, for much detailed information, and for making available her research records of past fern findings on the Mornington Peninsula. Also Miss Todd, and Miss Allender, of the National Herbarium, for checking the mass of material sent to them. To Dr. R. F. Parsons, La Trobe University, for checking manuscript drafts, plant identifications, and for helping in any way he could. To Dr. J. H. Willis, for relating past experiences of the Peninsula, and his considerable knowledge of stored Herbarium information.

### REFERENCES

- Archer, W. R. (1986) *Adiantum capillus-veneris* L. *Adiantaceae* A New Fern Species for Victoria. *Victorian Nat.*
- Beaughlehole, A.C. (1980) *Victorian Vascular Plant Checklists*. Western Victorian Field Naturalists Clubs Association, Portland.
- Black, J. M. (1978) *Flora of South Australia*. Part 1. 3rd Ed. Government Printer, South Australia.
- Calder, W. B. (1972) *The Natural Vegetation Pattern of the Mornington Peninsula*. M.Sc. Thesis, University of Melbourne.
- Calder, W. B. (1975) *Peninsula Perspectives*. Hedges and Bell, S. Melb.
- Crook, W. P. (1983) *An Account of the Settlement at Sullivan Bay Port Phillip 1803*. The Colony Press, Melbourne.
- Jones, D. L. and Clemesha, S. C. (1976) *Australian Ferns and Fern Allies*. A. H. and A. W. Reed Pty. Ltd., Sydney.
- Page, C. N. (1982) *The Ferns of Britain and Ireland*. Cambridge University Press, Melbourne.

Rogers, H. (1961) *The Early History of the Mornington Peninsula*. Hallcraft Publishing Co. Pty. Ltd., Melbourne.  
Wakefield, N. A. (1975) *Ferns of Victoria and Tasmania*. Reviewed by J. H. Willis, Field Naturalists Club of Victoria, Melbourne.

Willis, J. H. (1972) *A Handbook to Plants in Victoria* Vol. 2. Melbourne University Press, Melbourne.  
Willis, J. H. (1973) *A Handbook to Plants in Victoria*. Vol. 1. 3rd Ed. Melbourne University Press, Melbourne.

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## Notes from the National Herbarium of Victoria

Taxonomic research is reported in scientific journals not readily available to naturalists. Flora accounts, such as the 'Flora of Australia', and identifications by herbarium taxonomists often provide the naturalist with new names resulting from taxonomic research but rarely provide an insight into the research itself.

A series of short articles dealing with taxonomic research in Australia and matters of general interest from the National Herbarium of Victoria will be published in the Victorian Naturalist over the next 12 months.

The first three of these deal with investigations into the nomenclature and identification of *Eucalyptus* species which have posed a continuing problem both for the amateur naturalist and professional botanist.

### Notes from the National Herbarium of Victoria – 1 Review of recent studies in *Eucalyptus* – the genus.

BY STEPHEN FORBES

*Eucalyptus* L'Herit. includes over 500 species and dominates Australian open forests, woodlands and mallee shrublands. In the century following Bentham (1867), *Eucalyptus* has been retained as a single genus and investigations have not justified reassessment of this status. Recent investigations, using modern techniques, have questioned the origins and nature of the eucalypts and aim to establish a natural classification within the genus.

The first complete classification within the genus *Eucalyptus* relied primarily on anther shapes (Bentham 1867) and eventually resulted in eight sections (Blakely 1934). Carr and Carr (1962) first suggested *Eucalyptus* should be split into two genera on the basis of seed coat and operculum (bud cap) development. Subsequent studies based on a wide range of morphological, anatomical, genetical and ecological

characters demonstrated this proposal to be premature. As a result of these studies, Pryor and Johnson (1971) proposed that *Eucalyptus* should be divided into seven subgenera and considered *Angophora* to be of equivalent rank.

Pryor and Johnson note that the seven subgenera more satisfactorily account for evidence, from naturally occurring hybrids and manipulated crossings, of isolation of groups within the eucalypts than previous classifications.

More recent analysis based on further studies throughout the Myrtaceae and the Myrtales has allowed Johnson and Briggs (1984) to recognise, in principle, 10 or 11 genera within *Eucalyptus* and *Angophora* ('eucalypts' in the broad sense). Johnson and Briggs contend that these genera are more clearly distinguished than other traditional genera in the Myrtaceae (and other families). The genera are outlined (subject to the later revision) in Johnson and Briggs (1983). Johnson has retained a conservative approach to the no-

\*National Herbarium of Victoria  
Department of Conservation, Forests and Lands,  
Birdwood Avenue, South Yarra, 3141.

menclature up to the present day. Pryor and Johnson (1971) refrained from formally reducing the generic status of *Angophora* and Johnson and Briggs (1983) have not committed the proposed eucalypt genera to formal publication. Nevertheless Johnson's analysis suggests that the present generic status of *Angophora* and *Eucalyptus* is misleading, and that the 'eucalypts' are polyphyletic. (A polyphyletic group is derived from a number of ancestral taxa and is based on convergence rather than common ancestry.)

Ladiges and Humphries (1983) analysed Pryor and Johnson's subgenera (with some modifications) and argued that, regardless of generic concepts *Angophora* could be readily separated from *Eucalyptus* (*sensu lato*). Further, Ladiges and Humphries' analysis suggests that the eucalypts are monophyletic. (A monophyletic group shares a common ancestry.)

Further research by Johnson (National Herbarium of New South Wales) and Ladiges (Botany School, University of Melbourne) is in progress. The publication of Johnson's proposed monograph on the eucalypts and Ladiges' analyses of the informal subgenus *Monocalyptus* (including about 100 species) will provide substantial contributions to eucalyptology.

Formal publication of Johnson and Briggs proposed genera would entail massive disturbance to current nomenclature and this aspect of research has attracted some criticism. The resultant disruption in communication would certainly be inconvenient, although identification of individual species would be unaffected.

Willis (1984) considers such social aspects of considerable weight and argued against the adoption of Johnson and Briggs proposed genera.

On the other hand Maze, quoted by Pedley (1986), argues against the consideration of social aspects and that, 'Social needs or desire should not dictate, or even suggest, the outcome of scientific research'.

Van Steenis (1985) argues against the proposed system on the basis that adoption of 11 genera, 'yields no gain and is based on inflation leading to confusion rather than to clarity'.

The adoption or rejection of new generic concepts is finally determined by common usage. However, the generic concepts adopted for the *Eucalyptus* account in volume 19 of the 'Flora of Australia' may determine common usage after the proposed publication date of 1988. The draft account for the flora by Chippendale (unpublished) treats *Eucalyptus* as a single genus.

#### Acknowledgements

The author is grateful to Dr Pauline Ladiges (Univ. of Melbourne) and Mr David Albrecht (National Herbarium of Victoria) for valuable comments on the manuscript.

#### REFERENCES

- Bentham, G. (1867) *Flora Australiensis* Vol. 3 Reeve, London.
- Blakely, W. F. (1934) A key to the eucalypts 1st ed. Commonwealth of Australia. Forestry and Timber Bureau, Canberra.
- Carr, S.G.M. & Carr, D.J. (1962) Convergence and progression in *Eucalyptus* and *Symphyomyrtus*. *Nature* 196: 969-972.
- Chippendale, G.M. (unpub.) *Eucalyptus* Author's manuscript for *Flora of Australia* vol. 19.
- Johnson, L.A.S. & Briggs, B.G. (1983)\* Myrtaceae pp. 175-185 in B. Morley & H. Toelken (editors) *Flowering Plants in Australia*. Rigby, Adelaide.
- Johnson, L.A.S. & Briggs, B.G. (1984) Myrtales and Myrtaceae - a phylogenetic analysis. *Ann. Missouri Bot. Gard.* 71: 700-756.
- Ladiges, P.Y. & Humphries, C.J. (1983) A cladistic study of *Arillastrum*, *Angophora* and *Eucalyptus* (Myrtaceae). *Bot. J. Linn. Soc.* 87(2): 105-134.
- Pedley, L. (1986) Derivation and dispersal of *Acacia* (leguminosae), with particular reference to Australia and the recognition of *Senegalia* and *Racosperma*. *Bot. J. Linn. Soc.* 92(3): 219-254.
- Pryor, L.D. & Johnson, L.A.S. (1971) *A classification of the Eucalypts*. Australian National University, Canberra.
- van Steenis, C.G.G.J. (1985) The undesirability of splitting *Eucalyptus*. *Austral. Syst. Bot. Soc. Newsletter* 42: 13-16.
- Willis, J.H. (1984) Generic disintegration of *Eucalyptus*. *Austral. Syst. Bot. Soc. Newsletter* 38: 13-14.

\*Johnson & Briggs (1983) is especially useful as an introduction to the references cited in the text.

## OBITUARY – EDMUND DWEN GILL

We note with regret the death on 13th July last of Edmund Gill, research scientist, Museum Director, respected community leader, loved husband and father, and prolific contributor to the 'Victorian Naturalist'.

Much has been written about the demise of the all-rounder under present day pressures but Edmund managed to retain an authoritative voice in many spheres of earth science throughout a long and fruitful career.

From our Naturalists' viewpoint his wide field experience was one key to this expertise, and he used the 'Victorian Naturalist' to publish over 70 papers in the period from 1938 to 1985.

During that time he reported on subjects as varied as trilobites and volcanology, fossil plants and fossil penguins, Aborigines and carbon dating, erosion rates on the southern cliffs, climatology, and wildfires.

In later years he extended his international reputation into Quaternary geology and eustatic changes, basing his findings largely on the Warrnambool coastline in which area he had many years earlier first met his wife, Kathleen.

He led a fruitful Public Service career as Curator of Fossils and later Assistant Director of the National Museum of Victoria. He also served our Field Naturalists Club as speaker and excursion leader, and was a staunch supporter of other organisations, notably the Royal Society of Victoria where he served as Treasurer, Secretary (during a period of considerable problems) and eventually President in 1969 and 1970.

His work was recognised by award of the Royal Society of Victoria Research Medal in 1968, and our own Australian Natural History Medallion in 1973. There was a special Symposium of the Royal Society of Victoria in his honour in 1981, and he was invited as visiting lecturer at several overseas Universities later in his career.

Our Club can ill afford the loss of a supporter of his stature.

J. Douglas  
4/11/86

**GRAHAM MARTIN PIZZEY**  
**AUSTRALIAN NATURAL HISTORY MEDALLIST 1986**

Graham Pizzev will be awarded the Australian Natural History Medallion for 1986 at the meeting of the Field Naturalists Club of Victoria on 8 December. He will be well known to most Victorian naturalists because of his long involvement in natural history and, in particular, his popular writings.

Graham Pizzev was born at Heidelberg on 4 July 1930 and, after matriculating from Geelong Grammar School in 1947, went into the family business. In 1954 he began a regular natural history column in the Melbourne *Age* which continued until 1965 when he commenced writing for the Melbourne *Herald*. He contributed a weekly Saturday article in this paper for 18 years, covering an immense range of subjects with an ecological flavour and a conservation emphasis. "All Around Us", a mid-weekly letters from readers column complemented the weekend articles, which were illustrated with his own photographs.

Since 1959, when he left the business to devote time to writing about the natural world, including conservation issues, he has travelled extensively in Australia, observing, writing about, photographing and filming wildlife and its habitats. His photographs have been published in many newspapers, journals and books both in Australia and overseas and he has been involved in the production of several significant documentary films.



Graham Martin Pizzev, Naturalist

His prime interest has always been birds and his greatest contribution to their study has probably been **A Field Guide to the Birds of Australia** (Collins, 1980), a prize winning book, ten years in preparation and a treasure in every naturalists library. As of December 1985 over 42,000 copies had been sold. His other books are **A Time to Look** (Heinemann, 1959), **Animals and Birds in Australia** (Cassell, 1968), **A Separate Creation** (Currey O'Neil Ross, 1985) and **The World in Your Garden** (In preparation, Nelson, 1986). He is currently working on a biography of Crosbie Morrison (winner of the 1947 Australian Natural History Medallion) commissioned by the Victoria Museum.

His other major commitment in recent years has been the Coolart Reserve, Somers, Victoria. As Warden of the Reserve from 1980 to 1984 he oversaw the transformation of the property into an interpretative conservation area now attracting over 27,000 visitors a year. Work at Coolart included pioneering use of bird hides, development of new wetlands, the creation of interpretative audio-visual programmes, a large scale native tree planting programme and reclamation and regeneration work on native woodlands. Since 1984 he has been a Consultant to the Committee of Management.

He is a popular speaker, having addressed a wide range of community groups over a period of 25 years, and a coveted leader of bird watching tour groups. He has also been a member of a large number of natural history organisations and conservation groups including the RAOU (1946+), BOC (1958+), FNCV (1961+), and ACF (1965+). He was a Founding Member and later President of the Peninsula Conservation League (1966-69), Member of the Victorian National Parks Authority (1969-72), Council Member RAOU (1969-75) and has held other offices too numerous to mention.

In 1975 he was honoured for services to conservation and ornithology with the award of Member of the Order of Australia (AM).

Graham Martin Pizzev, the Field Naturalists Club of Victoria commends You!

### **The Australian Natural History Medallion Fund**

Donations from any organisation or individual wishing to support this fund will be appreciated and acknowledged. Contributions to the Hon. Treasurer, FNCV.

#### **AUSTRALIAN NATURAL HISTORY MEDALLION WINNERS**

1940	Alex H. Chisholm	Ornithology, General Natural History (Popularisation)
1941	Frederick Chapman	Geology, Palaeontology, Microscopy
1942	David H. Fleay	Mammalogy, Ornithology
1943	Herbert W. Wilson	General Natural History (Education)
1944	John McConnell Black	Botany
1945	Charles P. Mountford	Anthropology, Ethnology
1946	Heber A. Longman	Zoology, Palaeontology
1947	P. Crosbie Morrison	General Natural History (Popularisation)
1948	Ludwig Glauert	Herpetology (Palaeontology)
1949	Edith Coleman	General Natural History, Botany, etc.
1950	Bernard C. Colton	Conchology
1951	Tarleton Rayment	Entomology (Bees)
1952	John Burton Cleland	General Natural History, Ornithology (Botany, Ethnology, Conservation, etc.)
1953	Charles Leslie Barrett	Ornithology, General Natural History (Popularisation)
1954	Herman M. R. Rupp	Botany (Orchids)
1955	Stanley R. Mitchell	Anthropology, Geology
1956	Dominic Louis Serventy	Ornithology
1957	Charles E. Bryant	Ornithology
1958	Charles J. Gabriel	Conchology
1959	Keith A. Hindwood	Ornithology
1960	James H. Willis	Botany, General Natural History
1961	Emil H. Zeck	Entomology

## AUSTRALIAN NATURAL HISTORY MEDALLION WINNERS (CONT'D)

1962	Norman A. Wakefield	Botany, Ornithology, etc. (Mammalogy)
1963	Thistle Y. Stead	Botany, Conservation (Education)
1964	Winifred Waddell	Botany, Conservation
1965	Roy Wheeler	Ornithology
1966	J. Ros Garnet	Botany, Conservation
1967	Gilbert P. Whitley	Ichthyology (Oceanography)
1968	Norman Barnett Tindale	Anthropology, Entomology, etc.
1969	Charles A. Gardner	Botany
1970	Jean Galbraith	Botany, Conservation (General Natural History)
1971	Alexander Clifford Beaglehole	General Natural History (Botany, Entomology)
1972	Allen Axel Strong	Conservation (Ecology)
1973	Edmund D. Gill	Anthropology, Geology, Palaeontology
1974	Vincent Noel Serventy	Ornithology, Natural History (Conservation, Popularisation)
1975	Alison W. Ashby	Botany (Illustration, Cultivation)
1976	Winifred M. Curtis	Botany
1977	John Russell (Jack) Wheeler	Ornithology, General Conservation
1978	Allen Roy Sefton	Ornithology, General Conservation
1979	Helen Aston	Ornithology, Botany (Aquatic Plants)
1980	Michael Tyler	Herpetology (Frogs)
1981	Elizabeth Marks	Entomology
1982	Howard Jarman	Ornithology
1983	Trevor Pescott	Natural History (Ornithology, Conservation)
1984	Kevin Kenneally	Botany, Natural History
1985	Jack Hyett	Natural History (Ornithology)
1986	Graham Pizzey	Natural History (Ornithology)

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## Naturalist Review

### Ferns and Allied Plants of Victoria, Tasmania and South Australia

BY BETTY D. DUNCAN AND GOLDA ISAAC, MELBOURNE UNIVERSITY PRESS (1986),  
25 x 18cm, 258 pp. Price \$25

How many people have been attracted into botanical research through an initial fascination with the world of ferns or orchids (or both)? Such plants are notable either for their delicacy and consummate grace or for bizarre shapes and intriguing colours. Australia is certainly not deficient in literature – both scientific and popular – concerning its rich fern and orchid floras; there are published accounts for some whole States and for other sizeable regions (e.g. Central Australia), but these vary much in depth of treatment and pictorial detail.

Betty Duncan and Golda Isaac, working from the Department of Botany at Monash University, have long been aware of the growing need for a good, definitive guide to the ferns and fern-allies of south-eastern Australia, one that embraces reliable keys to genera and species, full descriptions, and such adequate illustrations that identifications can be made beyond all doubt. They have set out to supply this need for the three States of Victoria, Tasmania and South Australia which together cover an area of 1,279,900 km<sup>2</sup> – larger than all the British Isles, France, Holland, Belgium and greater Germany combined. This region makes up 17 per cent of the Commonwealth and includes 130 species of ferns etc. (all but eleven occurring in Victoria); the figure is substantially more than that for all species to be found in the West European countries mentioned above.

Following concise introductory sections on the life cycle, structure, taxonomy and identification of ferns, the authors present their detailed descriptions under chapter-headings which are arranged according to widely accepted family groups, e.g. "Fork-ferns (PSILO-TACEAE)", "Spleenworts (ASPLENI-ACEAE)" etc. Nomenclature is brought up to date; for instance, the common Rock Fern must now be called *Cheilanthes austrotenuifolia*, not "*C. tenuifolia*". The illustrations are copious and a sheer delight. Every species description is accompanied by good black-and-white photographs of fronds, supplemented by line drawings of such diagnostic features as trichomes, scales

and/or sori; in addition, there are 49 beautifully reproduced colour plates. All photography is the work of Mr. Bruce Führer, a sufficient guarantee of excellence.

Both Australian and overseas distribution is indicated, while Victorian readers have the bonus of an inset map for each species, showing its Victorian range by means of dots on a 10-minute grid (i.e. known occurrence within any rectangular area of approximately 18 x 15 km). An interesting chart of the State extends across pages 12 and 13; this indicates, for each of the 10-minute rectangles, the total number of species currently recorded therefrom. Thus, the third rectangle east from Port Phillip (at Brighton-Sandringham) shows 46 species – most of the Dandenong Ranges comes within this area which is well known and documented. On the other hand, many rectangles are left blank – especially in the Mallee, Wimmera and northern plains where careful field work still needs to be done. Chapter 22, by C. J. Goudey and R. L. Hill, gives information on the techniques of propagation and cultivation; the whole book is rounded off by a comprehensive bibliography (93 authors), a glossary of botanical terms, list of authors of plant names and full index (including synonyms).

The pleasing lay-out of this volume, its typography, clarity and freedom from even minor errors (at least, I cannot detect a single mistake!) merit high praise for the collaborating authors and for Melbourne University Press. Superlatives are justified for every phase of the work, and one agrees totally with the dust-jacket pronouncement: "This handsome book will be welcomed", i.e. by a wide circle of botanists, naturalists and fern-lovers. It is quite the finest and most useful production of its kind yet to enhance our botanical book-shelves, and for many serious students it will largely supersede the Club's own handbook, *Ferns of Victoria and Tasmania* by N.A. Wakefield (revised ed. 1975).

J. H. Willis

## Bequests to the Field Naturalists Club of Victoria

The Club is conscious of the extent to which its development and influence depend upon the assistance of benefactors. Donors may prefer to make their gifts during their lifetime or by their Wills. In either case the President and other officers will always be happy to discuss the nature and conditions of benefactions to ensure that they will be made in accordance with the overall needs of the Club.

Very often a gift expressed in general terms is more advantageous than one restricted to certain purposes.

At the same time the Club will always try to ensure that any special intention of a benefactor in relation to a gift is fully observed and carried into effect.

Should donors prefer to make their gifts by Will, the following form of bequest may prove of assistance:

"I give and bequeath to the Field Naturalists Club of Victoria the sum of ..... dollars to be paid free from all duties and to be applied for the purposes of the Club in such manner as the Council of the Club may determine and I direct that the receipt of the President or Treasurer shall be sufficient discharge for my Trustee(s)".

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All enquiries to D. E. McInnes, Victorian Naturalist Sales Officer, c/- National Herbarium, Birdwood Avenue, South Yarra.

## F.N.C.V. BAW BAWS SUMMER CAMP-OUT, 1986

The Club's third successive mountain excursion, over an Australia Day weekend, was to the Baw Baw plateau from January 25-27 last. Some 20 campers took part, and again we were blessed with perfect summer weather; it was a pleasure to welcome Mr. Arnold Piesse who had come all the way from Wangaratta. Idyllic tent-sites were available on rather open grassy ground under tall sheltering Silver Wattles (*Acacia dealbata*) about 2 km down the road from Gwinear car-park; water was readily accessible from a clear stream among myrtle beeches and tree-ferns less than 80 paces from the tents, while rounded granitic rocks and log seating surrounded ample space for a large central camp-fire. One collapsed iron hut was almost the only visible evidence that this had also served as the site for a forest workers camp during construction of the Gwinear roadway about 15 years earlier.

The vanguard (including Tom Sault in his "campervan") had arrived on Friday afternoon, but most participants came along next morning, ready for the first half-day outing after lunch. A few of the earlier arrivals enjoyed a pre-lunch walk up to the car-park and back, noting the transition from ash forest (*Eucalyptus regnans* and *E. delegatensis*) to a belt of Tingaringy Gum (*E. glaucescens*), then into predominant snow gum woodland (*E. pauciflora*, subsp.) with rising altitude. Arthur Thies found plenty of interest among moss colonies on the overhanging roadside boulders, and all admired the shell-like elegance of Summer Greenhood flowers (*Pterostylis decurva*) here and there.

Later our whole party, ferried to the car-park, set off on a rather strenuous walk over Mt. St. Gwinear to Mustering Flat — largest of the plateau's moss-bog formations. A few white-flowered orchids (*Caladenia lyallii*) and many trigger-plants (purple-spiked *Stylidium graminifolium*) added interest along the climb to St. Gwinear (1509m) where superb views were enjoyed and photographed. On the descent westward, into the head of North Cascade Creek, a fine flowering patch of yellow, single-headed Alpine Groundsel (*Senecio pectinatus*) evoked admiration. On marshy ground against the stream-banks we saw white flowers of alpine *Brachycome obovata*, *Drosera arcturi* and *Euphrasia gibbsiae* — the last a second blooming, with racemes of recently set, ripe capsules on the same plant. Hereabouts Will



Photo 1. The Baw-Baw Berry, *Wittsteinia vacciniacea*. Photo: Ilma Dunn.

Ashburner collected the tiniest frog anyone had ever seen — apparently mature but measuring only 10-15mm in length! Squelching our way up a steep "track" along the westerly gully-head of Cascade Creek, we emerged on the high ridge overlooking Mustering Flat. Two leek-orchids (*Prasophyllum alpinum* and *P. suttonii*) were flowering simultaneously around nearer edges of the Flat, but little else of note. The rough scramble up a westerly spur to the main east-west Baw Baws track, and the long walk past St. Phillack and St. Gwinear back to vehicle transport, proved uneventful.

Sunday (26.1.86) afforded us an easy, all-day walk to Mt. Kernot via Mt. St. Gwinear again, the long eastern head of North Cascade Creek and the main east-west track. Along the Cascade's mossy flats and attractive pools (ringed with the bluish sedge *Carex gaudi-chaudiana*), we were joined for the day by Mr. Wilhelm Hirsch — a Gippslander camped nearby. Beautiful floral displays along the plateau-top this day were provided by *Orites lancifolia* (on the dead capsules of which we found the minute orange cup-fungus *Bisporella oritis*), *Prostanthera cuneata*, *Olearia phlogopappa*, *Pimelea alpina*, *Stylidium graminifolium* and *Senecio pectinatus*. Pretty Grass-flag (*Libertia pulchella*) unfolded its paniculate clusters of white flowers on moist embankments shaded by shrubs, while out in open grassy spots the Sky Lily (*Herpolirion novae-zelandiae*) made carpets, with inch-wide pale star-flowers, amongst damp turf.

Mt. Kernot lies just north of the ridge track to Mt. Erica and across a small *Richea* flat with moss-beds where fragrant Sweet Holy Grass



Photo 2. Dwarf or Alpine Ballart (*Exocarpos nanus*).  
Photo: Alan Morrison.

(*Hierochloe redolens*) and blue Veined Sun-orchid (*Thelymitra venosa*) were blooming.

None of us had previously climbed this minor peak of the Baw Baws National Park; so it was exciting to reach the broad summit and be confronted by a marvellous spectacle of massed flowers:— white-headed Silver Daisy (*Celmisia asteliifolia*), purple spikes of Grass Trigger-plant in abundance, golden heads of the composites *Podolepis robusta*, *Craspedia glauca*, *Senecio pectinatus* and *S. linearifolius*.

On lower south-western slopes of the mount we were fortunate to encounter a large colony of tall Alpine Greenhood (*Pterostylis scabrada*, syn. *P. alpina*) — the eighth species of orchid recorded during this excursion, and probably the most striking of all. Before returning to Mt. St. Gwinear, the party made a detour southward to inspect lovely Tullicoutty Glen with its big pools and reflections, rich bog flora and occurrences of small Mountain Plum Pine (*Podocarpus lawrencei*). It was distressing to

find a steep muddy track trampled through *Baeckea* and *Richea* scrub onto a flat grassy patch among the deep moss-beds; here several tents had been erected. Camping should *never* be permitted in such a sensitive environment, within a National Park, and one shudders at the permanent damage wrought by incursions of this kind.

After packing up early on Monday, we drove on towards Erica and enjoyed our final half-day excursion by walking up the Mt. Erica track from car-park to the “Mushroom Rocks” — a spectacular series of jumbled tors, often mossy and sometimes capped by huge horizontal slabs. In creek-side scrub at the Scout Hut nearby, David Albrecht pointed out a small occurrence of Tasmanian *Richea gunnii*, more spindly and longer-leaved than the common mainland *R. continentis* and only recently confirmed as occurring in Victoria. The present forest of white-shafted *Eucalyptus nitens* (Shining Gum) and tall dense *Acacia dealbata* constitutes regrowth from the big bushfire of 13 Jan. 1939; it now makes a dramatic picture. Citrine-hued bells of Purple Apple-berry (*Billardiera longiflora*) cascaded attractively from wiry lianes on some of the smaller trees. Nearer the car-park are a few gullies that still carry sizeable trees of pre-1939 Myrtle Beech and Southern Sassafras — habitats for a wealth of mosses and hepatics. Here Arthur Thies built up his tally of bryophytes (noted for this week-end) to about 100 species: excellent effort.

For nearly a century, members of the F.N.C.V. have played a conspicuous part in the botanical investigation of the Baw Baws, as attested by copious specimens in the National Herbarium and sundry reports in this journal. Among the earliest visitors, after Baron von Mueller in 1860, were J. G. Luehmann, C. French Jr. and F. Tisdall (Dec. 1892-Jan. 1893) who collected on Mts. Erica and Mueller; Charles French Jr. made further collections on the Baw Baws in 1894 and Apr. 1895. Next, in early January 1905, Messrs. H. B. Williamson, G. Weindorfer and C. S. Sutton made a one-day dash to the summit of Mt. Erica (from upper Moondarra, 19 kilometres away) and managed to collect samples of 112 species — details of this memorable botanical trip were published in *Vict. Nat.* 22: 58-61 (Aug. 1905). F. G. A. Barnard, C. French Jr. again, J. O'Donoghue and party spent three days botanizing between Mts. Erica and St. Phillack late in January 1914 — see account in *Vic. Nat.* 30: 198-210 (Mar. 1914). Rev. A. C. F. Gates was thrice on Mt. Erica (Jan. 1925, Feb.

1926 and Nov. 1929), a list of the species he found appearing in *Vict. Nat.* 42: 254 (Mar. 1926). Innumerable visits by other naturalists have been made over the past 60 years, adding substantially to our knowledge of the plateau's flora.

The origin of place names in this National Park is rather interesting, especially those of the mountain peaks. The name *Baw Baw* itself probably stems from the aboriginal "bo-bo", meaning bandicoot (See Les Blake, *Place Names of Victoria*, Rigby 1977). Mt. Erica (also Erica township) denotes the profusion in this region of a native heath; apparently some non-botanical observer had mistaken our local genus *Epacris* for the Old-World *Erica*. Talbot Peak commemorates the name of Sir Reginald A. J. Talbot, Governor of Victoria (1903-1908); he officially opened the Warburton to Walhalla track (over the Baw Baws) in Jan. 1907. Mt.

*Kernot* was named as a tribute to W. C. Kernot, Professor of Engineering at Melbourne University (1883-1909). Mts. *St. Phillack* and *St. Gwinear* are of curious derivation: they were bestowed by a Cornishman, Mr. S. Barnes M.L.A., with undoubted patriotic zeal, after tiny villages near Hale, his home town in western Cornwall, U.K. Mt. *Whitelaw* perpetuates the name of O. P. Whitelaw, a track surveyor in Gippsland during the 1870's - he was drowned at Walhalla. Mt. *Mueller*, of course, is after the great botanist Baron Sir Ferdinand von Mueller who collected on these subalpine tops for a week in Dec. 1860, assisted by four companions; their outstanding discovery was the remarkable genus *Wittsteinia*, endemic in Victoria and now assigned to the small family Alseuosmiaceae (akin to Ericaceae).

- J. H. Willis.

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## FIELD NATURALISTS CLUB OF VICTORIA

Reports of recent activities

### General Meeting

Monday, 8th September

**Silence** was observed by the meeting in respect for Mr. Edmund D. Gill, as geologist and ex-Assistant Director of the National Museum of Victoria who died on the 13th of July.

This being the Club's Annual Members' Night, a number of members from the various Groups had agreed to speak.

The first speaker was Mr. Barry Kemp who spoke on the revegetation of Mt. Macedon following the bushfires of Ash Wednesday, 1983. He showed slides of various stages in the vegetational regrowth and told us of some interesting observations, such as that many of the trees in the ash forests which were "salvaged-logged" by the Forests Commission, were in fact only lightly damaged and growing back from epicormic shoots and that mistletoes were observed to be able to regrow from within the host tissue provided the host branch was still alive.

Mr. Bill Rocke of the Botany Group spoke on aspects of a trip he had made to

the "Corner Country" of N.S.W. - an area west of the Darling River and near the borders of N.S.W., S.A. and Queensland. He illustrated his talk with many interesting slides of local vegetation and scenery.

Mrs. Gabi Love then spoke on the history, interests and activities of the Geology Group which is to celebrate its 40th anniversary next year.

A brief history of the Mammal Survey Group was then recounted by Mr. Tom Sault. The Group was formed in the late 1950s by Norman Wakefield at a time when very little work was being done professionally on Victoria's native mammal fauna. A number of important finds were made by the M.S.G. including the rediscovery of Leadbeater's Possum and the New Holland Mouse and great extensions to the known ranges of the Smokey Mouse and the Swamp Antechinus. Mr. Julian Grusovin, also of the M.S.G. then briefly outlined some of the many techniques used by the Group to record the presence of animal species and showed slides of some of Victoria's native mammals.

Mr. Ian Gillespie then told the meeting about the Day Group which was formed in 1962 by Mr. Alf Fairhall for people interested in seeing some of the sights of Melbourne.

Mr. Andy Blackburn finished by showing some slides taken on recent Day Group excursions.

#### Exhibits

– Numerous species of flowering Acacias collected from Melbourne gardens. Miss Margaret Potter.

– About 180 species of beetles collected from the Big Desert and a written report prepared for the National Parks Service about them. Mr. Ian Faithfull.

– Under microscopes: Yellow Nudibranchs (*Doriopsilla carneola*) from Black Rock which have recently laid their egg ribbons. These nudibranchs feed on yellow sponges and are well camouflaged when on the sponge; a freshwater Hydra from the lake at Caulfield Racecourse and the resting stage of a green alga. Mr. Dan McInnes.

– Under microscopes: Pollen from a pine tree and a periwinkle flower. Mr. Urwin Bates.

– Prize-winning landscape photographs by Mr. Ern Mainka.

– Victorian graptolite fossils. Mr. Tom Sault.

– Pieces of fossilized wood. Mr. Andy Blackburn.

#### Nature Notes

– The Imperial White Butterfly pupae recently brought to a meeting by Mr. Tom Sault are now hatching at her house. Miss Wendy Clark.

– In giving his report of the Werribee Research Farm's Management Committee, Mr. Geoff Shepard mentioned how important the farm is for many of Victoria's rarer birds, including the Orange-bellied Parrot, the freckled and Blue-billed Ducks and many species of waders. Certain rare plants are found there and the Altona Skipper is endemic to the area.

General Meeting  
Monday, 6th October

**The speaker** for the evening was Dr. Jim Willis who spoke on "The Botanical Explorations of Baron von Mueller."

Dr. Willis began by pointing out to the meeting that it would be 90 years ago that week since Baron Sir Ferdinand von

Mueller died and lamented the fact that this great man and prolific author (with about 1,000 works published) is today so little known.

The Baron had great energy in collecting and describing plants. The very day (in 1847 at the age of 23) that he arrived in Adelaide from Europe, he collected his first Australian botanical specimen and in his lifetime described about 2,000 new species of Australian, New Zealand and Papua New Guinean plants. These were apparently described in a wide variety of journals, sometimes even in country newspapers.

After working for some years as a pharmacist in South Australia and Victoria, he was appointed by the Colony of Victoria to do vegetation surveys and then began a series of great botanical collecting trips.

Dr. Willis then went on to give a very interesting account of some of the Baron's longer journeys (sometimes covering thousands of miles) and showed slides of some of the sights and plants he would probably have seen on the way. He finished his talk with a selection of slides of plants which were named in honour of the Baron.

#### Exhibits

– Baron von Mueller's personal string dispenser made of Olive wood; a pair of his embroidered chamois leather braces; a portrait of the Baron as a foundation member of the F.N.C.V. and various publications by and about him. Dr. Jim Willis.

– Under microscopes: *Stentor auricula* (the only marine stentor) a red ciliate, *Holosticha rubra* and two green seaweeds, *Bryopsis* sp. and *Chaetomorpha* sp. all from Black Rock. Mr. Dan McInnes.

– A red-fruited lichen, *Cladonia macilenta* from Waterfall Gully, Red Hill. Mrs. Ilma Dunn.

– A sprig of *Grevillea willisii*, named in honour of our speaker.

#### Exhibits

A large Water Rat was seen under Princes Bridge tonight. It was eating something and then swam away. A recent article in 'The Age' reported Mr. Geoff Raymond as saying that he had seen Wombats near the Yarra in Toorak.

Does anyone else know of Wombats presently in this area? Mr. Ian Faithfull.  
- Bird-orchids seen flowering at Murrindindee. Mr. Arthur Thies.  
- At the Metcalfe Flora Reserve currently many Early Nancys, Bill Buttons and Morels. Mrs. Sheila Houghton.

- A large number of dead frogs were found on Sunday Island which had had their livers eaten out. Perhaps the Little Ravens did it.  
- On Fraser Island, Ravens were observed to take a very wide range of foods and even stole their breakfast cornflakes and muesli. Dr. Jim Willis.  
C. M. Shankly

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## SUBSCRIPTION INCREASE

Increases in the production and mailing costs of 'The Victorian Naturalist', upon which the subscription rates are based, have necessitated an increase in the subscription rates for 1987.

Metropolitan members, who have the opportunity of attending meetings, using the library, and so on, pay a higher rate. A membership fee of \$2.00, which covers both partners, is paid by joint members, in addition to the basic subscription rate.

The new subscription levels show an increase of \$5.00 on all categories except Student, which is to be increased by \$4.00, and Junior, which is to be increased by \$2.00. The Cover Price of the Victorian Naturalist will increase to \$3.50.

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## LATE FEE

The increasing costs of reminder notices - postage, stationery, and the numbers of late renewers have resulted in the need for a late fee to recoup some of these costs, which are substantial.

Therefore, in 1987 a Late Fee of \$2.00 shall be imposed on members who do not renew their subscriptions by the end of March, 1987.

Council draws members' attention to the following points:

- Subscriptions cover the calendar year from January to December.
- Persons joining the Club in the second half of the year may pay a six month or an eighteen month subscription. Anyone paying a full year subscription in the second half of the year will be regarded as having paid for the current year and will receive back issues of that volume of *The Victorian Naturalist*.
- Subscriptions do **not** run from mid year to mid year.
- Members who fail to renew their subscriptions by 15 May will automatically be removed from the mailing list.
- Prompt payment greatly facilitates the Club's operations.

M. D. HOWES  
Hon. Secretary

# 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.

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*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.)

*Mammal Survey:* Mr JULIAN GRUSOVIN, 17 Sutherland Street, Chadstone, 3148. (211 4997)

*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 1987

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